SOKKIA

GRX1

Operator's Manual

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GRX1
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Preface

Thank you for purchasing this Sokkia product. The materials available in this Manual (the "Manual") have been prepared by Sokkia for owners of Sokkia products, and are designed to assist owners with the use of the receiver and its use is subject to these terms and conditions (the "Terms and Conditions").

NOTICE Please read these Terms and Conditions carefully.

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Manual Conventions

This manual uses the following conventions:

Example	Description
File ▶ Exit	Click the **File** menu, and click **Exit**.
Connection	Indicates the name of a dialog box or screen.
Frequency	Indicates a field on a dialog box or screen, or a tab within a dialog box or screen.
Enter	Press or click the button or key labeled **Enter**.

Further information to note about the configuration, maintenance, or setup of a system.

Supplementary information that can help you configure, maintain, or set up a system.

Supplementary information that can have an affect on system operation, system performance, measurements, or personal safety.

Notification that an action has the potential to adversely affect system operation, system performance, data integrity, or personal health.

WARNING

Notification that an action *will* result in system damage, loss of data, loss of warranty, or personal injury.

DANGER

Under no circumstances should this action be performed.

Notes:

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Introduction

The GRX1 receiver is a multi-frequency, GNSS receiver built to be the most advanced and compact receiver for the surveying market. The receiver is a multi-function, multi-purpose receiver intended for survey and construction markets.

The GRX1 receives and processes multiple signal types (including GPS L1, L2, C/A, L2C GLONASS L1, L2, C/A signals) improving the accuracy and reliability of the survey points and positions, especially under difficult jobsite conditions. Several other features, including advanced multipath mitigation, provide under-canopy and low signal strength reception. The receiver provides the functionality, accuracy, availability, and integrity needed for fast and easy data collection.

Figure 1-1. GRX1 Receiver

Principles of Operation

Surveying with the right GPS receiver can provide users accurate and precise positioning; a requirement for any surveying project.

This section gives an overview of existing and proposed Global Navigation Satellite Systems (GNSS) and receiver functions so that basic operating principles can be applied.

GNSS Overview

Currently, the following two global navigation satellite systems (GNSS) offer line-of-site radio navigation and positioning, velocity, and time services on a global, all-weather scale to any user equipped with a GNSS tracking receiver on or near the Earth's surface:

- GPS – the Global Positioning System maintained and operated by the United States Department of Defense. For information on the status of this system, visit the US Naval Observatory website (http://tycho.usno.navy.mil/) or the US Coast Guard website (http://www.navcen.uscg.gov/).

- GLONASS – the Global Navigation Satellite System maintained and operated by the Russian Federation Ministry of Defense. For information on the status of this system, visit the Coordinational Scientific Information Center website (http://www.glonass-ianc.rsa.ru/).

Despite numerous technical differences in the implementation of these systems, satellite positioning systems have three essential components:

- Space – GPS and GLONASS satellites orbit approximately 12,000 nautical miles above Earth and are equipped with a clock and radio. These satellites broadcast ranging signals and various digital information (ephemerides, almanacs, time and frequency corrections, and so forth).

- Control – Ground stations located around the Earth that monitor the satellites and upload data, including clock corrections and new ephemerides (satellite positions as a function of time), to ensure the satellites transmit data properly.

- User – The community and military that use GNSS receivers to calculate positions.

Calculating Absolute Positions

When calculating an absolute position, a stationary or moving receiver determines its three-dimensional position with respect to the origin of an Earth-Center Earth-Fixed coordinate system. To calculate this position, the receiver measures the distance (called pseudo-ranges) between it and at least four satellites. The measured pseudo-ranges are corrected for clock differences (receiver and satellites) and signal propagation delays due to atmospheric effects. The positions of the satellites are computed from the ephemeris data transmitted to the receiver in navigation messages. When using a single satellite system, the minimum number of satellites needed to compute a position is four. In a mixed satellite scenario (GPS and GLONASS), the receiver must lock onto five or more satellites to account for the different time scales used in these systems and to obtain an absolute position.

Calculating Differential Positions

DGPS (Differential GPS) is a relative positioning technique where the measurements from two or more remote receivers are combined and processed using sophisticated algorithms to calculate the receivers' relative coordinates with high accuracy. DGPS accommodates various implementation techniques that can be classified according to the following criteria:

- The type of GNSS measurements used, either code-phase differential measurements or carrier-phase differential measurements

- If real-time or post-mission results are required. Real-time applications can be further divided according to the source of differential data and communication link used.

With DGPS in its most traditional approach, one receiver is placed at a known, surveyed location and is referred to as the reference receiver or base station. Another receiver is placed at an unknown location and is referred to as the remote receiver or rover. The reference station

collects the code-phase and carrier-phase measurements from each GNSS satellite in view.

- For real-time applications, these measurements and the reference station coordinates are then built up to the industry standard RTCM[1] – or another proprietary standard established for transmitting differential data – and broadcast to the remote receiver (s) using a data communication link. The remote receiver applies the transmitted measurement information to its observed measurements of the same satellites.

- For post-mission applications, the simultaneous measurements from reference and rover stations are normally recorded to the receiver's internal memory (not sent over communication link). Later, the data are downloaded to computer, combined, and processed. Using this technique, the spatially correlated errors – such as satellite orbital errors, ionospheric errors and tropospheric errors – can be significantly reduced, thus improving the position solution accuracy.

A number of differential positioning implementations exists, including post-processing surveying, real-time kinematic surveying, maritime radio beacons, geostationary satellites (as with the OmniSTAR service) and satellite based augmentation systems (WAAS/EGNOS/MSAS).

> **NOTE** Additional hardware and/or subscription fees may be required to use other systems separate from the GRX1 system.

---

1. The Radio Technical Commission for Maritime Services (RTCM) defines global standards for communication messages and protocols that are used in the GNSS positioning industry. In support of this standards-based approach, **Sokkia recommends use of the latest RTCM message formats (v3 or greater) for all RTK and DGPS communication needs**. Several legacy correction message formats are also provided by Sokkia GNSS products in order to support interoperability with older GNSS systems, but their use is now deprecated.

The real-time kinematic (RTK) method is the most precise method of real-time surveying. RTK requires at least two receivers collecting navigation data and a communication data link between the receivers. One of the receivers is usually at a known location (Base) and the other is at an unknown location (Rover). The Base receiver collects carrier phase measurements, generates RTK corrections and sends this data to the Rover receiver. The Rover processes this transmitted data with its own carrier phase observations to compute its relative position with high accuracy, achieving an RTK accuracy of up to 10mm horizontal and 15mm vertical.

Essential Components for Quality Surveying

Achieving quality position results requires the following elements:

- Accuracy – The accuracy of a position primarily depends upon the satellite geometry (Geometric Dilution of Precision, or GDOP) and the measurement (ranging) errors.
  - Differential positioning (DGPS and RTK) strongly mitigates atmospheric and orbital errors.
  - The more satellites in view, the stronger the signal, the lower the DOP number, the higher positioning accuracy.
- Availability – The availability of satellites affects the calculation of valid positions. The more visible satellites available, the more valid and accurate the position. Natural and man-made objects can block, interrupt, and distort signals, lowering the number of available satellites and adversely affecting signal reception.
- Integrity – Fault tolerance allows a position to have greater integrity, increasing accuracy. Several factors combine to provide fault tolerance, including:
  - Receiver Autonomous Integrity Monitoring (RAIM) detects faulty GNSS satellites and removes them from the position calculation.
  - Five or more visible satellites for only GPS or only GLONASS; six or more satellites for mixed scenario.
  - Satellite Based Augmentation Systems (WAAS/EGNOS/ MSAS) creates and transmit, along with DGPS corrections,

> data integrity information (for example, satellite health warnings).
>
> – Current ephemerides and almanacs.

Conclusion

This overview simply outlines the basics of satellite positioning. For more detailed information, visit the Sokkia website.

Receiver Overview

When the power is turned on and the receiver self-test completes, the receiver's 72 channels initialize and begin tracking visible satellites. Each of the receiver's channels can be used to track any one of the GPS or GLONASS signals. The number of channels available allows the receiver to track all visible global positioning satellites at any time and location.

An internal GNSS antenna equipped with a low noise amplifier (LNA) and the receiver's radio frequency (RF) device are connected with a co-axial cable. The wide-band signal received is down-converted, filtered, digitized and assigned to different channels. The receiver processor controls the process of signal tracking.

Once the signal is locked in the channel, it is demodulated and necessary signal parameters (carrier and code phases) are measured. Also, broadcast navigation data are retrieved from the navigation frame.

After the receiver locks on to four or more satellites, its absolute position in WGS-84 and the time offset between the receiver clock and GPS time are computed. This information and the measurement data can be stored in the optional SD card and downloaded later onto a computer, then processed using a post-processing software package. When the receiver operates in RTK mode, raw data measurements can also be recorded into the receiver's internal memory. This allows the operator to double check real-time results obtained in the field.

Depending on your options, capabilities of the receiver include:

• Satellite based augmentation systems (WAAS/EGNOS/MSAS).

- Adjustable phase locked loop (PLL) and delay lock loop (DLL) parameters

- Single- or Dual-frequency signal tracking modes, including static, kinematic, real-time kinematic (RTK)

- Differential GPS (DGPS) survey modes (DGPS modes include static, kinematic, and RTK)

- Automatic data logging

- Setting different mask angles, Setting different survey parameters, Static or dynamic modes

- Measurement and position output rates, up to 20 Hz

- Ability to update the firmware in the field

- Configurable long-range radios

Getting Acquainted

The GRX1 is a 72-channel GPS receiver, which includes the following:

- Detachable battery

- One data port

- One power port

- Interface for controlling and viewing data logging, tracked satellites and power status (LED display panel)

- External memory card slot

- Internal radio modem

- Bluetooth wireless technology module

- Optional GSM/GPRS/EDGE module

- Optional HSPA module (only with the Digital UHF II radio modem)

- Audible status messages

GRX1 Receiver

The GRX1 receiver's advanced design reduces the number of cables required for operation, allowing for more reliable and efficient surveying. The casing allocates space for one removable battery, SD and SIM card slots, Bluetooth wireless technology module and a radio modem communications board with GSM/HSPA cellar phone module (depending on the model).

The GRX1 comes in one of the following configurations:

• with a UHF II TX/RX radio modem

• with a UHF II TX/RX radio modem and GSM, HSPA, or CDMA (US) modules

• with a Satel radio modem and a GSM/HSPA module

Battery

The GRX1 receiver comes equipped with two detachable Li-Ion batteries (Figure 1-2 on page 1-9) for powering the receiver and one CDC68 charger.

The battery is capable of running for more than 7.5 hours on a single charge (only static observation).

The battery compartment door provides access to the main battery. The receiver can also be powered using an external power source.

Use one BDC58 rechargeable battery at a time to power the receiver.

The GRX1 also contains an internal backup battery, which maintains an internal RTC. The backup battery is automatically charged from the main battery.
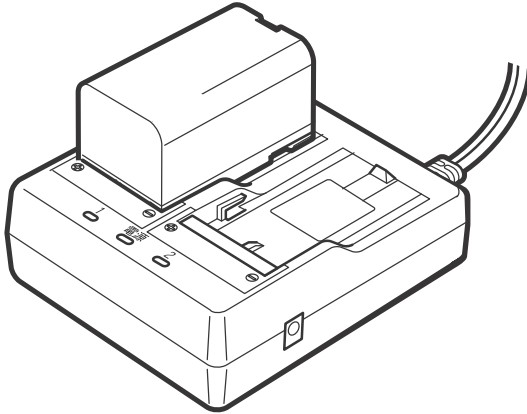
Figure 1-2. GRX1 Battery and Charger

Inserting and Removing the Battery

- First, before removing the battery, always turn off power to the instrument. If the battery is removed while the power is switched on, uncontrolled system shutdown will occur and file data may be lost as a result.

- When inserting or removing the battery, make sure that moisture, dust, or other foreign particles do not come in contact with the inside of the instrument.

- Remove batteries from the surveying instrument or charger before placing into storage.

- Store the battery in a dry room where the temperature is within the following ranges. For long-term storage, the battery should be charged at least once every six months.

Table 1-1. Battery Storage Time

Storage Period	Temperature
1 week or less	-20°C to +50°C
1 week to 1 month	-20°C to +45°C

Table 1-1. Battery Storage Time

Storage Period	Temperature
1 month to 6 months	-20°C to +40°C
6 months to 1 year	-20°C to +35°C

- The BDC58 uses the latest advances in high density lithium-ion battery technology. However, like all batteries, it still generates power using a chemical reaction and as a result, has a limited lifetime. Even when the battery is in storage and not used for long periods, the battery capacity deteriorates with the passage of time. This may result in the operating time of the battery shortening despite having been charged correctly. In this event, a new battery is required.

To Remove the Battery:

1. Turn the GRX1 over.
2. Push the battery buttons on both sides of the battery compartment cover, and lift the battery cover.
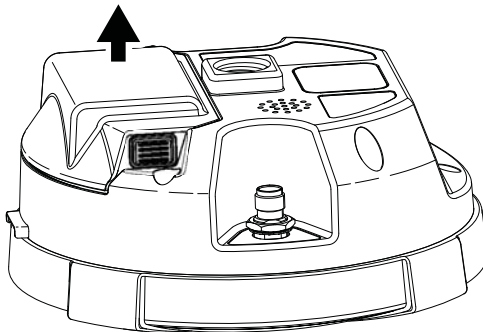
Figure 1-3. Remove Battery Compartment Cover

3. Slide the battery to the right, and separate the battery from the connector.
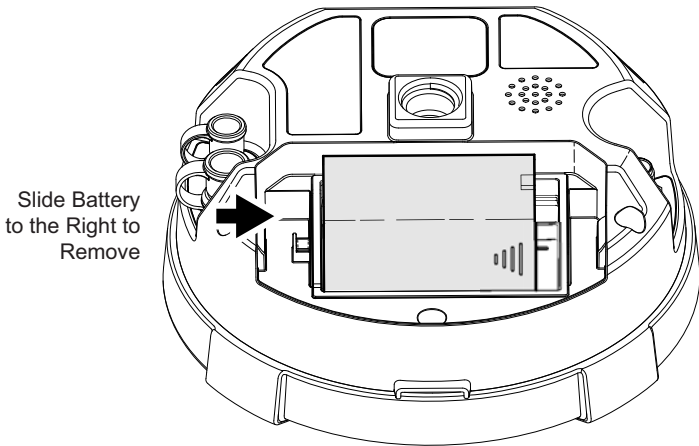
Figure 1-4. Remove Battery

4. Lift up the battery, and remove it from the receiver.

To Insert the Battery:

1. Remove the battery cover.

2. Gently slide the bottom of the battery along the battery guides until it snaps into place (Figure 1-5 on page 1-12).

Slide Battery
to the Left to
Lock in Place
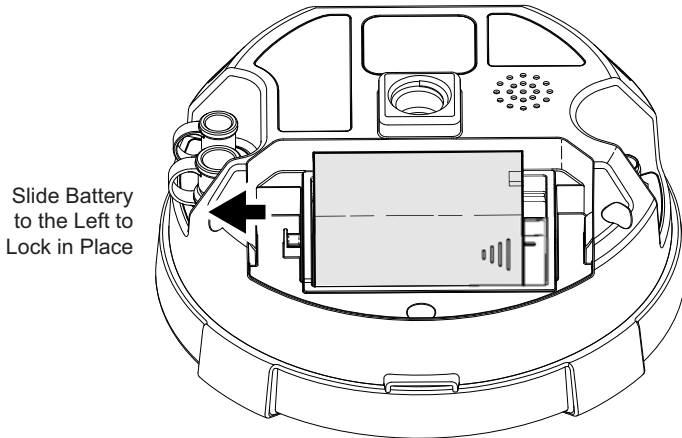
Figure 1-5. Remove Battery Compartment Cover

Charging the Battery

To charge the battery, use the included charger. It takes approximately 4 hours to completely charge one battery, and 8 hours to completely charge two batteries.

NOTE	The battery is shipped from the factory without power. Fully charge the Battery before surveying.

The Li-Ion batteries used in the battery packs should run at no less than 80% capacity after 500 charging cycles. These batteries do not need to be drained before recharging.

1. Connect the power cable to the charger and plug the charger into the wall outlet.

2. Mount the battery in the charger by matching the grooves on the battery with the guides on the charger.
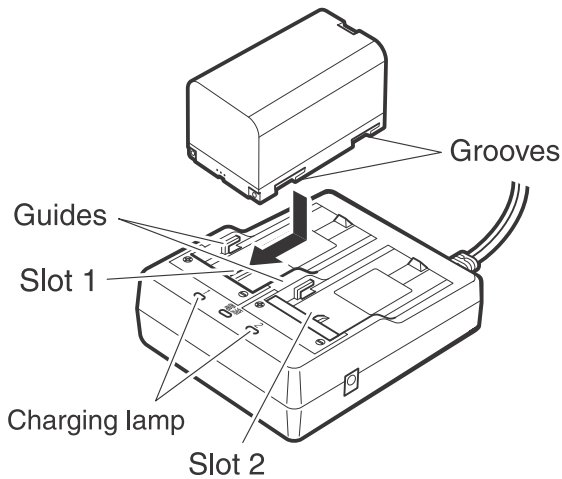
Figure 1-6. Insert Battery onto Charger

3. When charging begins, the lamp light blinks.

4. The lamp light is solid when charging is complete.

5. Remove the battery and unplug the charger.
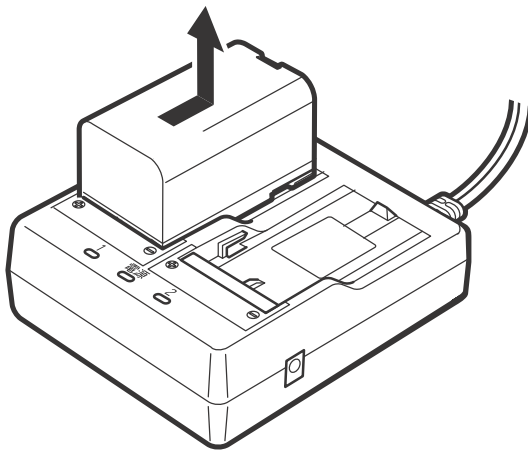
Figure 1-7. Remove Battery

Slots 1 and 2:

The charger starts charging the battery mounted first. If two batteries are placed in the charger, the battery in slot 1 is charged first, and then the battery in slot 2.

Charging lamp:

The charging lamp is off when the charger is outside the charging temperature range or when the battery is mounted incorrectly. If the lamp is still off after the charger falls within its charging temperature range and the battery is mounted again, contact a local dealer.

Charging time per battery (at 25°C):

BDC58: about 4 hours (Charging can take longer than the times stated above when temperatures are either especially high or low.)

LED Display Panel

The GRX1 LED status display panel indicates the receiver's current status (Figure 1-8).
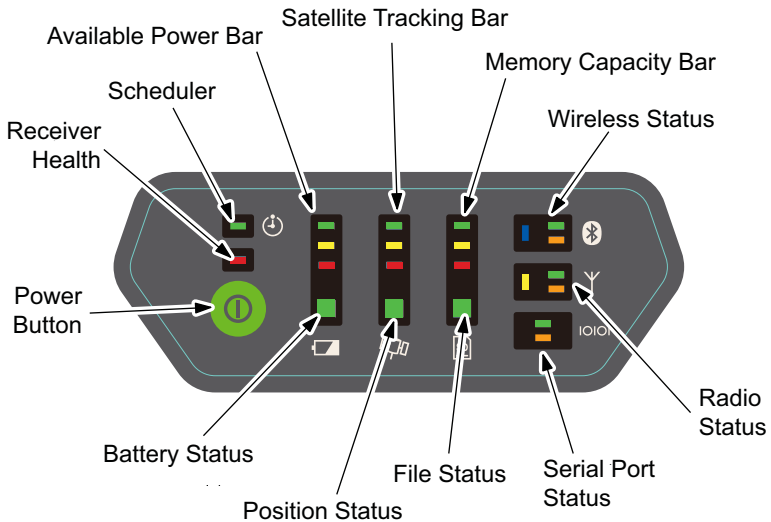
Figure 1-8. GRX1 LED Display Panel

Available Power Bar indicates the remaining battery charge or voltage.

- Green – indicates greater than 50%

- Yellow – indicates greater than 25%

- Red – indicates greater than 10%

- Red (blinking) – indicates less than 10%

When GRX1 uses an external power supply:

- Green – indicates greater than 8V

- Yellow – indicates greater than 7.5V

- Red – indicates greater than 6.5V

- Red (blinking) – indicates less than 6.5V

Battery Status LEDs indicates an available battery and the usage condition.

- Green – indicates only battery is available
- Red – indicates only external power is available
- Amber – indicates that both battery and external power are available

Satellite Tracking Bar indicates the number of satellites tracked.

- Green – indicates greater than 8 satellites
- Yellow – indicates 6 or 7 satellites
- Red – indicates 4 or 5 satellites
- Red blink – indicates 3, 2, 1 satellites

Position Status LEDs indicate the current type position computed.

- Green – indicates Integer RTK solution
- Yellow – indicates RTK Float or DGPS solution
- Red – indicates Single point position, User fixed position or Base mode

Memory Capacity Bar indicates a percentage of available space in the memory.

- Green – indicates greater than 50%
- Yellow – indicates greater than 25%
- Red – indicates greater than 10%
- Red (blinking) – indicates greater than 0%
- Green/Yellow/Red (blinking) – 0% or memory card is not ready

File Status LEDs indicate the status of the current file.

- Green – indicates a file is open
- Red blink – indicates writing to the file
- NO light (dark) – indicates that a file is not open or there is no memory card in slot

Wireless Status LEDs indicates the status of the internal Bluetooth module.

- Blue – internal Bluetooth connection is established
- Blue (blinking) – internal Bluetooth connection has not been made, as long as the module has power
- Green (flashing) – indicates data is transmitted from the Bluetooth port
- Orange (flashing) – indicates data is received from the Bluetooth port
- No light (dark) – internal Bluetooth module is turned off.

Radio Status LEDs indicates the status of the internal radio.

- Yellow – indicates internal radio is being powered
- Green (flashing) – indicates data is transmitted from the internal radio port
- Orange (flashing) – indicates data is received from the internal radio port

Serial Port Status LEDs indicates the status of the serial port.

- Green (flashing) – indicates data is transmitted from the serial port
- Orange (flashing) – indicates data is received from the serial port

Scheduler Status LED is not available at this time. The scheduler status LED feature will be available in future revisions of the GRX1.

The Power Button is used to turn the unit on or off, format or erase the internal memory, or perform a factory reset. The number of seconds that you press the power button determines how the receiver will behave. At each time interval, the receiver issues voice messages or sounds to guide you through the process.

Table 1-2. Power Button Action Status

Action	Number of Seconds	Description
Turn On	3 second	Press the button for more than 3 seconds and release to turn on the receiver. The battery life gauge indicates the progress of the startup sequence. After startup (approximately 20 seconds), the battery life gauge indicators will turn off for a short period, and you will hear the "Receiver Ready" message or sound that indicates that the system is operational. Note: It is normal for the receiver health indicator LEDs to illuminate during startup.
Turn Off	greater than 3 seconds, and less than 10 seconds	Press the button for 3 seconds to 10 seconds and/or until you hear the "Power Off" message or sound, and the top three battery life gauge LEDs illuminate.
Factory reset	greater than 10 seconds, and less than 20 seconds	With the receiver on, press the button for 10 seconds to 20 seconds until you hear the "Factory Reset" message or sound and the top three LEDs on the battery life, satellite tracking, and memory gauges illuminate. Release the button to reset all stored parameters on the receiver to their default values. Note: This action is irreversible.

Table 1-2. Power Button Action Status

Action	Number of Seconds	Description
Erase memory	greater than 20, and less than 25	With the receiver on, press the button for 20 seconds to 25 seconds until you hear the "Delete Files" message or sound and the top three LEDs on the memory gauge illuminate. Release the button to delete all the files from the memory. Notice: This action is irreversible. If you are unsure about whether you want to delete all the files, hold the button longer than 25 seconds, so that the receiver simply returns to normal operation. To delete individual files from the memory, use a data collector or Sokkia software, "SRU" on your PC.
Disregard	more than 25 seconds	When you hold the button longer than 25 seconds and you hear the "Continue Operation" message or sound, no action will be taken and the receiver will return to normal operation. The receiver will not turn Off, the data files will not be erased and the settings will not revert to factory settings.

Audible Annunciator

The GRX1 receiver is equipped with a voice notification, which issues a series of voice messages or sounds to alert you to system status and event conditions.

> **NOTE** Your receiver is preconfigured with either voice messages or sounds at a preset volume. To modify these settings, use SRU.

The frequency of the voice message or sound depends on the specific condition, the frequency is either once (when the condition first occurs) or repeated (every 30 seconds for a set period of time).

Data and Power Ports

The GRX1 has three ports (Figure 1-9):

- Power – rimmed in red; used to connect the receiver to an external power source. The body of the connector on the corresponding cable is red.
- Serial – rimmed in black; used for communication between the receiver and an external device. The body of the connector on the corresponding cable is black.
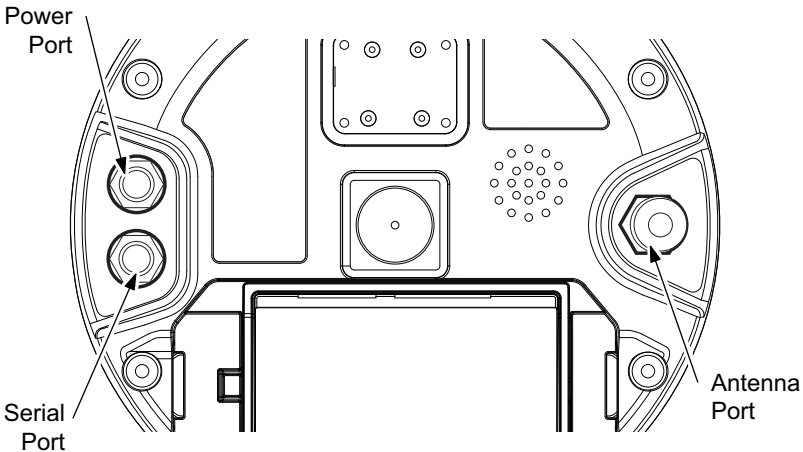
Figure 1-9. GRX1 Ports – Power, Antenna, Serial

External Radio Antenna Connector

The UHF antennas connect to the external antenna connector under the GRX1 housing (Figure 1-10 on page 1-21). Both modem antenna types include support for a GSM/HSPA modem.

The modem antenna depends on the type of modem installed in the receiver:

- UHF – Uses a BNC RF connection and comes in two versions: 410–440MHz (p/n 30-070003-01) and 440–470MHz (p/n 30-050503-01).

UHF/GSM/HSPA Antenna
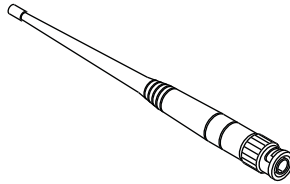
Figure 1-10. Modem Antenna

Connector

The bottom connector (Figure 1-11) connects the receiver to either a standard 5/8" thread pole or to an adapter.
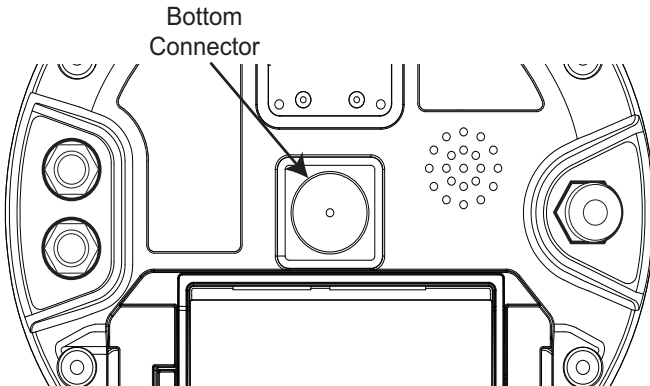
Bottom
Connector

Figure 1-11. GRX1 Bottom Connector

SD/SDHC and SIM Card Slots

The SD/SDHC and SIM card slots reside under the battery near the base of the dome.

The SD/SDHC card slot is located inside the battery pocket (Figure 1-12 on page 1-22). Once installed, the SD/SDHC card can be removed from the receiver. The data that resides on the SD/SDHC card can be accessed by removing the card and using an external SD/SDHC card reader, or by using SOKKIA software to download the data via a serial or Bluetooth connection. A secure digital card can be purchased from a local Sokkia dealer. The SD/SDHC card is

available in FAT16 or FAT32 format so that the removable SD/SDHC card is enabled for copying logging files directly to a PC.

The SIM card slot is located inside the battery pocket and allows a standard SIM card to be installed in the receiver. Once installed, the SIM card provides a unique identification for the receiver's GSM/HSPA module and enables the receiver's GSM/HSPA functionality, based on the subscribed services (the receiver board accesses the GSM/HSPA module which accesses the SIM card). The SIM card usually remains inside the receiver. The GSM/HSPA module with the SIM card installed can be accessed via SRU for configuration purposes. A SIM card can be purchased from a local cellular provider.
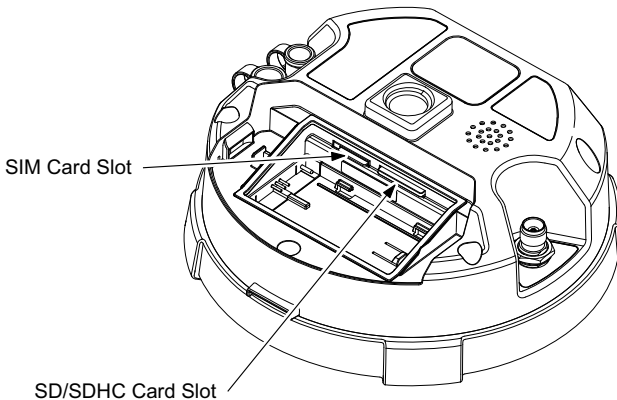
Figure 1-12. GRX1 Card Slot Example

To install the SIM card (Figure 1-13):

The SIM card must support Circuit Switched Data to communicate directly between receivers. The SIM card must have GPRS or EDGE support to communicate with a GPS Network IP address.

> **NOTICE**
>
> For direct communication between Base and Rover receivers, you must install a SIM card with a Circuit Switch Data plan and have subscriptions to the same service provider for proper data communication.

1. Ensure the receiver is turned off.
2. Remove the battery.
3. If needed, snap the SIM card into its holder.
4. Carefully insert the holder, label side down, into the SIM card slot located at the top of the battery pocket.
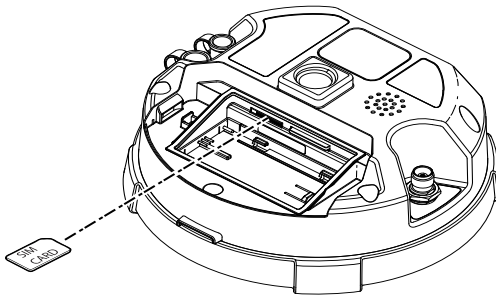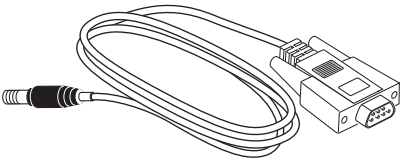
Figure 1-13. Install SIM Card

Once the receiver is turned on, the receiver board will detect the SIM card, and it will be ready to use.

Cable

The GRX1 package includes a serial communication cable for configuring the receiver. Table 1-3 describes the cable included in the GRX1 package.

Table 1-3. GRX1 Package Cable

Cable Description	Cable Illustration
Serial cable Connects the receiver to an external device (controller or computer) for data transfer and receiver configuration. Body of connector is black.	

Other Accessories

• Battery (BDC58) Li-ion Battery (4,300mAh, 7.2 VDC) x 2

- Battery Charger (CDC68)
- Power Cable (73113/A/B/C) CDC68 to AC outlet/plug (region specific)
- Manual CD

For more details on the accessories and package options available for the GRX1, contact your local Sokkia dealer.

Optional Accessories

Sokkia offers a wide variety of accessories designed to extend job reliability and efficiency. For more details on the optional accessories available for GRX1, contact your local Sokkia dealer.

- Radio Antenna for Digital modem (30-050503-01 or 30-070003-01)
- 10cm spacer
- SD Card industrial model
- Measuring Tape (22-050902-1) 3.7m HI (Calibrated)

Option Authorization File (OAF)

Sokkia issues an Option Authorization File (OAF) to enable the specific options that customers purchase. An Option Authorization File allows customers to customize and configure the receiver according to particular needs, thus only purchasing those options needed.

Typically, all receivers ship with a temporary OAF that allows it to be used for a predetermined period of time. When the receiver is purchased, a new OAF permanently activates purchased options. Receiver options remain intact when clearing the NVRAM or resetting the receiver.

The OAF enables the following kinds of functions. For a complete list of available options and details, visit the Sokkia website or consult a Sokkia dealer.

- Type of signal (standard L1; optional L2, GPS,/GLONASS)

- Update rate standard 1Hz (optional 5Hz, 10Hz, or 20Hz)

- RTK at 1Hz, 5Hz, 10Hz, and 20Hz

- RTCM/CMR Input/Output

- Advanced multipath reduction (AMR)

- SBAS(WAAS/EGNOS/MSAS)

- Receiver Autonomous Integrity Monitoring (RAIM)

Notes:

Pre-survey Preparation

Before beginning to survey with the GRX1 receiver, install the following software, charge the battery and apply the following configurations:

☐ Install receiver configuration software

See "Installing Sokkia Software" on page 2-2.

☐ Optional: install SD/SDHC card and/or SIM card

See "The SD/SDHC card slot" on page 1-21.

☐ Charge the Battery

See "Charging the Battery" on page 1-12.

☐ Configure the Bluetooth wireless technology module

See "Establishing a Wireless Connection" on page 2-5.

☐ Collect almanacs and ephemerides (after first-time configuration activities as described in Chapter 3)

See "Collecting Almanacs and Ephemerides" on page 2-8.

This chapter also discusses connecting the receiver and a computer.

Installing Sokkia Software

The Sokkia Receiver Utilities CD contains the SRU software program from Sokkia used for configuring and maintaining the receiver.

If you are installing SRU from the Sokkia Receiver Utilities CD, insert the CD into the computer's CD-ROM drive. If you are downloading the program(s) from the website, extract the program files into a folder on the hard drive.

The following sections describe installing this software, and other sections throughout the manual describe using this software with the receiver.

Installing SRU

SRU is a Windows® software application designed for configuring GNSS receivers (Figure 2-1).

Computer requirements for the SRU are: Microsoft® Windows XP / Vista/7 operating system and an RS-232C port or Bluetooth wireless technology. Use SRU to correctly configure the receiver.

To install SRU:

1. Navigate to the SRU folder, and double-click **SRU.zip**.
2. Extract the **SRU.exe** file to the SRU folder.
3. Double-click **SRU.exe** to run the installer, and then follow the on-screen instructions.

After installation, shortcuts on the desktop and in the Program menu are created.

Figure 2-1. Desktop Shortcut – Sokkia Receiver Utilities

To install optional SD/SDHC card and the optional SIM card, see "The SD/SDHC card slot" on page 1-21 for details.

Charging the Battery See "Charging the Battery" on page 1-12 for details.

Connecting the Receiver and a Computer

SRU provides an interface for various configuration, monitoring, and management functions for the receiver.

To configure, manage files, or maintain the receiver, connect the receiver and a computer using one of the following methods and start SRU:

- a Bluetooth-enabled external device (computer/controller)
- an RS232 serial cable and a computer/controller

Once a connection between the receiver and the computer/controller has been established, you will be able to use SRU to configure the receiver and its components, send commands to the receiver, download files from the receiver's memory, upload new GNSS firmware, upload an OAF and upload configuration files.

Establishing an RS232 Serial Cable Connection

To establish a connection to a receiver, take the following steps:

1. Press the **power** button on the receiver and computer to turn them on.
2. Using the RS232 serial cable, connect the serial port of the computer (usually COM1) to the receiver's serial port.
3. Run SRU.
4. Click **Device ▸ Application Mode ▸ Receiver Managing** (Figure 2-2 on page 2-4).

The computer/controller detects the device connected to the port.
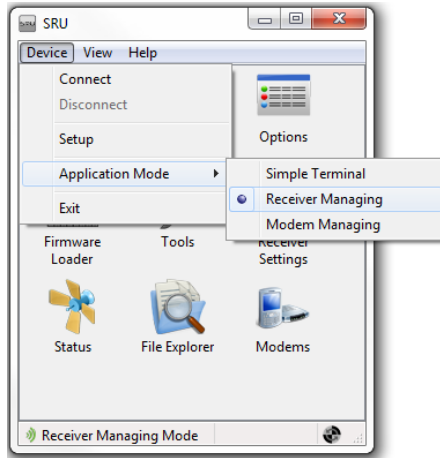
Figure 2-2. Sokkia Receiver Utility (SRU) Dialog Box

5.   Click **Device ▸ Connect**. The *Connection Parameters* dialog box
     displays (Figure 2-3). To establish a connection between the
     computer/controller and the receiver, press the **Connect** button.
     When detecting the receiver, the *Detecting Receiver* dialog box
     displays.
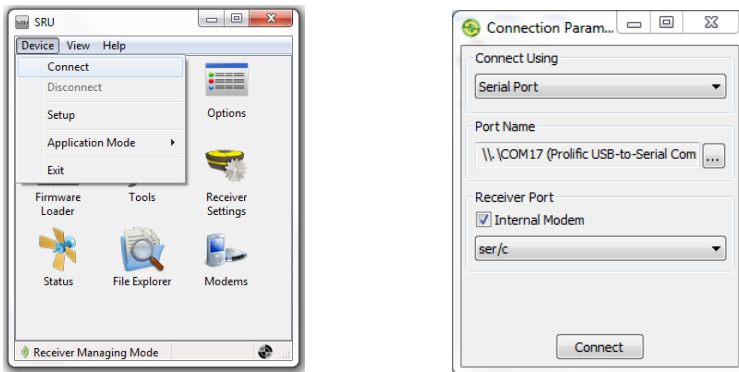
**Figure 2-3. Connecting the Receiver and Computer Controller via RS232 Serial
Cable**

6.   To close the connection between a receiver and the computer/
     controller, click **Device ▸ Disconnect**:
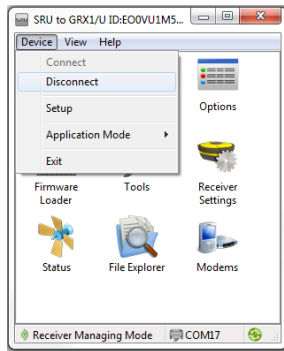
Figure 2-4. Disconnect the Receiver From the Computer/Controller

---

> **NOTE**
>
> To set a connection with the GRX1 receiver, do not check mark the ***External Receiver*** box in the ***Connection Parameters*** dialog box (Figure 2-3 on page 2-4).

Establishing a Wireless Connection

The GRX1 receiver contains Bluetooth wireless technology that allows file transfer and synchronization between the receiver and any other external device that supports Bluetooth wireless technology; for example, an SHC250, a computer with integrated Bluetooth or a Bluetooth adapter installed.

Before establishing a connection to the receiver via Bluetooth, make sure the module has Bluetooth power (Bluetooth Status LEDs blinks blue). If these LEDs do not blink, you must activate the receiver Bluetooth module by setting the connection between the computer and the receiver using an RS-232 serial cable (follow steps 1-5 described in "Establishing an RS232 Serial Cable Connection" on page 2-3).

To activate the Bluetooth module in the receive via Bluetooth:

• Click on the *Receiver Settings* icon in the main window, then click on the *Bluetooth* icon. The *Bluetooth* dialog box displays (Figure 2-5 on page 2-6):
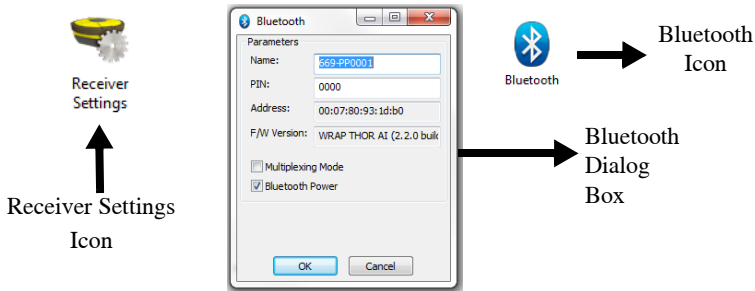
Figure 2-5. Bluetooth Receiver Settings

• Check mark the *Bluetooth Power* box, then click **OK** to activate the receiver Bluetooth module.

Wireless status will be indicated by LED lights blinking blue

• Close the connection between a receiver and computer/controller via RS-232 serial cable (see step 6 described in "Establishing an RS232 Serial Cable Connection" on page 2-3).

To establish a connection to a receiver via Bluetooth, take the following steps (Figure 2-6):

1. Press the **Power** buttons on the receiver and computer to turn them on.

2. Run SRU.

3. Click **Device ▶ Application Mode ▶ Receiver Managing** (Figure 2-6 on page 2-7):
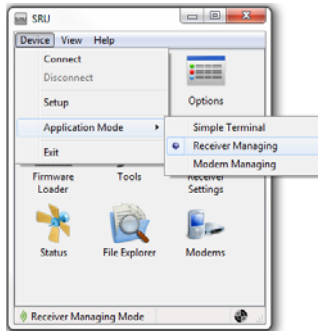
Figure 2-6. Application Mode

4. Click **Device ▸ Connect**.

5. Select **Bluetooth** from the *Connect Using* drop-down box.

6. Select the **Browse ...** button under *Device Name*.

    This will initiate a BT discovery.

7. Select your device from the list of discovered devices and press **OK**.

8. Press **Connect** (Figure 2-7).
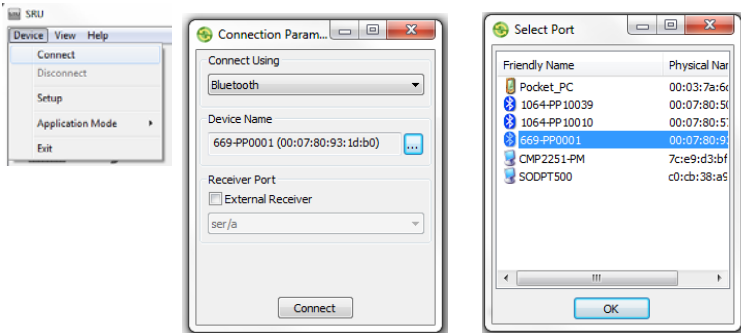
Figure 2-7. Searching for Bluetooth Devices

When detecting the receiver, the ***Detecting Receiver*** dialog box displays.
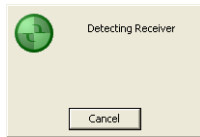
Figure 2-8. Connecting Receiver and Computer/Controller via Bluetooth

9. To close the connection between the receiver and computer/ controller, click **Device ▶ Disconnect**:
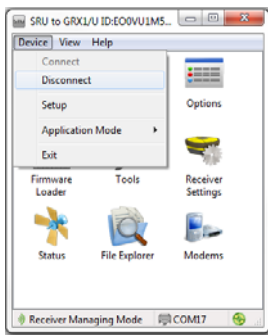
Figure 2-9. Disconnect the Receiver from the Computer

Collecting Almanacs and Ephemerides

Each satellite broadcasts a navigation message that includes the ephemeris parameters of the satellite, the almanac, and various other information. The ephemeris parameters describe the orbital motion of the satellite and are used to predict its location/trajectory. The almanac gives the approximate orbit (course) for the transmitting satellite and all other satellites in the same system.

*   GPS and GLONASS satellites broadcast ephemeris data cyclically, with a period of 30 seconds.

*   GPS satellites broadcast almanac data cyclically with a period of 12.5 minutes; GLONASS satellites broadcast almanac data cyclically with a period of 2.5 minutes.

If the receiver has an almanac, you can considerably reduce the time needed to search for and lock onto satellite signals.

The receiver regularly updates the almanac and ephemerides and stores the most recent versions in its Non-Volatile Random Access Memory (NVRAM).

Perform the following to collect Alamac and Ephemerides data:

1. Set up the receiver in a location with a clear view of the sky.
2. Turn on the receiver.
3. Wait for about 15 minutes while the receiver collects complete almanac and ephemeris data from the satellites.

NOTICE   If 15 minutes have passed and the receiver does not lock onto satellites, clear the NVRAM. See "Clearing the NVRAM" on page 5-10 for details.

You will need to collect or update the almanac and ephemerides under the following circumstances:

• If the receiver has been off for a long time
• If the last known receiver position, stored in the NVRAM, is different from the present position by several hundred kilometers
• After loading a new OAF
• After loading new GNSS firmware
• After clearing the NVRAM

POWERUP Script

The GRX1 POWERUP script feature uses specially formatted ASCII text file (GRIL commands) that, once installed, enables the receiver to perform a series of custom operations simply by pressing the power button to turn on the receiver. i.e.:

• Automatically start static data logging to the SD/SDHC card.
• Automatically begin message output to the serial port.
• Automatically configure and start the RTK Base radio.

Example For an easy "one button" base setup that is supported using the POWERUP script:

- Mount the receiver on a tripod and press the power button

- During RTK base operation, the receiver will also automatically collect raw measurement data to the SD/SDHC card.

- The receiver will automatically compute an averaged single-point RTK base position.

After pressing the **Power** button, the operator may simply walk away. No cabling, external data link, or data collector is required; work on site can begin almost immediately.

POWERUP Script Requirements

After turning on the GRX1 receiver, the POWERUP script executes when the receiver obtains valid position coordinates and the following requirements are satisfied:

- The POWERUP script has been installed to receiver.

- The POWERUP script function setting is ON.

- The receiver is not starting by using the timer.

- There is no enabled session timer.

Installing the POWERUP Script

To install the POWERUP script onto the GRX1 receiver:

1. Copy the POWERUP script file "**powerup.gcs**" to the "POWERUP" folder on the SD card.

2. Insert the SD card into the GRX1 receiver.

3. Perform a Factory Reset on the GRX1.

Once the installation is successful, the "**powerup.gcs**" file is removed from the SD card.

NOTICE

If the file attribution is Read only, the file will not be removed.

If there is an existing POWERUP script on the GRX1, the new script file will override the existing script.

Uninstalling the POWERUP Script

The POWERUP script can be uninstalled by using either of the following two methods.

Method 1: Install an empty (no script) "powerup.gcs" file.

Method 2: Send the command "set,/ext/powerup/clear,y" using the Terminal feature of SRU.

Editing the POWERUP Script

It is not possible to edit the existing POWERUP script in receiver directly. Install (overwrite) the new POWERUP script after modifying the script using SRU.

Enabling the POWERUP Script

It is necessary to enable the POWERUP script function in order to allow the GRX1to execute the POWERUP script at every startup of the receiver. Enable the POWERUP script by using any of the following three methods.

Method 1: Send the terminal command "set,/ext/powerup/mode,on".

Method 2: Perform a Factory Reset of the receiver.

Method 3: Enable using the SRU software.

Disabling POWERUP Script

Disable the POWERUP script by using either of the following two methods.

Method 1: Send the terminal command "set,/ext/powerup/mode,off".

Method 2: Disable by using the SRU software.

GRX1 Configuration

Both Base and Rover receivers must be configured depending upon the survey method needed.

When configuring receivers for RTK surveying, use the following checklist to ensure the receivers are properly set up.

☐ Perform pre-survey functions as described in Chapter 2.

☐ Configure one receiver as an RTK Base station and the other receiver as an RTK Rover. See "Configuring the Receiver" on page 3-16.

☐ Set up the Base receiver over a known point to begin collecting static observation data and transmitting corrections. Set up the Rover receiver to begin collecting RTK data. See "GRX1 Receiver Setup" on page 4-1 for more information.

When configuring receivers for post-processing surveying, use the following checklist to ensure the receivers are properly set up.

☐ Perform pre-survey functions as described in Chapter 2.

☐ Configure one receiver as a Base station and the other receiver as a Rover. See "Configuring the Receiver" on page 3-16.

☐ Set up the Base receiver over a known point to begin collecting static observation data. Set up the Rover receiver to begin collecting static or kinematic observation data. See "GRX1 Receiver Setup" on page 4-1 for more information.

> **NOTE**
> For more information about kinematic observation, refer to the Spectrum Survey Field reference manual.

Managing the Radio Modem

Sokkia's Receiver Utility (SRU) software supports configuration of all radio modems that are embedded in GRX1 receivers. SRU provides the following functions:

To configure the radio modem, have the following ready:

* PC running Windows XP/Vista/7 or newer
* SRU
* A Serial cable or Bluetooth capable device or PC.

Connecting with the Radio Modem

1. Turn on the receiver. Connect the computer and receiver using an RS-232 cable or Bluetooth wireless technology.

2. Open SRU (Figure 3-1). Click **Device** ▶ **Application Mode** ▶ **Modem Managing**. Then click **Device** ▶ **Connect**.
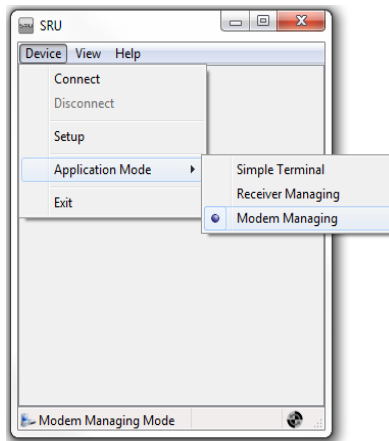
Figure 3-1. Modem Managing

3. Select the **COM Port** of the computer to which the receiver is connected (Figure 3-2 on page 3-3).

4. Click **OK**.
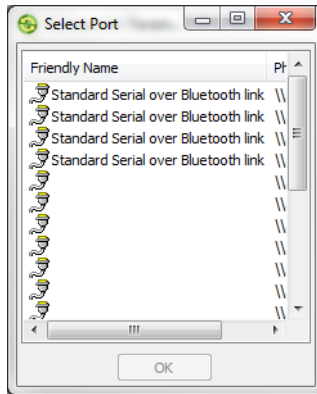
Figure 3-2. Select COM Port

5. Check mark the *Internal Modem* box and select **ser/c** from the drop-down menu (Figure 3-3).

   All internal modems for GRX1 are on port C.

6. Click **Connect**.
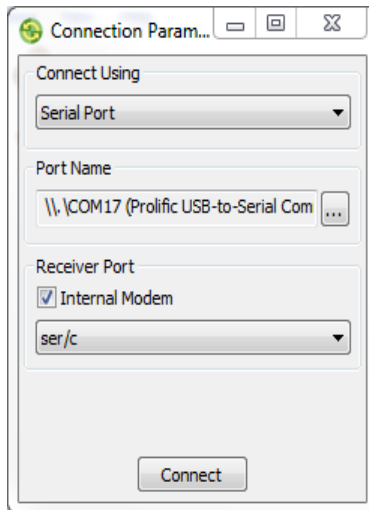
Figure 3-3. Connection Parameters

7. SRU will search through port speeds and flow settings until it finds the modem (Figure 3-4).

Figure 3-4. Detecting Modem

When the modem is found, SRU will return to the main screen.

Topcon Digital UHF II Modem

The following describes specific parameters and functions for the Topcon Digital UHF II modem.

General Information

The *General* page shows the modem model, and the product identification information (Figure 3-5).
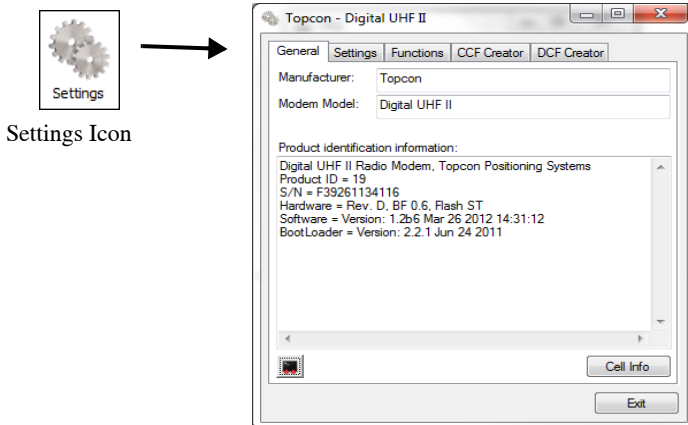
Figure 3-5. General Page

*   **Cell Info** – press to view information on the cell module.

Modem Settings

The *Settings* page allows setting values for parameters of the
connected modem (Figure 3-6).
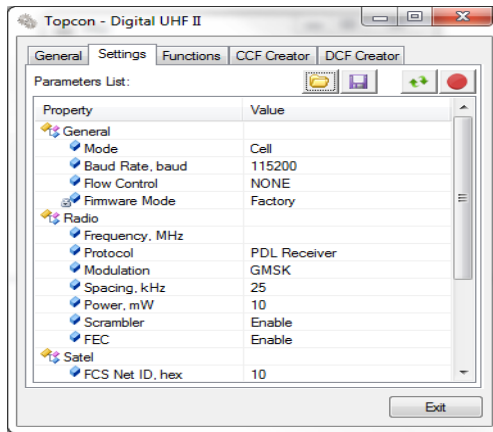
Figure 3-6. Settings Page

The *Settings* page displays general communication parameters, and
parameters specific for the modem. To change any editable
parameter, click on the Value field of the highlighted parameter and
select a desired value from the drop-down list appear.

- *General* parameters:
  - *Mode*: selects Radio or Cell to use for communication (the
    UHF or GSM/CDMA band, respectively).
  - *Baud Rate, baud*: selects a baud rate for the modem's serial
    port.
  - *Flow Control*: enables hardware flow control.
- *Radio* parameters:
  - *Frequency, MHz*: assigns an operating channel to the radio
    modem. Select the desired frequency from the list.
  - *Protocol*: sets the protocol for data receiving/transmitting.
  - *Modulation*: selects a modulation type for the radio modem.
  - *Spacing, kHz*: selects the channel spacing.
  - *Power, mW*: sets the transmission power for the base radio.

– *Scrambler*: when enabled, provides more robust data communication over high interference areas.

– *FEC*: (Forward Error Correction) Enable to maximize data communication. The rover radio modem has the capability to check and correct transmission errors (if any) in an incoming data stream.

- *Satel* parameters:

  – *FCS Net ID, hex*: Configures network ID.

  – *Address Receiving*: Configures address receiving.

  – *Address Transmission*: Configures address transmission.

  – *RX Address, hex*: Configures the receiving primary address.

  – *TX Address, hex*: Configures the transmission primary address.

Table 3-1 displays a list of possible values of the parameters. Default values are shown in bold.

Table 3-1. Possible Values of Parameters

Parameter Name	Values
Mode	**Radio** Cell
Baud Rate, baud	19200 **38400** 57600 115200
Flow Control	**NONE** RTC/CTS
Frequency, MHz	Carrier frequency displayed in MHz
Protocol	**PDL Receiver** PDL Transmitter PDL Repeater Satel Receiver Satel Transmitter Satel Repeater Satel FCS Receiver
Modulation	**GMSK** - Minimal Shift Keying with Gaussian Filtering 4FSK - Four Level Frequency Shift Keying

Table 3-1. Possible Values of Parameters

Parameter Name	Values
Spacing, kHz	12.5 20 **25**
Power	100, 250, 500, or 1000 mW
Scrambler	Disable **Enable**
FEC	Disable **Enable**
FCS Net ID	[0x0000...0xFFFF] Default value: 0x0010
Address Receiving	**Off** On
Address Transmission	**Off** On
RX Address, hex	[0x0000...0xFFFF] Default value: 0x0000
TX Address, hex	[0x0000...0xFFFF] Default value: 0x0000

Link Rate dependence on the modulation and the space value is presented in Table 3-2.

Table 3-2. Link Rate vs. Modulation and Space

Modulation	SpaceValues	12.5 kHz	20 kHz	**25** kHz
GMSK	Minimal Shift Keying with Gaussian Filtering	4.8 kbps	4.8 kbps	9.6 kbps
4FSK	Four Level Frequency Shift Keying	9.6 kbps	9.6 kbps	19.2 kbps

Modem Functions

The *Functions* page allows invoking modem's functions (Figure 3-7).
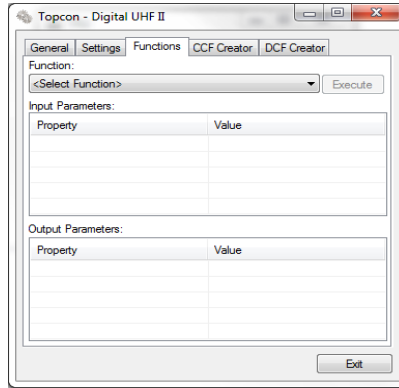
Figure 3-7. Topcon Digital UHF II Functions Page

The following functions are available for executing in this modem:

- *BootConfiguration* – This command is intended to reboot the unit using selected user settings. Two options are available, to use the default user settings defined by dealer or to use the settings defined by the end-user.

- *Factory Reset* – Resets all the parameters to their default values.

- *UploadFile* – Intended to upload Country Configuration (CCF) or Dealer Configuration (DCF) files.

NOTICE:

Please be aware that Digital UHF II modem supports a wide UHF frequency range of 400-470 MHz, and is delivered to you in a default factory configuration.

Before operating receiver equipped with Digital UHF II radio, you are required to upload the frequencies that you will need for radio communication in your specific region. UHF frequencies in your region may be licensed or unlicensed, but are always subject to some level of restriction within the overall 400-470 MHz range. Your receiver should come pre-loaded with the DCF file and proper

frequency options from your dealer. If your receiver is not loaded with the specific UHF frequencies, please contact your local dealer and request a DCF file containing licensed UHF frequencies and channel spacings.

To load a DCF file:

1. Copy the DCF file to your PC.
2. Turn on the receiver. Connect the computer and receiver using an RS-232 cable or Bluetooth wireless technology.
3. Open TRU and connect to the Radio modem (see "Connecting with the Radio Modem" on page 3-2)
4. Click on the **Settings** icon to open the *Digital UHF II Settings* screen, then select the Functions tab
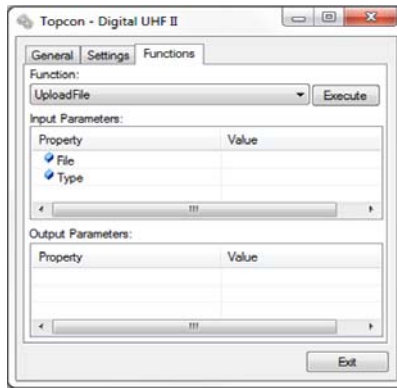
Figure 3-8. Topcon Digital UHF Functions Page

5. In the *Function* list, select **Upload File.**
6. Under Input Parameters, click the Value field for the File property
7. Select the DCF file saved to your PC
8. Click the Execute button
9. After the DCF file is loaded, open the Settings tab to ensure the frequencies are correctly loaded and available for use.

It is mandatory to load a valid DCF configuration before using the product. Failure to apply this procedure may result in non-operation of the Digital UHF II radio, or breach of local regulatory laws that govern radio communications. If you have further questions or concerns, please contact Topcon's Technical Support Group (TTS).

Satel Modem

The following describes specific parameters and functions for a Satel modem.

General Information

The *General* tab shows the modem model and the product identification information (Figure 3-9).
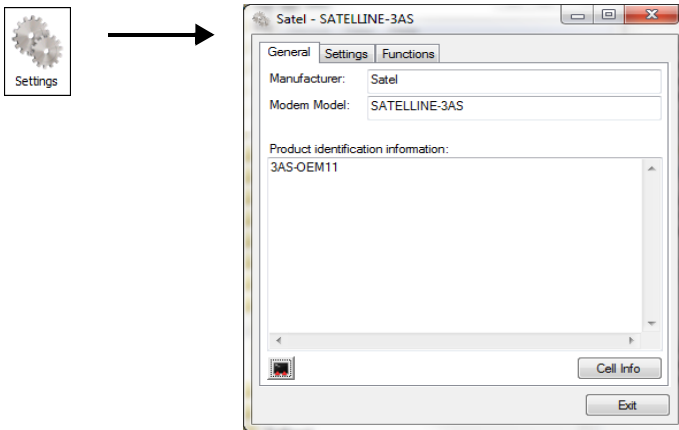
Figure 3-9. Satel General Page

- **Cell Info** - press to view information on the cell module.

Modem Settings

The *Settings* tab shows: general information about the modem type, software and hardware revisions, product code and serial number, and displays a list of settings for the modem ("Managing the Radio Modem" on page 3-2).

The UHF Satel radio modem offers a transmitter/receiver/repeater functionality with a maximum 1W power output for data transmission. The frequency range of the modem depends on the country in which the receiver is used.

> **NOTICE** The default settings for radio configuration are sufficient for most jobsites. Changing these settings can affect the operation of the radio modem and communication between receivers.

The settings can be read-only (marked by the 🗐 icon) or changeable (marked by the ☑ icon). Clicking on the corresponding line in the *Value* column of any editable parameter opens a field to enter or select from the drop-down list a needed value (see Figure 3-10 on page 3-12).

- *General* parameters:
    - *Model*: the product model identification text.
    - *HardwareVersion*: the hardware revision of the modem.
    - *FirmwareVersion*: the firmware version of the modem.
    - *Product Code*: specifies the product code.
    - *Serial Number*: specifies the serial number unique for the modem.
    - *Baud Rate, baud:* specifies the baud rate of the modem's serial port connected internally with the receiver's serial port, by default with hardware flow control.
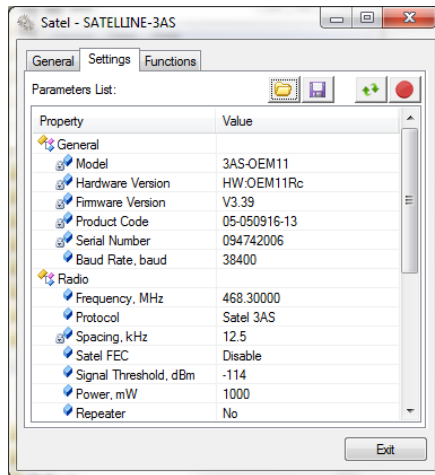
Figure 3-10. Satel Settings Page

- **Radio** parameters:

  – **Frequency, MHz**: the operating frequency used for data transmission and reception.

  – **Protocol**: selects a protocol and a modulation type.

  – **Spacing, kHz**: displays the channel spacing. This is determined by the hardware.

  – **Satel FEC**: Forward Error Correction technique to maximize data communication. The rover radio modem has the capability to check and correct transmission errors (if any) in an incoming data stream.

  – **Power, mW**: sets the appropriate level of output power.

  – **Repeater**: Enables/Disables repeater function.

  – **TX Delay, ms**: Specifies TX delay.

  – **TX Addressing**: Specifies TX address mode.

  – **TX Address, hex**: Specifies primary transmit address.

  – **RX Addressing**: Specifies RX address mode.

  – **RX Address, hex** - Specifies primary receive address.

- *FCS* parameters:
  - *FCS Mode*: Allows enabling Free Channel Scan mode. In free channel scan mode, the Base radio modem will regularly scan the current operating frequency to determine the degree of a radio noise (interference). Should the level of noise on the current operating frequency be greater than the threshold specified in the Signal Threshold field, the transmitter will stop broadcasting and switch to the next frequency.
  - *Net ID:* sets Free Channel Scan Net ID.

> **NOTICE** Occasionally, the receivers may encounter interference if a jobsite has more than one set of receivers. In this case, enter a different net ID for each set of receivers.

Table 3-3 displays a list of possible values of the parameters. Default values are shown in bold.

Table 3-3. Possible Values of Parameters

Parameter Name	Values
Baud Rate, baud	19200 **38400**
Protocol	Satel 3AS **PDL 4FSK** PDL GMSK w/EOT * * - PDL GMSK w/EOT protocol is supported by firmware 3.44n or later.
Spacing, kHz	12.5 20 25 The value is determined by the hardware
Satel FEC	**Disable** Enable

Table 3-3. Possible Values of Parameters (Continued)

Parameter Name	Values
Power, mW	100 200 500 **1000**
Repeater	**No** Yes
TX Addressing	**Disable** Enable
TX Address, hex	0000h - FFFFh Default: 0000h
RX Addressing	**Disable** Enable
RX Address, hex	0000h - FFFFh Default 0000h
FCS	OFF TX Master RX Slave RX/TX Repeater TX Master + Repeater RX Slave + Repeater
Net ID, hex	0000h - FFFFh Default: 0010h

NOTICE

To properly communicate, the Base and Rover radios require the same settings for Current Frequency, FCS and Net ID.

Modem Functions

The *Functions* page allows invoking modem's functions (Figure 3-11).
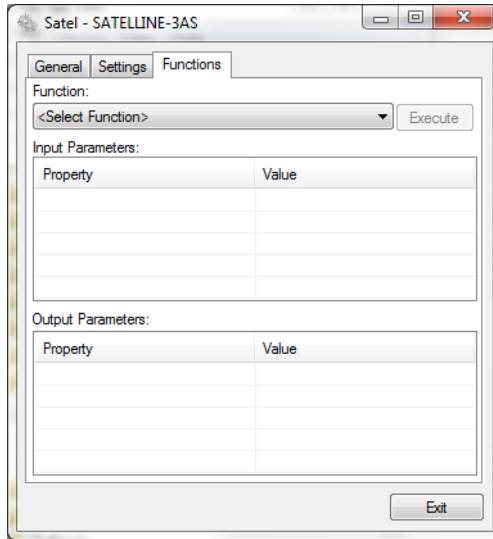
Figure 3-11. Functions page

The following functions are available for executing in this modem:

- *AddChannel*: This command is intended to add an operating frequency from a list defined by the dealer to the list defined by the user.

- *DeleteAllChannel*: Intended to delete all operating frequencies from the list defined by the user.

- *FactoryReset*: Resets all the parameters to their default values.

Configuring the Receiver

The GRX1 can be configured in several ways for collecting data for RTK or post-processing.

- A static Base station collects measurement information and saves this data to its internal memory.
- An RTK Base station collects measurement information, determines differential corrections, and transmits them to the RTK Rover(s).
- A static Rover collects observation data from the same satellites during the same time interval as the static Base station.
- An RTK Rover collects measurement information and accepts corrections from the RTK Base station to compute its relative position.

To configure, manage files, or maintain the receiver, connect the receiver and a computer using one of the following methods, and start SRU:

- use a Bluetooth-enabled external device (computer)
- use an RS232 serial cable

SRU configures the various parts of the receiver, saving the settings in the receiver's memory.

Once you have established a connection between the receiver and the computer, you can:

- configure the receiver and its components
- send commands to the receiver
- download files from the receiver's memory
- load a new OAF and other configuration files to a receiver

Once an SRU connection with the receiver has been established, all icons on the screen become active (Figure 3-12 on page 3-17).
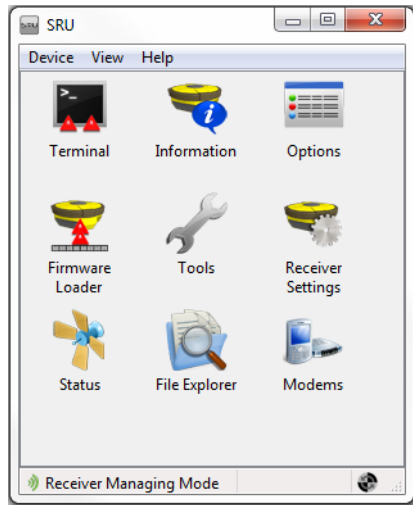
Figure 3-12. SRU Connection Established

1. Click on the *Receiver Settings* icon to open the **Receiver Settings**, then use the *Receiver Settings* options to configure the connected receiver (Figure 3-13).
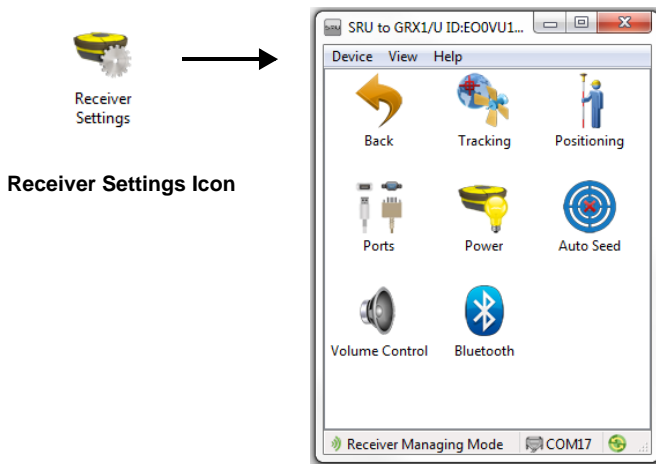
Figure 3-13. Receiver Settings

2. Click on the *Tracking* icon (Figure 3-14 on page 3-18).

3. On the *Antenna* tab, set the antenna type to be used with the connected receiver.

Tracking Icon
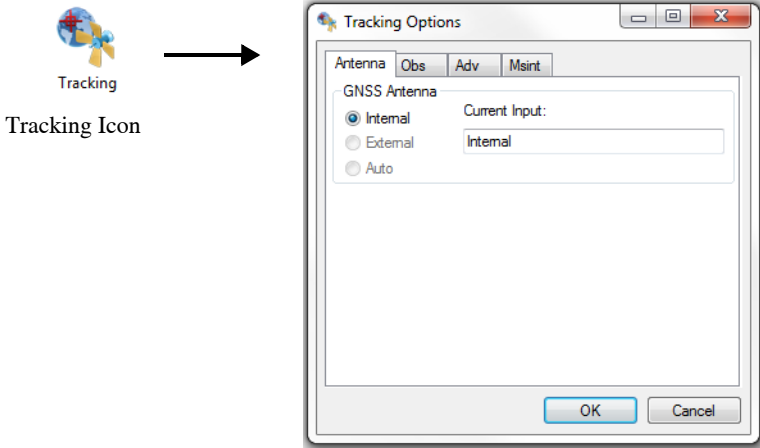
Figure 3-14. Set Antenna Parameters

4. Click on the (*Obs)ervation* tab (Figure 3-15 on page 3-19) to set the following parameters, then press **Ok** to save.

- *Elevation mask position computation:*
    – Set to 13°
- *PDOP mask for position computation panel:*
    – enter a *PDOP* mask value.
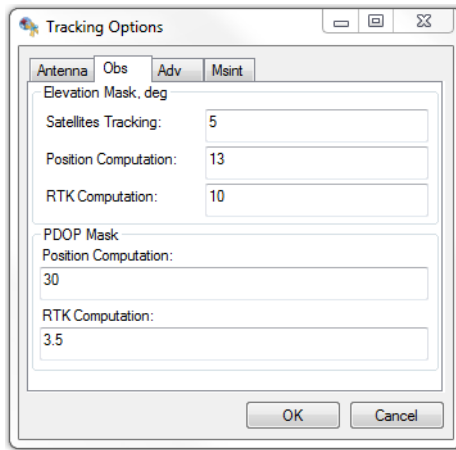
Figure 3-15. Configure Receiver Positioning – Elevation Mask

5. Click the *Advanced* tab to set the following parameters, then press **Ok** (Figure 3-16 on page 3-20) to save.

   • *Anti-jamming* – if available, enables suppression of narrow-band interference for GPS, GLONASS, L1, and L2 signals, for auto-detected or manually selected bands affected by interference if available for the connected receiver.

   • *C/A code multipath reduction* – enables the use of a special signal processing technique for reduction of C/A code phase multipath.

   • *C/A carrier phase multipath reduction* – enables the use of a special signal processing technique for reduction of C/A carrier phase multipath.

   • *Cinderella* – enables the Cinderella option which sets all receiver options to their maximum allowable values for 24 hours every other Tuesday at GPS midnight.

   • *Static Co-Op tracking* – allows only the static receiver to use satellites with lower signal-to-noise ratios. Use only if the receiver's antenna remains completely stationary throughout the survey. Any movement may result in losing the satellite lock.
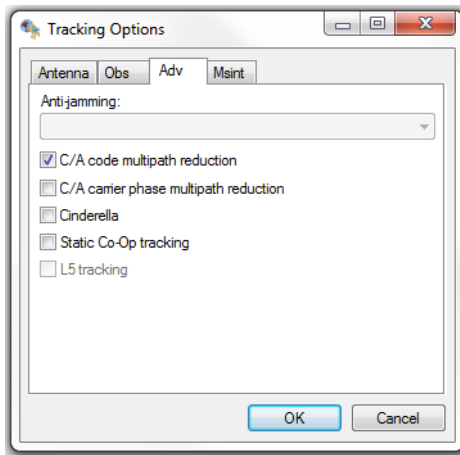
Figure 3-16. Configure Advanced Parameters

Configuring the Base

In addition to the settings from the previous section, the following Base configurations are recommended for the most common applications; however, you can select configuration parameters as needed for your particular jobsite

1. For the Base receiver, click the *Auto Seed* icon on the *SRU* dialog box (Figure 3-13 on page 3-17). The *Auto Seed* dialog box displays to set the following parameters (Figure 3-17 on page 3-21), then press **OK** to save.

   • *Enable Auto Seed* – enables the Auto-Seed functionality for the base receiver.

   Auto-seed feature will provide users the ability to quickly setup and begin RTK operations without using an external interface to localize the base receiver. The user will simply set up over a mark and power up. The base receiver will automatically select a new position gathered by autonomous averaging and save it for later re-occupation.

   • *Maximum distance* – selects a point from positions stored in memory if the point has been previously occupied and the receiver position falls within proper tolerance.

- *Enable averaging mode* – check mark this box to enable averaging autonomous positions for a occupation point with the interval set in the *Position averaging interval* field below in seconds.

Auto Seed Icon
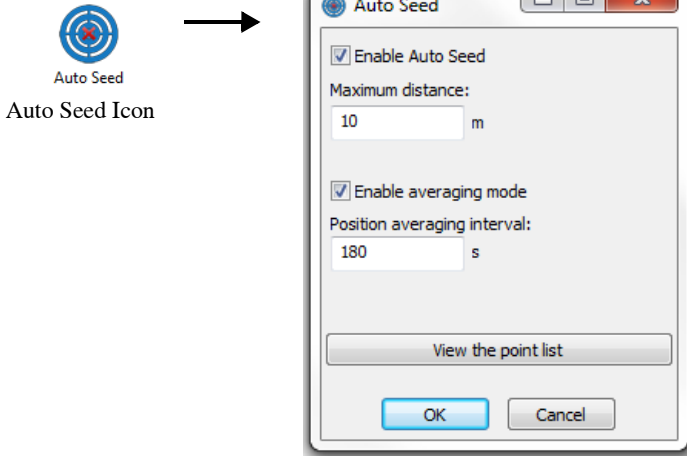
Figure 3-17. Base Configuration

- **View the point list** – press to open a list of previous occupations saved in the receiver memory.

  The *Auto Seed, Point List* contains information about all occupations which stored in the receiver memory: names, date and time, coordinates of phase center and/or antenna reference point, whether the point was auto determined and protected from deleting. For details on configuring the Auto Seed functionality, refer to the *SRU Reference Manual*.

Configuring the Rover

In addition to the settings outlined in the Receiver configuration section, the following Rover configurations are recommended for the most common applications; however, you can select configuration parameters as needed for your particular jobsite.

NOTICE   Do not make other changes without first consulting the *SRU Reference Manual.*

Connect the receiver and computer as described in "Connecting the Receiver and a Computer" on page 2-3.

1. For the Rover receiver, click the ***Positioning*** icon on the ***SRU*** dialog box (Figure 3-13 on page 3-17).

    On the ***Positioning*** dialog box, set the following parameters on the ***General*** tab, then press **OK** (Figure 3-18 on page 3-23) to save.

    *   ***Positioning Mode*** – For post-processed surveys, select Standalone; for RTK surveys, select RTK float or RTK fixed.
    *   ***Enable Solutions*** – select solutions used in position computation.
        *   – Standalone: where the receiver computes 3D coordinates in autonomous mode without using differential corrections.
        *   – Code Differential: where the Rover receiver computes the current relative coordinate in differential mode using only pseudo ranges.
        *   – RTK Float: where the Rover receiver computes the current relative coordinates in differential mode using both pseudo ranges and phases; however, with a float solution, the phase ambiguity is not a fixed integer number and the "float" estimate is used instead.

– RTK Fixed: where the Rover receiver computes current relative coordinates, with ambiguity fixing, in differential mode.
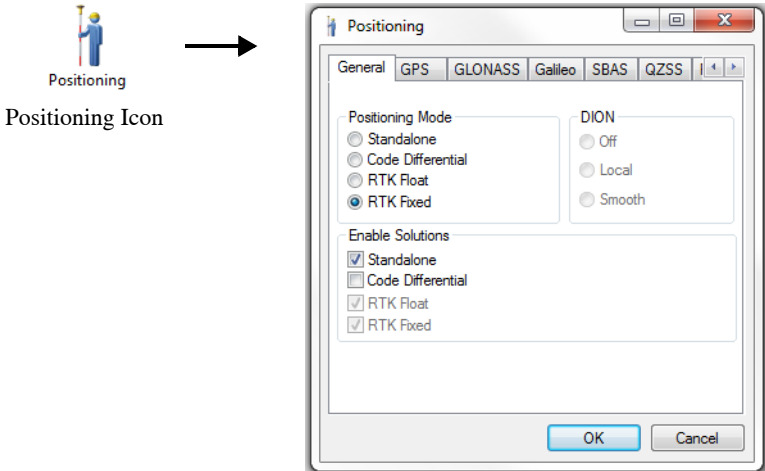
Positioning Icon

Figure 3-18. Rover Configuration

- DION solutions – select one of the following options:
  - Off: disables the DION engine.
  - Local: provides precise positioning with respect to a starting point.
  - Smooth: provides smoothed estimates of absolute positions using refined delta positions from carrier phase processing.

2. For RTK surveys, click the **Ports** icon on the *SRU* dialog box (Figure 3-13 on page 3-17), set the following port parameters for the serial port.
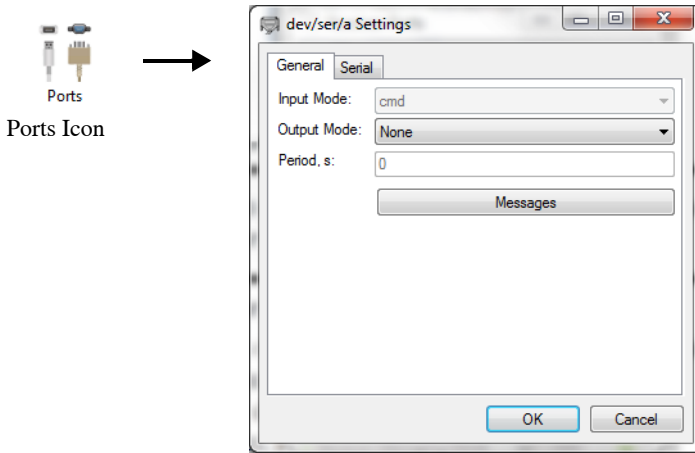
Figure 3-19. Ports Configuration

> **NOTICE**   For post-processed surveys, keep the default values for these parameters.

3. Press **OK** to save the settings and close the dialog box.

    Once the receiver is configured, the configuration will remain until you change it using SRU, by resetting the parameters to default values or by clearing the NVRAM. For more details on the settings available for configuring receivers, refer to the *SRU Reference Manual*.

4. For RTK Rover receivers, click the *Status* icon on the *SRU* dialog box (Figure 3-13 on page 3-17), to ensure the receiver obtains differential corrections. Usually, the receiver will start to output the coordinates of the antenna's phase center along with the solution type within 10–30 seconds. However, spread spectrum radios and GSM phones may take as long as 60 seconds to synchronize.

    The *Data Link* tab (Figure 3-20 on page 3-25) reflects the status of the received differential messages and contains the following information:

    • Data link quality in percentage
    • Time (in seconds) elapsed since the last received message

- Total number of received correct messages (dependent on the message type received)
- Total number of received corrupt messages (dependent on the message type received)

If, for some reason, the receiver is not receiving differential corrections, or if none of the ports has been configured to receive differential corrections, the ***Link Quality*** field will be empty or show 0%.

Status Icon
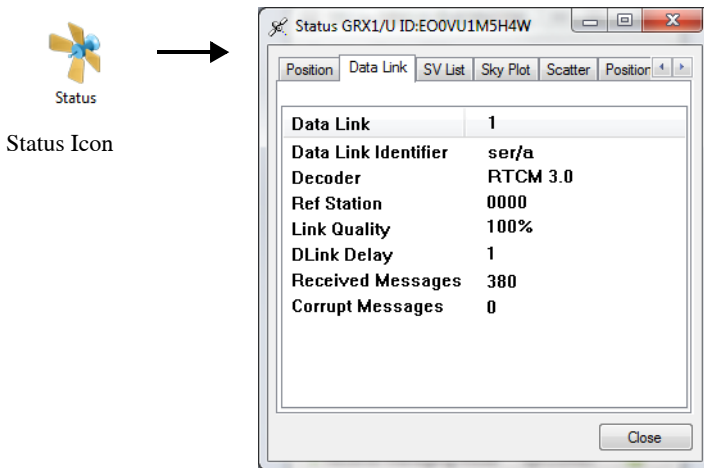
Figure 3-20. Status – Data Link

5. Continue with other configuration activities or click **Device ▸ Disconnect**.

6. Click **Device ▸ Exit** to quit SRU.

   Disconnecting before exiting ensures proper port management.

NOTICE Disconnect the receiver from SRU before exiting to eliminate possible conflicts with the management of the computer's serial ports.

For more information on any of the procedures in this section or on SRU, refer to the ***SRU Reference Manual (PN/7010-0980)***.

Sokkia's field survey software, Spectrum Survey Field, also has the ability to configure Sokkia receivers. Refer to the ***Spectrum Survey Field Reference Manual*** or the ***Spectrum Survey Field User's Manual*** for details.

GRX1 Receiver Setup

After receiver survey configuration, set up each receiver, measure its height, and begin surveying. The LED Display Panel provides quick access for logging data, changing receiver modes, and viewing general data logging and satellite information during a survey.

Receiver Setup

A typical GPS survey system consists of a Base station set up over a known point and a Rover receiver set up to be a mobile data collector. After setting up the Base and Rover receivers, the antenna height must be measured.

Before collecting data, make sure the Base and Rover receivers contain a current almanac and current ephemeris data (see "Collecting Almanacs and Ephemerides" on page 2-8).

Step 1: Set up the Receivers

The Base station must be set up, logging data, and correction data before setting up the Rover receiver. Receiver setup for either post-processing or RTK surveys is the same.

☐ Set up the Base station and its components.

See "To set up the Base receiver" below for details.

☐ Set up the Rover receiver.

See "To set up the Rover receiver" on page 4-3 for details.

To set up the Base receiver (Figure 4-1 on page 4-2), do the following:

1. Install a tripod over a known control point.

2. Secure the universal tribrach to the tripod. Place the tribrach adapter on the tribrach and tighten the screws.

3. Insert the horizontal spacer into the precision tribrach adapter.

4. Attach the 10cm spacer to the horizontal spacer.

5. Attach the GRX1 receiver to the 10cm spacer.

6. Carefully level the tripod and tighten the screws.

7. Attach any other accessories as needed (for example, a backup power supply).

GRX1 Receiver

10cm Spacer

Horizontal Spacer

Tribrach Adapter (Precision)

Universal Tribrach
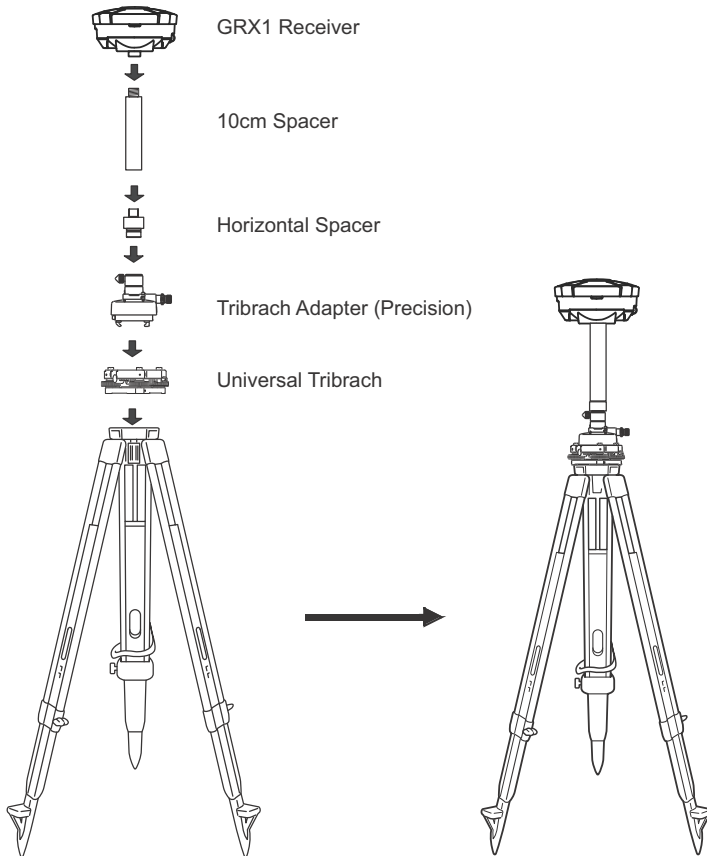
Figure 4-1. Install Tripod and Receiver over Control Point

To set up the Rover receiver (Figure 4-2):

> **NOTICE** Use a bipod during post-process surveys to ensure the antenna/receiver does not move during data logging.

Attach the GRX1 receiver to the top of the rover pole with 5/8"x11" thread. Make sure that the receiver is securely affixed to the top of the rover pole.

GRX1 Receiver

5/8 Inch Screw

Lock
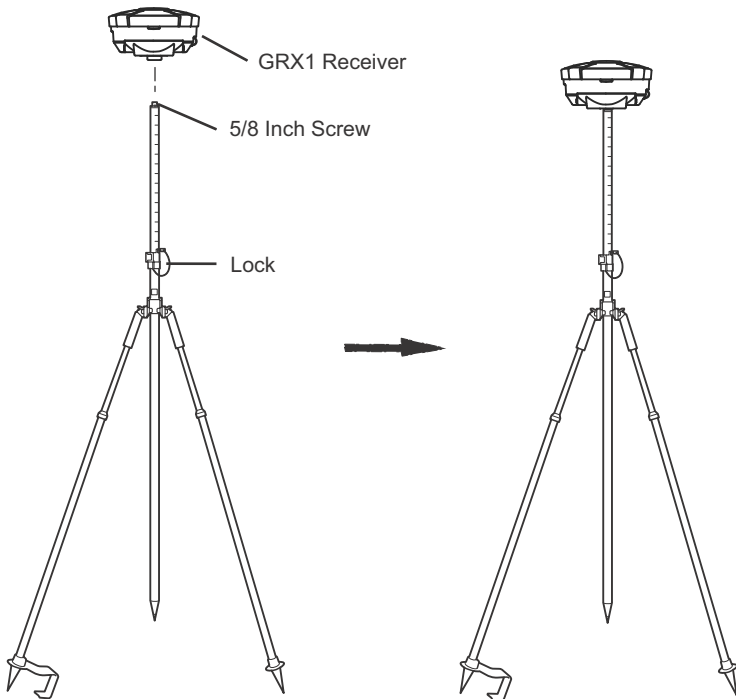
Figure 4-2. Connect GRX1 Receiver to Bipod

Step 2: Measure Antenna Height

The location of the antenna relative to the point being measured is very important for both surveys in which the elevation of the points is

important and in surveys for horizontal location only. Horizontal surveys are often larger in area than can reliably fit on a flat plane, therefore, the antenna adjustment must be done in three dimensions and then projected onto a two dimensional plane.

The receiver calculates the coordinates of the antenna's phase center. To determine the coordinates of the station marker, specify the following:

• Measured height of the antenna above the station marker

• Method of measuring the antenna height

• Model of the antenna used

Antennas have two types of measurements:

• Vertical – measured from the marker to the antenna reference point (ARP) located on the bottom of the receiver at the base of the mounting threads.

• Slant – measured from the marker to the lower edge of the antenna slant height measure mark (SHMM) located on both end panels of the receiver.

The surveying point that GPS/GLONASS uses to measure satellite systems is called the "Phase Center" of the antenna. The antenna Phase Center is analogous to the calibrated point to which a distance meter measures inside of a prism; i.e. it cannot be directly measured to in the field. For precision Sokkia GPS/GLONASS antennas – such as the one inside the GRX1 – the antenna Phase Center must be modeled using a detailed calibration in order to achieved optimal survey results. This model information consists of phase center offset (PCO) and phase center variation (PCV) components, and is applied internally by field software such as Spectrum Survey Field for RTK operations, and by Spectrum Survey Office software for post-mission operations[1].

The only information that must be supplied from field observations when using GRX1 is i) the measured instrument height, and ii) the measurement method used. The Sokkia field and office software will

1. This antenna calibration information (PCO and PCV data) does not need to be entered in the field.

automatically make all antenna Phase Center adjustments[1] that are necessary to deliver properly referenced marker coordinates.

1. Measure the antenna height above the control point or marker, either the slant height or the vertical height.
   You may either measure the vertical height to the Antenna Reference Point (ARP) located at the bottom of the GRX1, or measure the slant height to the Slant Height Measurement Mark (SHMM) on the side of the enclosure (Figure 4-3 on page 4-6).

2. Record the antenna height, points name, and start time in the field notes.

---

1. Advanced users may choose to configure the applied Phase Center model that is used for the GRX1, and this may be done using Sokkia application software such as Spectrum Survey Field and Spectrum Survey Office. This additional step is optional since Sokkia software automatically contains antenna Phase Center models for all Sokkia products, including the GRX1.
   Instead of Sokkia's supplied default Phase Center model for GRX1, alternate or updated Phase Center models (with PCO and PCV data) may be obtained from various government or private calibration services. The most widely recognized of these services are the U.S. National Geodetic Survey (NGS), the International GNSS Service (IGS), and Geo++ GmbH of Germany. The default Phase Center models supplied with Sokkia products are typically based on absolute calibration models from NGS.

89mm

SHMM

55.2mm

LV   LS
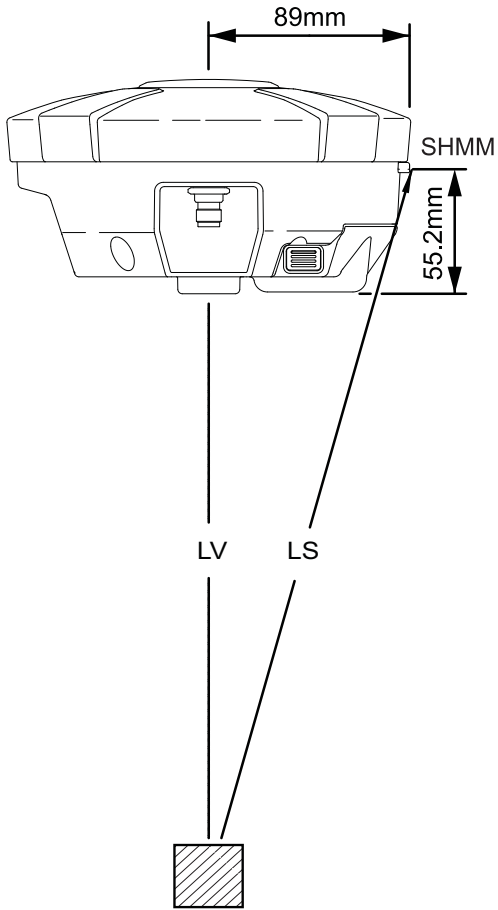
Figure 4-3. Antenna Height Measurement Points

Static Surveying for Base Stations

Static surveying is the classic survey method, well suited for all kinds of baselines (short, medium, long). At least two receiver antennas, plumbed over survey marks, simultaneously collect raw data at each end of a baseline during a certain period of time. These two receivers track four or more common satellites, have a common data logging rate (5-30 seconds), and the same elevation mask angles. The length of the observation sessions can vary from a few minutes to several hours. The optimal observation session length depends on the surveyor's experience as well as the following factors:

- The length of the baseline measured
- The number of satellites in view
- The satellite geometry (DOP)
- The antenna's location
- The ionospheric activity level
- The types of receivers used
- The accuracy requirements
- The necessity of resolving carrier phase ambiguities

Generally, single-frequency receivers are used for baselines whose lengths do not exceed 10 kilometers (6 miles). For baselines of 15 kilometers or greater, use dual-frequency receivers.

Dual-frequency receivers have two major benefits. First, dual-frequency receivers can estimate and remove almost all ionospheric effect from the code and carrier phase measurements, providing much greater accuracy than single-frequency receivers over long baselines or during ionospheric storms. Secondly, dual-frequency receivers need less observation time to reach the required accuracy.

After the survey completes, data the receivers collect can be downloaded onto a computer and processed using post-processing software (for example, Spectrum Survey Field).

Kinematic (Stop & Go) Surveying for Rover Stations

For kinematic stop and go survey, refer to the *Spectrum Survey Field Reference Manual*.

Receiver and File Maintenance

If post-processing the data after completing a survey, the data in the receiver's memory needs to download to a computer. Downloading and deleting files prepares the receiver's memory for the next survey. Occasionally, the receiver's NVRAM may need to be cleared to eliminate communication or tracking problems.

As project expectations expand, the receiver's OAF may need to be updated to provide expanded operation and functionality. The various boards inside the receiver (GPS, power, modem, and Bluetooth) require firmware to properly operate and provide appropriate functionality. Load GNSS firmware updates into the receiver right after Sokkia releases them to ensure the receiver operates at its full potential.

Downloading Files to a Computer

There are several ways to download files to the computer.

Downloading Files via SRU

SRU allows you to download files to your computer and to delete files from the receiver.

1. Connect your receiver and computer. Open SRU See "Connecting the Receiver and a Computer" on page 2-3 for this procedure.

2. Click on the *File Explorer* icon in the main window. The *File Explorer* dialog box displays all logged raw data files (Figure 5-1).
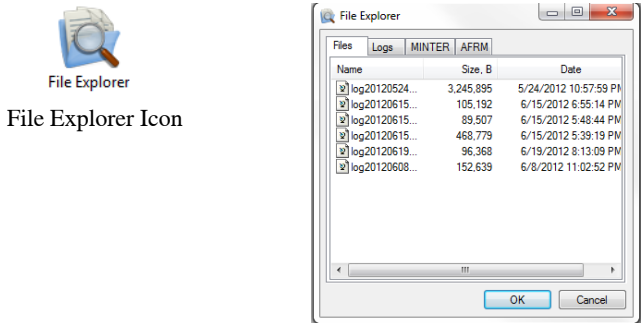
File Explorer Icon

Figure 5-1. File Explorer Dialog Window

3. To save a highlighted file into the computer, right-click and select *Download* from the pop-up menu. In the *Save As* dialog box navigate to or create a folder in which to download and store file (Figure 5-2).

4. Press **Save** to download the file.
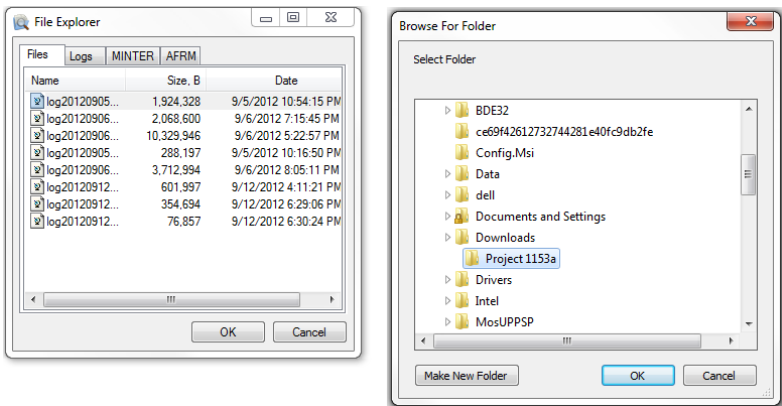
Figure 5-2. Download a File

5. When the process of transferring the file(s) from the receiver to the computer begins, the *Downloading* window (Figure 5-3 on page 5-3) displays the download in progress.
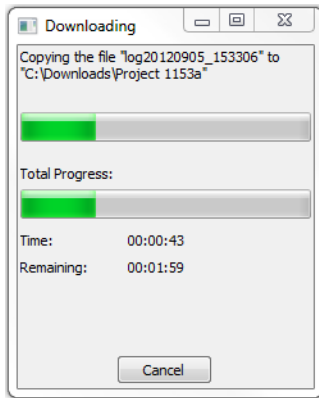
Figure 5-3. Downloading in Progress

Other ways to download files to a computer includes:

- Downloading files directly to Spectrum Survey Office (SSO).

- They could also be transferred by removing the SD card and using a SD card reader connect to a PC to transfer the files.

Deleting Files From the Receiver Using SRU

To delete files from your receiver, perform steps 1and 2 as described in "Downloading Files to a Computer" on page 5-1, then:

1. Highlight the desired file in the *File Explorer* dialog box, right click, and select **Delete** from the pop up menu.

2. Press **Ok** to delete the file.

3. On the *SRU* confirmation screen, press **Yes** to confirm the deletion (Figure 5-4 on page 5-4).
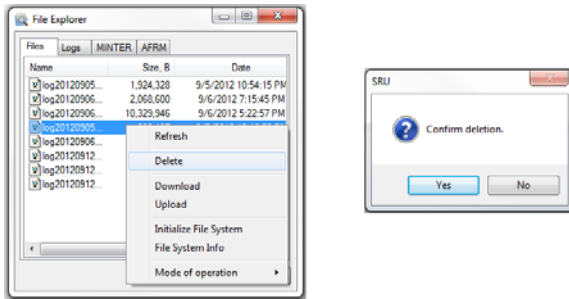
Figure 5-4. Deletion of a File

Deleting Files Using the Power Button

All files stored on the SD/SDHC card are deleted when the power button is pressed for 20 seconds and released in less than 25 seconds (see erase memory description in Table 1-2 on page 1-18).

Managing Receiver Memory

When using the receiver in static or dynamic applications, you may need to know the amount of memory the receiver's log file occupies. The specific memory size depends on the type of data being recorded. Use the formulas below to compute the approximate size of the receiver's log files. These equations are based on the default set of messages.

- SS – the estimated size of one epoch of raw data in the receiver's log file (expressed in bytes).

- N – the number of observed satellites per epoch.

    When recording only L1 data:

    $$SS = 183 + 22*N$$

    When recording L1 and L2 data:

    $$SS = 230 + 44*N$$

Managing Receiver Options

The Option Authorization File (OAF) enables certain functions, features, and options in the receiver, such as the following:

- the type of signal (L1, L1/L2, and so on) the receiver processes

- the amount of data the receiver stores in the memory

- the rate at which data is transmitted or received

For a complete list of available options and details, consult with your Sokkia dealer.

Checking the Receiver's OAF

Use SRU to view receiver status options.

1. Connect your receiver to the computer. Open SRU. See "Connecting the Receiver and a Computer" on page 2-3 for this procedure.

2. Click on the **Options** icon in the main window (Figure 5-5).

   The **Receiver Options** dialog box (Figure 5-5) displays the current authorization options and uploads new ones.
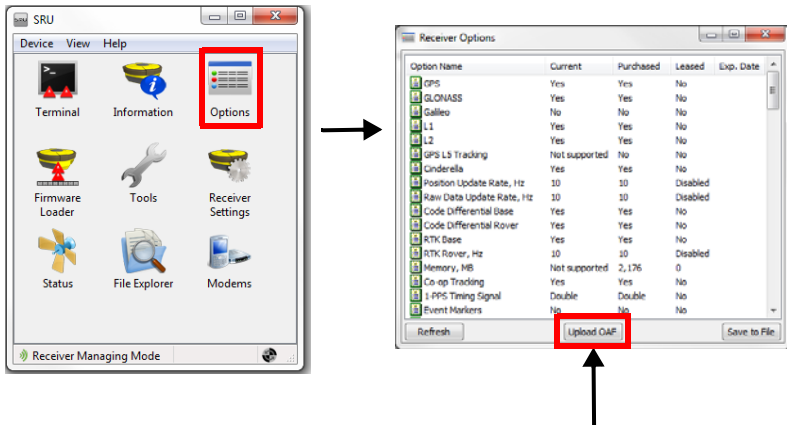
Figure 5-5. Checking Receiver Options

Uploading an OAF

OAF files comes from Sokkia dealers. For any OAF related questions, e-mail Sokkia at options@sokkia.com and include the receiver's ID number (see the bottom of the receiver for the ID).

1. To load a new OAF, follow steps one and two in "Checking the Receiver's OAF" on page 5-5.

2. Press **Upload OAF** at the bottom of the *Receiver Options* dialog box (Figure 5-5 on page 5-5).

3. Navigate to the location of the new Option Authorization File, select the appropriate file, and press **Open** (Figure 5-6).
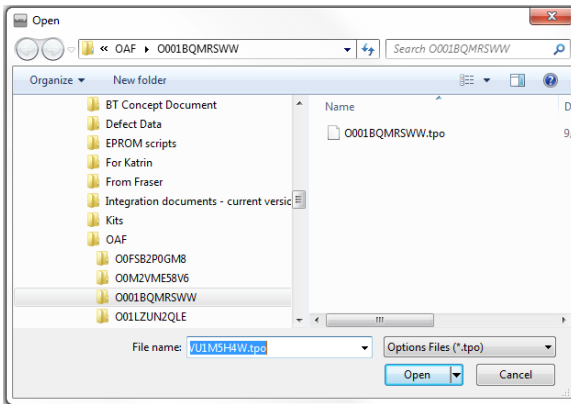
Figure 5-6. Load OAF

4. Sokkia SRU initially checks to see if the selected file is compatible with the currently connected receiver. If a file not intended for this receiver was selected, the *Upload OAF* dialog box (Figure 5-7 on page 5-7) displays an *error* icon next to the Receiver ID and disables the *Upload the File to the Receiver* button.
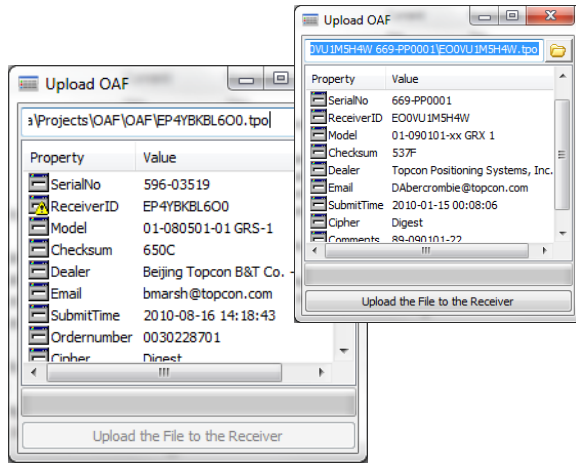
Figure 5-7. Compatibility Check of OAF

5. Press *Upload the File to the Receiver* to start loading the file.

 If an OAF file is uploaded to the receiver, SRU will display a *confirmation* dialog box to reset the receiver and put new authorization options into operation (Figure 5-8).

6. Press **Yes** on the *confirmation* dialog box (Figure 5-8).
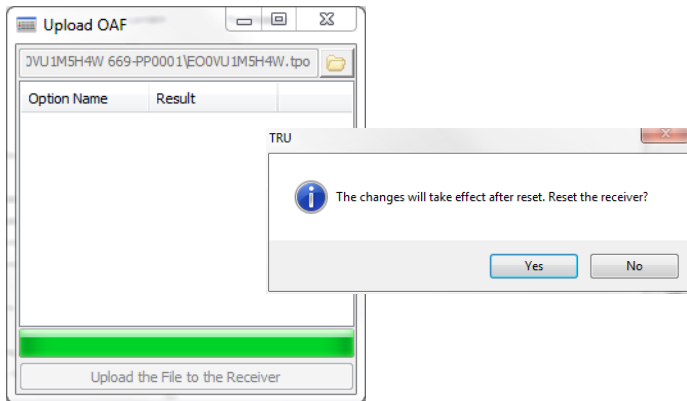
Figure 5-8. Reset the Receiver Confirmation Dialog Box

Loading New GNSS Firmware

Receiver board firmware is released as a compressed file that the user can download and decompress. This file contains the following two files:

- ramimage.ldr – the Receiver board RAM file
- main.ldp – the Receiver board Flash file

To upload firmware files to GRX1 receiver, do the following steps:

1. Connect your receiver and computer. Open SRU See "Connecting the Receiver and a Computer" on page 2-3 for this procedure.
2. Click on the *Firmware Loader* icon in the main window (Figure 5-9).

   On The *Upload Firmware Loader* dialog box (Figure 5-9) you can upload firmware files to the connected receiver.
3. In the *Device* field, select **Receiver/modem** from the drop-down list.
4. In the *Capture Method* field, select **Soft Break** (recommended) from the drop-down list.
5. Browse for and select the receiver board's RAM image file and Main Flash file (Figure 5-9)

Firmware Loader Icon
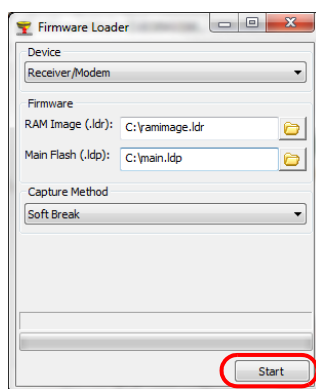
Figure 5-9. Upload Firmware Loader Dialog Box

6. Press **Start** to upload the selected files (Figure 5-9).

7. Press **OK** to complete uploading new firmware to the receiver (Figure 5-10).
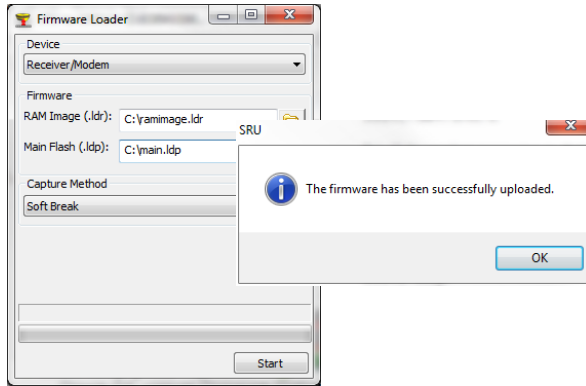
Figure 5-10. Firmware – Successfully Loaded

Loading New Main Board Firmware

1. Perform factory reset on the receiver.
2. Remove storage card from the receiver.
3. Load the "acpu.sbc" file onto the storage card in a folder named "Firmware".
4. Insert the storage card back into receiver.
5. Power on the receiver.
6. Factory Reset the receiver.

> **NOTICE**
>
> The receiver will power up 20-30 seconds slower than usual; the "l0l0l" LED will be flashing, which means that FW is upgrading.

7. Factory Reset the receiver once more to bring it back to its factory settings.
8. Use SRU to ensure that the firmware has been upgraded (by viewing the firmware version in the information screen).

Clearing the NVRAM

The receiver's Non-Volatile Random Access Memory (NVRAM) holds data required for satellite tracking, such as ephemeris data and receiver position. The NVRAM also keeps the current receiver's settings, such as active antenna input, elevation masks and recording interval, and information about the receiver's internal file system.

Even though clearing the NVRAM is not a common (nor normally a recommended) operation, there are times when clearing the NVRAM can eliminate communication or tracking problems. Clearing the NVRAM in your receiver can be interpreted as a "soft boot" in your computer.

After clearing the NVRAM, it takes around 15 minutes for the receiver to collect new ephemerides and almanacs.

Clearing the NVRAM of your receiver will not delete any files already recorded in your receiver's memory. However, it will reset your receiver to factory default values.

In addition, the NVRAM keeps information about the receiver file system.

Using SRU to Clear the NVRAM

1. Connect your receiver and computer. Open the SRU. See "Connecting the Receiver and a Computer" on page 2-3 for details.
2. Click on the *Tools* icon in the main window.

The *Tools* dialog box displays (Figure 5-11) that allows the user to reset the receiver and to clear the NVRAM.
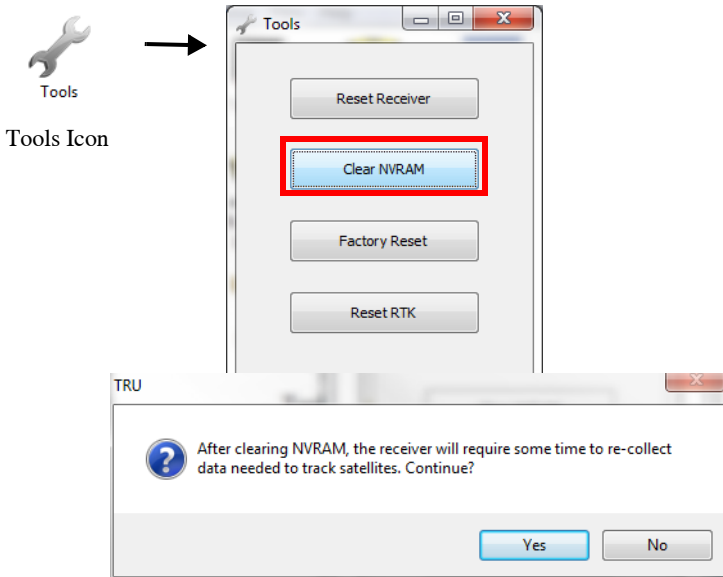
Figure 5-11. Tools Dialog Box

3. Press **Clear NVRAM** on the *Tools* dialog box (Figure 5-11)*.* The *SRU confirmation screen* displays (Figure 5-11).

4. On the *SRU confirmation screen*, press **Yes** to continue (Figure 5-11).

Notes:

Troubleshooting

This chapter will help you diagnose and solve some common problems you may encounter with your receiver.

> **WARNING** Do not attempt to repair equipment yourself. Doing so will void your warranty and may damage the hardware.

Check This First!

Before contacting Sokkia support, check the following:

- Check all external receiver connections carefully to ensure correct and secure connections. Double check for worn or defective cables.
- Check all power sources for a drained battery or incorrectly connected battery/cables.
- Check that the most current software is downloaded onto the computer and that the most current firmware is loaded into the receiver. Check out the Sokkia website for the latest updates.

Then, try the following:

- Restore default settings using SRU; click **Tools ▶ Factory Reset**.
- Clear the NVRAM (see Figure 5-5 on page 5-5).
- Initialize the file system (File Explorer, then right click and select **Initialize File System**). This will erase all files inside the SD/SDHC card in receiver.

If the problem persists, see the following sections for other solutions.

Troubleshooting Quick List

For receiver power issues:

If "The receiver does not power up," see page 6-2.

For receiver issues:

If "The receiver does not lock on to satellites for a long period of time," see page 6-4.

If "The receiver tracks too few satellites," see page 6-4.

If "The receiver cannot obtain Code Differential and/or RTK solutions," see page 6-5.

If "The receiver does not start logging data," see page 6-7.

For Bluetooth connection issues:

If "SRU error message: Can't find receiver," see page 6-7.

If "SRU error message: Open COM# port failed: Access is denied," see page 6-9.

If "SRU error message: Open COM# port failed: Access is denied," see page 6-9.

If "No discovery of available devices," see page 6-9.

If "Can see the icon for the receiver's Bluetooth module on the computer screen, but cannot connect to it," see page 6-9.

For modem issues:

If "SRU cannot connect to the receiver," see page 6-10.

> **TIP**
> Clearing the NVRAM returns the receiver to Auto power mode (see "Clearing the NVRAM" on page 5-10).

The receiver does not power up

⇨ The attachable battery may be improperly attached.

- Check that the battery is correctly attached.

- Check that the battery contacts at the top of the attachable battery are clean and dust free.

⇨ The battery may be discharged.

- Connect/attach a fully charged battery and retry. See "Charging the Battery" on page 1-12.
- Charge the battery overnight. See "Charging the Battery" on page 1-12.

⇨ The cable may be disconnected or damaged if using an external power source.

   Check that the cable is securely connected and undamaged.

⇨ The receiver may have a defective charger or defective battery.

   After changing the battery or connecting an external power source, if the receiver still does not power up, contact Sokkia Customer Support for advice.

Receiver Problems

The following are some of the most commonly encountered receiver problems.

The receiver cannot establish a connection to a computer or external controller

Cable specific problems:

⇨ The cable is not properly plugged in.

- Check that the cable connector is attached to the correct receiver port.
- Unplug the cable, then securely and properly reconnect it to the receiver.
- See "GRX1 Receiver" on page 1-8" and "Radio (Modem) RF Connector" on page A-15 for information on the receiver's connectors.

⇨ The cable is damaged.

   Use an undamaged cable. Contact your Dealer to replace the cable.

Generic problems:

⇨ The receiver port used for connection is not in Command mode.

1. Connect your receiver and a computer using a free port (see "Connecting the Receiver and a Computer" on page 2-3) and start SRU.
2. Click **Receiver Settings ▸ Ports**.
3. Change the *Input* for the port used for connection to "Cmd".

The receiver does not lock on to satellites for a long period of time

⇨ The receiver stores an old almanac.

Update the almanac. See "Collecting Almanacs and Ephemerides" on page 2-8 for details.

⇨ The corresponding receiver options may be disabled or expired (L1/L2, GPS/GLONASS must be on to track satellites).

• See "Managing Receiver Options" on page 5-5 for details on how to check current options.
• Order a new OAF with the desired options activated to enable or extend validity of the corresponding receiver options. Contact your dealer or visit the Sokkia website for details
• Refer to the *SRU Reference Manual* for a detailed description of options.

The receiver tracks too few satellites

⇨ The survey is conducted near obstructions (tree canopy, tall buildings, and so forth).

• Check that the Multipath Reduction boxes have been enabled.

1. Connect your receiver and a computer and start SRU. See "Connecting the Receiver and a Computer" on page 2-3.
2. Click **Receiver Settings ▸ Tracking ▸ Adv**; then enable *Multipath Reduction* settings.

• Move to an area free of obstructions, if applicable.

The receiver cannot obtain Code Differential and/or RTK solutions

⇨ Incorrect Base coordinates entered.

Specify the correct coordinates for the Base station using SRU or another suitable field data collection software.

⇨ The receiver is not configured as a Base or Rover.

• If the receiver should function as a Base, ensure it has the proper configuration. See Chapter 3 for details.

• If the receiver should function as a Rover, ensure it has the proper configuration. See Chapter 3 for details.

⇨ The corresponding receiver options may be disabled or expired.

• See "Managing Receiver Options" on page 5-5 for details on how to check current options.

• Order a new OAF with the required options activated to enable or extend validity of the corresponding receiver options. Contact your dealer or visit the Sokkia website for details

• Refer to the *SRU Reference Manual* for a detailed description of options.

⇨ There are not enough common satellites. In order to obtain a fixed solution, the Base and Rover should track at least five common satellites.

• Ensure that both the Rover and Base receivers use the same, and updated, almanac. See "Collecting Almanacs and Ephemerides" on page 2-8.

⇨ A discrepancy exists between the differential standards used at the Base and Rover receivers.

Ensure the Base and Rover receivers use the same corrections input/output format:

1. Connect your receiver and a computer and start SRU. See "Connecting the Receiver and a Computer" on page 2-3.

2.   Click **Configuration** ▸ **Receiver**, then the *Ports* tab. Use the same input/output format for both receivers.

⇨ The modem battery is low.

⇨ The transmitting and/or receiving antenna may be improperly connected.

  • Check that the radio modem's antenna is securely and properly connected to the antenna connector.
  • Check that the radio modem's antenna is undamaged. If damaged, contact your Sokkia dealer to replace the antenna.

⇨ The specified baud rate is incompatible with the baud rates the modem supports.

  The baud rate is the rate at which the receiver transmits differential messages to the modem and vice versa.

  • Change the baud rate to that which your modem supports. Refer to the modem's manual for information.

⇨ The Base and Rover modems use different radio link parameters.

  Configure the Base and Rover radio modems according to the procedures listed in the applicable section.

  • For details on a UHF II radio modem, see "Topcon Digital UHF II Modem" on page 3-4.
  • For details on the Satel Radio, see "Satel Modem" on page 3-10

⇨ The distance between the Base and Rover is too far.

  • Close the distance between the Base and the Rover.
  • Use repeaters to increase radio coverage.

⇨ There may be a source of radio interference that disrupts radio communications.

  • Change the RF channel (if possible).

- Use a spectrum analyzer to detect the radio characteristics of the interfering signal and change your system's configuration accordingly.
- Remove the source of jamming signal or relocate your radio antennas (if possible).

The receiver does not start logging data

⇨ The receiver has no SD/SDHC installed or the memory option is disabled or expired.

- Check that the card is properly inserted. For details, see "To install the SIM card" on page 1-22.
- Check that the memory option is enabled. For details, see "Checking the Receiver's OAF" on page 5-5.

⇨ The receiver's memory card has no free space.

- Download and/or delete data files to free up space for new files (see "Downloading Files to a Computer" on page 5-1 and "Deleting Files From the Receiver Using SRU" on page 5-3).

Connection Problems

The following are some of the most commonly encountered error messages and other problems.

SRU error message: Can't find receiver

⇨ The receiver is turned off.

Ensure the receiver has power and is turned on.

⇨ If using a cable, the cable's connectors are improperly attached.

- Check that the cable connector is attached to the correct serial port.
- Unplug the cable, then securely and properly reconnect it to the receiver.

⇨ If using a cable, the cable is damaged.

- Use an undamaged cable.
- Contact your Sokkia dealer to purchase a new cable.

⇨ The COM port the receiver is attached to differs from the one selected in SRU.

- Ensure that the RS232 serial cable is attached to the COM port specified in the SRU communication port list.
- See "Establishing a Wireless Connection" on page 2-5 for details.

⇨ The receiver port used for connection is not in Command mode.

1. Connect your receiver and a computer using a free port (see "Connecting the Receiver and a Computer" on page 2-3) and start SRU.
2. Click **Receiver Settings ▶ Ports**.
3. Change the *Input* for the serial port used for connection to "Command".

This is the most common cause for this error message. Use SRU to double-check the settings for the connection port.

⇨ The settings for Port D may have been changed.

- The settings for Port D are: 115200 baud rate, 8 data bits, 1 stop bit, no parity, and no handshaking.
- Try enabling RTS/CTS handshaking for Port D. Do not change other settings.

⇨ The corresponding receiver options may be disabled or expired (serial port D must be enabled).

- See "Managing Receiver Options" on page 5-5 for details on how to check current options.
- Order a new OAF with the required options activated to enable or extend validity of the corresponding receiver options. Contact your dealer or visit the Sokkia website for details

- Refer to the *SRU Reference Manual* for a detailed description of options.

SRU error message: Open COM# port failed: Access is denied

⇨ Another application uses the computer port dedicated for connection.

- Close the application, then re-connect.
- Connect the receiver via another, unused computer port.

No discovery of available devices

⇨ The receiver is not receiving power.

- Check that the receiver is getting power and is turned on.
- Check that the power cable is attached to the port marked "PWR".
- Unplug the cable, then securely and properly reconnect it to the receiver.
- If the power cable is damaged, contact your Dealer to purchase a new cable.

⇨ Slot 2(C) of the receiver is turned off.

1. Connect your receiver and a computer using an RS232 serial cable (see "Establishing an RS232 Serial Cable Connection" on page 2-3).
2. Click **Receiver Settings ▶ Bluetooth**.
3. In the *Turn on/off Slots* area, enable the Slot 2(C) check box.

Can see the icon for the receiver's Bluetooth module on the computer screen, but cannot connect to it

⇨ Device security settings probably differ.

- Make sure your Bluetooth enabled devices use the same security settings.
- See "Establishing a Wireless Connection" on page 2-5.

⇨ Bluetooth module settings may have changed.

1. If you changed settings for your Bluetooth module, remove it from the list of discovered Bluetooth devices using the Bluetooth manager program (supplied with the device used to manage the receiver).

2. Repeat the search.

SRU Problems

The following is the most commonly encountered SRU problem.

SRU cannot connect to the receiver

⇨ The receiver is turned off.

   Ensure the receiver has power and is turned on.

⇨ If using a cable, the cable's connectors are improperly attached.

   • Check that the cable connector is attached to the correct serial port.

   • Unplug the cable, then securely and properly reconnect it to the receiver.

⇨ If using a cable, the cable is damaged.

   • Use an undamaged cable.

   • Contact your Dealer to purchase a new cable.

⇨ If using Bluetooth wireless technology, the incorrect port is selected, or the receiver or computer does not support Bluetooth.

   • Use a computer or receiver that has Bluetooth wireless technology enabled/installed.

   • Check that the computer and receiver use the correct ports for communication. For the GRX1 receiver, this is port A.

⇨ The corresponding modem options may be disabled or expired.

   • See "Managing Receiver Options" on page 5-5 for details on how to check current options.

- Order a new OAF with the required options activated to enable or extend validity of the corresponding receiver options. Contact your dealer or visit the Sokkia website for details

Getting Technical Support

If the troubleshooting hints and tips in this Operator's Manual fail to remedy the problem, contact Sokkia Customer Support.

Website

The Sokkia website provides current information about Sokkia's line of products. The support site provides access to Sokkia field and office software, manuals, frequently asked questions, and so forth.

To access the Sokkia website, visit www.sokkia.com.

To access the Sokkia support site, visit www.sokkiasupport.com.

Phone

To contact Sokkia Customer Support by phone, call:

- 1-800-4-Sokkia or 1-800-476-5542
- 1-866-4-Topcon or 1-866-486-7266

Notes:

Specifications

This Sokkia product is a 72-channel GNSS receiver with an internal radio modem, a Bluetooth wireless technology module, an optional GSM, HSPA, or CDMA modules, an optional, removable SD/SDHC memory card, and a rugged magnesium housing complete with an LED Display Panel and cable connectors.

Receiver Specifications

The following sections provide specifications for the receiver and its internal components.

General Details

Table A-1 lists the receiver's general specifications.

Table A-1. Receiver General Specifications

Physical	
Enclosure	Magnesium alloy housing
Color	Sokkia Blue and Sokkia Gray
Dimensions	184 x H 95mm (7.24 x H 3.74 in)
Weight: • GRX1 receiver • BDC58 battery • Internal modems	1.1kg (2.43 lb.) 195g (6.9 oz.) 115 to 230g (4.1 to 8.2 oz.), depending on modem specifications
Antenna	Internal
Battery	Built-in, detachable/replaceable
Controller	External

Table A-1. Receiver General Specifications (Continued)

Mounting	5/8-11, quick release
Seals	Silicon
Keys	One key: Power (On/Off)
Status LEDs Indicators	**22 Status LEDs:** • Receiver Health Status • Scheduler Status • Available Power Bar • Battery Status • Satellite Tracking Bar • Position Status • Memory Capacity Bar • File Status • Wireless Status • Radio Status • Serial Port Status
Voice navigation	Multi-lingual voice messages for receiver status
Environment	
Operating temperature	• GRX1 receiver – -40 to +65°C (-40 to +149°F) • BDC58 battery – -20 to +65°C (-4 to +149°F) • UHF/GSM modems – -20 to +55°C (-4 to +131°F)
Storage temperature	-45°C to +70°C (-49 to +158°F)
Humidity	100% condensation
Dust/Water Protection	IP67 (IEC 60529:2001) with all connector caps closed. Protected against temporary immersion up to 1m (3.3ft) depth.
Shock	2m (6.56ft) pole drop
Power	
Built in battery, Rechargeable	BDC58 Li-ion 4,300mAh (Typical) / 7.2V DC

Table A-1. Receiver General Specifications (Continued)

Battery weight	195g
Battery charging time	4 hours at 25°C (77°F)
Operating time	Over 7.5 hours (20°C /68°F) / Only static tracking / with Bluetooth connection)
External power	1 port
Charger CDC68: • Recharging time • Input voltage External Power: • Input voltage	Approx. 4 hours at 25°C (77°F) 100 to 240V AC (50/60Hz)[a] 6.7 to 18V DC
Consumption	4W (w/o UHF modem)
Battery charge	Uses CDC68
On-board	Backup battery for NVRAM and RTC storage; Operation for approximately 100 days.
Data Management	
Memory	SD/SDHC card (FAT16/32 formats)
Data format	RTCM SC104 2.1/2.2/2.3/3.0/3.1, CMR, CMR+, NMEA, TPS
Update/output rate[b]	1Hz, 5Hz, 10Hzm 20Hz
Communication Port	RS-232C (4,800 to 115,200bps)
Port specifications	COM1: 4,800 to 115,200 bps (RS Level) 115,200bps (default) Bluetooth: 115,200bps (SPP / Single Channel mode)
LED Display Panel	Modem Antenna (BNC or reverse polarity TNC depending on modem type), PWR, RS232C Serial cable

Table A-1. Receiver General Specifications (Continued)

Wireless communication	
Bluetooth modem	V1.1.1, Class 1, 115,200bps
Digital UHF II modem[c]	Internal, receiver (RX) and transmitter (TX) 410 to 470MHz
GSM / HSPA / CDMA modem[d]	Internal
NMEA	
NMEA version	Ver. 2.1, 2.2, 2.3, 3.0
Messages	GGA, GLL, GNS, GRS, GSA, GST, GSV, HDT, RMC, VTG, ZDA, ROT, GMP
Output interval	10Hz, 20Hz, 50Hz, and 100Hz
DGPS	
Correction format	RTCM SC104 Ver 2.1, 2.2, 2.3, 3.0, 3.1
RTCM message type	1, 3, 9, 31, 32, 34; user selectable
Process interval	10Hz standard; 20Hz, 50Hz, and 100Hz optional
Output interval for RTCM correction data	10Hz standard; 20Hz, 50Hz, and 100Hz optional
Elevation mask	0 to 90° (independent of data logging)
RTK	
Correction format	CMR2/CMR+, RTCM SC104 Ver 2.2, 2.3, 3.0 or 3.1
RTCM message type	3, 18, 19, 20, 21, 22; user selectable
Ambiguity initialize	OTF (L1, L1/L2)
Baseline Length	Up to 50km in the morning and evening Up to 32km at noon

Table A-1. Receiver General Specifications (Continued)

Initialize time	5 seconds to 10 minutes depending on the base line length and multipath conditions
Output interval for CMR/RTCM	10Hz standard; 20Hz, 50Hz, and 100Hz optional
Elevation	0 to 90 degrees (independent of data logging)
Solution mode	Delay (synchronization) Extrapolation (not synchronized)
Process interval	10Hz standard; 20Hz, 50Hz, and 100Hz optional
Positioning Accuracy[e]	

Static	L1 only:
	    H: 3mm + 0.8ppm (x baseline length)
	    V: 4mm + 1.0ppm (x baseline length)
	 L1 + L2:
	    H: 3mm + 0.5ppm (x baseline length)
	    V: 5mm + 0.5ppm (x baseline length)

Fast Static	L1+L2:
	    H: 3mm + 0.5ppm x D
	    V: 5mm + 0.5mm x D

Kinematic	L1+L2:
	    H: 10mm +1ppm x D
	    V: 15mm +1mm x D

RTK	L1/L1 +L2:
	    H: 10mm + 1.0ppm (x baseline length);
	    V: 15mm + 1.0ppm (x baseline length)

DGPS	Post processing/RTCM: Typically less than 0.5m (RMS)
Cold start Warm start Reacquisition	< 40sec < 20sec (typical) < 1sec

a. Use with an appropriate AC power cable.
b. 1Hz standard. Higher rates available as option.
c. Internal "UHF modem" available as factory option.
d. Internal "UHF+GSM/HSPA/CDMA modem" available as factory option.

e. Accuracy depends on the number of satellites used, obstructions, satellite geometry (DOP), occupation time, multipath effects, atmospheric conditions, baseline length, survey procedures and data quality.

NOTICE	Performance specifications assume a minimum of 6 GPS satellites above 15 degrees in elevation and following the procedures recommended in this manual.

NOTICE	In areas of high multipath, during periods of large PDOP, and during periods of increased ionospheric activity, performance may degrade.

NOTICE	Use robust checking procedures in areas of extreme multipath or under dense foliage.

GPS Board Details

Table A-2 lists general specifications for the GPS board.

Table A-2. GPS Board Specifications

Receiver Type (set by activating the proper OAF)	
Internal board: GRX1	G: GPS L1 GD: GPS L1/L2 GG:GPS/GLONASS L1 GGD: GPS/GLONASS L1/L2
Hardware type: country/region/ purpose dependent	with Digital UHF II with Digital UHF II + GSM with Digital UHF II + HSPA with Digital UHF II + CDMA with SATEL + GSM
Tracking Specifications	

Table A-2. GPS Board Specifications (Continued)

Standard Channels	72 universal channels L1 CA, L1 P-code, L2C GPS and GLONASS, WAAS/EGNOS, PCode and Carrier
Tracked Signals[a]	GPS: L1 CA, L1/L2 P-code, L2C GLONASS: L1/L2 CA, L1/L2 P-code SBAS: WAAS, EGNOS, MSAS
Tracking Functions	
Multi-path reduction	Code and Carrier
PLL/DLL setting	Bandwidth, order, adjustable
Co-op tracking loop setting	On/Off, Static Mode, Bandwidth of individual PLL Bandwidth of common PLL
Smoothing interval	Code and Carrier
WAAS/EGNOS/ MSAS	Optional
Data Features	
Formats	TPS, NMEA, RTCM, CMR
Features	Up to 100 Hz update rate for real time position and raw data (code and carrier) 10cm code phase and 0.1mm carrier phase precision RTCM SC104 version 2.1, 2.2, 2.3, 3.0, and 3.1 I/O Multiple Base RTCM Geoid and Magnetic Variation models RAIM Different DATUMs support Output of grid coordinates CMR and CMR+ support
Memory	
Internal Memory	SD/SDHC card, removable
Capacity	Dependent upon the capacity of the installed SD/SDHC card
Logging Interval	0.05 to 86,400 seconds, depending on purchased options

a. Number of channels and tracked signals vary according to receiver configurations.

NOTICE   Cinderella days is an option that turns a single frequency GPS receiver into a dual-frequency GNSS receiver for 24 hours every other Tuesday at GPS midnight.

Refer to Sokkia's website for more information and specific Cinderella day events.

Internal UHF Satel Modem Details

Table A-3 lists general specifications for the internal UHF Satel modem.

Table A-3. Internal UHF Satel Modem Specifications

General	
Frequency Range	380–470; according to country TX: specific 2MHz frequency range allocated according to country RX: 3 frequency ranges from 410–430MHz, 430–450MHz, or 450–470MHz
Channel spacing	25 kHz (for Germany, 12.5 kHz)
Number of channels	Four to Six
Frequency stability	< ±1.5 kHz
Type of emission	F1D
Communication mode	Half-duplex
Data speed of serial interface	300–38400 bps
Data speed of radio interface	19200 bps (25kHz channel) 9600 bps (12.5kHz channel)
Data format	Asynchronous

Table A-3. Internal UHF Satel Modem Specifications (Continued)

Transmitter (TX)	
Carrier power	10mW–1W/50 ohms
Carrier power stability	+2dB / -3 dB
Adjacent channel power	according to EN 300 220-1/ETS 300 113
Spurious radiations	according to EN 300 220-1/ETS 300 113
Receiver (RX)	
Sensitivity	-116...-110 dBm (BER<10 E-3)
Common channel rejection	$\geq$ 12dB
Adjacent channel selectivity	> 60 dB @ 12.5 kHz > 70 dB @ 25 kHz
Intermodulation attenuation	> 65 dB
Spurious radiation	< 2nW

Internal Topcon Digital UHF II Modem General Specification Details[a]

Table A-4. Topcon Digital UHF II Specifications

General	
Operating frequency range[b]	UHF 400 – 470 MHz
Modulation techniques	GMSK and 4-Level FSK (4FSK)
Protocols[c,d]	Satel 4FSK PDL GMSK PDL 4FSK TrimTalk GMSK
Occupied bandwidth[b] (channel spacing)	25 kHz, 20 kHz or 12.5 kHz
Data transmission rate at 25 kHz Channel Spacing	9600 bps GMSK 19200 bps 4FSK[ψ]
Data transmission rate at 20 kHz Channel Spacing	4800 bps GMSK 9600 bps 4FSK
Data transmission rate at 12.5 kHz Channel Spacing	4800 bps GMSK[ψ] 9600 bps 4FSK[ψ]
Data speed of serial (RS-232) interface	Max 115200 bps
Forward Error Correction (FEC)	Yes
Scrambling	Yes
Communication mode	Half-duplex
Operation modes	Transmitter Receiver Repeater

a For complete detail on Topcon Digital UHF II modem, refer to ***Topcon Radio Guide Reference Manual*** (PN: 1001598-01).
b Dependent on country and region, and mode (base/rover) of operation. Contact your Dealer, or local government radio authority to understand licensed radio frequency requirements in your area.

c Use of PDL and Satel 4FSK protocols is recommended in applications where possible. Note that a minimum baud rate of 9600 bps is recommended for all RTK operations. Compatibility with TrimTalk is subject to some restrictions.

d *The data transmission configurations indicated (protocol and channel spacing) are the only protocols that provide compliance with UHF Narrowbanding restrictions that are effective as of January 1, 2013 in the US and Canada. For more information, please see* http://transition.fcc.gov/pshs/public-safety-spectrum/narrowbanding-faq.html *for details. Similar restrictions are also in place in other global markets. Please contact your Dealer or local government radio authority to ensure you understand local compliance obligations.*

Bluetooth Module Details

Table A-5 lists the Bluetooth wireless technology module's general specifications.

Table A-5. Bluetooth Module Specifications

Range	Up to 10 m (indoor), up to 50m (outdoor)
Type	Class 1
Service classes	Miscellaneous
Supported profiles	SPP
Frequency Country Code	North America and Europe

Optional Cell Module Details

Table A-6 lists cellular specifications.

Table A-6. Cellular Specifications

Quad Band GSM/GPRS/EDGE Module	
Supported Bands	GSM 850/900/1800/1900 MHz

Table A-6. Cellular Specifications (Continued)

TX Power	850/900 MHz – Class 4 (2 Watt) 1800/1900 MHz – Class 1 (1 Watt)
Data Features	GPRS, Multi-slot Class 10, ***Max downlink 85.6 kbps, max uplink 42.8 Kbps*** EDGE, Multi-slot Class 10, ***Max BR downlink 236.5 Kbps*** CSD, ***Max BR 14.4 Kbps***
AT Command Set	GSM 07.05, 07.07 and 07.10
Regulatory and Approvals	FCC, IC ANATEL (Brazil) COFETEL (Mexico) CMII (China) PTCRB R&TTE/CE GCF QS9000 manufacturing RoHS/WEEE/CCC

Dual Band CDMA 1xRTT Module	
Supported Bands[1]	CDMA 800/1900 MHz
TX Power	800 MHz – Class 3 (24 dBm) 1900 MHz – Class 2 (24 dBm)
Data	1x/QNC/HSPD CSD, ***Max BR 14.4 Kbps***
AT Command Set	N/A
Regulatory and Approvals	CDG1, CDG2 FCC, IC, CCC EMC QS9000 manufacturing RoHS/WEEE

[1]Topcon GNSS receivers equipped with integrated C24 wireless modules are authorized to operate in the US only on the Verizon[TM] wireless network.

Table A-6. Cellular Specifications (Continued)

3.5G Wireless Module (Quad-band GSM and UMTS/HSPA)	
Supported Bands	GSM 850/900/1800/1900 MHz UMTS/HSPA 850/1900/2100 MHz
TX Power	UMTS/HSPA - Class 3 (0.25 Watt) GSM 850/900 MHz – Class 4 (2 Watt) GSM 1800/1900 MHz – Class 1 (1 Watt) EDGE 850/900 MHz – Class E2 (0.5 Watt) EDGE 1800/1900 MHz – Class E2 (0.4 Watt)
Data Features	UMTS/HSDPA/HSUPA 3GPP, Release 6 GSM/GPRS 3GPP, Release 9 Max uplink 5.76 Mbps, max downlink 7.2 Mbps EDGE, Multi-Slot class 12 CSD, *Max BR 14.4 Kbps GSM, Max BR 14.4 Kbps UMTS*
AT Command Set	GSM 07.05, 07.07
Regulatory and Approvals	FCC, IC ANATEL (Brazil) PTCRB R&TTE/CE GCF RoHS/WEEE ACMA BABT

Battery (BDC58) Specifications

Table A-7 lists the BDC58 battery specifications.

Table A-7. Battery Specifications

General	
Nominal voltage	7.2V
Capacity	4.3Ah
Dimensions	38 (W) x 70 (D) x 40 (H) mm
Weight about	about 195g

Charger (CDC68) Specifications

Table A-8 lists specifications for the CDC68 charger.

Table A-8. Charger Specifications

General	
Input voltage:	AC100 to 240V
Charging time per battery (at 25°C)	about 4 hours (Charging can take longer than the times stated above when temperatures are either especially high or low.)
Charging temperature range	0 to 40°C
Storage temperature range	-20 to 65°C
Size:	94 (W) X 102 (D) X 36 (H) mm
Weight:	about 170g

Connector Specifications

The GRX1 has 3 external connectors; one UHF radio modem connector, one power connector, and one serial port connector.

Table A-9, Table A-11 on page A-16, and Table A-12 on page A-17 list the specifications for the external connectors.

Table A-9. UHG Modem Connector Specifications

Modem	Type	Signal Type	Dir	Details
UHF	BNC	Modem I/O	I/O	RF/GSM output from modem antenna

Radio (Modem) RF Connector

The modem connector (Table A-10) is a reverse polarity TNC connector for spread spectrum and a BNC connector for Digital and Satel modem.

Table A-10. Modem Connector Specifications

Modem	Type	Signal Type	Dir	Details
Spread Spectrum	Reverse polarity TNC	Modem I/O	I/O	RF/GSM input/output to/from modem antenna
Digital/Satel	BNC	Modem I/O	I/O	RF/GSM input/output to/from modem antenna

Power Connector

Rimmed in red, the power connector (Figure A-1) is a sealed receptacle, 5 pin, ODU part number G80F1C-T05QF00-0000.
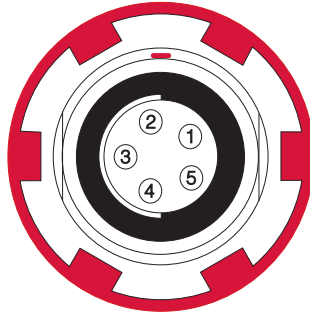
Figure A-1. Power Connector

Table A-11 describes power connector specifications.

Table A-11. Power Connector Specifications

Number	Signal Name	Dir	Details
1	Power_INP	P	9 to 21 volts DC input
2	Power_INP	P	9 to 21 volts DC input
3	Power_GND	P	Ground, power return
4	Power_GND	P	Ground, power return
5	Aux_Power	P	9 to 21 volts DC input

C-RS232 Serial Cable Connector

Rimmed in black, the RS232 serial cable connector (Figure A-2) is an 8 pin sealed receptacle.

Figure A-2. RS232 Serial Connector

Table A-12 gives the RS232 serial cable connector specifications.

Table A-12. RS232 Serial Connector Specifications

Number	Signal Name	Dir	Details
1			Not used
2	RXD	Input	Receive data
3	TXD	Output	Transmit data
4	GND	I/O	Signal ground
5	GND	I/O	Signal ground
6			Not used
7	RTS	Output	Request to send
8	CTS	Input	Clear to send

USB Connector

Rimmed in yellow, the USB connector is a sealed receptacle, 4 pin TPS cable connector (Figure A-3).
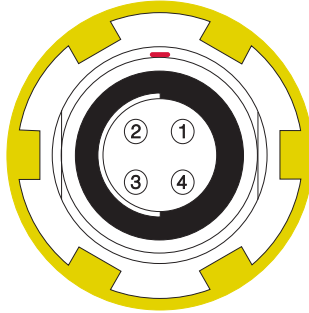

Figure A-3. USB Connector for GGD Options

Table A-13 gives the USB connector specifications.

Table A-13. USB Specifications

Number	Signal Name	Dir	Details
1	USB_PWR	P	Bus power input
2	USB D-	I/O	Data minus
3	USB D+	I/O	Data plus
4	GND	-	Ground

Safety Warnings

General Warnings

NOTICE

To comply with RF exposure requirements, maintain at least 25cm between the user and the radio modem.

WARNING

Sokkia receivers are designed for survey and survey related uses (that is, surveying coordinates, distances, angles and depths, and recording such measurements). This product should never be used:

- Without the user thoroughly understanding this manual.
- After disabling safety systems or altering the product.
- With unauthorized accessories.
- Without proper safeguards at the survey site.
- Contrary to applicable laws, rules, and regulations.

DANGER

Sokkia receivers should never be used in dangerous environments. Use in rain or snow for a limited period is permitted.

Battery Pack Warnings

DANGER Never attempt to open the casing of the detachable battery! Lithium-Ion batteries can be dangerous if mishandled!

DANGER Do not incinerate or heat battery pack above 212 degrees fahrenheit (100 degrees celsius). Excessive heat can cause serious damage and possible explosion.

WARNING Tampering with the battery by end users or non-factory authorized technicians will void the battery's warranty.

- Do not attempt to open the battery pack or replace it.
- Do not disassemble the battery pack.
- Do not charge in conditions different than specified.
- Do not use other than the specified battery charger.
- Do not short circuit.
- Do not crush or modify.

Usage Warnings

⚠ **CAUTION** If this product has been dropped, altered, transported or shipped without proper packaging, or otherwise treated without care, erroneous measurements may occur.

The owner should periodically test this product to ensure it provides accurate measurements.

Inform Sokkia immediately if this product does not function properly.

⚠ **CAUTION** Only allow authorized Sokkia warranty service centers to service or repair this product.

Notes:

Regulatory Information

The following sections provide information on this product's compliance with government regulations for use.

UHF Radio Usage

> **NOTICE**
>
> Using a UHF radio requires a license. Operating a UHF radio without a license may result in fines or other penalties. Be sure you comply with all local laws before operating a UHF radio. Contact your local authorities (such as, the FCC in the United States) for details.

Surveying in RTK mode has made UHF the most popular choice for communications between Base and Rover receivers. Know the strengths and weaknesses of this technology to get the best use out of your receiver. The quality and strength of the UHF signals translates into range for UHF communications.

1. The system's range will greatly depend on the local conditions. Topography, local communications and even meteorological conditions play a major role in the possible range of RTK communications. If needed, use a scanner to find clear channels.

2. The system's range will increase by adjusting the Base station's antenna using the following methods.

   • Ensure the Base radio has a fully charged battery.

   • Use directional antennas and/or repeaters to increase your system's range. Directional antennas concentrate the signal power within a more narrow direction, significantly increasing the range of your system.

- Check the Sokkia accessory line for items to raise the Base radio.

FCC Compliance

This equipment complies with FCC radiation exposure limits set forth for uncontrolled equipment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65. This equipment has very low levels of RF energy that it deemed to comply without maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated with at least 30cm and more between the radiator and person's body (excluding extremities: hands, wrists, feet and ankles). This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. 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 communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television equipment 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.

• Move the equipment away from the receiver.

• Plug the equipment into an outlet on a circuit different from that to which the receiver is powered.
• Consult the dealer or an experienced radio/television technician for additional suggestions.

> ⚠️ **CAUTION**
>
> Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void your authority to operate such equipment.

Canadian Emission Labeling Requirements

This equipment complies with IC radiation exposure limits set forth for uncontrolled equipment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment has very low levels of RF energy that it deemed to comply without maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated with at least 30cm and more between the radiator and person's body (excluding extremities: hands, wrists, feet and ankles).

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

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

3. This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte conform a la norme NMB-003 du Canada.

IC RF Radiation Exposure Statement

The installer of this device must ensure that the antenna is located or pointed such that it dose not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website at www.hc-sc.gc.ca/rpb.

IC Additional statement with Detachable Antennas

This device has been designed to operate with the antennas listed below, with a maximum gain of 2.4dB. Antennas not included in the list below or those having a gain greater than 2.4 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

- GRX1/U 2.4dBi whip antenna Manufacture/Type

    410-440MHz   ANTENEX/G420BN

    440-470MHz   CENTURION/EVR450

Community of Europe Compliance

The product described in this manual is in compliance with the R&TTE and EMC directives from the European Community.

European Community Declaration of Conformity with R&TTE Directive 1999/5/EC

The following standards were applied:

- (R&T*TE Directive 1999/5/EEC)
- ETSI EN 300 113-1 v1.7.1(2011-11)
- ETSI EN 300 113-2 v1.5.1(2011-11)
- ETSI EN 301 489-1 v1.9.2(2011-09)
- ETSI EN 301 489-7 v1.3.1(2005-11)
- ETSI EN 301 908-1 v5.2.1(2011-05)
- ETSI EN 301 908-2 v5.2.1(2011-07)

- ETSI EN 300 328   v1.7.1 (2006-10)
- ETSI EN 301 489-3   v1.4.1(2002-08)
- ETSI EN 301 489-24 v1.4.1(2009-05)
- ETSI EN 301 489-5 v1.3.1 (2002-08)
- ETSI EN 301 489-17 v2.1.1 (2009-05)
- ETSI EN 301 511 v9.0.2 (2003-03)
- EN 62311:2008
- EN 60950-1:2006/A1:2010

The following CE mark is affixed to the device.

$$C \in \textcircled{1}$$

> **NOTICE** Equipment that is labeled with a $C \in \textcircled{1}$ marking informs users that the DIG UHF frequency range 410-470 Mhz is not harmonized throughout Europe and that the specific country spectrum authority should be notified before a radio modem is used.

This equipment is intended to be marketed in these countries.

List of National Codes

- AT DE MT GB
- BE GR NL IS
- CY HU PL LI
- CZ IE PT NO
- DK IT SK CH
- EE LV SI BG
- FI LT ES RO
- FR LU SE TR

Declaration of Conformity with Regard to the R&TTE Directive 1999/5/EC

cs esky [Czech]	*(Sokkia)* tímto prohlašuje, že tento *(GRX1)* je ve shod se základními požadavky a dalšími píslušnými ustanoveními smrnice 1999/5/ES.
da Dansk [Danish]	Undertegnede *(Sokkia)* erklærer herved, at følgende udstyr *(GRX1)* overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
de Deutsch [German]	Hiermit erklärt *(Sokkia)* dass sich das Gerät *(GRX1)* in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 1999/5/EG befindet.
et Eesti [Estonian]	Käesolevaga kinnitab *(Sokkia)* seadme *(GRX1)* vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
en English	Hereby, *(Sokkia)* declares that this *(GRX1)* is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
es Español [Spanish]	Por medio de la presente *(Sokkia)* declara que el *(GRX1)* cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
el [Greek]	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ *(Topcon Positioning Systems, Inc.)* ΔΗΛΩΝΕΙ ΟΤΙ *(GRX1)* ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕΚ.
fr Français [French]	Par la présente *(Sokkia)* déclare que l'appareil *(GRX1)* est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.

it Italiano [Italian]	Con la presente *(Sokkia)* dichiara che questo *(GRX1)* è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
la Latviski [Latvian]	Ar šo *(Sokkia)* deklar, ka *(GRX1)* atbilst Direktvas 1999/5/EK btiskajm prasbm un citiem ar to saisttajiem noteikumiem.
li Lietuvi [Lithuanian]	Šiuo *(Sokkia)* deklaruoja, kad šis *(GRX1)* atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.
nl Nederlands [Dutch]	Hierbij verklaart *(Sokkia)* dat het toestel *(GRX1)* in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/ EG.
mt Malti [Maltese]	Hawnhekk, *(Sokkia)*, jiddikjara li dan *(GRX1)* jikkonforma mal-tiijiet essenzjali u ma provvedimenti orajn relevanti li hemm fid-Dirrettiva 1999/5/EC.
hu Magyar [Hungarian]	Alulírott, *(Sokkia)* nyilatkozom, hogy a *(GRX1)* megfelel a vonatkozó alapvetõ követelményeknek és az 1999/5/EC irányelv egyéb elõírásainak.
pl Polski [Polish]	Niniejszym, *(Sokkia)*, deklaruj, e *(GRX1)* spenia wymagania zasadnicze oraz stosowne postanowienia zawarte Dyrektywie 1999/5/EC.
pt Português [Portugues]	*(Sokkia)* declara que este *(GRX1)* está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.
sl Slovensko [Slovenian]	*(Sokkia)* izjavlja, da je ta *(GRX1)* v skladu z bistvenimi zahtevami in ostalimi relevantnimi doloili direktive 1999/5/ES.
da Slovensy [Slovak]	*(Sokkia)* týmto vyhlasuje, že *(GRX1)* spa základné požiadavky a všetky príslušné ustanovenia Smernice 1999/5/ES.

[fi] Suomi [Finnish]	*(Sokkia)* vakuuttaa täten että *(GRX1)* tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
[sv] Svenska [Swedish]	Härmed intygar *(Sokkia)* att denna *(GRX1)* står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.

WEEE Directive

The following information is for EU-member states only:

Use of the symbol below indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about the take-back and recycling of this product, please contact your supplier where you purchased the product or consult.

Warranty Terms

Sokkia laser and electronic positioning equipment are guaranteed against defective material and workmanship under normal use and application consistent with this Manual. The equipment is guaranteed for the period indicated, on the warranty card accompanying the product, starting from the date that the product is sold to the original purchaser by Sokkia's Authorized Dealers.[1]

During the warranty period, Sokkia will, at its option, repair or replace this product at no additional charge. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. This limited warranty does not include service to repair damage to the product resulting from an accident, disaster, misuses, abuse or modification of the product.

Warranty service may be obtained from an authorized Sokkia warranty service dealer. If this product is delivered by mail, purchaser agrees to insure the product or assume the risk of loss or damage in transit, to prepay shipping charges to the warranty service location, and to use the original shipping container or equivalent. A letter should accompany the package furnishing a description of the problem and/or defect.

The purchaser's sole remedy shall be replacement as provided above. In no event shall Sokkia be liable for any damages or other claims including any claim for lost profits, lost savings, or other incidental or consequential damages arising out of the use of, or inability to use, the product.

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1. The warranty against defects in a Sokkia battery, charger, or cable is 90 days.

Notes:

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ISO 9001:2000
FM 68448

GRX1 Operator's Manual
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