

 **TOPCON®**



# HiPer® Pro

## Operator's Manual



**PRECISION GPS+: HiPer Pro**





# **HiPer® Pro Operator's Manual**

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Rev B

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# Preface

Thank you for purchasing this Topcon product. The materials available in this Manual (the “Manual”) have been prepared by Topcon Positioning Systems, Inc. (“TPS”) for owners of Topcon products, and is 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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## **Regulatory Information**

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

### **FCC Class B Compliance**

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in 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 Emissions Labeling Requirements

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

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

## Manual Conventions

This manual uses the following conventions:

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

**TIP**

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



**NOTICE**

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



**CAUTION**

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

# Introduction

This chapter describes:

- The HiPer® Pro receiver (Figure 1-1)
- GPS and your receiver
- Common receiver functions
- Standard package contents and configurations
- Receiver components
- The Option Authorization File (OAF)



**Figure 1-1. HiPer Pro Receiver**

## Overview

Topcon Positioning System's HiPer Pro is a dual-frequency, GPS+ receiver built to be the most advanced and compact receiver for the surveying market. The HiPer Pro is a multi-function, multi-purpose receiver intended for precision markets. Precision markets means markets for equipment, subsystems, components and software for surveying, construction, commercial mapping, civil engineering, precision agriculture and land-based construction and agriculture machine control, photogrammetry mapping, hydrographic and any use reasonably related to the foregoing.

The HiPer Pro can receive and process both L1 and L2 signals, improving the accuracy of your survey points and positions. The dual-frequency and GPS+ features of HiPer Pro combine to provide a real time kinematic (RTK) system accurate for short and long baselines. Several other features, including multipath mitigation and co-op tracking, provide under-canopy and low signal strength reception. The receiver provides the functionality, accuracy, availability, and integrity needed for fast and easy data collection.

## 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 GPS and receiver functions to help you understand and apply GPS principles, allowing you to get the most out of your receiver.

## GPS Overview

The Global Positioning System (GPS) is a satellite-based, line-of-sight radio navigation system run by the United States Department of Defense (DoD). This system offers a global, all weather, 24-hour positioning, velocity, and time service to any user equipped with a GPS tracking receiver, who is on or near the Earth's surface. The Global Navigation Satellite System (GLONASS), is the Russian Federation Ministry of Defense counterpart to GPS.



For information on the current status of the GPS constellation, visit <http://tycho.usno.navy.mil/> or <http://www.navcen.uscg.gov/>. For GLONASS, visit <http://www.glonass-center.ru/frame.html>.

Despite numerous technical differences in the implementation of these systems, both GPS and GLONASS have three essential components:

- Space – GPS and GLONASS satellites orbiting approximately 12,000 nautical miles above Earth and are equipped with a clock and radio. These satellites broadcast digital information (ephemerides, almanacs, time&frequency corrections, etc.).
- 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 GPS/GLONASS receivers and the corresponding satellites to calculate positions.

## Calculating Positions

Once the receiver locks on to a satellite, it starts recording measurements and receiving the various digital information (ephemerides, almanac, and so on) the satellites broadcast. To calculate a position, receivers use the following formula:

$$\text{Velocity} \times \text{Time} = \text{Distance}$$

Where Velocity is the speed at which radio waves travel (i.e., the speed of light) and Time is the difference between the signal transmission time and signal reception time.

To calculate absolute 3-D positions—latitude, longitude, altitude—the receiver must lock on to four satellites. In a mixed, GPS and GLONASS scenario, receiver's must lock onto at least five satellites to obtain an absolute position.

To provide fault tolerance using only GPS or only GLONASS, the receiver must lock onto a fifth satellite. Six satellites will provide fault tolerance in mixed scenarios.

Once locked on to a satellite, the receiver collects ephemerides and almanacs, saving this information to its NVRAM (Non-Volatile RAM).

- 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.

## **GPS Positioning**

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, and counteracts anti-spoofing signals the US Department of Defense transmits with GPS signals.
  - 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 GPS and GLONASS 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 scenarios.

- Wide Area Augmentation Systems (WAAS, EGNOS, etc.) 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 GPS and GLONASS positioning. For more detailed information, visit the TPS website ([www.topconps.com/gpstutorial/](http://www.topconps.com/gpstutorial/)).

## Receiver Overview

When power is turned on and the receiver self-test completes, the receiver's 20 channels initialize and begin tracking visible GPS satellites. Each of the receiver's channels can be used to track C/A-L1, P-L1, or P-L2 signals. The number of channels available allows the receiver to track all visible GPS satellites at any time and location.

An internal GPS antenna equipped with a low noise amplifier (LNA) and the receiver's radio frequency (RF) device are connected with a coaxial 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, it is possible to solve the so-called "absolute positioning problem" and compute the receiver's coordinates (in WGS-84) and the time offset between the receiver clock and GPS time. All this information is stored in the receiver's memory, which can be downloaded later onto a computer and processed using a post-processing software package. When the receiver is run 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:

- Co-Op Tracking
- Multipath reduction
- Wide area augmentation system (WAAS)
- Adjustable phase locked loop (PLL) and delay lock loop (DLL) parameters
- Dual-frequency static, kinematic, real-time kinematic (RTK), and differential GPS (DGPS) survey modes
- Auto data logging
- Setting different mask angles
- Setting different survey parameters
- Static or dynamic modes

The range of the HiPer Pro is 2–4 miles (3.22–6.44 km).

## **Standard Package Contents**

The HiPer Pro comes in a real-time kinematic (RTK) package with two receivers, one as a Base Station and the other as a Rover Station (also, refer to the packaging instruction card). The contents of this package include:

- Two HiPer Pro receivers
- LitePole
- Tripod, tribrach, and adapter
- Topcon Tools™ software (optional)
- Cables, connectors, and adapters
- Literature

## Cables

Standard cables (Figure 1-2) can include the following:

- Receiver-to-computer RS232 serial cable (p/n 14-008005-03) – connects the receiver’s serial port and an external device (hand-held controller or computer)
- Receiver-to-SAE power cable (p/n 14-008016-03) – connects the receiver’s power port and the power supply’s SAE connector or the extension cable’s SAE connector
- SAE-to-SAE cable extension (p/n 14-008022-01) – connects SAE connectors over longer distances
- Alligator clips-to-SAE cable (p/n 14-008025-01) – connects any 12-volt DC power source and the Receiver-to-SAE power cable
- Power supply-to-outlet cable (p/n 14-008052-01 for U.S. or 14-008054-01 for E.U.) – connects the power charger to a power outlet
- USB cable (p/n 14-008031-01) – connects the receiver and an external device (hand-held controller or computer) via the USB ports

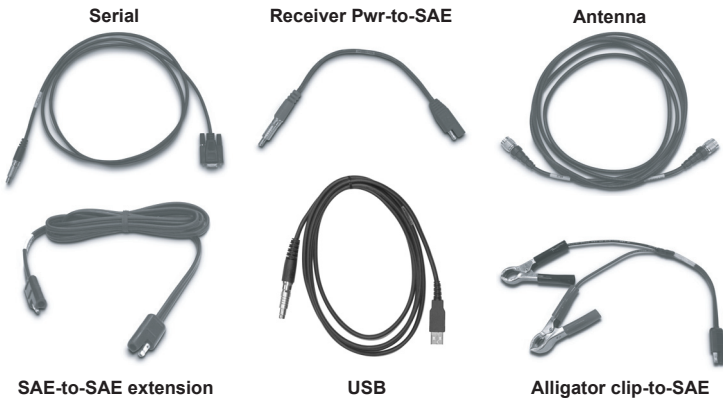


Figure 1-2. System Cables

## Power Supply/Charger

The Power Supply/Charger unit (p/n 22-034101-01) is used to charge the internal batteries when connected to a grounded outlet; it can also be used as an external power source (Figure 1-3). This unit converts the alternating current (AC) normally supplied from an electrical outlet to a direct current (DC) used to charge the batteries and power the receiver.

- input voltage – between 100 and 240 V AC
- frequency of input power – between 50 Hz and 60 Hz
- output voltage – 12 V DC@2.5 A (30 W)



Figure 1-3. Power Supply/Charger

## Software

Standard receiver software includes:

- PC-CDU – controller software that can run on a Windows®-based computer.
- FLoader – Topcon’s firmware loader; available on the Topcon website.
- BTCONF – Topcon’s Bluetooth® wireless technology module configuration program; available on the Topcon website.
- Modem-TPS – Topcon’s radio modem configuration software; available on the Topcon website.
- Topcon Tools – optional; Topcon’s post-processing software.

Software and software information are also available on the Topcon website ([www.topcongps.com/software/index.html](http://www.topcongps.com/software/index.html) or <http://www.topcongps.com/software/3rdparty.html>).

The following software will also be useful for operating, caring for and using your receiver, and may be required for some applications.

- TopSURV – Topcon’s field data collection software; among many other functions, can be used to configure the radio/modem.
- Survey Pro GPS – optional third-party software for data collection and display; contact your TPS dealer.
- Carlson SurvCE – optional third-party software for data collection; contact your TPS dealer.

## Literature

Receiver literature includes:

- One year warranty card
- *HiPer Pro Operator’s Manual*
- Functional specifications
- Packaging instruction card

Manuals and other product information are also available on the Topcon website—[www.topcongps.com/support/manuals.html](http://www.topcongps.com/support/manuals.html) or [www.topcongps.com/hardware/index.html](http://www.topcongps.com/hardware/index.html) (then click on the appropriate product).

The following manuals will also be useful for operating and caring for your receiver. These are also available on the Topcon website ([www.topcongps.com/support/manuals.html](http://www.topcongps.com/support/manuals.html)).

- *PC-CDU User’s Manual*
- *FLoader User’s Manual*
- *BTCONF User’s Manual*
- *Modem-TPS User’s Manual*

## Getting Acquainted

The HiPer Pro receiver is 159mm wide, 172mm deep, 88mm high, and weighs approximately 1.6kg. The receiver's advanced design allows users to significantly reduce the number of cables required for receiver operation, with the ability to perform jobs more reliably and efficiently, especially when moving.

The receiver is also versatile and can be configured in several different ways. The casing allocates space for two nonremovable, on-board Li-Ion batteries, a Bluetooth wireless technology module, and two Euro cards. One of those cards is the GPS receiver and the other is used for UHF communications.

See Table 1-2 on page 1-13 for a description of the operating times for the HiPer Pro receiver as a Base or Rover. For receiver specifications, see Appendix A.

## Internal Components

The following sections describe the internal components of the HiPer Pro receiver.

### GPS+ Antenna

An internal, micro-strip antenna capable of receiving GPS L1/L2 signals and GLONASS L1/L2 signals.

### Bluetooth Module

A combination of software and hardware technology that makes the HiPer Pro a mobile, wireless, GPS+ receiver that support a point-to-point serial profile. As such, the HiPer Pro can transfer and synchronize files between the receiver and any other Bluetooth wireless technology device that supports serial profile, including portable handheld devices and external controllers, Bluetooth adapters for PC-USB/RS ports, mobile computers and phones, IPAQs, PCMCIA-to-Bluetooth adapters, etc.



With Bluetooth wireless technology, the receiver's reception and transmission distance is 10 meters (32 feet) for interior projects and 30–50 meters (98–164 feet) for exterior projects.

The Bluetooth module's processor and firmware are independent of the receiver card and power board.

## Radio Modem

The receiver incorporates an internal, Satel UHF transmitter/receiver at 4MHz bandwidth or a UHF receiver at 20MHz bandwidth, with a 25kHz channel spacing, and a maximum 1W power output for data transmission. The Base station's modem transmits the carrier phase and code measurements along with the reference station information (that is, location) to the Rover station modem.

The HiPer Pro Base/Rover receivers are shipped with the most commonly used settings for the radio modem. The Rover settings are configured to match the Base settings.

The frequency range of the modem depends on the country in which the receiver is used: for North America, the frequency range is 461–465; for all other countries, contact your local distributor.



### WARNING

**Using the HiPer Pro with any other UHF radio will simply produce interference. Only use the HiPer Pro receiver with another HiPer Pro receiver.**

## Power Board

The internal power board manages receiver power and battery charging, and is connected to the receiver board and the batteries. The power board receives power from the internal batteries, even when the receiver is turned off. This feature allows the internal batteries to charge, regardless of the receiver's status (on or off). To prevent the batteries from discharging when the receiver is stored, put the receiver in Zero Power Mode (see “Zero Power Mode” on page 4-20 for more information). The batteries will not charge in this mode.

The power board's processor and firmware are independent of the receiver card. To ensure firmware compatibility, the GPS receiver board and power board must be loaded with firmware from the same package.

## GPS+ Receiver Board

The receiver is supplied with a Euro-112T card capable of processing the following signals:

- GPS L1 or GPS L1/L2
- GPS/GLONASS L1 or GPS/GLONASS L1/L2

Table 1-1 lists the options available for these cards.

**Table 1-1. Euro Card Options for HiPer Pro**

Euro Card Model	Available Options
Euro-112T (HGGDT)	G: GPS L1 GD: GPS L1/L2 GG: GPS/GLONASS L1 GGD: GPS/GLONASS L1/L2

A WAAS-enabled TPS receiver allows simultaneous tracking of two WAAS satellites. Each of the WAAS satellites is allocated its own channel.

## Battery

The receiver is equipped with two non-removable, on-board, rechargeable Lithium-Ion battery packs connected to the receiver's power board. Each one of these Lithium-Ion battery packs is 7.4 V and 4 Ah, giving you a total power of 7.4 V, nominal, and 8 Ah when fully charged.

Table 1-2 on page 1-13 describes the operating times for the HiPer Pro receiver, with the internal batteries fully charged and dependent on the mode of the modem.

**Table 1-2. Operating Times**

<b>Modem Mode</b>	<b>HiPer Pro</b>
TX mode ON (1W)	11 hours
RX mode ON	14 hours
Standby mode	13 hours
OFF	16 hours

The Li-Ion batteries used in the HiPer Pro should run at no less than 98% capacity after 500 charging cycles. These batteries do not need to be drained before recharging.

A battery charger (AC adapter) is included with the standard package. See Appendix A for technical specifications on the battery.

## **External Components**

The HiPer Pro casing includes panels for radio antenna attachment, a user interface, a power port, and ports for configuration.

### **Bottom Panel**

The bottom panel of the HiPer Pro receiver has the receiver serial number, receiver part number, receiver type (Base or Rover), and antenna reference point (ARP).

### **Radome**

Figure 1-4 on page 1-14 shows the radome components:

- Internal antenna – Location of GPS/GLONASS internal antenna.
- Modem antenna connector – Modem antenna connector used for internal modem RF connection. This is a BNC female connector for spread spectrum modems.



Figure 1-4. HiPer Pro Radome

## Front Panel

Figure 1-5 on page 1-15 shows front panel components for the HiPer Pro receiver:

- MINTER – The Minimum INTERface for the receiver consisting of three keys and four, three-color LEDs. See “Using the MINTER” on page 4-2 for descriptions and usages of the MINTER components.
- Reset – This key performs a hard reset for both the receiver board and the power board. Once this key is pressed, the controllers governing the receiver and power boards reboot and the device restarts.
- This key can be used to leave Zero Power Mode or if the receiver does not respond to commands. See “Using the MINTER” on page 4-2 for more information.
- Four serial ports:
  - Port A used for communication between the receiver and a controller or any other external device.
  - Port B used internally to connect the receiver board and Bluetooth module.

- Port C used internally to connect the modem and receiver boards.
- Port D used for communication between the receiver and an external device.
- USB – used for high-speed data transfer and communication between the receiver and an external device.
- PWR – The power input port to which an external power source (+6 to +28 V DC) is connected and where the unit is charged.
- Slant height measure mark (SHMM).

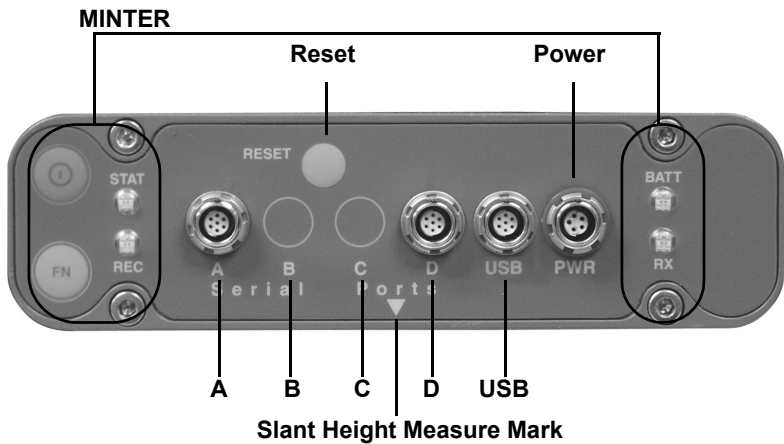


Figure 1-5. HiPer Pro Front Panel

## Back Panel

Figure 1-6 shows back panel components for the HiPer Pro.

- Vent plug – Equalizes the pressure between the inside of the receiver and the outside environment.
- Slant height measure mark (SHMM)



Figure 1-6. HiPer Pro Back Panels

If the Base Station receiver is configured with an external antenna port, see Appendix A for details.

## Option Authorization File (OAF)

Topcon Positioning Systems 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 desired, 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 TPS website ([www.topcongps.com/tech/index](http://www.topcongps.com/tech/index)) or consult your TPS dealer.

- Type of signal (standard L1; optional L2)
- Memory (standard 0MB; optional 1MB up to 1GB)
- Update rate standard 1Hz (optional 5, 10, or 20Hz)
- RTK at 1Hz, 5Hz, 10Hz, and 20Hz
- RTCM/CMR Input/Output
- Event marker
- Co-Op tracking
- Advanced multipath reduction
- Wide Area Augmentation System (WAAS)
- Receiver Autonomous Integrity Monitoring (RAIM)
- 1 PPS (Pulse-Per-Second; a timing signal)





# Configuration

This chapter describes:

- Receiver's power supply
- Connecting the receiver and a computer
- Configuring the receiver
- Minimum INTERface (MINTER) configuration
- Radio configuration
- Bluetooth module configuration
- Collecting almanacs

Before you can begin using the HiPer Pro receiver, do the following:

1. Charge the batteries. See “Powering the Receiver” on page 2-2.
2. Configure the various parts of your receiver. See:
  - “Connecting the Receiver and a Computer” on page 2-10,
  - “Receiver Configuration” on page 2-15,
  - “MINTER Configuration” on page 2-19,
  - “Radio Configuration” on page 2-26, and
  - “Bluetooth Module Configuration” on page 2-32.
3. Collect an almanac. See “Collecting Almanacs” on page 2-37.

# Powering the Receiver

You can power the receiver using the internal batteries, using an external battery, or a battery charger.

## Internal Batteries

With a full charge, and depending on the mode of the radio modem, the internal batteries should power the GPS receiver and the radio modem according to the times listed in Table 2-1.

**Table 2-1. Operating Times**

Modem Mode	HiPer Pro
TX mode ON (1W)	11 hours
RX mode ON	14 hours
Standby mode	13 hours
OFF	16 hours

- To charge the internal batteries:
  - Plug the receiver-to-SAE power cable into the receiver's power input port.
  - Connect the receiver-to-SAE power cable and the power supply-to-outlet cable to the AC adapter.
  - Plug the power supply-to-outlet cable into an available outlet.
- Press the **Reset** key on the receiver. This will ensure that the receiver is in Normal mode for charging. The receiver will not charge in Zero Power Mode (for details, see "Zero Power Mode" on page 4-20).
- Leave overnight. An approximately six-hour charge cycle will charge the batteries about 90%. An approximately eight-hour charge cycle will fully charge the receiver. The internal batteries can not be overcharged.

The speed of the charge depends on the Power and Charger settings on the Receiver Configuration screen, and whether the receiver is

turned off or on. See “Power Management” on page 2-5 for more information.

The Li-Ion batteries used in the receiver should run at no less than 98% capacity after 500 charging cycles. These batteries do not need to be drained before recharging.

## External Batteries

In addition to the internal batteries, you can use your receiver with external batteries (Figure 2-1 on page 2-4). External batteries allows you to continue using the receiver in case the internal batteries are discharged and requires the following:

- a 12 V, 2.3 A\*h battery
- a 2.3 A\*h battery clip-to-SAE cable
- an SAE-to-Power Plug cable



### NOTICE

*When the receiver uses external batteries, set the charger mode to Off. Otherwise, the external batteries will also charge the internal batteries, causing operation time to decrease. See “Power Management” on page 2-5 for more information on setting the charger mode.*

1. Connect the SAE ends of the battery clip-to-SAE and the SAE-to-power plug cables.
2. Plug the power cable into the receiver’s power port.
3. Attach the battery clip to the battery.

A single external 12 V, 2.3 A\*h battery should run the receiver for about 7 hours and the receiver and modem for 5 hours.



**Figure 2-1. External Battery Attached to Receiver**



**TIP**

You can also use an SAE-to-SAE extension cable and an Alligator clip-to-SAE cable, and power the receiver from a battery, such as the battery used to power your Base radio or similar battery.

## **Battery Charger**

The same charger used to charge the internal batteries can be used as an external power supply for the receiver. The charger is provided with the receiver package.

1. Connect the receiver-to-SAE cable to the receiver's power port.
2. Connect the SAE end of the cable to the battery charger.
3. Plug the battery charger's power cable into the AC adapter.
4. Plug the power cable into an available, grounded outlet. The power input for your battery charger should be AC between 90 and 264 V 1A (110 V AC) and between 47 Hz and 63 Hz. The battery charger outputs DC 12 V 2.5 A (30 W).

## Turning On/Off the Receiver

To turn ON the receiver, press and hold the green **power** key for about 0.5 seconds and release it.



### NOTICE

*If the receiver does not turn on, it may be in Zero Power Mode. See “Zero Power Mode” on page 4-20 for more information.*

To turn OFF the receiver, press and hold the green **power** key for more than one and less than four seconds (until both the STAT and the REC LEDs are off). This delay (about 1 second) will prevent the receiver from being turned off by mistake.

## Power Management

You can use Topcon’s PC-CDU software to manage your receiver’s power. The complete description of PC-CDU exceeds the scope of this manual, but can be found in the *PC-CDU User’s Manual*. The latest copy of this software and the manual can be downloaded from the TPS website.

To access the dialog box controlling the power settings for the receiver, take the following steps:

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-10 for this procedure.
2. Once connected, click **Configuration ▶ Receiver**.
3. Select the *Power Mode* drop-down list to set the desired power source (Figure 2-2 on page 2-6). *Current Mode* displays the current power source.
  - Auto – receiver automatically selects the power source
  - Mix – receiver automatically detects and consumes power from the source with the largest voltage
  - Battery A – receiver consumes power from battery A
  - Battery B – receiver consumes power from battery B

- External – receiver uses an external power supply

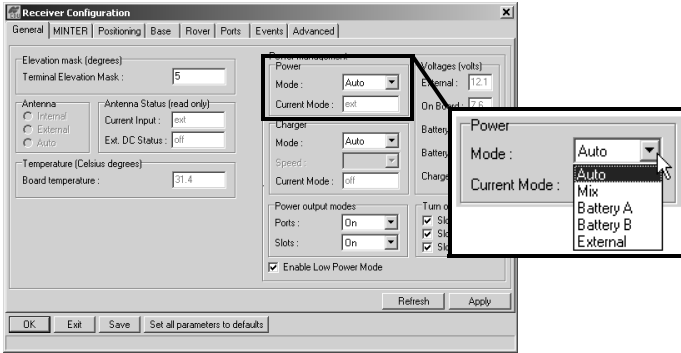


Figure 2-2. Select Power Mode

4. Select the *Charger Mode* drop-down list to set the desired charger mode (Figure 2-3). *Current Mode* displays the charging battery: a, b, or none (off).

- Off – receiver will not charge batteries
- Charge A – receiver charges only battery A
- Charge B – receiver charges only battery B
- Auto – receiver automatically detects and charges both batteries

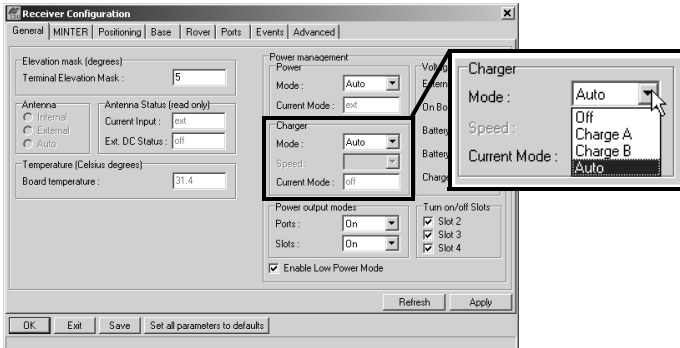
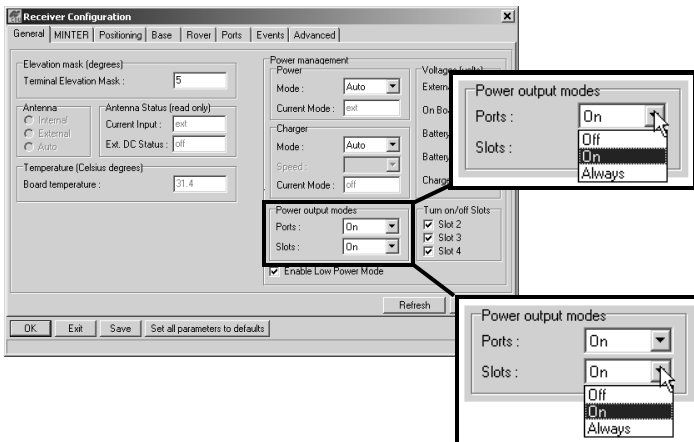


Figure 2-3. Select Charger Mode

5. Select the *Power output modes Ports* drop-down list to set power output on the serial ports (Figure 2-4).
  - On – the power board will deliver voltage on pin one of all serial port connectors when the receiver is turned on. If the receiver is turned off, there will be no power on any ports.
  - Off – power will be absent even if the receiver is on
  - Always – the power board will deliver voltage on pin one of all serial port connectors even if the receiver is turned off
6. Select the *Power output modes Slots* drop-down list to set power output on internal slots (Figure 2-4).
  - On – all slots are powered if the receiver is turned on
  - Off – internal slots will not be powered even if the receiver is turned on
  - Always – internal slots will be powered even if the receiver is turned off



**Figure 2-4. Select Power Output Modes – Ports and Slots**

7. View the *Voltages* information (Figure 2-5 on page 2-8).
  - External – displays the external power supply's voltage
  - On Board – displays the voltage drawn by the receiver board
  - Battery A – displays the voltage of battery A

- Battery B – displays the voltage of battery B
- Charger – displays the charger’s output voltage during battery charging

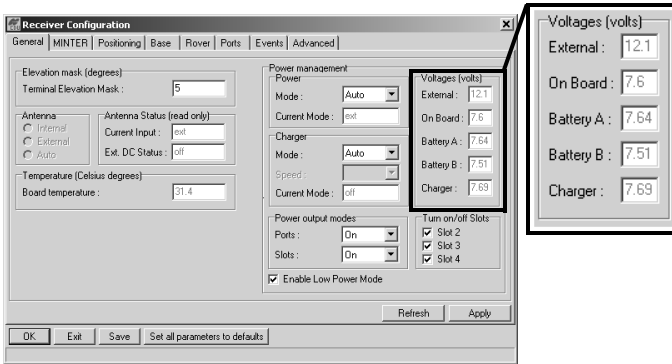


Figure 2-5. View Voltages Information

8. Select and check each of the *Turn on/off Slots* check boxes to enable the corresponding internal slots (Figure 2-6).
9. Select and check the *Enable Low Power Mode* check box to put the receiver’s processor into low power consumption mode (Figure 2-6).

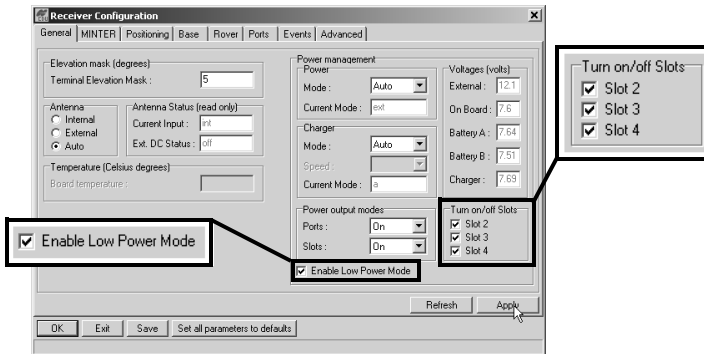


Figure 2-6. Enable and Apply Power Settings

10. Click **Apply**.



## Charging Internal Batteries

Use one of the following conditions for maximum battery charge speed:

- The receiver is turned off. Power Mode and Charger Mode are set to Auto. See “Power Management” on page 2-5 for setting these parameters.
  - The receiver is turned on. Power Mode is set to External and Charger Mode is set to Auto.
1. To charge the internal batteries:
    - Plug the receiver-to-SAE power cable into the receiver’s power input port.
    - Connect the receiver-to-SAE power cable and the power supply-to-outlet cable to the AC adapter.
    - Plug the power supply-to-outlet cable into an available outlet.
  2. Press the **Reset** key on the receiver. This will ensure that the receiver is in Normal mode for charging. The receiver will not charge in Zero Power Mode (see “Zero Power Mode” on page 4-20 for more information).
  3. Leave overnight. A nine-hour charge will charge the batteries about 90%. A ten-hour charge will fully charge the receiver. The internal batteries cannot be overcharged.
  4. When finished charging, set *Power Mode* to *Auto*.



### NOTICE

*If you remove a power supply cable before setting Power Mode to Auto, the receiver will be turned off. To turn it on, you will need to connect an external power supply once again.*

## Checking Internal Battery Status

To check the status of the internal batteries:

1. Check the BATT LED for battery status.
  - A green light indicates greater than 85% charge.
  - An orange light indicates an intermediate charge.
  - A red light indicates less than 15% charge.
2. Do one of the following:
  - Click on **Configuration ▶ Receiver** to view battery voltages on the *Receiver Configuration* screen.
  - Click on **Help ▶ About** to view battery voltages on the *About PC-CDU* screen.

## Connecting the Receiver and a Computer

To configure, manage files, or maintain the receiver, connect the receiver and a computer, and start PC-CDU:

- use a Bluetooth-enabled external device (computer)
- use an RS232 cable
- use a USB cable and a computer with the TPS USB driver installed (available at <http://www.topcongps.com/software/updates.html>)

Once you have established a connection between the receiver and the computer (whether through Bluetooth wireless technology, the RS232 cable, or the USB cable), you will be able to:

- configure the receiver and its components
- send commands to the receiver
- download files from the receiver's memory
- load new firmware using FLoader™, OAFs, and configuration files to a receiver

## Establishing a Wireless Connection

The HiPer Pro 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 iPAQ, or a computer with USB-to-Bluetooth adapter or PCMCIA-to-Bluetooth adapter installed.

### NOTICE

*Changing the receiver's Port B default settings will affect the Bluetooth link. The default settings for Port B are: 115200 bps, 8 data bits, 1 stop bit, no parity, and no handshaking.*

The receiver and external device connection procedure varies slightly depending on the type of external device used. In general, the connection procedure is as follows:

### NOTICE

*Refer to your Bluetooth-enabled external device documentation for detailed connection information.*

1. Turn on a Bluetooth-enabled external device and the receiver. The default external device mode is Master; the receiver's Bluetooth module mode is Slave.
2. Instruct the external device (Master) to search for the receiver (Slave).
3. Once the Master device detects the receiver, use the procedure described in the external device's documentation to connect it with the receiver.
4. Once connected, continue with Step 1 in "Establishing a PC-CDU Connection" on page 2-13.

If you cannot establish a connection, check that the receiver's slot three is enabled.

1. Connect your receiver and a computer using an RS232 cable or USB cable and PC-CDU as seen below.
2. Click **Configuration ▶ Receiver ▶ General**.
3. In the *Turn on/off Slots* area, ensure the *Slot 3 (B)* check box is enabled.

## **Establishing an RS232 Cable Connection**

1. Using the RS232 cable, connect the serial port of your computer (usually COM1) to the receiver's serial port A.
2. Press the **power** buttons on the receiver and computer to turn them on.
3. Continue with Step 1 in "Establishing a PC-CDU Connection" on page 2-13.

## **Establishing a USB Connection**

Make sure the computer has the TPS USB driver installed.

1. Using the USB cable, connect the USB port of your computer to the receiver's USB port.
2. Press the **power** buttons on the receiver and computer to turn them on.
3. Continue with Step 1 in "Establishing a PC-CDU Connection" on page 2-13.

## Establishing a PC-CDU Connection

PC-CDU is a Personal Computer-Control Display Unit software used to manage the various functions of your receiver. The full range of PC-CDU configuration and function is outside the scope of this manual. For more information on any of the procedures in this section or on PC-CDU, refer to the *PC-CDU User's Manual* available on the TPS website.

1. Once the receiver and a computer are connected, start PC-CDU on your computer. The PC-CDU main screen displays (Figure 2-7).

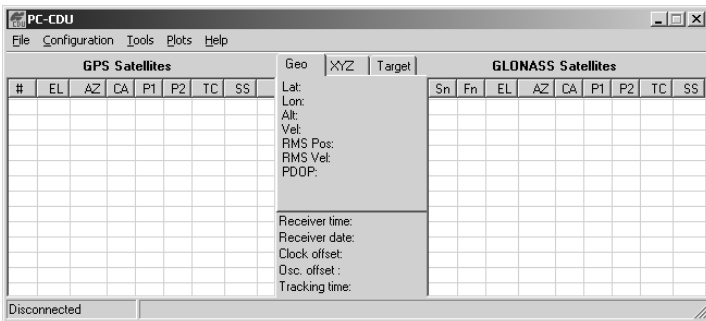
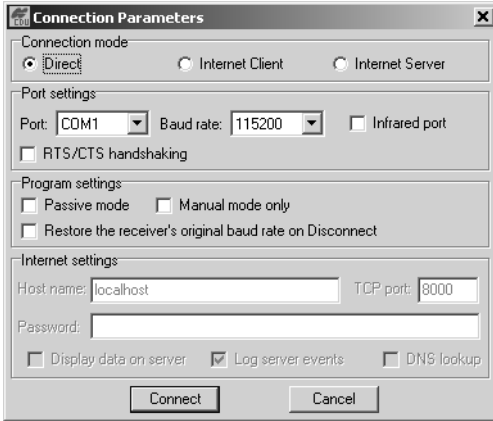


Figure 2-7. PC-CDU Main Screen

Notice that the lower-left hand corner shows the receiver status as “Disconnected”.

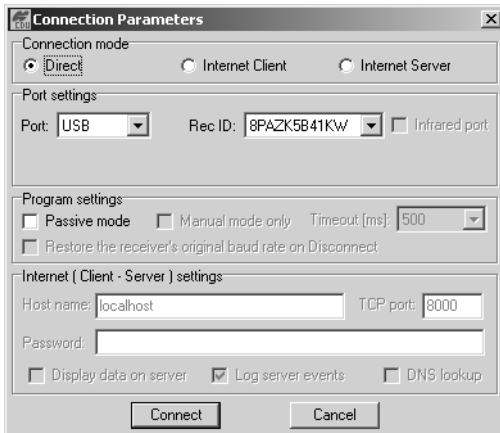
2. Click **File ► Connect**.
3. On the Connection Parameters dialog box, select the following parameters and click **Connect**:
  - for Bluetooth or RS232 connections (Figure 2-8 on page 2-14):
    - Set the Connection mode (Direct).
    - Set the port for your computer (typically COM1, COM2 for RS232 connection and COM3, COM4, etc. for Bluetooth connection) from the Port drop-down list.

- Set the communication rate between the receiver and the computer (usually 115200) from the Baud rate drop-down list.



**Figure 2-8. Bluetooth and RS232 Connection Parameters**

- for USB connections (Figure 2-9):
  - Set the Connection mode (Direct).
  - Set the port for your computer (USB) from the Port drop-down list.
  - Select the receiver’s ID from the Rec ID drop-down list.



**Figure 2-9. USB Connection Parameters**

Once a PC-CDU connection with the receiver has been established, the current communications settings—such as, port name, baud rate (if applicable), and flow control (if applicable)—display in the lower-left corner of the main window of PC-CDU. A timer begins to count up in the lower-right corner as well (Figure 2-10).

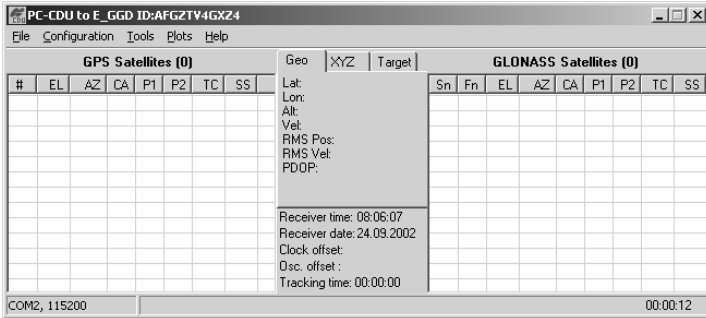


Figure 2-10. PC-CDU Connection Established

## Receiver Configuration

PC-CDU configures the various parts of the receiver, saving the settings in the receiver's memory, and will be reflected when you use the MINTER. The full range of PC-CDU configuration and function is outside the scope of this manual.



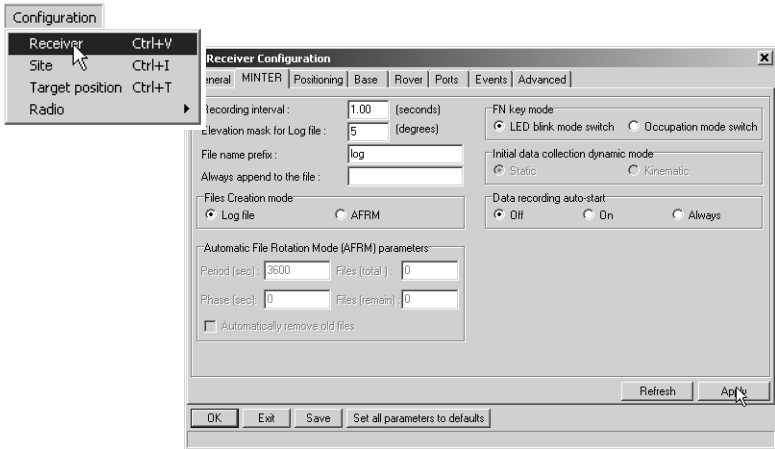
Refer to the *PC-CDU User's Manual* to manage all possible receiver configurations.

The following configuration is recommended for the most common applications. However, you can select configuration parameters as needed for your particular jobsite.



*Click Apply after making any configuration change, otherwise your receiver will not accept the change.*

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-10 for this procedure.
2. Once connected, click **Configuration ▶ Receiver** (Figure 2-11).
3. Click the **MINTER** tab, configure the following settings, and click **Apply** (Figure 2-11).
  - Set the Recording interval in seconds.
  - Set the Elevation mask for Log file in degrees.
  - Enter the File name prefix. Use the last three digits of the receiver serial number. The receiver’s serial number and part number can be found on the bottom panel of the receiver.



**Figure 2-11. Receiver Configuration – MINTER Tab**

If your jobsite is in an area that has obstructions (buildings, trees, etc.), and/or the antenna location is near reflective objects, configure the receiver to reduce errors from these sources.



**WARNING**

**Do not make other changes without consulting the *PC-CDU User’s Manual*.**



4. Click the **Advanced** tab then the **Multipath Reduction** tab, enable the following boxes, and click **Apply** (Figure 2-12).
  - *Code multipath reduction*
  - *Carrier multipath reduction*

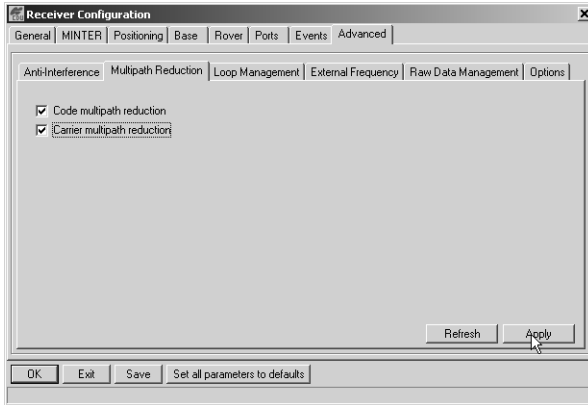


Figure 2-12. Receiver Configuration – Advanced Tab

5. Click the **Loop Management** tab, enable the following boxes, and click **Apply** (Figure 2-13).
  - *Enable Co-Op tracking*
  - *Static Mode*

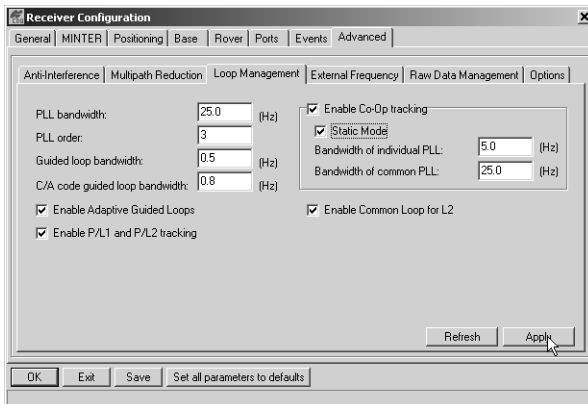
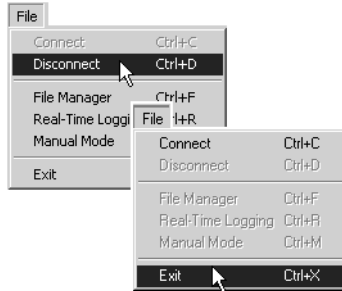


Figure 2-13. Advanced Configuration – Loop Management

6. Click **OK** to close the *Receiver Configuration* dialog box.
7. Click on **File ▶ Disconnect**, then **File ▶ Exit** to quit PC-CDU (Figure 2-14).



**Figure 2-14. Click Disconnect then Exit**

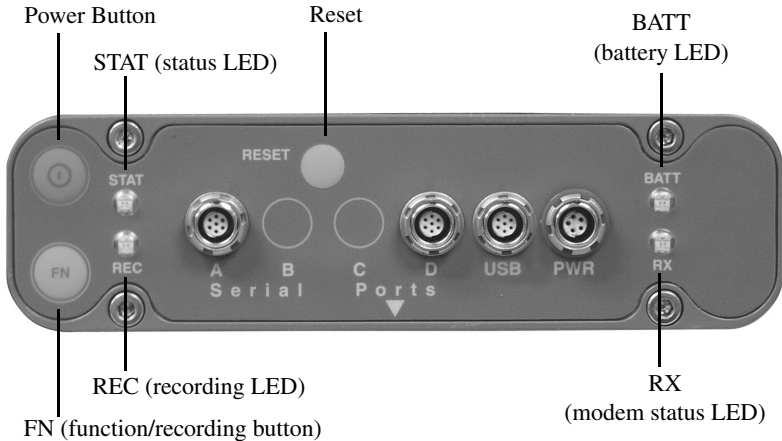
**NOTICE** NOTICE

*Disconnecting the receiver from the computer before exiting will eliminate any possible conflict in the management of your serial ports.*

Once the receiver is configured, the configuration will remain until you change it either using PC-CDU or clearing the NVRAM.

# MINTER Configuration

The Minimum INTERface (MINTER) consists of three keys (Power, FN, and Reset) and four LEDs (STAT, REC, BATT, and RX) that control and display the receiver's operation (Figure 2-15).



**Figure 2-15. MINTER**

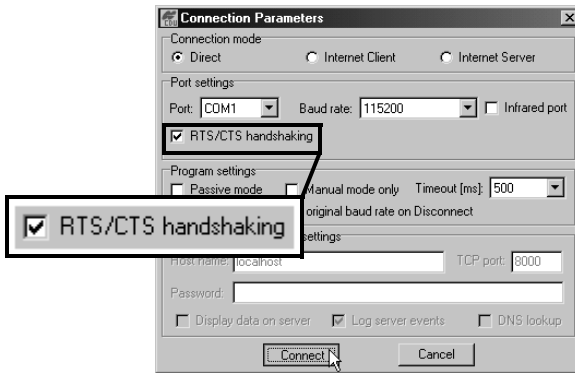
The MINTER performs numerous functions:

- Turn the receiver on or off, put it in either Sleep mode or Zero power mode.
- Turn data recording on or off (FN key).
- Change the receiver's information mode.
- Show the number of GPS (green) satellites being tracked (STAT led).
- Show data recording status (REC led).
- Show each time data is recorded to internal memory (REC led).
- Show the status of post-processing mode (static or dynamic) when performing a Post-Processing Kinematic survey with the help of FN key (REC LED).
- Show the status (high charge, intermediate charge, or low charge) of the battery (BATT LED).

- Show the power source for the receiver (BATT LED).
- Show the status of the modem and if it receives signals (RX LED).

Use PC-CDU to configure MINTER settings. Refer to the *PC-CDU User's Manual* for other possible MINTER configurations.

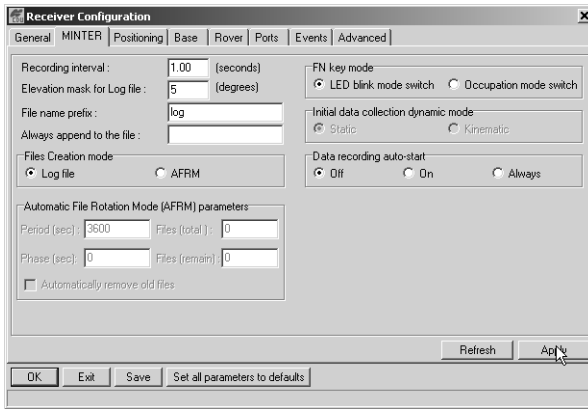
1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-10 for this procedure.
2. On the **Connection Parameters** dialog box, enable RTS/CTS handshaking (Figure 2-16).



**Figure 2-16. Connection Parameters – MINTER Settings**

3. Click **Configuration ▶ Receiver** then click the **MINTER** tab, set the following parameters and click **Apply** (Figure 2-17 on page 2-21). See the following pages for descriptions of these parameters:
  - *Recording interval* on page 2-21
  - *Elevation mask for log file* on page 2-21
  - *File name prefix* on page 2-21
  - *Always append to the file* on page 2-22
  - *Files Creation mode* on page 2-22
  - *Automatic File Rotation Mode (AFRM)* on page 2-22
  - *FN key mode* on page 2-23
  - *Initial data collection dynamic mode* on page 2-24

- *Data recording auto-start* on page 2-24



**Figure 2-17. Receiver Configuration – MINTER Tab**

### Recording Interval parameter

This parameter specifies the message output interval into the log file when the MINTER **FN** key (pressed for 1–5 seconds) activates data logging. This setting is used for both logging a single log file, and logging receiver data in AFRM mode. Values are 1–86400 seconds.

The default value is one second.

### Elevation Mask for Log File parameter

This parameter specifies the minimum elevation angle for the satellites whose data will be put in the receiver files logged when pressing **FN**.

The default value is five degrees.

### File Name Prefix parameter

This parameter specifies the prefix added to the names of receiver files created when pressing **FN**. The prefix can be up to 20 characters long.

The default value for the Name Prefix is “log”.

Log file names have the following structure:

<prefix><month><day><sequential alphabet letter>

The file name depends on both the file creation time (month and day) and additional letter suffixes to avoid confusion between files created on the same day.

#### Always Append to the File parameter

If you want new receiver data to be appended to an existing log file, enter the desired file name in this parameter. The setting can be up to 20 characters long.

#### Files Creation Mode parameter

This parameter has two possible operation modes:

- **Log file** – If the log file radio button has been selected, pressing the **FN** key closes the current log file. If data logging is off, pressing **FN** opens a new log file.
- **AFRM** – If AFRM radio button has been selected, pressing **FN** enables this mode. If AFRM has been enabled, pressing **FN** disables this mode.

#### Automatic File Rotation Mode (AFRM) parameters

TPS receivers are capable of automatically rotating log files. During a “file rotation” event, the receiver closes the current file and opens a new one according to a user-defined schedule. The Period and Phase parameters specify this schedule. File rotation launches the moment the receiver time module Period is equal to Phase. More precisely, a new log file opens immediately before the scheduled epoch causing data tagged with this epoch to be recorded to the new log file.

When opening a new log file, the receiver enables the default set of messages outputted with the default output period. Both the default set of messages and the default output period are programmable.

- **Period** – specifies the time duration of each log file created in AFRM mode.  
Values are 60 to 86400 seconds; default value is 3600 seconds.
- **Phase** – specifies the “phase” (constant time shift) of creating multiple log files in AFRM mode.  
Values are 0 to 86400 seconds; default value is zero seconds.

- **Files (total)** – a counter that specifies how many multiple log files must be created in AFRM until this mode automatically turns off. This counter decrements on every file rotation until its value becomes zero, then file rotation automatically stops. The counter initializes with AFRM.

Note that a log file opens immediately after turning AFRM on. This startup file is not considered a file rotation event; the AFRM counter will not decrement.

Values are 0 to  $[2^{31}-1]$ ; default value is 0 (zero). Zero means that an unlimited number of log files will be created.



### NOTICE

*The receiver's memory holds up to 512 files.*

- **Files (remain)** – specifies the number of files left for the receiver to create in AFRM.

Values are 0 to  $[2^{31}-1]$ ; default value is zero.

- **Automatically remove old files** – when no free memory is available to log data, automatically removes the earliest log file. If this parameter is enabled, your receiver will erase the file with the earliest file creation time/date. AFRM must be enabled to use this FIFO (First-In, First-Out) feature.

The default value is off (disabled).

### FN Key Mode parameter

Use these two radio buttons to program how the receiver will react when pressing the **FN** key.

- **LED blink mode switch** – pressing **FN** will toggle between the MINTER's normal/extended information modes and start/stop data recording of Static survey.
  - **FN** pressed for less than 1 second: changes the information mode (Normal or Extended Information (EI) Modes).
  - **FN** pressed for 1 to 5 seconds: starts or stops data recording (Static post-processing mode).

- Occupation mode switch – pressing **FN** (less than one second) will insert into the corresponding log file a message indicating that the survey type has been changed from static to kinematic, or vice versa. If the REC LED blinks green, the current mode is dynamic, if it blinks orange, the current mode is static. For more details, see Table 4-1 on page 4-5, and refer to the *MINTER User’s Manual* and *PC-CDU User’s Manual*.

**Initial Data Collection Dynamic Mode parameter**

These radio buttons specify the starting occupation type descriptor inserted at the beginning of receiver files logged. Select Static or Kinematic to specify that the corresponding log file will start with a static (STOP) or kinematic (GO, Trajectory) occupation, respectively.

**Data Recording Auto-start parameter**

These radio buttons allow you to program your receiver’s behavior in the event of a power failure.

Table 2-2 gives the different scenarios available and the results after power is restored to the receiver. “Specified file” refers to the file name entered in the Always append to file parameter.

**Table 2-2. Data Recording Parameter Behavior**

Before Power Failure	Enabled Radio Button Results		
	Off	On	Always
1 Receiver data logged to file specified.	Data logging will not resume when power is restored.	Receiver will resume data logging to the same file when power is restored.	Receiver will resume data logging to the same file when power is restored.
2 Receiver data logged to default file.	Data logging will not resume when power is restored.	A new log file will open when power is restored and data will log to this file.	A new log file will open when power is restored and data will log to this file.



**Table 2-2. Data Recording Parameter Behavior (Continued)**

<b>Before Power Failure</b>	<b>Enabled Radio Button Results</b>		
	<b>Off</b>	<b>On</b>	<b>Always</b>
3 File specified; receiver data logging not started.	No file will open with this name. Data logging will not start when power is restored.	No file will open with this name. Data logging will not start when power is restored.	A log file with this name will open and data logging will start after power is restored.
4 No file specified; receiver data logging off.	Data logging will not start when power is restored.	Data logging will not start when power is restored.	A log file with a default name will open and data logging will start after power is restored.

Also, if *Always* is enabled, your receiver will automatically start logging data (to a newly created or an existing file) in the following three cases:

- After turning on the receiver using the Power key.
- After resetting the receiver (using PC-CDU or pressing the Reset key).
- After taking the receiver out of Sleep Mode.

# Radio Configuration

Modem-TPS is Topcon's radio modem configuration utility for modems embedded in HiPer family receivers. Modem-TPS provides the following functions:

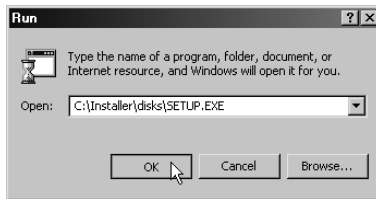
- Connecting a PC to an integrated radio modem via a serial port or Bluetooth wireless technology.
- Displaying information about the radio modem installed in the receiver.
- Programming the radio modem's settings.

For HiPer Pro receivers, the integrated Satel radio modem provides TX/RX UHF communications between a Base Station and Rover. To configure the Satel radio modems, have the following ready:

- Computer running Windows® 98 or newer
- Modem TPS ver 1.6 or newer
- Serial cable
- Frequency list
- NetID Setting

First, download and install Modem-TPS, then connect your computer and the receiver, and run the configuration program.

1. On your computer, click **Start ▶ Run** to open the **Run** dialog box. Click the **Browse** button to find the Modem-TPS "setup.exe" program, and click **OK** (Figure 2-18).



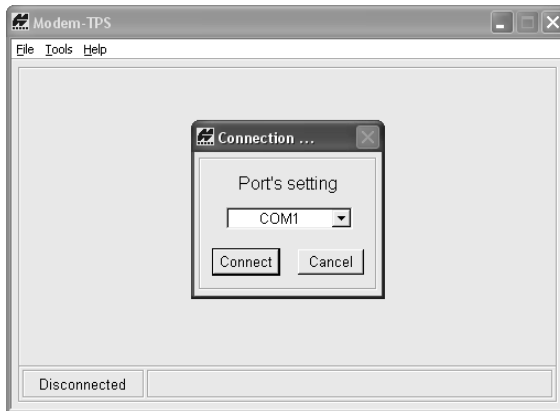
**Figure 2-18. Run Modem-TPS**

2. Follow the on-screen instructions to complete the installation.

To uninstall Modem-TPS, use the Start menu on your computer: Click **Start** ► **Programs** ► **Modem-TPS** ► **Uninstall Modem-TPS**, and click **Yes** at the prompt. Then click **OK** when the uninstall completes.

Both the Base Station and Rover will need to be configured with the same Radio Link and FCS settings to work properly together.

1. To connect to Modem-TPS, use an RS232 cable or Bluetooth wireless technology to connect the computer and HiPer Pro.
2. Turn on the receiver.
3. Open Modem-TPS and select the COM port the receiver is connected to (Figure 2-19).
4. Click **Connect**.



**Figure 2-19. Connect to Modem-TPS**

When finished configuring the radio modem, always disconnect from Modem-TPS before exiting to prevent conflicts with serial port management.

## Setting the Radio Link

The Base Station and Rover require the following same radio configuration settings to properly communicate:

- Current frequency
- Signal Threshold Level
- Free Channel Scan

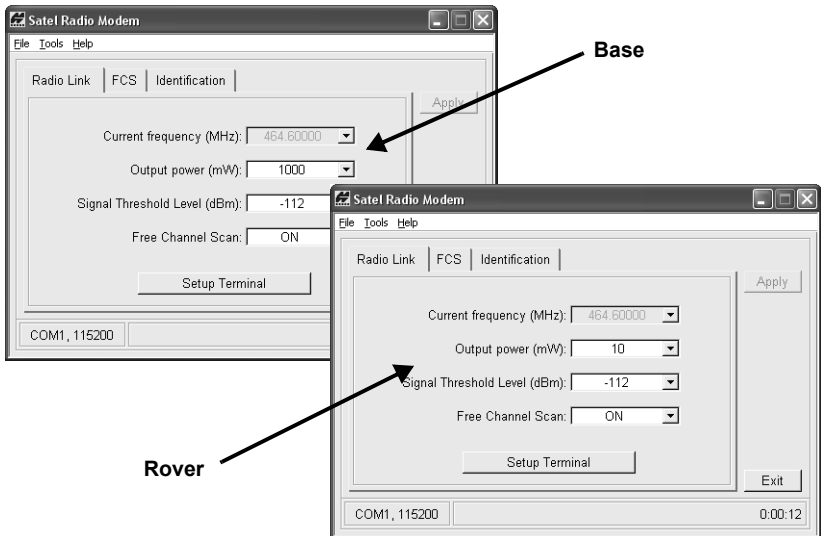
**NOTICE** NOTICE

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

The *Radio Link* tab (Figure 2-20 on page 2-29) has settings for establishing a link between the Base Station and Rover. Use the following table to determine the settings for the Base and Rover receivers (Table 2-3).

**Table 2-3. Radio Link Tab Settings**

Radio Link Settings	Optimal Scenario (~100m between receivers)	Maximum Distance Scenario (~3–4km between receivers)
Current Frequency	Base and Rover on same frequency.	Base and Rover on same frequency.
Output Power	Base at 10. Rover at 10.	Base at 1000. Rover at 10.
Signal Threshold Power	Base and Rover at -112.	Base and Rover at -112.
Free Channel Scan	Base and Rover on same setting.	Base and Rover on same setting.



**Figure 2-20. Radio Link Settings – Optimal Distance for Base and Rover**

The current frequency setting establishes the frequency used for communication between the Base Station and Rover. Available frequencies will vary by location.

1. To change the receiver's frequency, set the *Free Channel Scan* field to OFF.
2. Select a frequency from the list (Figure 2-21 on page 2-30). Use the same frequency for both receivers.
3. Click **Apply**.
4. If needed, set the Free Channel Scan back to ON.

5. Click **File ▶ Disconnect** then **File ▶ Exit** to quit Modem-TPS, or continue below to setup the frequency list.

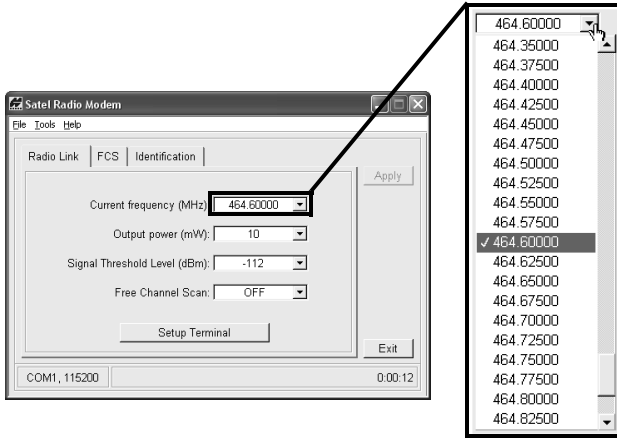


Figure 2-21. Select Current Frequency

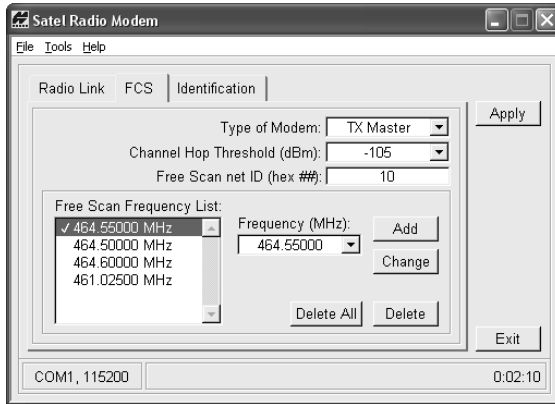
## Configuring Radio Channels

Modem-TPS also configures the channels used for radio modem communication. The Satel radio modems are a UHF transmitter/receiver at 4MHz bandwidth or a UHF receiver at 20MHz bandwidth, with a 25kHz channel spacing, and a maximum 1W power output for data transmission.

The FCS tab (Figure 2-22 on page 2-31) in Modem-TPS sets radio channels for the Base Station and Rover. Also, a Base Station can be reconfigured as a Rover station if needed.

1. If changing the mode of the Base Station, select either TX Master or RX Slave. For Rover receivers, this selection will always display as RX Slave.
2. For peak performance, leave the default setting for the Channel Hop Threshold (the default is -105).
3. For both the Base Station and Rover, set the same Free Scan net ID. The Net ID uses a hexadecimal format from 0 to FF.

Occasionally, the receivers may encounter interference if a jobsite has more than one set of HiPer Pro receivers. In this case, enter a different Free Scan net ID for each set of receivers.



**Figure 2-22. FCS Tab**

4. To set up the frequency list for communication between the Base Station and Rover, select a frequency from the *Frequency* list and click **Add**. Only select those frequencies that you have a license for and that are available in your location.
  - To change a frequency, select a frequency in the *Free Scan* list, then from the *Frequency* list. Click **Change**.
  - To delete a frequency, click **Delete all** or select one frequency and click **Delete**. Be sure to delete the same frequency for both receiver setups.



### NOTICE

*The frequencies must be in the same order for both Base Station and Rover setups.*

5. Click **Apply** after making changes to the radio configuration.
6. Click **File** ► **Disconnect** then **File** ► **Exit** to quit Modem-TPS.

# Bluetooth Module Configuration

Use BTCONF, the Bluetooth module's configuration program, and your computer to:

- access the Bluetooth wireless technology module
- configure the Bluetooth module
- check or change the module's configuration

To access the Bluetooth wireless technology module, first download and install BTCONF, then connect your computer and the receiver and run the configuration program.

1. Create or locate the following folder:

`C:\Program Files\TPS\BTCONF`

2. Download btconf.zip from the TPS website and unzip it into the BTCONF folder. This file contains Btconf.exe, the executable file for the Bluetooth module configuration program.

Each time you run BTCONF and configure the Bluetooth module, BTCONF saves your settings in a file (btconf.ini). BTCONF automatically updates the file each time you make changes to the Bluetooth module's settings.



**TIP**

To maintain unique Bluetooth module settings for different purposes, keep copies of BTCONF in separate folders.

To uninstall BTCONF, delete any applicable BTCONF directories or folders, and any BTCONF shortcuts.

Once you have BTCONF available, follow these steps to configure the Bluetooth module.

1. Using the RS232 cable, connect the serial port of your computer (usually COM1) to the receiver's serial port A. If needed, turn on the receiver and computer.



2. Run the Bluetooth module configuration program (Btconf.exe) (Figure 2-23).

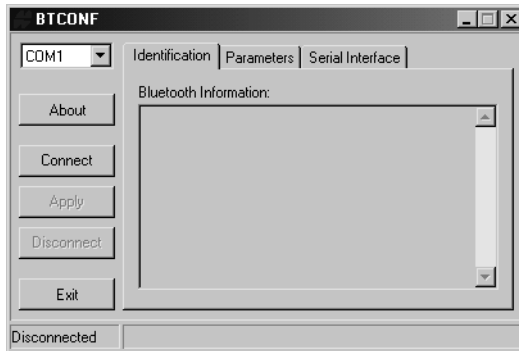


Figure 2-23. Bluetooth Module Configuration Main Screen

Notice that the lower left corner shows a “Disconnected” status for the computer and Bluetooth module.

For BTCONF version and copyright information, click the **About** button.

3. From the drop-down list in the upper left corner, select the computer serial port (usually COM1) used for communication (Figure 2-24).
4. Click **Connect** to connect the computer and Bluetooth module (Figure 2-24).

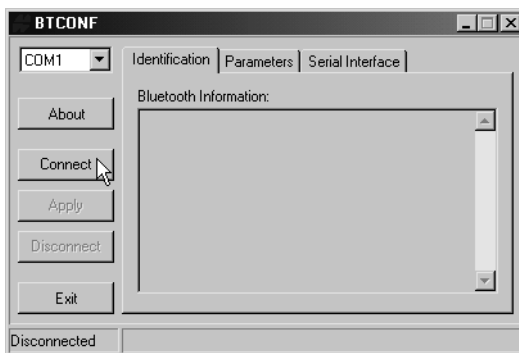
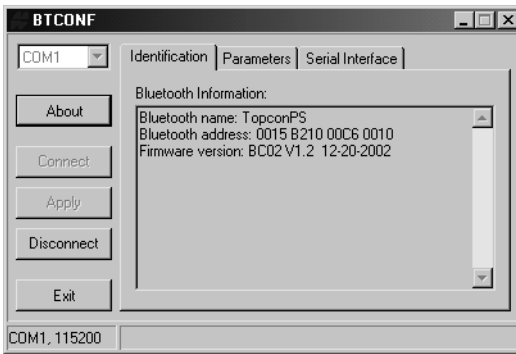


Figure 2-24. Select Communication Port and Click Connect

Once the receiver and computer connect through BTCONF, the Identification tab (Figure 2-25) displays the following information:

- Bluetooth name – the name of the Bluetooth module, set in the Parameters tab.
- Bluetooth address – the unique electronic address for your Bluetooth module.
- Firmware version – the current firmware version of the Bluetooth module.

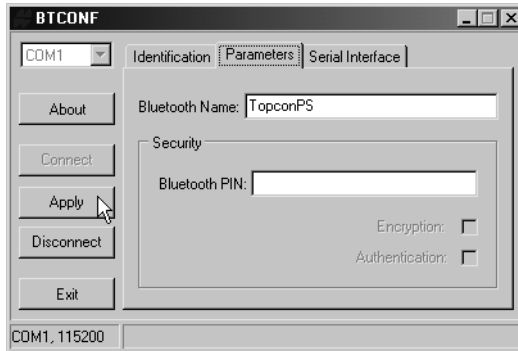


**Figure 2-25. BTCONF Identification Tab**

The COM port and baud rate display in the lower left corner.

5. Click the **Parameters** tab (Figure 2-26 on page 2-35). The Parameters tab sets identifying and security information for your Bluetooth module. The security section allows you to set data security and unauthorized access parameters for the Bluetooth module.

6. Enter up to 14 characters to set a unique name for the Bluetooth module (Figure 2-26), and click **Apply**.



**Figure 2-26. BTCONF Parameters Tab**

7. To set security parameters (Figure 2-27 on page 2-36), enter and enable the following, then click **Apply**:
- Bluetooth PIN – enter up to 16 characters to specify a personal identification number for the Bluetooth module.
  - Encryption – enable to have the Bluetooth module encrypt wirelessly sent data. To read encrypted data, the user must have the same PIN used in the device that sent the data.
  - Authentication – enable to require a PIN before two Bluetooth enabled devices (such as, the receiver and a computer) can establish a communication link. The two devices must use the same PIN.



### NOTICE

*If you do not need security settings, leave these parameters disabled.*

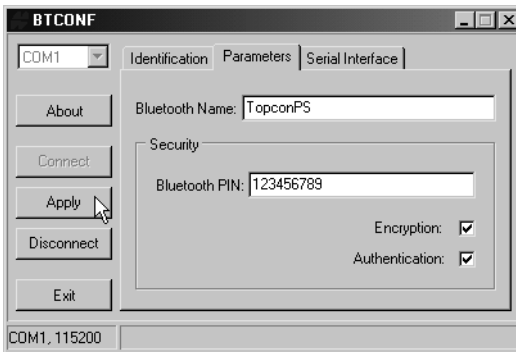


Figure 2-27. BTCONF Security Parameters

8. Click the **Serial Interface** tab (Figure 2-28). Enable Echo to display Bluetooth module replies and corresponding commands on the computer terminal. If needed, click **Apply**.

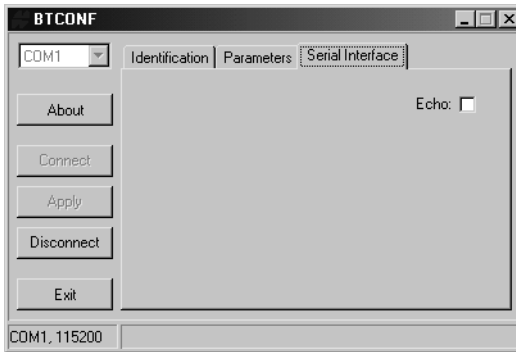


Figure 2-28. BTCONF Serial Interface Tab

9. Click **Disconnect** then **Exit** (Figure 2-29) to quit BTCONF.

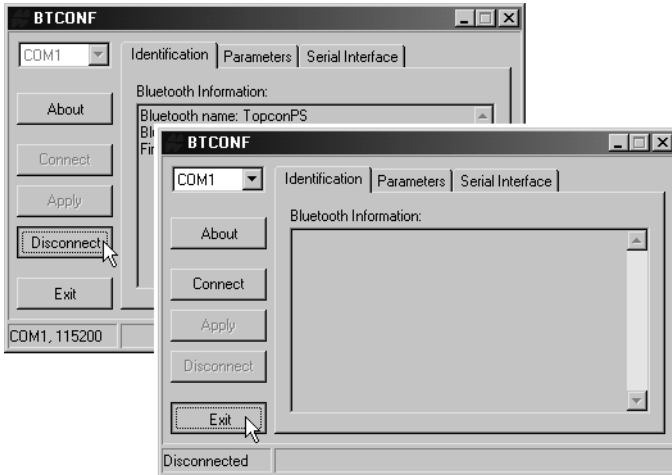


Figure 2-29. Click **Disconnect** then **Exit**

## Collecting Almanacs

Each satellite broadcasts a message (almanac) which gives the approximate orbit for itself and all other satellites. If the receiver has an almanac, you can considerably reduce the time needed to search for and lock on to satellite signals.

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

1. Set up the receiver (connect the external antenna, if needed) 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 almanac data from the satellites.

### **NOTICE** NOTICE

*If 15 minutes have passed and the receiver does not lock on to satellites, you may need to clear the NVRAM. See “Clearing the NVRAM” on page 4-17 for this procedure.*

You will need to collect or update the almanac:

- 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 firmware.
- After clearing the NVRAM.
- Before surveying.

# Setup and Survey

This chapter describes:

- Receiver setup
- RTK Base station setup
- RTK Rover setup
- Basic surveying with the HiPer Pro receiver

The HiPer Pro package use one receiver as the Base station and the other as the Rover station.

## Receiver Setup

To set up the receivers, you must:

1. Configure the receivers as shown in Chapter 2.
2. Set up the Base and Rover stations. See “Step 1: Set up the Receiver” on page 3-2.
3. Measure the antenna height. See “Step 2: Measure Antenna Height” on page 3-2 for internal antennas.
4. Begin collecting data. See “Step 3: Collect Data” on page 3-4.

All receivers include an internal, micro-strip antenna able to capture L1/L2 signals from GPS and GLONASS satellites.

## Step 1: Set up the Receiver

This section assumes the receiver has been configured using PC-CDU.

1. Place the receiver on the appropriate tripod or bipod.
2. Center the receiver over the point at which data will be collected. For most applications, this should be at a location with a clear view of the sky.

## 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.

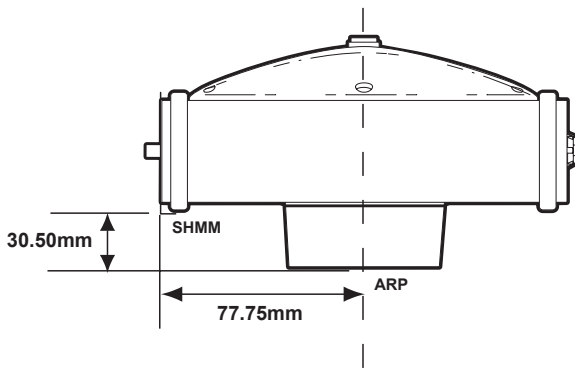
The receiver calculates the coordinates of the antenna's phase center. To determine the coordinates of the station marker, the user must specify the following:

- 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.
1. Measure the antenna height above the point or marker. Figure 3-1 illustrates the antenna offsets. (See Figure 1-5 on page 1-15 and Figure 1-6 on page 1-16 for the exact SHMM location.)





**Figure 3-1. HiPer Pro Antenna Offsets**

- SHMM to ARP vertical offset = 30.50mm
- SHMM to ARP horizontal offset = 77.75mm

Table 3-1 gives the offset values for the receivers.

**Table 3-1. Antenna Offset Values for Receiver Options**

	To L1 Phase Center	To L2 Phase Center
Up	105.9mm	97.1mm

The point to which surveying with GPS/GLONASS measures is called the Phase Center of the antenna. This is analogous to the point at which a distance meter measures in a prism. A user must enter the prism offset to compensate for this point not being at a physical surface of the prism. In the case of a GPS/GLONASS antenna, the offset is entered depending on the type of measurement taken. For vertical, the offset is simply added to the measured vertical height to produce a “true” vertical height. For slant height, the vertical height must first be calculated using the radius of the antenna, then the offset can be added. The offsets are not the same number because of the difference in location between the slant measuring point and the vertical measuring point.

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

3. Press the **power** key and release it to turn the receiver on. The STAT (status) light (LED) will blink red at first.
4. Once the receiver has locked on to one or more satellites, the STAT light will blink green for GPS satellites, orange for GLONASS satellites, and a short red blink indicating it has not solved a position. Four or more satellites provide optimal positioning.
5. Once the short red blink is gone, the receiver has a position and surveying can begin. You should wait for green and orange lights before beginning data collection. This ensures that the receiver has the correct date and time, and is locked on to enough satellites to ensure good quality data.

The process of locking on to satellites normally takes less than one minute. In a new area, under heavy tree canopy, or after resetting the receiver, it may take several minutes.

## Step 3: Collect Data

1. To begin collecting data, press and hold the **FN** (function) key for more than one second and less than five seconds.
2. Release the **FN** key when the REC (recording) LED light turns green. This indicates that a file has opened and data collection has started. The REC LED blinks each time data is saved to the internal memory.



### TIP

Use PC-CDU to configure data logging. See “MINTER Configuration” on page 2-19 or refer to the *PC-CDU User's Manual*.

3. When finished, press and hold the **FN** key until the REC LED light goes out.
4. To turn off the receiver, press and hold the **power** key until all lights go out, then release.

# Surveying with the Receiver

Your receiver can be used to perform the following types of surveying:

- Static
- Kinematic
- Real-time kinematic (RTK)

## Static Survey

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 15 kilometers (9.32 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 far less observation time to reach the desired accuracy requirement.

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

The procedure that follows describes the steps the operator should take to perform a Static Survey using MINTER.

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-10 for this procedure.
2. Open PC-CDU, click **Configuration ▶ Receiver ▶ MINTER** and specify the following parameters, then click **Apply** (Figure 3-2):
  - *Recording interval* – 15 seconds
  - *Elevation mask angle* – 15 degrees
  - *File name prefix* – last 3 digits of receiver serial number
  - *LED blink mode switch* – enable to start and stop static data recording using the FN key

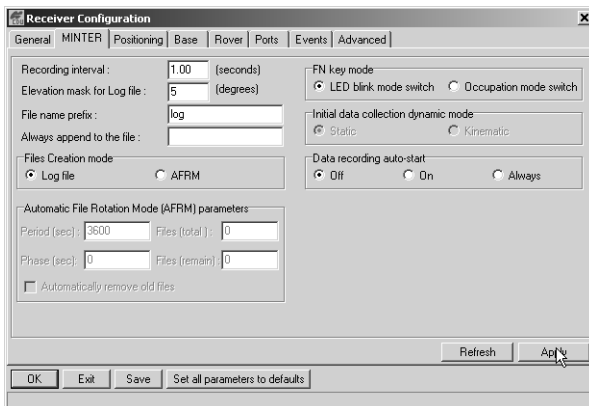
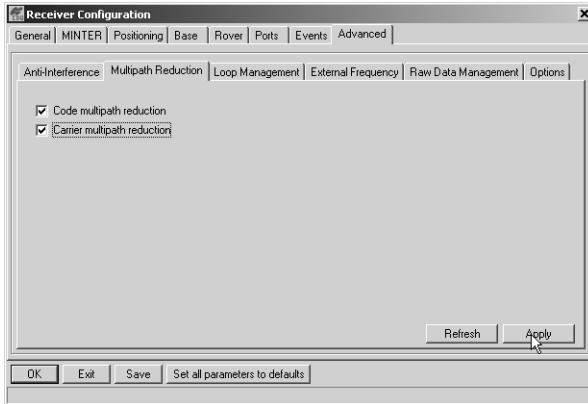


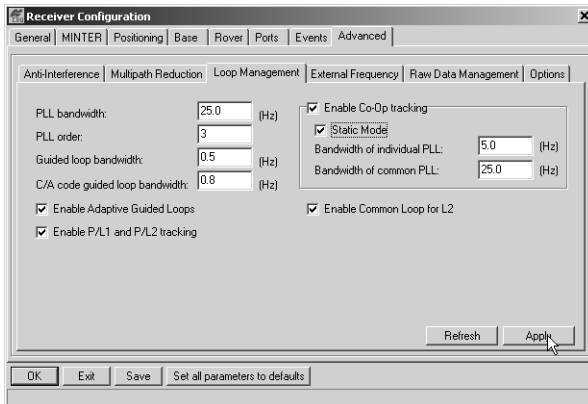
Figure 3-2. Configure MINTER

3. Click the *Advanced* tab and then the *Multipath* tab, set the following parameters, then click **Apply** (Figure 3-3):
  - *Code multipath reduction* – enable
  - *Carrier multipath reduction* – enable



**Figure 3-3. Configure Multipath**

4. Click the *Loop Management* tab and set the following parameters, then click **Apply** (Figure 3-4):
  - *Enable Co-Op tracking* – enable
  - *Static mode* – enable



**Figure 3-4. Configure Loop Management**

5. Set up each antenna and receiver as described in “Receiver Setup” on page 3-1.
6. Begin surveying.

## Kinematic (Stop and Go) Survey

In a kinematic, stop and go, survey, the stationary receiver (Base station) is set up over a point, such as a survey monument. The receiver continually tracks the satellites and logs the raw data into its memory. The rover receiver is set up over a point and collects data in static mode for 2 to 10 minutes.

1. Using PC-CDU, configure and set up the Base as described in “Static Survey” on page 3-5.
2. Using PC-CDU, click **Configuration ▶ Receiver ▶ MINTER**, and configure the Rover with the following parameters, then click **Apply** (Figure 3-5):

- *FN key mode, Occupation mode switch* – enable
- *Initial data collection dynamic mode, Kinematic* – enable

See Table 4-1 on page 4-5 for FN key functions and REC LED statuses.

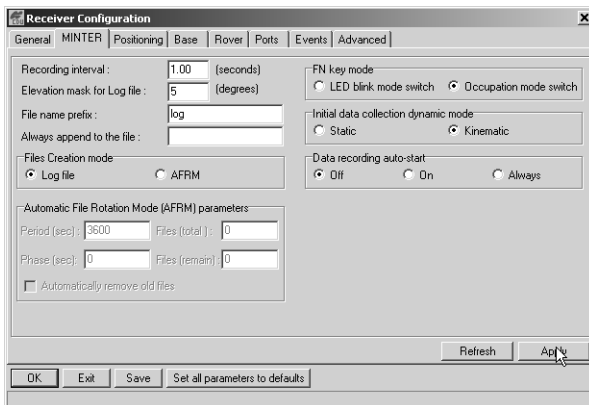


Figure 3-5. Rover MINTER Configuration

**NOTICE**

*Remember, both Base and Rover receivers must collect data from the same satellites, at the same data recording rate, and with identical elevation mask angles.*

3. Set up the Rover at an unknown point and press **power**. Allow the Rover to collect static data for two to ten minutes. The REC LED will be orange.
4. Check the STAT light for satellites tracked.
5. When finished, press the **FN** key for less than a second to assign the Rover to kinematic.

**TIP**

Remember, if the REC LED blinks green, the current mode is dynamic, if it blinks orange, the current mode is static.

6. Move the Rover to the next location (survey point), and press the **FN** key for less than a second to collect the data in static mode for two to ten minutes.
7. Repeat steps five and six until all points have been surveyed. The occupation time for the points depends on the same factors as for the static survey method.
8. When finished, press the **FN** key for one to five seconds to stop logging data. Turn off the Rover if needed.

This method of GPS survey allows the operator to reduce the point occupation time, thus permitting field crews to survey many more points compared to the other methods available.

## Real-time Kinematic Survey

Real-time kinematic (RTK) is a differential GPS process where information, such as differential corrections, is transmitted in real-time from a Base station to one or more Rover stations.

### Set up an RTK Base Station

To configure an RTK Base station using PC-CDU, take the following steps:

1. Set up the Base station receiver's antenna as described in "Receiver Setup" on page 3-1.
2. Press the **power** key on the receiver.
3. Check the STAT light for tracked satellites.
4. Connect your receiver and computer. See "Connecting the Receiver and a Computer" on page 2-10 for this procedure.
5. Click **Configuration ▶ Receiver**.
6. Click **Set all parameters to defaults** located at the bottom of the dialog box (Figure 3-6).

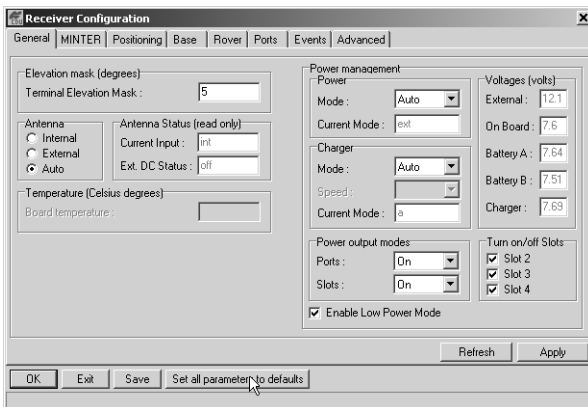


Figure 3-6. Set All Parameters to Defaults

7. On the **Receiver Configuration** screen, click the **MINTER** tab and specify the desired settings. Refer to the *PC-CDU User's Manual* for more information.



8. Click the *Positioning* tab and set the Elevation mask parameter to 15 (Figure 3-7), then click **Apply**.

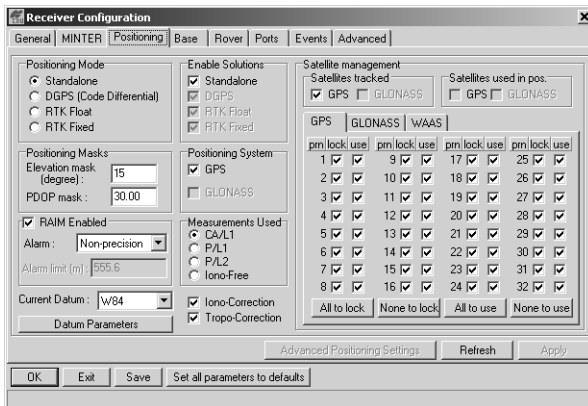


Figure 3-7. Configure Receiver Positioning – Elevation Mask

9. Select the **Base** tab, set the following parameters (Figure 3-8 on page 3-12), and click **Apply**:
- *GPS/GLO at one time* – enable
  - Antenna position – enter Lat, Lon, and Alt values. Do one of the following:
    - If known, type in the values.
    - Enable Averaged and enter the Averaged Span in seconds, then click **Apply**. Click **Tools ▶ Reset receiver** and wait until the specified interval (span) completes. Examine the Base coordinates on the Base tab, they should correspond to the coordinates obtained from the average. Click **Refresh** if the coordinates are zeros.
    - Click **Get from receiver**.



### NOTICE

*The reference geodetic coordinates specified on this tab relate to the antenna L1 phase center.*

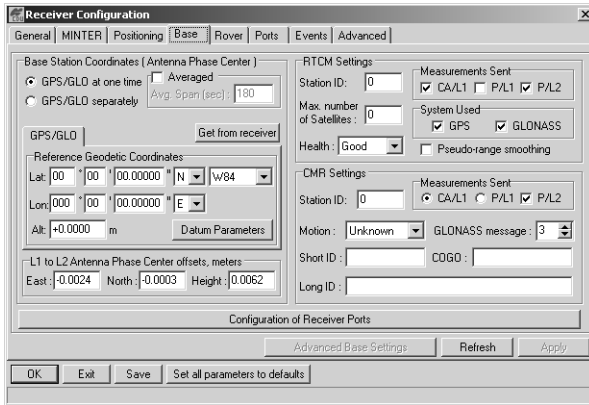


Figure 3-8. Base Configuration

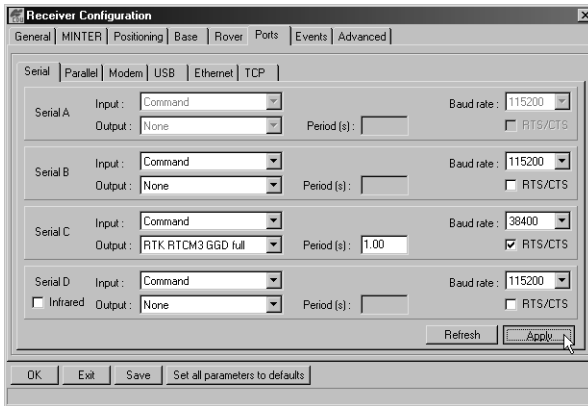
10. Click the **Ports** tab and set the following port parameters (Figure 3-9).

- *Output* drop-down list – select type and format of differential corrections.
- *Period (sec)* – enter interval at which receiver will generate differential corrections.
- *Baud rate* drop-down list – select a baud rate (i.e., the rate at which differential messages will be transmitted from receiver to modem).
- *RTS/CTS* – select to enable handshaking.



TIP

Use a 38400 baud rate.



**Figure 3-9. Base Configuration – Ports**

11. Click **Apply**. The receiver begins sending data to the selected port.

For more details on the settings available for configuring the Base station, refer to the *PC-CDU User's Manual*.

## Set up an RTK Rover

Use the following steps to set up an RTK Rover station. You should already have programmed the modem.

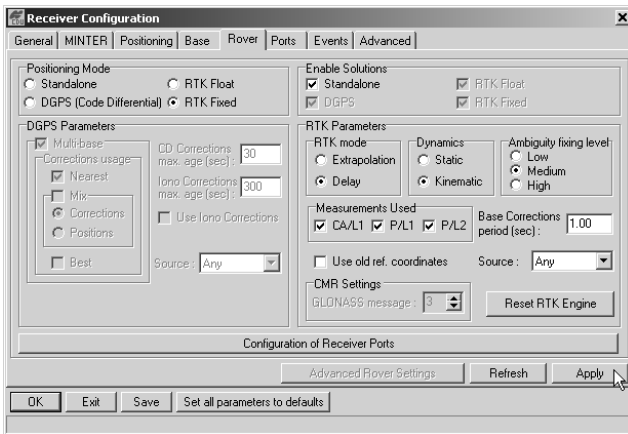
Figure 3-10 shows the hardware setup for a Rover station with an external controller.



**Figure 3-10. Rover Station Setup**

1. Set up the Rover station receiver's antenna as described in "Receiver Setup" on page 3-1.
2. Connect the receiver and computer. See "Connecting the Receiver and a Computer" on page 2-10.
3. Click **Configuration ▶ Receiver**.
4. Click the *Positioning* tab and set the *Position Masks, Elevation mask (degrees)* parameter to 15 (Figure 3-7 on page 3-11).

- Click the *Rover* tab and set the desired *Positioning Mode* (Figure 3-11).



**Figure 3-11. Rover Configuration**

Adjust the following RTK Parameters settings:

- Under RTK mode in the RTK Parameters section, choose either Extrapolation for RTK float (kinematic) or Delay for RTK fixed (static).
  - Extrapolation is for low-latency, high frequency output ( $\geq 5$  Hz) RTK applications. The rover will extrapolate the base station's carrier phase measurement corrections when computing the rover's current RTK position.
  - Delay is for 1 Hz high precision RTK applications. The Rover RTK engine will compute either a delayed RTK position (for the epoch to which the newly received RTCM/CMR message corresponds) or the current stand-alone position (while waiting for new RTCM/CMR messages coming from the base).
- Select the antenna status during RTK, either Static or Kinematic.
- Specify the Ambiguity fixing level (not applicable to RTK Float). The Ambiguity Fixing Level radio buttons govern the process of the RTK engine, fixing integer ambiguities. The RTK engine uses the ambiguity fix indicator when making

decisions whether or not to fix ambiguities. Low, Medium, and High correspond to the indicator's 95%, 99.5% and 99.9% states, respectively. The higher the specified confidence level, the longer the integer ambiguity search time

6. Click the *Ports* tab and set the following parameters for Serial C (Figure 3-12 on page 3-16):
  - *Input* drop-down list – select the desired differential correction format.
  - *Period (sec)* – leave as is.
  - *Baud rate* drop-down list – select a baud rate (i.e., the rate at which differential messages will be transmitted from modem to receiver).
  - *RTS/CTS* – select to enable handshaking.



TIP

Use a 38400 baud rate.

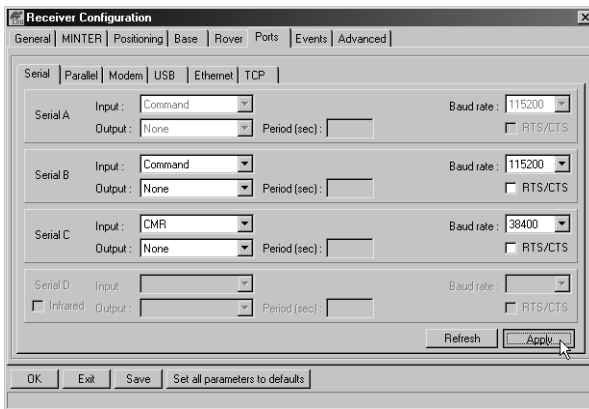


Figure 3-12. Rover Configuration – Ports

7. Click **Apply**.
8. Click **OK** to close the Receiver Configuration screen.

9. On the main screen (Figure 3-13), check the *LQ* field 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 may take as long as 60 seconds to synchronize.

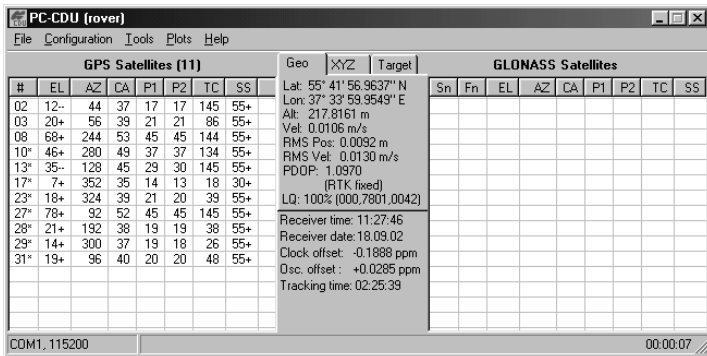


Figure 3-13. PC-CDU Main Screen

The geodetic coordinates displayed on the Geo tab are always computed in WGS84 and have four solution types.

- Standalone – where 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.

The *LQ* field 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 the receiver is not (for some reason) receiving differential corrections, or if none of the ports has been configured to receive differential corrections, the LQ field will either be empty or it will look like this: 100%(999,0000,0000).



# Operation

This chapter describes standard receiver operating procedures:

- Using the MINTER
- Downloading receiver files to a computer
- Deleting files from the receiver
- Checking and loading OAFs
- Managing receiver memory
- Clearing the NVRAM
- Changing receiver modes
- Checking and loading firmware

Topcon receivers are built to operate independent of the receiver type. Any minor exceptions for the HiPer Pro are noted.

# Using the MINTER

The MINTER (Figure 4-1) is Topcon’s Minimum INTERface used to display and control data input and output, and is the same for all HiPer family receivers.

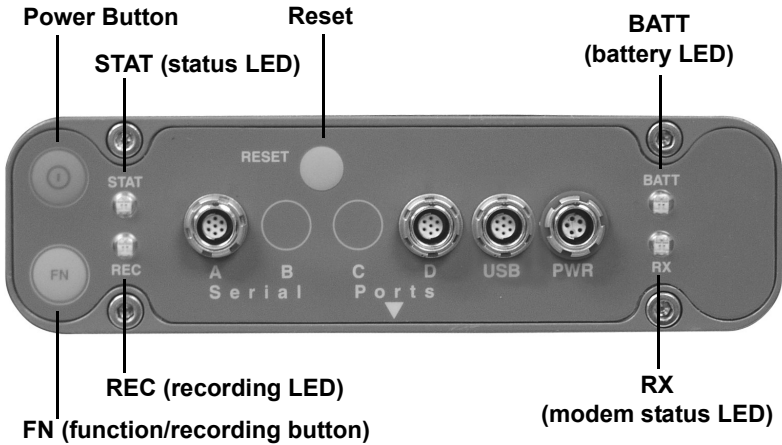


Figure 4-1. MINTER

## Power Key

Pressing the **power** key turns the receiver on and off.

## Status LED

- When the receiver is on and no satellites are tracked, the STAT LED will blink red.
- When satellites are tracked, the STAT LED will produce one blink for each tracked satellite (green for GPS, orange for GLONASS).

## Reset Key

Pressing and holding the **reset** key for about one second causes:

- a hard reset of the receiver.
- the receiver to leave Zero Power Mode and return to Normal Mode.



### NOTICE

*Only use this procedure if the receiver does not respond to commands or does not charge the internal batteries (is in Zero Power Mode).*

## FN Key and Record LED

Table 4-1 on page 4-5 summarizes FN key functions and REC LED statuses. See “FN Key Mode parameter” on page 2-23 for information on setting FN key modes.

- Pressing the **FN** key for less than one second switches the receiver between different information modes (normal and extended information), or between static and dynamic post-processing modes, depending on the receiver's configuration. During the first second of pressing the **FN** key, the REC LED is orange.

- Pressing and holding the **FN** key for more than one and less than five seconds will start/stop data recording.

During data recording the REC LED is green.

If the REC LED is red, the receiver has run out of memory, has a hardware problem, or contains an improper OAF (see “Option Authorization File (OAF)” on page 1-16 for more information on OAFs).

- The REC LED blinks green each time data is written to the internal receiver's memory.

You set the data recording time interval using PC-CDU. See “Recording Interval parameter” on page 2-21 for information on setting this function.

Each time you turn off or on data recording, either a new file opens or data appends to a particular file. See “Always Append to the File parameter” on page 2-22 and “Files Creation Mode parameter” on page 2-22 for information on setting this function.

- Pressing and holding the **FN** key for more than five and less than eight seconds will turn the baud rate of serial port A to 9600. After about five seconds of pressing the **FN** key, the REC LED becomes red. Release the **FN** key while the REC LED is red (during the next three seconds).

Pressing and holding the **FN** key for more than eight seconds has no impact.

- After loading new firmware or clearing the receiver’s NVRAM, the receiver checks its internal file system.

During this operation, the REC LED flashes orange, and the file system is not accessible for CDU (control display unit) applications or for data recording. This operation may require from fractions of a second to several minutes, depending on the circumstances and the amount of internal memory.

**Table 4-1. FN Key Functions and REC LED Status**

<b>FN Key</b>	<b>REC LED</b>	<b>Status</b>
When data recording is off, and the FN key is...		
Not pressed	No light	No data recording.
	Orange blink	Internal file system test in progress.
	Red	No free memory; hardware problem with data recording.
Pressed for < 1 second	If FN key mode is "LED blink mode switch"	
	Orange	Release to change information mode.
	If FN key mode is "Occupation mode switch"	
	Orange	No function.
Pressed for 1–5 seconds	If FN key mode is "LED blink mode switch"	
	Green	Release to start data recording (post-processing occupation mode undefined).
	If FN key mode is "Occupation mode switch"	
	Green	Release to start recording (Kinematic or Static post-processing occupation mode)
Pressed for 5–8 seconds	Red	Release to turn serial port A baud rate to 9600 bps.
Pressed for > 8 seconds	No light	No function.

**Table 4-1. FN Key Functions and REC LED Status (Continued)**

FN Key	REC LED	Status
When data recording is on, and the FN key is...		
Not pressed	Red	No free memory; hardware problem with data recording.
	If FN key mode is “LED blink mode switch”	
	Green	Data recording started (post-processing occupation mode undefined).
	If FN key mode is Occupation mode switch	
	Green	Data recording started (Kinematic post-processing occupation mode).
	Orange	Data recording started (Static post-processing occupation mode).
Pressed for < 1 second	If FN key mode is “LED blink mode switch”	
	Orange	Release to change information mode.
	If FN key mode is “Occupation mode switch”	
	Orange	Release to toggle between Static and Kinematic post-processing modes.
Pressed for 1–5 seconds	No light	Release to stop data recording.
Pressed for 5–8 seconds	Red	Release to turn serial port A baud rate to 9600 bps.
Pressed for > 8 seconds	No light	No function (data recording still on).

## Battery LED

The color of the BATT LED indicates the level of internal battery charge in the HiPer Pro:

- Green – indicates greater than 85% charge.
- Orange – indicates an intermediate charge.
- Red – indicates less than 15% charge.

The pattern of blinks of the BATT LED also indicates the source of power.

- Solid light – an external power supply is used and the batteries are not being charged.
- Blinking once a second – the batteries are being charged.
- Blinking once every five seconds – the HiPer Pro uses the internal batteries for power.
- Not blinking – the receiver is in Zero Power Mode or the internal batteries are completely discharged and no external power is connected.



### NOTICE

*When the internal batteries have completely discharged and no external power is connected, the receiver will go into Zero Power Mode to prevent the batteries from over discharging.*

## Modem LED

The color of the TX/RX modem LED indicates if the modem has power, is receiving signals, or is turned off.

For the Base TX/RX LED:

- No light – the modem is off
- Green flashes – the modem is in receiver mode
- Red flashes – the modem is in program mode
- Solid Green – a radio link has been established; the modem is in receiver mode
- Green flashes once a second – a radio link has been established; the radio is in transmit mode

For the Rover TX LED:

- No light – the modem is off
- Green flashes – the modem is in transmit mode
- Solid Red – the radio is transmitting

## Information Modes

The receiver has two information modes: Normal and Extended Information Mode (EIM).

### Normal

In normal mode, the STAT LED indicates the number of tracked satellites and the position's computation status.

### Extended Information Mode (EIM)

Extended Information Mode (EIM) is used for receiver testing purposes. In this mode, the receiver continues to work as usual, but the STAT LED indicates “extended” information using a

The Delimiter is a distinguishable double-blink that shows the overall status of tests performed in EIM. The LED color for delimiter is



calculated from the colors of other LED blinks, and will be one of the following colors when the tests complete:

- Orange – at least one blink is orange.
- Red – no orange blink and at least one red blink.
- Green – all other cases.

The delimiter double-blink is followed by six LED blinks corresponding to six receiver tests, where each blink indicates the following information:

Blink 1. Sufficient data for position computation.

Blink 2. GPS S/N ratios are good (Table 4-2 on page 4-9).

Blink 3. GLONASS S/N ratios are good (Table 4-2 on page 4-9).

Blink 4. Oscillator's frequency offset is less than three ppm.

Blink 5. Oscillator's Allan Variance is better than  $2.7e-10$ .

Blink 6. Continuous tracking time is more than 15 minutes.

**Table 4-2. Signal-to-Noise (S/N) "Good" Ratios**

	CA/L1	P/L1	P/L2
GPS	51	39	39
GLONASS	51	49	40

The color of the blink indicates that information for test is unavailable (orange), the receiver passed the test (green), or the receiver failed the test (red).

1. To switch to EIM, press and quickly release (within one second) the **FN** key on the MINTER.
2. Watch for the delimiter double-blink. With good receiver, antenna, and observation conditions, all blinks should be green within 15 minutes of powering on.
  - Green – ok
  - Orange – wait
  - Red – some tests failed
3. To switch back to normal mode, press the **FN** key.

# Downloading Files to a Computer

When your survey finishes, you can download survey files to a computer for storage, post-processing, or backup. Also, the receiver memory holds a finite amount of files and information, so downloading the files prevents files from being lost.

You should download files as soon as possible after collecting data at the jobsite. PC-CDU provides a File Manager to download files to your computer and delete files from the receiver.

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-10 for this procedure.
2. On the *Connection Parameters* dialog box, enable *RTS/CTS handshaking* (Figure 4-2).

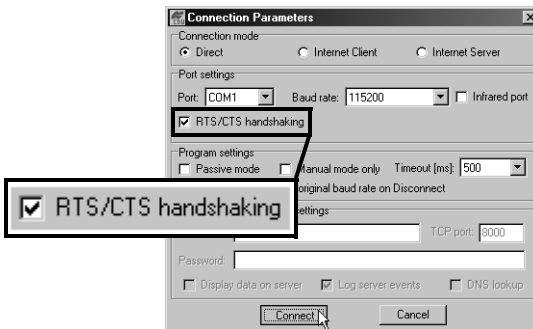


Figure 4-2. Connection Parameters – RTS/CTS Handshaking

3. Click **File** ► **File Manager**, then click the **Download path** tab on the *File Manager* dialog box (Figure 4-3).

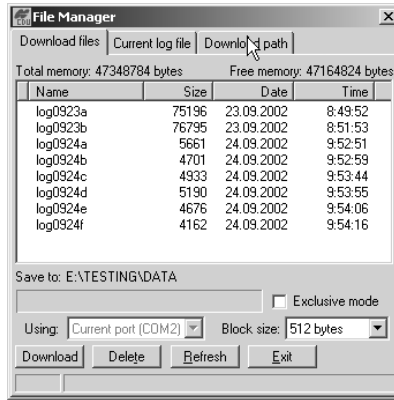


Figure 4-3. Find Files to Download

4. Navigate to or create (using the **Create** button) the folder in which to download and store files.
5. Click the **Download files** tab and select the file(s) to download (Figure 4-4 on page 4-11).

To select multiple files, hold down the **shift** key and click on non-sequential files to select several files at once; or, hold down the **Ctrl** key and click on individual files.

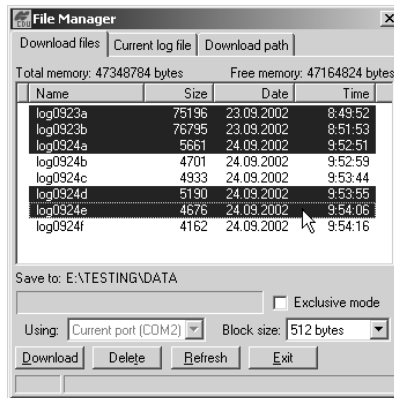


Figure 4-4. Download Files

6. Click the **Download** button. During the download, status indicators display next to each file (Figure 4-5).
  - Blue indicator – file in queue for downloading.
  - Red indicator – file currently downloading.
  - Green indicator – file has successfully downloaded.

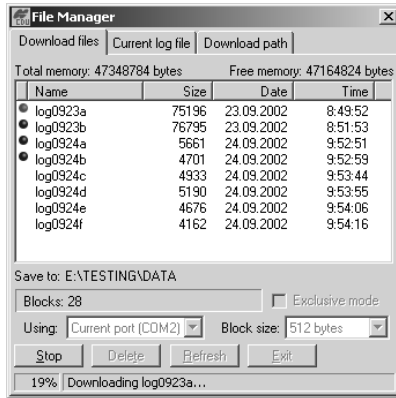


Figure 4-5. Download Files – Status Indicators

7. Click **Exit** on the File Manager dialog box.
8. Continue with other operations. Or, click **File ▶ Disconnect**, then **File ▶ Exit** to quit PC-CDU (Figure 4-6).

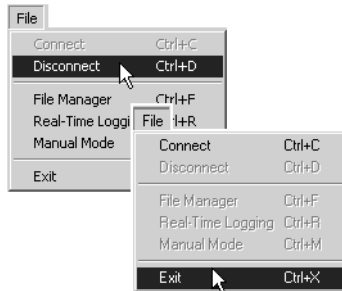


Figure 4-6. Click Disconnect then Exit

# Deleting Files

Use the following steps to delete files from your receiver.

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-10 for this procedure.
2. On the **Connection Parameters** dialog box, enable *RTS/CTS handshaking* (Figure 4-7).

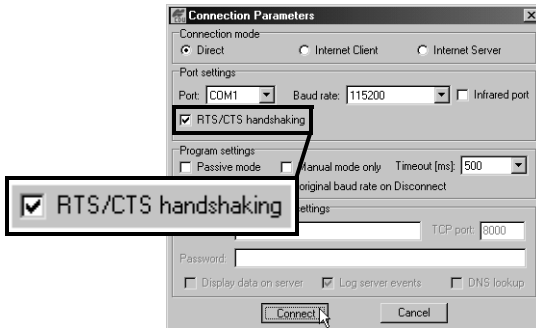


Figure 4-7. Connection Parameters – RTS/CTS Handshaking

3. Click **File ► File Manager** and select the file(s) to delete on the *Download files* tab (Figure 4-8).

To select multiple files, hold down the **shift** key and click on non-sequential files to select several files at once; or hold down the **Ctrl** key and click on individual files.

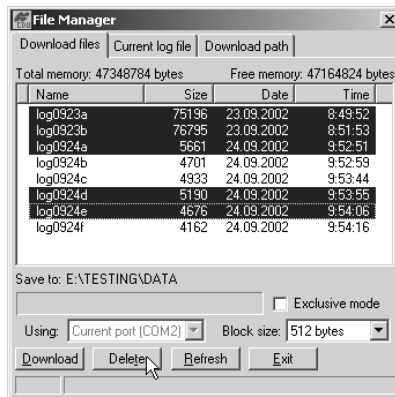


Figure 4-8. Delete Files

4. Click **Delete** (Figure 4-8 on page 4-13).
5. Click **Yes** at the delete files confirmation dialog box. PC-CDU deletes the selected files.
6. Click **Exit** on the File Manager screen.
7. Continue with other operations. Or Click **File ▶ Disconnect**, then **File ▶ Exit** to quit PC-CDU.

## Checking Receiver Options

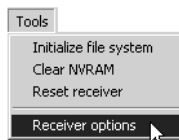


### TIP

For a complete list of options and their details, visit the Topcon website.

You can check the status of your receiver's options, and load any new OAFs, using the RS232 cable, a computer, and PC-CDU. Refer to the *PC-CDU User's Manual* for a more complete description of the PC-CDU software.

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-10 for this procedure.
2. Click **Tools ▶ Receiver Options** (Figure 4-9).



**Figure 4-9. Open Receiver Options**

The *Options Manager* dialog box displays (Figure 4-10 on page 4-15) and contains the following information:

- Option name – a name/description of the option
- Current – the current status of the option
- Purchased – if the option is purchased or not
- Leased – if the option is leased or not

- Expiration date – the date the option will be disabled, if applicable

Since Options can be both purchased and leased, the “Current” status of the option displays the currently effective value. Option values can be:

- -1 or “-----” – the firmware version does not support this option.
- 0 – the receiver option is disabled.
- positive integer – the option is enabled.
- yes or no – the option is either enabled or disabled.

Option name	Current	Purchased	Leased	Exp. date
GPS	yes	yes	no	
GLONASS	yes	yes	no	
L1	yes	yes	no	
L2	yes	yes	no	
Cinderella	yes	yes	no	
Position update rate (Hz)	20	20	0	
Raw data update rate (Hz)	20	20	0	
Code differential Base	yes	yes	no	
Code differential Rover	yes	yes	no	
RTK Base	yes	yes	no	
RTK Rover (Hz)	20	20	0	
Memory (Mb)	76	76	0	
Co-Op Tracking	yes	yes	no	
1-PPS Timing Signal	2	2	0	
Event Markers	2	2	0	
In-Band Int. Rejection	1	1	0	
Multipath Reduction	yes	yes	no	
Frequency Input	yes	yes	no	
Freq. Lock and Output	yes	yes	no	
Serial Port A (Kbps)	460	460	0	
Serial Port B (Kbps)	460	460	0	
Serial Port C (Kbps)	460	460	0	
Serial Port D (Kbps)	460	460	0	
Infrared Port	no	no	no	
Parallel Port	-----	no	no	
Sp.Sp. Freq. Hop.	no	no	no	
Sp.Sp. Direct	no	no	no	
RAIM	yes	yes	no	
Datums support	yes	yes	no	
Magnetic azimuth	yes	yes	no	
Geoid height	yes	yes	no	
Way Point Navigation	-----	yes	no	
WAAS	yes	yes	yes	8/1/2001
DMNISTAR	-----	yes	no	
RTCM Output	3	2	0	
RTCM Input	2	2	0	
CMR Output	1	1	0	
CMR Input	1	2	0	
JPS Output	1	0	0	
JPS Input	2	0	0	

Figure 4-10. Option Manager

3. When finished, click **Exit** on the Option Manager screen, then click **File ▶ Disconnect** to prevent conflicts with serial port management.

# Loading OAFs

Topcon Positioning System dealers provide customers with OAF files. For any OAF related questions, E-mail TPS at [options@topconps.com](mailto:options@topconps.com). Please have your receiver ID number available (see “Checking Firmware Version” on page 4-21).

1. To load a new OAF, follow steps one and two in “Checking Receiver Options” on page 4-14.
2. Click **Load** at the bottom of the Option Manager screen (see Figure 4-10 on page 4-15).
3. Navigate to the location of the new Option Authorization File. OAFs have .jpo or .tpo extensions and are unique to each receiver (Figure 4-11).

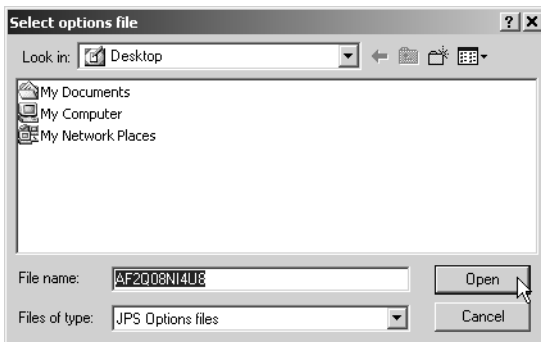


Figure 4-11. Load OAF

4. Select the appropriate file and click **Open** (Figure 4-11). The new receiver option loads onto the receiver and the Option Manager table updates.
5. When finished, click **Exit** on the Option Manager screen, then click **File ▶ Disconnect** to prevent conflicts with serial port management.



# 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:

$$SS = 230 + 44 * N$$

## 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, your receiver will require some time to collect new ephemerides and almanacs (around 15 minutes).

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

In addition, the NVRAM keeps information about the receiver file system. Note that after clearing the NVRAM, the receiver's STAT LED will flash orange for a few seconds indicating that the receiver is scanning and checking the file system. Firmware versions 2.2p1 or higher keep the spread spectrum modem on after clearing the NVRAM.

## Using MINTER to Clear NVRAM

1. Press the **power** key to turn off the receiver.
2. Press and hold the **FN** key.
3. Press and hold the **power** key for about one second. Release the **power** key while continuing to hold the **FN** key.
4. Wait until the STAT and REC LEDs are green
5. Wait until the STAT and REC LEDs blink orange.
6. Release the **FN** key while the STAT and REC LEDs blink orange.

## Using PC-CDU to Clear NVRAM

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-10 for this procedure.
2. Click **Tools** ▶ **Clear NVRAM** (Figure 4-12). The REC LED flashes green and red; the STAT LED flashes red.

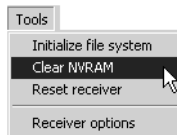


Figure 4-12. Clear NVRAM with PC-CDU

The receiver automatically disconnects when finished.

# Changing Receiver Modes

The HiPer Pro receiver has four modes, two information modes and two power modes:

- Normal Mode
- Extended Information Mode
- Sleep Mode
- Zero Power Mode

See “Information Modes” on page 4-8 for a description of Normal Mode and Extended Information Mode.

## Sleep Mode

In sleep mode, the power board and Bluetooth module will continue to draw power from the batteries, causing the batteries to drain over time. Put the receive in Zero Power Mode to prevent this (see “Zero Power Mode” on page 4-20). Follow these steps to put the HiPer Pro into sleep mode.

1. Turn on your receiver.
2. Press and hold the receiver’s **power** key for more than four seconds and less than eight seconds.
3. Release the **power** key when both the REC and STAT LEDs become orange. The receiver enters Sleep Mode.
4. Any activity on the RS232 port will turn the receiver on.



### NOTICE

*If you press and hold the power key for more than 14 seconds, it will be ignored. This protects receiver operation against stuck keys.*

## Zero Power Mode

When your receiver is off, even in Sleep Mode, the power board will continue to draw power from the batteries. This means that if you fully charge your receiver, turn it off and store it, the receiver will drain its battery power in less than two months. To stop the power board from draining the batteries, you can put your receiver in Zero Power Mode.

1. Turn on your receiver.
2. Press and hold the **power** key for more than 8 seconds, but less than 14 seconds.
3. Release the **power** key when both LEDs become red. When the LEDs turn off, your receiver will be in Zero Power Mode.
4. Press the **Reset** key for about one second to return to Normal mode.



### NOTICE

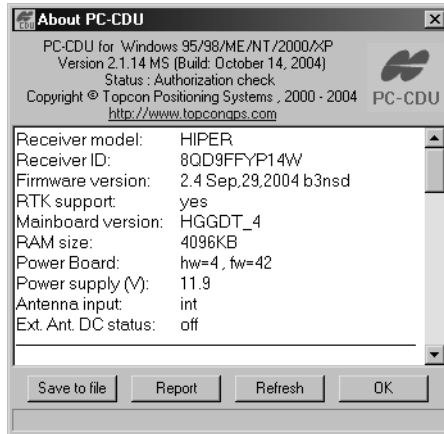
*When the internal batteries have completely discharged and no external power is connected, the receiver will go into Zero Power Mode automatically to prevent the batteries from over discharging.*

# Checking Firmware Version

Use PC-CDU to check the firmware version of the receiver.

1. Connect the receiver and a computer. See “Connecting the Receiver and a Computer” on page 2-10 for this procedure. Click **Help ▶ About**.

The About PC-CDU dialog box opens (Figure 4-13).



**Figure 4-13. About PC-CDU**

The About PC-CDU dialog box lists important information about the different hardware accessories and software properties. This list includes the following, which you will need if you contact TPS or your dealer:

- Receiver model
  - Receiver ID
  - Firmware version
2. When finished, click **OK**, then click **File ▶ Disconnect** to prevent conflicts with serial port management.

# Loading New Firmware

Base and Rover receivers must be loaded with the same firmware version. Use the latest firmware version, available for download from the TPS website, to ensure your receiver has the most recent updates.



## NOTICE

*The HiPer Pro receiver should be loaded with firmware version 2.4 or newer.*



## CAUTION

***Do not use firmware versions 2.3p2 or older.***

The receiver board and power board must be loaded with firmware from the same package. The Bluetooth module's firmware is independent of the receiver card and power board, and has a different firmware package.

The receiver uses FLoader, a Windows®-based utility, to load firmware onto the receiver and power boards. You can download FLoader to your computer from the TPS website. For more information, refer to the *FLoader User's Manual*, also available on the TPS website.

1. Download and install FLoader, if applicable.
2. Download the new firmware package to your computer.
3. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-10 for this procedure.
4. Activate FLoader (Figure 4-14 on page 4-23).
5. On the *Connection* tab, select the COM port on your computer that connects with your receiver and select its speed (usually 115200) (Figure 4-14 on page 4-23).

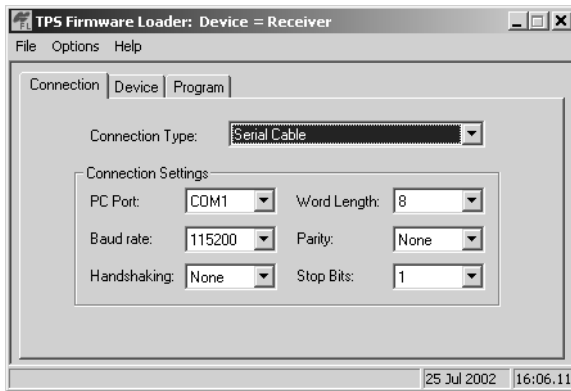


Figure 4-14. FLoader Main Screen

See the following sections to load the appropriate firmware.

## Receiver and Power Board Firmware

Receiver and power board firmware is released as a compressed file that you download and decompress. This file contains the following three files:

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



### NOTICE

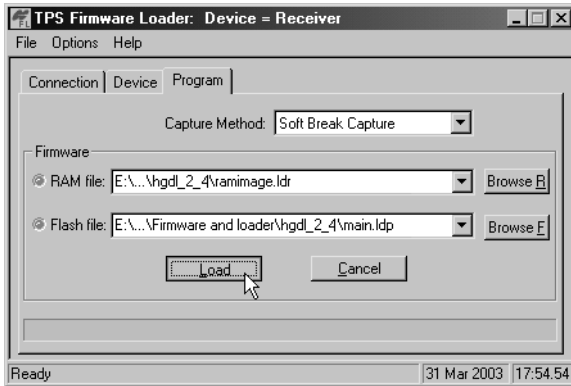
*You must load all three files when loading new firmware. These files must come from the same firmware package.*

1. In FLoader, click the *Device* tab and set the *Device Type* as Receiver. Then click **Get from Device** for device information (Figure 4-15).



**Figure 4-15. Set Device Type**

2. Click the *Program* tab and set the *Capture Method* to Soft Break Capture (recommended) (Figure 4-16).



**Figure 4-16. Program Tab Settings**

3. Browse for and select the receiver board's RAM file and Flash file (Figure 4-16).
4. Click **Load** and wait until 100% of the files load into the receiver.



**NOTICE** NOTICE

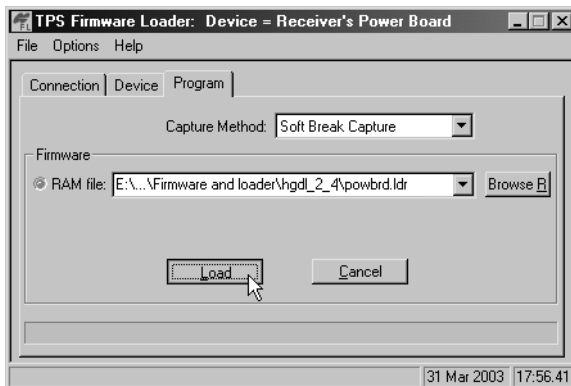
*If you selected an incorrect file, an error message displays at the bottom of the dialog box. Select the correct file.*

5. Select the **Device** tab and set the **Device Type** as Receiver's Power Board. Then click **Get from Device** for device information (Figure 4-17).



**Figure 4-17. Set Device Type**

6. Select the **Program** tab and set the Capture Method to Soft Break Capture (recommended) (Figure 4-18).



**Figure 4-18. Program Tab Settings**

7. Browse for and select the Power board's RAM file (Figure 4-18).

8. Click **Load** and wait until 100% of the power board file loads into the receiver.



**NOTICE**

*If you selected an incorrect file, an error message displays at the bottom of the dialog box. Select the correct file.*

9. Click **File ▶ Exit**.
10. Clear the receiver's NVRAM (see "Clearing the NVRAM" on page 4-17) and update the almanac (see "Collecting Almanacs" on page 2-37) after loading new firmware.

## Bluetooth Module Firmware

Bluetooth module firmware is released as a compressed file that you download and decompress. This file contains the following two files:

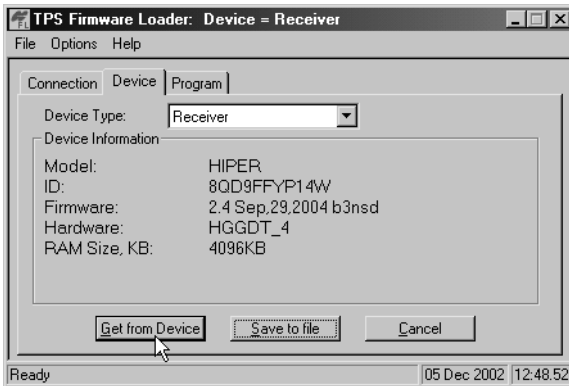
- btloader.ldr – the Bluetooth module RAM file
- btmain.ldr – the Bluetooth module Flash file



### NOTICE

*You must load both files when loading new firmware. These files must come from the same firmware package.*

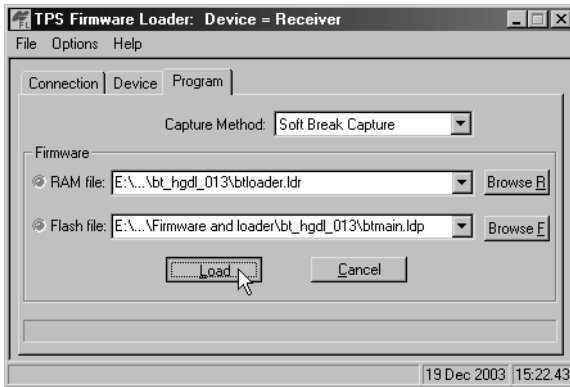
1. In FLoader, click the **Device** tab and set the *Device Type* as Receiver. Then click **Get from Device** for device information (Figure 4-19).



**Figure 4-19. Get Device Type**

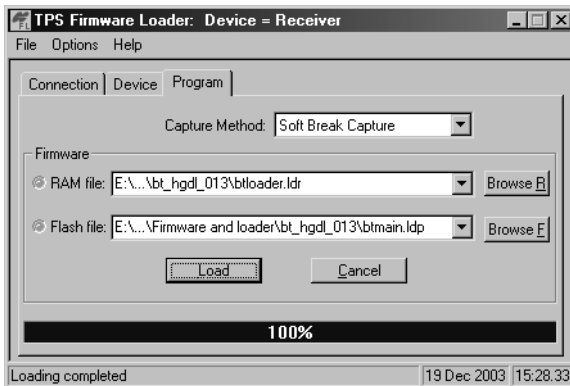
2. Select the *Program* tab and set the *Capture Method* to Soft Break Capture (recommended) (Figure 4-20 on page 4-28).

- Browse for and select the Bluetooth module's RAM file and Flash file (Figure 4-20).



**Figure 4-20. Program Tab Settings**

- Click **Load** and wait until 100% of the files load into your receiver (Figure 4-21).



**Figure 4-21. Bluetooth Firmware Load Complete**

**NOTICE** NOTICE

*If you selected an incorrect RAM or Flash file, an error message displays at the bottom of the dialog box. Reselect the correct file.*

- Click **File ▶ Exit**.

# Troubleshooting

In general, as long as you follow the maintenance and safety instructions provided in this manual, you should have few problems with your receiver. 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 TPS Customer support about any problems with the receiver, try the following:

- First, check all external receiver connections carefully to ensure correct and secure connections.
- Second, double check for worn or defective cables.
- Next, see the sections below for more specific solutions.

If the problem persists, try the following:

- Reset the receiver using PC-CDU (**Tools ▶ Reset receiver**).
- Restore default settings using PC-CDU (**Configuration ▶ Receiver**, then click **Set all parameters to defaults**).
- Clear the NVRAM (see “Clearing the NVRAM” on page 4-17).
- Initialize the file system (click **Tools ▶ Initialize file system**; this will erase all files inside the receiver).

# Power Problems

All receivers are preset in the factory as “Auto Mode” for both the power and charger. If you want to check these settings,

1. Connect your receiver and computer and run PC-CDU (see “Connecting the Receiver and a Computer” on page 2-10).
2. Once connected, click **Configuration ▶ Receiver**.
3. On the General tab, view the Power and Charger fields. These fields should be set to Auto. If not, change them to Auto and click **Apply**.



**TIP**

Clearing the NVRAM will also return the receiver to Auto Mode (see “Clearing the NVRAM” on page 4-17).

<b>Problem</b>	
The receiver does not power up.	
<b>Causes</b>	<b>Solutions</b>
The receiver may be in Zero Power Mode.	Press the <b>Reset</b> key.
If no external power source used, batteries may be discharged.	Connect a fully charged external power source and retry. See “Powering the Receiver” on page 2-2.
The receiver has an external power source, but internal batteries are discharged.	Charge the batteries overnight. See “Powering the Receiver” on page 2-2.
The receiver may have a defective charger or defective internal batteries.	If after charging your internal batteries overnight, and your receiver is not powering, contact TPS Customer Support for advice.

# Receiver Problems

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

<b>Problem</b>	
The receiver cannot establish a connection to a computer or external controller.	
<b>Causes</b>	<b>Solutions</b>
The cable is not properly plugged in.	<ul style="list-style-type: none"> <li>• Check that the cable connector is attached to the correct serial port.</li> <li>• Unplug the cable, then securely and properly reconnect it to the receiver.</li> <li>• See “External Components” on page 1-13 and “Connector Specifications” on page A-10 for information on the receiver’s connectors.</li> </ul>
The cable is damaged	Use an undamaged cable. Contact your Dealer to replace the cable.
The receiver port used for connection is not in Command mode.	<ol style="list-style-type: none"> <li>1. Connect your receiver and a computer using a free port (see “Connecting the Receiver and a Computer” on page 2-10) and start PC-CDU.</li> <li>2. Click <b>Configuration ▶ Receiver ▶ Ports</b>.</li> <li>3. Change the Input for the serial port used for connection to Command.</li> </ol>
<b>Problem</b>	
The receiver does not lock on to satellites for a long period of time.	
<b>Causes</b>	<b>Solutions</b>
The receiver stores an old almanac.	<ul style="list-style-type: none"> <li>• Update the almanac.</li> <li>• See “Collecting Almanacs” on page 2-37.</li> </ul>

<b>Problem</b>	
The receiver tracks too few satellites.	
<b>Causes</b>	<b>Solutions</b>
The elevation mask value is too high (e.g., above 15 degrees).	<ul style="list-style-type: none"> <li>• Lower the elevation mask.</li> <li>• See page 2-21 for information on setting the elevation mask.</li> </ul>
The survey is conducted near obstructions (tree canopy, tall buildings, etc.).	<ul style="list-style-type: none"> <li>• Check that the Multipath Reduction boxes have been enabled.                             <ol style="list-style-type: none"> <li>1. Connect your receiver and a computer and start PC-CDU. See “Connecting the Receiver and a Computer” on page 2-10.</li> <li>2. Click <b>Configuration</b> <ul style="list-style-type: none"> <li>▶ <b>Advanced</b> ▶ <b>Multipath Reduction</b> and enable the two boxes.</li> </ul> </li> </ol> </li> <li>• Move to an area free of obstructions, if applicable.</li> </ul>
<b>Problem</b>	
The receiver cannot obtain Code Differential and/or RTK solutions.	
<b>Causes</b>	<b>Solutions</b>
Incorrect Base coordinates entered.	Specify the correct coordinates for the Base station using PC-CDU or other suitable field data collection software.
The receiver is not configured as a Base or Rover.	<ul style="list-style-type: none"> <li>• If the receiver should function as a Base, ensure it has the proper configuration. See “Surveying with the Receiver” on page 3-5 for further information.</li> <li>• If the receiver should function as a Rover, ensure it has the proper configuration. See “Surveying with the Receiver” on page 3-5 for further information.</li> </ul>



<p>The corresponding receiver options may be disabled or expired.</p>	<ul style="list-style-type: none"> <li>• See “Checking Receiver Options” on page 4-14 for details on how to check current options.</li> <li>• Enable or prolong the validity of the corresponding receiver options by ordering a new OAF with the desired options activated.</li> </ul>
<p>There are not enough common satellites. In order to obtain a fixed solution, the Base and Rover should track at least five common satellites.</p>	<ul style="list-style-type: none"> <li>• Ensure that both the Rover and Base receivers use the same, and updated, almanac. See “Collecting Almanacs” on page 2-37.</li> <li>• Check the elevation masks of the Rover and Base receivers; they should be the same. See page 2-21 for information on setting the elevation mask.</li> </ul>
<p>Poor satellite geometry (PDOP/GDOP values are too high).</p>	<p>Conduct your survey when PDOP values are low.</p>
<p>The elevation mask is above 15 degrees.</p>	<ul style="list-style-type: none"> <li>• Lower the elevation mask.</li> <li>• See page 2-21 for information on setting the elevation mask.</li> </ul>
<p>The receiver and the antenna have a poor connection.</p>	<ul style="list-style-type: none"> <li>• Ensure the cable is undamaged.</li> <li>• Check the cable connector attachment to the receiver. Remove and reattach the cable connector to ensure a secure connection.</li> </ul>
<p>The Base and Rover modems are set to different radio channels.</p>	<ul style="list-style-type: none"> <li>• Set the Base and Rover receivers to the same radio channel.</li> </ul>

<p>A discrepancy exists between the differential standards used at the Base and Rover receivers.</p>	<p>Ensure the Base and Rover receivers use the same corrections input/output format:</p> <ol style="list-style-type: none"> <li>1. Connect your receiver and a computer and start PC-CDU. See “Connecting the Receiver and a Computer” on page 2-10.</li> <li>2. Click <b>Configuration ▶ Receiver ▶ Ports</b> and set the same input/output format for both receivers.</li> </ol>
<p>The specified link rate is not compatible with the link rates the modem supports.</p> <p>The link rate is the rate at which data transmits over the RF link.</p>	<ul style="list-style-type: none"> <li>• Change the link rate to that which your modem supports. See the modem’s manual for link rate support information.</li> </ul>
<p>The specified baud rate is not compatible with the baud rates the modem supports.</p> <p>The baud rate is the rate at which the receiver transmits differential messages to the modem and vice versa.</p>	<ul style="list-style-type: none"> <li>• Change the baud rate to that which your modem supports. See the modem’s manual for baud rate support information.</li> </ul>
<p>The modem battery is low.</p>	<ul style="list-style-type: none"> <li>• Attach an external power source to the receiver. See “External Batteries” on page 2-3.</li> <li>• See “Powering the Receiver” on page 2-2.</li> </ul>
<p>The distance between Base and Rover is too far.</p>	<ul style="list-style-type: none"> <li>• Close the distance between the Base and Rover.</li> <li>• Use repeaters to increase radio coverage.</li> </ul>

<b>Problem</b>	
The receiver does not start data logging.	
<b>Causes</b>	<b>Solutions</b>
The receiver has no free space for files.	<ul style="list-style-type: none"> <li>• Download receiver files to a computer (if needed) and delete files (see “Downloading Files to a Computer” on page 4-10 and “Deleting Files” on page 4-13).</li> <li>• Use the AFRM feature. See “Automatic File Rotation Mode (AFRM) parameters” on page 2-22.</li> </ul>
The receiver has already logged 512 files into the internal memory.	<ul style="list-style-type: none"> <li>• Delete unnecessary files (see “Deleting Files” on page 4-13).</li> <li>• Use the AFRM feature. See “Automatic File Rotation Mode (AFRM) parameters” on page 2-22.</li> </ul>

## Bluetooth Problems

The following are some of the most commonly encountered error messages. BTCONF reports the error messages in the status bar.

<b>Error Message</b>	
Can't find receiver.	
<b>Causes</b>	<b>Solutions</b>
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.	<ul style="list-style-type: none"> <li>• Check that the cable connector is attached to the correct serial port.</li> <li>• Unplug the cable, then securely and properly reconnect it to the receiver.</li> </ul>
If using a cable, the cable is damaged.	<ul style="list-style-type: none"> <li>• Use an undamaged cable.</li> <li>• Contact your Dealer to purchase a new cable.</li> </ul>

<p>The COM port the receiver is attached to differs from the one selected in BTCONF.</p>	<p>Ensure that the RS232 cable is attached to the COM port specified in the BTCONF communication port drop-down list. See “Bluetooth Module Configuration” on page 2-32 for details.</p>
<p>The receiver port used for connection is not in Command mode.</p>	<ol style="list-style-type: none"> <li>1. Connect your receiver and a computer using a free port (see “Connecting the Receiver and a Computer” on page 2-10) and start PC-CDU.</li> <li>2. Click <b>Configuration ▶ Receiver ▶ Ports</b>.</li> <li>3. Change the Input for the serial port used for connection to Command.</li> </ol>
<p>The settings for Port B may have been changed.</p>	<ul style="list-style-type: none"> <li>• The settings for Port B are: 115200 baud rate, 8 data bits, 1 stop bit, no parity, and no handshaking.</li> <li>• Try enabling RTS/CTS handshaking for Port B. Do not change other settings.</li> </ul>
<p>The corresponding receiver options may be disabled or expired.</p>	<ul style="list-style-type: none"> <li>• See “Checking Receiver Options” on page 4-14 for details on checking current options.</li> <li>• Enable, or prolong, the corresponding receiver options. Contact your dealer to order an OAF with desired receiver options.</li> </ul>

<b>Error Message</b>	
Can't find Bluetooth.	
<b>Causes</b>	<b>Solution</b>
The receiver's Slot 3 is turned off.	<ol style="list-style-type: none"> <li>1. Connect your receiver and a computer using an RS232 cable (see "Establishing an RS232 Cable Connection" on page 2-12).</li> <li>2. Click <b>Configuration ▶ Receiver ▶ General</b>.</li> <li>3. In the Turn on/off Slots area, enable the Slot 3 (B) check box.</li> </ol>
The Bluetooth module is linked with another device.	Close the connection with the device, then connect to your receiver.
The Bluetooth module's processor is overloaded.	<ol style="list-style-type: none"> <li>1. Put your receiver in Zero Power Mode. See "Zero Power Mode" on page 4-20 for details.</li> <li>2. Press and hold the <b>Reset</b> key for about one second to return the receiver to normal mode.</li> <li>3. Re-connect to the Bluetooth module.</li> </ol>
The receiver does not have a Bluetooth module.	Contact your dealer to purchase a Bluetooth enabled receiver.
<b>Error Message</b>	
Open COM# port failed: Access is denied.	
<b>Causes</b>	<b>Solution</b>
Another application uses the computer port dedicated for connection	<ul style="list-style-type: none"> <li>• Close the application, then re-connect.</li> <li>• Connect the receiver via another, unused computer port.</li> </ul>

<b>Problem</b>	
After searching for available devices, none are discovered.	
<b>Causes</b>	<b>Solution</b>
The receiver is not receiving power.	<ul style="list-style-type: none"> <li>• Check that the receiver is getting power and is turned on.</li> <li>• Check that the power cable is attached to the port marked “PWR”.</li> <li>• Unplug the cable, then securely and properly reconnect it to the receiver.</li> <li>• If the power cable is damaged, contact your Dealer to purchase a new cable.</li> </ul>
The receiver’s Slot 3 is turned off.	<ol style="list-style-type: none"> <li>1. Connect your receiver and a computer using an RS232 cable (see “Establishing an RS232 Cable Connection” on page 2-12).</li> <li>2. Click <b>Configuration ▶ Receiver ▶ General</b>.</li> <li>3. In the Turn on/off Slots area, enable the Slot 3 (B) check box.</li> </ol>
The devices may be out of acceptable radio range.	<ul style="list-style-type: none"> <li>• Verify that your devices are within acceptable radio range.</li> <li>• Move the devices within radio range.</li> </ul>
<b>Problem</b>	
Can see the icon for the receiver’s Bluetooth module on the computer screen, but cannot connect to it.	
<b>Causes</b>	<b>Solution</b>
Device security settings probably differ.	<ul style="list-style-type: none"> <li>• Make sure your Bluetooth enabled devices use the same security settings.</li> <li>• See “Bluetooth Module Configuration” on page 2-32, specifically Figure 2-27 on Figure 2-27 for details on changing security settings.</li> </ul>

Bluetooth module settings may have changed.	<ol style="list-style-type: none"> <li>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).</li> <li>2. Repeat the search.</li> </ol>
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## Radio Modem Problems

The following are some of the most commonly encountered radio modem problems.

<b>Problem</b>	
RX LED flashes red.	
<b>Causes</b>	<b>Solutions</b>
A fault condition has been detected.	<ul style="list-style-type: none"> <li>• Check that the radio modem's antenna is undamaged. Contact your dealer to replace the antenna.</li> <li>• Check that the radio modem's antenna is securely and properly connected to the antenna connector on the radome.</li> <li>• Move the antenna/receiver away from conducting objects (such as, large metal objects).</li> </ul>
The cable is damaged.	<ul style="list-style-type: none"> <li>• Use an undamaged cable.</li> <li>• Contact your Dealer to replace the cable.</li> </ul>

# Obtaining Technical Support

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

Before contacting TPS Customer support about any problems with the receiver, try the following:

- Reset the receiver using PC-CDU (**Tools ▶ Reset receiver**).
- Restore factory default settings using PC-CDU (click **Configuration ▶ Receiver**, then **Set all parameters to defaults**).
- Clear the NVRAM (see “Clearing the NVRAM” on page 4-17).
- Initialize the file system (click **Tools ▶ Initialize file system**; this will erase all files inside the receiver).

## Phone

To get in contact with TPS Customer Support by phone, call 1-866-4TOPCON (1-866-486-7266).

## E-mail

To get in contact with TPS Customer Support by e-mail, use the following electronic mail addresses.

**Table 5-1. Technical Support E-mail**

For Questions Related To...	Use...
Hardware (receivers, antennas, firmware)	hardware@topcon.com
GPS+ and 3DMC	psg@topcon.com
OAF	options@topcon.com
RTK	rtk@topcon.com
PC-CDU	pccdu@topcon.com

If in doubt about which e-mail address to use for your particular question, please send it to support@topcon.com.



## **Website**

The Topcon Positioning Systems website provides current information about Topcon's line of products. The support area of the website provides access to frequently asked questions, configuration procedures, manuals, e-mail support, etc.

To access the TPS website home page, use:

[www.topconpositioning.com](http://www.topconpositioning.com)

To visit the support area, use:

[www.topcongps.com/support/](http://www.topcongps.com/support/)



# Specifications

This TPS product is a 20-channel GPS receiver with an internal Satel® radio modem, a Bluetooth® wireless technology module, and a rugged aluminum housing complete with MINTER and cable connectors.

**NOTICE** NOTICE

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

**NOTICE** NOTICE

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

**NOTICE** NOTICE

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

# 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 Specifications**

<b>Physical</b>	
Enclosure	Aluminum extrusion, rainproof
Color	Topcon Yellow
Dimensions	W:159 x H:88 x D:172 mm
Weight	1.74 kg
Antenna	Internal
Battery	Two internal
Controller	External
Mounting	5/8-11
Seals	Silicon (molding in Color)
Keys	Three keys: Power – On/Off Function (FN) – start/stop data logging; switch information mode. Reset – receiver hardware reset
LEDs	Four LEDs: STAT – satellite and receiver status REC – record and data status BATT – battery status RX – modem status
<b>Environment</b>	
Operating temperature	-30 C° to + 60 C° with batteries

**Table A-1. Receiver Specifications (Continued)**

Storage temperature	-40 C° to +75 C° with batteries
Humidity	95%
<b>Power</b>	
Internal battery	Li-ion, 4000 mAh, 7.4 V Not removable
Battery size	132 x 35 x 18 (mm)
Battery weight	165 g (1 battery)
Number of built-in batteries	2 batteries
Operating time	With TX mode ON (1W): ~6 hours With RX mode ON: ~TBD With radio in STANDBY mode: ~13 hours With radio OFF: ~16 hours
External power	1 port
Input voltage	6 to 28 V DC (for work) 9 to 28 V DC (for charge battery) Minimum Charge Current <=2 Amp
Consumption	~10 W in TX mode (1W) ~TBD W in RX mode ~4.6 W in Standby mode ~3.6 W with radio off
On-board	Backup battery for timekeeping and almanac data storage; 10 years minimum operation
<b>I/O</b>	
Communication Ports	Up to four high speed RS232 serial ports, a USB port, and an internal Bluetooth communication port.
Connectors	Modem Antenna, PWR, USB

**Table A-1. Receiver Specifications (Continued)**

MINTER	Four external LEDs ON/OFF control input
<b>Data Features</b>	
	Up to 20 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, and 3.0 I/O Multiple Base RTCM Geoid and Magnetic Variation models RAIM Different DATUMs support Output of grid coordinates CMR and CMR+ support
<b>Technology</b>	
	Co-Op tracking Low signal tracking Advanced Multipath mitigation WAAS Adjustable PLL and DLL parameters
<b>NMEA</b>	
NMEA version	Ver. 2.1, 2.2, 2.3, 3.0 output
Messages	GGA, GLL, GNS, GRS, GSA, GST, GSV, HDT, RMC, VTG, ZDA, ROT, GMP
Output interval	1Hz standard; 5, 10, 20Hz optional
<b>DGPS</b>	
Correction format	RTCM SC104 Ver 2.1, 2.2, 2.3, and 3.0
RTCM message type	1, 3, 9, 31, 32, 34; user selectable
Process interval	1Hz standard; 5, 10, 20Hz optional
Output interval for RTCM correction data	1Hz standard; 5, 10, 20Hz optional
Elevation mask	0 to 90 deg (independent of data logging)

**Table A-1. Receiver Specifications (Continued)**

Multi-base DGPS	Differential correction select mode: Nearest, Mix, Best (optional)
<b>RTK</b>	
Correction format	CMR2/CMR+ (Trimble compatible), RTCM SC104 Ver 2.2, 2.3, or 3.0
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 32 km at noon.
Initialize time	5 seconds to 10 min depending on the base line length and multipath conditions
Output interval for CMR/RTCM	1Hz standard; 5, 10, 20Hz optional
Elevation	0 to 90 degrees (independent of data logging)
Solution mode	Delay (synchronization) Extrapolation (not synchronized)
Process interval	1Hz standard; 5, 10, 20Hz optional
Latency	Delay mode – 20 msec to 20 sec (depends on latency which receives corrections data from base receiver) Extrapolation – 20 to 30 msec
Raw Data logging	The receiver can record raw data at another interval during RTK operation
Status	Fix, Float, DOP, Data Link Status, Modem Latency, Common satellites, Percentage of fixing
Results	RTK coordinates, HRMS, VRMS, Covariance Matrix
Ambiguity fixing level	Selectable thresholds Low: 95%; Medium: 99.5%; High: 99.9%

**Table A-1. Receiver Specifications (Continued)**

<b>Survey Modes</b>	
Base or Rover	Static Kinematic (Stop and Go) RTK (Real-time Kinematic) DGPS (Differential GPS) WASS/EGNOS DGPS
<b>Survey Accuracy</b>	
Static, Fast Static	For L1+L2 – H: 3mm + 0.5ppm (x baseline length); V: 5mm + 0.5ppm (x baseline length)
Kinematic, RTK	For L1+ L2 – H: 10mm + 1.0ppm (x baseline length); V: 15mm + 1.0ppm (x baseline length)
DGPS	<1m
Cold Start Warm Start Reacquisition	< 60 sec < 10 sec < 1 sec

## GPS Board Details

Table A-2 lists the GPS board’s general specifications.

**Table A-2. GPS Board Specifications**

<b>Receiver Type (set by activating the proper OAF)</b>	
Euro-112T (HGGDT)	G: GPS L1 GD: GPS L1/L2 GG: GPS/GLONASS L1 GGD: GPS/GLONASS L1/L2
<b>Tracking Specifications</b>	
Standard Channels	20 channels (G, GG, GD, GGD) L1 GPS, L1/L2 GPS, L1 GLONASS, L1 GPS + L1 GLONASS, WAAS/EGNOS, PCode and Carrier
Optional	Cinderella days (see page A-7 for details)
Tracked Signals	GPS/GLONASS, L1/L2 C/A and P-Code and Carrier, WAAS/EGNOS



**Table A-2. GPS Board Specifications (Continued)**

<b>Tracking Functions</b>	
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	WAAS optional EGNOS optional
<b>Data Features</b>	
Formats	TPS, NMEA, RTCM, BINEX
Features	Up to 20 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, and 3.0 I/O Multiple Base RTCM Geoid and Magnetic Variation models RAIM Different DATUMs support Output of grid coordinates CMR and CMR+ support
<b>Memory</b>	
Internal Memory	Compact flash card (not removable)
Capacity	Standard – 0 MB Max – 1 GB
Logging Time	53 hours (8 MB, 15sec, L1/L2, 7 satellites)
Logging Interval	0.05 to 86400 seconds, depending on purchased options

Cinderella days is an option that turns a single frequency, GPS receiver into a dual-frequency, GPS+GLONASS receiver for 24 hours every other Tuesday at GPS midnight. Refer to Topcon's website for more information and specific Cinderella day dates.

## Bluetooth Module Details

Table A-3 lists the Bluetooth wireless technology module's general specifications.

**Table A-3. Bluetooth Module Specifications**

Type	Class 2
Service classes	Miscellaneous
Supported profiles	LM, L2CAP, SDP, PPP
Frequency Country Code	North America and Europe

## Internal UHF Satel Modem Details

Table A-4 lists the internal UHF Satel modem's general specifications.

**Table A-4. Internal UHF Satel Modem Specifications**

<b>General</b>	
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	$\pm 1.5$ 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 (12.5 kHz channel)

**Table A-4. Internal UHF Satel Modem Specifications (Continued)**

Data format	Asynchronous
<b>Transmitter (TX)</b>	
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
<b>Receiver (RX)</b>	
Sensitivity	-116...-110 dBm (BER<10 E-3)
Common channel rejection	>-12dB
Adjacent channel selectivity	>60 dB @ 12.5 kHz >70 dB @ 25 kHz
Intermodulation attenuation	> 65 dB
Spurious radiation	<2nW

# Connector Specifications

The following sections list HiPer Pro connector details.

## Radio (Modem) RF Connector

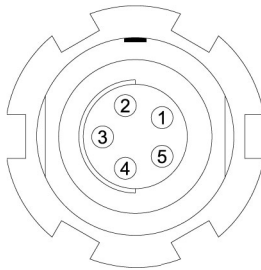
The Satel (UHF) modem connector type (Table A-5) is a BNC female RF connector.

**Table A-5. UHF Modem Connector Specifications**

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

## Power Connector

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-6 gives power connector specifications.

**Table A-6. Power Connector Specifications**

Number	Signal Name	Dir	Details
1	Power_INP	P	6 to 28 volts DC input
2	Power_INP	P	6 to 28 volts DC input
3	Power_GND	P	Ground, power return
4	Power_GND	P	Ground, power return

**Table A-6. Power Connector Specifications (Continued)**

Number	Signal Name	Dir	Details
5			Not used

## Serial C-RS232 Connector

For ports A and D. The RS232 connectors (Figure A-2) are sealed receptacle, 7 pin, ODU part number G80F1C-T07QC00-0000.

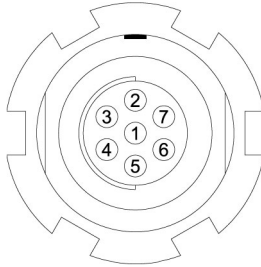
**Figure A-2. RS232 Connector**

Table A-7 gives the RS232 cable connector specifications.

**Table A-7. RS232 Connector Specifications**

Number	Signal Name	Dir	Details
1	Power_OUT	P	Power Output (Supplied Voltage)
2	GND	-	Signal ground
3	CTS	I	Clear to send
4	RTS	O	Request to send
5	RXD	I	Receive data
6	TXD	O	Transmit data
7			Not used

## USB Connector

The USB connector is a sealed receptacle, 5 pin TPS cable connector (Figure A-3).

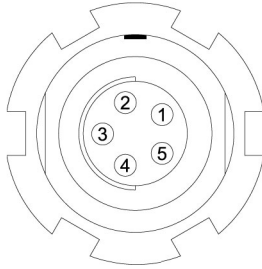


Figure A-3. USB Connector for GGD Options

Table A-8 gives the USB connector specifications.

Table A-8. USB Specifications

Number	Signal Name	Dir	Details
1			Not used
2	USB_PWR	P	Bus power input
3	GND	-	Ground
4	USB D+	I/O	Data plus
5	USB D-	I/O	Data minus

# Safety Warnings

## General Warnings



### **WARNING**

TPS 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**

**TPS RECEIVERS SHOULD NEVER BE USED IN DANGEROUS ENVIRONMENTS. USE IN RAIN OR SNOW FOR A LIMITED PERIOD IS PERMITTED.**

# Internal Battery Pack Warnings



## DANGER

**NEVER ATTEMPT TO OPEN THE RECEIVER'S CASING OR REPLACE THE BATTERIES! 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 internal batteries by end users or non-factory authorized technicians will void the receiver'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 TPS immediately if this product does not function properly.*

 **CAUTION**

*Only allow authorized TPS warranty service centers to service or repair this product.*



# UHF Radio Usage



## NOTICE

*Many countries require a license for radio users (such as the United States). Be sure you comply with all local laws while operating a UHF radio.*

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 for communication.

2. Your system's range will increase by adjusting the antenna of your Base station in one of the following ways.
  - 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 out the TPS accessory line for various items to raise your Base radio.



# Warranty Terms

TPS 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 TPS' Authorized Dealers.<sup>1</sup>

During the warranty period, TPS 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 TPS 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 TPS be liable for any damages or other claim 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.

---

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



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