TOPCON

NET-G3A

Reference Station GNSS Receiver

Operator's Manual

TOPCON
POSITIONING SYSTEMS

Net-G3A
Operator's Manual

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Rev A

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Manual Conventions

This manual uses the following conventions:

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

	Further information to note about the configuration, maintenance, or setup of a system.
	Supplementary information that can help you configure, maintain, or set up a system.
	Supplementary information that can have an affect on system operation, system performance, measurements, or personal safety.
	Notification that an action has the potential to adversely affect system operation, system performance, data integrity, or personal health.
	Notification that an action *will* result in system damage, loss of data, loss of warranty, or personal injury.
	Under no circumstances should this action be performed.

Introduction

The Net-G3A receiver (Figure 1-1 on page 1-2) is a multi-frequency, GNSS receiver built to be the most advanced and convenient reference station receiver available today. The receiver is a dedicated permanent or semi-permanent reference station intended for precision markets. Precision markets means markets for equipment, subsystems, surveying components and software, construction, commercial mapping, civil engineering, precision agriculture, land-based construction and agriculture machine control, photogrammetry mapping, hydrographics, and any use reasonably related to the foregoing.

The Net-G3A can receive and process multiple signal types (including the latest GPS L2C, L5, GLONASS C/A L2, and GALILEO[1] signals) improving the accuracy and reliability of the solution, especially under difficult job-site conditions. The following features combine to provide a positioning system efficient, secure, and appropriate for any survey or application that requires highly-accurate timing and positioning solutions:

- GNSS
- Multiple frequency detection
- One-Pulse-Per-Second (1PPS) output and external event time-tagging
- External frequency input and internal frequency output
- Network connections

Several other features, including multipath mitigation and anti-jamming suppressor, provide a reliable and versatile reception of weak signals in degraded signal environments. The receiver provides the functionality, accuracy, availability, and integrity needed for fast and easy data collection and management.

1. Contact Topcon Technical Support for detailed information about the supported GALILEO signals.

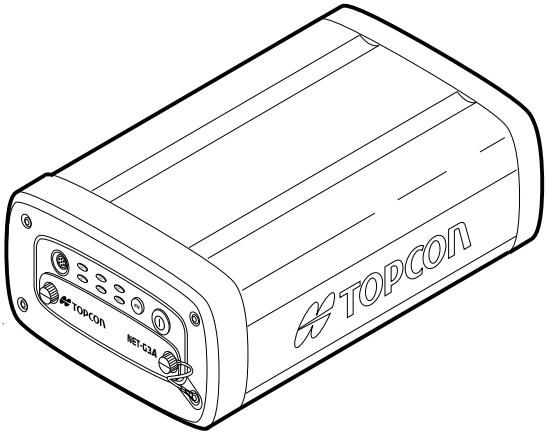


Figure 1-1. Net-G3A Receiver

Principles of Operation

Whether based on a single reference station or a network of reference stations, static and mobile applications that use GNSS data from a high performance reference station benefit from the highest possible levels of accuracy and precision.

This section gives an overview of existing and proposed Global Navigation Satellite Systems (GNSS) and receiver functions to help you understand and apply basic operating principles, allowing you to get the most out of your receiver.

GNSS Overview

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

- GPS – the Global Positioning System maintained and operated by the United States Department of Defense. For information on the status of this system, visit the US Naval Observatory website or the US Coast Guard website.

- GLONASS – the Global Navigation Satellite System maintained and operated by the Russian Federation Ministry of Defense. For information on the status of this system, visit the Coordinational Scientific Information Center website.
- GALILEO – an upcoming global positioning system maintained and operated by Galileo Industries, a joint venture of several European space agencies/companies working closely with the European Space Agency. Unlike GPS and GLONASS, this is a civil endeavor and is currently in the development and validation stage. For information on the status of this system, visit the Galileo Industries website.

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

- Space – GPS, GLONASS, and GALILEO satellites orbit approximately 12,000 nautical miles above earth and are equipped with a clock and radio. These satellites broadcast ranging signals and various digital information (ephemerides, almanacs, time&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 GNSS receivers to calculate positions.

Calculating Absolute Positions

When calculating an absolute position, a stationary or moving receiver determines its three-dimensional position with respect to the origin of an Earth-Center Earth-Fixed coordinate system. To calculate this position, the receiver measures the distance (called pseudoranges) between it and at least four satellites. The measured pseudoranges are corrected for clock differences (receiver and satellites) and signal propagation delays due to atmospheric effects. The positions of the satellites are computed from the ephemeris data transmitted to the receiver in navigation messages. When using a single satellite system,

the minimum number of satellites needed to compute a position is four. In a mixed satellite scenario (GPS, GLONASS, GALILEO), the receiver must lock on to five or more satellites to account for the different time scales used in these systems and to obtain an absolute position.

Calculating Differential Positions

DGPS, or Differential GPS, is a relative positioning technique where the measurements from two or more remote receivers are combined and processed using sophisticated algorithms to calculate the receivers' relative coordinates with high accuracy.

DGPS accommodates various implementation techniques that can be classified according to the following criteria:

- The type of GNSS measurements used, either code-phase differential measurements or carrier-phase differential measurements.
- If real-time or post-mission results are required, then real-time applications can be further divided according to the source of differential data and the communication link used.

With DGPS in its most traditional approach, one receiver is placed at a known, surveyed location and is referred to as the reference receiver or base station. Another receiver is placed at an unknown location and is referred to as the remote receiver or rover receiver. The reference station collects the code-phase and carrier-phase measurements from each GNSS satellite in view.

- For real-time applications, these measurements and the reference station coordinates are then built up to the industry standard RTCM—or various proprietary standards established for transmitting differential data—and broadcast to the remote receiver(s) using a data communication link. The remote receiver applies the transmitted measurement information to its observed measurements of the same satellites.
- For post-mission applications, the simultaneous measurements from reference and remote stations are normally recorded to the receiver's internal memory (not sent over communication link).

Later, the data is downloaded to a computer, combined, and processed.

Using this technique, the spatially correlated errors—such as satellite orbital errors, ionospheric errors, and tropospheric errors—can be significantly reduced, thus improving the position solution accuracy.

A number of differential positioning implementations exist, including post-processing surveying, real-time kinematic surveying, maritime radio beacons, geostationary satellites (as with the OmniSTAR service), and Satellite Based Augmentation Systems (WAAS, EGNOS, MSAS).

The real-time kinematic (RTK) method is the most precise method of real-time surveying. RTK requires at least two receivers collecting navigation data and a communication data link between the receivers. One of the receivers is usually at a known location (Base) and the other is at an unknown location (Rover). The Base receiver collects carrier phase measurements, generates RTK corrections, and sends this data, along with the coordinates of the reference station, to the Rover receiver. The Rover processes this transmitted data with its own carrier phase observations to compute its relative position with high accuracy, achieving an RTK accuracy of up to 1 cm horizontal and 1.5 cm vertical.

Essential Components for Quality Surveying

Achieving quality position results requires the following elements:

- Accuracy – The accuracy of a position primarily depends upon the satellite geometry (Geometric Dilution of Precision, or GDOP) and the measurement (ranging) errors.
  - Differential positioning (DGPS and RTK) strongly mitigates atmospheric and orbital errors, and counteracts Selective Availability (SA) 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 the 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:
  - Five or more visible satellites for only GPS or only GLONASS; six or more satellites for mixed scenarios.
  - Satellite Based Augmentation Systems (WAAS, EGNOS, etc.) creates and transmit, along with DGPS corrections, data integrity information (for example, satellite health warnings).
  - Current ephemerides and almanacs.

Receiver Overview

The Net-G3A, with G3 tracking technology, represents the latest in GNSS-capable technology. This receiver provides greater value by virtue of its ability to keep up with changes in GNSS-signal enhancements through simple firmware upgrades, protecting your investment to the highest possible degree.

When power is turned on and the receiver self-test is completed, the receiver's 144 channels initialize and begin tracking visible satellites. Each of the receiver's channels can be used to track any one of the GPS, GLONASS, or GALILEO signals. The number of channels available allows the receiver to track all visible GNSS satellites at any time and location.

An external GNSS 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, its absolute position in WGS-84 and the time offset between the receiver clock and GPS time are computed. This information and the measurement data can be stored in the optional Compact Flash card or the USB mass storage device (UMS) and downloaded later onto a computer, then processed using a post-processing software package. When the receiver operates in RTK mode, raw data measurements can also be recorded into the receiver's Compact Flash memory or a UMS. This allows the operator to double check real-time results obtained in the field.

The Net-G3A offers a unique collection of features and capabilities in a single design. They include:

- 144 universal tracking channels
- Multipath reduction
- Adjustable phase locked loop (PLL) and delay lock loop (DLL) parameters
- Anti-jamming suppressor
- 1PPS and event marker
- External oscillator input
- GNSS-disciplined internal crystal oscillator output
- RS232C and USB port connectivity
- USB storage device
- Removable memory
- Backup battery system
- Ethernet connectivity
- Web-based management
- Satellite Based Augmentation Systems (WAAS, EGNOS, etc.)
- Dual- or multi-frequency modes, including static, kinematic, real-time kinematic (RTK), and differential (DGPS) survey modes.

- Ntrip server/client and MAC functionality
- Multiple survey parameters, including multiple mask angles, static and dynamic modes, auto data logging, etc.

Getting Acquainted

The standard hardware configuration of the Net-G3A includes:

- a 144-channel GNSS receiver
- four serial data ports
- a USB device and USB host ports
- an Ethernet port
- an interface for controlling and viewing data logging, link, and power status
- a CF card slot
- an external GPS antenna port
- a frequency input/output port
- a 1PPS port and Event Marker port
- two internal batteries (for 25 hours of emergency operation)
- two power ports

Although this is the standard configuration, the OAF must enable some of these features for proper operation. See “Option Authorization File (OAF)” on page 1-21 for details.

The standard Net-G3A kit includes the Net-G3A, a set of cables, power supply, Topcon GPS+ software CD, Compact Flash card, and documentation.

Net-G3A Receiver

The Net-G3A receiver’s advanced and feature packed design provides greater versatility, reliability, and efficiency to implement a cost-effective and productive network infrastructure in a timely manner. Managed with the GNSS Receiver Interface Language (GRIL) and equipped with various hardware interfaces, this receiver offers unchallenged flexibility:

- Flexibility in software applications that control and monitor the receiver's behavior, including PC-CDU, TRU, and TopNET, as well as user-written applications.
- Flexibility in the physical interface used to connect the receiver with various external devices, including computers, network devices, various sensors, frequency sources, etc.

MINTER

The MINTER is the receiver's minimum interface used to display and control data input and output (Figure 1-2 on page 1-10).

The STAT LED displays the status of tracked satellites.

- Red blink – receiver is on, but no satellites are being tracked.
- Green blink – receiver is on and tracking satellites; one blink per tracked GPS satellite.
- Orange blink – receiver is on and tracking satellites; one blink per tracked GLONASS satellite.

The LINK LED displays Ethernet connection status.

- Solid Green – A valid Ethernet connection with an active device on the network is established.
- Off – No Ethernet connection is established.

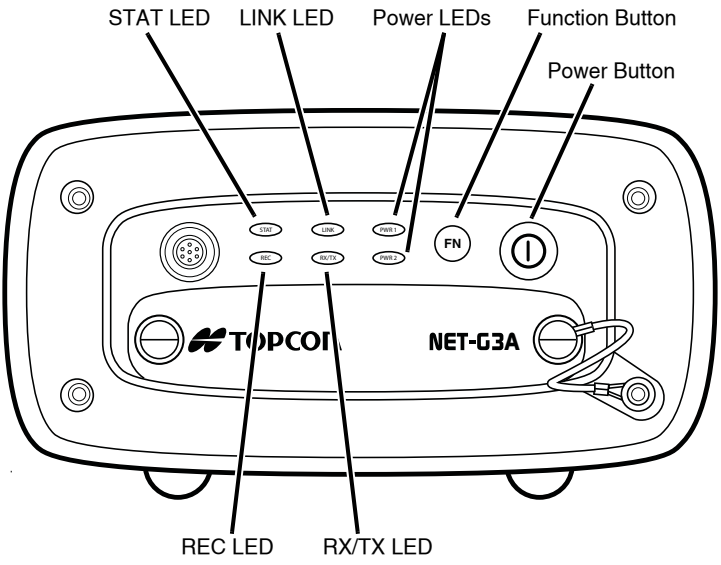


Figure 1-2. Net-G3A MINTER

The PWR LEDs display the status of power supplied from the corresponding external or internal power source.

- Solid Green – The receiver accepts power from an external power source connected to the corresponding PWR port. This power is within an allowed operating voltage range (6–28 V DC).

  The corresponding backup battery is fully charged.

- Solid Yellow – The receiver accepts power from an external power source connected to the corresponding PWR port, and this power is within an allowed operating voltage range (6–28 V DC), but is not being used to power the receiver.

- Solid Red – A power failure has occurred (with the connected power source) or power is not supplied to the corresponding PWR port. For details, see “Powering Problems” on page 5-2.

- Green blinks plus red blinks – The receiver accepts power from an external power source connected to the corresponding PWR port and is charging the corresponding battery.

- Red blinks – The receiver is charging the corresponding battery.
- Off – The receiver consumes power from internal backup batteries or the receiver is turned off.

The REC LED displays the data recording status. See “The FN button” on page 1-11 for more information on REC LED behavior when using the function button.

- Green blinks – Each blink indicates that data is being written to the CF card.
- Solid Orange – This indicates the receiver is changing modes.
- Orange blinks – This indicates that the receiver is checking its internal file system (after clearing the NVRAM or loading new firmware). During this operation, 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 memory on the CF card. If the LED blinks orange every second, this also indicates that raw data is being transferred to a UMS device.
- Solid Red – This indicates a fault condition with the receiver (memory full, no CF card installed, a hardware problem, or an improper OAF).

Table 1-1 on page 1-12 describes the REC LED status when using the FN button.

The RX TX LED displays the status of the internal radio modem. In the current version, the LED is off and is retained for future updates.

The power button turns the receiver on and off.

The FN button switches the receiver between information modes and post-processing modes, starts/stops data recording, and changes the baud rate of the serial port to 9600. See “MINTER Operation” on page 3-16 for more information.

Table 1-1 describes the REC LED status when using the FN button.

Table 1-1. FN Button Operations and REC LED Status

FN Key	REC LED	Status
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; no CF card.
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 1-1. FN Button Operations 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).

Data and Power Ports

The Net-G3A has ports on both the front and back panels.

The front panel has one port (Figure 1-3): Serial (7 pin ODU-MINI-SNAP) – used for communication between the receiver and an external device. This is the receiver's serial port A.

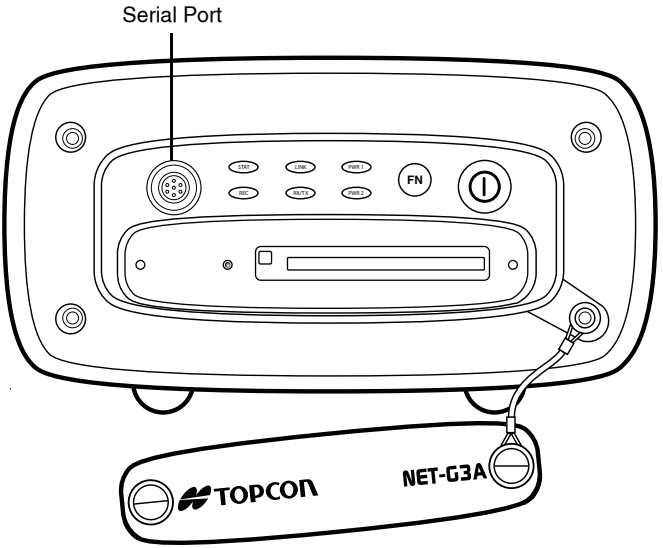


Figure 1-3. Net-G3A Front Panel Ports

The back panel has the following 10 ports (Figure 1-5 on page 1-16):

- Serial ports (9 pin D-shell connector) – used for communication between the receiver and an external device.

- Ethernet/USB port (12-pin ODU-MINI-SNAP) – used to connect the receiver to a computer or network via the adapter cable, which is also connected to the Ethernet/USB port.

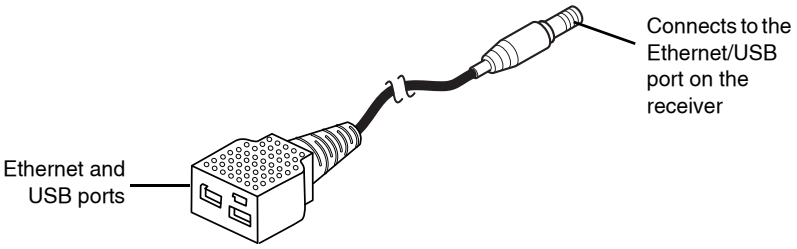


Figure 1-4. Adapter Cable

- 1 PPS port (BNC connector) – used for generating one pulse per second signals with programmable reference time, period, and offset. The pulse is synchronized to a specified reference time.
- Event Marker port (BNC connector) – used to input an event synchronized with a specified time reference.
- GPS Antenna port (Type N connector) – used for detecting GNSS signals.
- External Frequency port (BNC connector) – used for an external frequency input or the receiver's internal frequency output.
- Power ports (5 pin ODU-MINI-SNAP) – used to connect the receiver to an external power source.
- USB (Mini-B) – used for high-speed data transfer and communication between the receiver and an external device. This port is located on the adapter cable, which is connected to the Ethernet/USB port.
- USB (Type A) – used to transfer raw data files from the receiver's CF card to the connected USB mass storage device (UMS). This

port is located on the adapter cable, which is connected to the Ethernet/USB port.

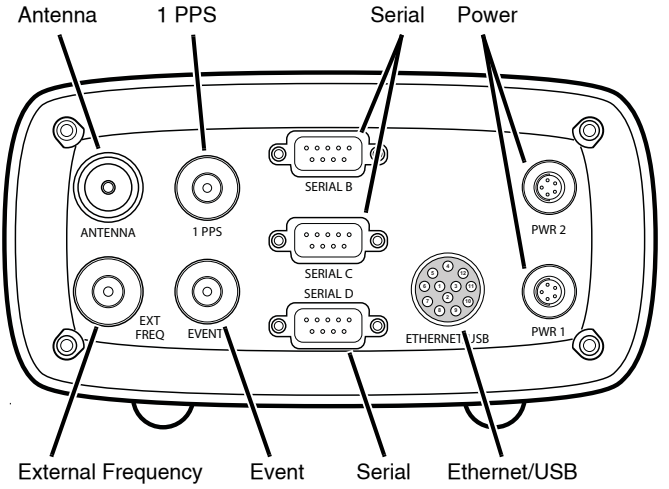


Figure 1-5. Net-G3A Back Panel Ports

CF Card Slot

The CF (Compact Flash) card slot resides on the front panel under the door (Figure 1-6 on page 1-17) and connects an optional CF card to the receiver board to provide memory. A Compact Flash card can be purchased at your local computer supply store. See “CF Cards Compatible with the Net-G3A” on page A-15 for a list of compact flash cards successfully tested with the Net-G3A. Before using any other CF cards, consult with Topcon customer support about compatibility. See “Obtaining Customer Support” on page 5-7.

The receiver recognizes up to 2 GB of memory. The recognizable capacity is controlled through the corresponding receiver option.

Once installed, the CF card usually remains inside the receiver. The data that resides on the CF card can be accessed via the serial, USB, or Ethernet port.

To preserve data integrity, only install or remove the CF card when the receiver is powered off.

Always initialize the file system on the installed CF card before the first use. The initialization procedure is described in “Initializing File System” on page 4-12.

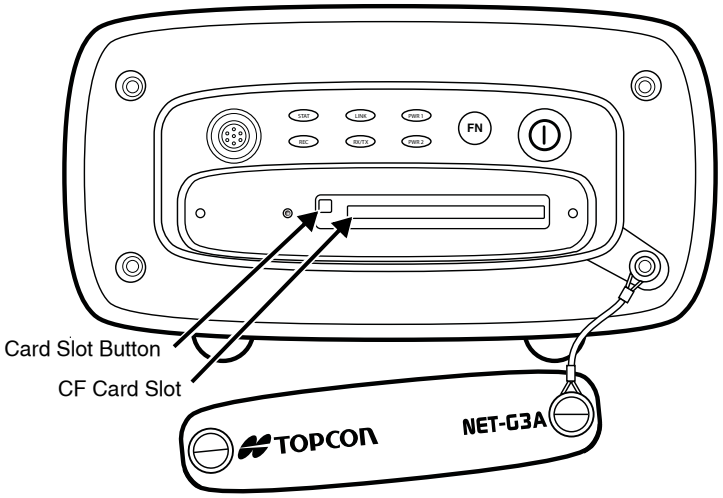


Figure 1-6. Net-G3A CF Card Slot

Mounting Holes

The receiver has four mounting holes on the bottom to install #8-32 screws for a permanent mount (Figure 1-7). Installing the receiver using these screws prevents unwanted movement.

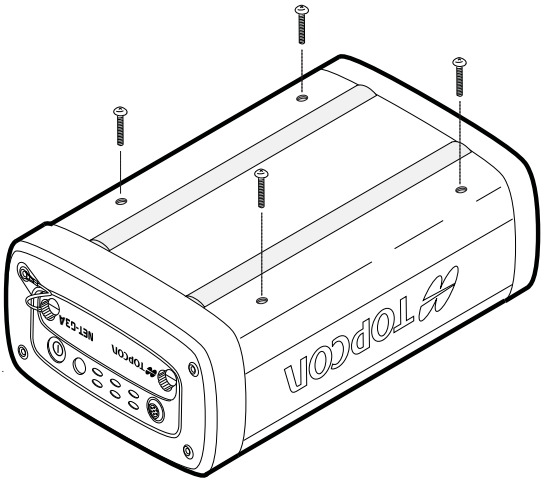


Figure 1-7. Net-G3A Bottom Mounting Holes

Cables and Power Supply

The Net-G3A package includes standard communication and power cables for configuring the receiver and providing a power source to the receiver. Table 1-2 lists these cables.

Table 1-2. Net-G3A Package Cables

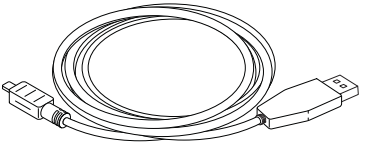
Cable Description	Cable Illustration
USB Cable Connects the receiver to an external device (controller or computer) for high-speed data transfer and receiver configuration. p/n 14-008081-01 This can also be purchased at any local computer store.	

Table 1-2. Net-G3A Package Cables (Continued)

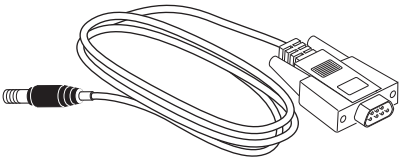
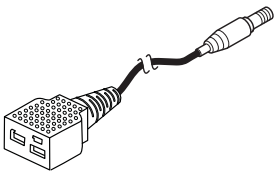
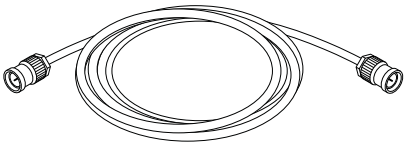
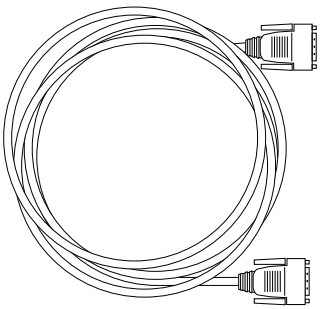
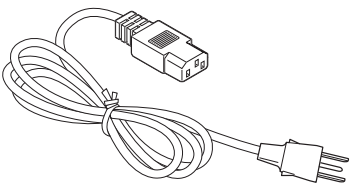
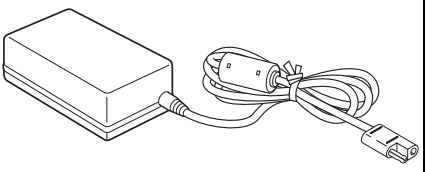
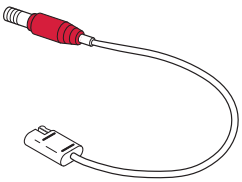
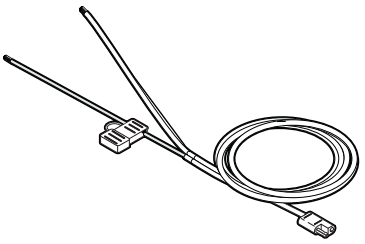
Cable Description	Cable Illustration
Serial Cable Connects the receiver to an external device (controller or computer) for data transfer and receiver configuration. Body of connector is black. p/n 14-008005-03	
Adapter Cable (with Ethernet and USB ports) Connects the receiver to a cross-over or straight-through Ethernet cable for networking. p/n 14-008180-01LF	
1PPS, Event Marker, External Frequency In/Out Cable Connects the receiver's 1PPS, EVENT, or EXT FREQ connector with the corresponding connector on an external device. p/n 14-008010-01LF	
Null Modem Cable Connects the receiver with an external device (controller or computer) for data transfer and receiver configuration. p/n 14-008086-01 Can also be purchased at any local computer store.	
Power Cable Connects the power supply unit to a grounded outlet. U.S. p/n 14-008052-01 Europe p/n 14-008054-01	

Table 1-2. Net-G3A Package Cables (Continued)

Cable Description	Cable Illustration
Power Supply Unit Converts the alternating current (AC) supplied from an electrical outlet to a direct current (DC) for powering the receiver. The unit connects to the receiver via the receiver power cable (see the power related sections in Chapter 2). p/n 22-034101-01	
Receiver Power Cable Connects the receiver and the power supply unit via SAE connectors. Body of connector is red. p/n 14-008016-04LF	
Fused Pigtail Cable Connects the receiver power cable via SAE connectors with a custom power supply unit via bare wires. p/n 14-008099-01	

Other Kit Accessories

The standard accessories in the Net-G3A package includes a 512 MB CF memory card, a CD that contains standard Topcon GPS+ configuration software, a fuse, and receiver documentation.

Figure 1-8. Net-G3A Included Accessories

For more details on the optional accessories and packages available for the Net-G3A, contact your local Topcon dealer.

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 at www.topconpositioning.com or consult your TPS dealer.

- Type of signal (standard L1; optional L2, L5 GPS, GLONASS, GALILEO)
- External CF memory card
- Update rate standard 1Hz (optional 5, 10, or 50 or 100Hz)
- RTK at 1Hz, 5Hz, 10Hz, 20Hz, and 50 or 100Hz
- RTCM/CMR Input/Output
- 1PPS
- Event Marker
- Frequency Input/Output
- Anti-jamming
- Ethernet
- FTP
- Advanced multipath reduction
- Satellite Based Augmentation System (WAAS, EGNOS, MSAS)

Notes:

Pre-setup Preparation

Successful deployment and operation of a Reference Station system with the Net-G3A receiver requires careful site planning, feasibility studies, and proper equipment configuration. These factors are critical to maximize the performance of the Net-G3A and to seamlessly integrate the receiver into an existing network or in establishing a new network.

Once a location for the Net-G3A has been determined, you can begin installing the hardware and software required to configure and maintain the Net-G3A. After determining the application, use the selected software to configure the receiver for your application. Finally, collect almanacs and ephemerides to begin working with the Net-G3A in its intended application. The following sections describe these steps in detail:

Determining the Reference Station Site

The site at which the reference station will be installed requires that the project team make in advance specific decisions about the goals of the project and therefore the application. Once the application has been decided and the goals clarified, a site inspection will help determine specific hardware/software setups and other requirements.

For more details on site planning, refer to the UNAVCO website (http://facility.unavco.org/) and the National Geodetic Survey (USA) CORS website (www.ngs.noaa.gov/CORS/Establish_Operate_CORS.html), specifically the document titled *Guidelines for New and Existing Continuously Operating Reference Stations (CORS)*.

Consider the Net-G3A Reference Station Application

Several decisions about the reference station application need to be determined before considering both the physical location and the receiver setup. These decisions affect virtually all the associated project planning, site inspection, hardware/software setup, and data gathering activities. Among the questions to consider are the following:

- who the end-user will be and how many there will be (those accessing the data, those analyzing the data, etc.)
- what kinds of communication links will be used
- what kind of data are required and data formats
- where the receiver needs to be placed (based on available sites and intended application)
- how the receiver will be used: as a single reference station or as part of a network
- how long the project will last: a short-term or a long-term project

All project team members should have a clear understanding of the project's purpose, goals, and application. Once the goals of the application have been identified, preliminary sites can be chosen, and then narrowed down to the most appropriate site.

Perform a Site Inspection for the Net-G3A Reference Station

When determining the location in which to place the Net-G3A, consider the relative safety of the physical location for both the receiver and personnel. Successful installation and operation of the reference station should meet the following guidelines:

- Location of the site and the receiver

  The building site should have a clear view of the sky with no reflective objects or surfaces in the vicinity.

  The location of the receiver Receiver should be indoors, placed on a flat surface (such as a table or stable shelf), provide free access to the receiver's front and rear panels, and be easy to reach and handle for maintenance activities.

- Equipment connectivity and antenna cabling system

  The site should provide appropriate routings for connecting the various equipment. Cables should be unobtrusive, but easy to maintain.

  For proper equipment connectivity and functionality, use only original and dedicated cables. Consider the following recommendations when connecting your devices:

  – Label each cable.
  On all cable ends, securely attach a sticker with a cable identifier.

  – Do not exceed standard cable lengths.
  The cable length should not exceed the maximum distance specified in appropriate standards for the cable being used.

  – Keep all cable connectors free of dust, dirt, and contaminants.

  - If you make your own cables, make sure that the cables are properly crimped.
  - Verify that you have connected each cable to its mating connector, and it is firmly seated.

  Building an antenna cabling system is one of the key components to successful operation of the Reference Station—especially when using an antenna cable longer than 30 meters or connecting multiple antennas to the same receiver. For guidelines on building a cabling system, see "Building an Antenna Cabling System" on page 3-20.

- Power accessibility

  The site should provide and meet power specifications for the receiver and other installed equipment. The receiver should have direct access to a grounded outlet.

  The Net-G3A is designed to accept two external power inputs and automatically switch during power fluctuations to keep the receiver operational.

  - PWR 1 can be connected to the main power using the Universal Power Supply included with the Net-G3A.
  - PWR 2 can be connected to any alternative power source capable of supplying 6 to 28 V DC (including an Uninterrupted Power Supply).

  If the main power fails, then the unit automatically switches from PWR 1 to PWR 2. When power is restored on PWR 1, the Net-G3A reverts to PWR 1, maintaining continuous operation throughout the power interruption.

  If both power inputs fail to deliver power to the receiver, then the intelligent Battery-based Energy STorage (iBEST) system will maintain continuous emergency operation. This system provides you with ample time (up to 25 hours) to save valuable data, isolate the problem, and restore the normal operation without an interruption in the service. When the normal operation is restored, the iBEST system automatically transfers the load to an external power source and maintains the backup batteries in a charged condition.

- Temperature and humidity control

The Net-G3A is designed to withstand harsh field environments and can be used as a temporary or semi-permanent Reference Station, as needed. For permanent installations, install the Net-G3A in a more protected and controlled environment.

- Protection against lightning and other power surges

  To protect against sudden surges in electricity, installing lightning finials, surge protectors, etc. will help shield electronic equipment from direct or indirect lightning strikes. Consult a certified electrician for recommendations and installation.

Installing Topcon Software

The Topcon GPS+ CD includes the following software programs used for configuring and maintaining the receiver. This software is also available on the Topcon website (www.topconpositioning.com) to registered users.

- PC-CDU
  ver. 7.12 or newer
- Topcon Link
  ver 7.2 or newer
- FLoader
  ver 1.0.07 or newer

If you are installing the program(s) from the GPS+ CD, insert the CD into the computer's CD-ROM drive. If you are downloading the program(s) from the website, then extract the program's files into a folder on the computer's hard drive. Refer to the Topcon Link documentation for details on installation and usage.

If you purchased the TopNET reference station software suite, then refer to the corresponding documentation for installing and using this software and for configuring the Net-G3A using TopNET.

Installing PC-CDU

PC-CDU™ is a comprehensive Windows® software product designed for controlling GPS+ receivers developed by Topcon Positioning Systems. PC-CDU uses the GNSS Receiver Interface Language (GRIL) to configure various receiver settings and diagnose receiver performance. PC-CDU is available for free on the Topcon website (www.topconpositioning.com) or the GPS+ CD.

Computer requirements for PC-CDU are: Windows® 98 or newer and an RS-232C or USB port. Use PC-CDU version 7.12 or newer to correctly configure the receiver.

NOTICE

Refer to the *PC-CDU Reference Manual* for full details on installing and using PC-CDU.

1. Create a PC-CDU folder on your computer's hard drive, and place the compressed PC-CDU zip file (retrieved from either the Topcon website or the GPS+ CD) in this folder.
2. Navigate to the PC-CDU folder, and double-click the PC-CDU zip file.
3. Extract the PCCDU.EXE and associated *.dll file to the PC-CDU folder (Figure 2-1).
4. Create a shortcut on the computer's desktop for quick access to PC-CDU (Figure 2-1).

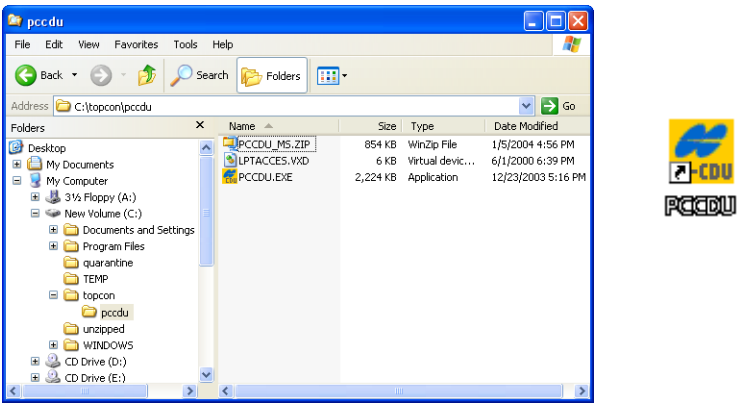


Figure 2-1. Extract Program and Create Shortcut

To uninstall PC-CDU, navigate to the location of the *.exe file. Select the file, and press **Delete**.

Installing FLoader

FLoader is a firmware loading program for the GPS board inside the receiver. FLoader is available for free on the TPS website (www.topconpositioning.com) or the GPS+ CD.

Computer requirements for FLoader are: Windows® 98 or newer and an RS-232C port. Use FLoader version 1.0.07 or newer to correctly configure the receiver.

1. Create an FLoader folder on your computer's hard drive, and place the compressed FLoader zip file (retrieved from either the website or the GPS+ CD) in this folder.
2. Navigate to the FLoader folder, and double-click the **FLoader zip file**.
3. Extract the FLoader.exe file to the FLoader folder (Figure 2-2).
4. Create a shortcut on the computer's desktop for quick access to FLoader (Figure 2-2).

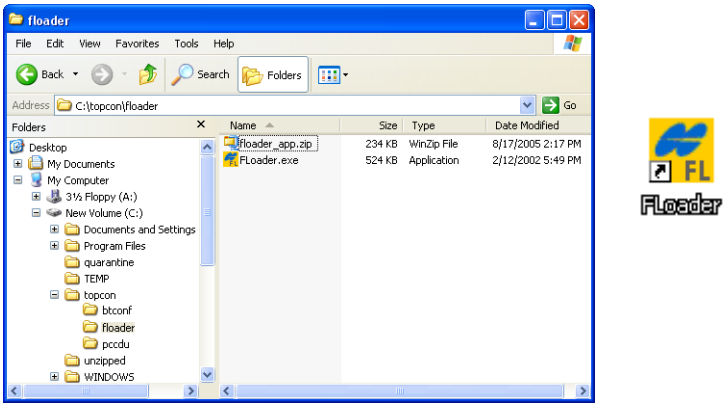


Figure 2-2. Extract Program and Create Shortcut

To uninstall FLoader, navigate to the location of the *.exe file. Select the file, and press **Delete**.

Installing the CF Card

Behind the door of the front panel is a slot for the optional CF card. The CF card provides memory space in which to save logged data. The Net-G3A package includes a 512MB CF card or an optional 2GB CF card. A CF card can also be purchased at your local computer supply store.

Make sure to install the CF card prior to operating the Net-G3A. The door also provides quick access to the card for removal.

To preserve data integrity, only install or remove the CF card when the receiver is powered off.

1. Ensure the receiver is turned off.
2. Turn the two door screws to the left to open the door.
3. Carefully insert the CF card, label side up, into the CF card slot (Figure 2-3 on page 2-8).

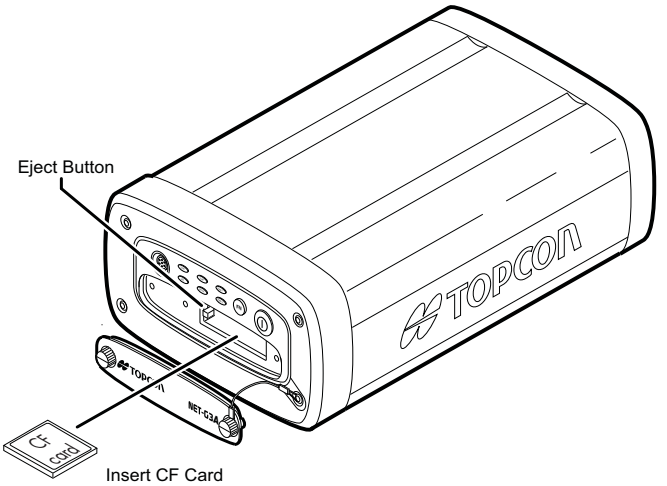


Figure 2-3. Install the CF Card

Ensure the button is recessed before closing the receiver door.

Once the receiver is turned on, the receiver board detects the CF card and is ready for use as needed.

Always initialize the file system on the installed CF card before the first use. The initialization procedure is described on "Initializing File System" on page 4-12.

To remove the CF card, first turn off the receiver. Open the receiver door, and press the small button to the left of the card slot. The CF card pops out.

Installing the USB Mass Storage Device (UMS)

Connect the adapter cable to the Ethernet/USB port on the rear panel. This adapter cable is equipped with a type A USB port for the optional UMS device. The UMS provides a sleek and high-capacity storage solution for transferring raw data files from the receiver's CF card. The Net-G3A supports flash-based UMS devices as well as hard drive-based UMS devices with USB 1.1/2.0 interface. A UMS device can be purchased at your local computer supply store.

Before using the UMS device, it should be formatted to a FAT32 file system, properly connected to the NET-G3A receiver, and activated. For more details, see "Formatting the UMS Device" on page 2-10 and "Connecting and Activating the UMS Device" on page 2-10.

Formatting the UMS Device

The NET-G3A requires an external UMS device formatted for the FAT32 file system. The UMS device can be formatted using the internal Disk Management application provided by Microsoft Windows; however, this application cannot create partitions larger than 32 GB. For more information about FAT32 limitations and how to format the UMS device to the FAT32 file system using the Disk Management application, refer to Microsoft® Help and Support at www.support.microsoft.com. If you want more than 32 GB of disk space on the UMS device, then use external disk-partition software.

Formatting the UMS device permanently erases all data on the device. Back up any data that you want to keep before formatting the device.

Connecting and Activating the UMS Device

1. Connect the adapter cable to the Ethernet/USB port on the rear panel of the Net-G3A receiver.

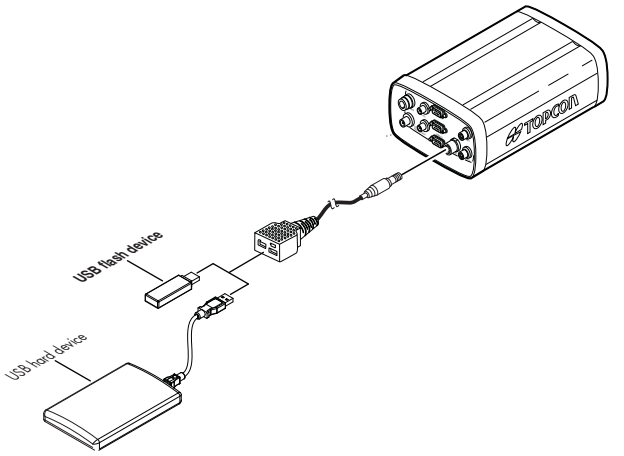


Figure 2-4. Connecting the UMS Device

2. Connect the UMS device to the type A USB port on the adapter cable. (See Figure 2-4). The receiver does not have to be turned

on. If the receiver is turned on, then the receiver board begins to detect the UMS device and the REC LED blinks yellow.

3. If necessary, supply power to the UMS device:
   - For a flash-based UMS device, the NET-G3A supplies enough power through the USB connection that an external power supply for the UMS device is not necessary.
   - For a hard drive-based UMS device, it is recommended to power it through an external AC power adapter available with the device.
4. To start using the UMS device, it should be activated. For information about the activation procedure, see "Downloading Data Files to a UMS Device" on page 4-4.

To remove the UMS device, Carefully take out the UMS device from the USB port.

To preserve data integrity, only install or remove the UMS device when the receiver's REC LED does not blink orange.

Powering the Receiver

The Net-G3A receiver is designed to derive power from external power sources (Figure 2-5 on page 2-12) or its backup batteries (iBEST). When setting up the receiver, consider the following powering requirements:

- Never use an extension cord for permanent power supply. This kind of setup can create a fire hazard.
- Always use a grounded outlet.
- Use a surge protector to protect connected electronics devices.

The Net-G3A has two power ports and either port powers the receiver.

To power on the Net-G3A:

1. Connect the power cable to the power supply unit.

2. Connect the SAE connectors on the power adapter cable and power supply unit.
3. Connect the power adapter cable to a PWR port on the receiver's rear panel.
4. Plug the power supply to an available outlet.

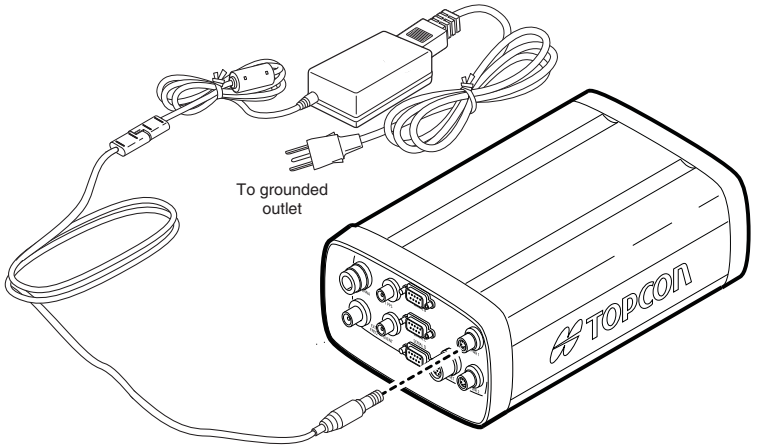


Figure 2-5. Connecting the Net-G3 to a Power Source

Checking Power Status

You can check the receiver's power status using the PWR LEDs or available Topcon software. The power LEDs on the receiver indicate the following power status:

- Solid Green – power within the acceptable range (6–28 V DC) is present on this PWR port and is being used to power the receiver.

  The corresponding backup battery is fully charged.
- Solid Yellow – power within the acceptable range (6–28 V DC) is present on this PWR port but is not being used to power the receiver.
- Solid Red – either a power failure has occurred (with connected power source) or power is not present on this PWR port. For details, see "Powering Problems" on page 5-2.

- Green blinks – power within the acceptable range (6–28 V DC) is present on this PWR port and is being used to power the receiver and to charge the corresponding battery.
- Red blinks – the corresponding backup battery is being charged.
- Off – the receiver consumes power from internal backup batteries or the receiver is turned off.

Refer to the corresponding software manual for details on checking the power status via installed software.

Turning On/Off the Receiver

To turn on the receiver, press and hold the **power** button until the LEDs briefly flash.

To turn off the receiver, press and hold the **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) prevents the receiver from being turned off by mistake.

Charging the Backup Batteries

The charging circuitry of the iBEST system automatically charges the backup batteries whenever the Net-G3A is plugged into an external power source via any PWR connector. The receiver has to be on to charge the batteries.

The iBEST system charges the backup batteries when the input voltage is between +12 and +16 Vdc.

An approximately 8-hour charge cycle fully charges the batteries; the batteries charge simultaneously. The batteries cannot be overcharged.

When fully charged, the iBEST system provides up to 25 hours of emergency operation (approximate, at room temperature). If the iBEST system detects the return of normal external voltages at any time during emergency operation, then the system automatically uses

the power supplied by the external source and maintains the backup batteries in a charged condition.

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

Collecting Almanacs and Ephemerides

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

- GPS and GLONASS satellites broadcast ephemeris data cyclically within 30 seconds.
- GPS satellites broadcast almanac data cyclically within 12.5 minutes; GLONASS satellites broadcast almanac data cyclically within 2.5 minutes.

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

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

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

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

To collect almanacs and ephemerides:

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

If 15 minutes have passed and the receiver does not lock onto satellites, then clear the NVRAM. See "Clearing the NVRAM" on page 4-18 for details.

Connecting the Receiver and a Computer

Once you have established a connection between the receiver and the computer, you can configure the receiver and its components, send commands to the receiver, and download files from the receiver's memory. To do this, use the installed software PC-CDU or use TopNET, etc. Both PC-CDU and TopNET provide an interface for various configuration, monitoring, and management functions for the receiver. Other software, such as FLoader, are used to update, maintain, or configure the components of a connected receiver.

The Net-G3A uses the following types of cables to connect with a computer:

- RS232 cable (See "Establishing an RS232 Cable Connection" on page 2-16.)
- USB cable – the TPS USB driver must be installed on the computer (See "Establishing a USB Cable Connection" on page 2-17.)
- Ethernet cable – the computer must have a network card and be configured with the TCP/IP protocol (See "Establishing an Ethernet Connection" on page 2-17.)

Establishing an RS232 Cable Connection

The following steps describe the physical connection of the cable, receiver, and computer. For a description of a software connection with the receiver, see “PC-CDU Connection Parameters” on page 2-22.

1. Using the RS232 cable, connect the serial port of your computer (usually COM1) to the receiver’s serial port (either ODU or DE-9). Use the serial port most convenient for you because both are equal in functionality but simply require different cables.

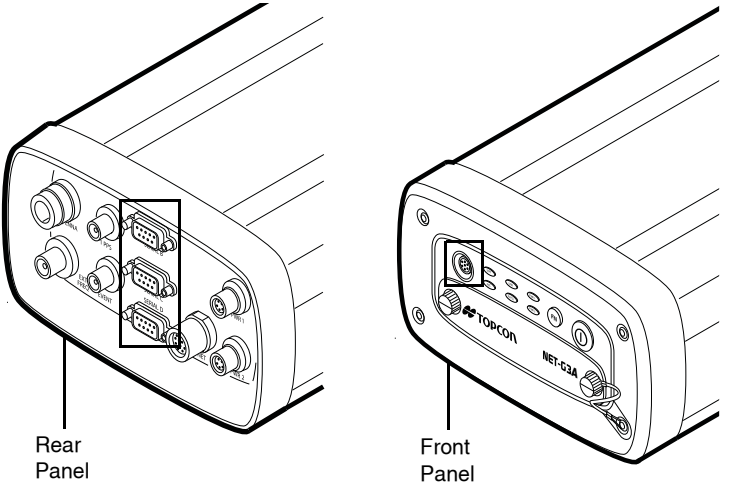


Figure 2-6. Net-G3A Serial Ports

2. Press the **power** buttons on the receiver and computer to turn them on.

Establishing a USB Cable Connection

Make sure the computer has the TPS USB driver installed. The following steps describe the physical connection of the cable, receiver, and computer. “PC-CDU Connection Parameters” on page 2-22 describes a software connection with the receiver.

1. Using the USB cable, connect the USB port of your computer to the receiver’s Ethernet/USB port located on the rear panel via the adapter cable.

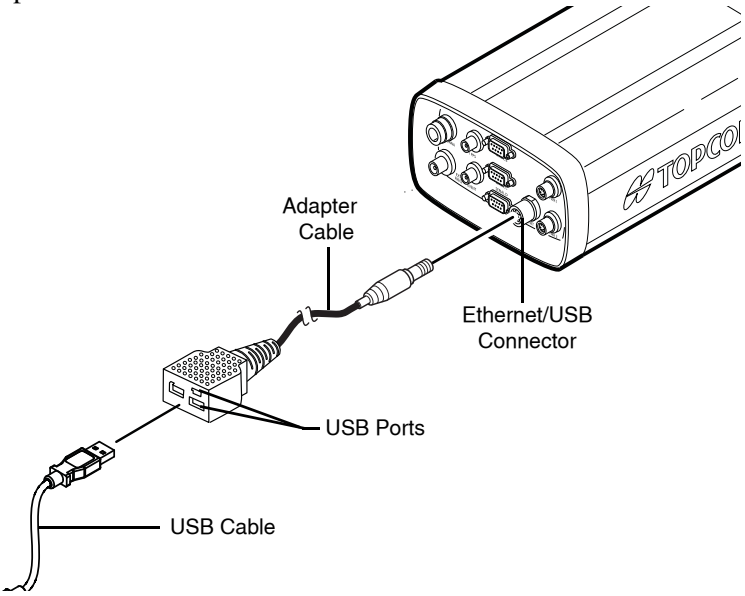


Figure 2-7. Net-G3A USB Ports

2. Press the **power** buttons on the receiver and computer to turn them on.

Establishing an Ethernet Connection

Make sure the IP settings of the receiver have been configured before connecting the receiver and computer using an Ethernet connection. This configuration requires connecting the receiver and computer using an RS232 cable before connecting them with an Ethernet cable. See “Configuring an Ethernet Connection Using PC-CDU” on page 2-19 for details.

The Net-G3A and associated software have two Ethernet connection options using the Ethernet adapter from the Net-G3A kit and an Ethernet cable purchased from a computer supply store:

- a direct connection – requires an Ethernet crossover cable
- an existing TCP/IP Ethernet network connection – requires an Ethernet straight-through cable

The following steps describe the physical connection of the cables, receiver, and computer. “PC-CDU Connection Parameters” on page 2-22 describes a software connection with the receiver.

1. Insert the 12-pin connector of the Ethernet adapter into the receiver’s ETHR port.
2. Connect the other end of this adapter to either end of the Ethernet crossover or straight-through cable.
3. Plug the second end of the Ethernet cable into the Ethernet jack on the back of the computer or into a network hub or switch.

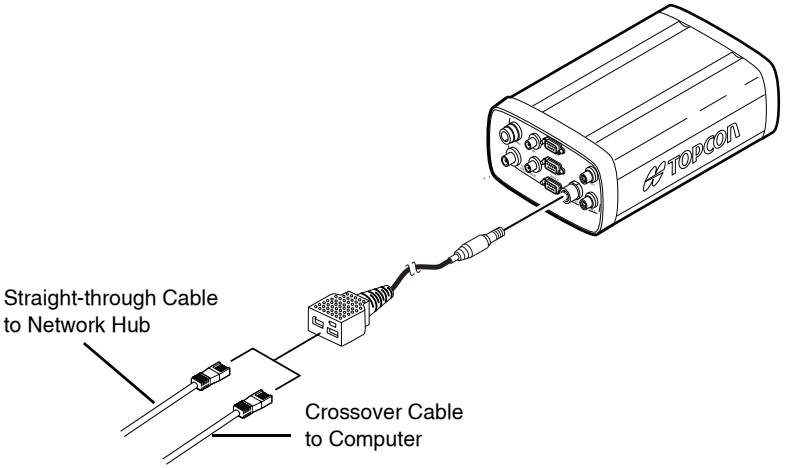


Figure 2-8. Connect Ethernet Cable

Configuring an Ethernet Connection Using PC-CDU

Before you can use the Ethernet option on a Net-G3A, the settings for this connection method need to be configured. You will need the following hardware/software components to use an Ethernet connection.

- A computer with an Ethernet card installed and the TCP/IP protocol configured.
- The latest version of PC-CDU.
- A Net-G3A receiver with an installed Ethernet port and the Ethernet port option enabled. For network connections, enable the FTP connections option. See “Managing Receiver Options” on page 4-14 for checking receiver options.
- A network connection requires a unique static IP address whether or not a Dynamic Host Configuration Protocol (DHCP) is used on the network, a subnet mask, and a default gateway for each receiver.

When connecting TPS receivers to a network, work closely with the system administrator to ensure a successful connection.

The following procedure describes how to connect the receiver to a computer using Ethernet ports and how to configure the receiver to be recognized in a network. The example in this procedure uses a protocol with the following settings:

- IP address – 192.168.0.1
- Gateway – 192.168.0.3 (For a direct connection: If two devices are directly connected and have no connections to another network, then the gateway address can be set to all zeros.)
- Subnet mask – 255.255.255.0

Both Ethernet connection methods are included in the following procedure.

Use a direct Ethernet connection to test the effectiveness of this connection method before connecting to a network.

1. Connect the receiver and computer using an RS232 cable. See “Establishing an RS232 Cable Connection” on page 2-16 for details.
2. Start PC-CDU, and select the following connection parameters. Click **Connect**.
   - Connection Mode – Direct
   - Port – the serial port connecting the computer and receiver
   - Baud rate – the communication rate between the computer and receiver (usually 115200)
3. Click **Configuration ▸ Receiver ▸ Ports ▸ Ethernet**.
4. Select the following **IP Settings** for the receiver (Figure 2-9 on page 2-21):
   - IP Address – enter the same value as the computer’s IP address, but increment the last number by one. The last number must differ from the computer's IP address but be within the 0 to 255 range (for example, 192.168.0.2).
   - IP Mask – enter the same number used for the computer.
   - Gateway – enter the same number used for the computer.
5. In the **Telnet Settings** area, leave all settings at the defaults, but ensure that TCP port is set to 8002 (Figure 2-9 on page 2-21).
   - TCP port – 8002 (default value). This is the port on which the receiver listens for telnet-like connections. The receiver allows up to five simultaneous telnet-like connections.
   - Timeout – 600 (default value). This parameter sets the amount of time in seconds the receiver allows an inactive connection to remain open. After this time, the receiver terminates the unused connection.

6. For network connections, configure **FTP Settings** (optional) with the following selections (Figure 2-9):
   - TCP port – 21 (default value). This is the port on which the receiver listens for an FTP connection. The receiver allows up to five FTP connections at a time.
   - Timeout – 600 (default value). This parameter sets the length of time in seconds the receiver allows an inactive connection to remain open. After this time, the receiver terminates the unused connection.
7. If required, enter a **Network Password** to access the FTP server (Figure 2-9).

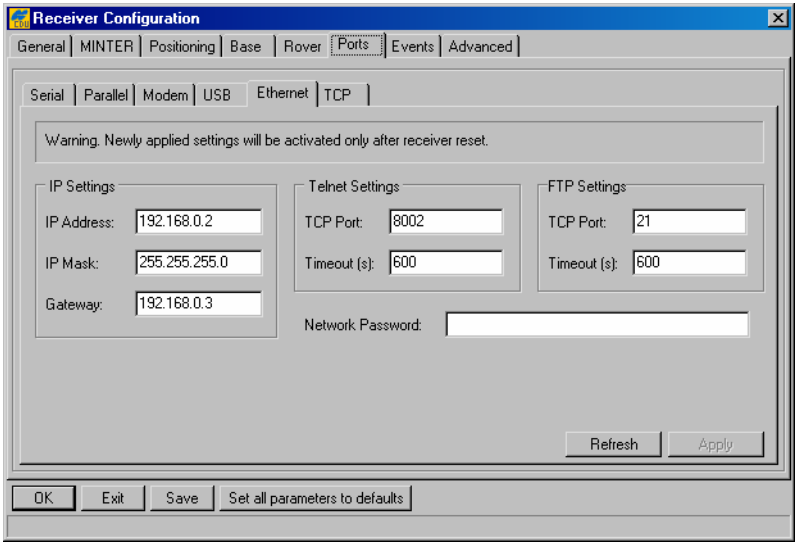


Figure 2-9. Ethernet Connection Settings – FTP Network Example

8. Click **Apply**, and then **OK** to set the parameters.
9. Click **Tools ▸ Reset receiver** to restart the receiver.
10. Click **File ▸ Disconnect**.
11. Connect the receiver and computer or a networking device (hub, switch, etc) as described in "Establishing an Ethernet Connection" on page 2-17.

PC-CDU Connection Parameters

When connecting to the receiver via PC-CDU, the type of connection determines the parameters to select. Table 2-1 and Table 2-2 list the parameters for the four connection types.

Table 2-1. PC-CDU Connection Parameters for RS232 and USB

Parameter	RS232	USB
Connection Mode	Direct	
Port	Port connecting the computer and receiver (typically COM1, COM2 for RS232)	USB
Baud Rate	Communication rate between the receiver and the computer (usually 115200)	n/a
Rec ID	n/a	Receiver's identification number

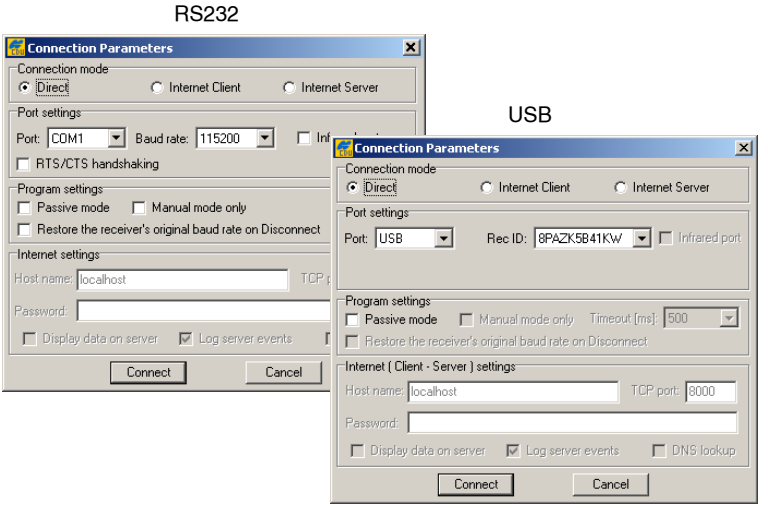


Figure 2-10. PC-CDU Connection Settings – RS232 and USB

Table 2-2. PC-CDU Connection Parameters for Ethernet

Parameter	Direct	Network
Connection Mode	Direct	
Port	ETHR	
TCP port	8002 (default)	
Host name	IP address assigned to the receiver	
Password	n/a	Assigned during initial setup

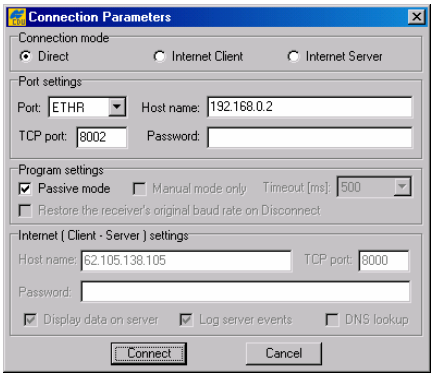


Figure 2-11. PC-CDU Connection Settings – Ethernet (Direct Example)

Power Management

Topcon's PC-CDU software provides an interface for various configuration, monitoring, and management functions for the receiver. For power management of the receiver, PC-CDU displays the current voltage for the power source.

1. Connect your receiver and computer. See "Connecting the Receiver and a Computer" on page 2-15 for this procedure.
2. Once connected, click **Configuration ▸ Receiver**.
3. View the **Voltages** information (Figure 2-12).

   External and **On Board** display the voltage drawn by the receiver.

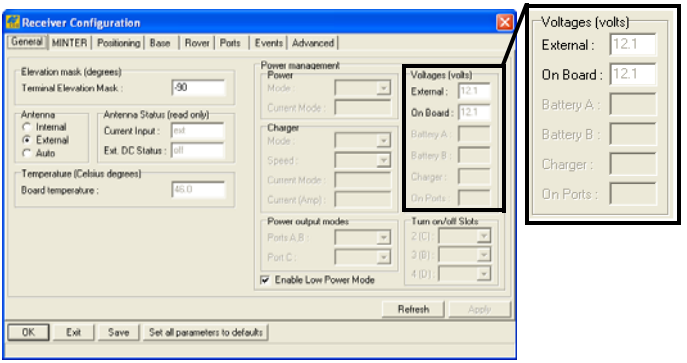


Figure 2-12. View Voltages Information

Net-G3A Configuration and Setup

The Net-G3A is intended primarily for use as a permanent or semi-permanent GNSS Reference Station to establish networks supporting both real-time and post-processing applications. Observation data can be streamed through any port to any device capable of receiving and utilizing it, including TopNET Reference Station software. Data can also be logged internally to removable CF cards for downloading to support static or kinematic surveying, mapping, monitoring, and positioning applications.

The Net-G3A is configurable for single to multiple scenarios, including the following:

- permanent and semi-permanent Reference Station
- temporary campaign receiver
- RTK or DGPS rover (for monitoring a fixed location, system monitoring, or mobile data collecting)

This chapter contains information on the basic configuration of the Net-G3A for some of these applications. Further configuration information is contained in the PC-CDU manual as well as the TopNET software manuals.

Regardless of the intended application or configuration software, the basic setup of the Net-G3A includes the following steps:

- “Configuring the Receiver” on page 3-2
- “MINTER Description and Configuration” on page 3-9
- “Receiver Setup as a Temporary Reference Station” on page 3-21
- “Static Surveying for Reference Stations” on page 3-26

Configuring the Receiver

The Net-G3A is generally configured as a static Reference Station that collects GNSS measurement information and logs the data internally to a removable CF card, streams the data to a central computer, and possibly connects directly to one or more radios (or any combination of these configurations). Topcon's PC-CDU and TopNET software are used to manage and configure the various functions of the receiver. Configuration settings are saved to the NVRAM of the GNSS receiver board and are reflected when using the MINTER.

The full range of both PC-CDU and TopNET configuration and operation are outside the scope of this manual. For more information on any of the procedures in this section, or on PC-CDU or TopNET, refer to the appropriate manual available from Topcon.

Once you have established a connection between the receiver and the computer, you will be able to:

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

The following is an example of a configuration for the Net-G3A as a Reference Station supporting internal data logging and real-time mobile unit support using a radio for transmission of GNSS correction data. This configuration uses PC-CDU to apply the appropriate parameters.

Do not make other changes without consulting the *PC-CDU Reference Manual*.

1. Connect the receiver and a computer using one of the methods described in "Connecting the Receiver and a Computer" on page 2-15.

2. Start PC-CDU, and connect to the receiver according to the settings described in "PC-CDU Connection Parameters" on page 2-22.

   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 3-1).

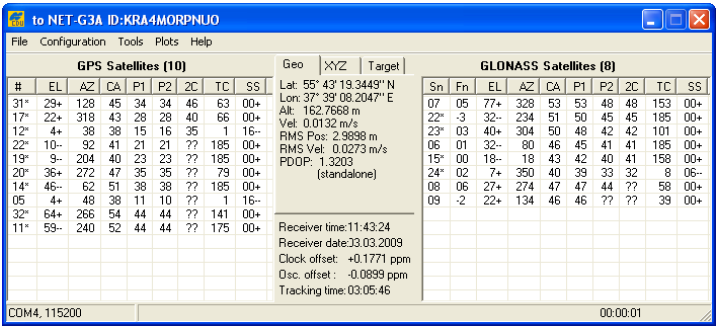


Figure 3-1. PC-CDU Connection Established

3. Click **Configuration ▸ Receiver**.

Click **Apply** after making any configuration change; otherwise, the receiver will not register the change.

4. Click **Set all parameters to defaults** (Figure 3-2).

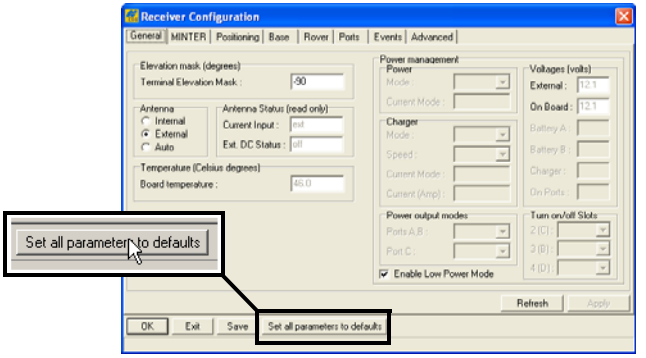


Figure 3-2. Set All Parameters to Defaults

5. Click the **MINTER** tab, configure the following settings (Table 3-1), and then click **Apply** (Figure 3-3).

Table 3-1. Receiver Parameters for the MINTER Tab

Parameter	Setting
Recording interval	Enter 15 seconds. (This variable depends on post-processing requirements.)
Elevation mask angle	Enter 15 degrees. Five degrees (default value) is recommended for base operations.
File name prefix	Enter the last 3 digits of the receiver's serial number.
FN key mode	(starts/stops data recording using the FN key)
	For Static data recording, select **LED blink mode switch**.

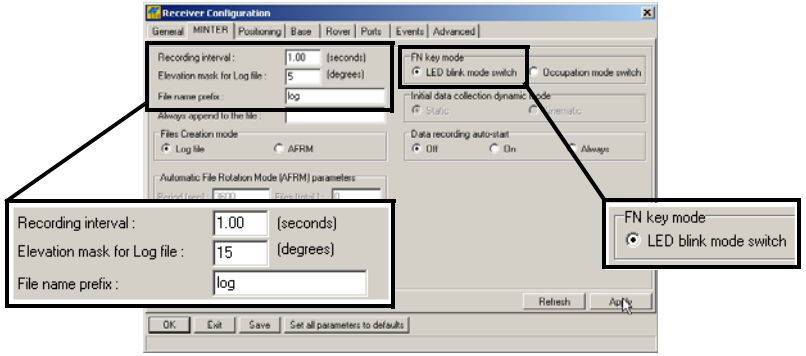


Figure 3-3. Configure MINTER for Static Data Recording

6. Click the **Positioning** tab, make sure the **Elevation mask** is set to 5 (default value), and then click **Apply**.

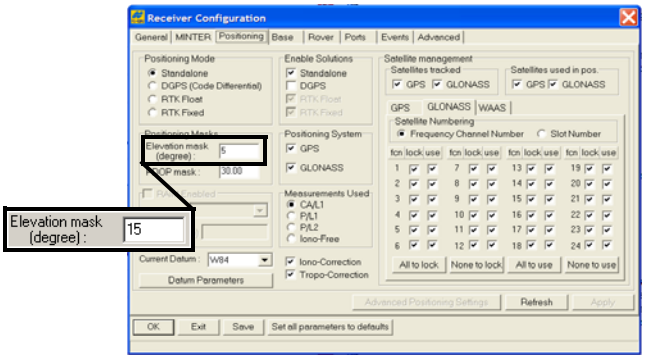


Figure 3-4. Configure Receiver Positioning – Elevation Mask

7. Click the **Base** tab, set the following parameters (Figure 3-5 on page 3-6), and then click **Apply**.
   - Base Station Coordinates – Select the point to which the entered coordinates are referred: Phase Center L1 or Antenna Reference Point.
   - Antenna Type – select the desired antenna type from the list of NGS standard antenna names.
   - Antenna position – enter Lat, Lon, and Alt values using one of the following methods:
     – If known, type in the values.

– Click **Get from receiver**.

NOTICE

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

8. Continue with step 8 on page 3-6 for RTK surveys or step 9 on page 3-7 for other configurations.

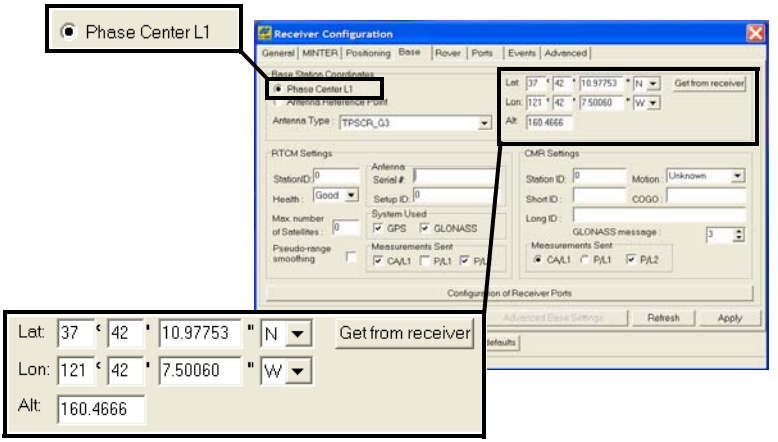


Figure 3-5. Base Configuration

9. For RTK surveys, click the **Ports** tab, set the following port parameters for the serial port (Table 3-2), and then click **Apply** (Figure 3-6 on page 3-7).

NOTICE

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

Table 3-2. Receiver Parameters for the Ports Tab

Parameter	Base Receiver
Input	n/a (Leave the default, “Command”.)
Output	Select the type and format of differential corrections.
Period (sec)	Enter the interval at which the receiver transmits differential corrections.

Table 3-2. Receiver Parameters for the Ports Tab (Continued)

Parameter	Base Receiver
Baud rate	Select a baud rate to use for transmitting differential messages from the receiver board to the modem module. The baud rate must match the modem's serial port speed.
RTS/CTS	Select to enable handshaking.

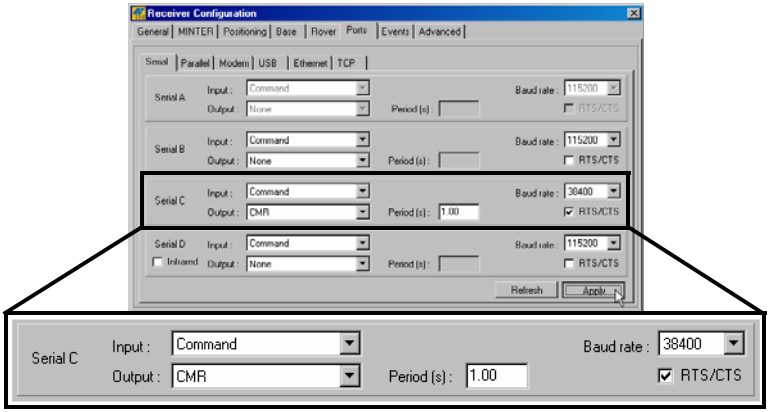


Figure 3-6. Base Configuration for RTK Surveys – Ports

10. Click the **Advanced** tab, and then the **Multipath** tab. Set the following parameters, and click **Apply** (Figure 3-7).
    - Code multipath reduction – enable

- Carrier multipath reduction – enable

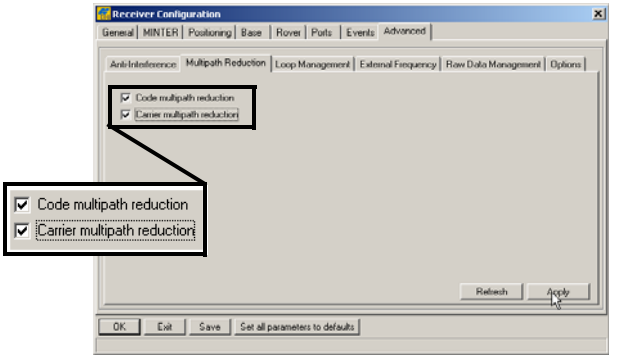


Figure 3-7. Configure Mulitpath Parameters

11. Click **OK** to save the settings and close the dialog box.

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

    For more details on the settings available for configuring the Base and Rover receivers, refer to the *PC-CDU Reference Manual*.

12. Continue with other configuration activities or click **File ▸ Disconnect**, and then **File ▸ Exit** to quit PC-CDU.

    Disconnecting before exiting ensures proper port management.

NOTICE

Disconnect the receiver from PC-CDU before exiting to eliminate possible conflicts with the management of the computer's serial ports.

MINTER Description and Configuration

The Minimum INTERface (MINTER) consists of two keys (power and FN) that control the receiver's operation, four LEDs that display the receiver's operational status, and two LEDs that display the power status (Figure 3-8).

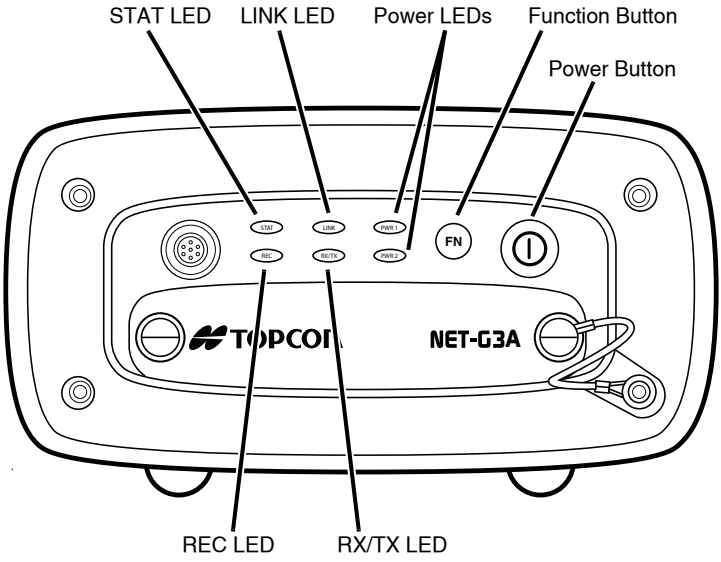


Figure 3-8. MINTER

The MINTER performs the following functions. For more information about using the MINTER, see "MINTER Operation" on page 3-16.

- Turns the receiver on or off; puts it in Sleep mode.
- Turns data recording on or off (FN button).
- Changes the receiver's information mode.
- Shows the number of GPS (green) and GLONASS (orange) satellites being tracked (STAT LED).
- Shows the data recording status (REC LED).
- Shows each time data is recorded to the memory (REC LED).

- Shows the status of post-processing mode (static or dynamic) when performing a Post-Processing Kinematic survey with the help of the FN key (REC LED).
- Shows the power status for the receiver (PWR LEDs).

Use PC-CDU to configure MINTER settings. The procedure below describes the most common settings; refer to the *PC-CDU Reference Manual* for other possible MINTER configurations.

Clearing the receiver's Non Volatile Random Access Memory (NVRAM) will return all settings made using PC-CDU to the factory default settings.

1. Connect your receiver and computer. See "Connecting the Receiver and a Computer" on page 2-15 for this procedure.
2. On the **Connection Parameters** dialog box, enable RTS/CTS handshaking (Figure 3-9).

   See "PC-CDU Connection Parameters" on page 2-22 for details on setting other parameters.
3. Click **Connect**.

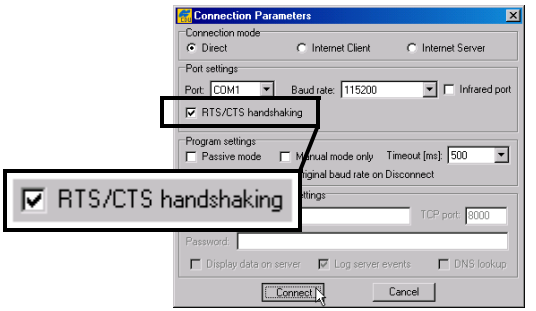


Figure 3-9. Connection Parameters – MINTER Settings

4. Click **Configuration ▸ Receiver,** and then click the **MINTER** tab. Set the following parameters, and click **Apply** (Figure 3-10). See the following pages for parameter descriptions:
   - *Recording interval* on page 3-11
   - *Elevation mask for log file* on page 3-11
   - *File name prefix* on page 3-11

- *Always append to the file* on page 3-12
- *Files Creation mode* on page 3-12
- *Automatic File Rotation Mode (AFRM)* on page 3-12
- *FN key mode* on page 3-13
- *Initial data collection dynamic mode* on page 3-14
- *Data recording auto-start* on page 3-14

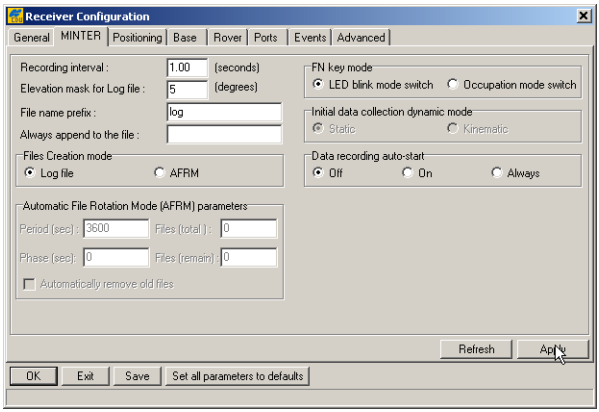


Figure 3-10. Receiver Configuration – MINTER Tab

Recording Interval parameter This parameter specifies the message output interval into the log file when the MINTER **FN** button (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 lowercase letter><numeric portion>

The file name depends on both the file creation time (month and day) and additional letter and numeric 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 the following operation modes:

- Log file – If the log file radio button has been selected, pressing the FN button closes the current log file. If data logging is off, pressing FN opens a new log file.
- AFRM – If the 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) for 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.

The receiver's memory holds up to 1024 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 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 1-1 on page 1-12 and refer to the *PC-CDU Reference 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 3-3 describes 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* field.

Table 3-3. Data Recording Parameter Behavior

Before Power Failure	Enabled Radio Button Results		
	Off	On	Always
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.
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.
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.

Table 3-3. Data Recording Parameter Behavior (Continued)

Before Power Failure	Enabled Radio Button Results		
	Off	On	Always
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, the 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 button.
- After resetting the receiver (using PC-CDU).
- After taking the receiver out of Sleep Mode.

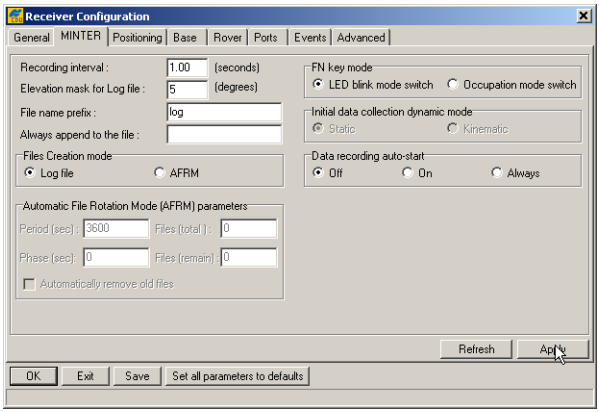


Figure 3-11. MINTER Tab

MINTER Operation

To turn on/off the receiver, press the **power** button (Figure 3-12).

- When turning on, press the **power** button until the MINTER's LEDs briefly flash.
- When turning off, press the **power** button until the PWR LEDs turn red, then release.

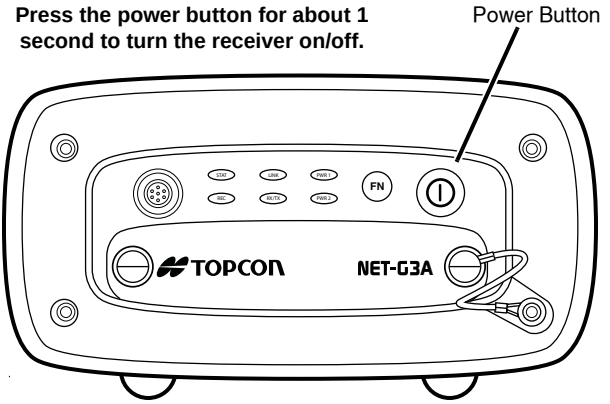


Figure 3-12. Power Button Functions

To start/stop logging data, press the **FN** button for 1 to 5 seconds (Figure 3-13).

- During data recording, the REC LED is green. Use PC-CDU to set the recording time interval. See "Recording Interval parameter" on page 3-11 for details.
- The REC LED blinks green each time data is written to the receiver's memory.
- 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 1-21 for more information).

Use PC-CDU to enable the desired FN key mode in the receiver, either "LED blink mode switch" for static surveys or "Occupation mode switch" for kinematic surveys. See "FN Key Mode parameter" on page 3-13 for details.

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 3-12 and “Files Creation Mode parameter” on page 3-12 for information on setting these functions.

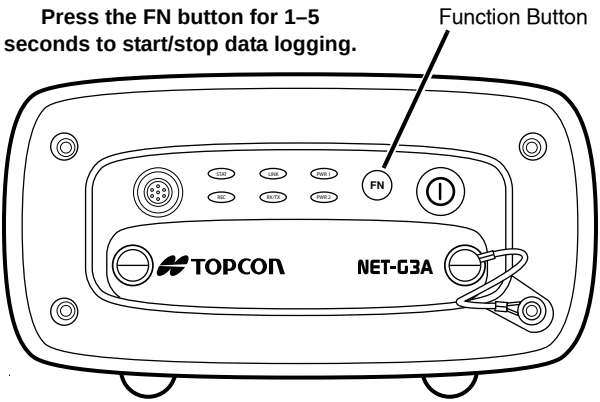


Figure 3-13. FN Button Functions

To toggle between post-processing modes, press the **FN** button for less than 1 second when “Occupation mode switch” has been enabled using PC-CDU.

To change the information mode of the receiver, press the **FN** button three times for less than 3 second when “LED blink mode switch” has been enabled using PC-CDU.

To change the baud rate of the receiver’s serial port, press the **FN** button for 5 to 8 seconds. This is useful if the data collector does not support the rate that the receiver port is set to.

After about five seconds, the REC LED becomes red. Release the **FN** button during the next three seconds.

Using the Web Interface

The Net-G3A includes a built-in Web server that allows you to configure and monitor the receiver via a Web user interface (or Web interface). The following Web browsers are recommended for accessing the receiver:

- Windows Internet Explorer 6.0 or later
- Mozilla Firefox 2.0 or later
- Opera 9.0 or later

The built-in Web server and Web interface use HTTP/HTTPS protocols for communication.

Accessing the Net-G3A through the Web Interface

Before accessing the Net-G3A using the Web interface, determine whether the valid network parameters (IP address, gateway, etc.) are specified in the receiver. Refer to "Configuring an Ethernet Connection Using PC-CDU" on page 2-19 for details regarding the network parameters.

1. Open a recommended Web browser.
   The browser window appears.
2. In the Address or Location bar of the Web browser, type one of the following addresses:

   http://ipaddress<:port number>

   or

   https://ipaddress<:port number> (if SSL is enabled)

   where *ipaddress* is the receiver's IP address; *port number* is the port number you should specify if set to a number other than the default port number (port 80 for HTTP, and port 443 for HTTPS).

The main page is displayed.

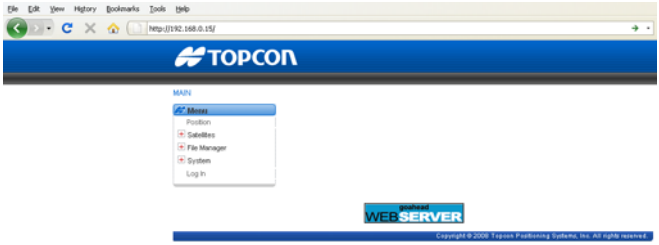


Figure 3-14. Web Interface – Main Page

When accessing the Web interface via SSL communications, a warning may appear stating the security certificate was issued by a company you have not chosen to trust. You can safely ignore this warning and continue with the login procedure. Your communications will use SSL.

3. Log in through the Web interface by entering the login name and password in the appropriate fields.
   The default login and password are *topcon*. Login names and passwords are case-sensitive and can be up to 12 alphanumeric characters.

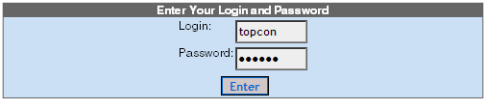


Figure 3-15. Web Interface – Login

4. Click **Enter**.
   After logging in to the Web interface, you can view and modify the receiver parameters.

You can access the receiver without entering the login name and password; however, you will be restricted to view-only activities.

Understanding the Web Interface

The Web interface is divided into two frames:

- Navigation menu – contains a list of menu items through which to access receiver functions.
- Content area – contains the various Web interface screens based on the item selected in the navigation menu.

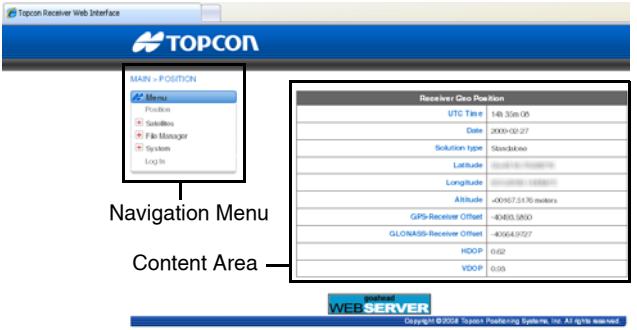


Figure 3-16. Web Interface Elements

Some of the screens in the Content area have the **Submit** button. Click it to apply changes made to the receiver parameters.

Building an Antenna Cabling System

A cable system running between the antenna(s) and the receiver must meet certain requirements to provide the minimum level of signal loss, thus delivering a quality signal. These requirements include the following:

- Cable length should be kept to a minimum.
  Topcon offers cables of various lengths, from 3 to 100 meters.
- Use only low-loss coaxial cables.
  For distances of up to 10 meters, it is recommended to use Topcon's RG-58 cable. If a greater length is required (up to 30 meters), it is recommended to use Topcon's RG-8 or LMR-400. For LMR-400 at 1600 MHz, the attenuation is 0.2–0.1 dB/meter.

- Beyond 30 meters, consider using in-line amplifiers or extra low loss cables.
  Topcon offers 30 and 60 meter cable options using LMR-400 and a 100 meter cable using LMR-600. For LMR-600 at 1600 MHz, the attenuation is 0.1 dB/meter.
- The total attenuation of the cable system should not be more than 10–12 dB at 1.6 GHz.

For installation with multiple receivers and a single antenna, use GNSS antenna splitters. The splitter(s) should normally have one RF output that passes DC current from the connected Net-G3A receiver through the splitter to the antenna. The other RF outputs should block DC current to prevent antenna damage. Also, the splitter should have a minimum of 20 dB RF isolation between its outputs to eliminate possible interference between the receivers connected with this splitter.

For applications where power is supplied from a separate source, consider using the bias tee. The bias tee typically has two coaxial connectors and a connector to power the antenna's LNA from an external power supply. One of the coax connectors is usually marked RF + DC and will have DC appearing on its center pin. The other connector is marked RF and it is DC-blocked. The remaining connector marked DC is where power should be applied.

Receiver Setup as a Temporary Reference Station

The typical permanent or semi-permanent Reference Station setup has the Net-G3A in a secure location with access to power and communication links as required. The antenna location has been surveyed very accurately and is free of signal obstructions and interference (RF, multipath, etc.).

As a temporary Reference Station, certain steps must be performed to ensure proper data collection. The following sections detail the use of the Net-G3A in a temporary Reference Station configuration.

Before logging data, make sure the receiver contains current almanac and current ephemeris data (see “Collecting Almanacs and Ephemerides” on page 2-14).

Step 1: Set up the Receiver

1. Place the receiver in the predetermined location. A sturdy shelf or out-of-the-way table may be a convenient spot.

See “Net-G3A Dimensions” on page A-2 for measurement details regarding the placement of screw holes for a permanent mount.

2. For a permanent mount, drill four screws through the mounting location (shelf) and into the receiver’s mounting holes.
3. Connect the power cable to an available and grounded outlet. See “Powering the Receiver” on page 2-11 for more details and precautions.
4. Connect the antenna cable. If recording data to an external device, such as a USB hard drive, connect it to the receiver using the required communication cable.

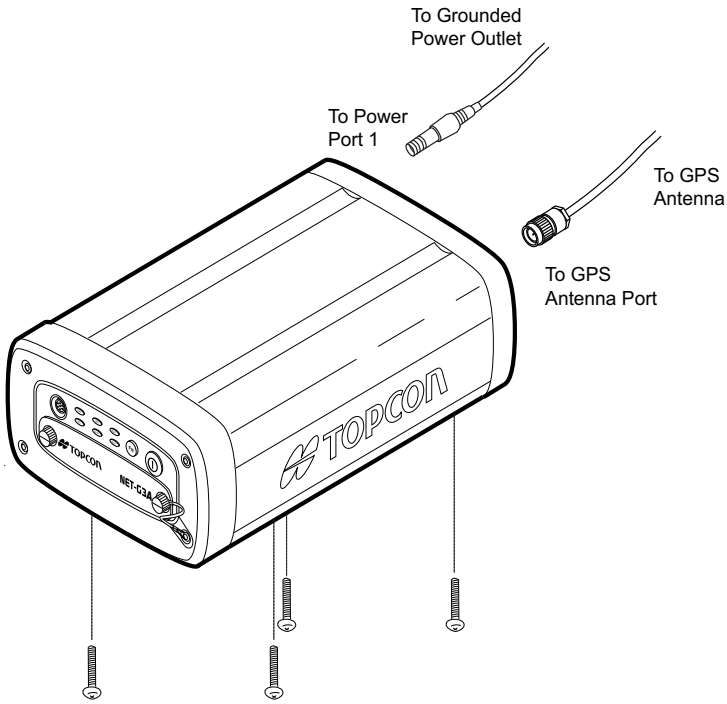


Figure 3-17. Mount Receiver and Connect Cables

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 point 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 antenna at the base of the mounting threads.
- Slant – measured from the marker to the lower edge of the antenna slant height measure mark (SHMM).

The point to which all measurements are being referenced 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. For a GNSS 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 different because of the difference in location between the slant measuring point and the vertical measuring point.

1. Measure the antenna height above the control point or marker, either the slant height or the vertical height (Figure 3-18 on page 3-25).
2. Record the antenna height, point name, and start time in the field notes.

   The height of the antenna and it’s offsets depend on the type of antenna used. Refer to the antenna’s documentation for details.

Refer to the antenna’s offset measurements card for measurement and offset details.

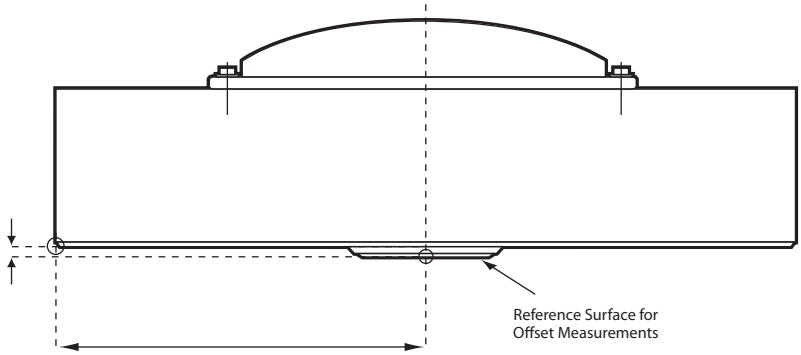


Figure 3-18. Measure Antenna Height – Example

Step 3: Collect Data

See the remaining sections in this chapter for more information about collecting data.

1. Turn on the receiver. The STAT (status) light LED blinks red at first.
   - Once the receiver has locked on to one or more satellites, the STAT LED will blink green for GPS satellites and orange for GLONASS satellites. A short red blink indicates that the receiver has not solved a position. Four or more satellites provide optimal positioning.
   - Once the short red blink is gone, the receiver has a position and surveying can begin; 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 or after resetting the receiver, it may take several minutes.
2. Press and hold the **FN** key (for more than one second and less than five seconds) to begin collecting data.
3. Release the **FN** key when the REC (recording) LED 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 memory.

Use PC-CDU to configure data logging. See "MINTER Description and Configuration" on page 3-9 or refer to the *PC-CDU Reference Manual*.

Stopping Data Logging

Stop logging data when you need to move the receiver, download data, or perform maintenance functions.

1. Press and hold the **FN** key until the REC LED light goes out.
2. To turn off the receiver, press and hold the **power** key until all lights go out, and then release.

Static Surveying for Reference Stations

Static surveying is the classic survey method, well suited for all kinds of base station surveys. One receiver over a survey marker collects raw data during a certain period of time. 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 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 baseline length

Generally, single-frequency receivers are used for baselines with lengths that 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).

Analyzing Signal-to-Noise Ratio

Knowing the strength and reliability of the ranging signal transmitted from the satellites will help determine the quality of the satellite signals. Use Table 3-4 to help estimate signal quality from a satellite vehicle.

Table 3-4. Typical SNR Values

SV[a] Elevation (degrees)	C/A channel (dB*Hz)	P1 channel (dB*Hz)	P2 channel (dB*Hz)
10–20	>35	>10	>10
20–40	>40	>20	>20
40–60	>45	>30	>30
60–90	>50	>40	>40

a. SV = satellite vehicle

If the SNR value of a satellite signal is less than the threshold value from the table, then pay close attention to this satellite because it can

potentially cause problems for getting accurate timing and positioning results.

Using the Anti-Jamming Suppressor (AJS)

The Net-G3A is equipped with advanced hardware and software components, called anti-jamming suppressor (AJS). These components suppress unintentional or intentional narrowband Radio Frequency Interference (RFI). AJS accurately estimates the interfering signals and intelligently mitigates them. Once AJS is enabled, interference mitigation improves the receiver's resistance to interference and allows the receiver continuous operation without degradation of positioning accuracy or loss-of-lock to the satellites in areas affected by RFI.

To enable AJS:

1. Run PC-CDU.
2. Click **Configure ▸ Receiver ▸ Advanced ▸ Anti-Interference**, and then select **Auto**.
3. Click **Apply ▸ OK**.

To view textual information about detected in-band interference signals, enable the JI message using the Manual Mode window.

Working with External Devices

The Net-G3A receiver can be connected with various external devices for frequency calibrations and time synchronization, external events time-tagging, meteorological measurements, and differential corrections distribution.

If you have any problems or questions on using the Net-G3A with these devices, contact your local Topcon dealer. For contact information, visit the TPS website at:

http://www.topconpositioning.com/static/dealer_pointer.php

Receiver and File Maintenance

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

As project expectations expand, the receiver's OAF may need to be updated to provide expanded operation and functionality. The GPS board inside the receiver requires firmware to properly operate and provide appropriate functionality. As Topcon releases firmware updates, loading these updates into the receiver will ensure that the receiver operates at its full potential.

Downloading Data Files from an Installed Memory Card

After completing a survey, download data files from the memory card installed in the receiver to a computer or a UMS device for storage, post-processing, or backup. Also, the memory card holds a finite amount of files and information, so downloading data prevents files from being lost. The following steps use PC-CDU to download files, but any Topcon receiver management software can be used.

Downloading Data Files to a Computer

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-15 for information about this procedure.
   PC-CDU automatically appears with the **Connection Parameters** dialog box open. If this dialog box is not open, then click **File ▸ File Manager** on the PC-CDU main page.
2. On the **Connection Parameters** dialog box, enable **RTS/CTS handshaking** and then click **Connect** (Figure 4-1 on page 4-2).

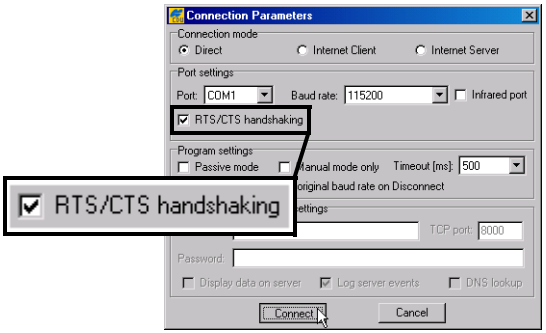


Figure 4-1. Connection Parameters – RTS/CTS Handshaking

3. Click **File ▸ File Manager**, and then click the **Download path** tab on the **File Manager** dialog box (Figure 4-2).

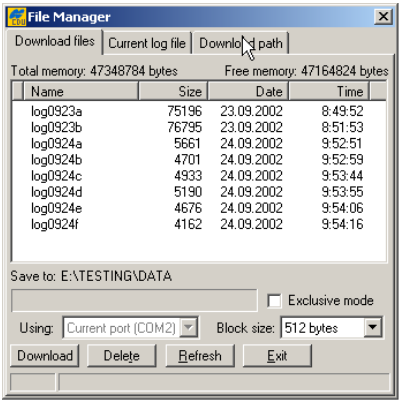


Figure 4-2. Find Files to Download

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 4-3 on page 4-3).

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

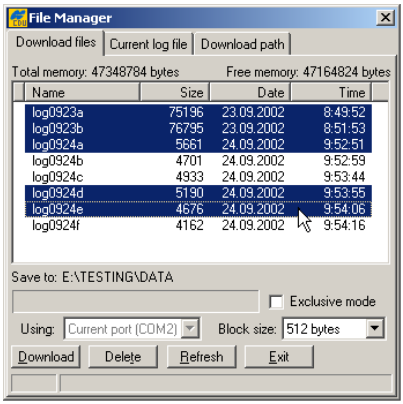


Figure 4-3. Download Files

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

- Green indicator – file has successfully downloaded.

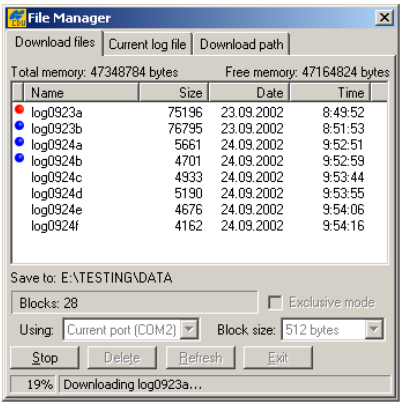


Figure 4-4. Download Files – Status Indicators

7. Click **Exit** on the **File Manager** dialog box.
8. Continue with other operations, or click **File ▸ Disconnect** and then **File ▸ Exit** to quit PC-CDU.

Downloading Data Files to a UMS Device

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-15 for information about this procedure.
2. Connect the UMS device as described in “Connecting and Activating the UMS Device” on page 2-10.
3. Run PC-CDU. The **Connection Parameters** dialog box appears. If this dialog box is not open, then click **File ▸ File Manager** on the PC-CDU main page.
4. On the **Connection Parameters** dialog box, enable **RTS/CTS handshaking** and then click **Connect** (Figure 4-1 on page 4-2).

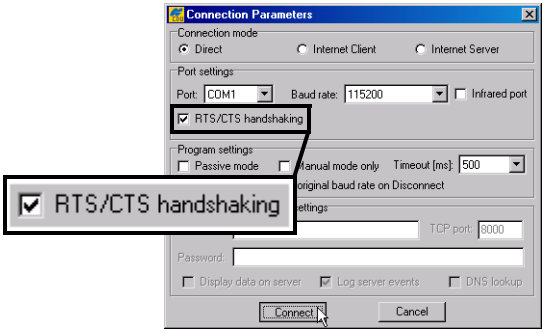


Figure 4-5. Connection Parameters – RTS/CTS Handshaking

5. Click **File ▸ File Manager**.
6. In the **File Manager** dialog box, click the **USB Copy** tab (Figure 4-6).

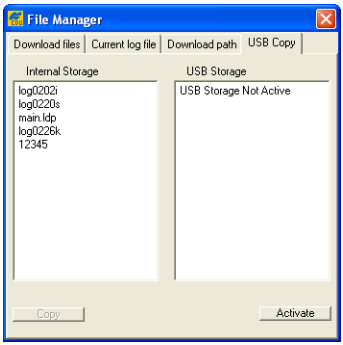


Figure 4-6. USB Copy

7. Click **Activate**, and then click **Yes** to make the inserted UMS device ready for copying.

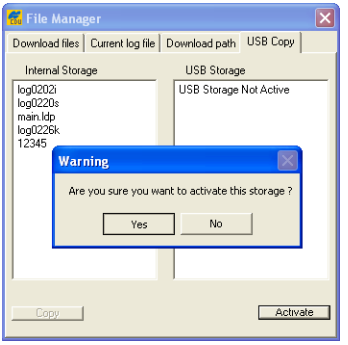


Figure 4-7. Activate the Inserted UMS device

8. In the **Internal Storage** box, select the file(s) to download (Figure 4-8 on page 4-7). To select multiple files, hold down the **shift** key and click on sequential files to select several files at once or hold down the **Ctrl** key and click on individual files.

NOTICE

The selected files also appear in the USB Storage box with color-coded names.

A black file name indicates that the file already resides on the UMS device.

A gray file name indicates that the file is selected and is ready for copying.

A red file name indicates that the file cannot be copied for some reason (either an incorrect file name or the file is already on the UMS device).

9. Click **Copy**. If any file names appear in red in the **USB Storage** box, then the **Copy** button will be unavailable (Figure 4-8).

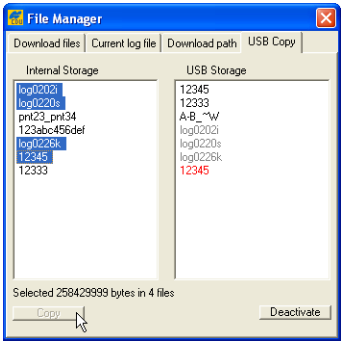


Figure 4-8. Copying Data Files to a UMS device

CAUTION

During the copying process, the REC LED will blink yellow every second. Do not remove the UMS device until the blinking stops.

Downloading Data Files from a Removed Memory Card

After removing a memory card from the receiver, the data can be downloaded using Topcon Link software. A CF card reader in or connected to the computer is required to access the data on the card. Before Topcon Link can read data on a Memory Card, the card must be formatted for Topcon devices.

- The device icon for a formatted card will be red.
- The device icon for an unformatted card will be gray.

NOTICE

Refer to the *Topcon Link User's Manual* for a complete description of working with data on a memory card.

To format a memory card:

1. Insert the memory card into the card reader.

2. Navigate to the Topcon Memory Cards device directory, and click the device icon.
3. Click the desired, formatted memory card device icon.

To download data files:

After formatting the card, select and copy, or select and drag-and-drop, the desired files into a directory on the computer. During the downloading process, the REC LED will blink yellow every second. Do not remove the UMS device until the REC LED stops blinking.

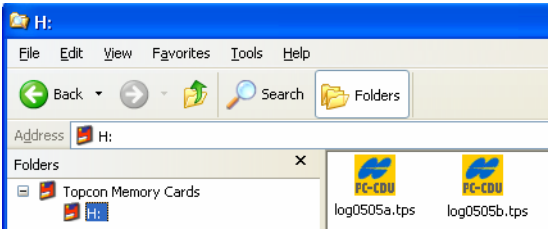


Figure 4-9. Import From Memory Card

Deleting Data Files from an Installed Memory Card

A memory card holds a finite amount of collected data. To free up space for more or new data, delete old data. For more information on managing the receiver's memory, see "Managing Receiver Memory" on page 4-10. The following steps use PC-CDU to delete files, but any Topcon receiver management software can be used.

You can also configure the receiver to automatically delete files using the first-in-first-out function (see "Automatic File Rotation Mode (AFRM) parameters" on page 3-12 for details).

1. Connect your receiver and computer. See "Connecting the Receiver and a Computer" on page 2-15 for information about this procedure.

2. On the **Connection Parameters** dialog box, enable **RTS/CTS handshaking** (Figure 4-10).

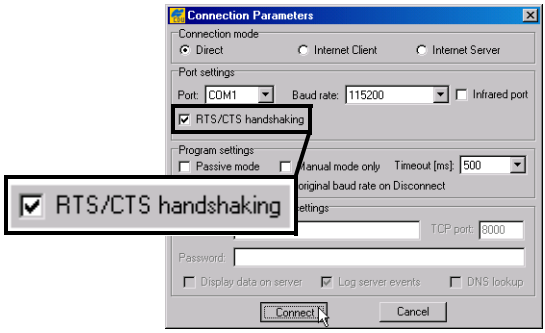


Figure 4-10. Connection Parameters – RTS/CTS Handshaking

3. Click **File ▸ File Manager** and select the file(s) to delete on the Download files tab (Figure 4-11 on page 4-10).

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

4. Click **Delete** (Figure 4-11 on page 4-10).
5. Click **Yes** on 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**, and then **File ▸ Exit** to quit PC-CDU.

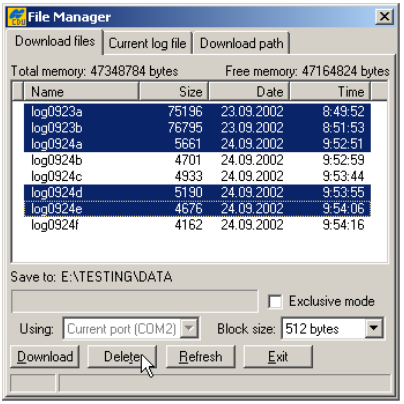


Figure 4-11. Delete Files

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

Table 4-1 shows the amount of receiver file memory required for the raw data measurements collected for an hour. The amount of memory

depends on the total number of GNSS satellites being tracked and used in position computation, and the recording interval.

Table 4-1. Amount of Memory Required to Store a One Hour File

#SVs	Recording Interval (seconds)				
	0.1	1	5	15	30
Single-frequency dual-system receiver Memory needed to record data					
6	11 MB	1.1 MB	221 KB	74 KB	37 KB
10	14 MB	1.4 MB	283 KB	94 KB	47 KB
14	17 MB	1.7 MB	345 KB	115 KB	57.5 KB
18	20 MB	2 MB	407 KB	136 KB	68 KB
Dual-frequency dual-system receiver Memory needed to record data					
6	17 MB	1.7 MB	347 KB	116 KB	58 KB
10	23 MB	2.3 MB	471 KB	157 KB	78.5 KB
14	29 MB	2.9 MB	595 KB	198 KB	99 KB
18	35 MB	3.5 MB	720 KB	240 KB	120 KB

Initializing File System

Initializing the file system of a connected receiver erases all of the receiver's data files. This process requires two confirmations before beginning and may take several minutes depending on the receiver's memory size.

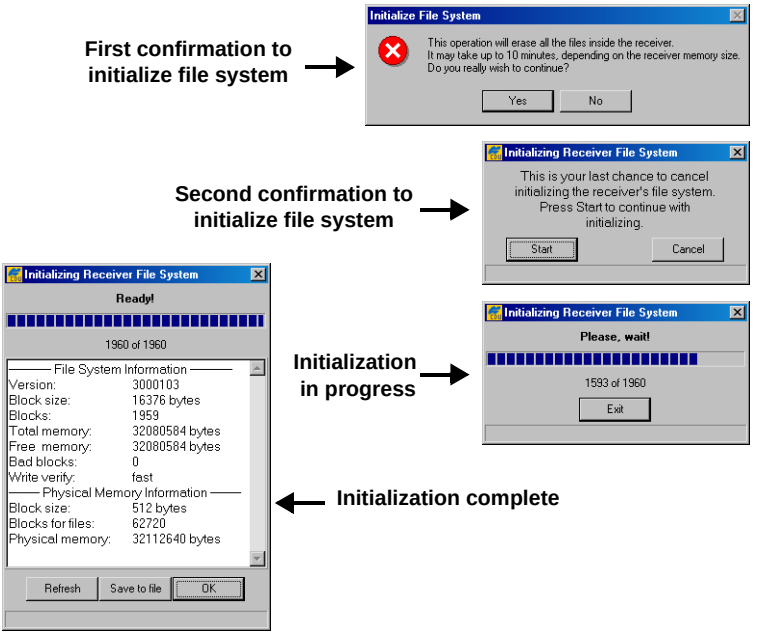


Figure 4-12. Initializing the File System

When the receiver's memory is initialized, information on the file system and physical memory displays.

- Refresh – reloads the information.
- Save to file – saves the files system and physical memory information to a text file.

Ok – closes the dialog box.

Always initialize the file system on the installed CF card before the first use. It is recommended to reinitialize the receiver file system on a regular basis.

Setting Raw Data & Position Update Rates to 50 Hz

This procedure sets the receiver to output measurement data and position information at 50 Hz.

1. In PC-CDU, click **Tools ▸ Receiver options**.
2. Make sure that the **Position update rate (Hz)** and **Raw data update rate (Hz)** options display 50 in the Current column, and then click **Exit**.
3. Click **Configuration ▸ Receiver**.
4. Click the **Advanced** tab, and then the **Raw Data Management** tab. Set the following parameters, and then click **Apply**:
   - Raw Measurement Update Rate, Update Rate – set to 20 ms.
   - Position Update Rage, Update Rate – set to 20 ms.
5. Click **Refresh**, and examine the values in the Current Update Rate fields. They should display 20.
6. Once verified, click **OK**.

When requesting any data recording or output with a period—that is, a recording or output not directly supported by the current state of the receiver—PC-CDU will launch the Output Period Setup Wizard. This wizard performs the same steps described above. For details on the wizard, see *PC-CDU Reference Manual*.

Managing Receiver Options

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

- the type of signal (L1 or L1/L2) the receiver will process
- the amount of data the receiver will store in the memory
- the rate at which data will be transmitted or received

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

Checking the Receiver's OAF

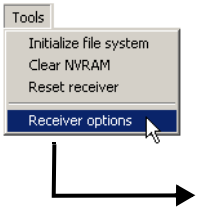
The receiver's OAF lists all enabled or disabled features. To determine if a feature is turned on or which features are available, check the receiver's OAF using available Topcon receiver management software. The following steps use PC-CDU to view options.

1. Connect your receiver and computer. See "Connecting the Receiver and a Computer" on page 2-15 for this procedure.
2. Click **Tools ▸ Receiver Options**. The **Options Manager** dialog box (Figure 4-13 on page 4-15) 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

   Because options can be both purchased and leased, the "Current" status of the option displays the currently effective value. Option values can be one of the following:
   - -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

3. When finished, click **Exit** on the **Option Manager** dialog box, and then click **File ▸ Disconnect** to disconnect from PC-CDU (and prevent conflicts with serial port management).



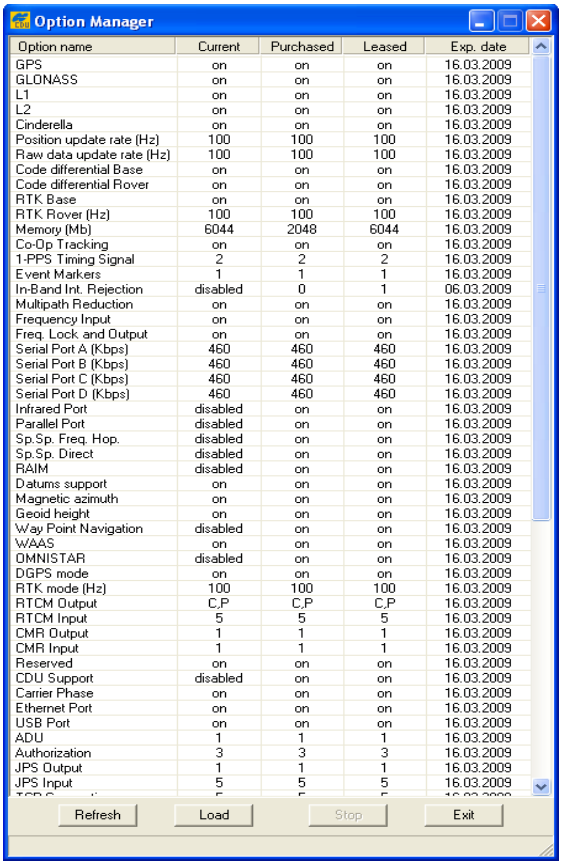


Figure 4-13. View Option Manager

Loading an OAF

Topcon Positioning System dealers provide customers with OAF files. If you purchase an updated OAF for the receiver, you need to load it before you can use the new feature. The following steps use PC-CDU to load the option file.

For OAF related questions, e-mail TPS at options@topcon.com and include the receiver's ID number.

1. Connect your receiver and computer. See "Connecting the Receiver and a Computer" on page 2-15 for this procedure.
2. Click **Tools ▸ Receiver Options**.
3. Click **Load** at the bottom of the **Option Manager** dialog box (see Figure 4-13 on page 4-15).
4. Navigate to the location of the new Option Authorization File. OAFs have .jpo or .tpo extensions and are unique to each receiver (Figure 4-14).

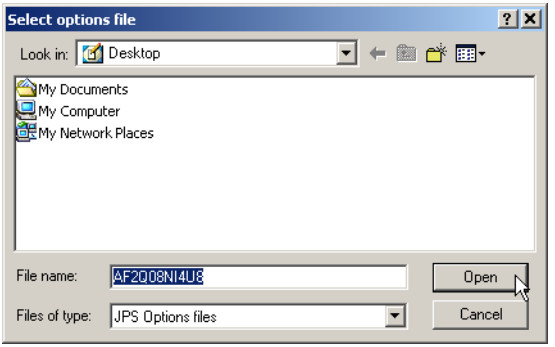


Figure 4-14. Load OAF

5. Select the appropriate file, and click **Open** (Figure 4-14). The new receiver option loads onto the receiver, and the **Option Manager** table updates.
6. When finished, click **Exit** on the **Option Manager** dialog box.
7. Click **File ▸ Disconnect** to prevent conflicts with serial port management.

Resetting the Receiver

If the receiver stops responding via buttons or software, then perform a hard reset. A hard reset should only be performed when the receiver is powered on and not otherwise responding.

NOTICE

A hard reset simply cycles the receiver's power. It does not erase information stored in the receiver's memory.

To perform a hard reset:

1. Remove the front door.
2. Insert a paper clip or any pointed stick small enough to fit into the pinhole (Figure 4-15).
3. Gently press the reset button for about one second until the unit powers off.

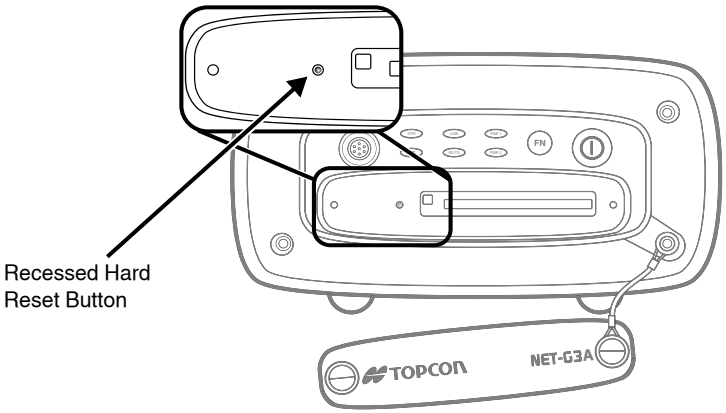


Figure 4-15. Reset the Receiver

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.

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 receiver'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.

Using the MINTER to Clear the 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 the NVRAM

1. Connect your receiver and computer. See “Connecting the Receiver and a Computer” on page 2-16 for this procedure.
2. Click **Tools ▸ Clear NVRAM** (Figure 4-16).

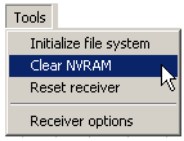


Figure 4-16. Clear NVRAM with PC-CDU

While the NVRAM clears, the REC LED flashes green and red; the STAT LED flashes red. The receiver automatically disconnects when finished.

Changing Receiver Modes

The receiver has the following two information modes and one power mode:

- Normal Mode – the standard surveying mode.
- Extended Information Mode – used for testing purposes during normal operation.
- Sleep Mode – turns the receiver off but keeps it powered on in “standby” and ready to activate via any input on a serial port.

Entering Extended Information Mode

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 delimiter.

The delimiter is a distinguishable double-blink that shows the overall status of tests performed in EIM. The STAT LED color for the delimiter is calculated from the colors of other LED blinks and will be one of the following colors when the test is 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).

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

Blink 4. Oscillator's frequency offset is less than three ppm (parts per million).

Blink 5. Oscillator's Allan Variance is better than 2.7e-10 (currently, always orange).

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 the 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 the **FN** key three times (within three seconds) 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 three times within three seconds.

Sleep (Off) Mode

Sleep mode is the normal “off” state of the receiver.

1. Turn on your receiver.
2. Press the receiver’s **power** key for more than four seconds and less than eight seconds. The STAT LED turns orange. The receiver enters Sleep Mode.
3. Activity on a serial communication port will turn on the receiver.

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

Loading New Firmware

Use the latest firmware version, available for download from the TPS website (www.topconpositioning.com), to ensure your receiver has the most recent updates.

The Net-G3A receiver must be loaded with firmware version 3.4 or newer.

Do not attempt to load firmware older than 3.4.

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

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

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

The receiver uses FLoader, a Windows®-based utility, to load firmware. You can download FLoader to your computer from the TPS website at www.topconpositioning.com. For more information, refer to the *FLoader User's Manual*, also available on the Topcon website. See "Installing FLoader" on page 2-7 for installing FLoader on the computer.

1. If needed, download the new firmware package to your computer.
2. Connect your receiver and computer. See "Connecting the Receiver and a Computer" on page 2-15 for this procedure.
3. Start FLoader.
4. On the **Connection** tab, select the COM port on your computer that connects with your receiver and then select its speed (usually 115200) (Figure 4-17).

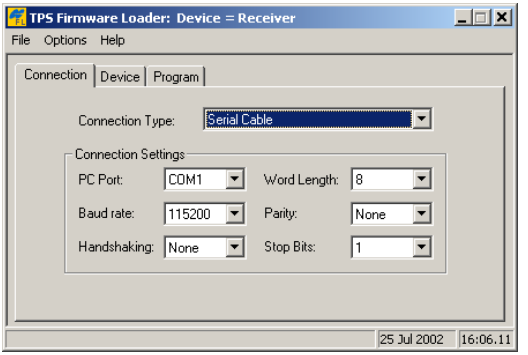


Figure 4-17. FLoader Main Screen

5. Click the **Device** tab, and then select **Receiver** from the **Device Type** drop-down list.

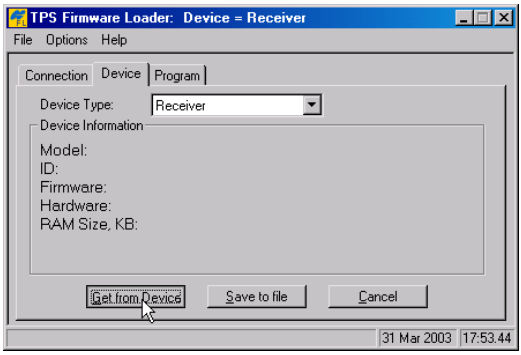


Figure 4-18. Set Device Type

6. Click **Get from Device** for device information (Figure 4-18).
7. Click the **Program** tab, and select **Soft Break Capture** from the **Capture Method** drop-down list (recommended) (Figure 4-19).

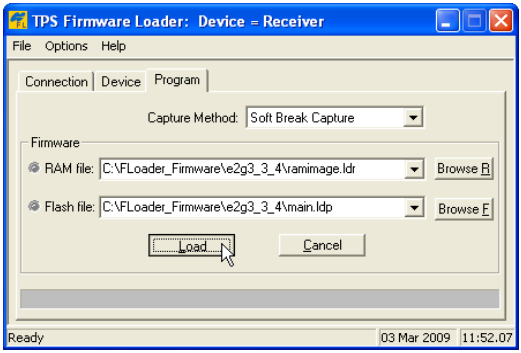


Figure 4-19. Program Tab Settings

8. Browse for and select the receiver board's RAM file and Flash file (Figure 4-19).
9. Click **Load**, and wait until every 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.

---

10. Click **File ▸ Exit**.
11. Clear the receiver's NVRAM (see "Clearing the NVRAM" on page 5-9) and update the almanac (see "Collecting Almanacs and Ephemerides" on page 2-23) after loading new firmware.

Troubleshooting

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

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

Check This First!

Before contacting Topcon support, check the following:

- Check all external receiver connections carefully to ensure correct and secure connections.
- Double check for worn or defective cables.
- Check all power sources.
- Check that the most current software is downloaded onto the computer and that the most current firmware is loaded into the receiver. Check the Topcon website at www.topconpositioning.com for the latest updates.

Then, try the following:

- Reset the receiver using PC-CDU (**Tools ▸ Reset receiver**).
- Restore default settings using PC-CDU (**Configuration ▸ Receiver**, and then click **Set all parameters to defaults**).
- Clear the NVRAM (see “Clearing the NVRAM” on page 4-18).
- Initialize the file system (click **Tools ▸ Initialize file system**). This erases all files inside the receiver.

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

Troubleshooting Quick List

For receiver power issues:

If “The receiver does not power up.” see page 5-2.

For receiver issues:

If “The receiver cannot establish a connection to a computer or external controller.” see page 5-3.

If “The receiver does not lock on to satellites for a long period of time.” see page 5-3.

If “The receiver tracks too few satellites.” see page 5-4.

If “The receiver cannot obtain Code Differential and/or RTK solutions.” see page 5-4.

If “The receiver does not start data logging.” see page 5-6.

Powering Problems

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

The receiver does not power up.

⇨ An external power source may be improperly connected.

- Check that the power source is correctly connected.
- Check that the power source contacts are clean and dust free.

⇨ The power source may be discharged (if a battery is used) or may not provide enough power.

Connect/attach a fully charged battery or a correct power supply and retry. See “Powering the Receiver” on page 2-11.

⇨ If you are using an external power source, the cable may be disconnected or damaged.

Check that the cable is securely connected and undamaged.

⇨ The receiver may have a defective power source.

Make sure that the external power source is working properly.

Receiver Problems

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

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

Cable specific problems:

⇨ The cable is not properly plugged in.

- Check that the cable connector is attached to the correct receiver port.
- Unplug the cable, and then securely and properly reconnect it to the receiver.
- See “Net-G3A Receiver” on page 1-8 and “Connector Specifications” on page A-9 for information about the receiver’s connectors.

⇨ The cable is damaged.

Use an undamaged cable. Contact your Topcon dealer to replace the cable.

Generic problems:

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

1. Connect your receiver and a computer using a free port (see “Connecting the Receiver and a Computer” on page 2-15) and start PC-CDU.
2. Click **Configuration ▸ Receiver ▸ Ports**.
3. Change the **Input** for the port used for connection to **Command**.

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

⇨ The receiver stores an old almanac.

Update the almanac. See “Collecting Almanacs and Ephemerides” on page 2-14 for details.

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

- See “Managing Receiver Options” on page 4-14 for details about how to check current options.
- Order a new OAF with the desired options activated to enable or extend validity of the corresponding receiver options. Contact your dealer or visit the Topcon website at www.topconpositioning.com for details.
- Refer to the *PC-CDU Reference Manual* for a detailed description of options.

The receiver tracks too few satellites.

⇨ The elevation mask value is too high (above 15 degrees).

Lower the elevation mask. See page 3-5 for information about setting the elevation mask.

⇨ The survey is conducted near obstructions (tree canopy, tall buildings, etc.).

- Check that the Multipath Reduction boxes have been enabled.
  1. Connect your receiver and a computer and start PC-CDU. See “Connecting the Receiver and a Computer” on page 2-15.
  2. Click **Configuration ▸ Advanced** and the **Multipath Reduction** tab. Enable the two boxes, and click **Apply**.
- Move to an area free of obstructions, if applicable.

The receiver cannot obtain Code Differential and/or RTK solutions.

⇨ Incorrect Base coordinates entered.

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

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

- If the receiver should function as a Base, ensure it has the proper configuration. See “Configuring the Receiver” on page 3-2 for details.
- If the receiver should function as a Rover, ensure it has the proper configuration. See “Configuring the Receiver” on page 3-2 for details.

⇨ The corresponding receiver options may be disabled or expired.

- See “Managing Receiver Options” on page 4-14 for details on how to check current options.
- Order a new OAF with the desired options activated to enable or extend validity of the corresponding receiver options. Contact your dealer or visit the Topcon website at www.topconpositioning.com for details.
- Refer to the *PC-CDU Reference Manual* for a detailed description of options.

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

- Ensure that both the Base and Rover receivers use the same updated almanac. See “Collecting Almanacs and Ephemerides” on page 2-14.
- Check the elevation masks of the Rover and Base receivers; they should be the same. See page 3-5 for information about setting the elevation mask.

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

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

1. Connect your receiver and a computer, and start PC-CDU. See “Connecting the Receiver and a Computer” on page 2-15.
2. Click **Configuration ▸ Receiver** and the **Ports** tab. Use the same input/output format for both receivers.

⇨ Poor satellite geometry (PDOP/GDOP values are too high).

Conduct your survey when PDOP values are low.

⇨ The elevation mask is above 15 degrees.

Lower the elevation mask. See page 3-5 for information on setting the elevation mask.

The receiver does not start data logging.

⇨ The receiver has no memory card installed or the memory option is disabled or expired.

- Check that the card is properly inserted. For details, see "Installing the CF Card" on page 2-8.
- Check that the memory option is enabled. For details, see "Checking the Receiver's OAF" on page 4-14.

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

- Download and/or delete data files to free up space for new files (see "Downloading Data Files from an Installed Memory Card" on page 4-1 and "Deleting Data Files from an Installed Memory Card" on page 4-8).
- Use the AFRM feature. See "Automatic File Rotation Mode (AFRM) parameters" on page 3-12.

Obtaining Customer Support

Before contacting Topcon customer support about any problems with the receiver, consult your local Topcon dealer and also see “Check This First!” on page 5-1 for some solutions that may fix the issue.

If, after taking the above steps, you still need assistance, contact Topcon customer support.

Phone

To contact Topcon customer support by phone, call:

1-866-4TOPCON (1-866-486-7266)
Monday through Friday
8 am to 8 pm, Eastern Standard time

E-mail

To contact Topcon customer support via e-mail, use TopconTechnicalSupport@topcon.com.

For quick and effective support, provide a detailed description of the problem.

When e-mailing Topcon customer support, provide the following information for better, faster service:

1. The receiver model and configuration settings.

   In PC-CDU, click **Help ▸ About** and then click **Save to file**. Enter a file name and save it to your computer. Attach this file to the email.
2. The system/hardware specifications for the computer running the Topcon software, such as operating system and version, memory and storage capacity, processor speed, etc.
3. The symptoms and/or error codes/messages that precede and follow the problem.

4. The activities being tried when the problem occurs. If possible, include the exact steps being taken up to when the error message or other problem occurred.
5. How regularly the problem occurs.

Generally, a customer support representative will reply within 24 hours, depending on the severity of the problem.

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 Topcon website, visit www.topconpositioning.com

Specifications

This Topcon product is a 144-channel GNSS receiver with an optional, removable CF memory card, a rugged aluminum housing complete with MINTER and cable connectors.

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

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

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

Net-G3A Dimensions

Figure A-1 shows the measurement dimensions for the Net-G3A receiver, including the placement of the screw holes.

Dimensions are in inches.

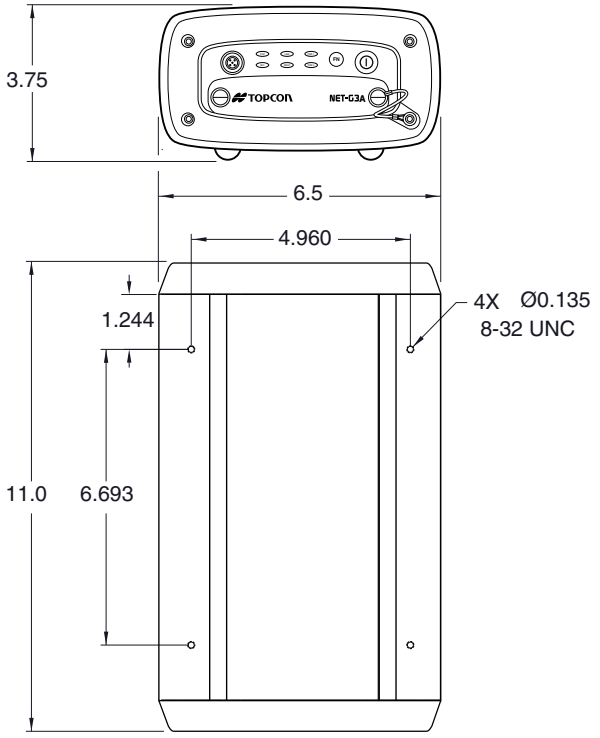


Figure A-1. Net-G3A Dimensions

Use these dimensions when drilling holes into a permanent mount, using four #8-32 screws to attach the receiver.

Receiver Specifications

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

General Details

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

Table A-1. Receiver General Specifications

Physical	
Enclosure	Aluminum, IP67 rated extrusion
Color	Topcon Yellow and Topcon Grey
Dimensions	W:166 mm x H:93 mm x D:275 mm 6.54" x 3.66" x 10.83"
Weight	3.0 kg (6.61 lbs)
Antenna	External
Controller	External MINTER
Keys	Two keys: Power – On/Off FN – start/stop data logging; switch information mode
LEDs	Six LEDs: STAT – satellite and receiver status REC – record and data status RX TX – modem status LINK – network connection status (currently n/a) PWR x 2 – power status
Environment	
Operating temperature	-40 C° to +65 C°
Storage temperature	-40 C° to +75 C°
Humidity	100% non-condensing
IP rating	IP67 waterproof/dustproof

Table A-1. Receiver General Specifications (Continued)

Power	
External power	2 ports
Input voltage	6 to 28 V DC
Consumption	4.5 W typical 5 W maximum
On-board	Backup battery for timekeeping and almanac data storage; 10 years minimum operation; two internal batteries for up to 25 hours of emergency operation.
I/O	
Communication Ports	4 high speed RS232 serial ports (1xODU-MINI-SNAP, 3xDE-9) 1 USB port (Mini-B) 1 USB port (Type A) 1 Ethernet port (RJ45)
Port specifications	RS232 serial port Baud rate: 460800,230400,115200(Default),57600, 38400,19200,9600,4800,2400,1200,600, 300 Flow control: RTS/CTS Length: 7,8 (default) Stop bit: 1 (default), 2 Parity: None (default), Odd, Even USB port Full speed: 12 Mb/s Ethernet port 10.100 Mb, Half/Full Duplex
Connectors	2x PWR, 4x RS232 Serial, USB Host/Device, Ethernet, GPS antenna, 1PPS, Event Marker, Ext. Frequency
MINTER	Six external LEDs (see “LEDs” on page A-3 for details) ON/OFF control input (power button) Data logging control (FN button)
Technology	
	Advanced Multipath mitigation SBAS Adjustable PLL and DLL parameters Anti-Jamming Suppressor (AJS)

Table A-1. Receiver General Specifications (Continued)

Data Features	
	Up to 50 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 Different DATUMs support Output of grid coordinates CMR and CMR+ support
NMEA	
NMEA version	Ver. 2.1, 2.2, 2.3, 3.0, 3.01 output
Messages	GGA, GLL, GMP, GNS, GRS, GSA, GST, GSV, HDT, RMC, ROT, VTG, ZDA, UID and P_ATT
Output interval	1Hz standard; 5, 10, 20, and 50 Hz optional
DGPS	
Correction format	RTCM SC104 Ver 2.1, 2.2, 2.3
RTCM message type	1, 3, 9, 31, 32, 34; user selectable
Process interval	1Hz standard; 5, 10, 20, 50 Hz optional
Output interval for RTCM correction data	1Hz standard; 5, 10, 20, 50 Hz optional
Elevation mask	0 to 90 deg (independent of data logging)
Multi-base DGPS	Differential correction select mode: Nearest, Mix, Best (optional)
RTK	
Correction formats	CMR/CMR+ (Trimble compatible); RTCM SC104 Ver 2.2, 2.3, or 3.0; TPS
RTCM message type	3, 18, 19, 20, 21, 22, 23, 24 by rover; 3, 18, 19, 22, 23, 24 by base; user selectable

Table A-1. Receiver General Specifications (Continued)

Ambiguity initialize	OTF (L1, L1/L2) and known point initialization
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, 20, 50 Hz optional
Elevation	0 to 90 degrees (independent of data logging)
Solution mode	Delay (synchronization) Extrapolation (not synchronized)
Process interval	1Hz standard; 5, 10, 20, 50 Hz optional
Latency	Delay mode – 20 msec to 20 sec (depends on latency, which receives corrections data from the base receiver) Extrapolation – 20 to 30 msec
Raw Data logging	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%
Survey Modes	
Base Rover (optional)	Static Kinematic (Stop and Go) RTK (Real-time Kinematic) DGPS (Differential GPS) WASS/EGNOS DGPS
Survey Accuracy	
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, L1 – H: 10mm + 1.0ppm (x baseline length); V: 15mm + 1.0ppm (x baseline length)

Table A-1. Receiver General Specifications (Continued)

DGPS	Post processing: less than 0.25m (HRMS) DGPS/RTCM based: less than 0.25m (HRMS)
Cold Start Warm Start Reacquisition	< 60 sec < 10 sec < 1 sec

GNSS Board Details

Table A-2 lists the GNSS board's general specifications.

Table A-2. GNSS Board Specifications

Receiver Type (set by activating the proper OAF)	
Internal board: E2G3	GPS: L1 (C/A & P), L2, L2C, L5 GLONASS: L1, L2 (both code and phase) GALILEO[a]
Tracking Specifications	
Standard Channels	144 universal channels (G, GG, GD, GGD)
Optional	Cinderella days (see page A-8 for details)
Tracked Signals	GPS/GLONASS, L1/L2 C/A, L5, GALILEO, and P-Code and Carrier, WAAS/EGNOS
Tracking Functions	
Multi-path reduction	C/A Code phase and Carrier phase
PLL/DLL setting	Bandwidth, order, adjustable
Smoothing interval	Code; user selectable
SBAS	WAAS optional; EGNOS optional
Data Features	
Formats	TPS, NMEA, RTCM, CMR, BINEX

Table A-2. GNSS Board Specifications (Continued)

Features	Up to 50 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 Different DATUMs support Output of grid coordinates CMR and CMR+ support
Memory	
Internal Memory	CF card, removable
Capacity	Dependent on capacity of the installed CF card, currently up to 2 GB. The capacity is extended by several hundred gigabytes when using a mass storage device connected to the USB host.
Logging Size	3.5 MB per hour (18 SVs, 1sec, L1/L2, default message set)
Logging Interval	0.01 to 86400 seconds, depending on purchased options

a. Contact Topcon Technical Support for detailed information about the supported GALILEO signals.

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 at www.topconpositioning.com for more information and specific Cinderella day dates.

Connector Specifications

The Net-G3A has the following connectors:

- Power x 2
- Serial RS232C: 1xODU and 3xDE-9
- USB Host/Device
- Ethernet
- GPS antenna
- 1PPS
- Event marker
- External Frequency

Power Connector

The power connector (Figure A-2) is a sealed receptacle, 5 pin, ODU part number G80F1C-T05QF00-0000.

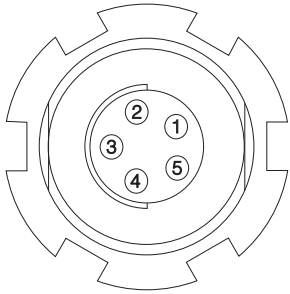


Figure A-2. Power Connector

Table A-3 gives power connector specifications.

Table A-3. 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
5	Aux_Power	P	6 to 28 volts DC input

Serial RS232C Connectors

The front panel serial RS232 connector (Figure A-3) is a sealed receptacle, 7 pin, ODU part number G80F1C-T07QC00-0000.

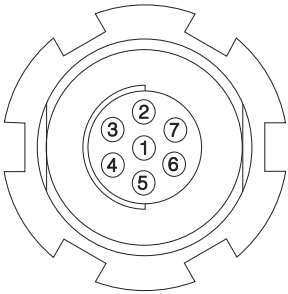


Figure A-3. Serial RS232 Connector

Table A-4 gives the RS232 cable connector specifications.

Table A-4. RS232 Connector Specifications

Number	Signal Name	Dir	Details
1	Ext_PWR	O	6 to 28 volts DC output at max load 0.5 A
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

The back panel serial RS232 connectors (Figure A-4) are a sealed receptacle, 9 pin, D-shell connector.

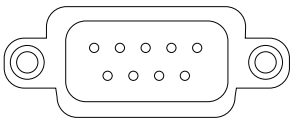


Figure A-4. Serial RS232 Connector

Table A-5 gives the RS232 cable connector specifications.

Table A-5. RS232 Connector Specifications

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

Ethernet/USB Connector

The Ethernet/USB connector is a 12-pin ODU-MINI-SNAP (Figure A-5).

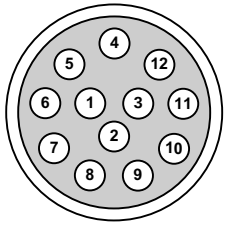


Figure A-5. Ethernet Connector

Table A-6 gives Ethernet/USB connector specifications.

Table A-6. Ethernet/USB Connector Specifications

Number	Signal Name	Dir	Details
1	LAN TXD+	O	Transmit data plus
2	LAN TXD-	O	Transmit data minus
3	LAN RXD+	I	Receive data plus
4	LAN RXD	I	Receive data minus
5	USB_PWR_HOST	P	Power to the UMS device
6	USB_HOST_D-	I/O	Data minus
7	USB_HOST_D+	I/O	Data plus
8	GND	-	Signal ground
9	USB_D-	I/O	Data minus
10	USB_D+	I/O	Data plus
11	GND	-	Signal ground
12	USB_PWR	P	Bus power input

GPS Antenna Connector

The external antenna connector type is a N-type connector.

Table A-7. External GPS Antenna Connector Specifications

Type	Signal Name	Dir	Details
TNC	Ant_IN	I	RF input from LNA, 60 mA at 5.0 volts

1PPS Connector

The 1PPS connector is a coaxial female receptacle of BNC series, Kings Electronics part number KC-79-108.

Table A-8. 1PPS Connector Specifications

Connector	BNC female
Polarity	Positive Pulse
Signal level	>=2 V, TTL into 50 Ohm load
Pulse Width	3.3 msec (normal pulse); 5.2 msec (marked pulse)
Rise Time	<= 3 nsec
Fall Time	<= 3 nsec
Synchronization Edge	Rising/Falling (user selectable)
Resolution	5 nsec
Period	10 to 1000000000 msec
Offset	-500000000 to 500000000 msec; -500000 to 500000 nsec
Reference time	GPS, GLONASS, UTC (USNO), UTC (SU)

Event Marker Connector

The Event Marker connector is a coaxial female receptacle of BNC series, Kings Electronics part number KC-79-108.

Table A-9. Event Marker Connector Specifications

Connector	BNC female
Polarity	Positive/Negative Pulse
Logical DC voltage levels	Low “0” from -40 V to +0.8 V High “1” from +1.4 V to +40 V
Input impedance	2 kOhm for -40 V to 0 V and +3.3 V to +40 V >100 kOhm for 0 V to +3.3 V

Table A-9. Event Marker Connector Specifications (Continued)

Pulse Width	>= 100 nsec
Synchronization Edge	Rising/Falling (user selectable)
Resolution	5 nsec
Reference time	GPS, GLONASS, UTC (USNO), UTC (SU)

External Frequency Connector

The External Frequency connector is a coaxial female receptacle of BNC series, Kings Electronics part number KC-79-108.

Table A-10. External Frequency Connector Specifications

Output	
Connector	BNC; 50 Ohm impedance
Frequency	20 MHz
Amplitude	0.6 Vp-p into 50 Ohm
Waveform	Sine wave
Harmonics	-19 dBc
Spurious	-70 dBc
Input	
Connector	BNC; 50 Ohm impedance
Frequency	5/10/20 MHz
Sensitivity	0.5...3 Vp-p into 50 Ohm

CF Cards Compatible with the Net-G3A

The following CF cards have been successfully tested with the Net-G3A and can be safely used with the receiver. Before using any other CF cards, consult with Topcon customer support about compatibility.

Table A-11. Net-G3A CF Cards Compatibility List

Capacity (MB)	Topcon part number	Manufacture part number
SanDisk		
16	22-006011-16	SDCFBI-16-101
32	22-006011-32	SDCFBI-32-101 SDCFBI-32-201-00 SDCFBI-32-201-00
64	22-006011-64	SDCFBI-64-101 SDCFBI-64-201-00
80	22-006011-80	SDCFBI-80-101
96	22-006011-96	SDCFBI-96-101
128	22-006011-128	SDCFBI-128-101 SDCFBI-128-201-00
160	22-006011-160	SDCFBI-160-101
192	22-006011-192	SDCFBI-192-101
256	22-006011-256	SDCFBI-256-201-00
512	22-006011-512	SDCFBI-512-201-00
1024	22-006011-001	SDCFBI-1024-201-00
2048	22-006011-002	SDCFX3-002G-A21 SDCFH-002G-A11 SDCFX4-2048-901
SiliconSystems		

Table A-11. Net-G3A CF Cards Compatibility List (Continued)

Capacity (MB)	Topcon part number	Manufacture part number
32	22-006011-32	SSD-C32MI-3012
128	22-006011-128	SSD-C12MI-3012
256	22-006011-256	SSD-C25MI-3012
512	22-006011-512	SSD-C51MI-3012
1024	22-006011-001	SSD-C01GI-3012
White Electronics Designs		
128	22-006011-128	WED7P128CFA7000I25
256	22-006011-256	WED7P256CFA7000I25
512	22-006011-512	WED7P512CFA7000I25
1024	22-006011-001	WED7P1G0CFA7000I25

Safety Warnings

General Warnings

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.

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

Usage Warnings

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.

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

Regulatory Information

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

FCC 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 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.

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

Community of Europe Compliance

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

WEEE Directive

Following information is for EU-member states only:

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

Warranty Terms

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.[1]

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 a Topcon battery, charger, or cable is 90 days.

Notes:

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