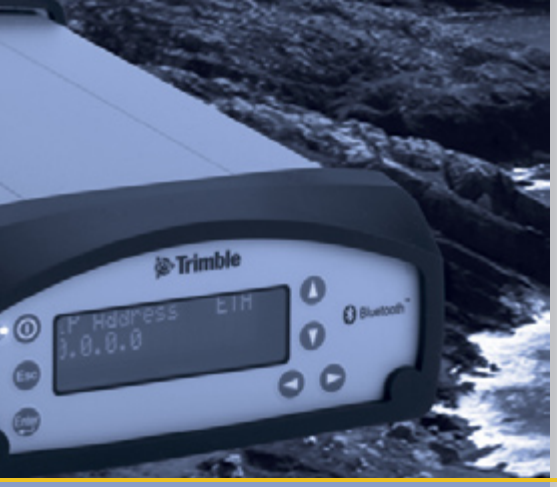

USER GUIDE

Trimble® NetR8 GNSS Reference Receiver

Trimble

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Trimble® NetR8 GNSS Reference Receiver

Version 3.80
Revision A
November 2008

Trimble

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Legal Notices

This product and its contained technologies are protected by the following US patents: 5,148,179; 5,187,450; 5,202,694; 5,311,149; 5,402,450; 5,493,588; 5,515,057; 5,519,620; 5,602,741; 5,757,646; 6,175,848; 6,252,863.

Release Notice

This is the November 2008 release (Revision A) of the *NetR8 GNSS Reference Receiver User Guide*. It applies to version 3.80 of the NetR8 GNSS Reference receiver firmware.

Limited Warranty Terms and Conditions

Product Limited Warranty

Subject to the terms and conditions set forth herein, Trimble Navigation Limited ("Trimble") warrants that for a period of (1) year from date of purchase this Trimble product (the "Product") will substantially conform to Trimble's publicly available specifications for the Product and that the hardware and any storage media components of the Product will be substantially free from defects in materials and workmanship.

Product Software

Product software, whether built into hardware circuitry as firmware, provided as a standalone computer software product, embedded in flash memory, or stored on magnetic or other media, is licensed and not sold. If accompanied by a separate end user license agreement, use of any such software will be subject to the terms of such end user license agreement (including any differing limited warranty terms, exclusions and limitations), which shall control over the terms and conditions set forth in this limited warranty).

Software Updates

During the limited warranty period you will be entitled to receive such Fix Updates and Minor Updates to the Product software that Trimble releases and makes commercially available and for which it does not charge separately, subject to the procedures for delivery to purchasers of Trimble products generally. If you have purchased the Product from an authorized Trimble distributor rather than from Trimble directly, Trimble may, at its option, forward the software Fix Update or Minor Update to the Trimble distributor for final distribution to you. Major Upgrades, new products, or substantially new software releases, as identified by Trimble are expressly excluded from this update process and limited warranty. Receipt of software updates shall not serve to extend the limited warranty period.

For purposes of this warranty the following definitions shall apply: (1) "Fix Update" means an error correction or other update created to fix a previous software version that does not substantially conform to its published specifications; (2) "Minor Update" occurs when enhancements are made to current features in a software program; and (3) "Major Upgrade" occurs when significant new features are added to software, or when a new product containing new features replaces the further development of a current product line. Trimble reserves the right to determine, in its sole discretion, what constitutes a significant new feature and Major Upgrade.

Warranty Remedies

If the Trimble Product fails during the warranty period for reasons covered by this Limited Warranty and you notify Trimble of such failure during the warranty period, Trimble at its option will repair OR replace the nonconforming Product, OR refund the purchase price paid by you for the Product, upon your return of the Product to Trimble in accordance with Trimble's standard return material authorization procedures.

How to Obtain Warranty Service

To obtain warranty service for the Product, please contact your Trimble dealer. Alternatively, you may contact Trimble to request warranty service at +1-408-481-6940 (24 hours a day) or e-mail your request to trimble_support@trimble.com. Please be prepared to provide:

- your name, address, and telephone numbers
- proof of purchase
- this Trimble warranty card
- a description of the nonconforming Product including the model number
- an explanation of the problem.

The customer service representative may need additional information from you depending on the nature of the problem.

Warranty Exclusions and Disclaimer

This Product limited warranty shall only apply in the event and to the extent that (i) the Product is properly and correctly installed, configured, interfaced, maintained, stored, and operated in accordance with Trimble's applicable operator's manual and specifications, and; (ii) the Product is not modified or misused. This Product limited warranty shall not apply to, and Trimble shall not be responsible for defects or performance problems resulting from (i) the combination or utilization of the Product with hardware or software products, information, data, systems, interfaces or devices not made, supplied or specified by Trimble; (ii) the operation of the Product under any specification other than, or in addition to, Trimble's standard specifications for its products; (iii) the unauthorized, installation, modification, or use of the Product; (iv) damage caused by: accident, lightning or other electrical discharge, fresh or salt water immersion or spray; or exposure to environmental conditions for which the Product is not intended; or (v) normal wear and tear on consumable parts (e.g., batteries). Trimble does not warrant or guarantee the results obtained through the use of the Product. NOTICE REGARDING PRODUCTS EQUIPPED WITH TECHNOLOGY CAPABLE OF TRACKING SATELLITE SIGNALS FROM SATELLITE BASED AUGMENTATION SYSTEMS (SBAS) (WAAS/EGNOS, AND MSAS), OMNISTAR, GPS, MODERNIZED GPS, OR GLONASS SATELLITES, OR FROM IALA BEACON SOURCES: TRIMBLE IS NOT RESPONSIBLE FOR THE OPERATION OR FAILURE OF OPERATION OF ANY SATELLITE BASED POSITIONING SYSTEM OR THE AVAILABILITY OF ANY SATELLITE BASED POSITIONING SIGNALS.

THE FOREGOING LIMITED WARRANTY TERMS STATE TRIMBLE'S ENTIRE LIABILITY, AND YOUR EXCLUSIVE REMEDIES, RELATING TO PERFORMANCE OF THE TRIMBLE PRODUCT. EXCEPT AS OTHERWISE EXPRESSLY PROVIDED HEREIN, THE PRODUCT AND ACCOMPANYING DOCUMENTATION AND MATERIALS ARE PROVIDED "AS-IS" AND WITHOUT EXPRESS OR IMPLIED WARRANTY OF ANY KIND, BY EITHER TRIMBLE OR ANYONE WHO HAS BEEN INVOLVED IN ITS CREATION, PRODUCTION, INSTALLATION, OR DISTRIBUTION, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, TITLE, AND NONINFRINGEMENT. THE STATED EXPRESS WARRANTIES ARE IN LIEU OF ALL OBLIGATIONS OR LIABILITIES ON THE PART OF TRIMBLE ARISING OUT OF, OR IN CONNECTION WITH, ANY PRODUCT.

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Limitation of Liability

TRIMBLE'S ENTIRE LIABILITY UNDER ANY PROVISION HEREIN SHALL BE LIMITED TO THE AMOUNT PAID BY YOU FOR THE PRODUCT. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL TRIMBLE OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGE WHATSOEVER UNDER ANY CIRCUMSTANCE OR LEGAL THEORY RELATING IN ANYWAY TO THE PRODUCTS, SOFTWARE AND ACCOMPANYING DOCUMENTATION AND MATERIALS, (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF DATA, OR ANY OTHER PECUNIARY LOSS), REGARDLESS OF WHETHER TRIMBLE HAS BEEN ADVISED OF THE POSSIBILITY OF ANY SUCH LOSS AND REGARDLESS OF THE COURSE OF DEALING WHICH DEVELOPS OR HAS DEVELOPED BETWEEN YOU AND TRIMBLE. BECAUSE SOME STATES AND JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES, THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

PLEASE NOTE: THE ABOVE TRIMBLE LIMITED WARRANTY PROVISIONS WILL NOT APPLY TO PRODUCTS PURCHASED IN THOSE JURISDICTIONS, SUCH AS COUNTRIES OF THE EUROPEAN ECONOMIC COMMUNITY, IN WHICH PRODUCT WARRANTIES ARE OBTAINED FROM THE LOCAL DISTRIBUTOR. IN SUCH CASE, PLEASE CONTACT YOUR TRIMBLE DEALER FOR APPLICABLE WARRANTY INFORMATION.

Registration

To receive information regarding updates and new products, please contact your local dealer or visit the Trimble website at www.trimble.com/register. Upon registration you may select the newsletter, upgrade or new product information you desire.

Notices

Class B Statement – Notice to Users. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes and modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under Federal Communications Commission rules.

Canada

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

This apparatus complies with Canadian RSS-310 and RSS-210.

Cet appareil est conforme à la norme CNR-310 et CNR-210 du Canada.

Europe

This product is intended to be used in all EU member countries.

This product has been tested and found to comply with the requirements for a Class B device pursuant to European Council Directive 89/336/EEC on EMC, thereby satisfying the requirements for CE Marking and sale within the European Economic Area (EEA). Contains Infineon radio module PBA 31307. These requirements are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential or commercial environment.

Australia and New Zealand

This product conforms with the regulatory requirements of the Australian Communications Authority (ACA) EMC framework, thus satisfying the requirements for C-Tick Marking and sale within Australia and New Zealand.

Taiwan – Battery Recycling Requirements

The product contains a removable Lithium-ion battery. Taiwanese regulations require that waste batteries are recycled.

廢電池請回收

Directive 1999/5/EC

Hereby, Trimble Navigation, declares that the NetR8 GNSS Reference receiver is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Notice to Our European Union Customers

For product recycling instructions and more information, please go to www.trimble.com/ev.shtml.

Recycling in Europe: To recycle Trimble WEEE (Waste Electrical and Electronic Equipment, products that run on electrical power.), Call +31 497 53 24 30, and ask for the "WEEE Associate". Or, mail a request for recycling instructions to:

Trimble Europe BV
c/o Menlo Worldwide Logistics
Meerheide 45
5521 DZ Eersel, NL

Declaration of Conformity

We, Trimble Navigation Limited,

935 Stewart Drive
PO Box 3642
Sunnyvale, CA 94088-3642
United States
+1-408-481-8000

declare under sole responsibility that the product:
NetR8
complies with Part 15 of 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.

Safety Information

Before you use your Trimble® NetR8 GNSS Reference receiver, make sure that you have read and understood all safety requirements.

Regulations and safety

The receiver contains an internal radio-modem for communicating signals through Bluetooth® wireless technology or through an external data communications radio. Regulations regarding the use of the radio-modems vary greatly from country to country. In some countries, the unit can be used without obtaining an end-user license. Other countries require end-user licensing. For licensing information, consult your local Trimble dealer.

Before operating a NetR8 GNSS Reference receiver, determine if authorization or a license to operate the unit is required in your country. It is the responsibility of the end-user to obtain an operator's permit or license for the receiver for the location or country of use.

For FCC regulations, see Notices at the front of this manual.

Type approval

Type approval, or acceptance, covers technical parameters of the equipment related to emissions that can cause interference. Type approval is granted to the manufacturer of the transmission equipment, independent from the operation or licensing of the units. Some countries have unique technical requirements for operation in particular radio-modem frequency bands. To comply with those requirements, Trimble may have modified your equipment to be granted Type approval. Unauthorized modification of the units voids the Type approval, the warranty, and the operational license of the equipment.

Exposure to radio frequency radiation

Safety. Exposure to RF energy is an important safety consideration. The FCC has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment as a result of its actions in General Docket 79-144 on March 13, 1986.

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

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

For Bluetooth radio

The radiated output power of the internal Bluetooth wireless radio is far below the FCC radio frequency exposure limits. Nevertheless, the wireless radio shall be used in such a manner that the Trimble receiver is 20 cm or further from the human body. The internal wireless radio operates within guidelines found in radio frequency safety standards and recommendations, which reflect the consensus of the scientific community. Trimble therefore believes the internal wireless radio is safe for use by consumers. The level of energy emitted is far less than the electromagnetic energy emitted by wireless devices such as mobile phones. However, the use of wireless radios may be restricted in some situations or environments, such as on aircraft. If you are unsure of restrictions, you are encouraged to ask for authorization before turning on the wireless radio.

Battery safety

WARNING – Do not damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage.
To prevent injury or damage:
– Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
– Do not expose the battery to fire, high temperature, or direct sunlight.
– Do not immerse the battery in water.
– Do not use or store the battery inside a vehicle during hot weather.
– Do not drop or puncture the battery.
– Do not open the battery or short-circuit its contacts.

WARNING – Avoid contact with the rechargeable Lithium-ion battery if it appears to be leaking. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage.
To prevent injury or damage:
– If the battery leaks, avoid contact with the battery fluid.
– If battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes!
– If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid.

WARNING – Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage.
To prevent injury or damage:
– Do not charge or use the battery if it appears to be damaged or leaking.
– Charge the Lithium-ion battery only in a Trimble product that is specified to charge it. Be sure to follow all instructions that are provided with the battery charger.
– Discontinue charging a battery that gives off extreme heat or a burning odor.
– Use the battery only in Trimble equipment that is specified to use it.
– Use the battery only for its intended use and according to the instructions in the product documentation.

Power over Ethernet safety

WARNING – When this product is connected to a Power over Ethernet (PoE) connection, the source of the Ethernet power must meet IEEE 802.11af, and its DC output (Ethernet power source) must be completely isolated from earth ground (floating). If this is not done, a shock hazard may exist.

WARNING – When this product is connected to a PoE connection, the DC voltage must be limited to 57 VDC +0% under both normal and single fault conditions. This product may present an electrical hazard if the recommended input voltage is exceeded.

DC power supply safety

WARNING – When DC voltage is applied to this product through connectors 2 or 3 (Lemo connectors), the DC voltage must be limited to 28 V DC +0% under both normal and single fault conditions. This product may present an electrical hazard if the recommended input voltage is exceeded.

Wet location safety

WARNING – This product is not intended to be used in a wet location or a location that may become wet when it is powered by the PoE interface, or by the an external DC power supply. The product should only be used in a wet location when operating on it own internal battery.

WARNING – The external power adapter and its associated power cord and plug are not intended to be installed outdoors, nor in a wet location.

WARNING – Do not power the receiver through external power when operating in a wet environment or an environment that may become wet. The power input connections must be sheltered.

Contents

CHAPTER

1

Introduction

Welcome to the *NetR8 GNSS Reference Receiver User Guide*. This manual describes how to set up and use the Trimble® NetR8 GNSS Reference receiver.

Even if you have used other Global Navigation Satellite Systems (GNSS) products before, Trimble recommends that you spend some time reading this manual to learn about the special features of this product. If you are not familiar with GNSS, visit the Trimble website (www.trimble.com) for an interactive look at Trimble and GNSS.

About the NetR8 GNSS Reference receiver

The NetR8 GNSS Reference receiver is a multiple-frequency GNSS receiver. It can track all GPS signals (L1/L2/L5) as well as GLONASS (L1/L2). You can use the front panel of the receiver or an office computer to configure the receiver, access files, and publish data files to a company intranet or to the Internet. The NetR8 receiver makes it easy for you to set up a powerful, flexible, and reliable reference station for continuous operation.

The Trimble NetR8 receiver is designed to serve in all common geodetic reference receiver roles. It can be the main component in a continuously operating reference station (CORS), streaming data to Trimble GNSS Infrastructure software. It can also work well as a campaign receiver prior to permanent deployment. The NetR8 makes an excellent portable RTK base station with its internal battery. This receiver also has specialized capabilities that make it an excellent reference receiver for scientific applications.

Related information

Sources of related information include the following:

- Release notes – The release notes describe new features of the product, information not included in the manuals, and any changes to the manuals. They are provided as a .pdf file on the *Trimble GNSS Reference Receivers CD* as well as on the Trimble website.
- Trimble training courses – Consider a training course to help you use your GNSS system to its fullest potential. For more information, go to the Trimble website at www.trimble.com/training.html.

Technical support

If you have a problem and cannot find the information you need in the product documentation, contact your local Infrastructure dealer. Alternatively, go to the Support area of the Trimble website (www.trimble.com/ support.shtml) and then select the product you need information on. Product updates, documentation, and any support issues are available for download.

If you need to contact Trimble technical support, complete the online inquiry form at www.trimble.com/support_form.asp.

Your comments

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

CHAPTER

2

Receiver Overview

In this chapter:

This chapter introduces the Trimble NetR8 GNSS Reference receiver. This receiver makes it easy to set up a powerful, and reliable Continuously Operating Reference Station (CORS) or to collect data from temporary field locations.

The NetR8 receiver is ideal for the following infrastructure applications:

- Use as part of a GNSS Infrastructure network in conjunction with Trimble GNSS Infrastructure software.
- Use as part of a permanent reference station with or without supporting software.
- Use a temporary field base station to broadcast RTK corrections and collect observations for postprocessing.
- Use as a scientific reference station collecting data for atmospheric or seismological studies.

Receiver framework

The NetR8 receiver integrates the latest multi-frequency GNSS technology into a specialized processing and communications framework. The receiver can operate as a standalone reference station or it can be integrated into a scalable network.

With Internet Protocol (IP) as the primary communications method, you can use public domain tools, such as a web browser and FTP client, to configure the receiver and access logged data files.

Note – *All references to the Internet are intended to mean either a Wide Area Network (WAN) or a Local Area Network (LAN) connection.*

You can enforce multiple levels of security, from a completely open system that allows anonymous access to all features, to a secured system that requires a password protected login for configuration changes and/or file access.

Use the network management features to create a base configuration with a variety of operating modes. You can then enable those modes as necessary instead of switching the global state of the receiver from one mode to another. For example, you can configure a number of streaming services with different configurations (such as measurement intervals or smoothing controls) on different TCP or UDP ports. To activate one or more modes, open the connection to the specific port. This allows multiple clients to access any given streaming service.

These features, and many more, shift the model of a GNSS receiver toward the concept of a “network appliance”.

The network appliance concept

Traditionally, a GNSS receiver has one operator. That person is the only user of the receiver so they can change settings without affecting other users.

With the NetR8 receiver, an operator can configure a receiver once, then make it available, as a network appliance, for general use by one or more users (or clients).

This network appliance concept lets you set up the receiver to provide one or more services that one or more users can access through a Local Area Network (LAN) or a Wide Area Network (WAN), such as the Internet. Once the receiver is set up, you need make only minimal changes, if any, to the receiver configuration.

When the receiver is operating as a network appliance, it provides services to all users attached to the receiver through the network.

Different streamed services may be configured on different ports, for example, with differing data rates or smoothing configurations. To obtain a service, the client has only to connect to a specific port. In this way, most users do not need to control the receiver. Changing global settings, such as masks, will affect all users of all services. However, the comprehensive set of controls that has been provided for streamed service and data logging configuration avoids global changes for the majority of applications.

The NetR8 receiver provides the following standard configuration and data logging services:

Use ...	to perform ...
HTTP	all manual and automated configuration operations manual operations to manage the logged data file space
FTP	remote manual and/or automated operations to manage the logged data file space

NetR8 services

The NetR8 receiver can provide one or more streaming or query services over a RS-232 serial port or a TCP/IP port:

- Streaming service

  Anyone with authorized access can obtain streamed information, such as GNSS measurements or RTCM corrections, without having to control or issue commands to the receiver. The client simply connects to the port that is streaming the required information. Normally the port should be set to Output only mode so multiple users can connect to receive correction data.

- Query service

  This allows bi-directional communications between the receiver and another application. All ports act as query ports unless Output only mode is selected. When Output only mode is selected, it also means the receiver is more secure; especially if it is on the Internet.

Multiple users can connect simultaneously to a single port as long as it is set to Output only mode.

NetR8 receiver features

The receiver provides the following features:

- 76-channel L1/L2/L2C/L5 GPS plus L1/L2 GLONASS receiver
- WAAS/EGNOS, MSAS, and L-band (OmniSTAR) Satellite Based Augmentation (SBAS) compatibility
- 4 GB on-board memory
- Integrated battery, providing up to 12 hours operation
- Integrated display and keypad for system configuration without a controller
- Integrated Bluetooth wireless technology for cable-free configuration and operation
- Permanent/semi-permanent and mobile quick setup base station capability
- Easy-to-use Web-interface menu system for rapid configuration and status checking
- Ability to operate as a Rover Integrity receiver with Trimble Infrastructure software to allow monitoring of Trimble VRS network performance
- Two-line, 16-character VFD (Vacuum Fluorescent Display)
- Rugged, weatherproof construction with an IP67 environmental rating
- -40 °C to +65 °C (-40 °F to +149 °F) operating temperature range
- 9.5 V to 28 V DC input power range, with over-voltage protection and configurable power-up and power-down settings
- Power over Ethernet (PoE) support
- Tracking and storage rates of up to 50 Hz
- Five independent data logging sessions with configurable memory pooling
- FTP push to allow uploading of logged data files to remote FTP sites
- Email client to alert system users of any issues with the system
- Ethernet and reference station configuration via the front panel
- Multiple languages available through the Web interface and receiver front panel
- Ntrip (Networked Transport of RTCM via Internet Protocol) client/server support to securely transfer data to and from an NtripCaster

Use and care

This product is designed to withstand the rough treatment and tough environment that typically occurs in CORS installation. However, the receiver is a high-precision electronic instrument and should be treated with reasonable care.

CAUTION – Operating or storing the receiver outside the specified temperature range can damage it. For more information, see Chapter 8, Specifications.

Electronic interference

High-power signals from a nearby radio or radar transmitter can overwhelm the receiver circuits. This does not harm the instrument, but it can prevent the receiver electronics from functioning correctly.

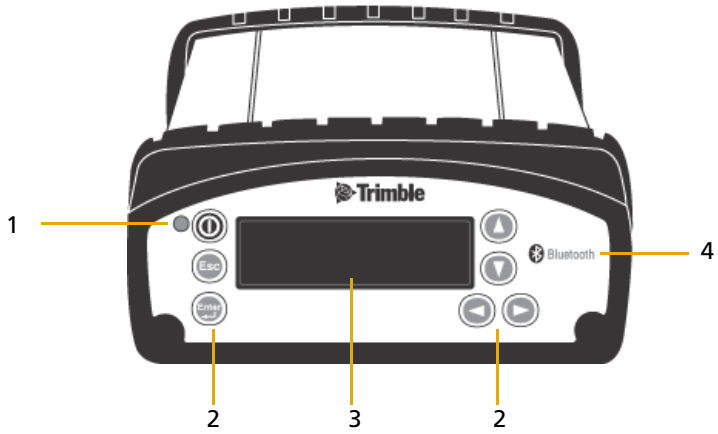
Avoid locating the receiver or antenna within 400 meters of powerful radar, television, or other transmitters or GNSS antennas. Low-power transmitters, such as those in cell phones and two-way radios, normally do not interfere with receiver operations.

COCOM limits

The U.S. Department of Commerce requires that all exportable GNNS products contain performance limitations so that they cannot be used in a manner that could threaten the security of the United States. The following limitations are implemented on this product:

- Immediate access to satellite measurements and navigation results is disabled when the receiver velocity is computed to be greater than 1000 knots, or its altitude is computed to be above 18 000 meters. The receiver GNSS subsystem resets until the COCOM situation clears. As a result, all logging and stream configurations stop until the GNSS subsystem is cleared.

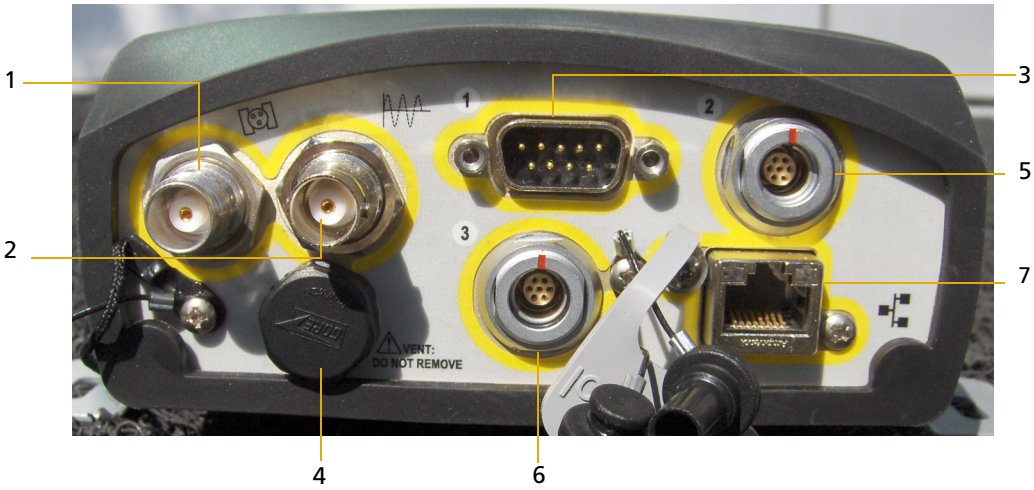
Keypad and display



	Feature	Description
1	Power LED	Indicates if the receiver is turned on or off.
2	Buttons	Used to turn on and configure the receiver (see Button functions, page 36).
3	Display	The receiver has a Vacuum Fluorescent Display. This display allows you to see how the receiver is operating and view the configuration settings.
4	Bluetooth antenna	Location of the Bluetooth antenna.

Figure 2.1 Front view of the NetR8 receiver

Rear connectors



	Connector type	Description
1	TNC	Connect to the GNNS antenna
2	BNC	10 MHz external frequency input
3	D9	Full 9-wire RS-232 serial port
4	Vent plug	External venting plug for pressure equalization
5	Lemo (7-pin/ 0-shell) (Port 2)	• 3 wire RS-232 serial communications using a 7-pin/ 0 shell Lemo cable (P/N 59044) • Event input and 1 pps output using a 36451-02 cable • Power from a Trimble AC/DC power supply (P/N 62546) in combination with P/N 59044
6	Lemo (7-pin/ 0-shell) (Port 3)	• 5 wire RS-232 serial communications using a 7-pin/ 0 shell Lemo cable (P/N59044) • Power from a Trimble AC/DC power supply (P/N 62546) in combination with P/N 59044
7	RJ45 jack	10/100 Base-T Ethernet communications

Figure 2.2 Rear view of the NetR8 receiver

CHAPTER

3

Batteries and Power

In this chapter:

The NetR8 GNSS receiver uses an internal rechargeable Lithium-ion battery, which can be replaced only at an Authorized Trimble Service Center.

The receiver can also be powered by an external power source that is connected to either of the Lemo ports.

The operational time provided by the internal battery depends on the type of measurement and operating conditions. Typically, the internal battery provides up to 12 hours operation.

Note – *All battery operational tests are carried out with new, fully charged batteries at room temperature, tracking both GPS and GLONASS satellites while storing and streaming data at 1 Hz. Older batteries, at temperatures significantly higher or lower than room temperature, will have a reduced performance. Power consumption increases with an increasing number of actively tracked satellites and well as increasing observation and storage rates.*

External power

The receiver uses an external power source in preference to its internal battery. If the receiver is not connected to an external power source, or if the external power supply fails, the internal battery is used.

The applied external power must offer between 9.5 V and 28 V DC and must be able to supply at least 5 W of power. The receiver's internal battery will only charge when the external voltage is above 15 V DC. Trimble recommends that external supply voltage be above 15 V DC for long-term installations. This will ensure that the internal battery is charged and ready to compensate for power supply disruptions.

While carrying out static measurements for postprocessed computations using the internal memory, if no external power is supplied and the internal battery is drained, the receiver shuts down. No data is lost and when power is restored, the receiver restarts in the same status as it was when power was lost.

If for some reason you do not want to use the internal battery as an uninterruptable power supply, you may disable this feature in the Web user interface. See Chapter 5 for details on the configuration setting.

WARNING – The external AC power adapter and its associated power cord and plug are not intended to be installed outdoors, nor in a wet location.

WARNING – Do not power the receiver through external power when operating in a wet environment or an environment that may become wet. The power input connections must be sheltered.

WARNING – When you apply DC voltage to this product through the Lemo connectors (connectors 2 or 3), the DC voltage must be limited to 28 V DC +0% under both normal and single fault conditions. This product may present an electrical hazard if the recommended input voltage is exceeded.

Battery safety

The receiver is powered by a rechargable internal Lithium-ion battery. Charge and use the battery only in strict accordance with the instructions below.

WARNING – Do not damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage.
To prevent injury or damage:
– Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
– Do not expose the battery to fire, high temperature, or direct sunlight.
– Do not immerse the battery in water.
– Do not use or store the battery inside a vehicle during hot weather.
– Do not drop or puncture the battery.
– Do not open the battery or short-circuit its contacts.

WARNING – Avoid contact with the rechargeable Lithium-ion battery if it appears to be leaking. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage.
To prevent injury or damage:
– If the battery leaks, avoid contact with the battery fluid.
– If battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes!
– If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid.

Battery performance

To optimize battery performance and extend battery life:

- Fully charge all new batteries before use.
- Batteries perform best when they are not used at extreme temperatures. The receiver is designed to operate at –40 °C to +65 °C (–40 °F to +149 °F). However, operation at temperatures of less than 0 °C (32 °F) can cause a rapid drop in battery life.
- Do not allow a battery that is in storage to discharge to below 5 V.

Charging the Lithium-ion battery

The rechargeable Lithium-ion battery is supplied partially charged. Charge the battery completely before using it for the first time. If the battery has been stored for longer than three months, charge it before use.

The internal battery charges fully in 24 hours when connected to a suitable power source.

WARNING – Charge and use the rechargeable Lithium-ion battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage.
To prevent injury or damage:
– Do not charge or use the battery if it appears to be damaged or leaking.
– Charge the Lithium-ion battery only within the NetR8 receiver. The battery can only be removed by an authorized Trimble Service Center.

Storing the Lithium-ion battery

If you must store a Lithium-ion battery for long periods, make sure that it is fully charged before it is stored, and that you charge it at least once every three months while it is stored.

Do not allow a battery that is in storage to discharge to below 5 V. A battery that reaches deep discharge level (5 V or less) cannot be recharged and must be replaced. (To protect a battery that is in use from deep discharge, the receiver switches power sources or stops drawing power when the battery pack discharges to 5.9 V.)

All batteries discharge over time when not in use, and they discharge faster in colder temperatures. Do not store the receiver at temperatures outside the range –40 °C to +70 °C (–40 °F to +158 °F).

The receiver has an internal Lithium-ion battery. The internal battery will only charge from an external power source that delivers more than 15 volts, for example, an AC power adaptor. The receiver is supplied with a mains power supply unit that recharges the battery inside the receiver when it is connected through the adaptor to either of the Lemo ports. When you use the receiver in a long-term deployment, Trimble recommends that you use this power supply or another that provides at least 15 V DC at all times to keep the internal battery charged. This will ensure that the internal battery provides an uninterrupted power supply that will keep the receiver operational for up to 12 hours after a power failure.

Keep all batteries on continuous charge when not in use. You can keep batteries on charge indefinitely without damage to the receiver or to the batteries.

Removing the rechargeable Lithium-ion battery

The internal Lithium-ion battery should be removed only at an authorized Trimble Service Center. If the battery is removed at an unauthorized service center, the remaining warranty on the product will be void.

CHAPTER

4

Setting up the Receiver

In this chapter:

This chapter describes best practices for setting up the equipment, and outlines the precautions that you need to take to protect the equipment. It also describes how to connect the receiver to external devices.

The antenna installation guidelines offered here are the minimum standards: When installing a geodetic antenna to gather precise observation data, always follow recommended CORS installation practices to the greatest extent possible.

Setup guidelines

When you set up the receiver, follow these guidelines.

Environmental conditions

The receiver has a waterproof housing. However, you should take reasonable care to keep the unit dry.

To improve the performance and long-term reliability of the receiver, avoid exposing the receiver to extreme environmental conditions, such as:

- Water
- Heat greater than 65 °C (149 °F)
- Cold less than -40 °C (-40 °F)
- Corrosive fluids and gases

Sources of electrical interference

Avoid locating the GNSS antenna near the following sources of electrical and magnetic noise:

- Gasoline engines (spark plugs)
- Televisions and computer monitors
- Alternators and generators
- Electric motors
- Equipment with DC-to-AC converters
- Fluorescent lights
- Switching power supplies
- Arc welding equipment

Uninterruptible power supply

Trimble recommends that you use an uninterruptible power supply (UPS) to power the receiver. The internal battery can also operate as a UPS for up to 12 hours. A UPS protects the equipment from power surges and spikes, and keeps the receiver running during short power outages.

Items operating with the receiver, such as an Ethernet switch, should also be on a UPS to provide uninterrupted operation.

For more information, contact your local Trimble dealer.

Lightning and surge protection

Trimble recommends that you install lightning protection equipment at permanent sites. All connections to the receiver should have surge protection. Typically, the minimum protection should include a surge protector in the antenna feed line, on the Ethernet connection between the receiver and the local area network, as well as on the receiver's power supply system. If serial devices are attached to the receiver, those serial connections should also be provided with surge protection. Also, protect any communications and power lines at building entry points. If you use other antennas, such as a radio modem that distributes real-time correction messages or a last-mile radio, install surge protection on those antenna feeds as well.

No surge protection devices can offer protection unless they are connected to an excellent ground using very low impedance conductors. Equipment damage caused by electrical surges occurs in many permanent installations even though surge protection is in place. Commonly, this is because the grounding system used was designed to protect against AC electrical hazards rather than to dissipate the sudden, high current surges caused by lightning. Please consult with a lightning protection expert or research the topic when planning permanent installations.

For more information, contact your local Trimble Infrastructure dealer, or go to the websites of surge protection and grounding system manufacturers. Trimble customers have reported good results when using products from the following manufacturers:

- Polyphaser (www.polyphaser.com)
- Huber and Suhner (www.hubersuhner.com)
- Harger (www.harger.com)
- Hyperlink Technologies (www.hyperlinktech.com)

Placing the antenna

The antenna location will have a significant effect on the quality of your NetR8 receiver's performance. In temporary devlopments it may not always be possible to set up on an ideal location with an excellent sky view. However, when installing a permanent station, be sure to plan the antenna location and mounting system carefully.

The general requirements for the antenna location and mount are:

- Clear sky from the zenith to the horizon to a 100 m (328 feet) radius, in all directions (360 degrees).
- Mounted 1.5 m (5 feet) above any nearby signal reflectors.
- Separation of at least 300 m (984 feet) from radio signal transmitters.
- Mount stability that is not influenced by thermal expansion, wind loading, or soil expansion/contraction.

For additional information on this topic, research the reference antenna installation guidelines published by:

- the US National Geodetic Survey (http://www.ngs.noaa.gov/PUBS_LIB/CORS_guidelines.pdf)
- the International GNSS Service (http://igscb.jpl.nasa.gov/network/guidelines/guidelines.html)

Connecting the receiver to external devices

You can connect a NetR8 receiver to the following devices:

- GNSS antenna
- Dial-up modems
- Radio modems
- Meteorological and tilt sensors

GNSS antenna

The NetR8 receiver provides a TNC-type female connector for connecting to an antenna. The receiver is intended for use with a Zephyr™ Geodetic Model 2 antenna pr a Trimble GNSS Choke Ring antenna.

Antenna cabling

Many permanent GPS installations have unique cabling requirements. Depending on the available infrastructure, you may need to mount the antenna a substantial distance from the receiver.

The NetR8 receiver can withstand a loss of 12 dB between the antenna and the receiver. The degree of loss in a coaxial cable depends on the frequency of the signal passing through it. The following table lists some common types of cable and the maximum length you can use before you need an inline amplifier .

Cable type	Maximum length for use without an inline amplifier
LMR-400	70 m (230 ft)
LMR-500	85 m (280 ft)
LMR-600	106 m (350 ft)
Heliax LDF4-50	165 m (540 ft)
Heliax. LDF4.5-50	225 m (740 ft)

Dial-up modems

The receiver can make automated dial-out connections to an Internet service provider. To set up the receiver to do this, in the Web interface select *Network Configuration/PPP*.

You can set up a streaming service, such as RT17/RT27 raw GNSS data, CMR™, or RTCM corrections over a serial port. When using a modem on the serial port, the modem itself must perform the auto-answer function.

Radio modems

You can connect the receiver to an external radio through the Lemo ports or the 9-pin serial port, whether or not the Ethernet port is in use. Trimble radios are supplied with the required cables to connect to the Lemo ports.

The NetR8 receiver supports the following Trimble base radios:

- TRIMMARK™ 3 (firmware 1.26 or later)
- Trimble HPB450
- Trimble PDL450

To use an external radio with the receiver, you need an external power source for the radio. Configure the external radio separately, using the configuration program for the external radio.

To configure the NetR8 receiver for RTK operation, you must do all of the following:

- Enable the RTCM or CMR RTK corrector stream on the selected serial port.
- Set the reference station coordinates and broadcast ID using the front panel of the receiver or the Web user interface.

Meteorological and tilt sensors

You can connect an external meteorological or tilt sensor to any of the three available serial ports on the NetR8 receiver.

The sensor responds to a request for information. The request and the response are time tagged and are entered into the NetR8 receiver's stored files and streamed observation data.

Note – *The sensor's serial configuration must include 8 data bits. Some sensors default to 7 data bits and this is incompatible with the NetR8 receiver.*

Supported sensors include the following:

- Paroscientific Met3, Met3A, Met4, and Met4A
- Vaisala PTU300
- Applied Geomechanics D700 and MD900 series

The *I/O Configuration / Port Configuration* menu allows you to enter the serial port settings and control commands for a meteorological/tilt sensor.

Other external devices

For all other external devices, connect to a suitable communications port and then configure that port for the connected device.

Installing the tripod clip

For campaign operations or temporary base deployments, the standard mounting base can be replaced with a tripod clip:

1. Remove the standard mounting base by unscrewing the four bottom screws that are located beneath the rubber end cap trim.
2. Use the two provided screws to attach the tripod clip to the two holes located at the bottom of the front panel of the receiver.

CHAPTER

5

Configuring the Receiver Using the Keypad and Display

In this chapter:

The NetR8 receiver features a front panel user interface with a keypad and as two-line alphanumeric display (see page 20). This interface allows you to configure many of the receiver's features without using an external controller or computer.

Button functions

The NetR8 has seven buttons on the front panel to control the receiver. Use the buttons to turn the receiver on and off and to check or change the receiver settings.

Button	Name	Function
	Power	Turn the receiver on/off. To turn the receiver off, hold the power button for two seconds.
	Escape	Return to the previous screen or cancel changes being made on a screen.
	Enter	Advance to the next screen or accept changes made on a screen.
	Up	Move the cursor between multiple fields on a screen or make changes.
	Down	Move the cursor between multiple fields on a screen or make changes.
	Left	Move the cursor between characters in an editable field.
	Right	Move the cursor between characters in an editable field. This button also initiates edit mode for the current field.

Power button operations

Press the power button  to turn the receiver on and off. In addition, you can tap the power button to return to the Home screen, or hold down the Power button to perform the following operations:

To ...	Hold the  button for ...	Notes
turn off the receiver	two seconds	The display shows a countdown timer. When the display goes blank, release the power button.
clear the almanac, ephemeris, and SV information	15 seconds	The display show a countdown timer. When the display goes blank, continue to hold the power button. The display shows a countdown time to clear the almanac and ephemeris. When the counter reaches 0, release the power button.
reset the receiver to its factory defaults and the default application file	35 seconds	The display show a countdown timer. When the display goes blank, continue to hold the power button. The display show a countdown to clear the almanac and ephemeris. When the counter reaches 0, continue to hold the power button. The display indicates a countdown to resetting the receiver. When the counter reaches 0, release the power button.
force the receiver to power down	at least 60 seconds	If the method above does not work, use this method to force the receiver to turn off. When the Power LED goes off, release the power button. ***Note –*** *All data stored in the receiver is lost when the receiver is forced to power down.*

Home screen

The Home screen is the main screen displayed on the NetR8 receiver. The receiver always returns to this screen if displaying any other screen and left idle for 60 seconds. The Home screen indicates:

- the number of satellites being tracked
- the internal battery power remaining
- the current operation mode
- if the receiver is logging data (the operating mode field will show the word Logging every three seconds is logging is enabled)

The front panel will go dark after a short period of inactivity as a power-saving feature. If the display is not lit and the receiver is on, press Enter to reactivate the display. If required, you can disable this power-saving feature in the Web interface.

Status screens

The NetR8 receiver has several status screens so that you can review the receiver's current settings. To access these screens, press ▲ or ▼ when the Home screen is displayed. The status screens provide the following information:

- Position solution
- CMR and RTCM IDs
- Base name and code
- Latitude, longitude, and height
- Antenna type
- Antenna height and measurement point
- Receiver firmware version and date
- Receiver serial number
- Current IP address
- Current subnet mask
- Current gateway

Setting up the receiver as a base station

The NetR8 receiver can be set up for Ethernet configuration and for real-time outputs so that the receiver can be used as a base station (also known as a *reference station*). To set up the receiver as a base station, use the receiver keypad.

The receiver uses a "step-by-step" configuration method to ensure that all appropriate settings are reviewed and set. Press Enter to move between steps in the configuration process.

Configuring the receiver as a base station

1. From the Home screen, press Enter to move to the next screen.

   The *Operation Mode* screen appears. Use this screen to configure the reference station setup, Ethernet configuration, system setup, or to view the SV (satellite) status.

2. As reference station setup is the default, press Enter to move to the next screen.

   The *Base Station* screen appears. Use this screen to select if the receiver is going to use a "Here" position or if the current coordinates in the receiver will be edited.

3. Do one of the following:

   – Press ▷ to edit the current position.

     Edit Current begins to flash. This indicates that you can now edit this setting. Press ▽ to change to New Base (Here). Press Enter to accept the change. The current coordinates that the receiver is using will be used as the base station coordinates.

   – Continue to the next step and manually enter the coordinates. Press Enter again.

4. Press Enter to move to the next screen.

Changing the name and description of the base station

The *Base Name* screen appears.

1. Press ▷ to edit the name of the base station. The name can be up to 16 characters.
2. Press ◁ or ▷ to select the character to edit and then press △ or ▽ to change it. When finished, press Enter to accept the change.
3. Press Enter to move to the next screen.

   The *Base Code* screen appears.
4. Press ▷ to edit the code (description) of the base station.
5. Press ◁ or ▷ to select the character to edit and press △ or ▽ to change it. When finished, press Enter.
6. Press Enter to move to the next screen.

Setting the reference latitude, longitude, and height of the base station

The *Base Latitude* screen appears.

1. Press ▷ to edit the reference latitude of the base station.
2. Press ◁ or ▷ to select the character to edit and then press △ or ▽ to change it. When finished, press Enter.
3. Press Enter to move to the next screen.

   The *Base Longitude* screen appears.
4. Press ▷ to edit the reference longitude of the base station.
5. Press ◁ or ▷ to select the character to edit and then press △ or ▽ to change. When finished, press Enter.
6. Press Enter to move to the next screen.

   The *Point Height* screen appears.
7. Press ▷ to edit the ellipsoidal height of the base station.
8. Press ◁ or ▷ to select the character to edit and then press △ or ▽ to change. When finished, press Enter.
9. Press Enter to move to the next screen.

Measuring and changing the antenna height

The *Antenna Type* screen appears.

1. Press ▷ to select the type of antenna used with the receiver.
2. Press △ or ▽ to select an antenna type. When finished, press Enter.
3. Press Enter to move to the next screen.

   The *Measured To* screen appears.
4. Press ▷ to select how the antenna height is measured.
5. Press △ or ▽ to select a measurement method. When finished, press Enter.
6. Press Enter to move to the next screen.

   The *Antenna Height* screen appears.
7. Press ▷ to edit the antenna height.
8. Press ◁ or ▷ to select the character to edit and then press △ or ▽ to change it. When finished, press Enter.
9. Press Enter to move to the next screen.

Outputting corrections

The *Output* screen appears.

1. Press ▷ to edit the name of the port which will be used to output corrections.
2. Press △ or ▽ to select the port (1, 2, or 3). When finished, press Enter.
3. Press ▽ to select the *Format* field and then press ▷ to edit this field.
4. Press ▽ until the required format choice is flashing.
5. Press Enter to move to the next screen.

Data logging

The *Logging* screen appears.

1. When you have configured the outputting corrections, press ▷ to set up internal logging on the receiver.
2. Press △ or ▽ to select the logging rate. Press Enter to accept.
3. Press ▽ to select Files. Press ▷ to edit and press △ or ▽ to select the appropriate length of time to log data for. When finished, press Enter.
4. Press Enter to move to the next screen.

Outputting observations

The *RT27* screen appears.

1. When you have configured the data logging configuration, press ▷ to set up RT27 message output from the receiver.
2. Press △ or ▽ to select the output port. Press Enter to accept.
3. Press ▽ to move the cursor to the output rate. Press ▷ to edit and then press △ or ▽ to select the rate at which RT27 messages will be output. Press Enter to accept.
4. Press Enter to move to the next screen.

The Home screen appears. Base station setup is now complete.

Setting up the receiver as part of an Ethernet configuration

1. From the Home screen, press Enter.

   The *Operation Mode* screen appears. Use this screen to select if you want to configure the base station setup, Ethernet configuration, or system setup, or to view the SV status.

2. As reference station setup is the default, press ▷ so that the Ref Stn Setup message is flashing.
3. Press ▽ to select Ethernet config.
4. Press Enter twice to edit the configuration.

   The *DHCP* menu appears.

5. Press ▷ to select the type of IP address to set up.
6. Press △ or ▽ to move through the options. You can choose either Enabled (the default) or Static IP address to program the Ethernet manually. When finished, press Enter.
7. Press Enter to move to the next screen.

   The IP address appears.

8. Press ▷ to edit the IP address.
9. Press ◁ or ▷ to select the number to edit and then press △ or ▽ to change. When finished, press Enter.

Note – *Editing starts from the right.*

10. Press Enter to move to the next screen.

    The subnet mask is shown.

11. Press ▷ to edit the subnet mask address.
12. Press ◁ or ▷ to select the number to edit and then press △ or ▽ to change. When finished, press Enter.

Note – *Editing starts from the right.*

13. Press Enter to move to the next screen.

    The gateway is shown.

14. Press ▷ to edit the default gateway address.
15. Press ◁ or ▷ to select the number to edit and press △ or ▽ to change. When finished, press Enter.

Note – *Editing starts from the right.*

16. Press Enter to move to the next screen.

    The Home screen appears. Ethernet setup is now complete.

Note – *If you change the IP address, restart the receiver for the changes to take effect.*

You can also use the keypad to configure the system setup or to view the satellite (SV) status using the same process as outlined in this chapter.

Setting up the receiver to log data

The NetR8 receiver can be set up to log data using the front panel.

The receiver supports up to five independent sessions: Only the Default session parameters can be configured using the front panel. The remaining four sessions can be activated from the front panel but their configuration must be performed beforehand using the web interface.

1. From the Home screen, press Enter.

   The *Operation Mode* screen appears.

2. As reference station setup is the default, press Enter repeatedly to move through the menu choices until *Logging* is displayed.

   The *Logging* screen allows you to edit the settings for the Default logging session.

3. Do one of the following:
   - Press ▷ to edit the default session logging rate. Press △ or ▽ to select the desired rate and then press Enter.
   - Press ▽ to move to the logging rate field. Press ▷ to edit the logging rate. Press ▽ to select a rate.

   To store the new settings, press Enter.

4. Press Enter to move to the next screen.

Enabling logging sessions

The *Logging Session* screen appears.

1. Press ▷ to change the session to be enabled. Press △ or ▽ to move among the session names. With the desired session name displayed, press Enter to enable editing.

Note – *If you have not set up an additional session using the web interface, you will only be able to select the "Default" session.*

2. Press ▽ to move to the *On/Off* field.
3. Press ▷ to edit the settting.
4. Press ▽ to change the setting to the required state. When finished, press Enter.
5. Press Enter to move to the next screen.

CHAPTER

6

Configuring the Receiver Settings

In this chapter:

You can configure the NetR8 receiver to perform a wide variety of functions. This chapter describes the configuration methods other than the front panel display, and explains when and why each method is used.

The WinFlash utility described in this chapter is used primarily to update the receiver firmware and configure the Ethernet settings in the NetR8 receiver.

Configuring Ethernet settings

The receiver has an Ethernet port in order to connect to an Ethernet network. You can use the Ethernet network to access, configure, and monitor the receiver. No serial cable connection to the receiver is necessary.

The receiver has the following Ethernet settings:

- IP setup: Static or DHCP
- IP address
- Netmask
- Broadcast
- Gateway
- DNS address
- HTTP port

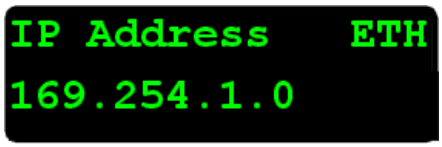
The default setting for the HTTP port is 80. The HTTP port is not assigned by the network. HTTP port 80 is the standard port for web servers. This allows you to connect to the receiver by entering only the IP address of the receiver in a web browser. If the receiver is set up to use a port other than 80, you will need to enter the IP address followed by the port number in a web browser.

Example of connecting to the receiver using port 80: http://169.254.1.0

Example of connecting to the receiver using port 4000: http://169.254.1.0:4000

The default setting of the receiver is to use DHCP. Using DHCP enables the receiver to automatically obtain an IP address, Netmask, Broadcast, Gateway, and DNS address from the network.

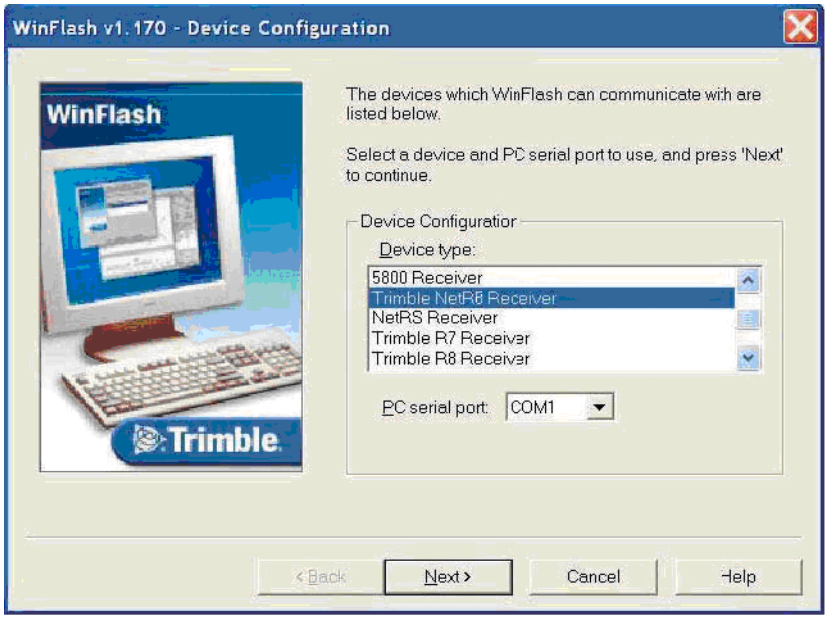
When a receiver is connected to a network using DHCP, an IP address is assigned to the receiver by the network. To verify the IP address of the receiver, select the up button from the keypad when the *Home* screen is displayed. The Ethernet IP address appears as shown.



If your network installation requires the receiver to be configured with a static IP address, you can configure the Ethernet settings either using the front panel as described in the Chapter 5, Configuring the Receiver Using the Keypad and Display, via the web server or the WinFlash utility. The web server can be only used when the receiver is connected to a network and has a valid Ethernet configuration.

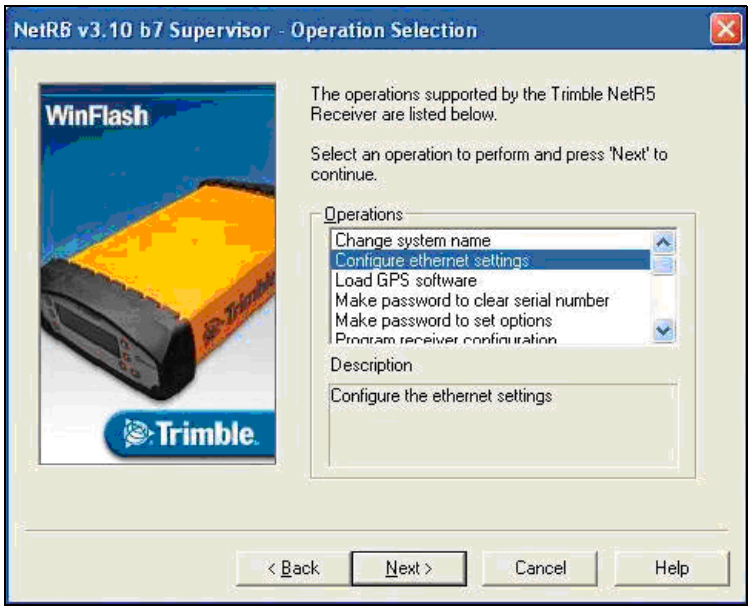
Use the WinFlash utility to configure the Ethernet settings of a receiver that is to be connected to a network that requires static IP addresses:

1. Contact the network administrator for the correct settings for the receiver.
2. Use the serial cable provided with the receiver to connect the receiver to a computer running the WinFlash utility.
3. Turn on the receiver.
4. On the computer, start the WinFlash utility.
5. From the *Device Configuration* screen:
   a. From the *Device type* list, select *Trimble NetR8 Receiver*.
   b. From the *PC serial port* list, select the appropriate PC serial port.

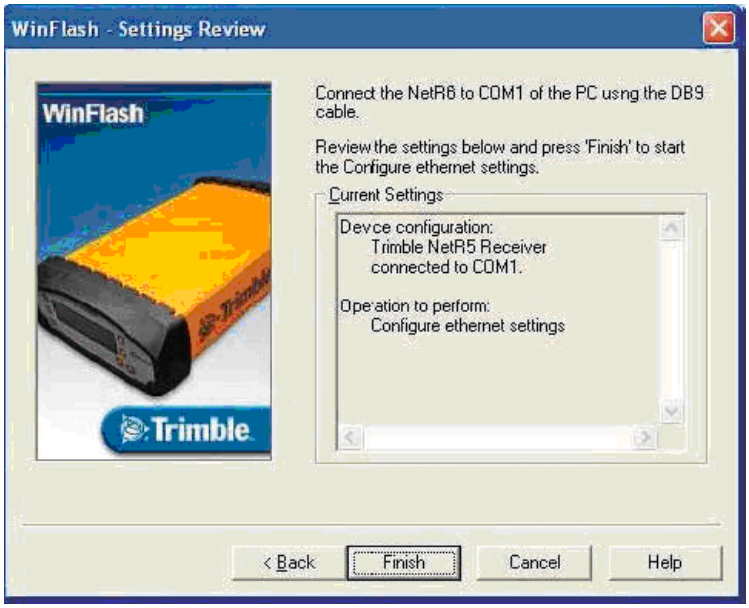


   c. Click **Next**.

6. From the *Operation Selection* screen, select *Configure ethernet settings*, and then click **Next**:

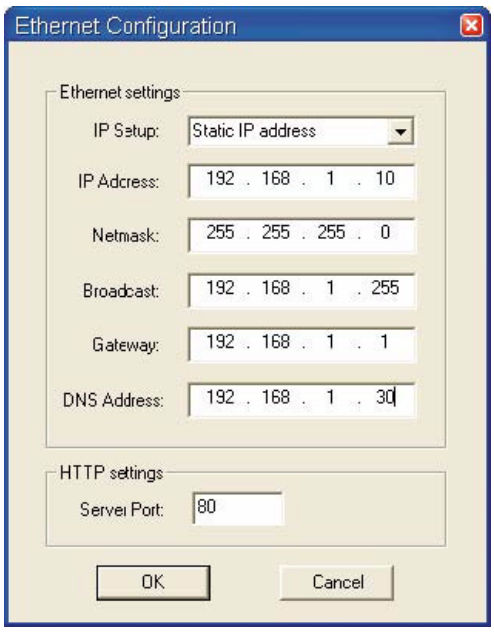


7. From the *Settings Review* screen, click **Finish**:



Once the WinFlash utility connects to the receiver, the *Ethernet Configuration* dialog appears.

8. Enter the network settings in the *Ethernet Configuration* dialog. Click **OK**:



The Broadcast setting is the IP address that is used to broadcast to all devices on the subnet. This is usually the highest address (usually 255) in the subnet.

Configuring the NetR8 receiver using a web browser

The receiver can be configured using the keypad and display, or a web browser. This section describes how to set up the receiver using a web browser.

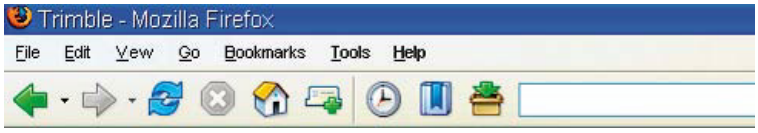
Supported browsers

- Mozilla Firefox version 3.0
- Microsoft Internet Explorer version 7.0 for Windows operating systems

Note – *Version 8.0 may have problems if the "Use Standards Mode" option is used in that browser software.*

To connect to the receiver using a web browser:

1. Enter the IP address of the receiver into the address bar of the web browser as shown:



2. If security is enabled on the receiver (by default, it is disabled), the web browser prompts you to enter a username and password:

The default login values for the receiver are:

- User Name: admin
- Password: password

If you cannot connect to the receiver, the password for the root account may have been changed, or a different account may be being used. Contact your receiver administrator for the appropriate login information.

Once you are logged in, the welcome web page (see Figure 6.1) appears.

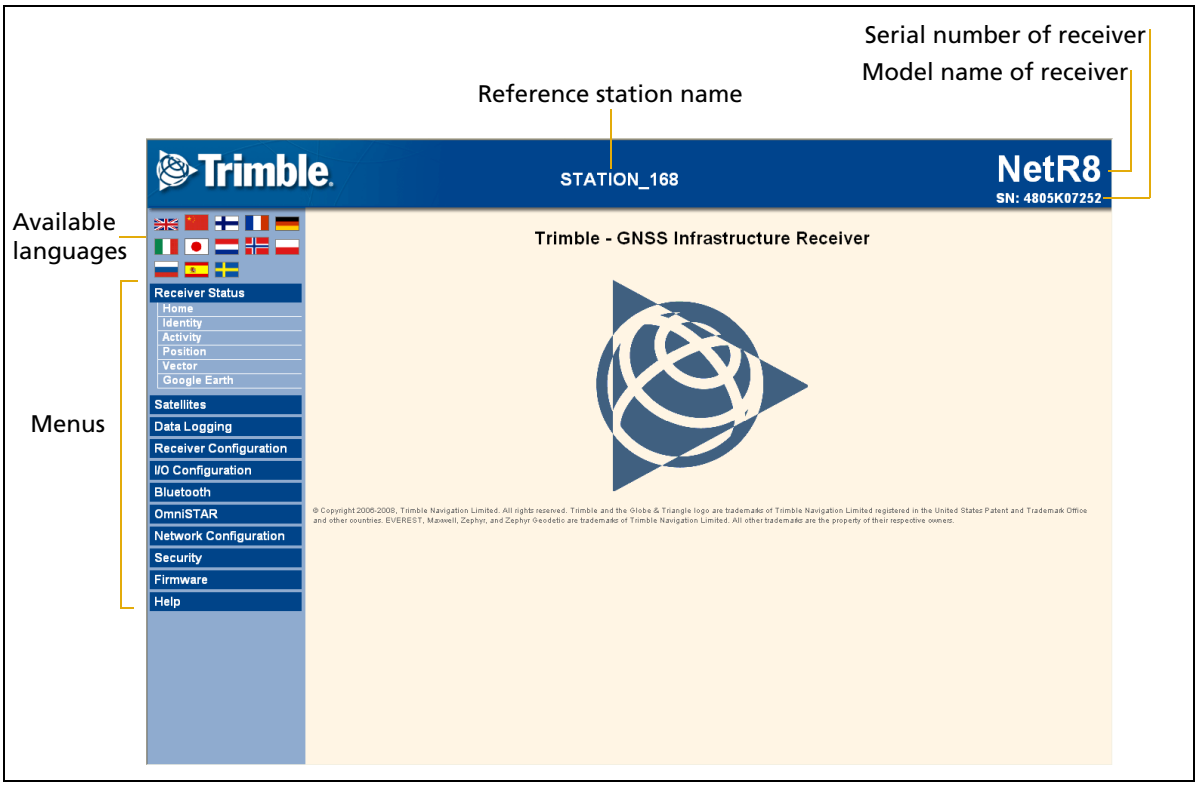


Figure 6.1 NetR8 receiver Home webpage

Changing the settings

Use the webpage to configure the receiver settings. The web interface shows the configuration menus on the left of the browser window, and the settings on the right. Each configuration menu contains related submenus to configure the receiver and monitor receiver performance.

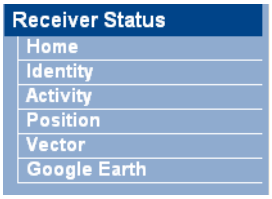
A summary of each configuration menu is provided here.

To display the web interface in another language, click the corresponding country flag. The web interface is available in the following languages:

- English
- German
- French
- Spanish
- Dutch
- Polish
- Italian
- Russian
- Chinese
- Japanese
- Norwegian
- Swedish

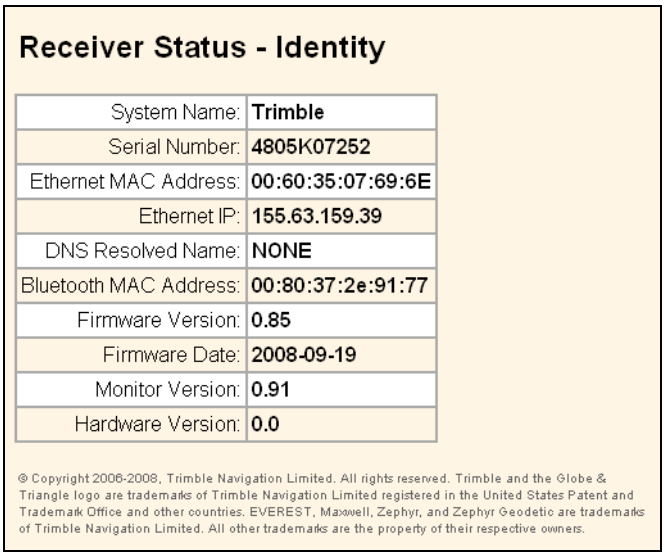
Receiver Status menu

The *Receiver Status* menu provides a quick link to review the receiver's available options, current firmware version, IP address, temperature, runtime, satellites tracked, current outputs, available memory, position information, and more.



Receiver Status – Identity

The *Receiver Status – Identity* screen shows a list of unique receiver items, including the Ethernet MAC address and the Bluetooth MAC address. It also lists variable items, including the current Ethernet IP address and the firmware version:

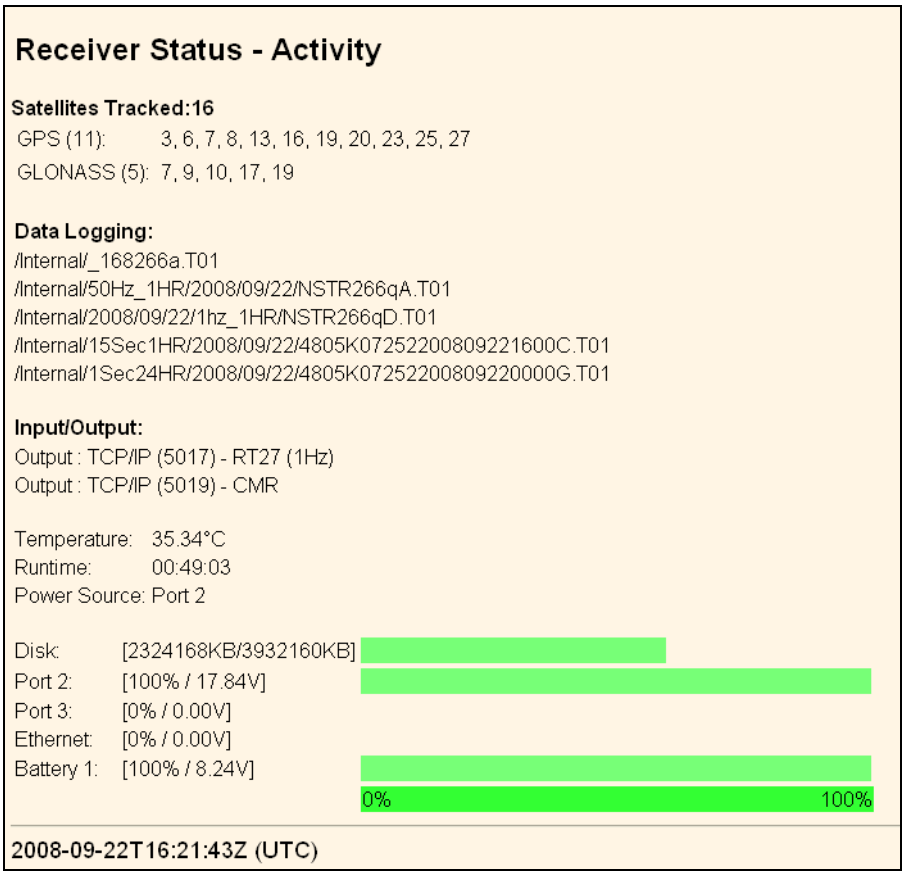


Receiver Status - Identity

System Name:	**Trimble**
Serial Number:	**4805K07252**
Ethernet MAC Address:	**00:60:35:07:69:6E**
Ethernet IP:	**155.63.159.39**
DNS Resolved Name:	**NONE**
Bluetooth MAC Address:	**00:80:37:2e:91:77**
Firmware Version:	**0.85**
Firmware Date:	**2008-09-19**
Monitor Version:	**0.91**
Hardware Version:	**0.0**

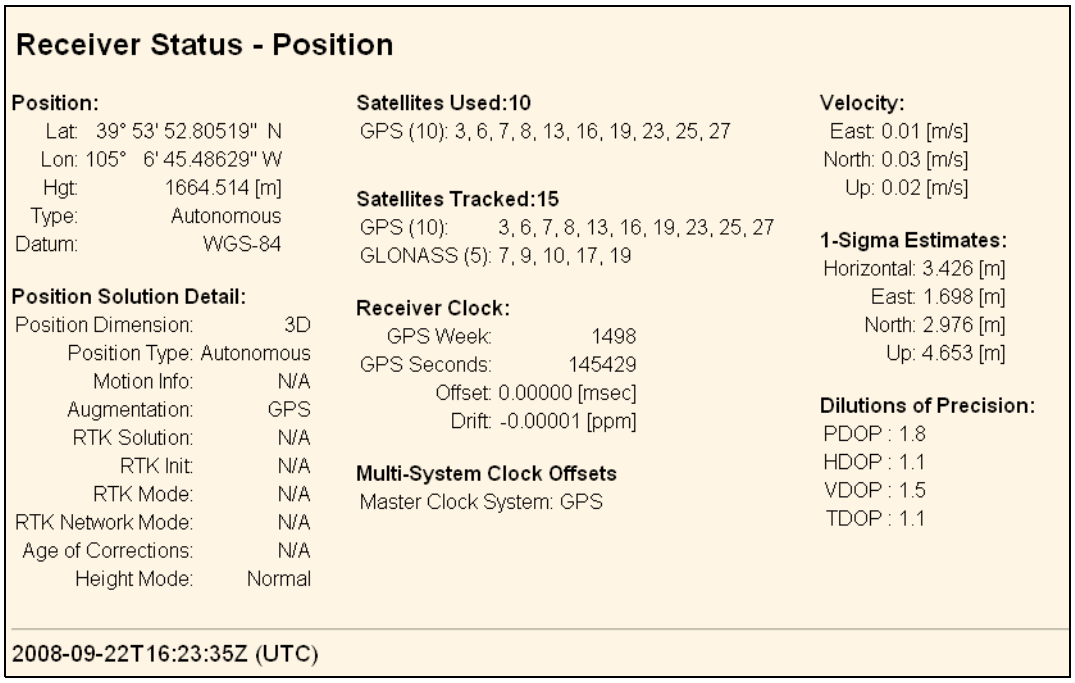
Receiver Status – Activity

The *Receiver Status – Activity* screens lists several important items to help you understand how the receiver is being used and its current operating condition. Items include the identities of currently tracked satellites, files being logged, data streams being input and output, the receiver's internal temperature, how long the receiver has been operational, power source voltages, and the state of the internal battery. With this information, it is easy to tell exactly what functions the receiver is performing.



Receiver Status – Position

The *Receiver Status – Position* screen provides all relevant information pertaining to the receiver's position solution. If the NetR8 receiver is operating as a reference station, this information may be of minimal concern, however, if the receiver is acting as a Rover Integrity Monitor, this menu provides all of the information needed to assess the quality of the receiver's RTK position and therefore, the quality of network correctors.



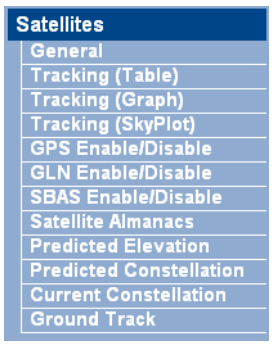
Receiver Status – Vector

The *Receiver Status – Vector* screen provides information on the vector between the NetR8 receiver and its RTK reference station.

Receiver Status – Google Earth

The Receiver Status – Google Earth menu allows the user to request a Google Earth position marker file for the reference receiver position. This .kmz file can be easily imported into Google Earth to allow that software to display the receiver's location on a map or aerial view.

Satellites menu



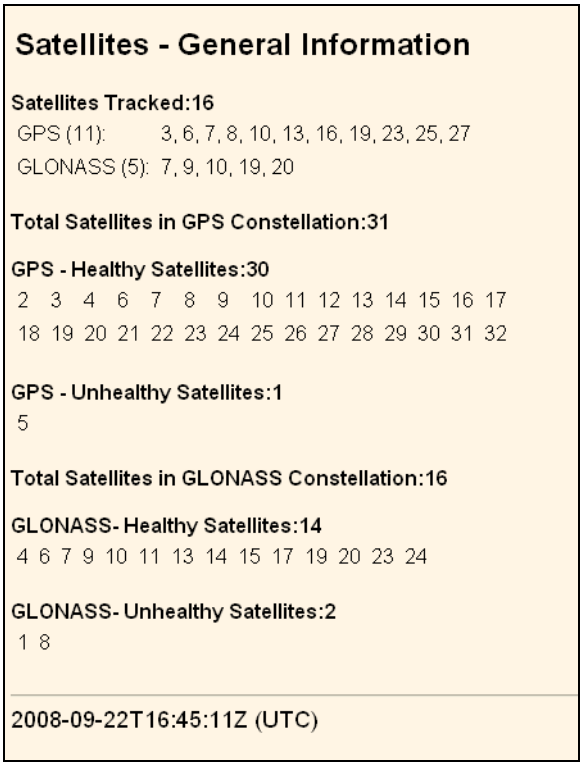
Use the *Satellites* menu to view satellite tracking details and enable/disable GPS, GLONASS, and SBAS (WAAS/EGNOS, and MSAS) satellites.

These menus include tabular and graphical displays to provide all needed information on satellite tracking status. Within this menu it is possible to:

- Manually disable the tracking of satellites.
- Download the latest broadcast ephemeris.

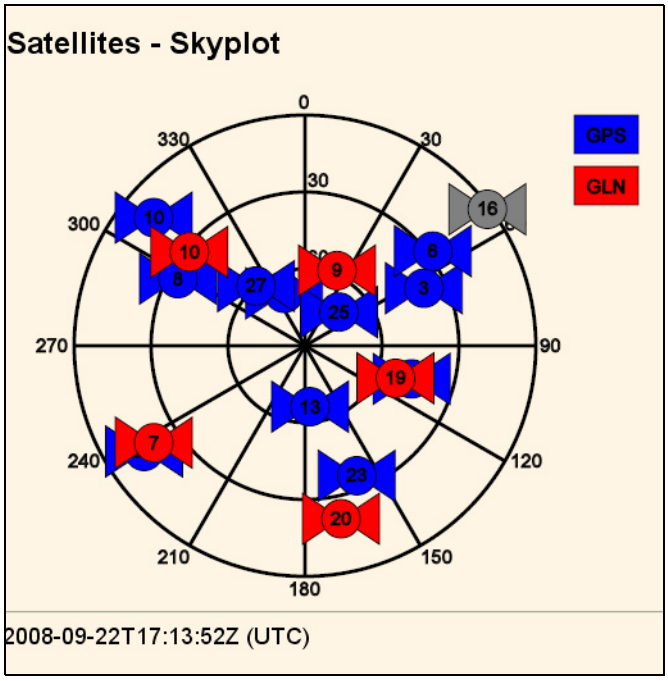
Satellites – General

The *Satellites – General* screen provides an overview of satellite tracking status:



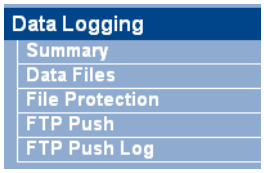
Satellites – Tracking (Skyplot)

This figure shows shows the Tracking (Skyplot) display as an example of the graphical views available in this menu.



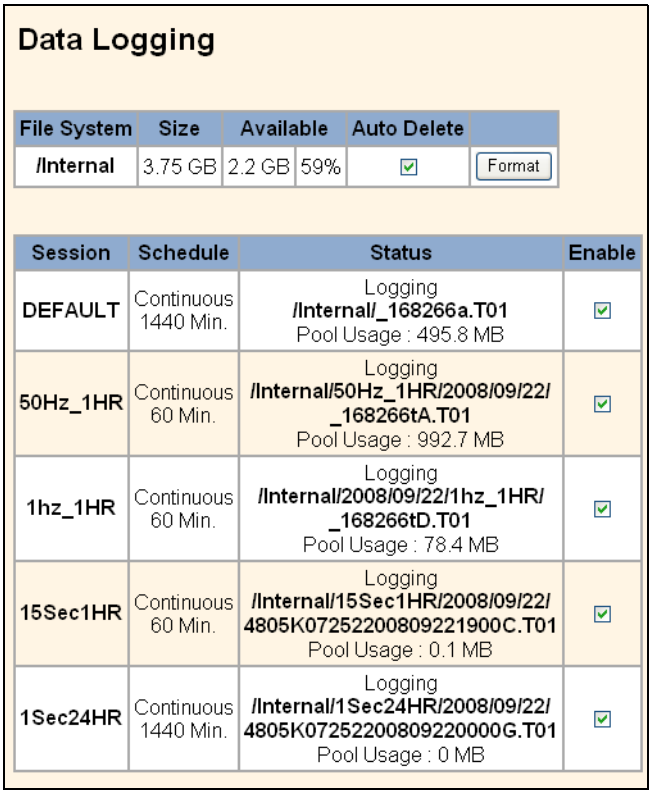
Data Logging menu

Use the *Data Logging* menu to set up the receiver to log static GNSS data and to view the logging settings. You can configure settings such as observable rate, position rate, continuous logging, continuous logging rate, and whether to auto delete old files if memory is low. This menu also provides the controls for the FTP push feature.



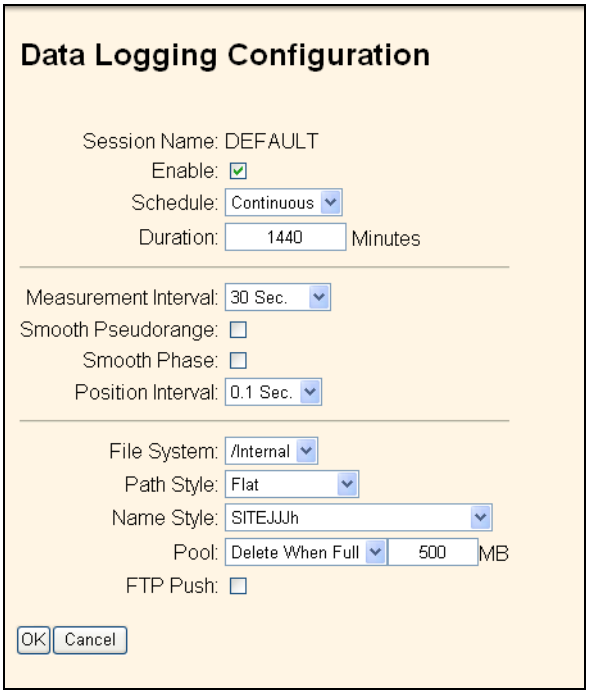
Data Logging – Summary

The *Data Logging – Summary* screen displays the files that are currently being stored. It shows their schedules, their names, whether they are using memory pooling, and in which directory they are being stored:



To edit a logging session, double-click the session name.

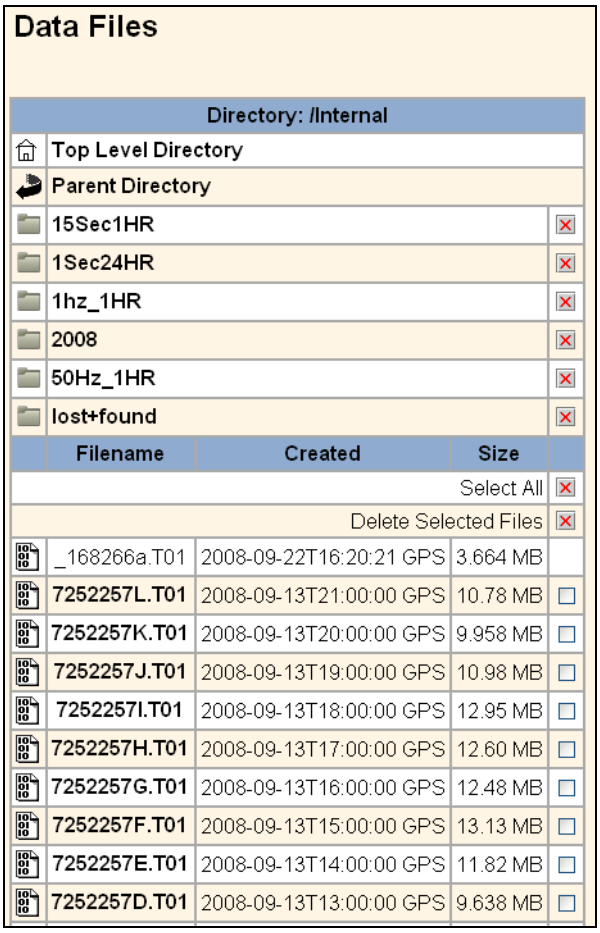
To create a new session, click the **New Session** button. The *Data Logging Configuration* screen appears:



Use the *Data Logging Configuration* screen to set all logging parameters and to determine whether the session files will be affected by the FTP Push function.

Data Logging – Data Files

Use the *Data Logging – Data Files* screen to view and/or download the files currently stored on the receiver:



Data Files

Directory: /Internal				
	Top Level Directory			
	Parent Directory			
	15Sec1HR			☒
	1Sec24HR			☒
	1hz_1HR			☒
	2008			☒
	50Hz_1HR			☒
	lost+found			☒
	Filename	Created	Size	
			Select All	☒
			Delete Selected Files	☒
	_168266a.T01	2008-09-22T16:20:21 GPS	3.664 MB	
	7252257L.T01	2008-09-13T21:00:00 GPS	10.78 MB	☐
	7252257K.T01	2008-09-13T20:00:00 GPS	9.958 MB	☐
	7252257J.T01	2008-09-13T19:00:00 GPS	10.98 MB	☐
	7252257I.T01	2008-09-13T18:00:00 GPS	12.95 MB	☐
	7252257H.T01	2008-09-13T17:00:00 GPS	12.60 MB	☐
	7252257G.T01	2008-09-13T16:00:00 GPS	12.48 MB	☐
	7252257F.T01	2008-09-13T15:00:00 GPS	13.13 MB	☐
	7252257E.T01	2008-09-13T14:00:00 GPS	11.82 MB	☐
	7252257D.T01	2008-09-13T13:00:00 GPS	9.638 MB	☐

To download a file, double-click the file name or its icon and then follow the standard procedures to complete the download.

To select a group of files for download, select the checkbox to the right of the required file names before double-clicking to start the download. To select all files, click the **Select All** button.

To delete files, select the checkbox to the right of all files to be deleted and then click the **Delete Selected Files** button.

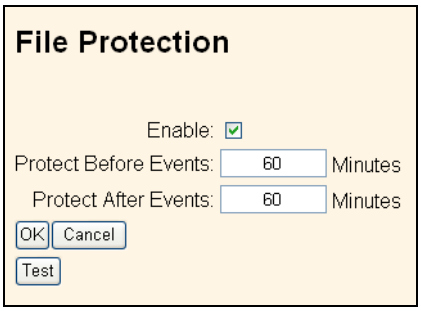
The following six file naming options are available in the NetR8 receiver:

Name style	Description
####JJJx	Last four digits of receiver serial number, 3 digit Julian calendar day, alphabetic session identifier
##########YYYYMMDDhhmm	Receiver serial number, 4 digit year, 2 digit month, 2 digit day, 2 digit hour, 2 digit minute of file start
SITEJJJh	4 character site identifier, 3 digit Julian calendar day, single letter hour of day identifier
SITEJJJhmm	4 character site identifier, 3 digit Julian calendar day, single letter hour of day identifier, 2 digit minute of the hour of file start
YYMMDDhh	2 digit year, 2 digit month, 2 digit day, 2 digit hour of file start
YYMMDDhhmm	2 digit year, 2 digit month, 2 digit day, 2 digit hour, 2 digit minute of file start

Data Logging – File Protection

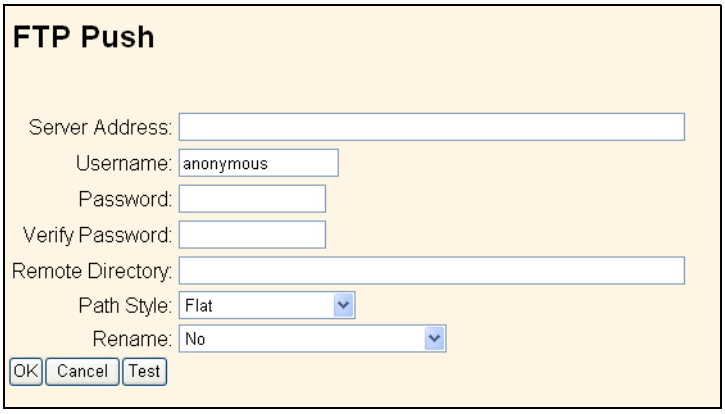
Use the *Data Logging – File Protection* screen to configure the protection of stored data files when an event signal is received. This feature allows important data to be protected from the standard memory pool automatic deletion function. The idea is that an event input from an external sensor, such as a seismic detector, will protect data from automatic deletion for a time period before and after the event. This ensures that this data is available for later study.

You must manually delete protected data to remove it from system memory.



Data Logging – FTP Push

Use the *Data Logging – FTP Push* screen to configure the receiver to push stored files to the FTP server of your choice. Only files that are configured to use FTP push are transmitted:

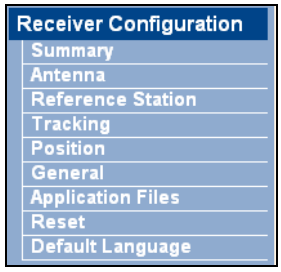


Data Logging – FTP Push Log

The *Data Logging – FTP Push Log* screen shows the status of all FTP Push operations.

Receiver Configuration menu

Use the *Receiver Configuration* menu to configure settings such as elevation mask and PDOP mask, the antenna type and height, the reference station position, and the reference station name and code.



Receiver Configuration – Summary

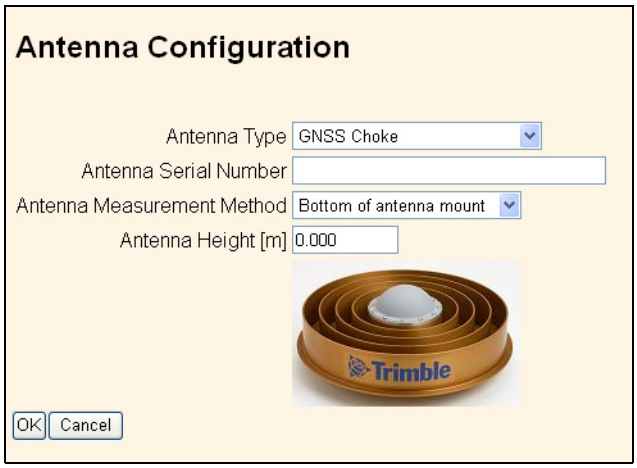
The *Receiver Configuration – Summary* screen provides an overview of the status of many of the important configuration items:

Receiver Configuration

Elevation Mask:	0°
PDOP Mask:	7
Horizontal Precision:	0.30 [m]
Vertical Precision:	0.30 [m]
Clock Steering:	Enabled
Everest™ Multipath Mitigation:	Enabled
Antenna ID:	27
Antenna Type:	Choke Ring
Antenna Height:	0.000 [m]
1PPS On/Off:	Disabled
Event 1 On/Off:	Disabled
Event 1 Slope:	Positive
External Frequency Available:	Undetected
RTK Mode:	Low Latency
Motion:	Static
CMR Input Filter:	Disabled
Reference Latitude:	39°53'52.88392"N
Reference Longitude:	105°6'45.40964"W
Reference Height:	1669.804 [m]
RTCM 2.x ID:	168
RTCM 3.x ID:	168
CMR ID:	9
Station Name:	STATION_168
Ethernet IP:	155.63.159.39
System Name:	Trimble
DNS Resolved Name:	NONE
Serial Number:	4805K07252
Firmware Version:	0.85
Firmware Date:	2008-09-19

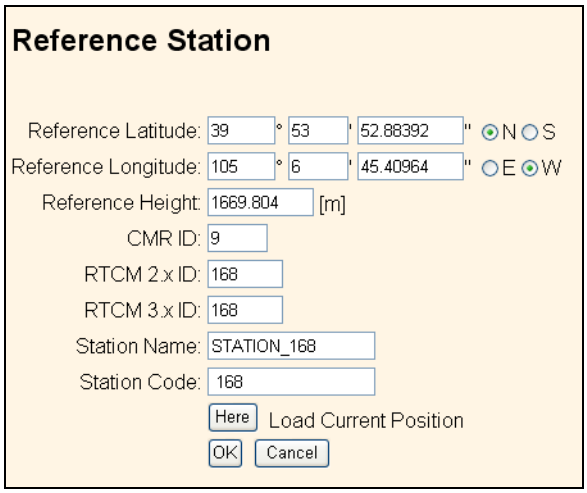
Receiver Configuration – Antenna

Use the *Receiver Configuration – Antenna* screen to configure all of the items relating to the GNSS antenna. You must enter the correct values for all antenna-related fields as the choices you make will significantly affect the accuracy for logged data and broadcast RTK correctors:



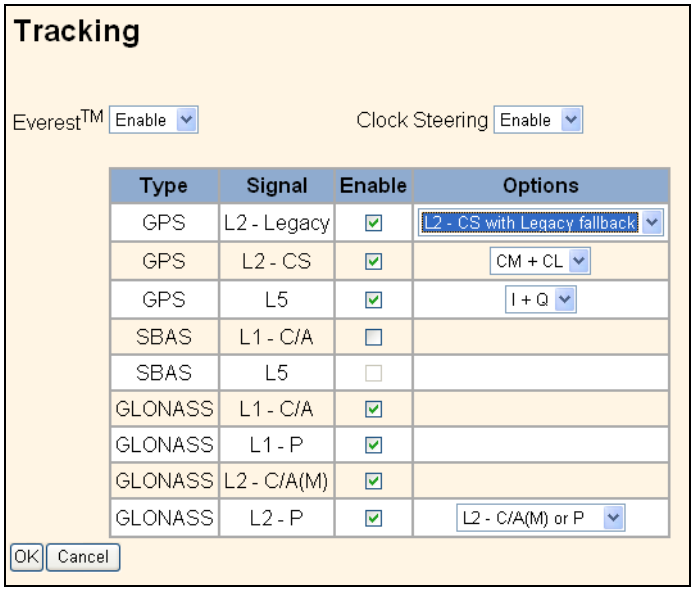
Receiver Configuration – Reference Station

Use the *Receiver Configuration – Reference Station* screen to configure settings such as the station coordinates and the broadcast station identifiers. You must enter accurate information in these fields as this data can significantly affect the accuracy of logged data files and broadcast RTK correctors:



Receiver Configuration – Tracking

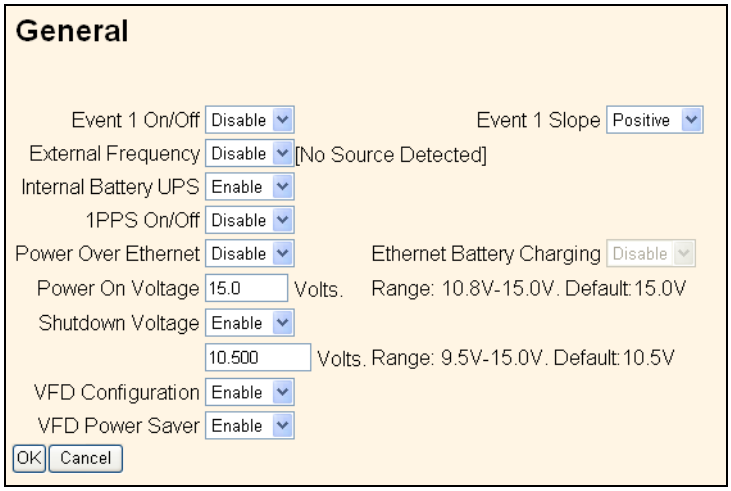
Use the *Receiver Configuration – Tracking* screen to determine whether Everest technology and clock steering are used. This screen also allows you to select which signals relating to particular satellites are to be stored:



Receiver Configuration – Position

Use the *Receiver Configuration – Position* screen to configure settings relating to using the receiver as a Rover Integrity Monitor.

Receiver Configuration – General



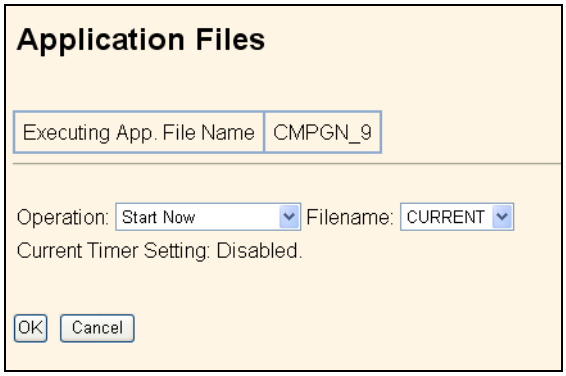
Use the *Receiver Configuration – General* screen to determine:

- Whether event signals and an external frequency source will be used.
- Choose to output a one-pulse-per-second signal (1 PPS).
- Disable the use of the internal battery as an uninterruptable power supply.
- Enable Power over Ethernet.

Note – *The VFD Configuration item determines whether users can operate the receiver using its front panel display and keypad. If you disable this feature and Ethernet communications are lost, the only way to regain control of the receiver will be to perform a hard reset of the receiver using the Power button.*

Receiver Configuration – Application Files

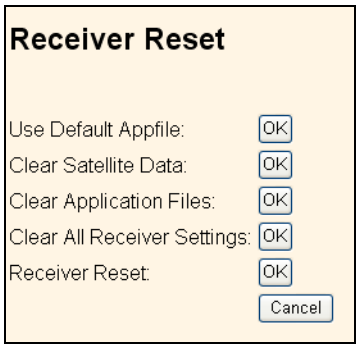
Use the *Receiver Configuration – Application Files* screen to configure all of the settings that make up an application file, save that file, and select an application file for use:



See also Chapter 7 for a complete description of this process.

Receiver Configuration – Reset

Use the *Receiver Configuration – Reset* screen to completely or partially reset the receiver:



Receiver Configuration – Default Language

Use the *Receiver Configuration – Default Language* screen to select the language that the receiver will display on start up.

I/O Configuration menu

Use the *I/O Configuration* menu to set up all outputs of the receiver. The receiver can output CMR, RTCM, NMEA, GSOF, RT17, RT27, or BINEX messages. These messages can be output on TCP/IP, UDP, serial, or Bluetooth ports..

This figure shows an example of the screen that appears when you select *I/O Configuration* / *Port Summary*.

I/O Configuration

Type	Port	Input	Output
TCP/IP	5017	-	RT27(1Hz)
TCP/IP	5018	-	-
TCP/IP	5019	-	CMR
TCP/IP	5020	-	-
TCP/IP	5021	-	-
NTripClient	-	-	-
NTripServer	-	-	-
NTripCaster 1	8000	-	-
NTripCaster 2	8001	-	-
NTripCaster 3	8002	-	-
Serial	Serial 1 (115K-8N1)	-	-
Serial	Serial 2 (115K-8N1 RTS/CTS)	-	-
Serial	Serial 3 (38.4K-8N1)	-	-
Bluetooth	1	-	-
Bluetooth	2	-	-
Bluetooth	3	-	-

Bluetooth menu

Use the Bluetooth menu to configure Bluetooth settings.

This figure shows an example of the screen that appears when you select *Bluetooth/Info*:

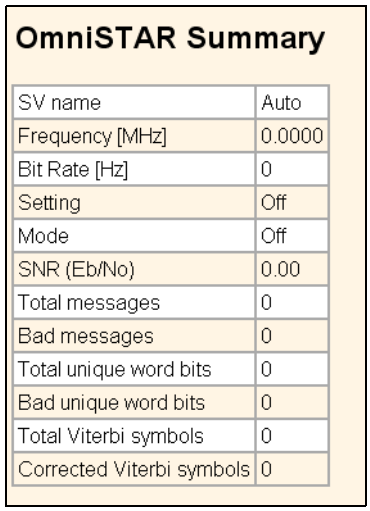
Bluetooth Info

Module Info	Infineon UniStone H/W: v2.3; F/W: v8.5.8
Stack Version	1.21:1.2/2.0
Local Name	NetR8, 4805K07252: Trimble
Bluetooth MAC Address	00:80:37:2e:91:77
Discoverable	True
Pin Code	0000

OmniSTAR menu

Use the OmniSTAR menu to configure OmniSTAR settings.

This figure shows an example of the screen that appears when you select *OmniSTAR/Summary*:



OmniSTAR Summary

SV name	Auto
Frequency [MHz]	0.0000
Bit Rate [Hz]	0
Setting	Off
Mode	Off
SNR (Eb/No)	0.00
Total messages	0
Bad messages	0
Total unique word bits	0
Bad unique word bits	0
Total Viterbi symbols	0
Corrected Viterbi symbols	0

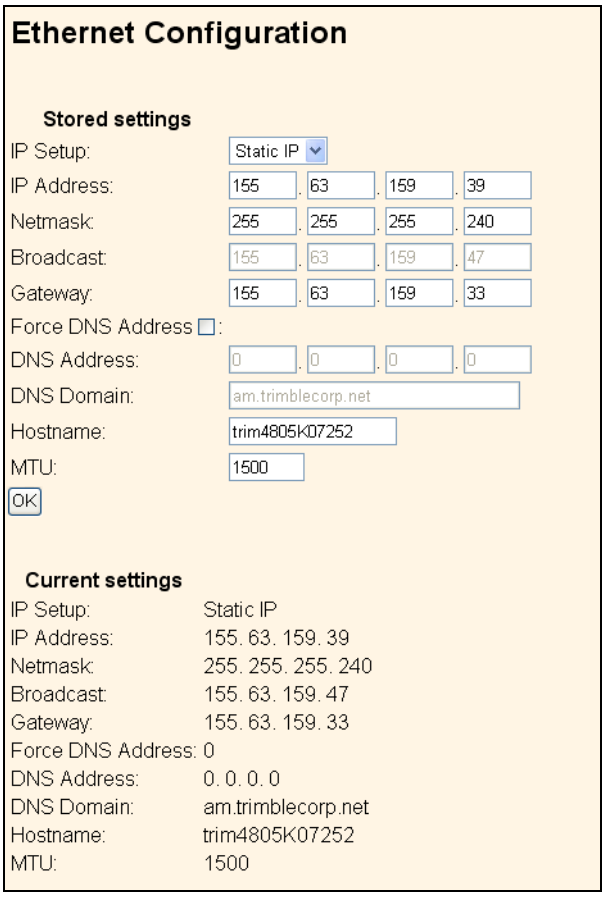
Network Configuration menu

Use the *Network Configuration* menu to configure Ethernet settings, email alerts, PPP connection, HTTP port, FTP port, and VFD (Virtual Front Display) port settings of the receiver.

The VFD port allows you to use the NetR8 Remote Control application to view and navigate the receiver through a mock display and keypad interface. To allow the NetR8 Remote Control to connect to the receiver, select *Network Configuration* / *VFD* to enable the VFD port. A viewing utility is available on the *Trimble Survey and Reference Receivers CD* under NetR8 utilities.

The receiver can notify a system administrator by sending alerts about general status changes in the receiver as well as warning messages in case of problems to a specified email address. This requires the use of an SMTP server. To find out how to connect the receiver to the server, contact your network administrator.

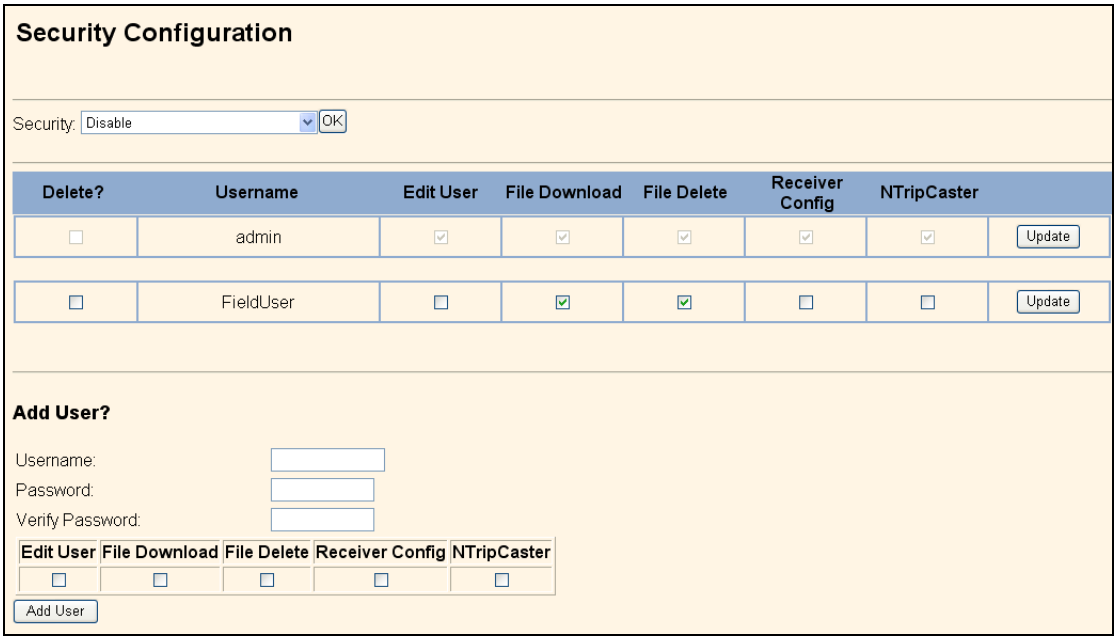
This figure shows an example of the screen that appears when you select *Network Configuration / Ethernet:*



Security menu

Use the *Security* menu to configure the login accounts for all users who will be permitted to configure the receiver using a web browser. Each account consists of a username, password, and permissions. Administrators can use this feature to limit access to other users. By default, security is disabled to make it easier to configure the receiver. However, Trimble encourages administrators to enable security to avoid unwanted changes. If security is enabled with anonymous access, it allows users to browse the receiver settings but they cannot make changes.

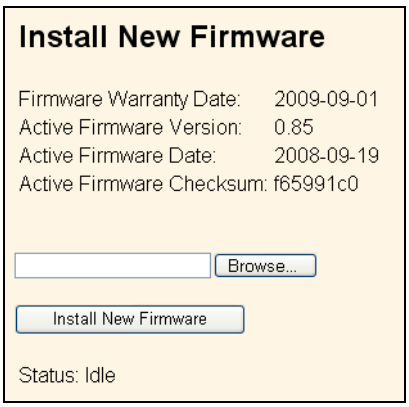
This figure shows an example of the screen that appears when you select *Security / Configuration*.



Firmware menu

Use the *Firmware* menu to verify the current firmware and load new firmware to the receiver. You can upgrade firmware across a network or from a remote location without having to connect to the receiver with a serial cable.

This figure shows an example of the screen that appears when you select *Firmware*.



CHAPTER

7

Default Settings and Application Files

In this chapter:

Most of the receiver settings are stored in application files. The default application file, Default.cfg, is stored permanently in the receiver, and contains the factory default settings for the NetR8. Whenever the receiver is reset to its factory defaults, the current settings (stored in the current application file, Current.cfg) are reset to the values in the default application file.

The NetR8 receiver extends the use of application files to allow simplified receiver setting duplication in multiple receivers. This is sometimes referred to as receiver cloning and is very useful when preparing a large group of receivers for a field data collection campaign.

Default receiver settings

These settings are defined in the default application file.

Function		Factory default
SV Enable		All SVs enabled
General Controls:	Elevation mask	10°
	PDOP mask	7
	RTK positioning mode	Low Latency
	Motion	Static
Lemo Ports:	Baud rate	38,400
	Format	8-None-1
	Flow control	None
D9 Port	Baud rate	38,400
	Format	8-None-1
	Flow control	None
Input Setup:	Station	Any
NMEA/ASCII (all supported messages)		All ports Off
Streamed output		All types Off Offset = 00
RT17/RT27/Binary		All ports Off
Reference position:	Latitude	0°
	Longitude	0°
	Altitude	0.00 m HAE (Height above ellipsoid)
Antenna:	Type	Zephyr Geodetic™ Model 2
	Height (true vertical)	0.00 m
	Measurement method	True vertical

Resetting the receiver to factory defaults

To reset the receiver to its factory defaults, press ⏻ for 35 seconds.

Using application files to duplicate receiver settings

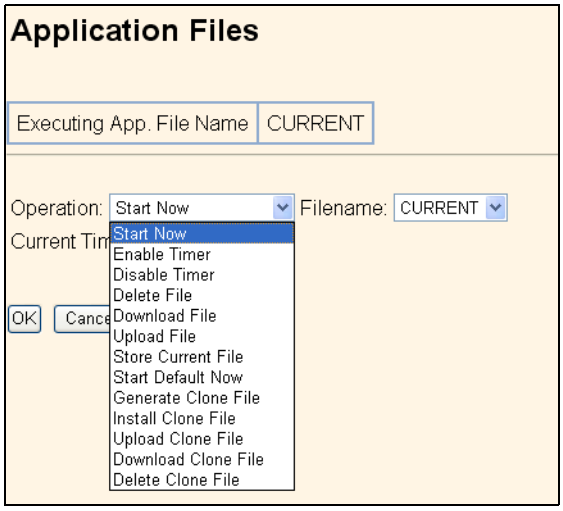
The NetR8 receiver allows the extensive use of application files in order to retain a unique receiver configuration. With the NetR8 you can create an application file that includes most of the receiver's unique configuration settings. That application file can then be copied and placed on another NetR8 receiver to quickly configure it to match the first receiver.

For settings that are not stored in an application file there are also “clone” files. Clone files allow you to capture all of the settings not included in the application file. Both the clone file and the application file can be loaded onto other NetR8 receivers to give

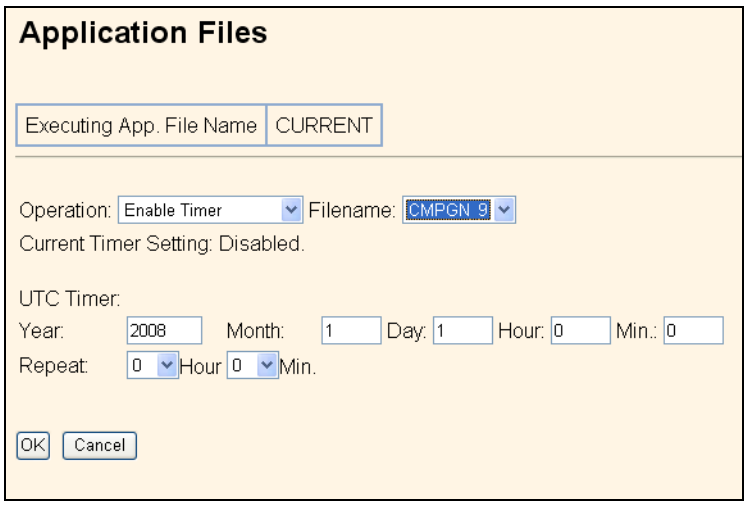
them the exact configuration as the first receiver. This is called "receiver configuration cloning" or "cloning". Receiver cloning greatly reduces the time required to prepare a large group of receivers for field operations.

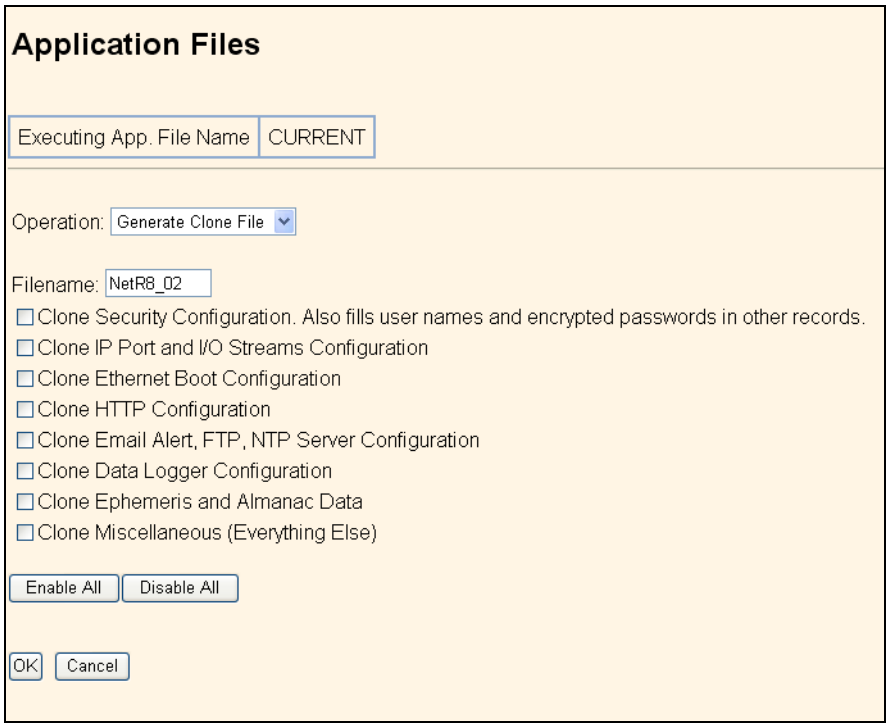
The *Application Files* submenu (select *Receiver Configuration/Application Files*) provides the required tools to use these features. There are two variable fields:

- *Filename* allows you to enter a unique name for a stored configuration file.
- *Operation* allows you to select a particular operation from a drop-down list:



The avaiilable operations are:

Operation	Description
Start Now	Applies the selected application file.
Enable Timer	Determines at what time and date the receiver will automatically power-up (wake up) and at what interval it will automatically power-up thereafter.
	
Disable Timer	Overrides all previously configured power-up timer settings.
Delete File	Deletes the currently selected application file.

Operation	Description
Download File	Allows you to download the currently selected application file to your browsing computer.
Upload File	Allows you to send a file from your browsing computer to the target NetR8 receiver.
Store Current File	Allows you to store an application file including all current custom settings under a new name.
Start Default Now	Returns the receiver to factory default settings.
Generate Clone File	Allows you to create a named xml file including the receiver configuration items of your choice.
	
Install Clone File	Tells the receiver to accept the clone file settings in a particular file.
Upload Clone Fine	Allows you to move a clone file from your browsing computer to the targer receiver.
Download Clone File	Allows you to move a clone file from the receiver to your browsing computer.
Delete Clone File	Allows you to delete a clone file stored on the receiver.

The following generated Clone file selections are available:

Generate Clone File selection	Affected items
Clone Security Configuration	Clones all security settings on the source receiver. See the *Security* menu. • All system users with Username, Password,and access settings. • Security status: – Enable – Enable with Anonymous Access – Disable
Clone IP Port and I/O Streams Configuration	Clones all Input/Output stream configurations from the source receiver. See the *I/O Configuration* menu. • TCP/IP Port • NTripClient • NTripServer • NTripCasters • Serial ports • Bluetooth ports: If the "Maintain configuration when connection dropped" switch is set. ***Note –*** *The source receiver's clone files will not overwrite any ports currently configured on the recipient receiver.*
Clone Ethernet Boot Configuration	Clones all Ethernet settings of the source receiver. See the *Network Configuration/Ethernet* menu. • IP Setup – DHCP – Static IP • IP Address • Netmask • Broadcast • Gateway • Force DNS Address switch • DNS Address • DNS Domain ***Note –*** *If the source receiver has a static IP address, you may need to edit the static IP address of the recipient receiver after the clone file is passed to that recipient.*
Clone HTTP Configuration	Clones all HTTP and HTTPS settings of the source receiver. See the *Network Configuration/HTTP* menu. • HTTP Enable switch • HTTP Server Port • HTTPS Secure Enable switch • HTTPS Secure Port • Certificate Information

Generate Clone File selection	Affected items
Clone Email Alert, FTP, NTP Server Configuration	Clones all Email Alert controls, all FTP/FTP Push controls and NTPServer settings. **Email alerts** • Enable switch • Authorization Required switch • SMTP Server • SMTP Port • From Email Address • Any Alert switches The user must enter the email address to which the email is to be sent, login, and the email password. **FTP** • FTP Server Enable switch • FTP Server Port • FTP Push Controls – FTP Server Address – Remote Directory (at server) – Path Style – Rename setting The user must enter the username and password **NTP server** • External Time Servers • NTP Port • Enable switch
Clone Data Logger Configuration	Clones all configured Data Logging Sessions from the source receiver. • Session Name • Enable switch • Schedule setting • Duration • Measurement Interval • Smoothing settings • Position Interval • File System setting • Path and Name Style • Pool setting • FTP Push switch
Clone Ephemeris and Almanac Data	Clones all Ephemeris and Almanac data from the source receiver for expediting SV tracking of recipient receiver. • GPS Satellites - SV1~SV32 • SBAS Satellites - SV120~SV138 • GLONASS SV1~SV24 • NAV Chan 0~11 • SBAS for correction • WAAS Ephemeris • WAAS Iono Bands • Position • UTC • Almanac Health

Generate Clone File selection	Affected items
Clone Miscellaneous (Everything Else)	• Position Controls – Elevation Mask – PDOP Mask – RTK Mode – Motion – Precisions • General Controls – Event On/Off and Slope – External Frequency – Internal Battery UPS setting – 1PPS On/Off – Power Over Ethernet Enabled/Disabled – Ethernet Battery Charging setting – Shutdown Voltage settings – VFD Configuration – VFD Power Saver setting • Tracking Controls – Everest setting – Clock Steering setting – Signal Enable switches and Options • Antenna Settings – Antenna Type – Measurement Method – Antenna Height
Clone Miscellaneous (Everything Else), ***continued***	• Reference Station settings – Latitude/Longitude/Height – CMR ID – RTCM 2.x/3.x ID – Station Name – Station Code • Bluetooth Controls • OmniSTAR Configuration – External OmniSTAR Data – Internal OmniSTAR Demodulator – SV Name – Seed with RTK setting – NAD83>ITRF Transformation switch

CHAPTER

8

Specifications

In this chapter:

This chapter details the specifications for the NetR8 GNSS Reference receiver.

Specifications are subject to change without notice.

General specifications

Feature	Specification
Keyboard and display	Vacuum Fluorescent Display (VFD), 16 characters by 2 rows Escape and Enter key for menu navigation 4 arrow keys (up, down, left, right) for option scrolls and data entry
Receiver type	GNSS Reference receiver
Antenna type	Zephyr Geodetic Model 2 or Trimble GNSS Choke Ring antenna preferred. Other models supported.

Physical specifications

Feature	Specification
Dimensions (LxWxH)	26.5 cm (10.43 in) x 19 cm (7.48 in) x 6.75 cm (2.64 in) including connectors
Weight	2.08 kg (4.59 lbs) receiver with internal battery and no radio
Temperature[1]	
Operating	–40 °C to +65 °C (–40 °F to +149 °F)
Storage	–40 °C to +80 °C (–40 °F to +176 °F)
Humidity	100%, condensing
Waterproof	IP67 for submersion to depth of 1 m (3.28 ft)
Shock and vibration	Designed to survive a 1 m (3.28 ft) drop onto a hard surface.
Shock, non operating	Survival to 75 g, 6 mS
Shock, operating	To 25 g, 10 msec, saw-tooth
Vibration	10 Hz to 300 Hz 0.04 g^2 / Hz; 300 Hz to 1000 Hz -6 dB/Octave
Measurements	• Advanced Trimble Maxwell™ Custom GNSS chip • L2C Civil signal and L5 signal for GPS modernization • Very low noise L1, L2, and L5 carrier phase measurements with <1 mm precision in a 1 Hz bandwidth • Proven Trimble low elevation tracking technology • 76 Channels L1 C/A Code, L2C, L5C, L1/L2/L5 Full Cycle Carrier, GLONASS L1/L2 • WAAS/EGNOS, and MSAS
Code differential GPS positioning[2]	
Horizontal accuracy	±(0.25 m + 1 ppm) RMS
Vertical accuracy	±(0.50 m + 1 ppm) RMS
WAAS/EGNOS, and MSAS	
Horizontal accuracy[3]	Typically <1 m (3.28 ft)
Vertical accuracy[2]	Typically <5 m (16.40 ft)
Real Time Kinematic (RTK) positioning[4]	
Horizontal	±(10 mm + 1 ppm) RMS, ± (0.38 in +1 ppm) RMS
Vertical	±(20 mm + 1 ppm) RMS, ± (0.78 in +1 ppm) RMS
Initialization reliability[5]	Typically >99.9%

[1] Receiver will operate normally to –40 °C.

[2] Accuracy and reliability may be subject to anomalies such as multipath, obstructions, satellite geometry, and atmospheric conditions. Always follow recommended practices.

[3] Depends on WAAS/EGNOS, and MSAS system performance.

[4] Only for use with Trimble GNSS Infrastructure software, in conjunction with rover integrity module.

[5] May be affected by atmospheric conditions, signal multipath, and satellite geometry. Initialization reliability is continuously monitored to ensure highest quality.

Electrical specifications

Feature	Specification
Power	
Internal	Integrated internal battery 7.4 V, 7800 mA-hr, Lithium-ion Internal battery canoperate as a UPS in the event of external power source outage Internal battery will charge from external power source when input voltage is >15 V or via Power over Ethernet supply
External	Power input on Lemo 7P0S has a user-defined cut off threshold of 9.5 V or higher. Power source supply (Internal / External) is hot swap capable in the event of power source removal or cut-off Power input on Lemo ports is 9.5 V to 28 V DC external power input with over-voltage protection Receiver will auto power on when connected to external power of a user-defined voltage. The default value is 15 V.
Power over Ethernet	Requires a Class 3 Ethernet power supply.
Power consumption	4.3 W typical when using a Zephyr Geodetic 2 antenna
Reference station operation times on internal battery	Up to 12 hours
Certification	Part 15.247 FCC certifications Class B Device FCC Part 15 and ICES-003 certifications RSS-310 and RSS-210 Industry Canada certifications CE mark compliance C-tick mark compliance UN ST/SG/AC.10.11/Rev. 3, Amend. 1 (Li-Ion Battery) UN ST/SG/AC. 10/27/Add. 2 (Li-Ion Battery) WEEE

Communication specifications

Feature	Specification
Communications	
Port 1 (D9 male)	Full 9-wire RS-232
Port 2 (OS 7P Lemo)	3-wire RS-232, 1PPS output, event input, DC power input
Port 3 (OS 7P Lemo)	5-wire RS-232, DC power input
RJ45 Jack	Ethernet, PoE

Feature	Specification
Bluetooth	Fully integrated, fully sealed 2.4 GHz Bluetooth[1]
External GSM/GPRS, cellular phone support	Cellular phone or GSM/GPRS modem inside TSC2™ controller
Receiver position update rate	1 Hz, 2 Hz, 5 Hz, 10 Hz, and 20 Hz positioning
Data Input and Output	CMR, CMR+™, RTCM 2.3, RTCM 3.1
Outputs	NMEA, GSOF, RT17, RT27, BINEX

[1] Bluetooth type approvals are country specific. Contact your local Trimble office or representative for more information.

APPENDIX

A

NMEA-0183 Output

In this appendix:

This appendix describes the formats of the subset of NMEA-0183 messages that are available for output by the receivers. For a copy of the NMEA-0183 Standard, go to the National Marine Electronics Association website at www.nmea.org.

NMEA-0183 message overview

When NMEA-0183 output is enabled, a subset of NMEA-0183 messages can be output to external instruments and equipment connected to the receiver serial ports. These NMEA-0183 messages let external devices use selected data collected or computed by the GNSS receiver.

All messages conform to the NMEA-0183 version 3.01 format. All begin with $ and end with a carriage return and a line feed. Data fields follow comma (,) delimiters and are variable in length. Null fields still follow comma (,) delimiters but contain no information.

An asterisk (*) delimiter and checksum value follow the last field of data contained in an NMEA-0183 message. The checksum is the 8-bit exclusive of all characters in the message, including the commas between fields, but not including the $ and asterisk delimiters. The hexadecimal result is converted to two ASCII characters (0-9, A-F). The most significant character appears first.

The following table summarizes the set of NMEA messages supported by the receiver, and shows the page that contains detailed information about each message.

Message	Function	Page
ADV	Position and Satellite information for RTK network operations	84
GGA	Time, position, and fix related data	85
GSA	GPS DOP and active satellites	86
GST	Position error statistics	87
GSV	Number of SVs in view, PRN, elevation, azimuth, and SNR	88
HDT	Heading from True North	89
PTNL,AVR	Time, yaw, tilt, range, mode, PDOP, and number of SVs for Moving Baseline RTK	90
PTNL,GGK	Time, position, position type and DOP values	91
PTNL,PJK	Local coordinate position output	92
PTNL,VGK	Time, locator vector, type and DOP values	93
PTNL,VHD	Heading Information	94
RMC	Position, Velocity, and Time	95
ROT	Rate of turn	96
VTG	Actual track made good and speed over ground	97
ZDA	UTC day, month, and year, and local time zone offset	98

Common message elements

Each message contains:

- a message ID consisting of *$GP* followed by the message type. For example, the message ID of the GGA message is *$GPGGA*.
- a comma
- a number of fields, depending on the message type, separated by commas
- an asterisk
- a checksum value

Below is an example of a simple message with a message ID ($GPGGA), followed by 13 fields and a checksum value:

$GPGGA,172814.0,3723.46587704,N,12202.26957864,W,2,6,1.2,18.893,M,-25.669,M,2.0,0031*4F

Message values

NMEA messages that the receiver generates contain the following values.

Latitude and longitude

Latitude is represented as *ddmm.mmmm* and longitude is represented as *dddmm.mmmm*, where:

- *dd* or *ddd* is degrees
- *mm.mmmm* is minutes and decimal fractions of minutes

Direction

Direction (north, south, east, or west) is represented by a single character: *N*, *S*, *E*, or *W*.

Time

Time values are presented in Universal Time Coordinated (UTC) and are represented as *hhmmss.cc*, where:

- *hh* is hours, from 00 through 23
- *mm* is minutes
- *ss* is seconds
- *cc* is hundredths of seconds

NMEA messages

When NMEA-0183 output is enabled, the following messages can be generated.

ADV Position and Satellite information for RTK network operations

An example of the ADV message string is shown below. Table A.1 and Table A.2 describe the message fields. The messages alternate between subtype 110 and 120.

$PGPPADV,110,39.88113582,-105.07838455,1614.125*1M

Table A.1 ADV subtype 110 message fields

Field	Meaning
0	message ID $PPGPADV
1	Message sub-type 110
2	Latitude
3	Longitude
4	Ellipsoid height
6	Elevation of second satellite, in degrees, 90° maximum
7	Azimuth of second satellite, degrees from True North, 000° through 359°
8	The checksum data, always begins with *

$PGPPADV,120,21,76.82,68.51,29,20.66,317.47,28,52.38,276.81,22,42.26,198.96*5D

Table A.2 ADV subtype 120 message fields

Field	Meaning
0	message ID $PPGPADV
1	Message sub-type 120
2	First SV PRN number
3	Elevation of first satellite, in degrees, 90° maximum
4	Azimuth of first satellite, degrees from True North, 000° through 359°
5	Second SV PRN number
6	Elevation of second satellite, in degrees, 90° maximum
7	Azimuth of second satellite, degrees from True North, 000° through 359°
8	The checksum data, always begins with *

GGA Time, Position, and Fix Related Data

An example of the GGA message string is shown below. Table A.3 describes the message fields.

$GPGGA,172814.0,3723.46587704,N,12202.26957864,W,
2,6,1.2,18.893,M,-25.669,M,2.0,0031*4F

Table A.3 GGA message fields

Field	Meaning
0	message ID $GPGGA
1	UTC of position fix
2	Latitude
3	Direction of latitude: N: North S: South
4	Longitude
5	Direction of longitude: E: East W: West
6	GPS Quality indicator: 0: Fix not valid 1: GPS fix 2: Differential GPS fix 4: Real Time Kinematic, fixed integers 5: Real Time Kinematic, float integers
7	Number of SVs in use, range from 00 through 12
8	HDOP
9	Orthometric height (MSL reference)
10	M: unit of measure for orthometric height is meters
11	Geoid separation
12	M: geoid separation is measured in meters
13	Age of differential GPS data record, Type 1 or Type 9. Null field when DGPS is not used.
14	Reference station ID, ranging from 0000 through 1023. A null field when any reference station ID is selected and no corrections are received.
15	The checksum data, always begins with *

GSA GPS DOP and active satellites

An example of the GSA message string is shown below. Table A.4 describes the message fields.

$GPGSA,<1>,<2>,<3>,<3>,,,,,<3>,<3>,<3>,<4>,<5>,<6>*<7><CR><LF>

Table A.4 GSA message fields

Field	Meaning
0	message ID $GPGSA
1	Mode 1, M = manual, A = automatic
2	Mode 2, Fix type, 1 = not available, 2 = 2D, 3 = 3D
3	PRN number, 01 through 32, of satellite used in solution, up to 12 transmitted
4	PDOP-Position dilution of precision, 0.5 through 99.9
5	HDOP-Horizontal dilution of precision, 0.5 through 99.9
6	VDOP-Vertical dilution of precision, 0.5 through 99.9
7	The checksum data, always begins with *

GST Position Error Statistics

An example of the GST message string is shown below. Table A.5 describes the message fields.

$GPGST,172814.0,0.006,0.023,0.020,273.6,0.023,0.020,0.031*6A

Table A.5 GST message fields

Field	Meaning
0	message ID $GPGST
1	UTC of position fix
2	RMS value of the pseudorange residuals; includes carrier phase residuals during periods of RTK(float) and RTK(fixed) processing
3	Error ellipse semi-major axis 1 sigma error, in meters
4	Error ellipse semi-minor axis 1 sigma error, in meters
5	Error ellipse orientation, degrees from true north
6	Latitude 1 sigma error, in meters
7	Longitude 1 sigma error, in meters
8	Height 1 sigma error, in meters
9	The checksum data, always begins with *

GSV Satellite Information

The GSV message string identifies the number of SVs in view, the PRN numbers, elevations, azimuths, and SNR values. An example of the GSV message string is shown below. Table A.6 describes the message fields.

$GPGSV,4,1,13,02,02,213,,03,-3,000,,11,00,121,,14,13,172,05*67

Table A.6 GSV message fields

Field	Meaning
0	message ID $GPGSV
1	Total number of messages of this type in this cycle
2	Message number
3	Total number of SVs visible
4	SV PRN number
5	Elevation, in degrees, 90° maximum
6	Azimuth, degrees from True North, 000° through 359°
7	SNR, 00–99 dB (null when not tracking)
8–11	Information about second SV, same format as fields 4 through 7
12–15	Information about third SV, same format as fields 4 through 7
16–19	Information about fourth SV, same format as fields 4 through 7
20	The checksum data, always begins with *

HDT Heading from True North

The HDT string is shown below, and Table A.7 describes the message fields.

$GPHDT,123.456,T*00

Table A.7 Heading from true north fields

Field	Meaning
0	message ID $GPHDT
1	Heading in degrees
2	T: Indicates heading relative to True North
3	The checksum data, always begins with *

PTNL,AVR

Time, Yaw, Tilt, Range for Moving Baseline RTK

The PTNL,AVR message string is shown below, and Table A.8 describes the message fields.

$PTNL,AVR,181059.6,+149.4688,Yaw,+0.0134,Tilt,,,60.191,3,2.5,6*00

Table A.8 AVR message fields

Field	Meaning
0	message ID $PTNL,AVR
1	UTC of vector fix
2	Yaw angle in degrees
3	Yaw
4	Tilt angle in degrees
5	Tilt
6	Reserved
7	Reserved
8	Range in meters
9	GPS quality indicator: 0: Fix not available or invalid 1: Autonomous GPS fix 2: Differential carrier phase solution RTK (Float) 3: Differential carrier phase solution RTK (Fix) 4: Differential code-based solution, DGPS
10	PDOP
11	Number of satellites used in solution
12	The checksum data, always begins with *

PTNL,GGK Time, Position, Position Type, DOP

An example of the PTNL,GGK message string is shown below. Table A.9 describes the message fields.

$PTNL,GGK,172814.00,071296,3723.46587704,N,12202.26957864,W,3,06,1.7,EHT-6.777,M*48

Table A.9 PTNL,GGK message fields

Field	Meaning
0	message ID $PTNL,GGA
1	UTC of position fix
2	Date
3	Latitude
4	Direction of latitude: N: North S: South
5	Longitude
6	Direction of Longitude: E: East W: West
7	GPS Quality indicator: 0: Fix not available or invalid 1: Autonomous GPS fix 2: Differential, floating carrier phase integer-based solution, RTK(float) 3: Differential, fixed carrier phase integer-based solution, RTK(fixed) 4: Differential, code phase only solution (DGPS). Also, OmniSTAR XP/HP converging 5: SBAS solution – WAAS, EGNOS 6: RTK Float 3D in a VRS/Network. Also OmniSTAR XP/HP converged 7: RTK Fixed 3D in a VRS/Network 8: RTK Float 2D in a VRS/Network
8	Number of satellites in fix
9	DOP of fix
10	Ellipsoidal height of fix
11	M: ellipsoidal height is measured in meters
12	The checksum data, always begins with *

Note – *The PTNL,GGK message is longer than the NMEA-0183 standard of 80 characters.*

PTNL,PJK Local Coordinate Position Output

An example of the PTNL,PJK message string is shown below. Table A.10 describes the message fields.

$PTNL,PJK,010717.00,081796,+732646.511,N,+1731051.091,E,1,05,2.7,EHT-28.345,M*7C

Table A.10 PTNL,PJK message fields

Field	Meaning
0	message ID $PTNL,PJK
1	UTC of position fix
2	Date
3	Northing, in meters
4	Direction of Northing will always be N (North)
5	Easting, in meters
6	Direction of Easting will always be E (East)
7	GPS Quality indicator: 0: Fix not available or invalid 1: Autonomous GPS fix 2: Differential, floating carrier phase integer-based solution, RTK(float) 3: Differential, fixed carrier phase integer-based solution, RTK(fixed) 4: Differential, code phase only solution (DGPS). Also, OmniSTAR XP/HP converging 5: SBAS solution – WAAS, EGNOS 6: RTK Float 3D in a VRS/Network. Also OmniSTAR XP/HP converged 7: RTK Fixed 3D in a VRS/Network 8: RTK Float 2D in a VRS/Network
8	Number of satellites in fix
9	DOP of fix
10	Ellipsoidal height of fix
11	M: ellipsoidal height is measured in meters
12	The checksum data, always begins with *

Note – *The PTNL,PJK message is longer than the NMEA-0183 standard of 80 characters.*

PTNL,VGK Vector Information

An example of the PTNL,VGK message string is shown below. Table A.11 describes the message fields.

$PTNL,VGK,160159.00,010997,-0000.161,00009.985,-0000.002,3,07,1,4,M*0B

Table A.11 PTNL,VGK message fields

Field	Meaning
0	message ID $PTNL,VGK
1	UTC of vector in hhmmss.ss format
2	Date in mmddyy format
3	East component of vector, in meters
4	North component of vector, in meters
5	Up component of vector, in meters
6	GPS Quality indicator: 0: Fix not available or invalid 1: Autonomous GPS fix 2: Differential, floating carrier phase integer-based solution, RTK(float) 3: Differential, fixed carrier phase integer-based solution, RTK(fixed) 4: Differential, code phase only solution (DGPS). Also, OmniSTAR XP/HP converging 5: SBAS solution – WAAS, EGNOS 6: RTK Float 3D in a VRS/Network. Also OmniSTAR XP/HP converged 7: RTK Fixed 3D in a VRS/Network 8: RTK Float 2D in a VRS/Network
7	Number of satellites if fix solution
8	DOP of fix
9	M: Vector components are in meters
10	The checksum data, always begins with *

PTNL,VHD Heading Information

An example of the PTNL,VHD message string is shown below. Table A.12 describes the message fields.

$PTNL,VHD,030556.00,093098,187.718,-22.138,-76.929,-5.015,0.033,0.006,3,07,2.4,M*22

Table A.12 PTNL,VHD message fields

Field	Meaning
0	message ID $PTNL,VHD
1	UTC of position in hhmmss.ss format
2	Date in mmddyy format
3	Azimuth
4	ΔAzimuth/ΔTime
5	Vertical Angle
6	ΔVertical/ΔTime
7	Range
8	ΔRange/ΔTime
9	GPS Quality indicator: 0: Fix not available or invalid 1: Autonomous GPS fix 2: Differential, floating carrier phase integer-based solution, RTK(float) 3: Differential, fixed carrier phase integer-based solution, RTK(fixed) 4: Differential, code phase only solution (DGPS). Also, OmniSTAR XP/HP converging 5: SBAS solution – WAAS, EGNOS 6: RTK Float 3D in a VRS/Network. Also OmniSTAR XP/HP converged 7: RTK Fixed 3D in a VRS/Network 8: RTK Float 2D in a VRS/Network
10	Number of satellites used in solution
11	PDOP
12	The checksum data, always begins with *

RMC Position, Velocity, and Time

The RMC string is shown below, and Table A.13 describes the message fields.

$GPRMC,123519,A,4807.038,N,01131.000,E,022.4,084.4,230394,003.1,W*6A

Table A.13 GPRMC message fields

Field	Meaning
0	message ID $GPRMC
1	UTC of position fix
2	Status A=active or V=void
3	Latitude
4	Longitude
5	Speed over the ground in knots
6	Track angle in degrees (True)
7	Date
8	Magnetic variation in degrees
9	The checksum data, always begins with *

ROT Rate and Direction of Turn

The ROT string is shown below, and Table A.14 describes the message fields.

$GPROT,35.6,A*4E

Table A.14 ROT message fields

Field	Meaning
0	message ID $GPROT
1	Rate of turn, degrees/minutes, "–" indicates bow turns to port
2	A: Valid data V: Invalid data
3	The checksum data, always begins with *

VTG Over Ground and Speed Over Ground or Track Made Good and Speed Over Ground

An example of the VTG message string is shown below. Table A.15 describes the message fields.

$GPVTG,,T,,M,0.00,N,0.00,K*4E

Table A.15 VTG message fields

Field	Meaning
0	message ID $GPVTG
1	Track made good (degrees true)
2	T: track made good is relative to true north
3	Track made good (degrees magnetic)
4	M: track made good is relative to magnetic north
5	Speed, in knots
6	N: speed is measured in knots
7	Speed over ground in kilometers/hour (kph)
8	K: speed over ground is measured in kph
9	The checksum data, always begins with *

ZDA UTC Day, Month, And Year, and Local Time Zone Offset

An example of the ZDA message string is shown below. Table A.16 describes the message fields.

$GPZDA,172809,12,07,1996,00,00*45

Table A.16 ZDA message fields

Field	Meaning
0	message ID $GPZDA
1	UTC
2	Day, ranging between 01 and 31
3	Month, ranging between 01 and 12
4	Year
5	Local time zone offset from GMT, ranging from 00 through ±13 hours
6	Local time zone offset from GMT, ranging from 00 through 59 minutes
7	The checksum data, always begins with *

Fields 5 and 6 together yield the total offset. For example, if field 5 is –5 and field 6 is +15, local time is 5 hours and 15 minutes earlier than GMT.

APPENDIX

B

Upgrading the Receiver Firmware

In this appendix:

The receiver is supplied with the latest version of the receiver firmware already installed. If a later version of the firmware becomes available, use the WinFlash utility to upgrade the firmware on your receiver.

Firmware updates are available to download from the Trimble website. Go to www.trimble.com/Support and select the link to the receiver that you need updates for and then click Downloads. Running the WinFlash installer installs the appropriate files to your hard drive.

You can also upgrade the NetR8 receiver through the web interface. The firmware file required to upgrade the receiver through the Web interface is located in C:\Program Files\Trimble\WinFlash\Firmware. The file type required is the format wm_vxxx.img where xxx represents the version of firmware.

The WinFlash utility

The WinFlash utility communicates with Trimble products to perform various functions including:

- installing software, firmware, and option upgrades
- running diagnostics (for example, retrieving configuration information)
- configuring radios

For more information, online help is also available when using the WinFlash utility.

Note – *The WinFlash utility runs on Microsoft Windows XP operating systems.*

Installing the WinFlash utility

You can install the WinFlash utility from the *Trimble GNSS Reference Receivers CD*, or from the Trimble website.

To install the WinFlash utility from the CD:

1. Insert the disk into the CD drive on your computer.
2. From the main menu select *Install individual software packages*.
3. Select *Install WinFlash*.
4. Follow the on-screen instructions.

The WinFlash utility guides you through the firmware upgrade process, as described below. For more information, refer to the *WinFlash Help*.

Upgrading the receiver firmware

1. Start the WinFlash utility. The *Device Configuration* screen appears.
2. From the *Device type* list, select your receiver.
3. From the *PC serial port* field, select the serial (COM) port on the computer that the receiver is connected to and then click **Next**.

   The *Operation Selection* screen appears. The *Operations* list shows all of the supported operations for the selected device. A description of the selected operation is shown in the *Description* field.
4. Select *Load GPS software* and then click **Next**.

   The *GPS Software Selection* window appears. This screen prompts you to select the software that you want to install on the receiver.
5. From the *Available Software* list, select the latest version and then click **Next**.

   The *Settings Review* window appears. This screen prompts you to connect the receiver, suggests a connection method, and then lists the receiver configuration and selected operation.

6. If all is correct, click **Finish**.

   Based on the selections shown above, the *Software Upgrade* window appears and shows the status of the operation (for example, Establishing communication with <your receiver>. Please wait.).

7. Click **OK**.

   The *Software Upgrade* window appears again and states that the operation was completed successfully.

8. To select another operation, click **Menu**; to quit, click **Exit**.

   If you click **Exit**, the system prompts you to confirm.

9. Click **OK**.

Forcing the receiver into Monitor mode

If the receiver will not go into Monitor mode to load new firmware, complete the following steps:

1. Turn off the receiver.
2. Press and hold Esc while turning on the receiver.
3. Continue to hold the Esc button as the display shows the countdown timer.
4. Once the display shows Remote Monitor Active:1, release the Esc button.
5. The receiver is forced into Monitor mode and you can load the new firmware.

APPENDIX

C

Troubleshooting

In this appendix:

- Receiver issues

Use this appendix to identify and solve common problems that may occur with the receiver.

Please read this section before you contact Technical Support.

Receiver issues

This section describes some possible receiver issues, possible causes, and how to solve them.

Issue	Possible cause	Solution
The receiver does not turn on.	External power is too low.	Check the charge on the external battery and, if applicable, check the fuse.
	Internal power is too low.	Check the charge on the internal battery.
	External power is not properly connected.	Check that the Lemo connector is seated correctly and that the cable is secured to the receiver.
		Check for broken or bent pins in the connector.
	Faulty power cable.	Check that you are using the correct cable for the port/battery.
		Check that the correct battery is connected to a particular port.
		Check pinouts with a multimeter to ensure internal wiring is intact.
Receiver does not log data.	Insufficient memory.	Delete old files. Do one of the following: • Press ⏻ for 35 seconds. • Use the delete and purge functions in the *Data Logging* menu of the web interface.
	The receiver is tracking fewer than four satellites.	Wait until the receiver display shows that more than four satellites are being tracked.
	The internal memory needs to be reformatted	Press ⏻ for 35 seconds.
The receiver is not responding.	Receiver needs a soft reset.	Turn off the receiver and then turn it back on again.
	Receiver needs a full reset.	Press ⏻ for 35 seconds.
The reference station receiver is not broadcasting	Port settings between reference receiver and radio are incorrect.	Check the port settings for the receiver by using the front panel or the Web interface. Check that the radio ports are correctly set up.
	Faulty cable between receiver and radio.	Try a different cable.
		Examine the ports for missing pins.
		Use a multimeter to check pinouts.
	No power to radio.	If the radio has its own power supply, check the charge and connections.
Rover receiver is not receiving radio.	The base station receiver is not broadcasting.	See the issue,The base station receiver is not broadcasting. above.
	Incorrect over air baud rates between reference and rover.	Connect to the rover receiver radio, and make sure that it has the same setting as the reference receiver.
	Incorrect port settings between roving external radio and receiver.	If the radio is receiving data and the receiver is not getting radio communications, use the SCS900 software to check that the port settings are correct.
	The radio antenna cable and GNSS antenna cable are mixed up.	Make sure that the external radio antenna cable is connected between the TNC connector marked RADIO and the radio antenna.

Issue	Possible cause	Solution
The receiver is not receiving satellite signals	The GNSS antenna cable is loose.	Make sure that the GNSS antenna cable is tightly seated in the antenna connection on the GNSS antenna.
	The cable is damaged.	Check the cable for any signs of damage. A damaged cable can inhibit signal detection from the antenna at the receiver.
	The GNSS antenna is not in clear line of sight to the sky.	• Make sure that the GNSS antenna is located with a clear view of the sky. • Restart the receiver as a last resort (turn off and then turn it on again).

Glossary

almanac
A file that contains orbit information on all the satellites, clock corrections, and atmospheric delay parameters. The almanac is transmitted by a GPS satellite to a GPS receiver, where it facilitates rapid acquisition of GPS signals when you start collecting data, or when you have lost track of satellites and are trying to regain GPS signals.

The orbit information is a subset of the emphemeris / ephemerides data.

base station
Also called *reference station*. A base station in construction, is a receiver placed at a known point on a jobsite that tracks the same satellites as an RTK rover, and provides a real-time differential correction message stream through radio to the rover, to obtain centimeter level positions on a continuous real-time basis. A base station can also be a part of a virtual reference station network, or a location at which GPS observations are collected over a period of time, for subsequent postprocessing to obtain the most accurate position for the location.

BINEX
BInary EXchange format. BINEX is an operational binary format standard for GPS/GLONASS/SBAS research purposes. It has been designed to grow and allow encapsulation of all (or most) of the information currently allowed for in a range of other formats.

broadcast server
An Internet server that manages authentication and password control for a network of VRS servers, and relays VRS corrections from the VRS server that you select.

carrier
A radio wave having at least one characteristic (such as frequency, amplitude, or phase) that can be varied from a known reference value by modulation.

carrier frequency
The frequency of the unmodulated fundamental output of a radio transmitter. The GPS L1 carrier frequency is 1575.42 MHz.

carrier phase
The time taken for the L1 or L2 carrier signal generated by the satellite to reach the GPS receiver. Measuring the number of carrier waves between the satellite and receiver is a very accurate method of calculating the distance between them.

cellular modems
A wireless adaptor that connects a laptop computer to a cellular phone system for data transfer. Cellular modems, which contain their own antennas, plug into a PC Card slot or into the USB port of the computer and are available for a variety of wireless data services such as GPRS.

CMR
CMR+
Compact Measurement Record. A real-time message format developed by Trimble for broadcasting corrections to other Trimble receivers. CMR is a more efficient alternative to RTCM.

covanance
The mean value.

datum

Also called *geodetic datum*. A mathematical model designed to best fit the geoid, defined by the relationship between an ellipsoid and, a point on the topographic surface, established as the origin of the datum. World geodetic datums are typically defined by the size and shape of an ellipsoid and the relationship between the center of the ellipsoid and the center of the earth.

Because the earth is not a perfect ellipsoid, any single datum will provide a better model in some locations than in others. Therefore, various datums have been established to suit particular regions.

For example, maps in Europe are often based on the European datum of 1950 (ED-50). Maps in the United States are often based on the North American datum of 1927 (NAD-27) or 1983 (NAD-83).

All GPS coordinates are based on the WGS-84 datum surface.

deep discharge

Withdrawal of all electrical energy to the end-point voltage before the cell or battery is recharged.

DGPS

See real-time differential GPS.

differential correction

Differential correction is the process of correcting GPS data collected on a rover with data collected simultaneously at a base station. Because the base station is on a known location, any errors in data collected at the base station can be measured, and the necessary corrections applied to the rover data.

Differential correction can be done in real-time, or after the data has been collected by postprocessing.

differential GPS

See real-time differential GPS.

DOP

Dilution of Precision. A measure of the quality of GPS positions, based on the geometry of the satellites used to compute the positions. When satellites are widely spaced relative to each other, the DOP value is lower, and position accuracy is greater. When satellites are close together in the sky, the DOP is higher and GPS positions may contain a greater level of error.

PDOP (Position DOP) indicates the three-dimensional geometry of the satellites. Other DOP values include HDOP (Horizontal DOP) and VDOP (Vertical DOP), which indicate the accuracy of horizontal measurements (latitude and longitude) and vertical measurements respectively. PDOP is related to HDOP and VDOP as follows: $PDOP^2 = HDOP^2 + VDOP^2$

dual-frequency GPS

A type of receiver that uses both L1 and L2 signals from GPS satellites. A dual-frequency receiver can compute more precise position fixes over longer distances and under more adverse conditions because it compensates for ionospheric delays.

EGNOS

European Geostationary Navigation Overlay Service. A satellite-based augmentation system (SBAS) that provides a free-to-air differential correction service for GPS. EGNOS is the European equivalent of WAAS, which is available in the United States.

elevation mask

The angle below which the receiver will not track satellites. Normally set to 10 degrees to avoid interference problems caused by buildings and trees, and multipath errors.

ellipsoid

An ellipsoid is the three-dimensional shape that is used as the basis for mathematically modeling the earth's surface. The ellipsoid is defined by the lengths of the minor and major axes. The earth's minor axis is the polar axis and the major axis is the equatorial axis.

emphemeris / ephemerides

A list of predicted (accurate) positions or locations of satellites as a function of time. A set of numerical parameters that can be used to determine a satellite's position. Available as broadcast ephemeris or as postprocessed precise ephemeris.

epoch The measurement interval of a GPS receiver. The epoch varies according to the measurement type: for real-time measurement it is set at one second; for postprocessed measurement it can be set to a rate of between one second and one minute. For example, if data is measured every 15 seconds, loading data using 30-second epochs means loading every alternate measurement.

feature A feature is a physical object or event that has a location in the real world, which you want to collect position and/or descriptive information (attributes) about. Features can be classified as surface or non-surface features, and again as points, lines/breaklines, or boundaries/areas.

firmware The program inside the receiver that controls receiver operations and hardware.

GLONASS Global Orbiting Navigation Satellite System. GLONASS is a Soviet space-based navigation system comparable to the American GPS system. The operational system consists of 21 operational and 3 non-operational satellites in 3 orbit planes.

GNSS Global Navigation Satellite System.

GSOF General Serial Output Format. A Trimble proprietary message format.

HDOP Horizontal Dilution of Precision. HDOP is a DOP value that indicates the accuracy of horizontal measurements. Other DOP values include VDOP (vertical DOP) and PDOP (Position DOP).

Using a maximum HDOP is ideal for situations where vertical precision is not particularly important, and your position yield would be decreased by the vertical component of the PDOP (for example, if you are collecting data under canopy).

L1 The primary L-band carrier used by GPS satellites to transmit satellite data.

L2 The secondary L-band carrier used by GPS satellites to transmit satellite data.

L5 The third L-band carrier used by GPS satellites to transmit satellite data. L5 will provide a higher power level than the other carriers. As a result, acquiring and tracking weak signals will be easier.

MSAS MTSAT Satellite-Based Augmentation System. A satellite-based augmentation system (SBAS) that provides a free-to-air differential correction service for GPS. MSAS is the Japanese equivalent of WAAS, which is available in the United States.

multi-frequency GPS A type of receiver that uses multiple carrier phase measurements (L1, L2, and L5) from different satellite frequencies.

multipath Interference, similar to ghosts on a television screen, that occurs when GPS signals arrive at an antenna having traversed different paths. The signal traversing the longer path yields a larger pseudorange estimate and increases the error. Multiple paths can arise from reflections off the ground or off structures near the antenna.

NMEA National Marine Electronics Association. NMEA 0183 defines the standard for interfacing marine electronic navigational devices. This standard defines a number of 'strings' referred to as NMEA strings that contain navigational details such as positions. Most Trimble GPS receivers can output positions as NMEA strings.

OmniSTAR The OmniSTAR HP/XP service allows the use of new generation dual-frequency receivers with the OmniSTAR service. The HP/XP service does not rely on local reference stations for its signal, but utilizes a global satellite monitoring network. Additionally, while most current dual-frequency GPS systems are accurate to within a meter or so, OmniSTAR with XP is accurate in 3D to better than 30 cm.

PDOP	Position Dilution of Precision. PDOP is a DOP value that indicates the accuracy of three-dimensional measurements. Other DOP values include VDOP (vertical DOP) and HDOP (Horizontal Dilution of Precision). Using a maximum PDOP value is ideal for situations where both vertical and horizontal precision are important.
postprocessing	Postprocessing is the processing of satellite data after it has been collected, in order to eliminate error. This involves using computer software to compare data from the rover with data collected at the base station.
real-time differential GPS	Also known as *real-time differential correction* or *DGPS*. Real-time differential GPS is the process of correcting GPS data as you collect it. Corrections are calculated at a base station and then sent to the receiver through a radio link. As the rover receives the position it applies the corrections to give you a very accurate position in the field. Most real-time differential correction methods apply corrections to code phase positions. RTK uses carrier phase measurements. While DGPS is a generic term, its common interpretation is that it entails the use of single-frequency code phase data sent from a GPS base station to a rover GPS receiver to provide sub-meter position accuracy. The rover receiver can be at a long range (greater than 100 kms (62 miles)) from the base station.
reference station	See base station.
rover	A rover is any mobile GPS receiver that is used to collect or update data in the field, typically at an unknown location.
Roving mode	Roving mode applies to the use of a rover receiver to collect data, stakeout, or control earthmoving machinery in real time using RTK techniques.
RTCM	Radio Technical Commission for Maritime Services. A commission established to define a differential data link for the real-time differential correction of roving GPS receivers. There are three versions of RTCM correction messages. All Trimble GPS receivers use Version 2 protocol for single-frequency DGPS type corrections. Carrier phase corrections are available on Version 2, or on the newer Version 3 RTCM protocol, which is available on certain Trimble dual-frequency receivers. The Version 3 RTCM protocol is more compact but is not as widely supported as Version 2.
RTK	real-time kinematic. A real-time differential GPS method that uses carrier phase measurements for greater accuracy.
SBAS	Satellite-Based Augmentation System. SBAS is based on differential GPS, but applies to wide area (WAAS/EGNOS and MSAS) networks of reference stations. Corrections and additional information are broadcast via geostationary satellites.
signal-to-noise ratio	SNR. The signal strength of a satellite is a measure of the information content of the signal, relative to the signal's noise. The typical SNR of a satellite at 30° elevation is between 47 and 50 dBHz. The quality of a GPS position is degraded if the SNR of one or more satellites in the constellation falls below 39.
skyplot	The satellite skyplot confirms reception of a differentially corrected GPS signal and displays the number of satellites tracked by the GPS receiver, as well as their relative positions.
SNR	See signal-to-noise ratio.
UTC	Universal Time Coordinated. A time standard based on local solar mean time at the Greenwich meridian.

VRS

Virtual Reference Station. A VRS system consists of GNSS hardware, software, and communication links. It uses data from a network of reference stations to provide corrections to each rover that are more accurate than corrections from a single base station.

To start using VRS corrections, the rover sends its position to the VRS server. The VRS server uses the reference station data to model systematic errors (such as ionospheric noise) at the rover position. It then sends RTCM or CMR correction messages back to the rover.

WAAS

Wide Area Augmentation System. WAAS was established by the Federal Aviation Administration (FAA) for flight and approach navigation for civil aviation. WAAS improves the accuracy and availability of the basic GPS signals over its coverage area, which includes the continental United States and outlying parts of Canada and Mexico.

The WAAS system provides correction data for visible satellites. Corrections are computed from ground station observations and then uploaded to two geostationary satellites. This data is then broadcast on the L1 frequency, and is tracked using a channel on the GPS receiver, exactly like a GPS satellite.

Use WAAS when other correction sources are unavailable, to obtain greater accuracy than autonomous positions. For more information on WAAS, refer to the FAA website at http://gps.faa.gov.

The EGNOS service is the European equivalent and MSAS is the Japanese equivalent of WAAS.

WGS-84

World Geodetic System 1984. Since January 1987, WGS-84 has superseded WGS-72 as the datum used by GPS.

The WGS-84 datum is based on the ellipsoid of the same name.

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