USER GUIDE

Trimble BX982
GNSS Receiver Enclosure

Version 5.11
Revision A
December 2015

Corporate Office

Trimble Navigation Limited
Integrated Technologies
510 DeGuigne Drive
Sunnyvale, CA 94085
USA
www.trimble.com/gnss-inertial
Email: GNSSOEMSupport@trimble.com

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This is the December 2015 release (Revision A) of the BX982 GNSS Receiver Enclosure User Guide. It applies to version 5.11 of the receiver firmware.

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This notice applies to the BD910, BD920, BD920-W, BD920-W3G, BD930, BD930-UHF, BD935-INS, BD960, BD970, BD982, BX960, BX960-2, and BX982 receivers.
The U.S. Department of Commerce requires that all exportable GPS 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 1,000 knots, or its altitude is computed to be above 18,000 meters. The receiver GPS subsystem resets until the COCOM situation clears. As a result, all logging and stream configurations stop until the GPS subsystem is cleared.

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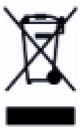

For product recycling instructions and more information, please go to www.trimble.com/Corporate/Environmental_Compliance.aspx.
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Trimble Europe BV
c/o Menlo Worldwide Logistics
Meerheide 45
5521 DZ Eersel, NL

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Introduction

- About the BX982 receiver
- BX982 features
- Receiver architecture
- Configuring the BX982 receiver
- Technical support

This manual describes how to set up, configure, and use the Trimble® BX982 GNSS receiver module. The receiver uses advanced navigation architecture to achieve real-time centimeter accuracies with minimal latencies.

Even if you have used other GNSS or GPS 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 or GPS, visit the Trimble website (www.trimble.com).

About the BX982 receiver

The BX982 receiver enclosure allows OEM and system integrator customers to rapidly integrate high accuracy GNSS into their applications. The receiver can be used as either a base station or a rover and is also suited for applications that require precise heading and attitude information in addition to position.

The receiver provides reliable operation in all environments, and a positioning interface to an office computer, external processing device, or control system. You can control the receiver through a serial or Ethernet port using binary interface commands or the web interface.

***Note** – Use the information in this manual with the BD982 GNSS Receiver User Guide.*

BX982 features

The receiver has the following features:

- Position antenna based a on 220-channel Trimble Maxwell™ 6 chip:
  - GPS: Simultaneous L1 C/A, L2E, L2C, L5
  - GLONASS: Simultaneous L1 C/A, L1 P, L2 C/A L2 P
  - SBAS: Simultaneous L1 C/A, L5
  - GALILEO: Simultaneous L1 BOC, E5A, E5B, E5AltBOC
  - BeiDou: Simultaneous B1, B2
  - QZSS: Simultaneous L1 C/A, L1 SAIF, L2C, L5
  - L-Band OmniSTAR VBS, HP, and XP
- Vector antenna based on a second 220-channel Maxwell 6 chip:
  - GPS: Simultaneous L1 C/A, L2E, L2C
  - GLONASS: Simultaneous L1 C/A, L1 P, L2 C/A, L2 P
  - BeiDou: Simultaneous B1
- Advanced Trimble Maxwell 6 Custom Survey GNSS Technology
- Very low noise GNSS carrier phase measurements with <1 mm precision in a 1 Hz bandwidth
- Proven Trimble low elevation tracking technology
- 1 USB port
- 1 CAN port

- 1 LAN Ethernet port:
  - Supports links to 10BaseT/100BaseT networks
  - All functions are performed through a single IP address simultaneously—including web interface access and raw data streaming
- Network Protocols supported:
  - HTTP (web interface)
  - NTP Server
  - NMEA, GSOF, CMR over TCP/IP or UDP
  - NTripCaster, NTripServer, NTripClient
  - mDNS/UPnP Service discovery
  - Dynamic DNS
  - Email alerts
  - Network link to Google Earth
  - Support for external modems through PPP
- 3 × RS-232 ports (baud rates up to 460,800)
- 1 Hz, 2 Hz, 5 Hz, 10 Hz, 20, and 50 Hz positioning and heading outputs (depending on the installed option)
- Up to 50 Hz raw measurement and position outputs
- Correction inputs/outputs: CMR, CMR+™, sCMRx, RTCM 2.1, 2.2, 2.3, 2.4, 3.X, and 3.2.
  Note:
  - The functionality to input or output any of these corrections depends on the installed options.
  - Different manufacturers may have established different packet structures for their correction messages. Thus, the BD9xx receivers may not receive corrections from other manufacturers' receivers, and other manufacturers' receivers may not be able to receive corrections from BD9xx receivers.
- Navigation outputs:
  - ASCII: NMEA-0183: GBS; GGA; GLL; GNS; GRS; GSA; GST; GSV; HDT; LLQ; PTNL,AVR; PTNL,BPQ; PTNL,DG; PFUGDP; DTM; PTNL,GGK; PTNL,PJK; PTNL,PJT, PTNL,VGK; PTNL,VHD; RMC; ROT; VTG; ZDA.
  - Binary: Trimble GSOF
- Control software: HTML Web browser (Google Chrome (recommended), Internet Explorer®, Mozilla Firefox, Apple Safari, Opera)
- 1 pulse-per-second (1PPS) output
- LED drive support

Receiver architecture

The BX982 receiver provides an enclosure for a single BD982 GNSS receiver. Simply connect power and antennas to create a complete GNSS system. Three LEDs indicate power, differential corrections, and satellite tracking status. Access to serial, Ethernet, and 1PPS is available through DB connectors.

When computing offsets from the main antenna to the point of interest at the vector antenna, or for consistent vehicle orientation, heading information is critical. The BX982 receiver contains a single BD982 receiver that can provide accuracy information between its two antennas. The technique of moving base RTK provides an accurate vector between the two antennas—primary (position) and secondary (vector). Moving base RTK vector outputs can be sent in ASCII or binary format through the board’s serial ports.

Configuring the BX982 receiver

Use this manual with the *BD982 GNSS Receiver User Guide*. All firmware features and software configuration utilities are documented in that manual.

The connectors support the following I/O. For more information, see BX982 receiver pinout information, page 19.

BX982 receiver I/O

Type	Connector
Serial Port 1	DB26 connector labeled Data/Power
Serial Port 2	
Ethernet	
USB	
1PPS	
Serial Port 4	DB9 connector labeled Port 4
CAN	DB9 connector labeled CAN

Configuring the BX982 receiver to output reference station data

1. Connect the computer to the DB9 port labeled GPS4 or use the provided adapter cable to connect to the DB26 port labeled Data/Power.
2. Do one of the following:
   - Enter a base station position using known coordinates (Web interface or binary commands).
   - Select the *Here* position (Web interface only), to set the base station position.
3. Use the Web interface or binary commands to enable CMR or RTCM outputs from serial Ports 1/Port 2 (using the Data/Power connector) or from serial Port 4.

Configuring the BX982 receiver to output rover RTK positions

1. Supply differential data to either the DB9 port labeled Port 4 or the DB26 port labeled Data/Power through Port 1, Port 2, Ethernet, or USB (depending on the available connector type).

   If there is an antenna attached, the differential data (middle) LED on receiver 1 lights up. This shows that you are receiving valid differential data. It does not show that you are computing a fixed solution. For additional details on LED functionality, operation and troubleshooting, refer to the Configuring the Receiver section of the www.trimble.com/OEM_receiverHelp/.

2. Connect the computer to the DB9 port labeled Port 4 or use the provided cable to connect to the DB26 port labeled Data/Power.
3. Use the Web interface to ensure that you are computing fixed solutions – RTK fix mode.
4. Use the Web interface or binary commands to enable the required ASCII (NMEA) or Binary (Data Collector Format Report Packets) messages from serial port 1, 2, 4, Ethernet, or USB.

Configuring the BX982 receiver to output heading data

1. Connect the computer to the DB9 port labeled Port 4 or use the provided adapter cable to connect to the DB26 port labeled Data/Power.

   The internal BD982 receiver automatically calculates heading between both its antennas (internal vector relative to true North) when both the antennas are connected and are tracking satellites.

2. When both the primary (position) and secondary (vector) antenna are connected, the receiver calculates the internal vector and heading. This can be confirmed by looking at the satellite-tracking LED on the device that displays the following blinking pattern: It blinks at 1 Hz for a 5 second interval, followed by a short high-frequency LED blinking burst.
3. Use the Web interface or binary commands to enable either:
   - ASCII messages (NMEA AVR/HDT – Internal vector; or NMEA VHD – External vector between primary position antenna of the BX982 and an external base station)
   - Binary (Report Packet 40h, Type 27 record) messages from any of the serial ports, Ethernet or USB outputs.

For more information

For more advanced information on how to configure the receivers inside the BX982 receiver enclosure, refer to the Configuring the Receiver section of the www.trimble.com/OEM_receiverHelp/.

Technical support

If you have a problem and cannot find the information you need in the product documentation, send an email to GNSSOEMSupport@trimble.com.

Documentation, firmware, and software updates are available at: www.intech.trimble.com/support/oem_gnss/receivers/trimble.

CHAPTER 2

Specifications

- Performance specifications
- Physical specifications
- Electrical specifications
- Environmental specifications
- Communication specifications
- Receiver drawings
- BX982 receiver pinout information

This chapter details the specifications for the receiver.

Specifications are subject to change without notice.

Performance specifications

Feature	Specification

Measurements	• Position antenna based on a 220-channel Maxwell 6 chip:
	  ◦ GPS: Simultaneous L1 C/A, L2E, L2C, L5
	  ◦ GLONASS: Simultaneous L1 C/A, L1 P, L2 C/A (GLONASS M only), L2 P
	  ◦ SBAS: Simultaneous L1 C/A, L5
	  ◦ GALILEO: Simultaneous L1 BOC, E5A, E5B, E5AltBOC
	  ◦ BeiDou: Simultaneous B1, B2
	  ◦ QZSS: Simultaneous L1 C/A, L1 SAIF, L2C, L5
	  ◦ L-Band OmniSTAR VBS, HP, and XP
	• Vector antenna based on a second 220-channel Maxwell 6 chip:
	  ◦ GPS: Simultaneous L1 C/A, L2E, L2C
	  ◦ GLONASS: Simultaneous L1 C/A, L1 P, L2 C/A, L2 P
	  ◦ BeiDou: Simultaneous B1
	• Advanced Trimble Maxwell™ 6 Custom Survey GNSS Technology
	• High precision multiple correlator for GNSS pseudorange measurements
	• Unfiltered, unsmoothed pseudorange measurements data for low noise, low multipath error, low time domain correlation and high dynamic response
	• Very low noise GNSS carrier phase measurements with <1 mm precision in a 1 Hz bandwidth
	• Signal-to-Noise ratios reported in dB-Hz

Code differential GPS positioning accuracy[1]	3D: Typically, < 1 m
SBAS accuracy[2]	<5 m 3DRMS
RTK positioning accuracy	Horizontal: ±(8 mm + 1 ppm) RMS Vertical: ±(15 mm + 1 ppm) RMS

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

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

Feature	Specification
(<30 km)	Heading: 2 m baseline <0.09°; 10 m baseline <0.05°
Initialization time	Typically, less than 10 seconds
Initialization reliability[1]	Typically >99.9%

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

Physical specifications

Feature	Specification
Dimensions (L x W x H)	261 mm x 140 mm x 55 mm
Weight	1.6 kg
Vibration	MIL810F, tailored Random 6.2 gRMS operating Random 8 gRMS survival
Mechanical shock	MIL810D ±40 g operating ±75 g survival
I/O connector	D-sub DE9 and DB26
Antenna connector	TNC

Electrical specifications

Feature	Specification
Voltage	9 V to 28 V DC external power input with over-voltage protection
Power consumption	Maximum 4.1 W (with both antennas connected)

Environmental specifications

Feature	Specification
Temperature	Operating: -40°C to 70°C (-40°F to 158°F)
	Storage: -55°C to 85°C (-67°F to 185°F)
Vibration	MIL810F, tailored Random 6.2 gRMS operating Random 8 gRMS survival
Mechanical shock	MIL810D +/- 40 g operating +/- 75 g survival
Operating humidity	5% to 95% R.H. non-condensing, at +60°C (140°F)

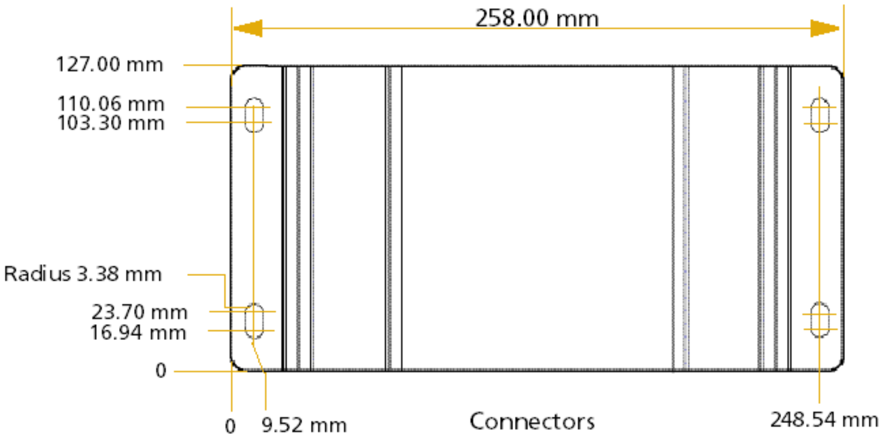
Communication specifications

Feature	Specification	
Communications	1 LAN port	• Supports links to 10BaseT/100BaseT networks. • All functions are performed through a single IP address simultaneously – including web interface access and data streaming.
	3 x RS-232 ports	Baud rates up to 460,800
	1 USB 2.0 port	
Receiver position update rate	1 Hz, 2 Hz, 5 Hz, 10 Hz, 20 Hz and 50 Hz positioning	
Correction data input	CMR, CMR+™, sCMRx, RTCM 2.0–2.4, RTCM 3.X, 3.1	
Correction data output	CMR, CMR+, sCMRx, RTCM 2.0 DGPS (select RTCM 2.1), RTCM 2.1–2.4, RTCM 3.X, 3.2	
Data outputs	1PPS, NMEA, Binary GSOF, ASCII Time Tags	

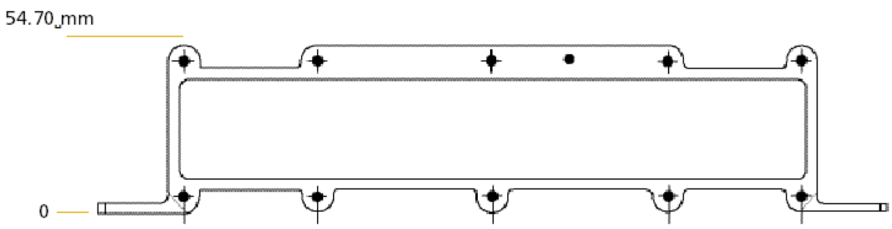
Receiver drawings

The following drawings show the dimensions of the BX982 receiver. Refer to these drawings if you need to build mounting brackets and housings for the receiver.

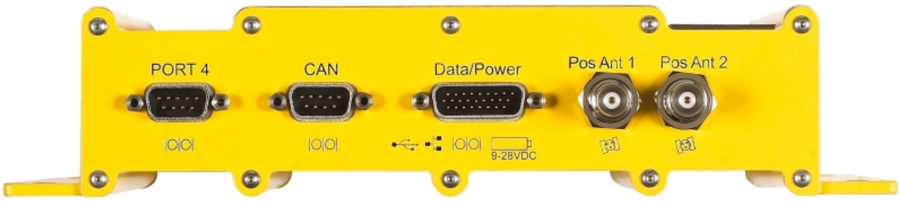
Plan view



Edge view



BX982 receiver pinout information



Port 4 pinout

Pin	Usage
1	Not connected
2	RS-232 RX data in (BD982 Port 4)
3	RS-232 TX data out (BD982 Port 4)
4	Not connected
5	GND
6	Not connected
7	Not connected
8	Not connected
9	Not connected

CAN pinout

Pin	Usage
1	Not connected
2	CAN-
3	Not connected
4	Not connected
5	GND

Pin	Usage
6	Not connected
7	CAN+
8	Not connected
9	Not connected

Data/power pinout

Pin	Usage
1	Not connected
2	Not connected
3	Not connected
4	Not connected
5	Not connected
6	GND
7	RS-232 Port 2 transmit data (TX)
8	RS-232 Port 2 receive data (RX)
9	USB +
10	Ethernet ground (ET_GND RJ45 Pin 4)
11	Not connected
12	RS-232 Port 1 transmit data (TX)
13	Ethernet ground (GND RH45 Pin 5)
14	Ethernet ground (GND RH45 Pin 8)
15	USB ID
16	Ethernet receive data- (RD-RJ45 Pin 6)
17	Ethernet transmit data- (TD-RJ45 Pin 2)
18	USB-

Pin	Usage
19	USB Power
20	1PPS
21	RS-232 Port 1 receive data (RX)
22	Ethernet ground (GNSD RJ45 Pin 7)
23	GND
24	DC power in, 9 – 28 V DC
25	Ethernet receive data+ (RD+ RJ45 Pin 3)
26	Ethernet transmit data+ (TD+ RJ45 Pin 1)

Troubleshooting Receiver Issues

This section describes some possible receiver issues, possible causes, and how to solve them. Please read this section before you contact Technical Support.

Issue	Possible cause	Solution
The receiver does not turn on.	External power is too low.	Check that the input voltage is within limits.
The base station receiver is not broadcasting.	Port settings between reference receiver and radio are incorrect.	Check the settings on the radio and the receiver.
	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.
		Examine the ports for missing pins.
		Use a multimeter to check pinouts.
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, check that the port settings are correct.
The receiver is	The GPS antenna cable is	Make sure that the GPS antenna cable is tightly

Issue	Possible cause	Solution
not receiving satellite signals.	loose.	seated in the GPS antenna connection on the GPS 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 GPS antenna is not in clear line of sight to the sky.	Make sure that the GPS 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

1PPS	Pulse-per-second. Used in hardware timing. A pulse is generated in conjunction with a time stamp. This defines the instant when the time stamp is applicable.
almanac	A file that contains orbit information on all the satellites, clock corrections, and atmospheric delay parameters. The almanac is transmitted by a GNSS satellite to a GNSS receiver, where it facilitates rapid acquisition of GNSS signals when you start collecting data, or when you have lost track of satellites and are trying to regain GNSS signals. The orbit information is a subset of the ephemeris/ephemerides data.
base station	Also called *reference station*. In construction, a base station 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 GNSS observations are collected over a period of time, for subsequent postprocessing to obtain the most accurate position for the location.
BeiDou	The BeiDou Navigation Satellite System (also known as BDS) is a Chinese satellite navigation system. The first BeiDou system (known as BeiDou-1), consists of four satellites and has limited coverage and applications. It has been offering navigation services mainly for customers in China and from neighboring regions since 2000. The second generation of the system (known as BeiDou-2) consists of satellites in a combination of geostationary, inclined geosynchronous, and medium earth orbit configurations. It became operational with coverage of China in December 2011. However, the complete Interface Control Document (which specifies the satellite messages) was not released until December 2012. BeiDou-2 is a regional navigation service which offers services to customers in the Asia-Pacific region. A third generation of the BeiDou system is planned, which will expand coverage globally. This generation is currently scheduled to be completed by 2020.
BINEX	BInary EXchange format. BINEX is an operational binary format standard for GPS/GLONASS/SBAS research purposes. It is 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	Is the cumulative phase count of the GPS or GLONASS carrier signal at a given time.
cellular modems	A wireless adapter 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.
CMRx	A real-time message format developed by Trimble for transmitting more satellite corrections resulting from more satellite signals, more constellations, and more satellites. Its compactness means more repeaters can be used on a site.
covariance	A statistical measure of the variance of two random variables that are observed or measured in the same mean time period. This measure is equal to the product of the deviations of corresponding values of the two variables from their respective means.
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 GNSS 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 is collected by postprocessing.
differential GPS	See real-time differential GPS.
DOP	Dilution of Precision. A measure of the quality of GNSS 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 precision is greater. When satellites are close together in the sky, the DOP is higher and GNSS 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 precision 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 GNSS. EGNOS is the European equivalent of WAAS, which is available in the United States.
elevation	The vertical distance from a geoid such as EGM96 to the antenna phase center. The geoid is sometimes referred to as Mean Sea Level.
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, atmospheric issues, 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.

EHT	Height above ellipsoid.
ephemeris/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 GNSS 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/break lines, or boundaries/areas.
firmware	The program inside the receiver that controls receiver operations and hardware.
GAGAN	GPS Aided Geo Augmented Navigation. A regional SBAS system currently in development by the Indian government.
Galileo	Galileo is a GNSS system built by the European Union and the European Space Agency. It is complimentary to GPS and GLONASS.
geoid	The geoid is the equipotential surface that would coincide with the mean ocean surface of the Earth. For a small site this can be approximated as an inclined plane above the Ellipsoid.
GHT	Height above geoid.
GIOVE	Galileo In-Orbit Validation Element. The name of each satellite for the European Space Agency to test the Galileo positioning system.
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.
GPS	Global Positioning System. GPS is a space-based satellite navigation system consisting of multiple satellites in six orbit planes.
GSOF	General Serial Output Format. A Trimble proprietary message format.
HDOP	Horizontal Dilution of Precision. HDOP is a DOP value that indicates the

	precision 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).
height	The vertical distance above the Ellipsoid. The classic Ellipsoid used in GPS is WGS-84.
IBSS	Internet Base Station Service. This Trimble service makes the setup of an Internet-capable receiver as simple as possible. The base station can be connected to the Internet (cable or wirelessly). To access the distribution server, the user enters a password into the receiver. To use the server, the user must have a Trimble Connected Community site license.
L1	The primary L-band carrier used by GPS and GLONASS satellites to transmit satellite data.
L2	The secondary L-band carrier used by GPS and GLONASS satellites to transmit satellite data.
L2C	A modernized code that allows significantly better ability to track the L2 frequency.
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.
Location RTK	Some applications such as vehicular-mounted site supervisor systems do not require Precision RTK accuracy. Location RTK is a mode in which, once initialized, the receiver will operate either in 10 cm horizontal and 10 cm vertical accuracy, or in 10 cm horizontal and 2 cm vertical accuracy.
Mountpoint	Every single NTripSource needs a unique mountpoint on an NTripCaster. Before transmitting GNSS data to the NTripCaster, the NTripServer sends an assignment of the mountpoint.
Moving Base	Moving Base is an RTK positioning technique in which both reference and rover receivers are mobile. Corrections are sent from a “base” receiver to a “rover” receiver and the resultant baseline (vector) has centimeter-level accuracy.
MSAS	MTSAT Satellite-Based Augmentation System. A Satellite-Based Augmentation System (SBAS) that provides a free-to-air differential correction service for GNSS. MSAS is the Japanese equivalent of WAAS, which is available in the United States.

multipath	Interference, similar to ghosts on an analog television screen that occurs when GNSS 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 GNSS receivers can output positions as NMEA strings.
NTrip Protocol	Networked Transport of RTCM via Internet Protocol (NTrip) is an application-level protocol that supports streaming Global Navigation Satellite System (GNSS) data over the Internet. NTrip is a generic, stateless protocol based on the Hypertext Transfer Protocol (HTTP). The HTTP objects are extended to GNSS data streams.
NTripCaster	The NTripCaster is basically an HTTP server supporting a subset of HTTP request/response messages and adjusted to low-bandwidth streaming data. The NTripCaster accepts request messages on a single port from either the NTripServer or the NTripClient. Depending on these messages, the NTripCaster decides whether there is streaming data to receive or to send. Trimble NTripCaster integrates the NTripServer and the NTripCaster. This port is used only to accept requests from NTripClients.
NTripClient	An NTripClient will be accepted by and receive data from an NTripCaster, if the NTripClient sends the correct request message (TCP/UDP connection to the specified NTripCaster IP and listening port).
NTripServer	The NTripServer is used to transfer GNSS data of an NTripSource to the NTripCaster. An NTripServer in its simplest setup is a computer program running on a PC that sends correction data of an NTripSource (for example, as received through the serial communication port from a GNSS receiver) to the NTripCaster. The NTripServer - NTripCaster communication extends HTTP by additional message formats and status codes.
NTripSource	The NTripSources provide continuous GNSS data (for example, RTCM-104 corrections) as streaming data. A single source represents GNSS data referring to a specific location. Source description parameters are compiled in the source-table.
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 GNSS systems are accurate to within a meter or so, OmniSTAR with XP is accurate in 3D to better than 30 cm.
Orthometric elevation	The Orthometric Elevation is the height above the geoid (often termed the height above the 'Mean Sea Level').
PDOP	Position Dilution of Precision. PDOP is a DOP value that indicates the precision 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 is collected, in order to eliminate error. This involves using computer software to compare data from the rover with data collected at the base station.
QZSS	Quasi-Zenith Satellite System. A Japanese regional GNSS, eventually consisting of three geosynchronous satellites over Japan.
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. While DGPS is a generic term, its common interpretation is that it entails the use of single-frequency code phase data sent from a GNSS base station to a rover GNSS receiver to provide submeter position accuracy. The rover receiver can be at a long range (greater than 100 kms (62 miles)) from the base station.
rover	A rover is any mobile GNSS 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 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 GNSS receivers. There are three versions of RTCM correction messages. All Trimble GNSS 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/MSAS) networks of reference stations. Corrections and additional information are broadcast using geostationary satellites.
sCMRx	Scrambled CMRx. CMRx is a new Trimble message format that offers much higher data compression than Trimble's CMR/CMR+ formats.
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 dB-Hz.
skyplot	The satellite skyplot confirms reception of a differentially corrected GNSS signal and displays the number of satellites tracked by the GNSS receiver, as well as their relative positions.
SNR	See signal-to-noise ratio.
Source-table	The NTripCaster maintains a source-table containing information on available NTripSources, networks of NTripSources, and NTripCasters, to be sent to an NTripClient on request. Source-table records are dedicated to one of the following: • data STReams (record type STR) • CASters (record type CAS) • NETworks of data streams (record type NET) All NTripClients must be able to decode record type STR. Decoding types CAS and NET is an optional feature. All data fields in the source-table records are separated using the semicolon character.
triple frequency GPS	A type of receiver that uses three carrier phase measurements (L1, L2, and L5).
UTC	Universal Time Coordinated. A time standard based on local solar mean time at the Greenwich meridian.
xFill	Trimble xFill™ is a new service that extends RTK positioning for several minutes when the RTK correction stream is temporarily unavailable. The Trimble xFill service improves field productivity by reducing downtime waiting to re-establish RTK corrections in black spots. It can even expand productivity by allowing short excursions into valleys and other locations where continuous correction messages were not

	previously possible. Proprietary Trimble xFill corrections are broadcast by satellite and are generally available on construction sites globally where the GNSS constellations are also visible. It applies to any positioning task being performed with a single-base, Trimble Internet Base Station Service (IBSS), or VRS™ RTK correction source.
variance	A statistical measure used to describe the spread of a variable in the mean time period. This measure is equal to the square of the deviation of a corresponding measured variable from its mean. See also covariance.
VDOP	Vertical Dilution of Precision. VDOP is a DOP value (dimensionless number) that indicates the quality of GNSS observations in the vertical frame.
VRS	Virtual Reference Station. A VRS system consists of GNSS hardware, software, and communication links. It uses data from a network of base 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 base station data to model systematic errors (such as ionospheric noise) at the rover position. It then sends RTCM 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 GNSS 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 GNSS receiver, exactly like a GNSS 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.