USER GUIDE

*Ag*GPS® 332 GPS Receiver

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*Ag*GPS® 332 GPS Receiver

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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 digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

Europe

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 ROK 104001. These requirements are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential or commercial environment.

Taiwan – Battery Recycling Requirements

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

Notice to Our European Union Customers

For product recycling instructions and more information, please go to www.trimble.com/environment/summary.html.

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

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CHAPTER

1

Introduction

In this chapter:

- Welcome
- About the Product
- Related Information
- Technical Assistance
- Your Comments

Welcome

This manual describes how to install and configure the Trimble® AgGPS® 332 receiver.

Even if you have used other Global Positioning System (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 GPS, visit the Trimble website (www.trimble.com) for an interactive look at Trimble and GPS.

About the Product

The *Ag*GPS 332 receiver is an innovative GPS receiver that provides "the ultimate choice" for Agricultural GPS positioning. Scalable accuracy levels allow the option of SBAS (Satellite Based Augmentation System), Beacon, OmniSTAR-VBS/XP/HP, and RTK (Real-Time Kinematic). The AgGPS 332 can provide the level of accuracy needed for any operation.

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.
- Trimble training courses – Consider a training course to help you use your GPS system to its fullest potential. For more information, go to the Trimble website at www.trimble.com/training.shtml.

Technical Assistance

If you have a problem and cannot find the information you need in the product documentation, ***contact your local dealer***.

Your Comments

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

APPENDIX

2

Overview

In this chapter:

- Introduction
- Receiver Connections
- Receiver Input/Output
- GPS Positioning Methods

Introduction

This chapter describes the *Ag*GPS 332 receiver and gives an overview of GPS, DGPS, and related information.

The *Ag*GPS 332 receiver combines high-performance GPS reception with a DGPS-capable receiver in a lightweight, durable housing. The *Ag*GPS 332 receiver also contains the ultimate choice in technology enabling WAAS/EGNOS, OmniSTAR, or Coast Guard Beacon Tower real-time differential capabilities. When used with a Real-Time Kinematic (RTK) base station, the *Ag*GPS 332 receiver provides RTK positioning for high-accuracy, centimeter-level applications. For physical specifications, see Appendix B, Specifications..

You can use the receiver with a variety of farming equipment, including:

- *Ag*GPS EZ-Guide® Plus lightbar guidance system
- *Ag*GPS EZ-Steer™ assisted steering system
- *Ag*GPS Autopilot™ automated steering system
- yield monitors
- variable-rate planters
- spray application controllers
- portable field computers for field mapping and soil sampling
- any device that requires a GPS input

Standard Features

A standard *Ag*GPS 332 receiver provides the following features:

- 10 Hz (10 positions per second) output rate
- 12 GPS (C/A-code, L1and L2) tracking channels, code carrier channels
- Submeter differential accuracy (RMS), assuming at least five satellites and a PDOP (Position Dilution of Precision) of less than four[1] (when used with SBAS correction)
- LED display
- Outputs a 1 PPS (pulse per second) strobe signal on both ports. This signal enables an external instrument to synchronize its internal time with a time derived from the very accurate GPS system time.
- WAAS differential correction[2]
- Beacon differential correction[2]
- OmniSTAR VBS correction compatibility
- RTK positioning compatibility
- EVEREST™ multipath rejection technology
- Two ports that support both CAN 2.0B and RS-232:
  - CAN:

    J1939 and NMEA 2000 messages

    Note – *The AgGPS 332 receiver is ISO 11783 compliant. It supports some ISO 11783 messages.*
  - RS-232 :

    NMEA-0183 output: GGA, GLL, GRS, GST, GSA, GSV, MSS, RMC, VTG, ZDA, XTE (the default NMEA messages are GGA, GSA, VTG, and RMC).

    Note – *PTNLDG, PTNLEV, PTNLGGK, PTNLID, and PTNLSM are Trimble proprietary NMEA output messages.*

    RTCM SC-104 output.

    Trimble Standard Interface Protocol (TSIP) input and output.

1. When used with SBAS correction.
2. Where available.

Receiver Connections

Figure 2.1 shows the connector ports on the *Ag*GPS 332 receiver.

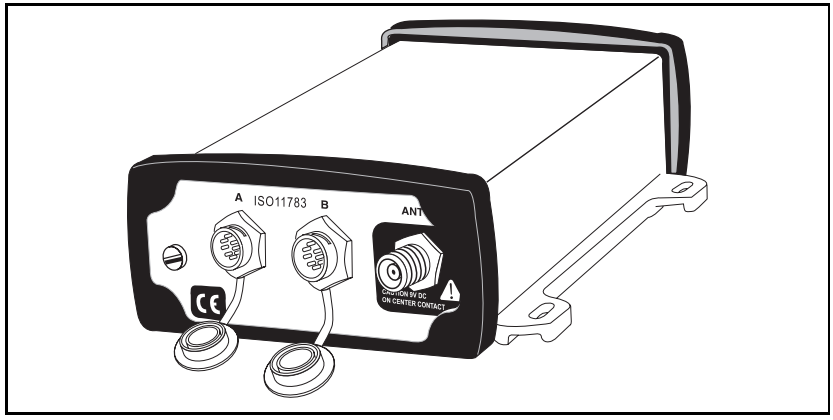


Figure 2.1 *Ag*GPS 332 receiver connector ports

The two connectors (Port A and Port B) can perform the following functions:

- accept power
- accept TSIP, RTCM, ASCII, and (if enabled) CMR inputs
- output RTCM, TSIP, and NMEA messages
- output 1 PPS signals
- provide support for the J1939 (CAN) serial bus

For more information about the inputs, outputs, and LCD display, see the information in the rest of this section.

Receiver Input/Output

The *Ag*GPS 332 receiver data/power cable (P/N 30945) connects to a receiver connector port to supply power. It also enables the following data exchanges:

- TSIP, RTCM, and ASCII input from an external device

  The receiver is able to receive ASCII data from an external device, convert this data into an NMEA message, and export the message to another device. TSIP command packets configure and monitor GPS and DGPS parameters. The receiver is also able to accept RTCM data from an external device, such as a radio.

- CMR input from an external device

  If the receiver is to be used in RTK mode, set the port that is connected to the radio to the ***RtkLnk*** protocol. This protocol enables the receiver to receive CMR messages.

- TSIP and NMEA output to an external device

  When you are using an external radio, the receiver can also receive DGPS corrections.

  NMEA is output when the receiver is exporting GPS position information to an external device, such as a yield monitor, or to a mapping software program.

  For more information on the National Marine Electronics Association (NMEA) and Radio Technical Commission for Maritime Services (RTCM) communication standard for GPS receivers, go to the following websites:

  – www.nmea.org

  – www.rtcm.org

  On the Trimble website (www.trimble.com), refer to the document called *NMEA-0183 Messages Guide for AgGPS Receivers*.

- 1 PPS output

  To synchronize timing between external instruments and the internal clock in the receiver, the connection port outputs a strobe signal at 1 PPS (pulse per second). To output this signal, the receiver must be tracking satellites and computing GPS positions.

- J1939 (CAN) bus

  Both connection ports on the receiver support the J1939 Controller Area Network (CAN) bus protocol. This protocol standardizes the way multiple microprocessor-based electronic control units (ECUs) communicate with each other over the same pair of wires. It is used in off-highway machines, such as those used in agriculture, construction, and forestry.

  For more information, go to the Society of Automotive Engineers (SAE) International website at www.sae.org/servlets/index.

- ISO 11783 messages

  Both CAN ports support some ISO 11783 messages.

Position output format

The *Ag*GPS receiver outputs positions in Degrees, Minutes, and Decimal Minutes (DDD°MM.m'). This is the NMEA standard format and is commonly used worldwide for data transfer between electronic equipment.

GPS Positioning Methods

GPS positioning systems are used in different ways to provide different levels of accuracy. Accuracy is measured in absolute terms (you know exactly where you are in a fixed reference frame).

Table 2.1 summarizes the GPS positioning methods. Imperial units in this table are rounded to two decimal places. The values shown are 2 sigma.

Table 2.1 Absolute accuracy of GPS positioning method

GPS positioning method	Corrections used	Approximate absolute accuracy
Real-Time Kinematic (RTK) GPS	Trimble CMR corrections broadcast by a local base station	2.5 cm (0.98 in) + 2 ppm horizontal accuracy, 3.7 cm (1.46 in) + 2 ppm vertical accuracy
OmniSTAR HP Differential GPS	OmniSTAR HP	10 cm (3.94 in) after the signal has fully converged[1]
OmniSTAR XP Differential GPS		20 cm (7.87 in) after the signal has fully Differential GPS converged
Satellite Differential GPS	OmniSTAR VBS	78 cm (30.71 in)
Radio Beacon	Coast Guard radio beacon towers	.4 inch through 12 inch (10 cm through 30 cm) RMS 15 min
Satellite Differential GPS	WAAS/EGNOS	95 cm (37.40 in)

[1]Convergence time can vary, depending on the environment. Time to the first fix (submeter accuracy) is typically <30 seconds; time to the first high accuracy fix (<10 cm accuracy) is typically <30 minutes.

For more information about each positioning method, see below.

RTK GPS positioning

The *Ag*GPS 332 receiver uses the RTK positioning method to achieve centimeter-level accuracy. To use the RTK method, you must first set up a base station. The base station uses a radio link to broadcast RTK corrections to one or more rover receivers. The *Ag*GPS 332 receiver is a rover receiver, so another compatible receiver, such as a Trimble MS750™ or *Ag*GPS 214 GPS receiver, must be used as the base station.

A transmitter in the base station sends the corrections through a radio link to the rover radio, which sends the corrections to the *Ag*GPS 332 receiver. The rover receiver uses RTK corrections from the base station to calculate its position to centimeter-level accuracy. As part of this process, the rover receiver must calculate an initialization. This takes a few seconds. While the receiver is initializing, an RTK Float solution is generated. Once initialized, an RTK Fixed solution is generated. It is the RTK Fixed solution that provides centimeter-level accuracy.

The parts per million (ppm) error is dependent on the distance (baseline length) between the base and rover receiver. For example, if the distance is 10 km, a 2 ppm error equals 20 mm.

For more information about RTK positioning, go to the Trimble website at www.trimble.com/gps/.

Differential GPS positioning (DGPS)

For differential positioning, the *Ag*GPS 332 receiver uses corrections from SBAS (WAAS/EGNOS)/OmniSTAR satellites and Radio Beacons.

These differential systems use special algorithms to provide differential corrections that allow the rover receiver to calculate its position more accurately.

Free corrections

WAAS/EGNOS corrections are free in North America and Europe.

For more information about WAAS, go to the Federal Aviation Administration website at http://gps.faa.gov/Programs/WAAS/waas.htm.

For more information about EGNOS, go to the European Space Agency website at www.esa.int/export/esaSA/GGG63950NDC_navigation_0.html.

Radio Beacon corrections are available free worldwide. For more information about the Coast Guard Beacon, go to www.navcen.uscg.gov/Default.htm.

Subscription-based corrections

The *Ag*GPS 332 receiver uses OmniSTAR XP/HP or OmniSTAR VBS differential corrections in the same way that it uses WAAS/EGNOS corrections but are provided on a subscription basis.

The corrections that are produced by OmniSTAR XP/HP algorithms are more accurate than the corrections that are produced by OmniSTAR VBS algorithms. The accuracy of the positions reported using OmniSTAR HP/XP increases with the time that has elapsed since the instrument was turned on. This process is called convergence. Convergence to where the error is estimated to be below 30 cm (approximate 12 inches) typically takes around 20 minutes. Factors that influence the time to convergence include the environment, the geographical location and for OmniSTAR HP, the distance to the closest OmniSTAR corrections base station. OmniSTAR is continually improving this service. OmniSTAR XP is not dependent on distance to base station

For more information about OmniSTAR, go to the OmniSTAR website at www.omnistar.com. Alternatively, call 888 883 8476 (USA or Canada). For information about activating an OmniSTAR subscription, go to the OmniSTAR website (www.omnistar.com) or call 888-883-8476 (USA or Canada).

Autonomous GPS positioning

Autonomous GPS positioning uses no corrections. The rover receiver calculates its position using only the GPS signals it receives. This method does not have high absolute accuracy, but the relative accuracy ***can be comparable depending on geographic location and overall environment***.

Sources of Error in GPS Positioning

The GPS positioning method influences the accuracy of the GPS position that is output by the *Ag*GPS 332 receiver. The factors described in Table 2.2 also affect GPS accuracy.

Table 2.2 Factors that influence the accuracy of GPS positions

Condition	Optimum value	Description
Atmospheric effects		GPS signals are degraded as they travel through the ionosphere. The error introduced is in the range of 10 meters. The error is removed by using a differential or RTK positioning method.
Number of satellites used	> 5	To calculate a 3D position (latitude and longitude, altitude, and time), four or more satellites must be visible. To calculate a 2D position (latitude and longitude, and time), three or more satellites must be visible. For RTK positioning, five satellites are needed for initialization. Once initialized, four or more satellites provide RTK positions. The number of visible satellites constantly changes and is typically in the range 5 through 9. The *Ag*GPS receiver can track up to 12 satellites simultaneously. ***Note –*** *To see when the maximum number of GPS satellites are available, use the Trimble Planning software and a current ephemeris (satellite history) file. Both files are available free from the Trimble website at www.trimble.com.*
Maximum PDOP	< 4	Position Dilution of Precision (PDOP) is a unitless, computed measurement of the geometry of satellites above the current location of the receiver. A low PDOP means that the positioning of satellites in the sky is good, and therefore good positional accuracy is obtained.
Signal-to-noise ratio	> 6	Signal-to-noise ratio (SNR) is a measure of the signal strength against electrical background noise. A high SNR gives better accuracy. Normal values are: • GPS 6 • WAAS 3+ • Beacon 12+ • OmniSTAR XP/HP/VBS 6+

Table 2.2 Factors that influence the accuracy of GPS positions (continued)

Condition	Optimum value	Description
Minimum elevation	> 10	Satellites that are low on the horizon typically produce weak and noisy signals and are more difficult for the receiver to track. Satellites below the minimum elevation angle are not tracked.
Multipath environment	Low	Multipath errors are caused when GPS signals are reflected off nearby objects and reach the receiver by two or more different paths. The receiver incorporates the EVEREST multipath rejection option.
RTCM-compatible corrections		These corrections are broadcast from a Trimble 4000RSi, or equivalent reference station.
RTK base station coordinate accuracy		For RTK positioning, it is important to know the base station coordinates accurately. Any error in the position of the base station affects the position of the rover; every 10 m of error in a base station coordinate can introduce up to 1 ppm scale error on every measured baseline. For example, an error of 10 m in the base station position produces an error of 10 mm over a 10 km baseline to the rover. For more information about how to make sure the position of your base station is accurate, refer to the manual for your base station receiver.
Multiple RTK base stations		If you are using several base stations to provide RTK corrections to a large site area, all base stations must be coordinated relative to one another. If they are not, the absolute positions at the rover will be in error. For more information about how to use several base stations to cover your site, contact your local Trimble Reseller.

Coordinate systems

Geographic data obtained from different sources must be referenced to the same datum, ellipsoid, and coordinate format. Different formats provide different coordinate values for any geographic location. In North America, the datums NAD-27 and NAD-83 are commonly used in Agricultural mapping applications.

The *Ag*GPS 332 receiver outputs position coordinates in several datums and ellipsoids depending on the GPS positioning method being used. See Table 2.3.

Table 2.3 DGPS coordinate systems

GPS positioning method	Datum	Ellipsoid
None – Autonomous mode	WGS-84 [1]	WGS-84
OmniSTAR VBS North American Beams	NAD-83 [2]	GRS-80
OmniSTAR VBS Rest of World Beams	ITRF [3]	GRS-80
OmniSTAR HP	ITRF 2000	ITRF 2000
WAAS Beams	WGS-84	WGS-84
Beacon	NAD-83	NAD-83
OmniSTAR XP	ITRF 2000	ITRF 2000
RTK	WGS-84	WGS-84

[1] World Geodetic System (WGS) 1984. Datum and ellipsoid.

[2] North American Datum (NAD) 1983. Equivalent to WGS-84 in North America.

[3] International Terrestrial Reference Frame (ITRF). Contact the DGPS provider for details.

For more information, go to the National Geodetic Survey website at www.ngs.noaa.gov/faq.shtml#WhatDatum.

Satellite DGPS mode status indicators

When the receiver is in Satellite mode, the second line of the *Home* screen displays the status indicators shown in Figure 2.2.

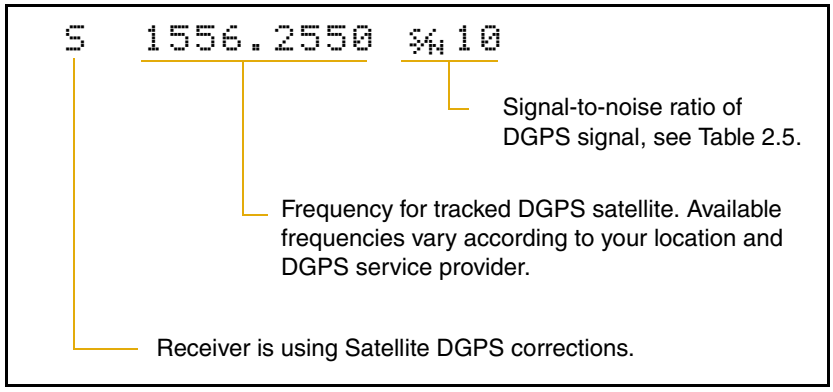


Figure 2.2 Satellite DGPS mode status indicators

Table 2.4 shows the possible satellite differential mode indicators.

Table 2.4 Satellite differential mode status indicators

Indicator	Description
S ####.### S/N ##	Operating in Satellite Differential mode.
S SRCH ###.##	Searching for Satellite Differential signal.
S TRCK ####.##	Tracking satellite without acquiring signal lock.

Table 2.5 explains the signal-to-noise ratio values for both Satellite and WAAS/EGNOS DGPS modes.

Table 2.5 Signal-to-noise values

Value	Description
Below 4	Unusable
4–8	Fair
>8	Excellent

Receiver input / output

The receiver is able to output RTCM in base station mode. When you are using an external radio, it can also receive DGPS corrections. NMEA is output when the receiver is exporting GPS position information to an external device, such as a yield monitor or to a mapping software program.

DGPS accuracy

Submeter accuracy from the *Ag*GPS 332 receiver utilizing differential correction is best achieved under the conditions described in Table 2.6.

Table 2.6 DGPS accuracy

Condition	Optimum Value	Description
		To calculate a 3D position (latitude and longitude, altitude, and time), four or more satellites must be visible. To calculate a 2D position (latitude and longitude, and time), three or more satellites must be visible. The number of visible satellites constantly changes and is typically in the range 5–9. *Ag* to 12 satellites simultaneously. ***Note –*** *To see when the maximum number of GPS satellites are available, use the Quickplan utility and a current ephemeris (satellite history) file. Both files are available free from: www.trimble.com/support_trl.asp?Nav=Collection-3627.*
Maximum PDOP	< 4	Position Dilution of Precision (PDOP) is a unitless, computed measurement of the geometry of satellites above the receiver's current location. ***Note –*** *In some agricultural applications that do not require high accuracy, a maximum PDOP of 12 or more can be used.*
	> 6	Signal-to-Noise ratio (SNR) is a measure of the satellite signal strength against electrical background noise. A high SNR gives better accuracy.
Minimum Elevation	> 7.5	Satellite that are low on the horizon typically produce weak and noisy signals and are more difficult for the receiver to track. Satellites below the minimum elevation angle are not tracked.

Table 2.6 DGPS accuracy (continued)

Multipath environment	Low	Multipath errors are caused when GPS signals are reflected off nearby objects and reach the receiver by two or more different paths. The receiver incorporates the EVEREST multipath reduction option.
RTCM-compatible corrections		These corrections are broadcast from a Trimble 4000RSi™ or equivalent reference station.

Receiving Beacon DGPS

To obtain free radiobeacon differential signals, the *Ag*GPS 332 receiver uses dual-channel, fully-automatic beacon receiver electronics and tracks broadcasts that conform to the IALA (International Association of Lighthouse Authorities) Standard. When you use beacon DGPS, the receiver selects the closest of the 10 most powerful radiobeacons in the vicinity. You can configure the receiver to search for particular station frequencies, or use the EZ beacon feature to select local beacons.

The receiver continuously monitors the integrity of the data received from the differential radiobeacons. If it finds unacceptable errors in the data stream, the receiver automatically switches to a different radiobeacon, if one is available.

Radiobeacon signal reception is generally not affected by:

- hilly or mountainous terrain
- tree canopy
- location of the receiver inside a canyon (the signal reception depends on the proximity of the receiver to the transmitter)

Radiobeacon signal reception is affected to varying degrees, by:

- natural “noise”, such as lightning
- human-made “noise”, such as alternators, electric fan motors, radio speakers, and high voltage power lines

- Sky wave interference with ground wave

  During darkness, when the beacon tower is more than 240–480 kilometers (150–300 miles) from the receiver, the sky wave beacon signal may be reflected off the ionosphere. This causes interference with the ground wave beacon signal. Self-jamming at night may be a problem with stronger beacon stations.

- Geographic de-correlation

  This phenomenon causes radiobeacon signal accuracy to decrease as the distance between the beacon tower and the base station increases. Ionospheric conditions can affect accuracy by as much as 1 meter (3 feet) for every 100 km (60 miles).

CHAPTER

3

Connecting the Receiver

- Introduction
- System Components
- Mounting the Receiver
- Connecting to an External Device
- System Components
- Routing and Connecting the Antenna Cable
- Connecting to the EZ-Guide Plus System
- Connecting to the EZ-Steer Assisted Steering System
- Connecting to a Laptop Computer
- Connecting to a Windows Handheld Computer

Introduction

This chapter describes how to check the equipment that you have received, set up the receiver, and connect the receiver to another device.

System Components

Check that you have received all components for the *Ag*GPS system that you have purchased. If any containers or components are damaged, immediately notify the shipping carrier. Table 3.1 and Table 3.2 lists the components.

Table 3.1 ***Ag*GPS 332 receiver (P/N 55580-*xx*)**

Quantity	Description
1	AgGPS 332 DGPS receiver (P/N 55580)
1	Power Data Cable (P/N 30945)
1	*Ag*GPS 332 GPS Receiver User Guide (this manual, P/N 56370-00-ENG)
1	Warranty Activation Card (P/N 25110-00)
1	OmniSTAR Activation Card (P/N 33965)
1	Antenna (P/N 33580-00 or P/N 56981)

Optional components

You may also have ordered the following item:

Table 3.2 **Receiver option**

Quantity	Description
1	RTK capability (P/N 51264)
1	OmniSTAR XP/HP upgrade (P/N 55951)

For ordering and pricing details, contact your local Trimble Reseller.

Mounting the Receiver

WARNING – For continued protection against the risk of fire, the power source (lead) to the model *Ag*GPS 332 receiver should be provided with a 10 A (maximum) fuse.

Choosing a location

When choosing a location, consider the following:

Mount the receiver:

- on a flat surface along the centerline of the vehicle
- in any convenient location that is within 5.5 meters (18 ft) of the port on the external instrument; if necessary, use the optional extension cable to connect the receiver and external device

  Note – *If you are using a Trimble AgGPS Autopilot system, refer to the installation instructions that are provided with the Autopilot.*
- at the highest point on the vehicle, with no metal surfaces blocking the receiver's view of the sky
- in such a way that it is not damaged when you drive the machine into a shed or storage area

Do ***not*** mount the receiver:

- close to stays, electrical cables, metal masts, CB radio antennas, cellular phone antennas, air-conditioning units (machine cab blower fan), or machine accessory lights
- near transmitting antennas, radar arrays, or satellite communication equipment
- near areas that experience high vibration, excessive heat, electrical interference, and strong magnetic fields

  Note – *A metal combine grain tank extension can block satellites.*

Environmental conditions

Although the receiver has a waterproof housing, you should install it in a dry location. To improve the performance and long-term reliability of the receiver, avoid exposure to extreme environmental conditions, including:

- water
- excessive heat (> 70 °C or 158 °F)
- excessive cold (< –30 °C or –22 °F)
- high vibration
- corrosive fluids and gases

Electrical interference

As far as possible, when you install the receiver, you should avoid placing it near sources of electrical and magnetic noise, such as:

- gasoline engines (spark plugs)
- computer monitor screens
- alternators, generators, or magnetos
- electric motors (blower fans)
- equipment with DC-to-AC converters
- switching power supplies
- radio speakers
- high-voltage power lines
- CB radio antennas
- cellular phone antennas
- machine accessory lights

Connecting to an External Device

After installing the receiver and connecting the appropriate cabling, you can connect the receiver to various external devices. For example:

To connect the *Ag*GPS 332 receiver to ...	use the cable ...
an EZ-Guide Plus system	P/N 30945
an Autopilot system	P/N 54609
a Field computer	P/N 30945
a Yield monitor	P/N 30945
a Trimble SiteNet™ radio, for RTK positioning	P/N 39941
multiple devices (access to ports A, B, and C)	P/N 37382

Figure 3.1 shows how to connect the receiver to an external device using the Power data cable.

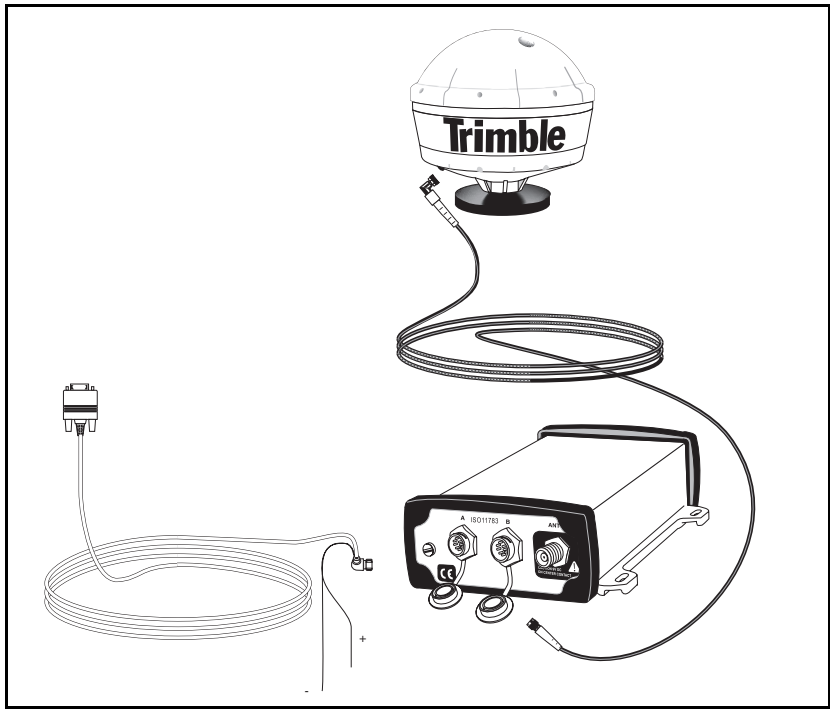


Figure 3.1 Standard power/data cable connections

When routing the cable from the receiver to the external device, avoid:

- sharp objects
- kinks in the cable
- hot surfaces (exhaust manifolds or stacks)
- rotating or moving machinery parts
- sharp or abrasive surfaces
- door and window jams
- corrosive fluids or gases

When the cable is safely routed and connected to the receiver, use tie-wraps to secure it at several points, particularly near the base of the receiver, to prevent straining the connection. Coil any slack cable, secure it with a tie-wrap, and tuck it into a safe place.

The external device may have to be configured to work with the AgGPS receiver. The configuration tools for the external device should be provided with the device. For more information about configuring the receiver, see Chapter 5, Configuring the Receiver. For information about connecting a particular external device, refer to the manual for that device or contact your local Trimble Reseller.

System Components

Mount the receiver on a level, flat surface. To mount it on a ceiling, contact your local Trimble Reseller for the appropriate bracket. Place the antenna upright with the magnetic base on a flat metal surface.

Note – *A metal combine grain tank extension can block satellites.*

Figure 3.2 shows the recommended location for sprayer boom applications.

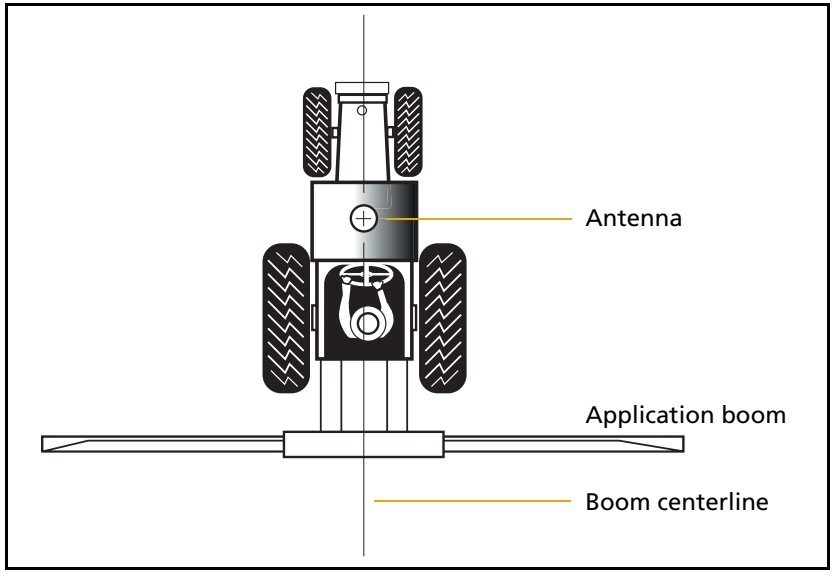


Figure 3.2 *Ag*GPS 332 receiver antenna mounting for ground sprayer boom applications

The receiver

To mount the *Ag*GPS 332 receiver:

1. Drill four holes in the mounting surface. Use the slotted holes in the mounting brackets as a template.
2. Use screws to secure the brackets to the mounting surface.

Note – *If you use machine screws, tap the mounting holes to fasten the receiver to the mounting surface. Trimble recommends that you use 8-32 UNF socket head cap screws. Alternatively, use self-tapping screws.*

The antenna

Mount the antenna where it is safe from damage during normal operation.

Routing and Connecting the Antenna Cable

A 5.5 m (18 ft) antenna cable (P/N 32608) is included with the receiver. See Figure 3.3. One end of the antenna cable features a right-angle connector. The opposite end features a straight connector. Connect the right-angle connector to the antenna; then route the cable to the receiver.

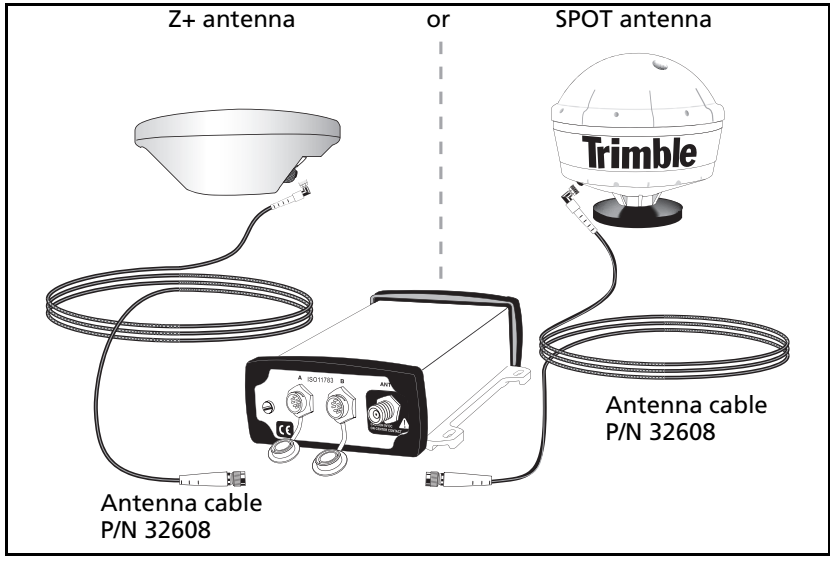


Figure 3.3 Antenna cable connections

When routing the antenna cable, avoid the following hazards:

- sharp objects
- kinks in the cable
- hot surfaces (exhaust manifolds or stacks)
- rotating or moving machinery parts
- sharp or abrasive surfaces
- door and window jams
- corrosive fluids or gases

After routing the cable, connect it to the receiver. Use tie-wraps to secure the cable at several points along the route. One tie-wrap is required to secure the cable near the base of the antenna. This provides strain relief for the antenna cable connection.

When the cable is secured, coil any slack. Secure the coil with a tie-wrap and tuck it into a safe place.

Tip – Use the tape (coax tape seal) that is provided with the antenna to seal the antenna connector at the antenna. The tape prevents moisture from entering the connection.

After installing the receiver and antenna, connect and route the power/data cable (P/N 30945). The receiver can be powered by a vehicle or by a customer-supplied 10–32 V DC power source.

Figure 3.4 shows how to connect the receiver to an external device using the 5.5 m (18 ft) standard power/data cable.

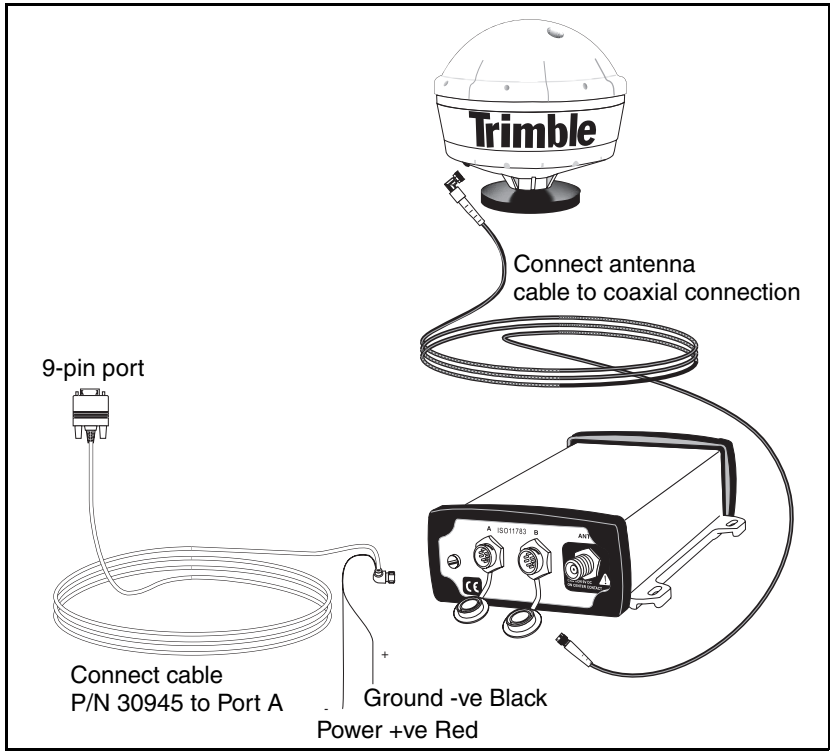


Figure 3.4 Standard power/data cable connections

Plug the:

- right-angle connector into the receiver
- straight 9-pin connector into the external device

When routing the cable from the receiver to the external device, avoid the hazards listed on page 27.

When the cable is safely routed and connected to the receiver, use tie-wraps to secure it at several points, particularly near the base of the receiver to prevent straining the connection. Coil any slack cable, secure it with a tie-wrap and tuck it into a safe place.

Connecting to the EZ-Guide Plus System

Figure 3.5 and Figure 3.6 show how to connect the *Ag*GPS 332 receiver to the *Ag*GPS EZ-Guide Plus system.

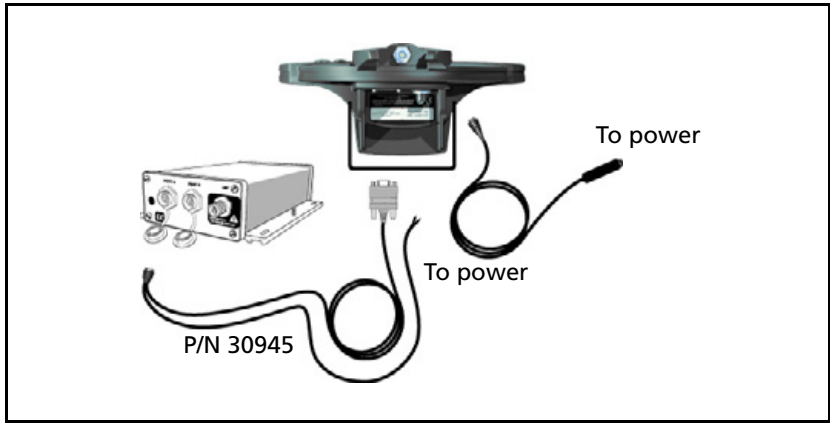


Figure 3.5 Connecting the *Ag*GPS 332 receiver to the *Ag*GPS EZ-Guide Plus system without the remote control

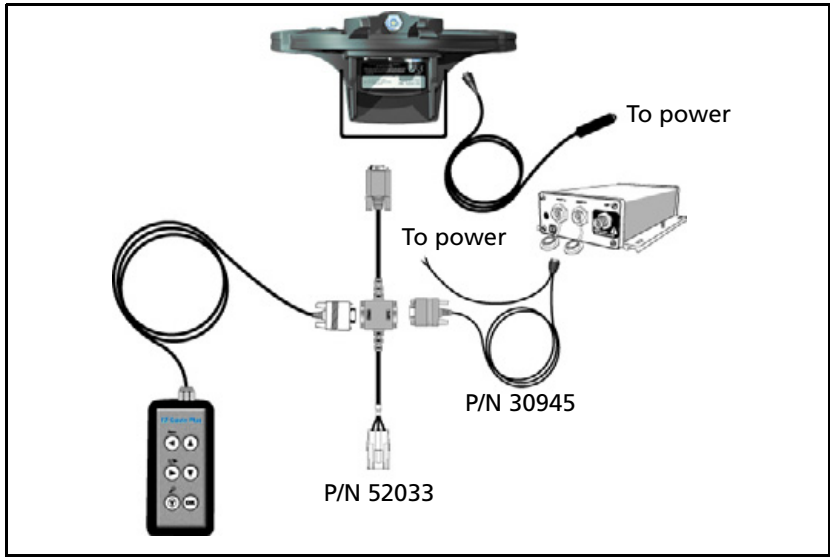


Figure 3.6 Connecting the *Ag*GPS 332 receiver to the *Ag*GPS EZ-Guide Plus system with the remote control

Connecting to the EZ-Steer Assisted Steering System

Figure 3.7 and Figure 3.8 show how to connect the *Ag*GPS 332 receiver to the *Ag*GPS EZ-Steer assisted steering system.

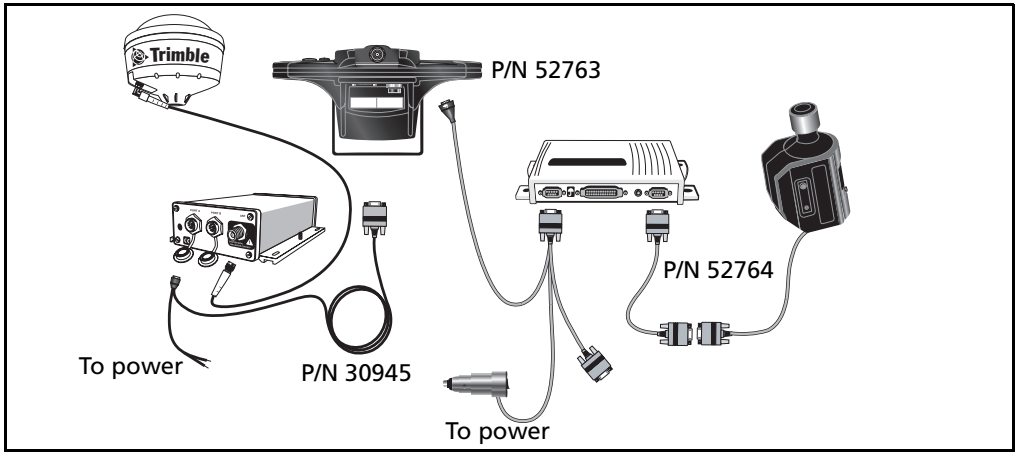


Figure 3.7 Connecting the *Ag*GPS 332 receiver to the *Ag*GPS EZ-Steer assisted steering system with the remote control

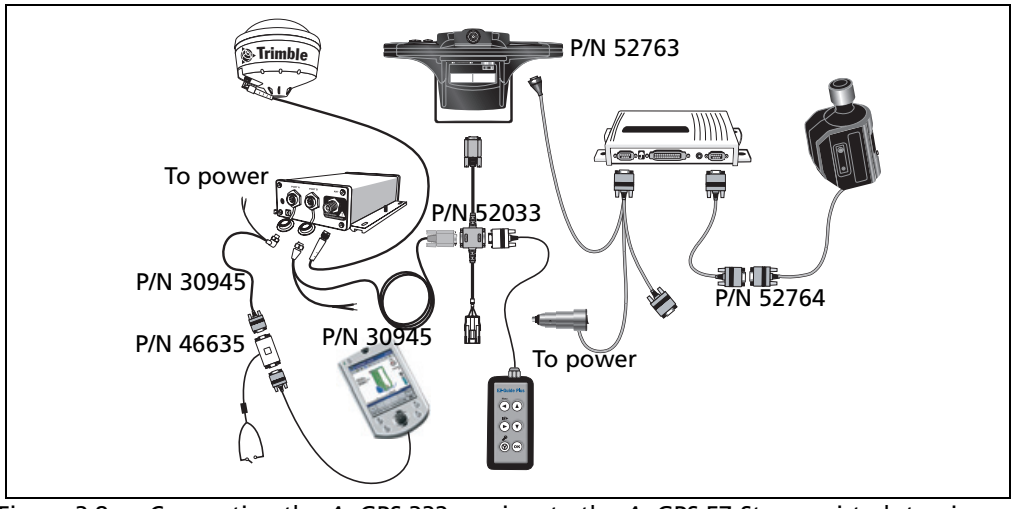


Figure 3.8 Connecting the *Ag*GPS 332 receiver to the *Ag*GPS EZ-Steer assisted steering system with the remote control and Pocket PC for field mapping capability

Connecting to a Laptop Computer

Figure 3.9 shows how to connect the receiver power/data cable to a laptop computer.

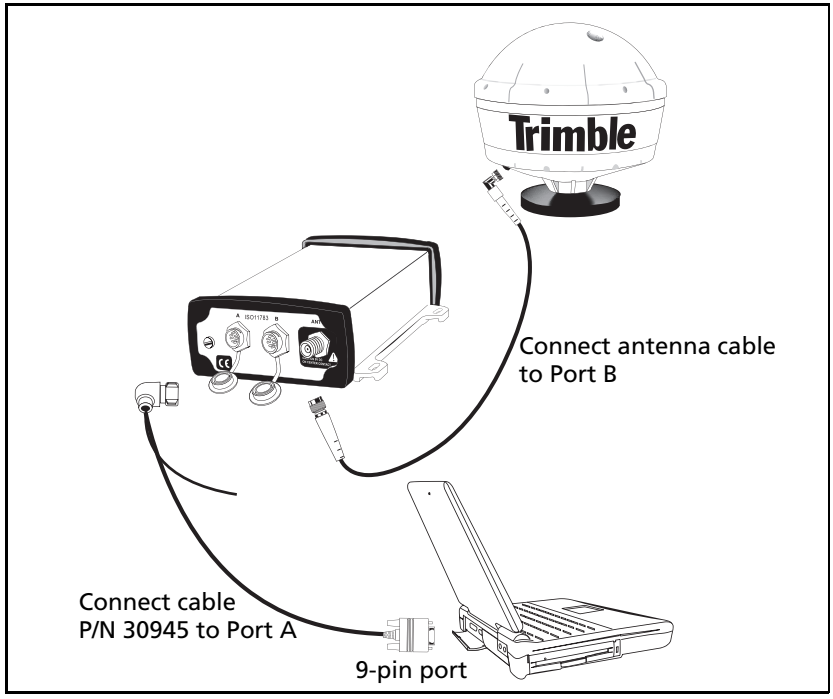


Figure 3.9 Connecting the receiver to a laptop computer

Connecting to a Windows Handheld Computer

Figure 3.10 shows how to connect the receiver power/data cable to a Windows CE handheld computer.

Note – *To connect the receiver to a Compaq iPAQ handheld computer, you require a RS232 9-pin serial cable (PN 236251-B21). This cable is available from Compaq.*

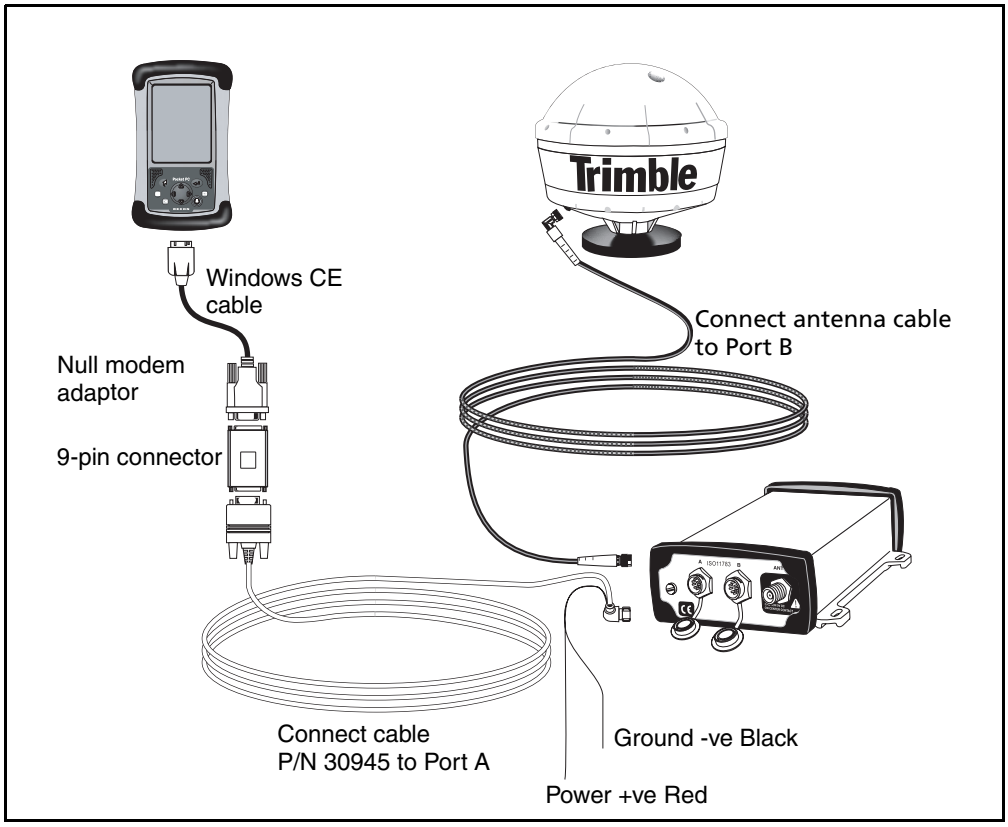


Figure 3.10 Connecting the receiver to a Windows CE handheld computer

CHAPTER

4

Getting Started

In this chapter:

- Introduction
- Front Panel
- Navigating the Menus and Screens
- Menu System Fields
- The Home Screen
- Updating the Firmware

Introduction

This chapter describes how to set up and begin using the *Ag*GPS 332 receiver. It includes an overview of the *Ag*GPS menu system.

Front Panel

The *Ag*GPS 332 receiver includes an integrated display and keypad for accessing the internal *Ag*GPS menu system. Use the menus and screens in this system to configure the receiver settings and review receiver status. To view the entire *Ag*GPS menu system, go to the Trimble website (www.trimble.com/aggps332_ts.asp).

Figure 4.1 shows the LCD display and keypad on the *Ag*GPS 332 receiver front panel.

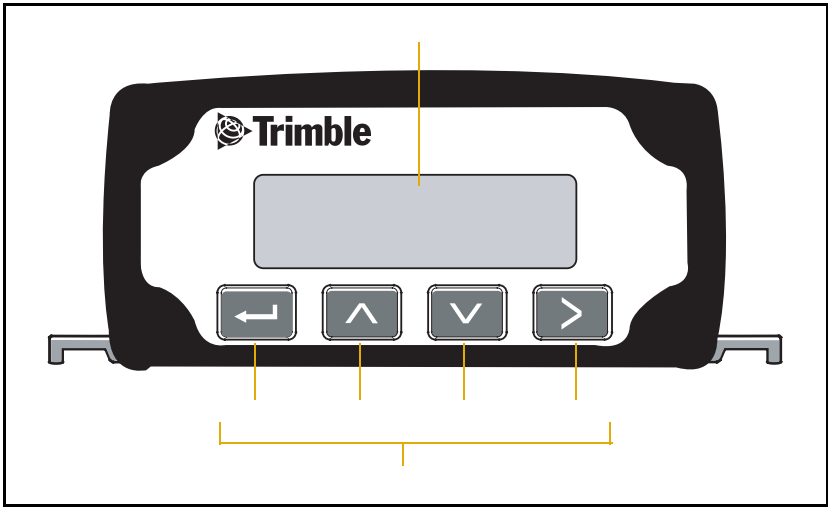


Figure 4.1 The *Ag*GPS 332 receiver front panel

Navigating the Menus and Screens

Note – *Use a menu to navigate to screens or other menus. Use a screen to view the receiver status or to change a configuration setting.*

The top level of the menu system consists of the *Home*, *Status*, and *Configuration* menus. Each of these has one or more lower level menus (sub-menu) which you can use to access screens for selecting options, viewing status information, and entering data. For a map showing the full menu system, go to the Trimble website (www.trimble.com/aggps332_ts.asp).

When you are using the receiver front panel keypad to navigate the menu system, press  +  simultaneously to move to the previous menu. Press and hold (or press repeatedly)  +  simultaneously to return to the *Home* screen.

Figure 4.2 shows the structure of a typical sub-menu, for example *Display Options*.

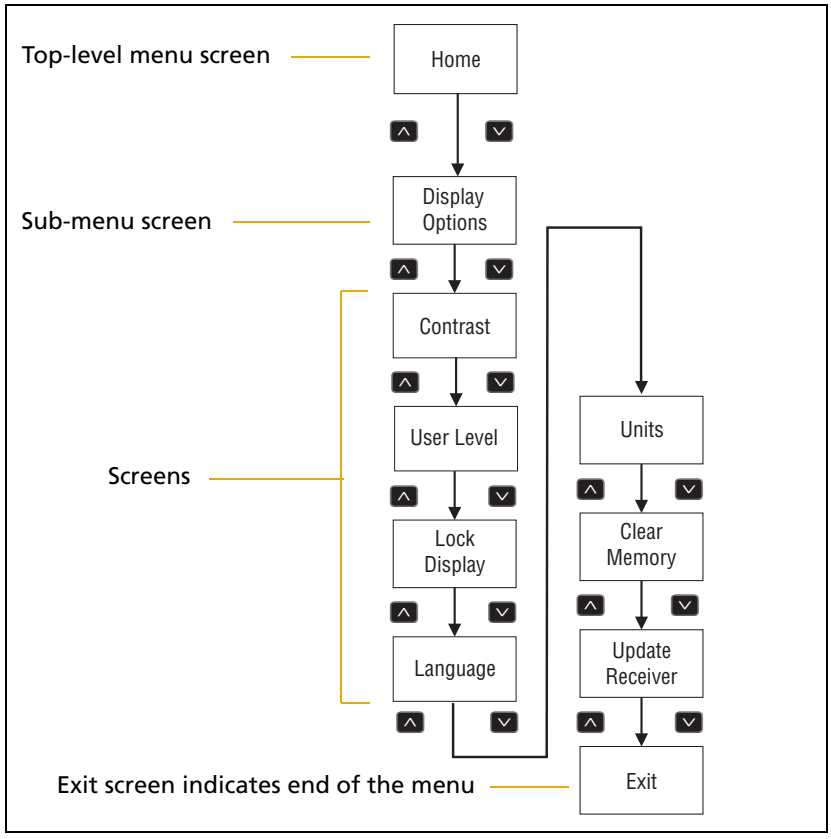


Figure 4.2 Typical menu structure

Press ▼ or ▲ to move between screens. Within screens, select options, view receiver status, or enter data. When ⇶ appears in a screen, press ↵ to perform the action specified for that screen.

Menu System Fields

Fields in a screen contain status information or configuration settings. The information or settings appear in fields that are:

- display-only
- multiple-choice
- text

Display-only fields

A display-only field shows status information and other data that is automatically generated by the receiver or acquired from satellite signals. You cannot edit this field. Examples include fields that display the DGPS data on the *Home* screen and the fields in the screen in Figure 4.3, which show details of the current receiver options.

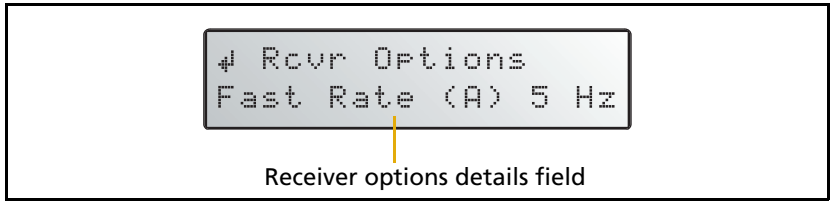


Figure 4.3 Example of a display-only field

Multiple-choice fields

In a mulitple-choice field, you select one option from a list. Only one option can appear in the field at one time. Press > to select a multiple-choice field, the press v or ^ to move through the list. When the required option appears, press ↵ to select it and save the changes.

Examples include the two multiple-choice fields that appear in the *EZ Sat DGPS Configuration* screen (see Figure 4.4). These are the fields which list available satellite providers, and satellite coverage beams.

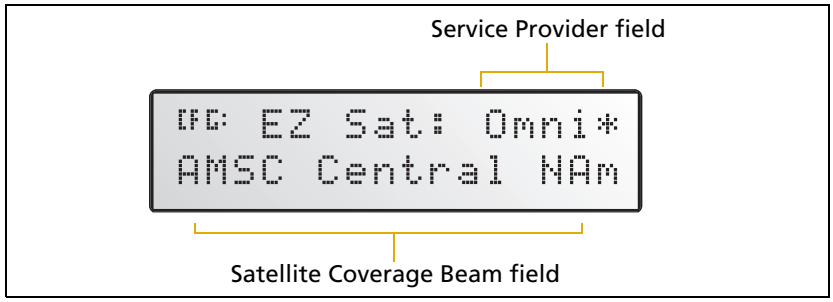


Figure 4.4 Example of a multiple-choice field

Text fields

In these fields, you can enter only letters (alpha screens), only numbers (numeric screens), or a combination of the two (alphanumeric screens):

1. Press > to select the field and activate the cursor on the first letter or number.
2. Press ^ or v to move through the list of letters or numbers until the required letter or number appears.
3. Press > to move to the next place in the field.
4. Repeat Step 2 through Step 3 to enter all required characters.
5. Press ↵ to save the changes.

The Home Screen

One example of a numeric field appears in the *Satellite Freq* screen. You manually enter the broadcast frequency of a satellite service provider. See Figure 4.5.

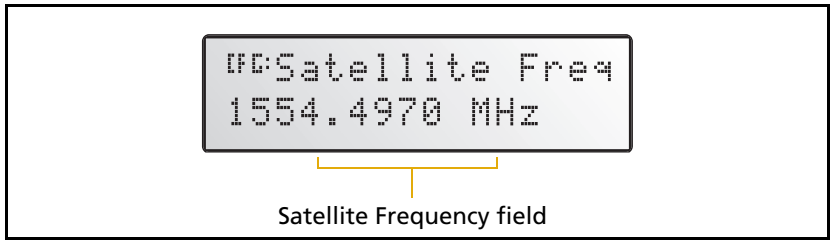


Figure 4.5 Example of a numeric field

When you start the receiver, the *Home* screen appears. See Figure 4.6.

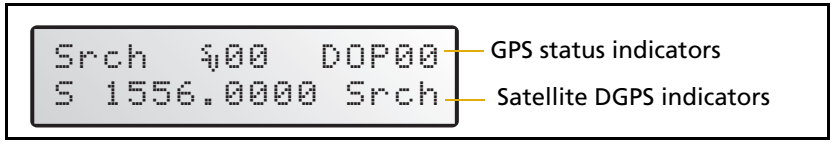


Figure 4.6 The Home Screen

You can leave this screen running during operation. It enables you to monitor the receiver status. To return to the *Home* screen after viewing other receiver menus and screens, press Esc one or more times.

The *Ag*GPS 332 receiver is a combined Beacon and Satellite DGPS receiver. The information that appears on the *Home* screen depends on how the receiver is configured.

Satellite DGPS mode

In this manual, references to Satellite DGPS apply only to the *Ag*GPS 332 receiver. When the receiver is in Beacon DGPS mode, a B, Beacon Searching, Beacon Tracking, or Beacon FFT message appears in the lower-left corner of the screen. To change between modes, press ↵ and hold for five seconds. To display satellite differential information, press ↵ until an S appears in the lower left corner of the screen.

Satellite and SBAS DGPS mode

The *Ag*GPS 332 receiver can receive L1/L2, LBand, Beacon, and RTK signals. The *Home* screen indicates which mode the receiver is in for differential correction.

Figure 4.7 explains the GPS status indicators that can appear on the first line of the *Home* screen display.

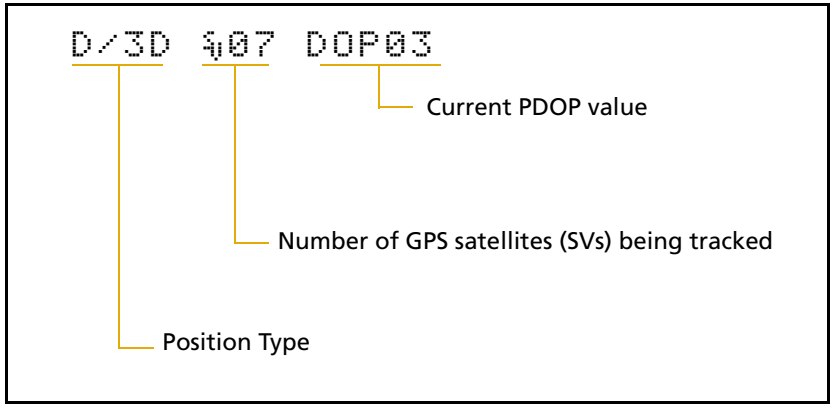


Figure 4.7 GPS status

Table 4.1 explains the indicators that can appear in the *Position Type* field.

Table 4.1 Position types

Display	Description
SRCH	Searching for satellites
TRCK	Tracking satellites
G/2D	Outputting 2-dimensional autonomous positions
G/3D	Outputting 3-dimensional autonomous positions
D/2D	Outputting 2-dimensional differential positions
D/3D	Outputting 3-dimensional differential positions
x/3D	Outputting unconverged OmniSTAR XP differential positions
X/3D	Outputting converged OmniSTAR XP differential positions

Table 4.1 Position types (continued)

Display	Description
h/3D	Outputting unconverged OmniSTAR HP differential positions
H/3D	Outputting converged OmniSTAR HP differential positions
r/3D	Outputting float RTK positions
R/3D	Outputting fixed RTK positions

Note – *The "/" symbol in the position type spins when the receiver is operating correctly.*

Satellite DGPS mode status indicators

When the receiver is in Satellite mode, the second line of the *Home* screen displays the status indicators shown in Figure 4.8.

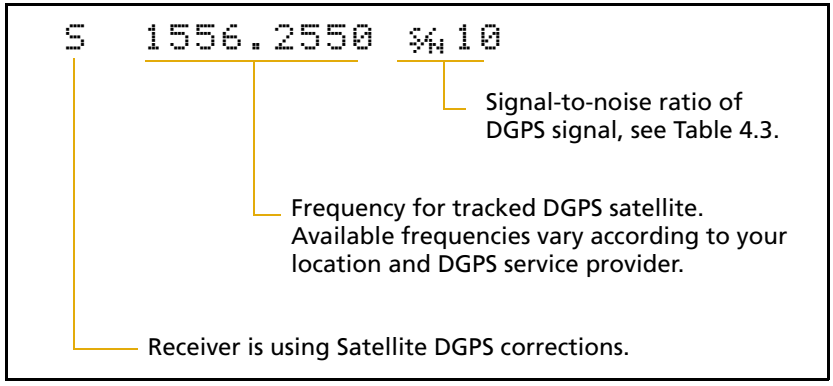


Figure 4.8 Satellite DGPS mode status indicators

Table 4.2 shows the possible satellite differential mode indicators.

Table 4.2 Satellite differential mode status indicators

Indicator	Description
S ####.### S/N ##	Operating in Satellite Differential mode.

Table 4.2 Satellite differential mode status indicators

Indicator	Description
S SRCH ###.##	Searching for Satellite Differential signal.
S TRCK ####.##	Tracking satellite without acquiring signal lock.

Table 4.3 explains the signal-to-noise ratio values for both Satellite and WAAS/EGNOS DGPS modes.

Table 4.3 Signal-to-noise values

Value	Description
Below 4	Unusable
4–8	Fair
>8	Excellent

SBAS DGPS mode status indicators

When the receiver is in SBAS DGPS mode, the second line of the *Home* screen displays the status indicators shown in Figure 4.9.

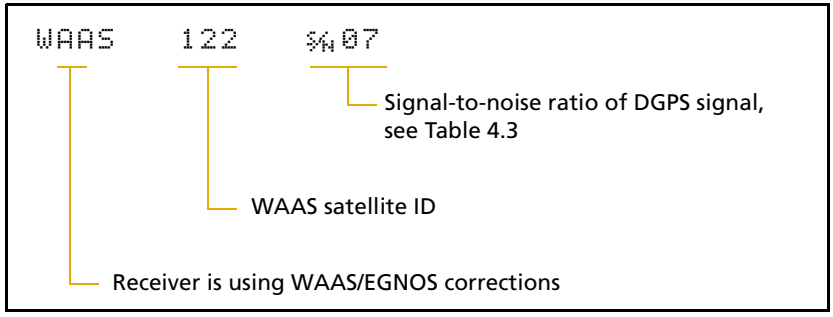


Figure 4.9 SBAS DGPS mode status indicators

Beacon DGPS mode

When in Beacon DGPS mode, the *Home* screen displays "B" (Beacon DGPS) in the lower left corner. Figure 4.10 explains the status indicators that appear on the first line of the *Home* screen display when the receiver is in this mode.

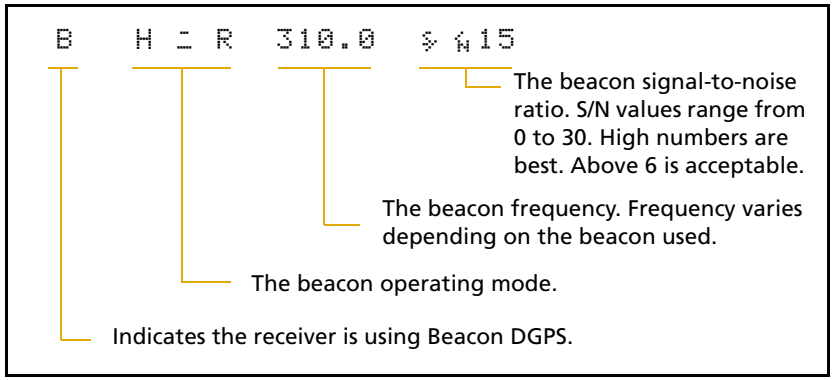


Figure 4.10 Beacon DGPS status

Table 4.4 describes messages that can appear when the receiver is in Beacon DGPS mode.

Table 4.4 Beacon DGPS operating mode messages

Message	Description
B	The receiver is operating in Beacon mode.
Beacon Searching	The receiver is searching for beacon signals.
Beacon Tracking	The receiver is tracking beacon signals and is attempting to gain lock.
Beacon Idle	Beacon DGPS is not active.
Beacon FFT	The receiver is looking for a beacon across the signal spectrum.
Beacon Disabled	Beacon DGPS is disabled in the receiver. You will need to change configuration settings to enable Beacon DGPS.
External RTCM	Differential corrections are being provided by an external source, through port A or port B.

Updating the Firmware

To ensure that the receiver and office computer connect, when you are ready to update the firmware, do one of the following:

- If you use a Windows CE or pocket PC device with the computer, make sure that Microsoft ActiveSync® technology is disabled from using the COM port on the computer.
- If you use a Palm Pilot with the computer, make sure that the Palm Synchronization program is disabled from using the COM port on the computer.

To update the receiver firmware when a new version is released:

1. Download the upgrade files.
2. Install the FlashLoader200 utility.
3. Connect the receiver to an office computer.
4. Upgrade the firmware from the office computer, using the upgrade files.

For full details of how to do this, refer to the *Release Notes* provided with your receiver firmware.

If you have problems when you update the firmware, see Chapter 6, Troubleshooting. For further assistance, contact your local Trimble reseller.

CHAPTER

5

Configuring the Receiver

In this chapter:

- Introduction
- Home Screen
- Configuring Differential GPS
- Configuring the AgGPS Receiver to Operate in Beacon Mode
- Configuring the AgGPS Receiver to Operate in RTK Mode
- Configuring the Communication Ports
- Display Options
- Installing Passcodes

Introduction

Use the LCD screen to change configuration settings in the *Ag*GPS 332 receiver. You will need to configure the receiver if you connect to another device, for example.

- If a Trimble *Ag*GPS Autopilot system is configured to use an *Ag*GPS receiver, and the port on the receiver is set to 8-N-1, 38.4 K, the Autopilot system automatically configures the receiver.
- The EZ-Guide Plus and EZ-Steer systems require that NMEA is set to 8-N-1, 38.4K.

Note – *OmniSTAR VBS, XP, and HP are subscriber services that need to be activated. For more information, see OmniSTAR, page 47.*

Home Screen

Figure 5.1 shows the *Ag*GPS 332 *Home* screen when WAAS corrections are being received.

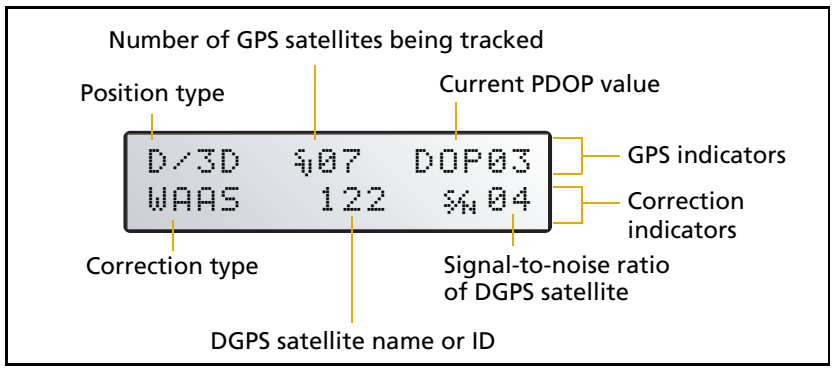


Figure 5.1 *Ag*GPS 332 Home screen

Configuring Differential GPS

For the receiver to output GPS position coordinates of submeter accuracy, you must first select a differential signal from one of the following sources:

- SBAS (WAAS/EGNOS) – free service, limited availability

  The Wide Area Augmentation System (WAAS) augments GPS with additional signals for increasing the reliability, integrity, accuracy, and availability of GPS in the United States. The European Geostationary Navigation Overlay System (EGNOS) is the European equivalent of WAAS.

- OmniSTAR – paid subscription, available worldwide

  You can use this paid service as an alternative to WAAS/EGNOS. It provides over-the-air DGPS activation.

For more information, see Differential GPS positioning (DGPS), page 10.

OmniSTAR

The *Ag*GPS 332 receiver can use OmniSTAR corrections. To do this, you need to configure the receiver and purchase an OmniSTAR subscription.

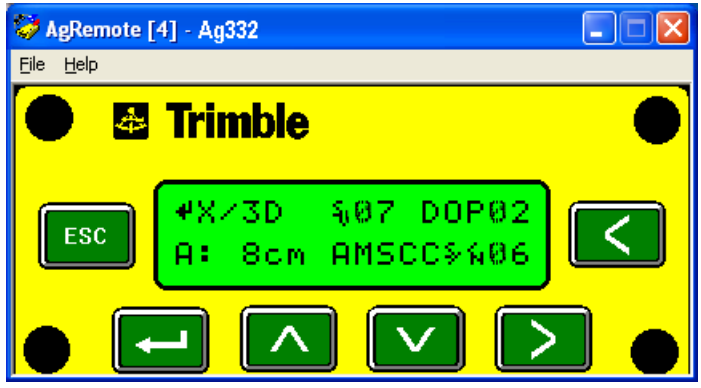
Note – *To track the OmniSTAR satellite, the receiver must be outside with a clear view of the sky, turned on, and configured to receive OmniSTAR VBS or HP corrections.*

To activate an OmniSTAR subscription:

1. From the Home screen, select *Configuration* / *DGPS Config*.
2. Set the *Source Select* field to one of the following:
   - Omnistar HP
   - Omnistar VBS
   - Omnistar XP

3. Set the *EZ Sat: Omni** field to the area you are operating in. For example, if you are working in California, select N. America West.
4. Press ↵ then Esc to complete the procedure.
5. Obtain an OmniSTAR licence from OmniSTAR. All licenses are activated over the air. Contact OmniSTAR on 1-888-883-8476 (USA or Canada) and provide the following details:
   - your billing information
   - serial number
   - satellite beam name

   OmniSTAR will activate the receiver. Activation can take 5 to 30 minutes.



WAAS/EGNOS

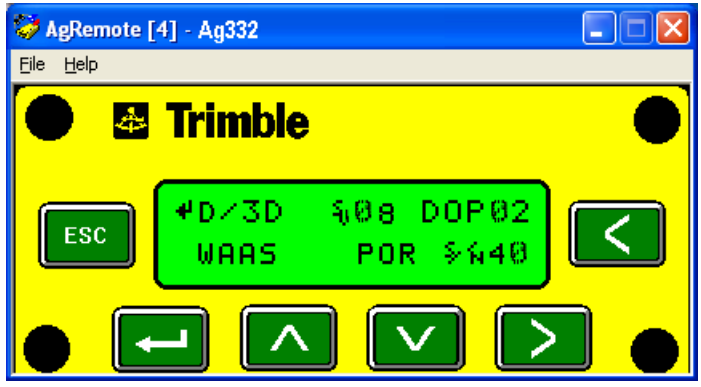
WAAS is a free satellite-based DGPS service that is available only in North America; EGNOS is a free satellite-based DGPS service that is available only in Europe.

To use the WAAS/EGNOS DGPS signal, you must first configure the receiver.

1. From the Home screen, select *Configuration* / *DGPS Config*.
2. Set the *Source Select* field to WAAS.
3. Press ↵ then Esc to complete the procedure.

To enable WAAS reception in the field:

1. Take the receiver outside. Make sure that it has a clear southeast and southwest view of the sky.
2. Turn on the receiver. WAAS activation can take two or more minutes. Once activation succeeds, the *Home* screen displays D/3D:



Configuring the *Ag*GPS Receiver to Operate in Beacon Mode

To configure the receiver in Beacon mode:

1. From the Home screen, select *Configuration* / *DGPS Config*.
2. Set the *Source Select* field to Beacon.
3. Press ↵ then Esc to complete this part of the procedure.

Configuring the *Ag*GPS Receiver to Operate in RTK Mode

To configure the receiver in RTK mode:

1. From the Home screen, select *Configuration* / *DGPS Config*.
2. Set the *Source Select* field to RTK.
3. Press ↵ then Esc to complete this part of the procedure.
4. For RTK operation, connect the radio to a port. Change the port input settings for that port to RtkLnk.

Configuring the Communication Ports

If the receiver is to be connected to an external device, configure Ports A and B so that the proper data type is input to and output from the receiver.

To configure Port A:

1. From the Home screen, select *Configuration* / *Port A Config*.
2. Use the menu commands to configure the communication ports. Ensure that the receiver outputs the correct GPS position data type for the hardware device or software program that is connected to the receiver.

To configure Port B:

- Repeat the above steps but in Step 1 select *Configuration* / *Port B Config*.

To configure Port C:

- Repeat the above steps but in Step 1 select *Configuration* / *Port C Config*.

Configuring input/output communication

The port input and output settings appear in the first screen. In Figure 5.2, the port is set to accept TSIP inputs at a baud rate of 115,000 with a parity of 8-Odd-1. The outputs are TSIP, also at a baud rate of 115,000.

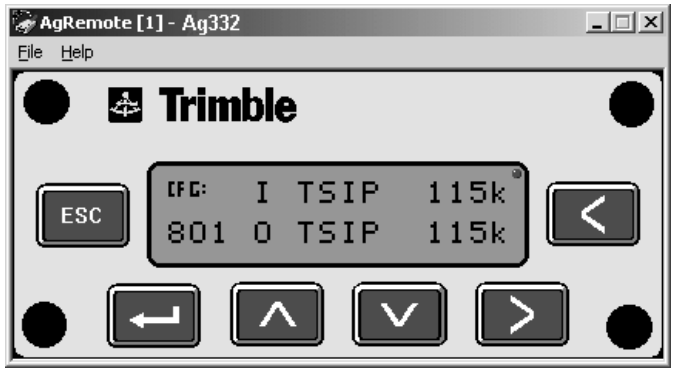


Figure 5.2 Communication settings

To communicate with the *Ag*GPS Autopilot, EZ-Guide Plus, or EZ-Steer systems, or with external hardware devices and software programs, configure the port input/output settings. Table 5.1 describes the input settings.

Table 5.1 Port input settings

Setting	Description
None	Inputs nothing to the receiver.
TEXTB	The receiver can accept ASCII data from an external device, such as a chlorophyll meter, on Port A, merge it with NMEA GPS data, and output the combined data on Port B. The incoming data must be limited to 66 ASCII characters and terminated by a carriage return and line feed (hex characters 0x0D 0x0A). The NMEA string outputs as $PTNLAG001,<up to 66 ASCII characters>*<2 digit checksum><CR><LF>. For the receiver to output the combined NMEA string, NMEA must be selected as the output protocol on Port B.
TEXTA	See the description for the TEXTB setting (above). TEXTA input outputs text on Port A. The default port settings are 8-N-1 TSIP 38.4 K. These may vary by product.

Table 5.1 Port input settings (continued)

Setting	Description
RTCM	The receiver can accept RTCM data from an external DGPS device, such as an external radio.
TSIP	The receiver can accept or output TSIP data packets from the port when using the *Ag*GPS 170 Field Computer.
RtkLnk	The receiver can accept real-time corrections (CMR data) from an external device such as a Trimble radio.

The default port settings are:

		Port A	Port B
Baud rate	In	TSIP 38,400	TSIP 38,400
	Out	TSIP 38,400	TSIP 38,400
Data bits		8	8
Parity		None	None
Stop bits		1	1

Note – *If the receiver is to work with an Autopilot system, ensure that the receiver port communication settings are 8-N-1 TSIP 38.4 K. To work with some other devices and software programs, the receiver port communication settings must be 8-N-1 NMEA 4800.*

When using a Trimble SiteNet 900 radio, make sure that the communication settings are correct in the receiver. The default settings to use with the SiteNet radio are:

Setting	Description
Baud rate	38,400
Data bits	8
Parity	None
Stop bits	1

Changing the input or output port settings

1. From the *Port A Config* screen, press ⌄ until the *Port-A Input/Output* screen appears.
2. Press > to activate the cursor.
3. Press ^ or ⌄ to change the value.
4. Press >.
5. Repeat Step 3 through Step 4 until you have set all the required values.
6. Press ↵ to save all the changes.
7. Press ⌄ to move to the next screen.

NMEA settings

Three screens (NMEA1, NMEA2, and NMEA3) show what NMEA messages are output from the port. Message types shown in upper case are being output; message types shown in lower case are not.

For more information about NMEA message types, refer to the document called *NMEA-0183 Messages Guide for AgGPS Receivers* on the Trimble website (www.trimble.com).

Port output rate

This setting can be used to vary the NMEA and TSIP output rate. A setting of 1 outputs one position each second.

ASAP equals the rate selected on the *Position Rate* screen under the *GPS Config* menu. A setting of ASAP outputs positions five or ten times every second. The default (factory) setting is 1 Hz.

To change the receiver configuration settings, enter the *Port Config* screens under the configuration menus.

Display Options

Use the *Display Options* menu to control how information is displayed in the screens that you can access from the *Status* and *Configuration* menus.

To view the *Display Options* menu:

- From the *Home* screen, press v:

Setting the language

To change the language displayed:

1. Navigate to the *Language* screen:

2. Press > to select the *Language* field.
3. Press ^ or v until the required language is displayed.
4. Press ↵ to select it and save the changes.
5. Press Esc to return to the *Display Options* menu.

   The screen automatically displays the selected language.

Setting the units

The *Units* screen displays U.S., Metric, or Nautical units in the screens that you access from the *Field Operation*, *Status,* and *Configuration* menus.

Note – *This setting does not affect GPS position data output.*

1. Navigate to the *Units* screen:

2. Press > to select the *Units* field.
3. Press ^ or v until the required unit is displayed.
4. Press ↵ to select it and save the changes.
5. Press Esc to return to the *Display Options* menu.
6. Press Esc again to return to the *Home* screen.

Locking the Configuration menus

To prevent unauthorized changes to the configuration, you can lock the Configuration menus:

1. Navigate to the *Lock Display Cfg* screen.
2. Press ↵ to display the *Enter Password* screen. The cursor is active on the first digit:

3. Use the last five numbers of the receiver serial number as the password ("passcode").
4. Press ^ or v until the first digit of the serial number appears.
5. Press > to select the next digit. Repeat step 3 until all five digits are entered.
6. Press ↵ to save the changes.
7. The Valid Password message appears, and the Configuration menus are no longer displayed when you navigate the menus.

   If the message Invalid Password appears, enter the password again.

Tip – When the Configuration menus are locked, you can view most Configuration menu settings from the Status menus.

To unlock the Configuration menus, repeat the above procedure.

Clearing battery-backed RAM

WARNING – When you select the Clear BB Ram option, any changes that you have made in the Configuration menus are deleted and cannot be restored.

Use the *Clear BB RAM* screen to remove all configuration settings in the receiver memory (RAM) and return the receiver to its factory default configuration settings:

To delete battery-backed memory:

1. Navigate to the *Clear BB RAM* screen:
2. Press > to activate the cursor.
3. Press ^ or v to select *Yes*.

Installing Passcodes

When you purchase an option with your receiver, your Trimble Reseller provides the necessary password. Once entered, the password is stored in permanent memory and remains even when the receiver is switched off.

Use the *Update receiver* screen of the *Ag*GPS menu system to enter the password directly into the receiver and activate the option for immediate field use.

1. Navigate to the *Update receiver* screen. Press ↵.

   The active cursor highlights the first digit.
2. Press ^ or v to enter the first number of the password.

3. Press > to move to the next digit.
4. Repeat Step 2 through Step 3 until all numbers are entered.
5. Press ↵ to save changes.

The screen displays the selected option as enabled.

If an error message appears, enter the password again. If you are still unsuccessful, contact your local Trimble Reseller for assistance.

FlashLoader200 utility

If you have not yet done so, install the latest version of FlashLoader200 utility on the office computer. See page 44. Use FlashLoader200 to enter one or more passwords:

1. On the office computer, click Start, then select *Programs* / *Flashloader200*.
2. In the dialog that appears, select the *Update receiver with password* check box. Click **Proceed**.
3. The *Flash Progress* dialog appears while the utility attempts to find the receiver. When the receiver is found, the *Enter Passwords* dialog appears.

   If the receiver cannot be found, check that the cables are properly connected and try again.
4. In the *Enter Passwords* dialog, enter the 10-digit password into the first blank line. If you have more than one option, enter each password on a separate line. Click **OK**.

   The process takes a few seconds and a message appears when completed.
5. In the dialog that appears, click **Yes** to continue.
6. When the successful operation message appears, click **OK**.

   The option is successfully installed.

If any password operation fails, the FlashLoader200 utility displays a message that identifies the failed option. Disconnect the receiver, then reconnect it and try again. If you are still unsuccessful, contact your local Trimble Reseller for assistance.

CHAPTER

6

Troubleshooting

In this chapter:

- Introduction
- Problems with GPS
- Interference Problems
- Problems with the GPS Receiver
- Problems with the FlashLoader200 Utility

Introduction

This chapter describes some problems that can arise and explains how to solve them. It includes a series of flowcharts to help with troubleshooting.

As you work through this chapter, you may need to view the receiver status or change values in some fields. For information on how to do this, refer to the document called *NMEA-0183 Messages Guide for AgGPS Receivers*. This document is on the Trimble website (www.trimble.com).

Problems with GPS

Problem	Possible solution
Poor accuracy	
The accuracy of GPS positions is poor because the receiver is picking up poor quality signals from the satellites. The receiver always calculates the most accurate position it can, given the current GPS satellite differential operating conditions.	Change some or all of the following GPS settings: • Minimum elevation – Increase the setting (the default is 8°). • Minimum Signal Strength – Increase the System Mask AMU setting (the default is 3). • Maximum PDOP – Decrease the setting (the default is 13). • GPS Mode – Change to Manual 3D (the default is Auto 2D/3D). • DGPS Mode – Change to DGPS (the default is DGPS Auto/On/Off).
GPS signals are reflecting off nearby trees and/or metal buildings and horizontal surfaces.	To reduce multipath noise, mount the GPS receiver so that it has a clear view of the sky. The receiver must be away from trees and large metal objects.
Intermittent loss of lock on satellite	
The receiver loses the satellite signal from time to time.	Make sure that the receiver is mounted on the highest point of the vehicle and is clear of metal surfaces. Check Maximum PDOP and Minimum Signal Strength settings (see **Poor accuracy**, above).

Problem	Possible solution
Intermittent DGPS signal	
The correction signal strength can drop to unusable levels. Causes include tree canopy cover between the receiver and the differential satellite, radar sets, and microwave transmitters.	Move the receiver away from the tree cover and/or from sources of electromagnetic interference.
Tracking but not receiving a differential signal	
The receiver is tracking satellites and tracking an OmniSTAR satellite beam, but is not receiving DGPS signals. The *Home* screen indicates how many satellites are being tracked, and whether a differential source is being tracked. You see: h-3D for HP not converged H-3D for HP converged r-3D for RTK float R-3D for RTK fixed D-3D for DGPS HP and RTK also give an indication of positional accuracy on the *Home* screen.	Check that your DGPS service subscription is still current and enabled. For OmniSTAR service: 1. Use the *Ag*Remote utility to navigate to one of the following screens, depending on what you are using: • the *Omni HP Info* screen • the *Omni VBS Info* screen. 2. Press ↵ until *Stop Date* appears. If the message Access Unknown appears, contact OmniSTAR to reactivate your subscription. For more information, see OmniSTAR, page 47. The receiver must be switched on and configured to track the correct satellite coverage beam before it can be reactivated. The receiver automatically tracks the correct beam based on receiver geographic location. If the receiver is manually changed, automatic tracking is deactivated until you perform a hard reset or firmware flash. When a satellite subscription is activated, the *Home* screen displays D/3D.
Long time to initialize	
In RTK mode, longer baselines require longer initialization times. (The baseline is the distance between the base receiver and the rover receivers.)	Wait for the receiver to initialize or consider repositioning the base receiver to shorten the baseline. Make sure the rover is in a clear area.

Problem	Possible solution
Loss of initialization	
In RTK mode initialization can be lost when the rover receiver is close to trees or buildings and the number of satellites falls below four. Additionally, initialization may be lost if the receiver has not been tracking RTK corrections for some time. For more information, see the next item.	Move away from trees and obstructions to initialize. Once initialized, approach the obstructed area again. If the obstructions are severe, GPS positioning may not work in that area. Because the GPS satellites move, there may be times of the day when you are working in an area with obstructions. For more information, see the Trimble Planning software on the Trimble website (www.trimble.com).
Not tracking RTK corrections	
The radio link is down or intermittent.	• Ensure that the line-of-sight between the base and rover receivers is not obstructed. • Ensure that the rover receiver is within range of the radio. • Ensure that the radio power supply is on.

Interference Problems

Problem	Possible solution
Strong magnetic fields	
Strong magnetic fields have no effect on GPS or satellite DGPS signals. However, some computers and other electric equipment radiate electromagnetic energy that can interfere with a GPS receiver.	If you suspect interference from a local magnetic field, move the receiver away from, or turn off, the suspect electronics while observing the number of satellites being tracked on the receiver or the signal-to-noise ratio (SNR) of the satellite. If the SNR goes up when the electronics are turned off, there may be interference from the local electronics.
FM 2-way radios	
Transmitting FM 2-way radios can interfere with OmniSTAR, WAAS, and GPS signal reception.	Make sure that there is at least 1 m (3 ft) between the FM 2-way radio antenna and the receiver.

Problem	Possible solution
Engine noise	
An unshielded ignition system can cause enough noise to block reception of a differential signal.	Use resistor spark plug wires on the vehicle ignition system.
An alternator can cause noise that interferes with a differential signal.	• Use bypass capacitors, commonly available in automotive stores for cleaning up interference to CB and other radios. If the problem persists, shield engine components with aluminum foil. • Relocate the antenna on the machine. • Determine the optimal antenna location by watching the SNR value on the Home screen. ***Note –*** *Before replacing engine parts in an attempt to solve this problem, make sure that the problem is not caused by a computer or power source near the receiver. Some computers and their power sources cause noise that disrupts GPS and satellite DGPS signals.*

Problems with the GPS Receiver

Problem	Possible solution
Mounting location	
The receiver is not picking up a clear signal.	Mount the receiver on the centerline of the vehicle, away from any sources of interference and with a clear view of the sky (see Choosing a location, page 21).

Problem	Possible solution
Cables	
One of the cables seems faulty.	Use an ohmmeter to check the cable. The resistance of a good cable between connector pins at each end of the cable is zero. If the cable is sound, but the problem persists, try exchanging the cable with one that you know is working. If the cable is defective, contact your local Trimble Reseller for an RMA number (if the Trimble product is still under warranty), or to purchase a replacement cable.
Real-time clock battery	
A lithium-ion battery in the receiver powers the internal real-time clock and so enables the receiver to get a first fix faster. The battery has a life of 7.5 years. When the battery fails, the internal clock cannot keep accurate time and the receiver may take longer to output GPS positions.	Please ***contact your local Trimble Reseller*** to get the batteries replaced. You cannot replace the battery yourself.
Factory defaults	
You need to restore the receiver factory defaults.	To restore receiver factory default settings: 1. Connect the receiver to a computer. Turn on the receiver. 2. Run the *Ag*Remote utility. 3. Navigate to the *Clear BB RAM* screen. 4. Press ▽ until Yes appears. 5. Press ↵. The factory default settings are restored. The DGPS service subscription is not lost.

Problems with the FlashLoader200 Utility

Problem	Possible solution
The FlashLoader 200 utility cannot detect the receiver or download the firmware.	Make sure that: • Other programs, such as Microsoft ActiveSync technology, are not using the COM port that the computer is using. • The receiver is connected to a 12–32 V DC power source. • All cables are connected correctly between the device and the computer. • The receiver is connected to the correct computer COM port. To do this: 1. From the FlashLoader200 menu, select *Settings*. 2. Select the check box for a serial link. 3. At *Port*, select Auto. Click **OK**. 4. Select the *Upload firmware to receiver* check box. 5. Navigate to where the firmware file is saved and select the file. Click **Proceed**. 6. From the *Auto Port Select dialog,* select *Use receiver on port...* and click **OK**. Once you have checked this, turn off the receiver then turn it on again. Try again to connect the FlashLoader200 utility.

APPENDIX

A

Cables and Connectors

In this appendix:

- Introduction
- Port A and Port B Connectors
- Standard Power/Data Cable

Introduction

This appendix contains pin-out information for standard and optional cables. Use the information to troubleshoot communication problems with the receiver and devices not supported by the standard and optional cables.

Port A and Port B Connectors

Table A.1 gives pin-out requirements for the Port A, Port B, and Port C connectors.

Table A.1 *Ag*GPS 332 receiver Port A, Port B, and Port C

Pin	Port A connector	Port B connector	Port C connector
1	Event In	Event In	Event In
2	RS-232 B Out	RS-232 A Out	
3	RS-232 B In	RS-232 A In	
4	CAN Hi	CAN Hi	CAN Hi
5	Ground	Ground	Ground
6	RTS Out	RTS Out	RTS Out
7	Power On/Off	Power On/Off	Power On/Off
8	CTS In	CTS In	CTS In
9	CAN Low	CAN Low	CAN Low
10	Battery +V	Battery +V	Battery +V
11	Battery –V	Battery –V	Battery –V
12	1 PPS Output	1 PPS Output	1 PPS Output

Standard Power/Data Cable

Table A.2 gives pin-out information for the standard power/data cable (P/N 30945).

Table A.2 Standard power/data cable

To receiver P1 connector 12-pin (female)			7 cond cable	To computer P2 connector DE9 (female)		To DC power 2 conductor cable	
Pin	**Signal**		**Color**	**Pin**	**Signal**	**Color**	**Signal**
1	Event In	←	Black	4	DTR		
2	TXD	→	Orange	2	RXD		
3	RXD	←	Red	3	TXD		
4							
5	SIG GND	↔	Shield	5	SIG GND		
6	RTS	→	Yellow	8	RTS		
8	CTS	←	Green	7	CTS		
9							
7[1]	PWR ON	←					
10[1]	V+ IN	←	Red			Red	V+ IN
11	V– IN	←	Black			Black	V– OUT
12	PPS	→	Blue	9	PPS		

[1]Pins 7 and 10 of the P1 connector are jumpered with a 5 kOhm, 5% resistor.

APPENDIX

B

Specifications

In this appendix:

- Introduction
- AgGPS 332 Receiver Physical Characteristics
- GPS Channels Performance
- L-Band Satellite Differential Correction Receiver with OmniSTAR Support
- Receiver Default Settings
- DGPS Antenna
- Dual-Frequency Antenna
- Beacon Channels

Introduction

This appendix details specifications for the *Ag*GPS 332 receiver and the compatable Trimble antennas.

*Ag*GPS 332 Receiver Physical Characteristics

Item	Description
Size	14.78 cm wide x 5.58 cm high x 21.59 cm deep (5.70 in x 2.20 in x 8.60 in)
Power	Nominal 350 mA at 12 V DC
Operating temperature	–30 °C (–22 °F) through +70 °C (+158 °F)
Storage temperature	–40 °C (–40 °F) through +85 °C (+185 °F)
Humidity	Complies with Mil 810E Method 507.3 Procedure III Aggravated Cyclic Humidity. Ten 24 hour cycles of constant 95% RH, with cycling temperature and dwells +30 °C (+86 °F) and +60 °C (140 °F). Unit sealed to +/- 5 PSID
Casing	Low-profile UV-resistant plastic. Dust-proof, waterproof, shock resistant, with recessed protected connectors.
Connectors	12-pin Deutsch connectors
Ports	Two connection ports, both of which support RS-232 and CAN
Mounting	Three holes for 10 mm (0.39 in) bolts
Compliance	FCC Part 15 Class A, C-Tick, E-mark, CE-mark

GPS Channels Performance

Item	Description
General	12-channel, parallel tracking L1 1571.42 MHz and L2 1227.60 MHz. C/A code and carrier phase filtered measurement.
Update rate	1, 5, 10 Hz
RTK speed accuracy	0.16 kph (0.10 mph)

Item	Description
RTK position accuracy	***Horizontal 2.5 cm (0.98 in) + 2 ppm, 2 sigma, and vertical 3.7 cm (1.46 in) + 2 ppm, 2 sigma, if all of the following criteria are met:*** • At least 5 satellites • PDOP <4 • CMR corrections • Standard format broadcast from a Trimble MS750, *Ag*GPS 214, or equivalent reference station
Differential speed accuracy	0.16 kph (0.1 mph)
Differential position accuracy	Less than 1 m (3.28 ft) horizontal if all of the following criteria are met: • At least 5 satellites • PDOP <4 • RTCM SC-104 corrections • Standard format broadcast from a Trimble MS750, *Ag*GPS 214, or equivalent reference station
OmniSTAR HP speed accuracy	0.16 kph (0.1 mph)
OmniSTAR HP position accuracy	***10 cm (3.94 in) after convergence, 2 sigma, if all the following criteria are met:*** • At least 5 satellites • PDOP <4 • OmniSTAR HP corrections Convergence time can vary, depending on the environment. Time to the first fix (submeter accuracy) is typically <30 seconds; time to the first useable fix (<10 cm accuracy) is typically <30 minutes.
OmniSTAR XP position accuracy	***20 cm (7.87 in) after convergence, 2 sigma, if all the following criteria are met:*** • At least 5 satellites • PDOP <4 • OmniSTAR XP corrections Convergence time can vary, depending on the environment. Time to the first fix (submeter accuracy) is typically <30 seconds; time to the first useable fix (<10 cm accuracy) is typically <30 minutes
Time to first fix	<30 seconds, typical
Multipath mitigation	EVEREST technology

Item	Description
Satellite differential compatibility	OmniSTAR, WAAS, and EGNOS
NMEA messages	GGA 1 1[1], GLL, GSA1, GST, GSV, GST, MSS, PTNLDG, PTNL PJK, PTNL PJT, PTNL VGK, PTNL VHD, PTNLEV, PTNLID, PTNLSM, RMC1, VGK, VTG1, XTE, ZDA

[1] By default, the receiver is configured to output GCA, GSA, RMC, and VTG messages at a 1 Hz (1 position per second) update rate.

L-Band Satellite Differential Correction Receiver with OmniSTAR Support

Item	Description
Bit error rate	10^{-5} for Eb/N of >5.5 dB
Acquisition and reacquisition time	<5 seconds, typical
Frequency band	1525–1559 MHz
Channel spacing	0.5 kHz

Receiver Default Settings

Item	Description
DGPS source	WAAS/EGNOS
Dynamics	Land
Minimum elevation	8°
AMU mask	3
PDOP mask	13
PDOP 2D/3D switch	11
DGPS mode	Auto On/Off
DGPS correction age limit	250 seconds
Pos fix rate	1 Hz

DGPS Antenna

Item	Description
Size	15.5 cm D x 14.0 cm H (6.1 in x 5.5 in)
Weight	0.55 Kg (1.2 lb)
Operating temperature	–30°C to +65°C
Storage temperature	–40°C to +80°C
Humidity	100% condensing, unit fully sealed
Casing	Dust-proof, waterproof, shock resistant

Dual-Frequency Antenna

Item	Description
Size	16 cm D x 7.5 cm H x (6.25 in x 3 in H)
Weight	0.55 Kg (1.2 lb)
Operating temperature	–30°C to +65°C
Storage temperature	–40°C to +80°C
Humidity	100% condensing, unit fully sealed
Casing	Dust-proof, waterproof, shock resistant

Beacon Channels

Item	Description
Frequency range	283.5 kHz to 325.0 kHz
Channel Spacing	500 Hz
Beacon modulation	50, 100, and 200 bits/second
Signal strength	10 mV/meter minimum
Dynamic range	100 dB
Channel selectivity	70 dB @ > 500 Hz offset
Frequency offset	17 ppm maximum
3rd order intercept	+15 dBm @ RF input (min. AGC setting)
Beacon acquisition time	<5 seconds, typical
Operating modes	Auto Power, Auto Range, and Manual

APPENDIX

C

NMEA-0183 Messages

In this appendix:

- Introduction
- NMEA-0183 Message Structure
- NMEA Message Summary
- GGA (GPS Fix Data)
- GLL (Position Data)
- GRS (GPS Range Residuals)
- GSA (GPS DOP and Active Satellites)
- GST (GPS PRN)
- GSV (GPS Satellites in View)
- MSS (Beacon Receiver Signal Status)
- RMC (Recommended Minimum Specific GPS Data)
- VTG (Course Over Ground and Ground Speed)
- XTE (Cross-Track Error)
- ZDA (Time and Date)
- PTNLEV Proprietary (Event Marker)
- PTNLID Proprietary (Trimble Receiver ID)
- PTNLDG Proprietary (Trimble DGPS Receiver Status)
- PTNL,GGK (Time, Position, Position Type, and DOP)
- PTNLSM Proprietary (RTCM Special)

Introduction

Trimble *Ag*GPS receivers output NMEA (National Marine Electronic Association) messages for GPS position data transfer between electronics equipment. Information on the NMEA-0183 communication standard for GPS receivers is available at www.nmea.org.

This appendix describes NMEA-0183 standard messages that are configured using TSIP command packets.

Other messages are supported only when specific Trimble options are installed on the receiver. Messages beginning with PTNL are Trimble proprietary messages.

NMEA-0183 Message Structure

NMEA-0183 messages are strings of comma-delimited text. Figure C.1 shows the structure of an NMEA-0183 message.

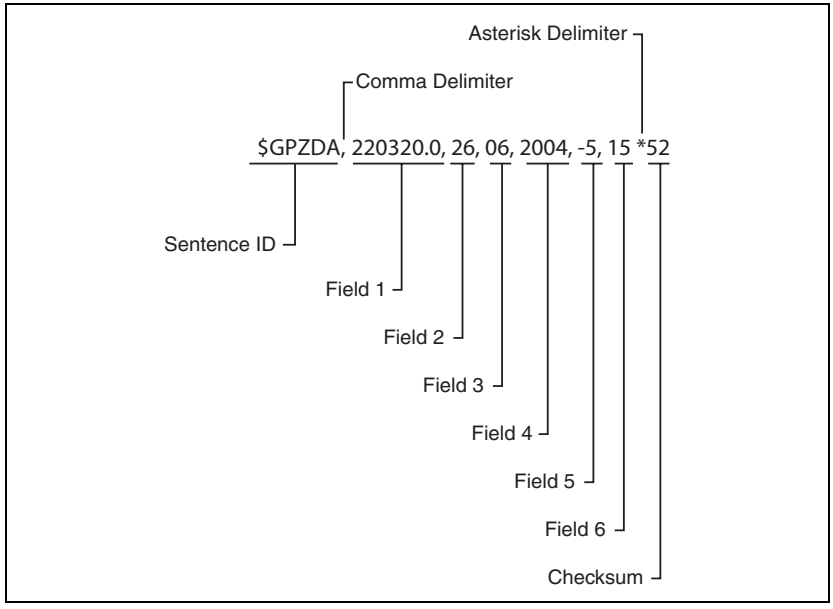


Figure C.1 Example showing NMEA-0183 message structure — ZDA

Each NMEA message includes:

- an identifier to distinguish it from other messages in the data stream
- one or more fields of data, separated by a comma
- a checksum (preceded by *) to validate the data

Table C.1 explains the fields in the ZDA example shown in Figure C.1.

Table C.1 Fields in an NMEA-0183 message — ZDA

Field	Data	Description
1	220320.0	Time in UTC
2	26	Day (01 to 31)
3	06	Month (01 to 12)
4	1997	Year
5	-5	Local time zone offset from GMT (in hours 00 to ±13 hours)
6	15	Local time zone offset from GMT (in minutes)

Fields 5 and 6 together give the total offset. Local time is 5 hours and 15 minutes earlier than GMT.

Symbols and delimiters

All messages follow the NMEA-0183 Version 2.1 format, in which symbols and delimiters identify or separate the message data.

NMEA-0183 messages always:

- begin with a dollar sign ($) followed by a talker ID code (for example GP) and a message ID code (for example, ZDA)
- end with a carriage return and line feed

Checksum values

Newer Trimble receivers conform to the NMEA-0183 Version 2.1 format, in which checksums are mandatory for all messages.

The checksum is calculated from all characters in the message, including commas but excluding the "$" and "*" delimiters. The hexadecimal result is converted to two ASCII characters (0–9, A–F), of which the most significant appears first.

Field formats

The data values output by Trimble *Ag*GPS receivers meet the NMEA-0183 Version 2.1 standard.

Null fields

If a message contains a fixed number of fields, null (empty) fields are included if no data is available. These fields are usually reserved for data that is transmitted on a periodic or irregular basis.

Talker ID codes

Talker ID code identifies the source of the data (for example, GPS, Loran C, or Sounder). Table C.2 describes the Talker ID codes that are available for NMEA-0183 output from most Trimble receivers.

Table C.2 Supported Talker ID codes

Code	Description
GP	GPS
LG	Loran C/ GPS
LC	Loran C
II	Integrated Instrumentation

Latitude and longitude values

The latitude and longitude values in NMEA-0183 messages are presented in degrees, minutes, and decimal minutes, in a single field:

- latitude (ddmm.mmmm)
- longitude (dddmm.mmmm)

Latitude and longitude direction values are sent in a separate field as N, S, E, or W.

Time values

Time values in Universal Time Coordinated (UTC) are presented in hhmmss.ss format, where hh is hours (00–23), mm is minutes, and ss.ss is seconds and fractions of seconds.

Reading NMEA string format

Be aware that NMEA strings can be of varying length, depending on how the receiver is configured. Comma delimited parsing is recommended.

NMEA Message Summary

Table C.3 describes the NMEA-0183 message set that is supported by the *Ag*GPS receivers.

Note – *Some messages are only supported when specific Trimble options are installed on the receiver.*

Messages beginning with PTNL are Trimble proprietary messages.

Table C.3 NMEA message summary

Message	Message Contents
GGA (GPS Fix Data)	Time, position, and fix related data
GLL (Position Data)	Position fix, time of position fix, and status
GRS (GPS Range Residuals)	GPS range residuals
GSA (GPS DOP and Active Satellites)	GPS position fix mode, SVs used for navigation and DOP values
GST (GPS PRN)	GPS Pseudorange Noise (PRN) statistics
GSV (GPS Satellites in View)	Number of SVs visible, PRN numbers, elevation, azimuth and SNR values
MSS (Beacon Receiver Signal Status)	Signal strength, signal-to-noise ratio, beacon frequency, and beacon bit rate
RMC (Recommended Minimum Specific GPS Data)	UTC time, status, latitude, longitude, speed over ground (SOG), date, and magnetic variation of the position fix
VTG (Course Over Ground and Ground Speed)	Actual track made good and speed over ground
XTE (Cross-Track Error)	Cross-track error
ZDA (Time and Date)	UTC time, day, month, and year, local zone number and local zone minutes
PTNLDG Proprietary (Trimble DGPS Receiver Status)	Beacon channel strength, channel SNR, channel frequency, channel bit rate, channel number, channel tracking status, RTCM source, and channel performance indicator
PTNLEV Proprietary (Event Marker)	Time, event number, and event line state for time-tagging change of state on an event input line

Table C.3 NMEA message summary (continued)

Message	Message Contents
PTNL,GGK (Time, Position, Position Type, and DOP)	Time, Position, Position Type and DOP values
PTNLID Proprietary (Trimble Receiver ID)	Receiver machine ID, product ID, major and minor release numbers, and firmware release date
PTNLSM Proprietary (RTCM Special)	Reference Station Number ID and the contents of the Special Message included in valid RTCM Type 16 records

All messages in this appendix are presented in the format shown in Table C.1. In each example, the structure is shown in the paragraph before the table.

GGA (GPS Fix Data)

The GGA message contains the time, position, and fix related data.

The GGA message structure is:

$GPGGA,151924,3723.454444,N,12202.269777,
W,2,09,1.9,–17.49,M,–25.67,M,1,0000*57

Table C.4 describes these fields.

Table C.4 GGA message fields

Field	Description
1	UTC of position fix in HHMMSS.SS format
2	Latitude in DD MM,MMMM format (0-7 decimal places)
3	Direction of latitude N: North S: South
4	Longitude in DDD MM,MMMM format (0-7 decimal places)
5	Direction of longitude E: East W: West
6	GPS Quality indicator 0: fix not valid 1: GPS fix 2: DGPS fix
7	Number of SVs in use, 00-12
8	HDOP
9	Antenna height, MSL reference
10	“M” indicates that the altitude is in meters
11	Geoidal separation
12	“M” indicates that the geoidal separation is in meters
13	Age of differential GPS data record, Type 1; Null when DGPS not used
14	Base station ID, 0000-1023

GLL (Position Data)

The GLL message specifies the position fix, time of position fix, and status.

The GLL message structure is:

```
$GPGLL,3723.4543,N,12202.2696,W,151933,
A*3E
```

Table C.5 describes these fields.

Table C.5 GLL message fields

Field	Description
1	Latitude in dd mm,mmmm format (0-7 decimal places)
2	Direction of latitude
3	Longitude in ddd mm,mmmm format (0-7 decimal places)
4	Direction of longitude
5	UTC of position in hhmmss.ss format
6	Fixed text “A” shows that data is valid

GRS (GPS Range Residuals)

The GRS message is used to support the Receiver Autonomous Integrity Monitoring (RAIM).

The GRS message structure is:

```
$GPGRS,220320.0,0,-0.8,-0.2,-0.1,
-0.2,0.8,0.6,,,,,,*55
```

Table C.6 describes these fields.

Table C.6 GRS message fields

Field	Description
1	UTC time of GGA position fix
2	Residuals Residuals used to calculate position given in the matching GGA line 1: Residuals recomputed after the GGA position was computed
3-14	Range residuals for satellites used in the navigation solution, in meters

Note – *Because the contents of this NMEA message do not change significantly during a one-second interval, the receiver outputs this message at a maximum rate of 1 Hz.*

GSA (GPS DOP and Active Satellites)

The GSA message identifies the GPS position fix mode, the SVs used for navigation, and the Dilution of Precision values.

The GSA message structure is:

$GPGSA,A,3,19,28,14,18,27,22,31,29,,,,,
1.7,1.0,1.3*35

Table C.7 describes these fields.

Table C.7 GSA message fields

Field	Description
1	Mode M: Manual, forced to operate in 2D or 3D A: Automatic, 3D/2D
2	Mode 1: Fix not available 2: 2D 3: 3D
3–14	IDs of SVs used in position fix (null for unused fields)
15	PDOP
16	HDOP
17	VDOP

GST (GPS PRN)

The GST message is used to support Receiver Autonomous Integrity Monitoring (RAIM).

The GST message structure is:

$GPGST,220320.0,1.3,0.8,0.5,166.1,0.8,0.5,1.6,*4F

Table C.8 describes these fields.

Table C.8 GST message fields

Field	Description
1	UTC time of GGA fix
2	RMS value of the standard deviation of the range inputs to the navigation process (range inputs include pseudoranges and DGPS corrections)
3	Standard deviation of semi-major axis of error ellipse, in meters
4	Standard deviation of semi-minor axis of error ellipse, in meters
5	Orientation of semi-major axis of error ellipse, in degrees from true north
6	Standard deviation of latitude error, in meters
7	Standard deviation of longitude error, in meters
8	Standard deviation of altitude error, in meters

Note – *Because the contents of this NMEA message do not change significantly during a one-second interval, the receiver outputs this message at a maximum rate of 1 Hz.*

GSV (GPS Satellites in View)

The GSV message identifies the number of SVs in view, the PRN numbers, elevation, azimuth and SNR values.

The GSV message structure is:

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

Table C.9 describes these fields.

Table C.9 GSV message fields

Field	Description
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, 90^0 maximum
6	Azimuth, degrees from true north, 000^0 to 359^0
7	SNR, 00-99 dB (null when not tracking)
8–11	Information about second SV, same format as fields 4–7
12–15	Information about third SV, same format as fields 4–7
16–19	Information about fourth SV, same format as fields 4–7

Note – *Because the contents of this NMEA message do not change significantly during a one-second interval, the receiver outputs this message at a maximum rate of 1 Hz.*

MSS (Beacon Receiver Signal Status)

The MSS message identifies the status of the beacon signal, including the beacon signal strength, beacon signal-to-noise ratio (SNR), beacon frequency, and beacon bit rate.

The MSS message structure is:

$GPMSS,52.5,23.7,287.0,100*4C

Table C.10 describes these fields.

Table C.10 MSS message fields

Field	Description
1	Signal strength (SS), dB ref: 1 υV/m
2	Signal-to-Noise Ratio (SNR), dB
3	Beacon frequency, 283.5–325.0 kHz
4	Beacon bit rate (25, 50, 100, 200), bits per second
5	Channel number

Note – *Because the contents of this NMEA message do not change significantly during a one-second interval, the receiver outputs this message at a maximum rate of 1 Hz.*

RMC (Recommended Minimum Specific GPS Data)

The RMC message identifies the UTC time, status, latitude, longitude, speed over ground (SOG), date, and magnetic variation of the position fix.

The RMC message structure is:

```
$GPRMC,184804.00,A,3723.476543,N,
12202.239745,W,000.0,0.0,051196,15.6,E*7C
```

Table C.11 describes these fields.

Table C.11 RMC message fields

Field	Description
1	Time: UTC time of the position fix in hhmmss.ss format
2	Status Valid V: Navigation Receiver Warning (V is output whenever the receiver suspects something is wrong)
3	Latitude coordinate (the number of decimal places, 0–7, is programmable and determined by the numeric precision selected in TSIP Talker for a RMC message)
4	Latitude direction N = North, S = South
5	Longitude coordinate (the number of decimal places, 0–7, is programmable and determined by the numeric precision selected in TSIP Talker for a RMC message)
6	Longitude direction W: West E: East
7	Speed Over Ground (SOG) in knots (0–3 decimal places)
8	Track Made Good, True, in degrees
9	Date in dd/mm/yy format
10	Magnetic Variation in degrees

Table C.11 RMC message fields (continued)

Field	Description
11	Direction of magnetic variation E: Easterly variation from True course (subtracts from True course) W: Westerly variation from True course (adds to True course)
12	Mode indication A: Autonomous D: Differential N: Data not valid

VTG (Course Over Ground and Ground Speed)

The VTG (Velocity True Ground) message identifies the actual track made good and speed over ground.

The VTG message structure is:

$GPVTG,0,T,,,0.00,N,0.00,K*33

Table C.12 describes these fields.

Table C.12 VTG message fields

Field	Description
1	Track made good
2	Fixed text “T” shows that track made good is relative to true north
3	Not used
4	Not used
5	Speed over ground in knots (0–3 decimal places)
6	Fixed text “N” shows that speed over ground is in knots
7	Speed over ground in kilometers/hour (0–3 decimal places)
8	Fixed text “K” shows that speed over ground is in kilometers/hour

Note – *Because the contents of this NMEA message do not change significantly during a one-second interval, the receiver outputs this message at a maximum rate of 1 Hz.*

XTE (Cross-Track Error)

The XTE message reports the vessel's cross-track error.

The XTE message structure is :

$GPXTE,A,A,0.050,L,N*5E

Table C.13 describes these fields.

Table C.13 XTE message fields

Field	Description
1	
2	
3	Cross-track error, in nautical miles
4	Direction to steer L: Left R: Right
5	N: Nautical mile units

ZDA (Time and Date)

The ZDA message identifies UTC time, day, month, and year, local zone number and local zone minutes.

The ZDA message structure is:

$GPZDA,184830.15,05,11,1996,00,00*66

Table C.14 describes these fields.

Table C.14 ZDA message fields

Field	Description
1	UTC time
2	Day
3	Month
4	Year
5	Local zone number (– for East Longitude)
6	Local zone minutes

Note – *Because the contents of this NMEA message do not change significantly during a one-second interval, the receiver outputs this message at a maximum rate of 1 Hz.*

PTNLEV Proprietary (Event Marker)

The PTNLEV message is a Trimble proprietary message for time-tagging and marking when an event input occurs. If enabled, this event message is output whenever an event is detected.

The PTNLEV message structure is:

$PTNLEV,184804.00,0*XX

Table C.15 describes these fields.

Table C.15 PTNLEV message fields

Field	Description
1	Time: UTC time of the position fix in hhmmss.ss format
2	Event number, starting with event 0

PTNLID Proprietary (Trimble Receiver ID)

The PTNLID message is a Trimble proprietary message for identifying the receiver's machine ID, product ID, major and minor release numbers, and firmware release date.

The PTNLID message structure is:

$PTNLID,097,01,XXX,XXX,DD/MM/YY*XX

Table C.16 describes these fields.

Table C.16 PTNLID message fields

Field	Description
1	Machine ID
2	Product ID
3	Major firmware release number
4	Minor firmware release number
5	Firmware release date, in dd/mm/yy format

The PTNLID message, if enabled, is output every 30 seconds.

PTNLDG Proprietary (Trimble DGPS Receiver Status)

The PTNLDG message is a Trimble proprietary message for identifying the DGPS receiver channel strength, channel SNR, channel frequency, channel bit rate, channel number, channel tracking status, RTCM source, and channel performance indicator for either beacon DGPS or satellite DGPS.

The PTNLDG message structure is:

$PTNLDG,87.0,5.2,1558510.0,1200,2,4,1,25,,,*01

Table C.17 describes these fields.

Table C.17 PTNLDG message fields

Field	Description
1	Channel signal strength, in 1 dBuV/m. For beacon, this is the electromagnetic field intensity level. For satellite, this is the ADC input voltage level.
2	Channel signal to noise (SNR) level, in dB
3	Channel frequency, in kHz
4	Channel bit rate, in bits per second (bps)
5	Channel number, 0–99
6	Channel tracking status 0: Channel idle 1: Wideband FFT search 2: Searching for signal 3: Channel has acquired signal 4: Channel has locked on signal 5: Channel disabled
7	Specified channel is used as RTCM source 0: Not used 1: Used
8	Channel tracking performance indicator. For beacon, this is the number of errors in the last 255 words. For satellite, this is the time since last sync, in tenths of seconds ranging from 0–255.

The PTNLDG message fields are defined in free format.

The maximum number of characters in each field is indicated above (for example, 25 bps displayed as xxx,25,xxx instead of xxx,00025,xxx).

If a channel is disabled, the channel fields can be null fields (showing commas only). If more than one channel is available, the message should be repeated for each channel.

This message can be enabled using TSIP. If enabled, it is output at the NMEA report rate.

Note – *Because the contents of this NMEA message do not change significantly during a one-second interval, the receiver outputs this message at a maximum rate of 1 Hz.*

PTNL,GGK (Time, Position, Position Type, and DOP)

The PTNL,GGK message structure is:

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

Table C.18 describes these fields.

Table C.18 PTNL,GGK message fields

Field	Description
1	UTC of position fix, in hhmmss.ss format
2	UTC Date of position, in mmddyy format
3	Latitude, in degrees and decimal minutes (for example, dddmm.mmmmmmm)
4	Direction of latitude N: North S: South
5	Longitude, in degrees and decimal minutes (for example, dddmm.mmmmmmm)
6	Direction of longitude E: East W: West
7	GPS quality indicator 0: Fix not available or invalid 1: Autonomous GPS fix 4: Differential, code phase only solution (DGPS)
8	Number of satellites used in GPS solution
9	DOP of fix
10	Ellipsoidal height of fix (antenna height above ellipsoid)
11	M: Ellipsoidal height is measured in meters

PTNLSM Proprietary (RTCM Special)

The PTNLSM message is a Trimble proprietary message for identifying the Reference Station ID and the ASCII Text message that is included in an RTCM Type 16 Special Message. The PTNLSM message is generated anytime an RTCM stream receives a valid Type 16 Special Message.

The PTNLSM message structure is:

$PTNLSM,0022,This is a message,*.XX

Table C.19 describes these fields.

Table C.19 PTNLSM message fields

Field	Description
1	Reference station ID number, ranging from 0 to 1023. Leading zeros must be added to fill four-digit field.
2	ASCII text message contained within the Type 16 RTCM message.

APPENDIX

D

Third-Party Interface Requirements

In this appendix:

- Software
- Hardware

Software

The following table lists the interface requirements for connecting an *Ag*GPS receiver to third-party software.

Software	Company	Protocol	NMEA messages	Baud rate	Other	Pos Rate	Cable P/N required	Notes
AgGPS EZ-Map	Trimble	NMEA	GGA	38.4K	8-N-1	5Hz	30945, 40947-18, 46441	Do not output ZDA message.
AgView	GIS Solutions	NMEA	VTG, GLL	4800	8-N-1	1Hz	30945, 40947-18, 46441	
FarmGPS	Red Hen	NMEA	GGA, GSA, VTG	4800	8-N-1	1 Hz	30945, 40947-18, 46441	
Field Rover	SST Dev Group	NMEA	GGA, GSA, GSV, VTG	4800	8-N-1	1 Hz	30945, 40947-18, 46441	Do not output MSS message.
Field Worker Pro	Field Worker	NMEA	GGA, GLL, RMC, VTG	4800, 9600	8-N-1	1 Hz	30945, 40947-18, 46441	
FieldLink DOS	Agris	NMEA	GGA, GSA, VTG	4800,9 600	8-N-1	1 Hz	30945, 40947-18, 46441	
FieldLink Windows	Agris	NMEA	GGA, GSA, VTG	4800, 9600	8-N-1	1 Hz	30945, 40947-18, 46441	
GuideMate	Raven/Far mworks	NMEA	GGA, VTG	19.2K	8-N-1	1 Hz, 5 Hz	30945, 40947-18, 46441	
HGIS	Starpal	NMEA	GGA, RMC	4800, 9600	8-N-1	1 Hz	30945, 40947-18, 46441	
Instant Survey	AgriLogic (Case-IH)	NMEA	GGA, GSA, RMC	4800	8-N-1	1 Hz	30945, 40947-18, 46441	
Pocket Survey	AgriLogic (Case-IH)	NMEA	GGA, GSA, RMC	4800	8-N-1	1 Hz	30945, 40947-18, 46441	
SiteMate	Farmworks	NMEA	GGA, VTG	4800	8-N-1	1 Hz	30945, 40947-18, 46441	
SST Stratus	SST Dev Group	NMEA	GGA, RMC	38.4K	8-N-1	1 Hz	30945, 40947-18, 46441	

Hardware

The following table lists the interface requirements for connecting an *Ag*GPS receiver to third-party hardware.

Company	Hardware	Protocol	NMEA messages	Baud rate	Other	Pos rate	Cable P/N required	Notes
Ag Leader	Insight	NMEA	GGA, VTG	9600, or 19.2K	8-N-1	5Hz	30945, 40947-18, 46441	Requires Ag Leader adapter cable, P/N 2000819, or T-P/N 18532, or standard serial cable with null modem.
Ag Leader	PF Advantage	NMEA	GGA, VTG	4800	8-N-1	1 Hz	30945, 40947-18, 46441	Requires Ag Leader adapter cable, P/N 2000929. Connect to Aux1 port on PFAdvantage.
Ag Leader	PF3000 Yield Monitor	NMEA	GGA, VTG	4800	8-N-1	1 Hz	39903	Do not set position output faster than 1 Hz.
Ag Leader	PF3000Pro Monitor without GPS	NMEA	GGA, VTG	4800	8-N-1	1 Hz	30945, 40947-18, 46441	Requires Ag Leader adapter cable, P/N 2000929. Connect to Aux1 port on PF3000Pro.
Ag Leader	Yield Monitor 2000	NMEA	GGA, VTG	4800	8-N-1	1 Hz	39903	P/N 39903 replaces cable P/N 30660, Do not set position output faster than 1Hz.
AGCO	FieldStar Yield Monitor (1997–mid 2001)	NMEA	GGA, VTG, GSV, GSA @ 1 Hz, VTG @ 5 Hz	9600	8-N-1	1 Hz, 5 Hz	30945, 40947-18, 46441	FieldStar Com Unit is DB9 male. Requires a null modem RS-232 adapter.
AGCO	FieldStar Yield Monitor (2003 or later)	NMEA	GGA, VTG, GSV, GSA @ 1 Hz, VTG @ 5 Hz	9600	8-N-1	1 Hz, 5 Hz	30945, 40947-18, 46441	Requires AGCO adapter cable, P/N 71395221 (DB9 male to 9 pin circular AMP connector).
AGCO	FieldStar Yield Monitor (mid 2001–2002)	NMEA	GGA, VTG, GSV, GSA @ 1 Hz, VTG @ 5 Hz	9600	8-N-1	1 Hz, 5 Hz	30945, 40947-18, 46441	FieldStar Com Unit is DB9 female. Requires a null modem RS-232 adapter plus gender changer, or a male-male null modem adapter.
AgNav	Ag-Nav2	NMEA	GGA, VTG	9600, 19.2K	8-N-1	5 Hz	30945	
Auto Control, Inc.	AutoCal	NMEA	VTG	4800	8-N-1	5 Hz	30945	Adapter cable is purchased from Jim Graves, Auto Control Inc., Houma, LA

Company	Hardware	Protocol	NMEA messages	Baud rate	Other	Pos rate	Cable P/N required	Notes
Case Tyler	Aim Navigator	NMEA	GGA	19.2K	8-N-1	5 Hz	30945, 40947-18	
Case-IH	AFS Yield Monitor w/ Universal Display or Universal Display Plus	NMEA	GGA, VTG	4800	8-N-1	1 Hz	32609, (Case P/N 87302445)	Do not set position output faster than 1Hz Needs (Case P/N 87302445) when hooking up to new AFX Series.
Case-IH (Ag Leader YM2000)	AFS Yield Monitor	NMEA	GGA, VTG	4800	8-N-1	1 Hz	32609	Do not set position output faster than 1Hz
CNH	Case-IH & New Holland Yield Monitors	CAN	***will auto-configure***					Requires P/N 46651. Needs an extension cable (P/N: 401129) if using a smartspot receiver.
Claas	Caterpillar Cebis Yield Monitor	NMEA	GGA	4800, 9600	8-N-1	1 Hz	30945, 40947-18, 46441	
Cultiva	ATC	NMEA	GGA, VTG	9600	8-N-1	5 Hz	30945, 40947-18	
Cultiva	Marker Lite	NMEA	GGA, VTG	9600	8-N-1	5 Hz	30945, 40947-18	
Cultiva	Marker Lti	NMEA	GGA, VTG	9600	8-N-1	5 Hz	30945, 40947-18	
Del Norte	Del Norte Aerial Guidance	RTCM		9600	8-N-1	1 Hz	30945	Requires a null modem RS-232 adapter plus gender changer, or a male-male null modem adapter.
John Deere	GreenStar Yield Monitor (brown mobile processor)	NMEA	GGA, GSA, RMC	4800, 9600	8-N-1	1 Hz	34189	
John Deere	GreenStar Yield Monitor (silver wedge box mapping processor)	NMEA	GGA, GSA, RMC	4800, 9600	8-N-1	1 Hz	34189	
Mid-Tech	CenterLine	NMEA	GGA, VTG	19.2K	8-N-1	5 Hz	30945, 40947-18, 46441	
Mid-Tech	DataLink	NMEA	VTG	19.2k	8-N-1	1 Hz	30945, 40947-18, 46441	Software version 5.0 required on DataLink.
Mid-Tech	Legacy 2000	NMEA	GGA, VTG	19.2K	8-N-1	5 Hz	30945, 40947-18,46441	

Company	Hardware	Protocol	NMEA messages	Baud rate	Other	Pos rate	Cable P/N required	Notes
Mid-Tech	Legacy 6000	NMEA	GGA, VTG	38.4K	8-N-1	5 Hz	30945, 40947-18, 46441	
Mid-Tech	MC1000	NMEA	GGA, VTG	19.2K	8-N-1	5 Hz	30945, 40947-18	
Mid-Tech	Swath XL	NMEA	GGA	19.2K	8-N-1	5 Hz	30945, 40947-18	
New Holland (Ag Leader PF3000)	New Holland PLMS Yield Mont.	NMEA	GGA, VTG	4800	8-N-1	1 Hz	39903	Do not set position output faster than 1 Hz.
OnBoard Systems	CropHawk 7/B	HAWK		9600	8-N-1	1 Hz	30945	CropHawk wiring harness has DB9 female connector. Requires P/N: 40572 male-male null modem ***or*** null modem RS-232 adapter plus gender changer adapter.
Pacific Crest	PDL Radio	RTCM		9600	8-N-1	1 Hz	30945, 40947-18	Requires Pac Crest adapter cable, Lemo-to-DB9 male.
Position Inc.	Contour	NMEA	GGA	19.2K	8-N-1	5 Hz	30945, 40947-18	
Raven	AMS200	NMEA	GGA, VTG, ZDA, GSA	9600	8-N-1	1 Hz	30945, 40947-18, 46441	
Raven	Databoy	NMEA	GGA, VTG, ZDA, GSA	4800	8-N-1	1 Hz	30945, 40947-18, 46441	
Raven	RGL 500/600	NMEA	GGA, VTG	19.2K , 38.4K	8-N-1	5 Hz, 10 Hz	30945, 40947-18	
Raven	SCS-4400	NMEA	GGA, VTG, ZDA, GSA	9600	8-N-1	1 Hz	30945, 40947-18, 46441	
Raven	SmarTrax	NMEA	GGA, VTG	38.4K	8-N-1	5 Hz, 10 Hz	30945, 40947-18	
Raven	Swath Smart	NMEA	GGA, VTG	38.4K	8-N-1	5 Hz, 10 Hz	30945, 40947-18	
Raven	Viper (**Using Raven Lightbar**)	NMEA	GGA, VTG, RMC	38.4K	8-N-1	5 Hz	30945, 40947-18, 46441	Be sure to turn GSA "**OFF**"
Raven	Viper (**Mapping/ VRT**)	NMEA	GGA, VTG, RMC	4800/ 9600	8-N-1	1 Hz	30945, 40947-18, 46441	
Rockwell	VCD (Vision Display Controller)	NMEA	GGA, GLL, VTG, ZDA	4800	8-N-1	1 Hz	30945, 40947-18, 46441	

Company	Hardware	Protocol	NMEA messages	Baud rate	Other	Pos rate	Cable P/N required	Notes
SoilTeq	Falcon II Controller	NMEA	GGA, VTG	9600, 19.2K	8-N-1	5 Hz, 10 Hz	30945, 40947-18	
SoilTeq	Falcon VR Controller	NMEA	GGA, VTG	9600	8-N-1	5 Hz	30945, 40947-18, 46441	
SoilTeq	Falcon VR Controller with Falcon Track LBAR	NMEA	GGA, VTG	9600, 19.2K	8-N-1	5 Hz, 10 Hz	30945, 40947-18	
Springhill	Ag Navigator	RTCM		9600	8-N-1	10 Hz	30945, 40947-18	Connect to COM1. Make sure Pin 9 is not connected.
Starlink	LB-3, LB-4, LB-5	NMEA	GGA, VTG	19.2K	8-N-1	5 Hz, 10 Hz	30945, 40947-18	
TeeJet	GuideLine	NMEA	GGA	19.2K	8-N-1	5 Hz	30945, 40947-18	
Terradox	Sitewinder	NMEA	GGA	9600	8-N-1	5 Hz	30945, 40947-18	
Trimble	*Ag*GPS Autopilot (DGPS)	TSIP		38.4K	8-N-1	5 Hz	43172	Connect to Port A on *Ag*GPS 132. Firmware version 2.0 and later automatically configures the AgGPS receiver port communication.
Trimble	*Ag*GPS Autopilot (RTK)	GSOF		38.4K	8-N-1	5 Hz	43172	Connect to Port A on *Ag*GPS 214. Firmware version 1.1 and later automatically configures the AgGPS receiver port communication.
Trimble	TrimFlight™ GP400	RTCM		9600	8-N-1	1 Hz	34903	
Trimble	TrimFlight MMD	NMEA	GGA, VTG	9600	8-N-1	5 Hz	30945	Connect to male DB9 port on MMD.
Trimble	TrimFlight TF300	RTCM		9600	8-N-1	1Hz	34903	

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