*Ag*GPS™ 124 / 132

Operation Manual

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Trimble Navigation Limited warrants that Software and Firmware products will substantially conform to the published specifications provided it is used with the Trimble products, computer products, and operating system for which it was designed. For a period of ninety (90) days, commencing thirty (30) days after shipment from Trimble, Trimble also warrants that the magnetic media on which Software and Firmware are distributed and the documentation are free from defects in materials and workmanship. During the ninety (90) day warranty period, Trimble will replace defective media or documentation, or correct substantial program errors at no charge. If Trimble is unable to replace defective media or documentation, or correct program errors, Trimble will refund the price paid for The Software. These are your sole remedies for any breach in warranty.

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1. Improper or inadequate maintenance by the buyer
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4. Operation outside of the environmental specifications of the product
5. Improper installation, where applicable
6. Lightning or other electrical discharge
7. Fresh or salt water immersion or spray
8. Normal wear and tear on consumable parts (for example, batteries)

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About This Manual

Welcome to the *AgGPS 124 /132 Operation Manual*. This manual describes how to install and configure the *Ag*GPS™ 124 and 132 receivers. It includes step-by-step instructions for installing the AgGPS receiver and guidelines for using the LCD screen display to view and configure operating parameters. Also included are guidelines for interfacing the receiver to a PC and agricultural instruments, information about the selection of NMEA messages supported by the receiver, and connector pin-out diagrams for Port A, Port B, and cable connections.

Scope and Audience

Even if you have used other Global Positioning System (GPS) products before, we recommend that you spend some time reading this manual to learn about the special features of this product. If you are not familiar with GPS, we suggest that you read the booklet *GPS, A Guide to the Next Utility*, available from Trimble.

The following sections provide a guide to this manual, as well as to other documentation that you may have received with this product.

Organization

This manual contains the following:

- Chapter 1, Overview, provides a brief overview of Differential GPS, and *Ag*GPS 124 /132 components.
- Chapter 2, Installing the AgGPS Receiver, contains installation and interfacing instructions for the *Ag*GPS 124 and 132 receivers.
- Chapter 3, Getting Started, gives instructions for using the *Ag*GPS 124 /132 display and keypad.
- Chapter 4, Operation Screens, shows you how to record line length and field area.
- Chapter 5, Status, explains the status screens.
- Chapter 6, Configuring the AgGPS 124 and 132 Receiver, gives instructions for configuring *Ag*GPS 124 /132 operating parameters.
- Chapter 7, Troubleshooting, gives guidelines for solving potential problems.
- Appendix A, Specifications, identifies the physical characteristics and general specifications of the *Ag*GPS 124 and 132 receivers.
- Appendix B, Receiver Defaults, contains the default settings for the *Ag*GPS 124 and 132 receivers.
- Appendix C, Cables and Connectors, includes pin-out diagrams for the standard and optional cables.
- Appendix D, NMEA-0183 Sentences, describes the structure of NMEA messages generated by the *Ag*GPS 124 and 132 receivers and the information included in them.
- Appendix E, Flash Loader 100, explains how to use the Flash Loader 100 software to update the receiver firmware.

- Appendix F, Activating a Satellite DGPS Service, provides step-by-step instructions for activating a satellite DGPS service. (*Ag*GPS 132 only)

Related Information

The following sections discuss other sources of information that introduce, extend, or update this manual.

Update Notes

There is a warranty activation sheet with this product. Send it in to receive update notes automatically as they become available. These contain important information about software and hardware changes. Contact your local Trimble Dealer for more information about the support agreement contracts for software and firmware.

Other Information

This section lists sources that provide other useful information.

World Wide Web (WWW) Site

For an interactive look at Trimble, visit our site on the World Wide Web:

- www.trimble.com

File Transfer Protocol (FTP) Site

Use the Trimble FTP site to send files or to receive files such as software patches, utilities, and FAQs. The address is:

- ftp://ftp.trimble.com

You can also access the FTP site from the Trimble World Wide Web site (www.trimble.com/support/support.htm).

Technical Assistance

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

If you need further assistance, contact the Trimble Technical Assistance Center (TAC) by phone, fax, or email. A support technician can help determine the cause of the problem and provide technical assistance.

To contact TAC:

Phone:	+1-800-SOS-4TAC (North America) +1-408-481-6940 (International) Phones are answered from 6 am to 5.30 pm Pacific Standard Time.
Fax:	+1-408-481-6020
Email:	trimble_support@trimble.com

When you contact TAC, have the following information available:

1. The Trimble product name, any software or firmware version number(s), and if appropriate, the serial number.
2. Your specific question or problem.

   Please detail background information, such as the configuration of your data collector or receiver, and the exact type, make, and configuration of your computer. If you have received error messages, please specify the exact wording.

If you need to send a data file along with your inquiry, please compress the file using PKZIP Software by PKWARE, Inc., and name the file with the extension .ZIP.

Use one of the following methods to send the file:

- Attach the file to your email inquiry.
- Put the file on the Trimble FTP site and include the filename in your email inquiry.

Reader Comment Form

Thank you for purchasing this product. We would appreciate feedback about the documentation. Use the reader comment form at the back of this manual or, if this is not available, send comments and suggestions to the address in the front. All comments and suggestions become the property of Trimble Navigation Limited.

Document Conventions

Italics identify software menus, menu commands, dialog boxes, and the dialog box fields.

SMALL CAPITALS identify DOS commands, directories, filenames, and filename extensions.

`Courier` represents messages printed on the screen.

`Courier Bold` represents information that you must type in a software screen or window.

Helvetica Bold identifies a software command button.

[Return] or [Ctrl] + [C] identifies a hardware function key or key combination that you must press on a PC.

`Screen Font` is used to show information displayed on the *Ag*GPS 124 /132 LCD display.

[∧], [∨], [>], and [↵] are the buttons on the *Ag*GPS 124 /132 front panel.

Warnings, Cautions, Notes, and Tips

Warnings, cautions, notes, and tips draw attention to important information and indicate its nature and purpose.

Warning – Warnings alert you to situations that could cause personal injury or unrecoverable data loss.

Caution – Cautions alert you to situations that could cause hardware damage or software error.

Note – Notes give additional significant information about the subject to increase your knowledge, or guide your actions.

Tip – Tips indicate a shortcut or other time- or labor-saving hint that can help you make better use of the product.

1 Overview

The *Ag*GPS receivers combine high-performance GPS reception with radiobeacon DGPS capability in a single, lightweight, durable, waterproof housing.

Additionally, the *Ag*GPS 132 receiver (see Figure 1-1) contains The Choice™ technology, enabling OmniSTAR and Racal LandStar real-time differential capabilities.

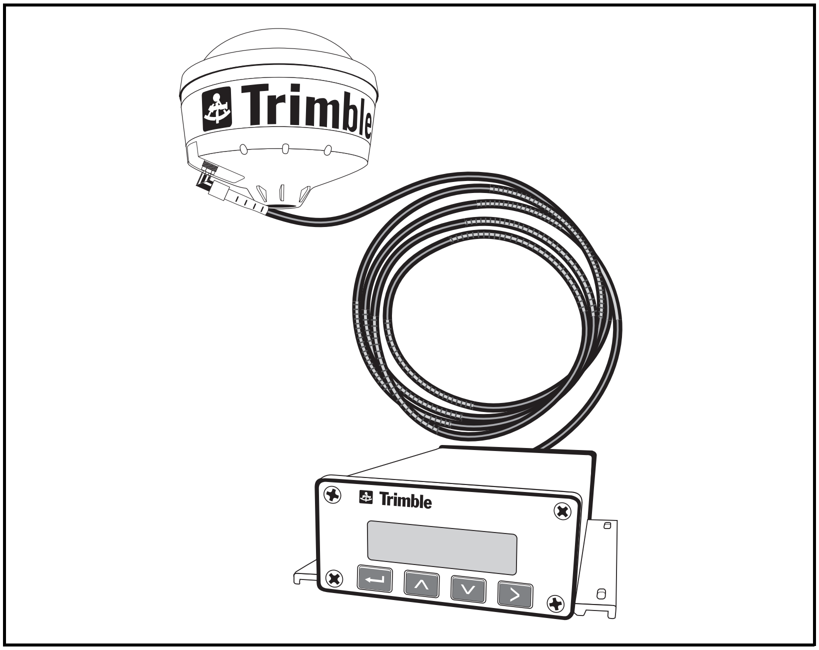


Figure 1-1 *Ag*GPS Receiver

As a part of a precision agriculture system, the *Ag*GPS receiver outputs submeter GPS position information to a variety of farming equipment, including yield monitors, parallel swathing guidance systems, variable rate planters, spray application and soil sampling controllers, and portable field computers.

The *Ag*GPS receivers output real-time submeter positions and 0.1 mile-per-hour (0.16 kph) velocity accuracy through NMEA-0183 and TSIP (Trimble Standard Interface Protocol) messages. A 1 PPS (pulse per second) strobe signal can also be used to synchronize time and log event marker input when using external instruments.

1.1 Differential GPS Positioning

The *Ag*GPS receivers use differential GPS (DGPS) to achieve submeter (<3.28 ft) accuracy. DGPS requires two or more receivers. One receiver, called the reference or base station, is located at a known point to determine the GPS measurement errors. An unlimited number of mobile *Ag*GPS receivers, sometimes called rovers, collect data at unknown locations within the transmission range of the reference station. The reference station broadcasts correction values, which are applied to the AgGPS receiver position. Errors common at both the reference and rover receivers are corrected.

1.1.1 Sources of GPS Error

The largest source of GPS position error is Selective Availability (S/A). S/A is induced by the U.S. government for the purpose of restricting full GPS accuracy to all except authorized users. The magnitude of S/A combined with other error sources results in autonomous (single receiver) horizontal accuracies of up to 100 meters (328 feet). If the U.S. government turns S/A off, autonomous GPS horizontal accuracy would be about 10 meters (32.8 feet).

Atmospheric conditions (especially in the ionosphere), multipath (GPS signals bouncing off objects before reaching the antenna), and receiver (electronic) noise are in large part responsible for the remaining 10 meters (32.8 feet) of error.

DGPS removes most of the errors caused by S/A and the atmosphere. The *Ag*GPS receivers use the latest advancements in receiver design to minimize these errors. For more information about S/A, atmospheric effects, and other sourced of error, review *All About GPS* tutorials found on the Trimble web site (WWW.TRIMBLE.COM).

1.1.2 DGPS Accuracy

Accuracy of the *Ag*GPS receiver with differential correction is better than 1 meter RMS (3.2 feet) + 10 ppm times the distance between the reference station and the mobile receiver given the following conditions:

- Number of satellites used: > 5
- PDOP: < 4
- Signal to Noise Ratio: > 6
- Satellite Elevation Mask: > 7.5
- Low multipath environment
- RTCM-compatible corrections broadcast from a Trimble 4000RSi or equivalent

Number of visible satellites

Four or more satellites must be visible to calculate a three-dimensional position (latitude and longitude, altitude, and time). Three or more satellites must be visible to calculate a two-dimensional position (latitude and longitude, and time). One or more satellites must be visible to compute a zero-dimensional (time only) position. Three-dimensional positions are most accurate. On the *Ag*GPS receiver you can set configurations to determine how many satellites are used to compute GPS positions.

Position Dilution of Precision (PDOP)

PDOP is a unitless measure indicating when the satellite geometry can provide the most accurate results. When satellites are spread around the sky, the PDOP value is low and the computed position is most accurate. When the satellites are grouped closely together, the PDOP is high and positions are less accurate. You can configure a PDOP Mask to control the point at which the *Ag*GPS receiver stops outputting position reports. For submeter accuracy, the PDOP must be 4 or less.

In some agricultural applications, a PDOP Mask of 12 or more can be used to prevent loss of data. However, accuracy can suffer as PDOP rises. There is a trade-off between optimal GPS accuracy and continuous operation.

Signal-to-Noise Ratio

Signal-to-Noise Ratio (SNR) is a measure of the satellite signal strength. Accuracy improves as the signal strength increases. More signal with less noise equals better accuracy. To compute positions with strong signals, the SNR mask should be set to the default, 6 or more.

Elevation Mask

When a satellite is low on the horizon, the GPS signals must travel a great distance through the atmosphere, delaying reception by the *Ag*GPS receiver. You can minimize noisy data by adjusting (tuning) the Elevation Mask. Satellites below the mask are excluded from the position computation. The recommended setting for highest accuracy is 8°. There is a trade-off between accuracy and continuous operation; lowering the mask ensures continuous operation.

Multipath

GPS signals are sometimes reflected off nearby objects, particularly metallic objects, creating false or erroneous results. This phenomenon is known as multipath. Severe multipath can induce errors of many meters, while mild multipath may cause small, undetectable errors. Optimal accuracy is obtained by collecting data in an environment that is devoid of large reflective surfaces, like buildings and trees. The *Ag*GPS receiver Everest™ multipath reduction option helps reduce the effects of multipath.

Base station receiver

*Ag*GPS receiver differential position accuracy is dependent upon the differential correction quality supplied in the RTCM SC-104 message format.

1.2 Measuring GPS Accuracy

To measure GPS accuracy you must have some knowledge of coordinates and datums. When comparing geographic data obtained from different sources, the data must be referenced to the same datum and coordinate system. Different datums and coordinate systems provide different coordinate values for any geographic location.

In North America, for example, two different datums, NAD 27 and NAD 83, are commonly used. A particular place on the surface of the earth has different latitude and longitude coordinates in each datum. The *Ag*GPS receivers provide coordinates in the NAD 83 datum. Existing background maps for the NAD 27 datum do not register with GPS data based on the NAD 83 datum.

Note – The North American Datum 1983 (NAD 83) is, for all practical purposes, equivalent to WGS-84 (World Geodetic Survey 1984). GPS data is referenced to the WGS-84 datum.

1.2.1 Receiving Beacon DGPS

To utilize free radiobeacon differential signals, the *Ag*GPS receivers use dual-channel, fully-automatic beacon receiver electronics for tracking broadcasts conforming to the IALA Standard. The default configuration when using beacon DGPS allows the *Ag*GPS receiver to determine the ten most powerful radiobeacons in your vicinity. The closest beacon is used. Both Beacon channels are configured to search and track the two nearest radiobeacons in the database.

The receiver can also be configured to search for user-defined station frequencies. The EZ beacon feature enables easy local beacon selection.

The *Ag*GPS receivers continuously monitor the integrity of the data received from the differential radiobeacon(s). If excessive errors in the data stream are found, the receiver automatically switches to a different radiobeacon, if one is available.

Radiobeacon signals propagate through ground and sky waves. Hilly and mountainous terrains generally do not affect the beacon reception. Near the beacon transmitter the signal can be received even in canyons. Canopy has no effect on signal reception.

Beacon signals are greatly effected by natural and human-made noise. Lightning, automobile ignition, electric motor, and high voltage power lines can be a severe source of noise. In addition, during night hours at longer distances from the beacon station (240 to 480 Km or 150 to 300 mi), the sky wave (reflected off the ionosphere) can interfere with the ground wave beacon signal. This self-jamming at night may be a problem with stronger beacon stations. Integrity monitoring of the beacon frequency can be performed with the optional TSIP Talker software.

Note – A phenomenon called geographic de-correlation, causes radiobeacon signals to become less accurate as the distance from the base station increases. The amount of beacon accuracy degradation depends on the ionosphere and the amount of Selective Availability. Degradation can be as much as 1 meter (3 feet) for every 100 km (60 miles).

1.2.2 Receiving Satellite DGPS (*Ag*GPS 132 only)

Satellite differential GPS signals are sent from a ground station through a satellite transponder to users within view of the satellite. The corrections are sent in a format that allows the construction of a local differential correction applicable to the entire coverage region.

The *Ag*GPS receiver contains both OmniSTAR and Racal-LandStar satellite differential technology. To enable satellite differential capabilities, contact either supplier. Depending on which supplier is involved, the receiver can be activated by an on-the-air signal or an encrypted activation message entered on the receiver front panel.

Satellite differential signals provide valid corrections over a large area, but are decoded to provide an accurate correction applicable to any location within the satellite view area. This is accomplished by special software algorithms for generating wide area differential corrections. These algorithms, called Virtual Reference Station (VRS) and Virtual Base Station (VBS), depending on the vendor, compute differential corrections that a base station would generate if it were at the receiver's location. This correction is constantly updated, so as the receiver moves around, the correction remains at full accuracy.

Satellite differential signals are line-of-sight and can be blocked by a mountain, hill, or tree canopy. Wet canopy, from a heavy rain, reduces the signals even more. The same local environmental factors, like radar and microwave transmitters, that affect the GPS signals can interfere with the satellite signals. Power lines usually have no effect.

For specific information about the providers, visit
WWW.OMNISTAR.COM or WWW.RACAL-LANDSTAR.COM
on the World Wide Web.

1.3 Standard Features

The standard *Ag*GPS 124 and 132 system provides the following:

- 12 GPS (C/A-code) tracking channels, carrier-phase filtering
- Submeter differential accuracy (RMS): assumes at least 5 satellites and PDOP less than 4
- Combined GPS/DGPS antenna
- Magnetic antenna mount
- 5-meter ruggedized antenna cable
- Data/Power cable
- LCD display with four-button keypad to configure and view system properties
- Two RS-232 serial and CAN-ready ports:
  - NMEA-0183 output: ALM, GGA, GLL, GSA, GSV, MMS, RMC, VTG, ZDA (The default NMEA messages are GGA, GSA, and VTG)
  - RTCM SC-104 input and output
  - TSIP input and output
  - Outputs 1 PPS (pulse per second) strobe signal on either serial port, allowing an external instrument to synchronize its internal time with the *Ag*GPS clock oscillator.

1.4 Receiver Enhancements

*Ag*GPS systems contain several purchase options designed to maximize receiver performance. Depending on the system you ordered, the following options may or may not be included.

1.4.1 Fast Rate (P/N 33176-10)

The Fast Rate option enables the *Ag*GPS receiver to output position data up to 10 times per second. Fast Rate output is important in parallel swathing and variable rate applications. (A 5 Hz Fast Rate option is included with the Parallel Swathing Option.)

1.4.2 Differential Base Station (P/N 33176-30)

The Differential Base Station option enables the *Ag*GPS receiver to output RTCM differential corrections. With a radio link, these corrections can be broadcast and used by other DGPS receivers.

1.4.3 Everest Technology (P/N 33176-40)

The Everest™ multipath reduction option improves DGPS receiver accuracy by filtering reflected GPS signals before they are processed by the DGPS receiver. Everest technology provides maximum accuracy near trees, buildings, and reflective surfaces.
(The Everest multipath reduction option is included with the Parallel Swathing Option.)

1.5 Application Options

The AgGPS system contains several purchase options that increase the number of applications for which the *Ag*GPS receivers can be used.

1.5.1 Parallel Swathing (P/N 34623)

The AgGPS Parallel Swathing option enhances the *Ag*GPS receiver with an easy-to-use, plug-and-play lightbar. The lightbar indicates off-track error, which the operator uses to steer back on-line.

The AgGPS Parallel Swathing Option helps reduce farm expenses by minimizing redundant applications and skipped areas. Efficient field coverage enables maximum ground coverage in the shortest possible time.

Independent data ports enable the *Ag*GPS receiver to simultaneously operate the lightbar and output data to a variable rate controller or other device.

1.5.2 Ag Field Pack (P/N 32294)

The Ag Field Pack includes the lumbar pack, antenna poles, batteries, and cables to keep hands free when operating the *Ag*GPS receiver on foot. The Field Pack is ideal for crop scouting and field mapping applications.

1.6 Receiver Connections

Figure 1-2 shows the *Ag*GPS receiver back panel and its associated ports.

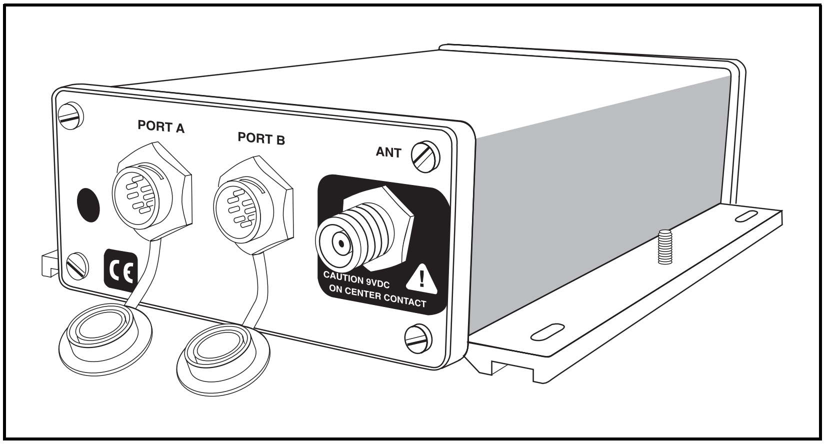


Figure 1-2 Back Panel

Both Port A and Port B can accept power. The standard power/data cable (P/N 30945) supplies power.

1.6.1 ASCII, TSIP, and RTCM Input

Both Port A and Port B are used to input ASCII, TSIP, RTCM, and CAN data from an external device. ASCII data can be received from an external sensor, converted into a NMEA message, and exported to another device. TSIP command packets are used to set and monitor GPS and Beacon parameters from the optional TSIP Talker software. RTCM data can be input from an external source such as an FM pager.

1.6.2 RTCM, TSIP and NMEA Output

Both Port A and Port B are used to output RTCM, TSIP, NMEA 0183 or CAN messages to an interface device. RTCM is output when operating in base mode. TSIP is output when communicating with the optional TSIP Talker software. NMEA is output when exporting GPS position information to an external device, such as a yield monitor. CAN is used when operating a CAN bus.

1.6.3 1 PPS Output

Either port can output a 1 PPS (pulse per second) strobe signal to synchronize the external instruments to the receiver's internal clock.

2 Installing the *Ag*GPS Receiver

This chapter shows you how to:

- unpack and inspect the shipment
- install the following:
  - *Ag*GPS receiver
  - antenna
  - interface devices

We recommend you read this chapter before attempting to install your *Ag*GPS receiver.

2.1 Unpacking and Inspecting the Shipment

Inspect the shipping cartons for any signs of damage or mishandling before unpacking the receiver.

Report any damage to the shipping carrier immediately.

2.1.1 Opening the Shipping Carton

The shipment could include one or more cartons, depending on the number of optional accessories ordered. Open the shipping cartons and make sure that all of the components indicated in Tables 2-1 through 2-3 are included.

Table 2-1 *Ag*GPS 132 Only Components

Qty	P/N	Description
1	33302-01	*Ag*GPS 132 Receiver
1	33580-00	*Ag*GPS Antenna

Table 2-2 *Ag*GPS 124 Only Components

Qty	P/N	Description
1	33606-00	AgGPS 124 Receiver
1	29635-50	AgGPS 124 Antenna

Table 2-3 AgGPS Receiver Components

Qty	P/N	Description
1	12920-00	Magnetic Mount for Antenna
1	32608	5-meter (16-foot) Ruggedized Antenna Cable
1	30945	Data/Power Cable
1	33301-00	*Ag*GPS 124/132 Operation Manual
1	11093	Coax Tape Seal
1	25110-00	Warranty Activation Card

As shown in Table 2-4, the bill of lading could list one or more of the following factory installed enhancements.

Table 2-4 *Ag*GPS Receiver Enhancements

Qty	P/N	Description
1	33176-10	Fast rate capability
1	33176-30	DGPS Base capability
1	33176-40	Everest multipath reduction technology

As shown in Table 2-5, the bill of lading could list one or more of the following options.

Table 2-5 *Ag*GPS Application Options

Qty	P/N	Description
1	32294-00	Ag Field Pack 120 volts
1	32294-10	Ag Field Pack 240 volts
1	34623-00	Parallel Swathing

The bill of lading could include one or more of the items listed in Table 2-6 if optional components or accessories are ordered.

Table 2-6 Optional Components

Qty	P/N	Description
1	29510	10-meter (32-foot) Antenna Cable
1	30660	Ag Leader Power/Data Cable
1	30700	3.6-meter (12-foot) Extension Data Cable DE9-M to DE9-F
1	32015	Power/Data Cable RTCM/NMEA
1	32609	CASE AFS Power/Data Cable
1	34189	John Deere GreenStar Data Cable
1	35142	RDS Cable
1	38112	Receiver ceiling mounting bracket
1	30661	Windows CE Cable with Power Leads
1	35283	Windows CE Cable with Cigarette Power Adapter

2.1.2 Reporting Shipping Problems

Report any problems discovered after you unpack the shipping cartons to both Trimble Customer Support and the shipping carrier.

2.2 Installation Guidelines

*Ag*GPS receivers are designed to be mounted on a flat surface in any orientation. The bottom of the receiver has mounting flanges for securing to a flat surface with screws. For ceiling mounts, ask your local dealer about Trimble's ceiling mounting bracket.

2.2.1 Choosing a Location

The *Ag*GPS receiver can be installed in any convenient location close to the external device. The location you choose should:

- allow visibility of the front panel
- provide clearance for the antenna and interface connections
- be within 3.6 meters (12 feet) of the external instrument port (The optional 3.6-meter (12-foot) extension cable can be used.)

2.2.2 Considering Environmental Conditions

Although the *Ag*GPS receiver is located within a waterproof housing, it should be installed in a dry location. Avoid exposure to extreme environmental conditions, including:

- water
- excessive heat (> 65°C or 149°F)
- excessive cold (< -20°C or -4°F)
- high vibration
- corrosive fluids and gases

Avoiding these conditions improves the receiver's performance and long-term product reliability.

2.3 Mounting the Receiver

To mount the receiver:

1. Drill four holes in the mounting surface using the slotted holes in the mounting brackets as a template.

Note – If machine screws are used, tap the mounting holes to fasten the receiver to the mounting surface. Use 8-32 socket head cap screws to fasten the receiver to the mounting surface. Alternatively, use self-tapping screws to secure the receiver.

2. Use screws to secure the brackets to the mounting surface.

2.4 Mounting the Antenna

Choose a location for the antenna that is safe from damage during normal operation. The antenna can be mounted to a flat surface using the magnetic mount. Use the following guidelines when selecting a location:

- Place the antenna on a flat surface along the center line of the vehicle.
- Choose an area with clear view to the sky above metallic objects. The top of a mast or pole is recommended.
- Do not mount the antenna close to stays, electrical cables, metal masts, and other antennas.
- Do not mount the antenna near transmitting antennas, radar arrays, or satellite communication equipment.
- Avoid areas with high vibration, excessive heat, electrical interference, and strong magnetic fields.

Caution – A grain tank extension may block low elevation satellites.

2.4.1 Sources of Electrical Interference

Several sources of electrical and magnetic noise are:

- gasoline engines (spark plugs)
- televisions and PC monitors
- alternators and generators
- electric motors
- propeller shafts
- equipment with DC-to-AC converters
- florescent lights
- switching power supplies

Note – You can check the antenna installation for locally generated noise by connecting a PC to the receiver and running the optional TSIP Talker program. If you observe interference, move the antenna to a different location. Raising the antenna several decimeters may minimize the noise. TSIP Talker can be downloaded from Trimble's FTP site: ftp.trimble.com.

2.5 Routing and Connecting the Antenna Cable

A 5-meter (16.5-foot) antenna cable is included with your *Ag*GPS receiver (see Figure 2-1). One end of the antenna cable features a 90-degree connector. The opposite end features a straight connector. Connect the 90-degree connector to the antenna, then route the cable to the receiver.

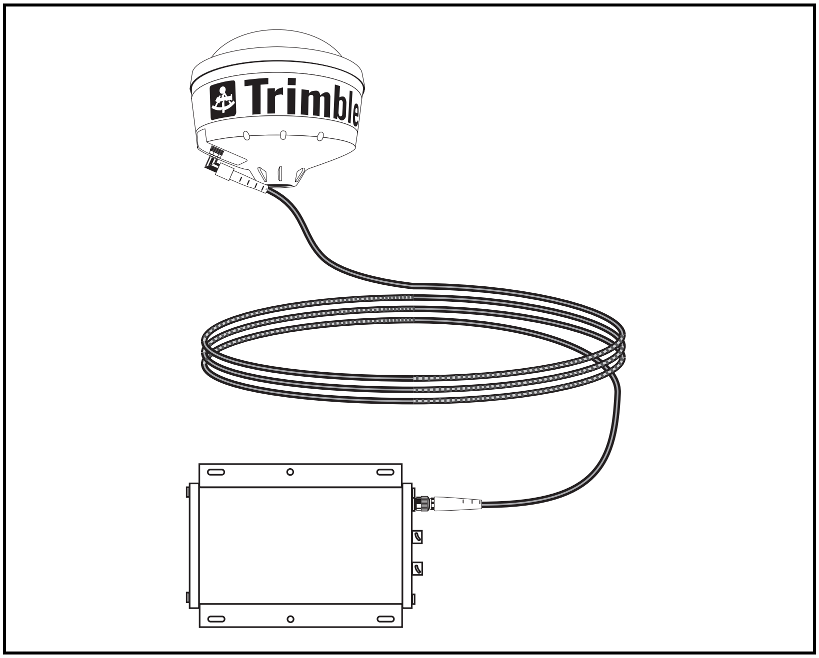


Figure 2-1 Antenna Cable Connections

When routing the antenna cable, avoid the following hazards:

- sharp ends or kinks in the cable
- hot surfaces (exhaust manifolds or stacks)
- rotating or reciprocating equipment
- sharp or abrasive surfaces
- door and window jams
- corrosive fluids or gases

After routing the cable, connect it to the *Ag*GPS 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 in a safe place.

☞ **Tip –** Use the coax seal tape, provided with the antenna, to seal the antenna connector at the antenna. The tape prevents water and moisture from entering the connection.

2.6 Connecting External Devices

After installing the antenna and receiver, connect and route the interface cables. The receivers can be powered by a vehicle or a customer supplied 12-volt switched power source. Once the receiver is installed and powered on, the front panel LCD screen lights.

The following sections contain installation instructions for different power/data cables. Depending on the cable(s) you own, complete the appropriate installation.

2.6.1 Connecting the Standard Data/Power Cable (P/N 30945)

The Standard Data/Power Cable connects the *Ag*GPS receiver to many types of external devices (see Figure 2-2).

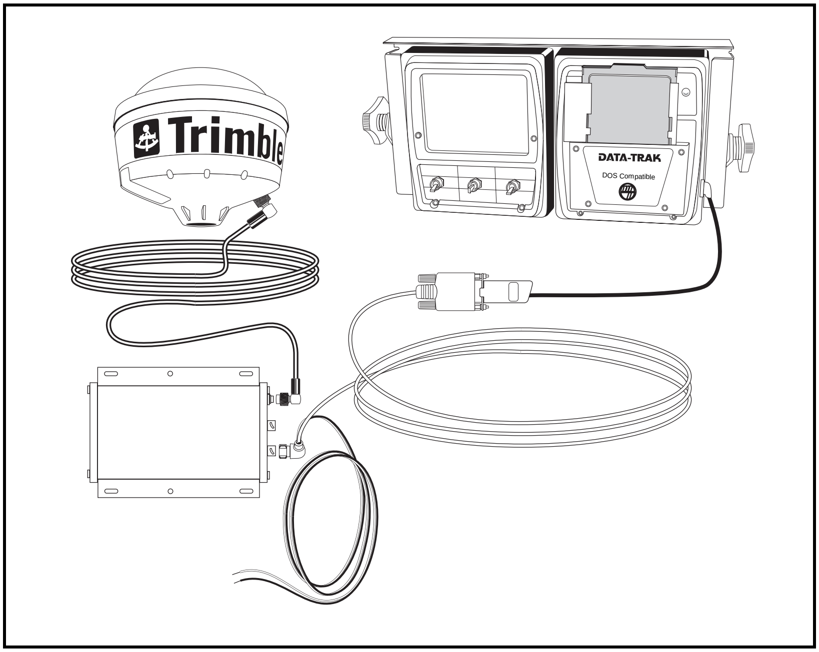


Figure 2-2 External Device Cable Connections

To connect the *Ag*GPS receiver to an external device:

1. Connect the CONXALL right angle connector to either port on the *Ag*GPS receiver.
2. Connect the 9-pin DE-9 Male connector to the external device DE-9 Female connector.
3. Connect the power leads to a switched power source.

Note – The red lead must be connected to the +12 volts and the black lead to Ground.

4. Coil excess slack and secure the cable.

Tip – Install the optional 3.6-meter (12-foot) Extension Cable (P/N 30700) to extend the Standard Data/Power Cable (P/N 30945) to 7.2 meters (24 feet).

2.6.2 Connecting the Optional CASE AFS Power/Data Cable (P/N 32609)

The 1-meter (3-foot) CASE AFS Power/Data Cable connects the *Ag*GPS receiver to a CASE AFS installation.

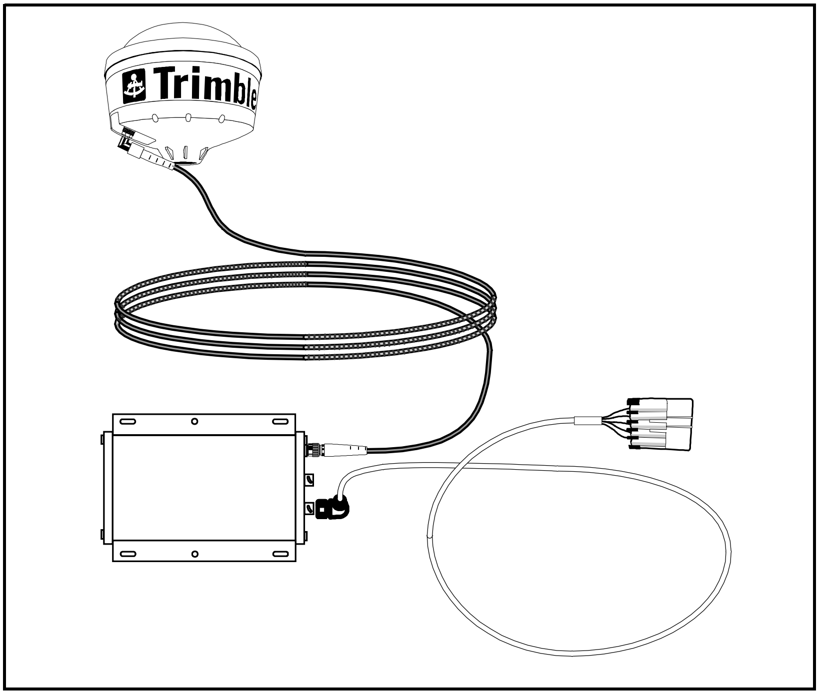


Figure 2-3 CASE AFS Power/Data Cable Connection

To connect the *Ag*GPS receiver to a CASE AFS installation:

1. Connect the straight CONXALL connector to Port A on the *Ag*GPS receiver.
2. Connect the 5-pin connector to the CASE AFS wiring harness.
3. Coil excess slack and secure the cable.

2.6.3 Connecting the Optional John Deere GreenStar Data Cable (P/N 34189)

The 1-meter (3-foot) John Deere GreenStar Data Cable connects the *Ag*GPS receivers to the John Deere GreenStar system (see Figure 2-4).

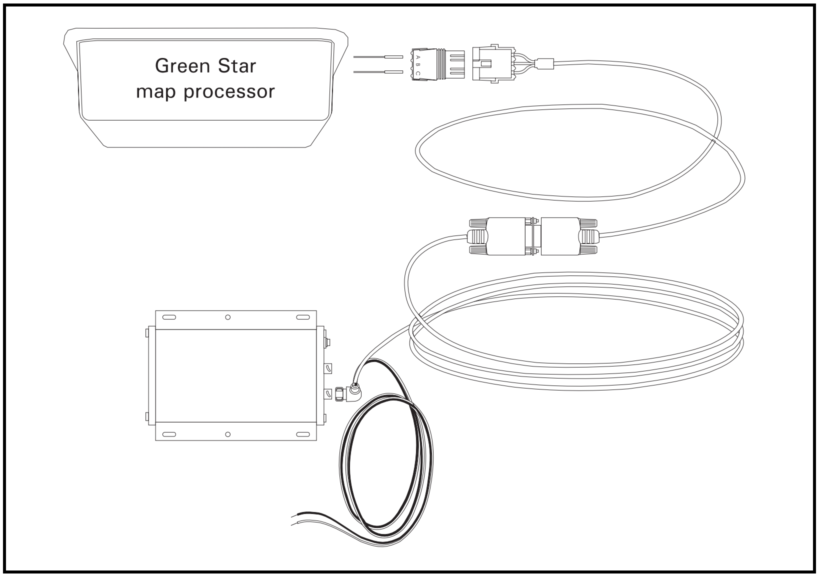


Figure 2-4 GreenStar Data Cable Connection

Before installing the *Ag*GPS receiver, you *must* determine if there is a GPS receiver currently attached to the GreenStar System.

- If there is *not* a GPS receiver attached to the GreenStar system, proceed with Step 1.
- If there is a GPS receiver attached to the GreenStar system, disconnect it from the wiring harness. This is required to activate the GreenStar RS 232 port. The harness can be disconnected from the receiver at the antenna located above the grain tank. When disconnected, proceed with Step 1.

To connect the *Ag*GPS-series receiver to the John Deere GreenStar system:

1. Inside the cab behind the seat, locate the wiring harness that connects to the GreenStar mapping processor. From this wiring harness, gently pull the three short wires from the casing. (They are approximately 10 inches long; orange, black and blue; and sealed with shrink wrap). You do not use the blue cable.
2. Connect the orange wire labeled 967 to the Metripack connector pin. Insert the pin into the Metripack connector (P/N 12015793) slot A.
3. Connect the black wire labeled 20E to the Metripack connector pin. Insert the pin into the Metripack connector (P/N 12015793) slot C.
4. Connect the AgGPS-GreenStar cable (P/N 34189) to the Metripack connector (P/N 12015793).
5. Connect the data/power cable (P/N 30945) to the AgGPS-GreenStar cable (P/N 34189).
6. Attach the data power cable (P/N 30945) to port A of the AgGPS receiver.
7. Attach the power leads of the data/power cable (P/N 30945) to switched power. Connect the red wire to positive and the black wire to negative.

2.6.4 Connecting the Optional Ag Leader Power/Data Cable (P/N 30660)

The 3.6-meter (12-foot) Ag Leader Yield Monitor Cable connects *Ag*GPS receivers to an Ag Leader Yield Monitor (see Figure 2-5).

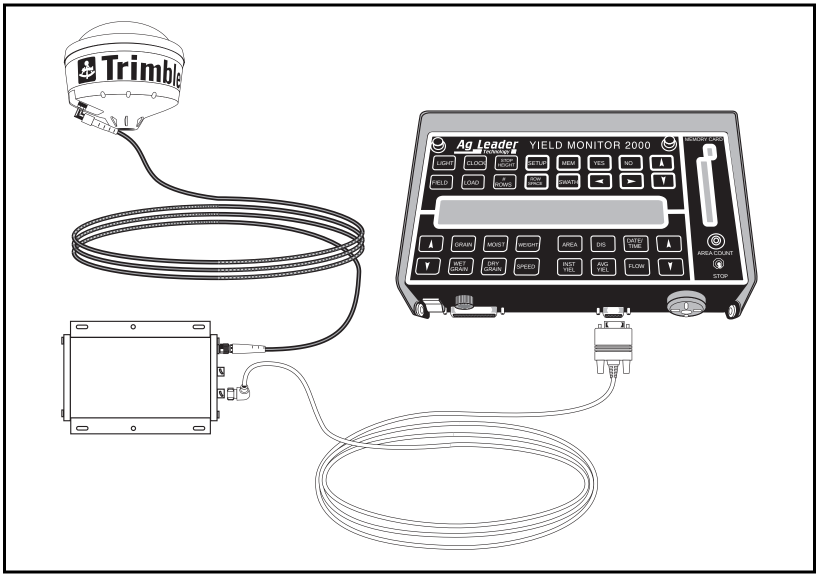


Figure 2-5 Ag Leader Power/Data Cable Connections

To connect the *Ag*GPS receiver to an Ag Leader Yield Monitor:

1. Connect the CONXALL right-angle connector to either port on the *Ag*GPS receiver.
2. Connect the 9-pin DE-9 Male connector to the data/power port on the Ag Leader Yield Monitor.
3. Coil excess slack and secure the cable.

Tip – Install the optional 3.6-meter (12-foot) Extension Cable (P/N 30700) to extend the Ag Leader Yield Monitor Cable to 7.2 meters (24 feet).

2.6.5 Connecting the Optional Power/Data RTCM/NMEA Cable (P/N 32015)

This cable is useful for sharing an *Ag*GPS receiver port with several devices. One interface device can be connected to each side of the connector. This cable can also input external RTCM data while outputting NMEA to an external device (see Figure 2-6).

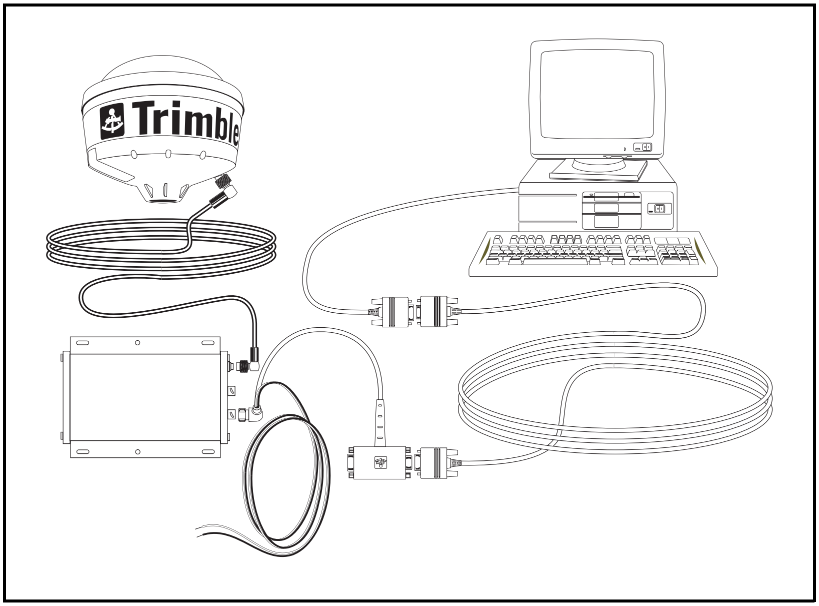


Figure 2-6 Power/Data RTCM/NMEA Cable Connections

To connect the optional Power/Data RTCM/NMEA cable:

1. Connect the CONXALL right-angle connector to port A on the *Ag*GPS receiver.
2. Connect the 9-pin DE-9 Male connector(s) to the external device DE-9 Female connector.
3. Connect the power leads to a switched power source.

Note – The red lead must be connected to the +12 volts and the black lead to Ground.

4. Coil excess slack and secure the cable.

2.6.6 Connecting the Optional RDS Cable (P/N 35142)

The 3.6 meter (12 foot) RDS cable connects an *Ag*GPS receiver to an RDS Yield Monitor.

To connect the optional RDS cable:

1. Connect the 12-pin CONXALL connector to port A on the *Ag*GPS receiver.
2. Attach the 9-pin RS 232 Connector to the RDS Yield Monitor.

2.6.7 Connecting the Optional Windows CE with Cigarette Power Adapter Cable (P/N 35283)

The optional Windows CE cable connects an *Ag*GPS receiver to a Windows CE computer.

To connect the optional Windows CE with Cigarette Adapter cable:

1. Connect the 12-pin CONXALL connector to port A on the *Ag*GPS receiver.
2. Attach the 9-pin RS 232 connector to the Windows CE computer.
3. Connect the cigarette adapter to the power source.

2.6.8 Connecting the Optional Windows CE Cable (P/N 30661)

To connect the optional Windows CE cable:

1. Connect the 12-pin CONXALL connector to port A on the *Ag*GPS receiver.
2. Attach the 9-pin RS 232 connector to the Windows CE computer.
3. Connect the power leads to a switched power source.

3 Getting Started

This chapter shows you how to use the:

- keypad on the front panel
- *Home* screen

We recommend you read through this chapter to learn basic menu operations before attempting to use your *Ag*GPS receiver.

3.1 Using the Front Panel

After powering on the receiver, the front panel displays the *Home* screen. From the *Home* screen, press ∨ or > to access other receiver screens. Figure 3-1 displays the screen organization. Chapters 3, 4, 5 and 6 explain each screen in detail.

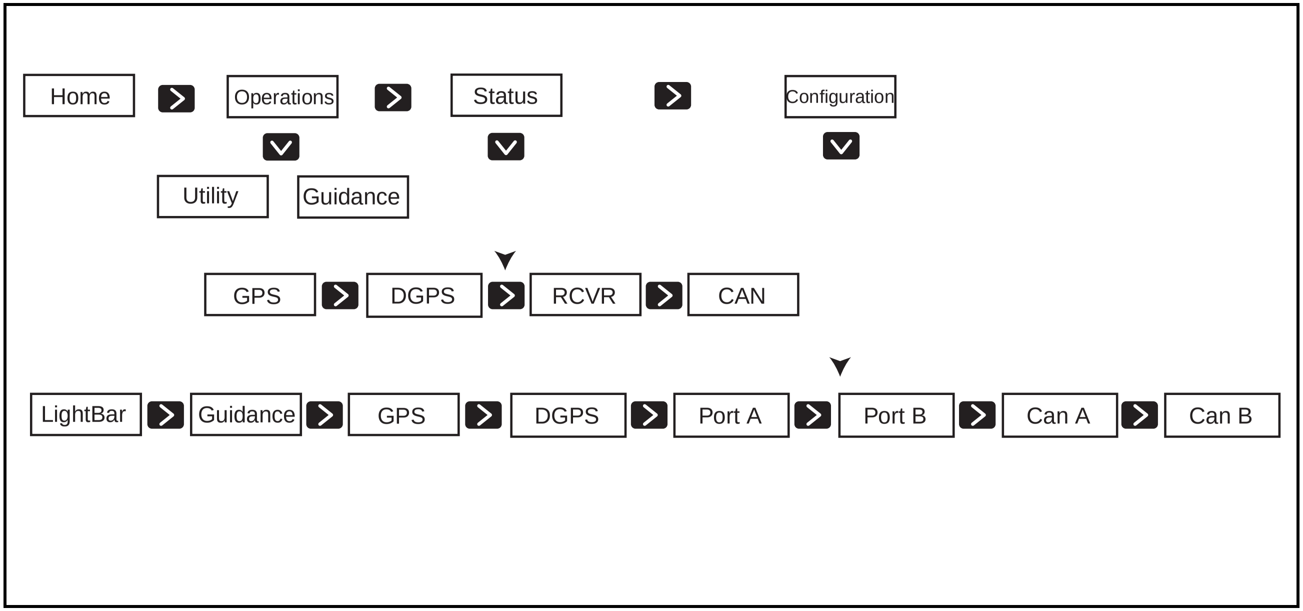


Figure 3-1 ***Ag*GPS Screen Hierarchy**

3.1.1 Viewing Status Screens

Figure 3-2 shows the keypad and the four keys that navigate through the *Ag*GPS menu hierarchy.

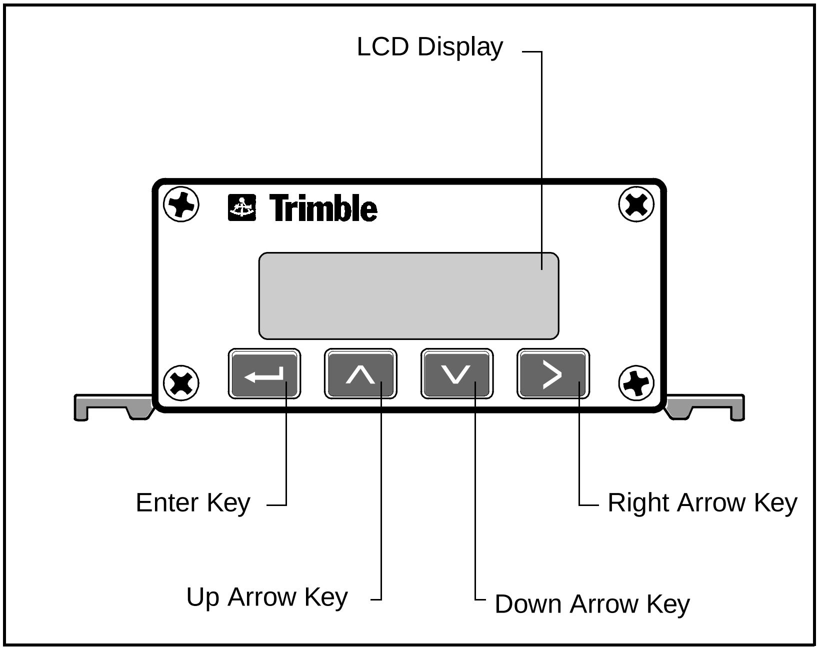


Figure 3-2 *Ag*GPS 124 and 132 Receiver Front Panel

Table 3-1 describes the actions performed by the keys.

Table 3-1 Keypad Actions

Key	Description
↵	Performs several actions: • Press ↵ to cycle through the options displayed on a screen. When options are available, the ↵ symbol appears in the upper right-hand corner of the screen. • Press ↵ and hold to change DGPS mode. (AgGPS 132 only)
∧	Cycles through the available screens.
∨	Cycles through the available screens.
>	Moves through the main menu screens.
∧ + ∨	Moves back one level in screen hierarchy. Ultimately, it returns you to the *Home* screen. • When in a view screen described in this chapter, returns you to the *Home* screen. • When in a configuration screen described in Chapter 6, Configuring the AgGPS 124 and 132 Receiver, returns you to the main menu configuration screen. Press again to return to the *Home* screen.

3.2 The Home Screen

The *Home* screen is just the first option in the main menu. The top line of the *Home* screen displays important GPS status indicators. The bottom line displays important DGPS indicators.

Figure 3-3 shows the *Home* screen and following screens.

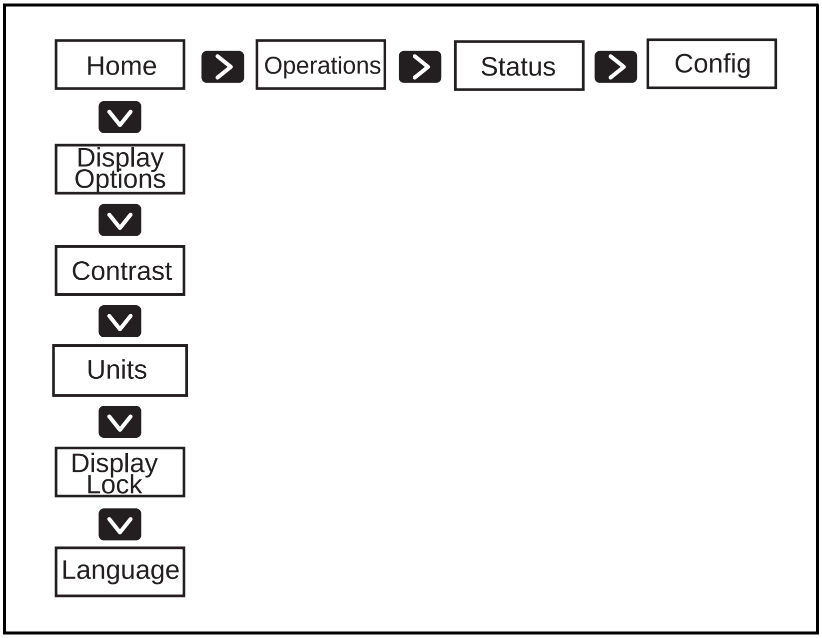


Figure 3-3 Home Screen Hierarchy

3.2.1 Beacon and Satellite Mode Home Screens

Note – Reference to Satellite DGPS applies only to the *Ag*GPS 132.

Tip – When in Beacon mode, a B, `Beacon Searching`, `Beacon Tracking`, or `Beacon FFT` message appears in the lower left corner of the screen. To change modes, press and hold for 5 seconds. To display satellite differential information, press until an S appears in the lower-left corner of the screen.

When beacon information appears in the *Home* screen, the *Ag*GPS receiver operates in Beacon mode. When satellite DGPS information appears in the *Home* screen, the *Ag*GPS 132 receiver operates in Satellite Differential mode. The DGPS source configuration setting is changed.

The following is a sample *Home* screen with Beacon DGPS:

```
G/3D Sv:07 DOP03
B A-R 310.0 S/N 15
```

The following is a sample *Home* screen with Satellite DGPS (*Ag*GPS 132 only):

```
G/3D Sv:07 DOP03
S 1556.225 S/N 15
```

Figure 3-4 explains the GPS status indicators.

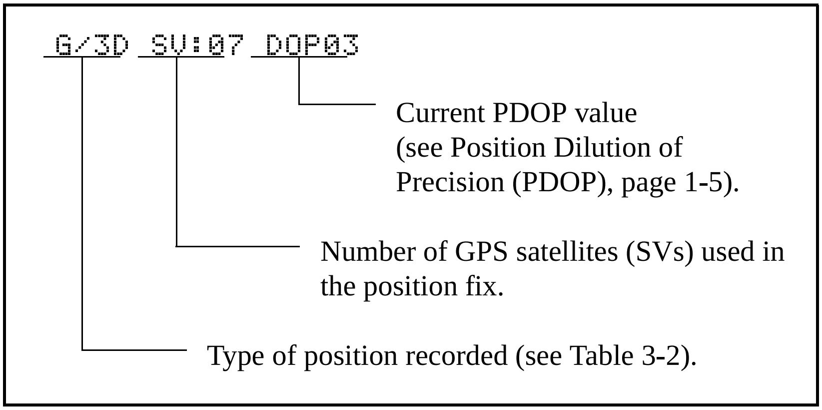


Figure 3-4 GPS Status

Table 3-2 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.
Ant?	No antenna connected to receiver.

Note – The / symbol spins when the receiver is operating properly. When the / symbol is still, an error occurred.

Figure 3-5 explains the beacon DGPS status indicators.

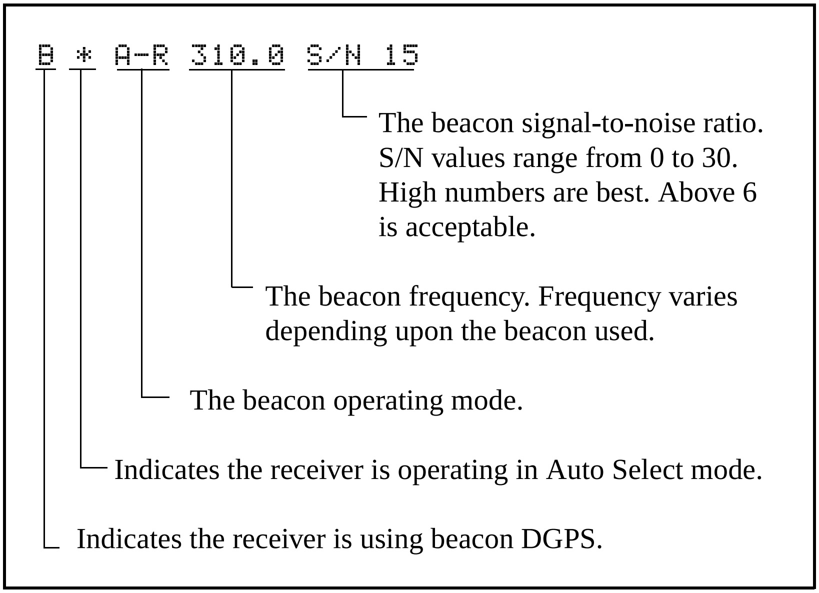


Figure 3-5 Beacon DGPS Status

Table 3-3 describes the options available in Beacon operating mode.

Table 3-3 Options in Beacon Operating Mode

Value	Description
B	Operating in beacon mode.
Beacon Searching	Searching for beacon signals.
Beacon Tracking	The receiver is tracking beacon signals and is attempting to gain lock.
Beacon Idle	The *Ag*GPS beacon receiver is not active.
Beacon FFT	The *Ag*GPS receiver is looking for a beacon across the signal spectrum.
Beacon Disabled	Beacon DGPS is disabled. Check configuration settings to enable beacon DGPS.
External RTCM	Differential corrections are provided by an external source through port A or B.
Battery is Low	Warning replaces DGPS information when battery voltages are low.

Figure 3-6 explains the satellite DGPS status indicators. (*Ag*GPS 132 only)

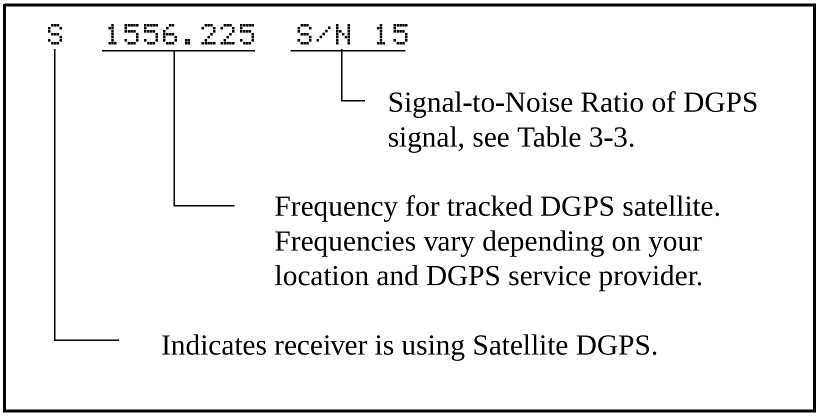


Figure 3-6 Satellite DGPS Status

Table 3-4 explains signal-to-noise ratio values.

Table 3-4 DGPS Signal-to-Noise Values

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

Table 3-5 shows the possible satellite differential mode indicators.

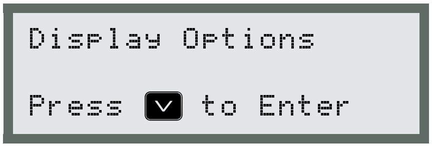
Table 3-5 Satellite Differential Mode Status Indicators

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.

3.3 Below Home Screen Configurables

The *Contrast, Units, Configuration Lockout* and *Language* settings are found under the *Home* screen. To display these screens:

1. Display the *Home* screen.
2. Press ∨ to view the *Display Options* screen.



3. Press ∨.

3.3.1 Contrast

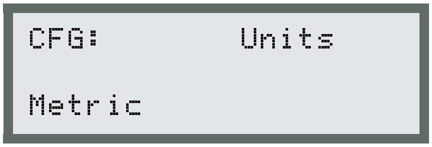
As lighting conditions change, the LCD display could become difficult to read. To decrease the contrast, enter a low number. Higher numbers increase screen contrast.

To change the contrast:

1. Press >.
2. Press ∧ to lighten the contrast.
3. Press ∨ to darken the contrast.

3.3.2 Units

The *Units* screen enables the receiver to display either U.S. or Metric units. This setting does not affect data output.



To change the units:

1. Press >.
2. Press ∨ to select the appropriate units.
3. Press ↵ to save.

3.3.3 Configuration Lockout Screen

The *Configuration Lockout* screen provides protection against tampering. To make the configuration screens invisible, input the last five digits of the receiver serial number. To view the configuration screens again, input the five-digit number a second time.

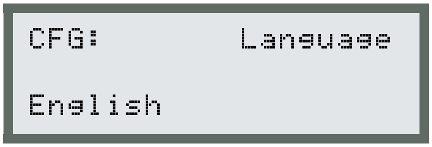
To enter the password:

1. Press ↵ to enter the Lock Display screen.
2. Press ∨ or ∧ to input the values.
3. Press > to input the next number.
4. Continue until complete.
5. Press ↵ to accept.

When complete, `Valid Password` appears. The configuration screens are not visible. Repeat the procedure above to unlock the configuration screens.

3.3.4 Language Screen

The *Language* screen provides the ability to display English, German, French, Portuguese, and Spanish on the front panel.



To change the display language:

1. Press >.
2. Press ∨ or ∧ to select the desired language.
3. Press ↵.

The screen automatically displays the configured language.

4 Operation Screens

This chapter shows you how to:

- use the Guidance Operation screens
- use the Utility screens

Trimble recommends that you read through this chapter to learn basic skills before attempting to calculate field area and measure line lengths. Figure 4-1 maps the operation screens.

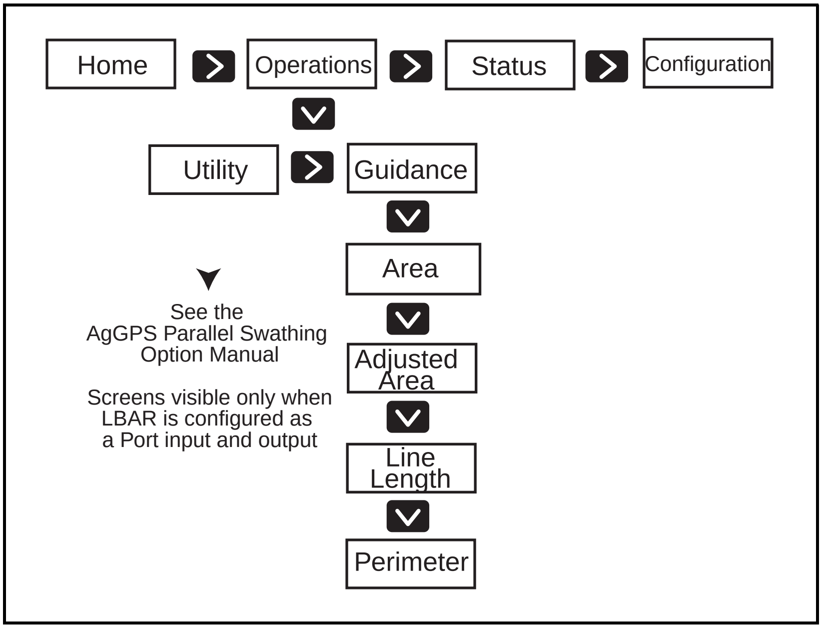
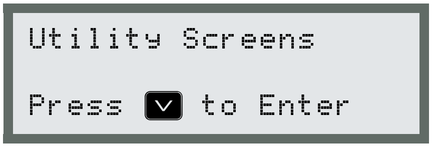


Figure 4-1 Operation Screen Hierarchy

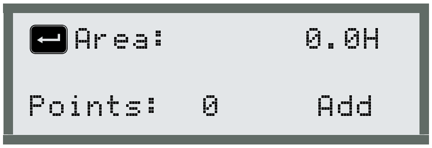
4.1 Utility Screens

To view the Utility screens, press > from the *Home* screen until the *Operations* screen appears. Press ∨. Press > until the *Utility* screen appears.



4.1.1 Area Calculation

Figure 4-2 explains the following *Area Calculation* screen.



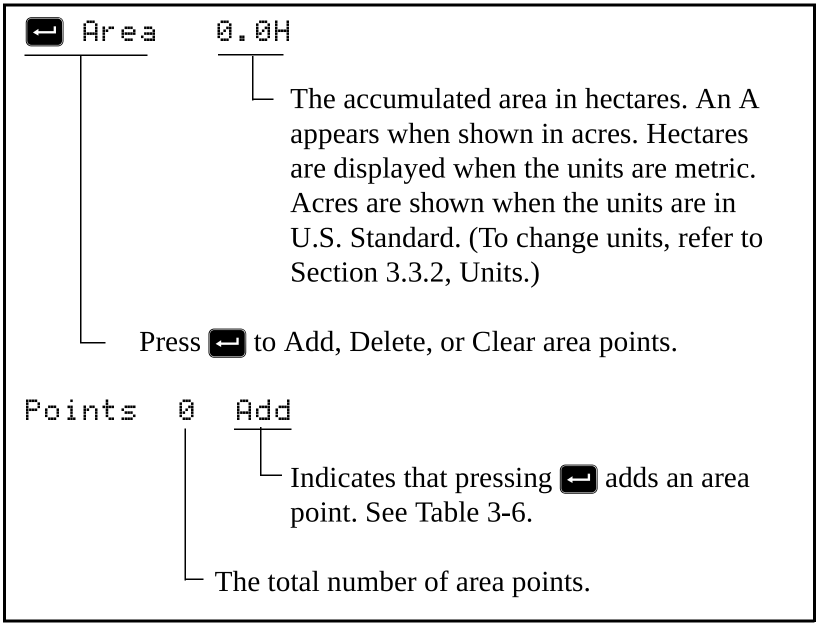


Figure 4-2 Area Calculation Screen

Table 4-1 describes the Area Calculation functions.

Table 4-1 Area Calculation Functions

Value	Description
Add	Adds area points
Del	Deletes last area points
CLR	Clears all area points. Use before beginning a new field.

To change the Delete/Add/Clear function:

1. Press >.

   The cursor flashes.

2. Press ∨ or ∧ until the option you desire is visible.
3. Press ↵ to accept the change.

4.1.2 Adjusted Area

The *Adjusted Area* screen displays an area offset by 1/2 the swath width setting in the *Guidance Configuration* menu.
(See *AgGPS Parallel Swathing Option Manual*.)

Note – The *Adjusted Area* screen is only used when operating the AgGPS Parallel Swathing Option.

When using the parallel swathing option, obtain an accurate field area by driving the field perimeter. Place the end of the applicator boom over the field boundary. Entered area points are offset to the Boom end. The resulting area is displayed here, in the *Adjusted Area* screen.

4.1.3 Path Length

The *Path Length* screen displays the length traveled between entered area points.

```
Path Length

0            meters
```

As area points are added, the path length increases.

4.1.4 Perimeter

The *Perimeter* screen displays the perimeter of entered area points. A line between the last and first entered area point is used to close the area.

```
Perimeter

0            meters
```

As area points are added, the perimeter increases.

4.1.5 Segment Length

The *Segment Length* screen displays the length between the last two entered area points.

```
Segment Length

0            meters
```

As area points are added, the last segment length is calculated.

5 Status

This chapter shows you how to use the GPS, DGPS, Receiver, and CAN status screens.

Trimble recommends that you read through this chapter when troubleshooting and verifying the status of the *Ag*GPS receiver.

Figure 5-1 maps the *Ag*GPS status screens.

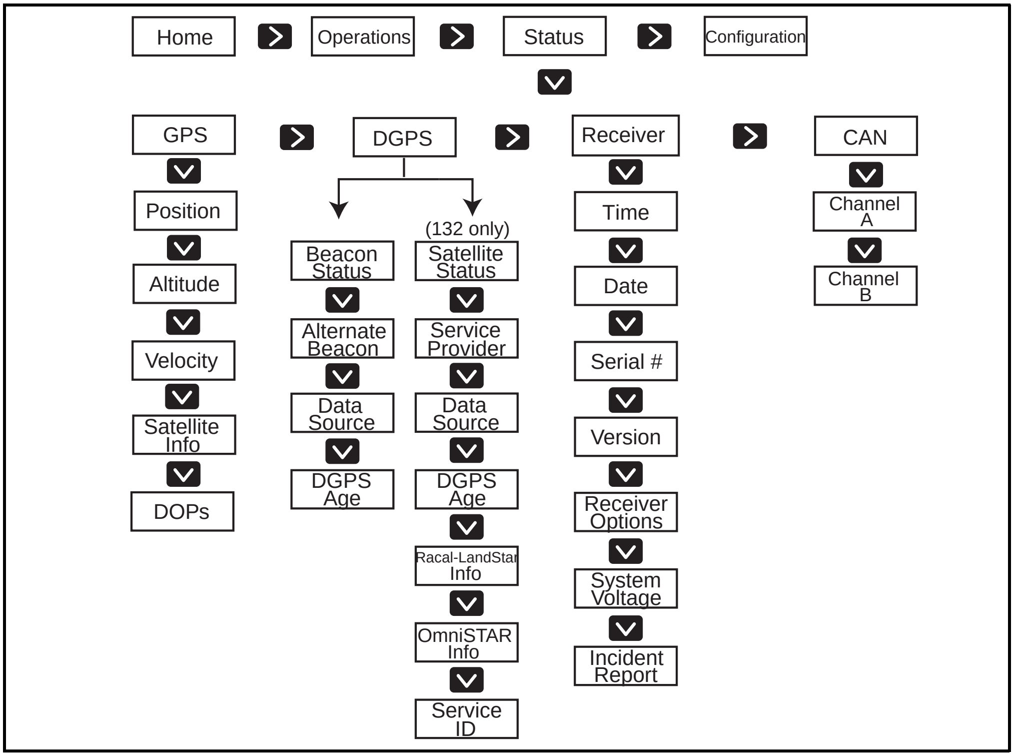
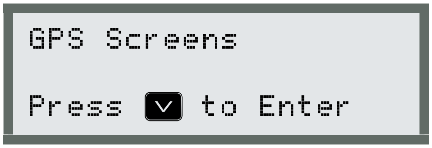


Figure 5-1 Status Screen Hierarchy

To view the status screens, press > from the *Home* screen until the *Status* screen appears. Press ∨.

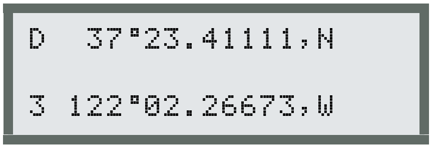
5.1 GPS Status Screens

To view the status of the GPS information, press until *GPS Status* appears. Press to view the available screens.



5.1.1 Location

Figure 5-2 explains the following *Location* screen.



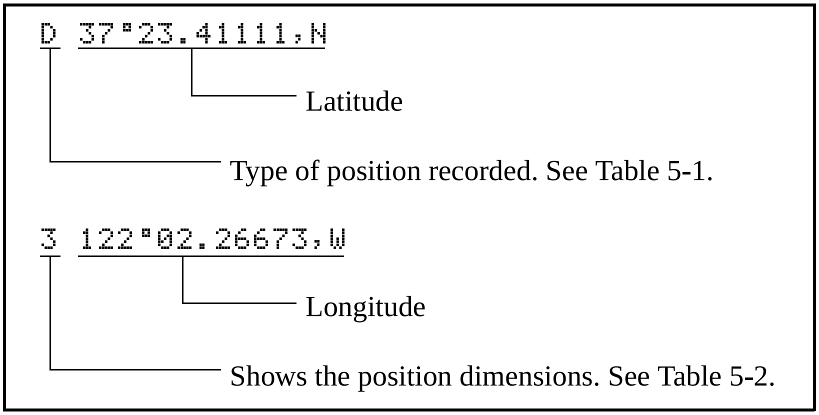


Figure 5-2 Location

Table 5-1 Types of Recorded Positions

Value	Description
D	Differential GPS
S	Searching for DGPS satellites. Current position is old.
G	Autonomous GPS
-	No valid satellites are tracked.

Table 5-2 Position Dimensions

Value	Description
2	Two-dimensional position
3	Three-dimensional position

5.1.2 Altitude

Figure 5-3 explains the following *Altitude* screen.

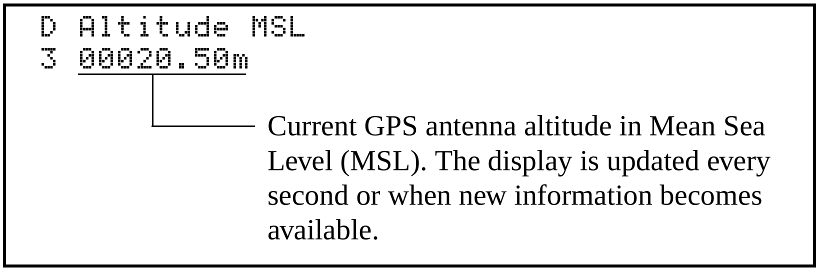
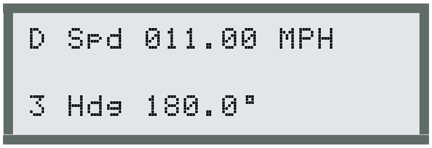


Figure 5-3 Altitude

5.1.3 Velocity

Figure 5-4 explains the following *Velocity* screen.



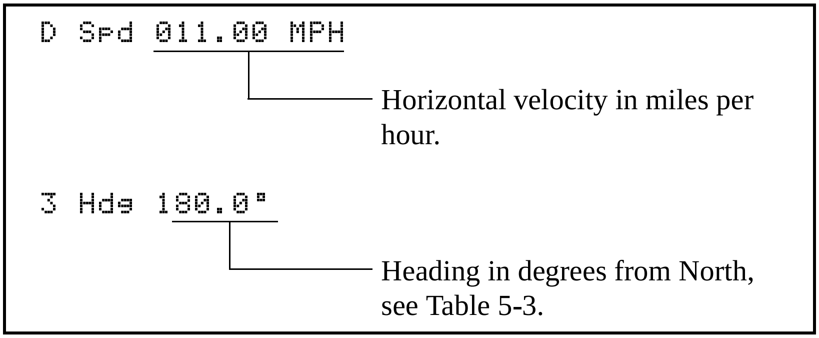


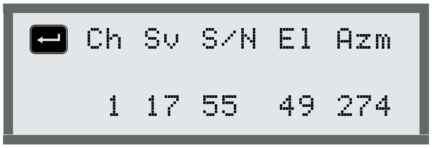
Figure 5-4 Velocity

Table 5-3 Heading Values

Value	Description
0°	North
90°	East
180°	South
270°	West

5.1.4 GPS Satellite Information

Figure 5-5 explains the following *GPS Satellite Information* screen.



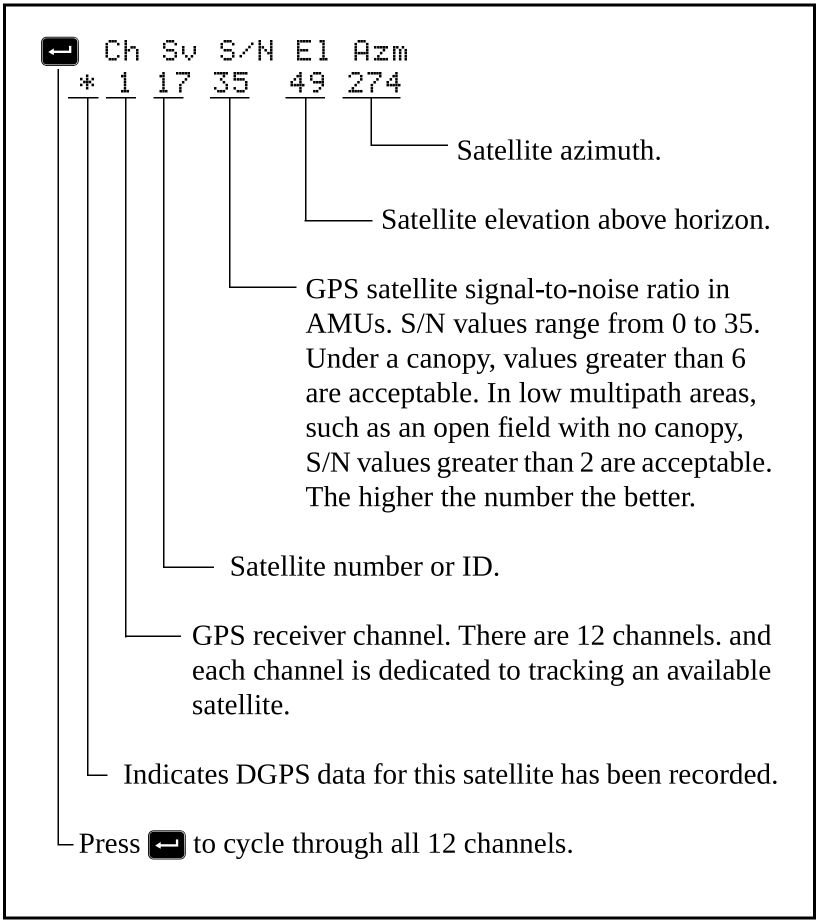


Figure 5-5 GPS Satellite Information

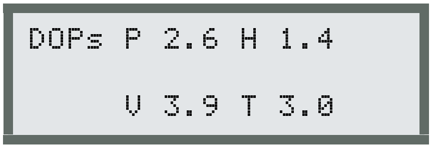
A channel may contain incomplete satellite information. Table 5-4 explains the messages that could appear on the screen.

Table 5-4 Incomplete Satellite Data Messages

Ch Sv S/N El Azm	Meaning
1 17 35 -- --	No data yet received from the satellite.
1 17 Searching	Searching for but not tracking satellite.
1 Idle	No satellite available to track.

5.1.5 DOPs

Figure 5-6 explains the following *DOPs* screen.



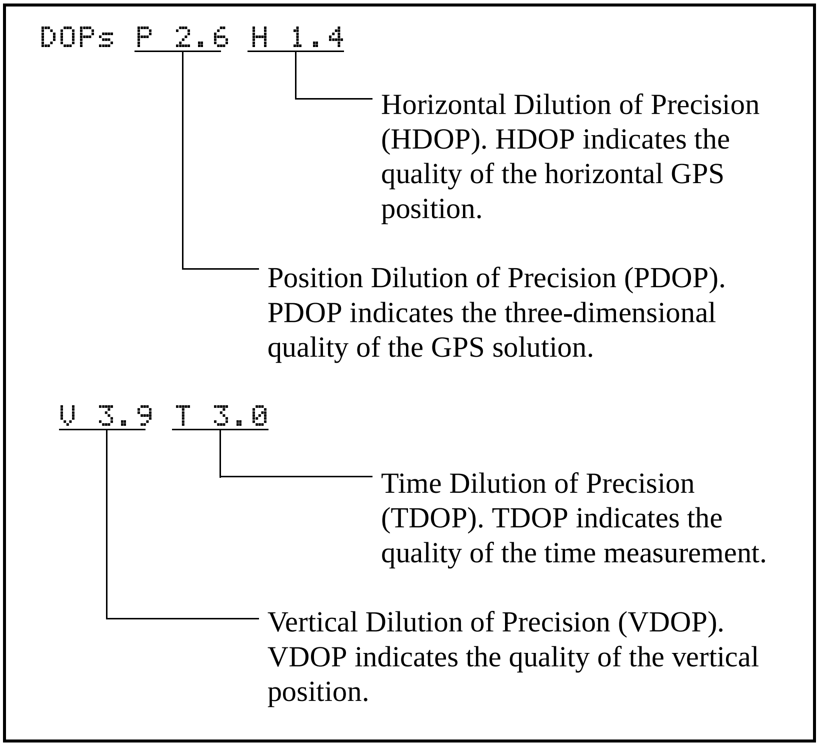


Figure 5-6 DOPs

When viewing DOP information, lower numbers are better. For a description see Position Dilution of Precision (PDOP), page 1-5.

Press to return to the main menu.

5.2 Beacon DGPS Status (Beacon Mode Only)

Note – If using an *Ag*GPS 132, press + until the *Home* screen becomes visible. Press and hold until B appears in lower left corner. This ensures you are in beacon mode.

To view the status of the DGPS information, press from the *Status* screen. Press until *DGPS Status* appears. Press to move through each screen.

5.2.1 Beacon Status

Figure 5-7 explains the following *Beacon Status* screen.

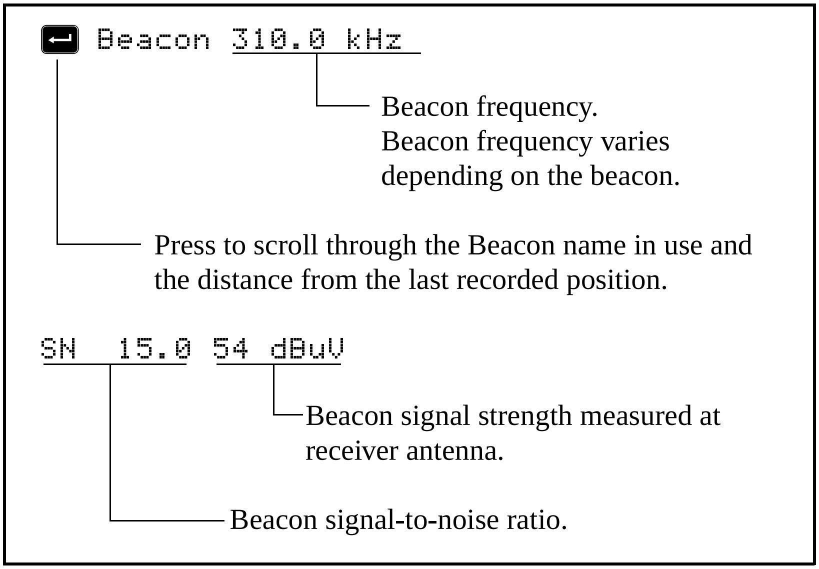


Figure 5-7 Beacon Status

Note – When searching for a beacon signal, the bottom line display switches between `Idle`, `Wideband FFT`, `Tracking`, `Searching`, and `Disabled` Messages.

5.2.2 Alternate Beacon

Figure 5-8 explains the following *Alternate Beacon* screen.

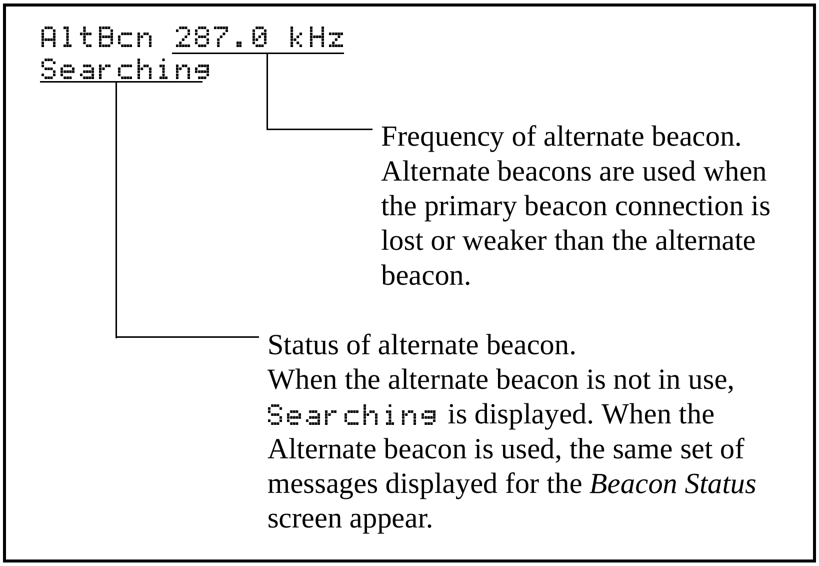


Figure 5-8 Alternate Beacon

5.2.3 DGPS Data Source

Figure 5-9 explains the following *DGPS Data Source* screen.

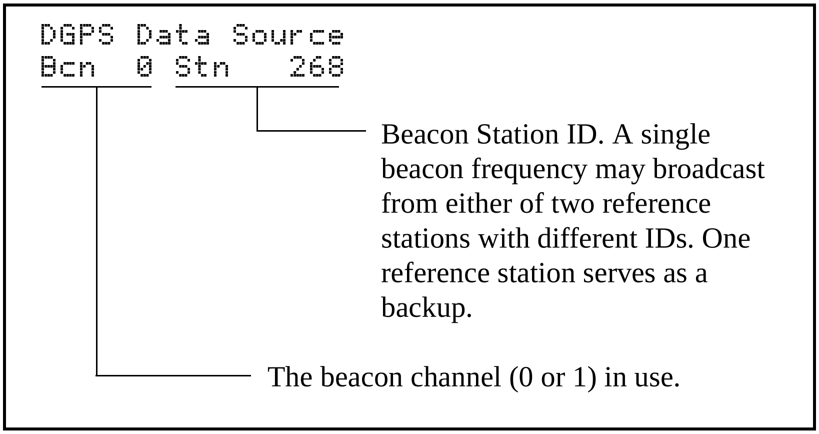


Figure 5-9 DGPS Data Source

5.2.4 DGPS Age

Figure 5-10 explains the following *DGPS Age* screen.

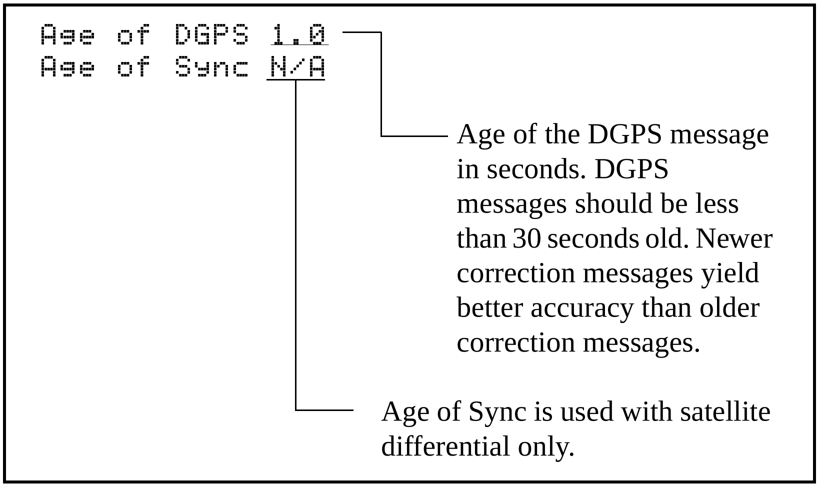


Figure 5-10 DGPS Age

Press to return to the main menu.

5.3 Satellite DGPS Status (*Ag*GPS 132 in Satellite Mode Only)

Note – Press + to return to the *Home* screen. Press until an S appears in lower-left corner. This ensures you are in satellite mode.

To view the status of the DGPS information, press until the *Status* screen appears. Press . Press until *DGPS Status* appears. Press to move through each screen.

5.3.1 Satellite Differential Status

Figure 5-11 explains the following *Satellite Differential Status* screen.

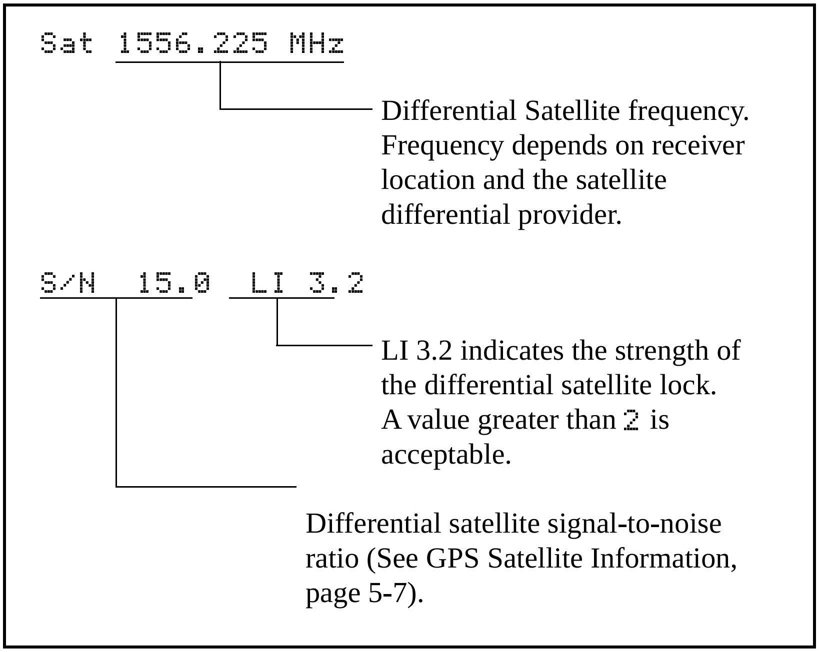


Figure 5-11 Satellite Differential Status

5.3.2 Service Provider ID

Figure 5-12 explains the following *Service Provider ID* screen.

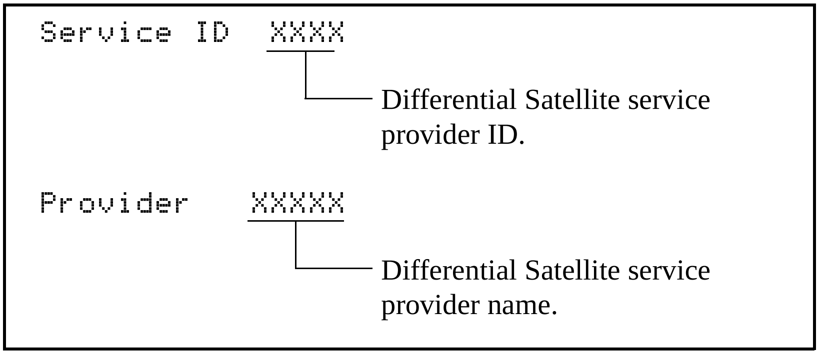


Figure 5-12 Service Provider ID

5.3.3 DGPS Data Source

Figure 5-13 explains the following *DGPS Data Source* screen.

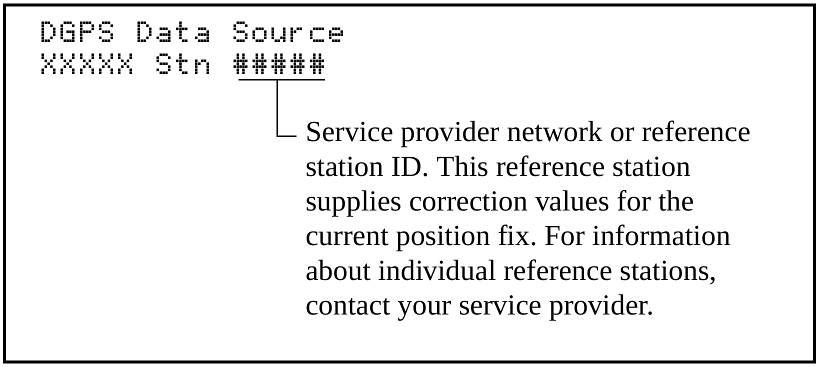
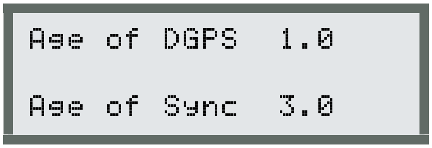


Figure 5-13 DGPS Data Source

5.3.4 DGPS Age

Figure 5-14 explains the following *DGPS Age* screen.



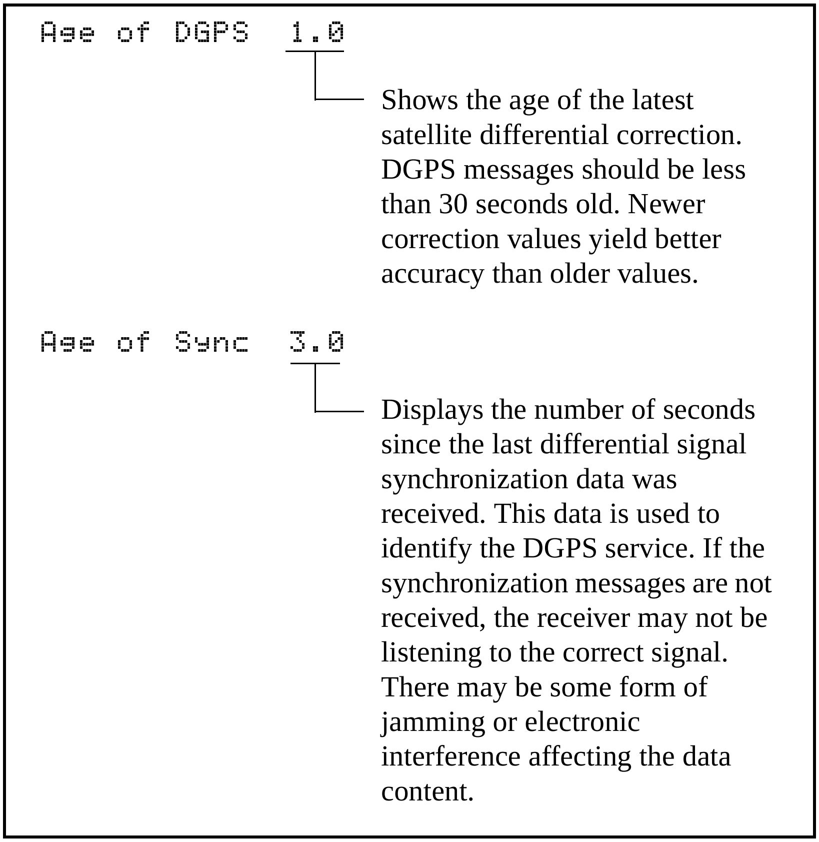


Figure 5-14 DGPS Age

5.3.5 Racal-LandStar Service Info

Table 5-5 describes options available in the following *Racal-LandStar Service Info* screen.

Press ↵ to move through the options.

Table 5-5 Racal-LandStar Subscription Options

Option	Meaning
User Code XXXXX	Racal-LandStar user code. This number is needed when subscribing to Racal-LandStar service.
Access Unknown	Subscription status is unknown.
User Enabled	Subscription is active.
User Disabled	Subscription is inactive.
Version XX.XX	Racal-LandStar decoder software version.

For subscription installation information, see Appendix F, Activating a Satellite DGPS Service.

5.3.6 OmniSTAR Service Info

Table 5-6 describes the options available in the following *OmniSTAR Service Info* screen.

Press to move through the options.

Table 5-6 OmniSTAR Subscription Options

Option	Meaning
Init Decoder	OmniSTAR decoder is initializing.
Decoder Ready 1-4	Decoder is ready, but DGPS data not yet received.
Access Confirmed	Access confirmed, but no data yet.
Received Data	System providing DGPS corrections.
No Recent Data	Data has been received in the past, but not in the last 10 seconds.
No Decoder Available	OmniSTAR decoder not available or is not operating correctly.
Access Unknown	No access to OmniSTAR DGPS.
Stop XX/XX/XX	End date of OmniSTAR DGPS subscription.

For subscription installation information, see Appendix F, Activating a Satellite DGPS Service.

5.3.7 Service ID and Initialization Vector (IV)

The *Service ID and Initialization Vector (IV)* screen is shown below:

Press to cycle through the *Ag*GPS Service ID and IV database. This database contains information about supported DGPS services. You can add to this database in configuration if you require a service not automatically listed.

Press to return to the main menu.

5.4 Receiver Status

From the *Status* screen, press [∨]. Press [>] to display the *Receiver Status* screen. Use [∨] to move through the screens.

```
Receiver screens
Press [∨] to Enter
```

5.4.1 Time Screen

Figure 5-15 explains the following *Time* screen.

```
D Time    UTC
3 Mon 21:07:27
```

```
D Time    UTC
3 Mon 21:07:27
```

The current time in UTC (Universal Coordinated Time). UTC time is Greenwich Mean Time plus a few seconds.

Figure 5-15 Time

5.4.2 Date and GPS Week

Figure 5-16 explains the following *Date and GPS Week* screen.

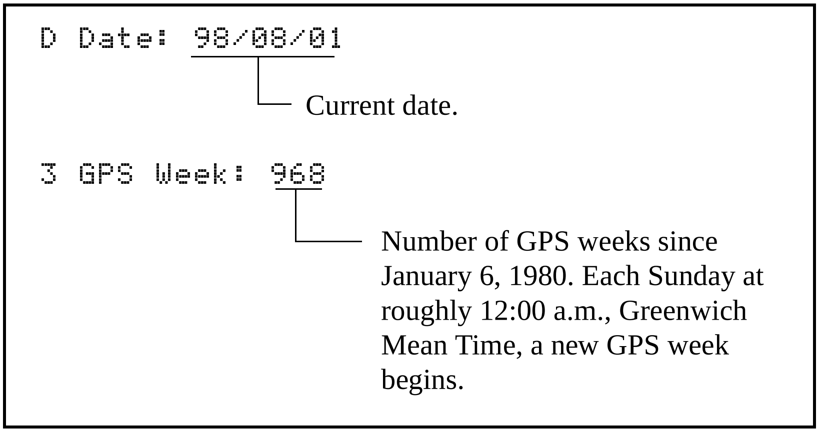
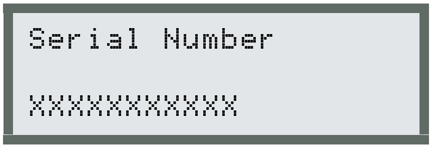


Figure 5-16 Date and GPS Week

5.4.3 Receiver Serial Number

Figure 5-17 explains the following *Receiver Serial Number* screen.



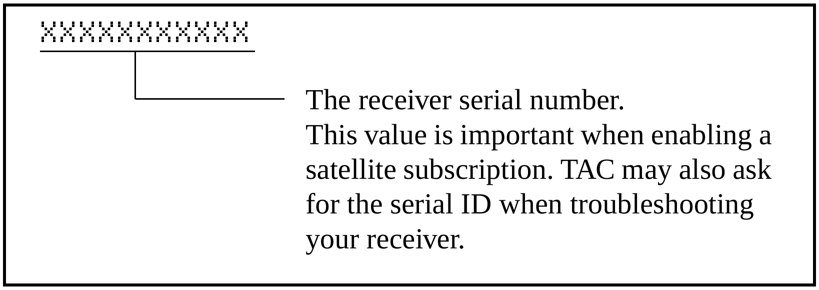


Figure 5-17 Receiver Serial Number

5.4.4 Firmware Version and Release Date

Figure 5-18 explains the following
Firmware Version and Release Date screen.

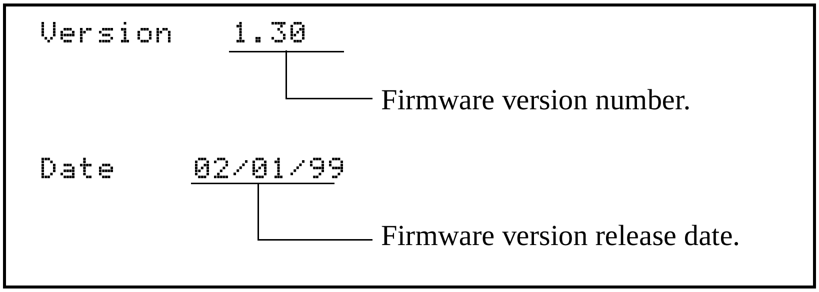
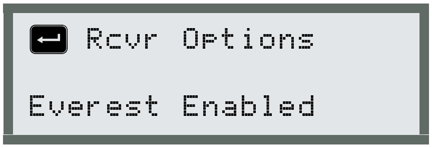


Figure 5-18 Firmware Version and Date

5.4.5 Receiver Options

Table 5-7 describes options available in the *Receiver Options* screen.



Press to cycle through the available options.

Table 5-7 Receiver Options

Option	Screen Appearance	Description
Fast Rate	Fast Rate (U) 1 Hz	1 Hz fix only.
	Fast Rate (A) 1 Hz	Fast Rate available but currently tracking at 1Hz.
	Fast Rate (U) 5 Hz	Fast Rate is not activated, but the system is outputting LBAR messages to the *Ag*GPS Parallel Swathing Option LightBar at 5 Hz.
	Fast Rate (A) 10 Hz	Operating in Fast Rate mode.
Base Stn	Base Station (A) On	Operating in base mode.
	Base Station (A) Off	Base station option is available, but Off.
	Base Station (U) Off	Base station option unavailable.
Everest	Everest MPR (U)	Everest option is unavailable.
	Everest MPR (A)	Everest option is On.
Parallel Swathing Option	Guidance (A) Off	Parallel Swathing option available, but Off.
	Guidance (A) On	Parallel Swathing option operating.
	Guidance (U)	Parallel Swathing option unavailable.
Providers	ALL	OmniSTAR and Racal Corrections available.
	OmniSTAR	Only OmniSTAR corrections available.
	Racal	Only Racal corrections available.
D&E	D&E Sub 2/1/99	Expiration date for CSI/D&E encrypted beacon service.

For option descriptions, see Chapter 1, Overview.

5.4.6 System Voltages

Figure 5-19 explains the following *System Voltages* screen.

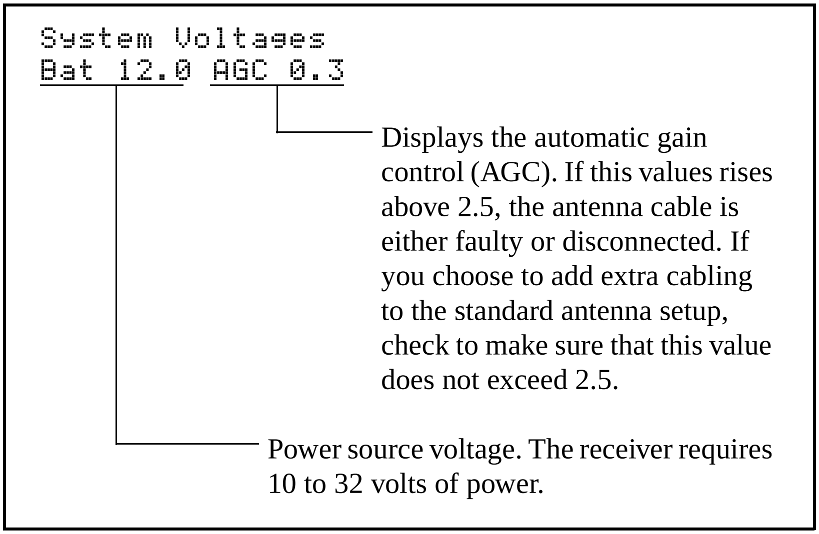


Figure 5-19 System Voltages

Press [V] to return to the main menu.

5.4.7 Incident Report

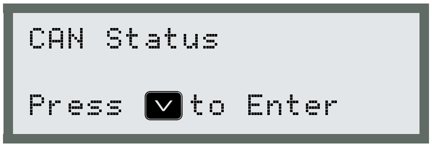
The *Incident Report* screen is shown below.

If a problem occurs with the receiver, a diagnostic code appears. This code provide information to Trimble technical support.

5.5 CAN Status

From the *Status* screen, press .

Press to display the *CAN Status* screen.

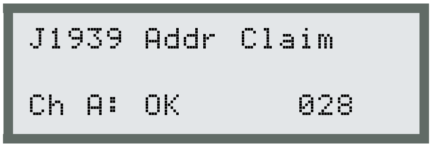


Use to move through the screens.

Note – The *CAN Status* screens are used only when operating the CAN Bus. The CAN Bus is an optional wiring configuration that replaces the traditional serial connection. For more information, contact your local dealer.

5.5.1 Channel A Status

The *Channel A* Status screen provides connection status information when the CAN Bus is connected to receiver Port A.



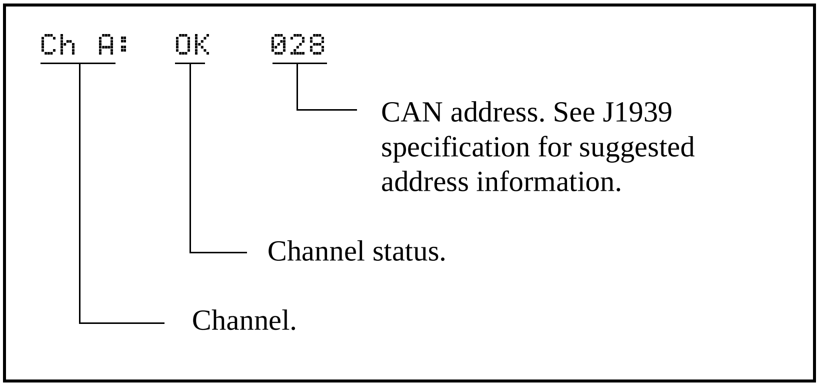


Figure 5-20 Channel A Status

Table 5-8 Channel Status

Option	Description
None	No address has been claimed.
OK	Address successfully claimed.
Trying	Address claim in process.
Failed	The receiver was unable to establish an address on the CAN Bus.

5.5.2 Channel B Status

The *Channel B* status screen provides connection status information when the CAN Bus is connected to receiver port A.

The *Channel B* status screen operates exactly like the *Channel A* status screen. See section 5.5.1.

6 Configuring the *Ag*GPS 124 and 132 Receiver

This chapter shows you how to configure your *Ag*GPS receiver:

- for data collection applications
- to operate as a base station

We recommend you read through this chapter before attempting to configure your *Ag*GPS receiver.

6.1 Configuring the *Ag*GPS Receiver

The GPS and beacon operating parameters are set to predefined values. These settings are suitable for many different applications and allow the *Ag*GPS receiver to be used immediately after installation. You can use the front panel to change configuration parameters for special applications and, if operating an *Ag*GPS 132 receiver, activate satellite differential services.

Figure 6-1 maps the *Ag*GPS receiver configuration screens.

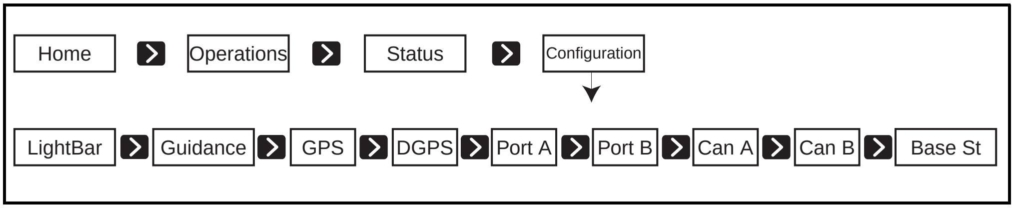


Figure 6-1 Configuration Screen Hierarchy

6.1.1 Using the Keypad to Change Configuration Settings

In the configuration menus, the keypad contains more functions than when navigating through the *Status* screens. For more information, see Viewing Status Screens, page 3-3.

To use a typical configuration screen:

1. On the main menu, move to a *Configuration* screen and press .
2. Press to cycle through the *Configuration* screens.
3. Press to activate the configurable options.

   The first setting option flashes.
4. Press or to cycle through the available settings. If there are multiple settings on a single screen, press to activate the next setting.
5. When all settings are complete, press .
6. Press to display the next *Configuration* screen.

6.2 GPS Configuration

GPS configuration screens determine how the *Ag*GPS receiver computes position data. To display the main menu *GPS Configuration* screen:

1. Display the *Home* screen.
2. Press > until the main menu *GPS Config* screen appears.

```
Config GPS
Press v to Enter
```

3. Press v to cycle through the available screens.

GPS configuration screens are described in the following sections.

☞ **Tip –** The GPS Configuration default settings are ideal for most applications.

6.2.1 Restore Defaults

The *Restore Defaults* screen returns the GPS mode settings to default. This screen is particularly valuable when troubleshooting. An incorrect GPS configuration can prevent the output of GPS positions. Restoring defaults eliminates GPS configuration errors.

```
CFG:  GPS  Defaults
Restore          No
```

To restore GPS defaults:

1. Press >.
2. Press v until yes is displayed on the front panel.
3. Press ↵.

   The defaults are restored.

6.2.2 GPS Mode

The GPS mode setting determines if two-dimensional or three-dimensional position data is output. Three-dimensional positions contain latitude, longitude, altitude, and time. Two-dimensional positions contain latitude, longitude, and time. When submeter accuracy is required, Manual 3D is the recommended setting. When continuous data is more important than accuracy, Auto 2D/3D is recommended. The *GPS Mode* screen is shown below:

Table 6-1 describes the GPS Mode settings.

Table 6-1 GPS Mode Settings

Setting	Description
Manual 2D	Three satellites are used to calculate 2-dimensional positions. The altitude computed at the last 3-dimensional position is used for all 2-dimensional positions. The altitude value may change slightly if it is inconsistent with the position values.
Manual 3D	Four or more satellites are used to calculate 3-dimensional positions. This is the most accurate setting, but only yields positions when 4 or more satellites are visible.
Auto 2D/3D	Four or more satellites are used to calculate 3-dimensional positions when possible. When only three satellites are available or PDOP exceeds a user defined mask, 2-dimensional positions are output. The altitude computed at the last 3-dimensional position is used for all 2-dimensional positions.

Caution – Inaccurate altitude values have a significant impact on 2-dimensional position accuracy. As a rule of thumb, every meter (3 feet) of error in the altitude component is likely to cause at least three meters (9 feet) of horizontal error.

6.2.3 System Masks

System masks filter poor satellite data that reduces position accuracy. The AMU mask filters data based on signal to noise ratio. The Elevation mask determines the lowest elevation, in degrees, at which the *Ag*GPS receiver uses a GPS satellite. The *System Masks* screen is shown below:

```
CFG: System Masks

AMU  6  Elev 8
```

To set the system masks:

1. Press > to activate the AMU mask.

   When collecting data under a canopy, the recommended mask setting is 6. When working in open fields you can reduce the setting to 2. If the signal-to-noise ratio for a particular GPS satellite falls below the mask value, the satellite is not used when computing a position.

2. Press > to activate the Elevation mask. The recommended setting for highest accuracy is 15°. There is a trade-off between accuracy and continuous operation. Lower the elevation mask to ensure continuous operation.
   The default is 8°.

3. Press ↵ to save your settings.

Note – The AMU mask can be set from 0 to 10 and the Elevation mask from 0° to 90°.

6.2.4 PDOP Settings

GPS data with high PDOPs yield poor position accuracy. PDOP settings determine how high the PDOP can rise before the receiver stops providing position data or, if in Auto 2D/3D mode, switches to 2-dimensional positions. The *PDOP Settings* screen is shown below:

```
CFG: PDOP Settings

Mask 12  2D-3D  8
```

Table 4-2 describes the PDOP Mask and 2D-3D settings.

Table 6-2 PDOP Mask and 2D-3D Settings

Setting	Description
Mask	GPS positions are not output when the PDOP values rise above the PDOP mask. A low mask (below 8) ensures quality positions are output, but when PDOP rises, no data is available. A high mask (8 and above) can increase the amount of data output, but some data may be less accurate. Raise the PDOP mask when accuracy is less important than continuous data.
2D-3D	Two-dimensional positions are output when PDOP rises above the 2D-3D setting. This setting is only valid if Auto 2D/3D is selected as the position mode.

Note – The PDOP mask and PDOP switch can be set from 0 to 99.

6.2.5 PV Filter and Position Rate

The PV Filter and Position Rate settings affect the data quality collected from a moving antenna. The *PV Filter and Pos Rate* screen is shown below:

```
CFG: PV Filter D+S

Pos Rate      1 Hz
```

Table 6-3 describes the PV Filter and Position Rate setting.

Table 6-3 PV Filter and Position Rate Settings

Setting	Option	Description
PV Filter		Smooths position data when the antenna is moving and attempts to reduce the effects of position disturbances, which include reflected signals and small outages of DGPS corrections. The recommended setting for PV filter is D+S.
	D+S	This setting is ideal for Dynamic and Static applications. That is, applications where the antenna is stationary or moving at greater than 0.1 m/s. (3 ft. per second).
	DYN	This setting is ideal for slow vehicles where the antenna moves less than 0.1 m/s (3 ft. per second) or 0.2 m.p.h.
	OFF	No position filtering.
Pos Rate		Determines how often GPS positions are updated. The standard rate is 1 Hertz (1 Hz). If the Fast Rate option was purchased, a 10 Hz rate is available. A 10 Hz setting updates the GPS position 10 times a second. 1 Hz updates the position once every second. The Fast Rate option is ideal for applications where the antenna moves at high velocity.

Note – The Fast Rate option enables 10 Hz data output. When using the Parallel Swathing Option, up to 5 Hz is available.

6.2.6 Dynamic Mode

The Dynamics Code field informs the receiver of your usual operation mode. The *Dynamic Mode* screen is shown below:

```
CFG: Dynamic Mode

Type: Land
```

A correct Dynamics Code setting reduces the initial satellite acquisition time. There are four available dynamic codes: Static, Land, Sea, and Air. The recommended setting for most agriculture applications is Land. When operating in a plane or helicopter, choose Air.

Note – If you configure the Dynamics code incorrectly, you may notice a slightly degraded acquisition and reacquisition of satellite signals.

6.3 DGPS Configuration

DGPS Configuration screens determine which differential source the *Ag*GPS 132 receiver uses. When using an *Ag*GPS 124, only Beacon screens are available.

To display the main menu *DGPS Configuration* screen:

1. Press [>] until the *DGPS Config* screen appears.

```
Config DGPS

Press ↵ to Enter
```

2. Press [∨] to cycle through the screens. DGPS Configuration screens are described in the following sections.

6.3.1 DGPS Mode

DGPS mode determines if corrections are applied to every output position. This configuration setting is crucial when DGPS accurate data is required. The *DGPS Mode* screen is shown below:

```
CFG: DGPS Mode

DGPS Auto On/Off
```

Table 6-4 describes the DGPS mode settings.

Table 6-4 DGPS Mode Settings

Setting	Description
DGPS Only	Outputs only GPS positions that are real-time corrected. Assures the best accuracy possible; but when the DGPS source is lost, no data is output.
DGPS Auto On/Off	DGPS positions are output when available. When the DGPS source is lost, autonomous positions are generated.
DGPS Manual Off	Outputs only autonomous positions. Positions are only accurate up to 100 meters.

6.3.2 DGPS Correction Age

The DGPS Correction Age setting determines the maximum age of a differential correction to be applied. If the most recent correction is older than the maximum age setting, no differential correction is applied.

```
CFG:  DGPS Corr Age
30 second limit
```

The default setting is 30 seconds.

Warning – The lower the setting the more likely a loss of DGPS will occur. The maximum setting is 60 seconds.

6.3.3 DGPS Source (*Ag*GPS 132 only)

When using an *Ag*GPS 132 receiver, the DGPS Source setting determines whether beacon or satellite differential corrections are applied. The *Ag*GPS 132 receiver defaults to beacon differential. The *DGPS Source* screen is shown below:

```
CFG: DGPS Source
Beacon Only
```

Table 6-5 describes the DGPS source settings.

Table 6-5 DGPS Source Settings

Setting	Description
Beacon Only	Beacon DGPS corrections are used.
Satellite Only	Satellite DGPS corrections are used (subscription must be activated to receive data).

6.3.4 Beacon Mode

This setting determines which radiobeacon the *Ag*GPS receiver chooses when operating in Beacon Mode. The Beacon Mode setting is important when more than one beacon is available in your operating area. The *Beacon Mode* screen is shown below:

Table 6-6 describes the Beacon Mode settings.

Table 6-6 Beacon Mode Settings

Setting	Description
Manual Frequency	Uses corrections from the beacon broadcasting at a user-defined location.
Auto Range	Uses corrections from the closest beacon.
Auto Power	Uses corrections from the strongest beacon signal.
Disabled	Disables beacon DGPS receiver.

6.3.5 EZ Beacon 0

The *EZ Beacon 0* screen enables manual configuration of the primary beacon.

Note – The *EZ Beacon* screen is only necessary when manual frequency is selected as the Beacon Mode.

The beacon selected provides differential corrections. If this beacon becomes inoperable, the receiver defaults to the alternate beacon. (See Section 6.3.6.)

To manually select a beacon:

1. Press >.

   The cursor flashes.

2. Press ∨ or ∧ to scroll through the available beacons.

Note – Beacons within 800 km (approximately 500 miles) from the last position collected are visible.

Tip – Beacon distance from the last collected position is shown in the upper right corner of the screen. If you know of a local beacon that is not included in the receiver database, use the manual frequency screen to configure.
(See Section 6.3.7, Manual Beacon Frequencies.)

3. Press ↵ to accept the desired beacon.

Note – The receiver must record a position before the EZ Beacon selection can be used. If no position has been collected or if no

beacons are available within 800 km, the screen reads:
No Known Beacon.

6.3.6 EZ Beacon 1

The *EZ Beacon 1* screen enables manual configuration of the alternate or secondary beacon.

```
CFG: EZ Bcn1:230 km
Chico
```

The *EZ Beacon 1* screen is similar to the *EZ Beacon 0* screen. See Section 6.3.5, EZ Beacon 0, for operating instructions.

6.3.7 Manual Beacon Frequencies

Tip – This screen is only used when the beacon mode is set to manual frequency and the local beacon is not in the receiver database visible on the EZ Beacon screens (see Section 6.3.5 and Section 6.3.6).

Manual beacon frequencies can be defined when the Beacon Mode is set to Manual Frequency. The *Ag*GPS receiver contains two beacon channels. If there are multiple beacons in your area, set a frequency for each channel. If the primary beacon, Channel 0, is not available, the *Ag*GPS receiver uses the secondary beacon, Channel 1. The *Manual Beacon Freqs* screen is shown below:

```
CFG: Man Bcn FREQS
0:XXX.X  1:XXX.X
```

To configure manual beacon frequencies:

1. Press >.

   The first configurable number flashes.
2. Press ^ or v to change the value.
3. Press > to highlight the next configurable number.
4. Continue until the proper frequencies are set, then press ↵.

For a listing of local beacon frequencies, contact your national coast guard. In the USA, a beacon frequency list is available on the internet at WWW. NAVCEN.USCG.MIL.

6.3.8 Easy Satellite DGPS Configuration (*Ag*GPS 132 Only)

The *Easy Satellite DGPS Configuration* screen automatically sets the satellite frequency and baud rate based on the location specified. Enter your location and the receiver knows what frequency and baud rate to use.

```
CFG: EZ Sat:  XXXXX

N. America central
```

When you obtain your satellite subscription, the service provider tells you which location to choose. To enter the provider and select the desired location:

1. Press >.
2. Press ∨ until your provider is listed.
3. Press >.
4. Press ∨ until your location is displayed.
5. Press ↵ to accept and save.

6.3.9 Satellite Frequency (*Ag*GPS 132 Only)

☞ **Tip –** The *Satellite Frequency* and *Satellite Baud* screens are only used when the satellite frequency is not found under the *Easy Satellite DGPS Configuration* screen. This can occur when the DGPS provider changes frequency or baud rate after the release of the receiver firmware.

To apply corrections from a satellite differential service, you can manually enter the appropriate satellite frequency. Change the satellite frequency *only* when instructed by the DGPS provider. The *Satellite Freq* screen is shown below:

To set the differential service satellite frequency:

1. Press >.

   The first configurable number flashes.

2. Press ∧ or ∨ to change the value.
3. Press > to highlight the next configurable number.
4. Continue until the proper frequency is set, then press ↵.

The satellite frequency depends on your geographic location and differential service provider. For a listing of local satellite frequencies, contact your differential provider.

6.3.10 Satellite Baud

The satellite baud must match the output rate set by your differential provider. The satellite baud screen is shown below.

```
CFG: Satellite Baud

1200 bps
```

Available baud rates are 600, 1200, and 2400.

6.3.11 OmniSTAR Activation

This setting contains a 24-digit OmniSTAR satellite differential service activation code. The *Omni** screen is shown below.

```
CFG:Omni* 00000000

0000000000000000
```

To activate the OmniSTAR satellite differential service, see Appendix F.

Note – If an incorrect number (such as all zeros) is input, retry using the correct activation code. Incorrect codes have no effect on receiver operations.

6.3.12 Racal Solution

In some locations, Racal network DGPS solutions are not available. In these locations the corrections can be received from the nearest reference station. The *Racal Stations* screen is shown below:

```
CFG: Racal Stns

Use Network Stn
```

Table 6-7 describes the Racal Station settings.

Table 6-7 Racal Station Settings

Setting	Description
Use Network Stn	Uses corrections from the Racal Network. These corrections are usually more accurate than from a single station.
Use Closest Stn	Uses corrections from the closest reference station. These solutions are necessary if you are located outside the network range.

6.4 Configuring Port Parameters

Note – Port A and B can simultaneously communicate in both RS232 and CAN. The port parameter screens configure RS232 messages. If using CAN, see Section 6.5, Configuring CAN Parameters.

Ports A and B must be configured to make sure the proper data type is input and output from the *Ag*GPS receiver. The configuration of Port A and Port B is identical; therefore, only Port A is discussed in this chapter.

To display the *Port A Configuration* screen:

1. Display the main menu.
2. Press > until the *Port A Configuration* screen appears.

3. Press to cycle through the screens. *Port A configuration* screens are described in the following sections.

6.4.1 Setting the Port Input Parameters

Port input parameters are important when communicating with the *Ag*GPS LightBar and other external devices. The *Port-A Input* screen is shown below:

```
CFG: Port-A in

TSIP 9600 8-0-1
```

Table 6-8 describes the Port input parameter settings.

Table 6-8 Port Input Parameter Settings

Setting	Description
None	Nothing is input.
TEXTB	ASCII data from an external device, such as a chlorophyll meter, can be input on Port A, merged with NMEA GPS data, and output on Port B. The incoming data must be limited to 66 ASCII characters and must be 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>. 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. TEXTA inputs on Port A, not Port B.
RTCM	Inputs RTCM data from an external DGPS device, such as an FM pager.
TSIP	Inputs TSIP data packets from the port when using the optional TSIP Talker software.
LBAR	Inputs data from the *Ag*GPS LightBar. This setting is required when using the *Ag*GPS Parallel Swathing Option.

The remaining settings configure baud rate, data bits, stop bits, and parity. The defaults are 9600, 8-O-1.

6.4.2 Setting the Port Output Parameter

Output parameters define the data type transmitted from the *Ag*GPS receiver. Output settings are important when sending data to external devices such as a yield monitor or guidance lightbar.
The *Port A Output* screen is shown below:

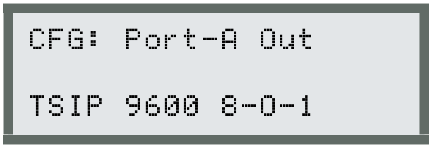


Table 6-9 describes the Port Output Parameter settings.

Table 6-9 Port Output Parameter Settings

Setting	Description
None	Nothing is output.
RTCME	Outputs RTCM data generated from an external source such as a radiobeacon, or satellite differential system. This option is sometimes referred to as bent pipe functionality.
RTCMI	Outputs RTCM data generated by a *Ag*GPS receiver operating in base mode. For information about operating in Base mode, see Base Station Configuration, page 6-29.
NMEA	Outputs your selection of NMEA messages (see NMEA 1 Settings, page 6-22 and NMEA 2 Settings, page 6-23).
TSIP	Outputs TSIP data. This setting is required if you are outputting TSIP packets using the optional TSIP Talker software
LBAR	Outputs data to the *Ag*GPS LightBar. This setting is required when operating the *Ag*GPS Parallel Swathing Option.
TSIP R	Outputs RTCM data within a TSIP string. For more information, see the *TSIP Reference* manual.

The remaining settings configure baud rate, data bits, stop bits, and parity. The defaults are 9600, 8-O-1.

6.4.3 NMEA 1 Settings

When NMEA data is selected as the port output setting, you can change the selection of NMEA messages output by the receiver. The default messages are GGA, GSA, VTG, and RMC.
The Port A *NMEA-1* screen is shown below:

```
CFG: NMEA-1 GGA gll
VTG gsv GSA zda
```

To change the NMEA messages output:

1. Press >. The first three-letter NMEA message type flashes.
2. Press ^ or v to change the capitalization of the NMEA message type. When capitalized, the NMEA message is output. Lower case NMEA message types are not output.
3. Capitalize the NMEA message(s) to be output, and press ↵ when you are finished.

Note – More NMEA data types are available on the Port A and Port B *NMEA-2* and *NMEA-3* screens.

6.4.4 NMEA 2 Settings

The settings on the Port A *NMEA-2* screen are extensions of the options found on the Port A *NMEA-1* screen. Three NMEA screens are required to present all of the NMEA options. Capitalized NMEA data types on both the *NMEA-1* and *NMEA-2* and *NMEA-3* screens are output. The Port A *NMEA-2* screen is shown below:

```
CFG: NMEA-2 RMC mss
ptnlid ptnldg
```

6.4.5 NMEA 3 Settings

The settings on the Port A *NMEA-3* screen are extensions of the options found on the Port A *NMEA-1* and *NMEA-2* screens. Capitalized NMEA data types on each NMEA screen are output. The Port A *NMEA-3* screen is shown below:

```
CFG: NMEA-3 grs gst
ptnlsm ptnlggk
```

☞ **Tip –** For detailed information about content and structure of NMEA messages, see Appendix D.

6.4.6 Message Rate

This setting can be used to vary the NMEA and TSIP output rate. For example, if the parallel swathing option is purchased, lightbar data is output at a rate of 5 times per second (5 Hz). Meanwhile, on the other port, NMEA or TSIP data can be output to a computer software package, yield monitor, variable rate controller, or other equipment at a slower rate.

The message rate screen is shown below:

```
CFG: NMEA out  ASAP
TSIP out       ASAP
```

To modify the port output rate, select the NMEA or TSIP message and choose the required rate. ASAP equals the rate selected on the *PV Filter and Position Rate* screens. A setting of *1s* outputs a position each second.

Warning – No messages are output unless the message type is selected in the *Port Output* screen.

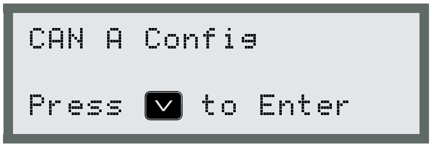
6.5 Configuring CAN Parameters

Note – Port A and B can simultaneously communicate in both RS232 and CAN. The CAN parameter screens are used to configure CAN messages. If using RS232, see Section 6.4, Configuring Port Parameters.

Ports A and B can be configured to ensure the AgGPS receiver secures an address on the CAN Bus. The configuration of Port A and Port B is identical; therefore, only CAN A is discussed in this chapter.

To display the *CAN A configuration* screen:

1. Display the main menu.
2. Press > until the *CAN A* configuration screen appears.



3. Press > to cycle through the screens. Port A configuration screens are described in the following sections.

6.5.1 CAN Rate

This setting is used to vary the CAN Rate or bits per second.

```
SFG: CAN A 250 kbs
J1939
```

The default speed is 250kbs. This conforms to the J1939 CAN specification.

6.5.2 Address

This setting is used to secure a receiver address on the CAN Bus.

```
SFG: J1939 Adr: 028
ECU: 000 Fnct: 000
```

The recommended setting is 028. For more information, see the J1939 CAN specification.

6.5.3 Message Tape

This setting determines what data is included in the CAN message.

```
CFG: J1939 Msgs-1
POS VEL TIME
```

The available messages are shown in Table 6-10:

Table 6-10 Messages

		J1939 Identifier	
Message	**Description**	**PDU Format**	**PDU Specific**
POS	GPS Position	254	243
VEL	Velocity	254	232
TIME	Time	254	230

Upper-case messages are included in the CAN message. Lower-case messages are not included in the CAN message.

To include or exclude individual messages:

1. Press >.

   The cursor flashes.

2. Press ∨ or ∧ to change the message status.
3. Press > to arrow to the next message.
4. Press ↵ to save.

6.5.4 Interval

This setting determines the message interval or how often the selected messages are sent over the CAN Bus.

```
CFG: J1939 Interval

1 second
```

The default rate in the receiver is 1 second. If outputting at 5 Hz, configure for 200 msecs (milliseconds). If outputting at 10 Hz, configure for 100 msecs.

6.6 Base Station Configuration

If you have not purchased the base station option, the following screens are not available.

Note – The base station configuration screens are only required when operating in base mode.

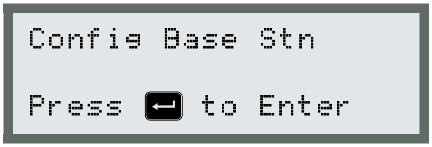
In base mode, the *Ag*GPS receiver outputs RTCM data to a customer supplied radio solution. The radio then broadcasts the RTCM data to other receivers in the field.

The *Ag*GPS is an ideal receiver to operate in base mode because its real-time capabilities allow a submeter reference position to be created in seconds. Set the receiver over an unknown location and allow it to calculate a real-time position(s) to be used as the reference position. Once a reference position is supplied, the *Ag*GPS receiver can begin generating RTCM data.

Use base station configuration screens to create the base reference position, turn on base mode, and configure the *Ag*GPS serial ports.

To display the main menu *Base Station Configuration* screen:

1. Display the main menu.
2. Press until the *Base Stn Config* screen appears.



3. Press . Press to cycle through the screens.

6.6.1 Base Location

The *Base Location* screen is used to view and set the reference station coordinates. The *Base Location* screen is shown below:

To view the reference coordinates press .
Press to cycle through latitude, longitude, and altitude screens.

Note – Reference coordinates are provided in Latitude/Longitude. The datum is WGS-84. Altitude is referenced to Mean Sea Level (MSL).

Set from here

To set the reference position from your current location:

1. Press >.
2. Press ∨.

   The screen reads:

   ```
   CFG: Base Location
   Set From Here
   ```

3. Press ↵.

   The receiver automatically displays three screens showing your latitude, longitude, and altitude values. There are two options in each screen:

   - To save the reference coordinate value, press ↵.
   - To change the reference coordinate value, press ∧ or ∨. Move to the next value by pressing >. Press ↵ to save your changes.

4. After pressing ↵ to accept the altitude value, the receiver asks whether or not to accept the new position. There are two options:

   - To accept the position, press ↵.
   - To reject the position, press ∧ or ∨. Then press ↵.

Edit

To edit the current reference position:

1. Press >.
2. Press ∨.

   The screen reads:

   ```
   CFG: Base Location
   Edit Base Pos
   ```

3. Press ↵.

   The receiver automatically displays three screens showing latitude, longitude, and altitude values. In each screen:

   - Press ∧ or ∨ to change a value.
   - Move to the next value by pressing >.
   - Press ↵ to save your changes.

4. After pressing ↵ to accept changes to the altitude value screen, the receiver asks whether or not to accept the new position. There are two options:

   - To accept the position, press ↵.
   - To reject the position, press ∧ or ∨. Then press ↵.

Set by averaging positions

To edit the current reference position by averaging 100 positions:

1. Press >.
2. Press ∨.

   The screen reads:

   ```
   CFG: Base Location
   Set Firm Avg  100
   ```

Note – Determining the reference position by averaging 100 positions may provide slightly better accuracies than the Set From Here option.

3. Press ↵.

   The receiver begins averaging 100 positions. There are two options:

   - Press > to cancel.
   - Wait until 100 positions are collected.
     Press ↵ to accept the averaged position.

6.6.2 Enabling Base Mode

To operate the *Ag*GPS receiver as a base station, the base mode must be configured *On*.

Tip – You cannot enable Base mode unless a reference position is set.

The following screen appears:

```
CFG: Base Station
Mode: Off
```

To enable base mode:

1. Press .
2. To toggle between off and on, press or .
3. Press to save the setting.

Note – In base mode, the receiver does not output positions through TSIP.

6.6.3 Port A Output

To output RTCM data, the port output setting must be configured. The following screen appears:

```
CFG: Port-A Out

TSIP 9600 8-0-1
```

1. Press >.
2. Press ^ or v to select RTCMI (internally generated RTCM) as the output setting.
3. Press >.
4. Configure the baud, data bits, stop bits, and parity to match the radio connection.
5. Press ↵.

☞ **Tip –** If the receiver is used for different applications, the port output parameters must be configured each time to make sure the proper data type is output.

6.6.4 Port B Output

Port A or B can be used to output RTCM data. If the radio link is connected to Port B, arrow to the Port B Output screen and follow the instructions provided in Port A Output, page 6-35. Substitute Port B for Port A.

7 Troubleshooting

This chapter covers frequently asked questions and troubleshooting techniques for the AgGPS 124 and 132 receiver. Trimble recommends you read through this chapter before calling technical support.

7.1 Increasing GPS Accuracy

The *Ag*GPS receiver always gives the most accurate position under the current GPS, beacon, or satellite differential operating conditions. By manipulating various GPS masks, some satellite configurations are locked out, preventing less accurate positions from being computed. However, these changes can prevent positions from being output.

If your GPS application can tolerate occasional outages, then more accuracy is possible by changing the various GPS receiver parameters from their default values.

There are many GPS receiver parameters that affect accuracy:

- Elevation Mask

  The default Elevation Mask is 8°. Raising this mask prevents the receiver from using some low elevation satellites, often a source of inaccurate positions.

- Signal Strength Mask

  The default Signal Strength Mask is 6. Increasing the signal strength mask prevents the use of weaker GPS signals that contribute to inaccurate positions.

- PDOP Mask

  The default PDOP Mask is 6. Lowering this mask ensures the receiver uses only satellite constellations that provide the highest accuracy.

- GPS Mode

  The default GPS position mode is Auto 2D/3D. Three-dimensional positions are more accurate than two-dimensional positions, so changing the receiver to Manual 3D prevents 2D positions from being computed.

- DGPS Mode

  The DGPS mode default setting is DGPS Auto/On/Off. Selecting DGPS Only, restricting the receiver to only output differential GPS positions, prevents autonomous (non-differential) positions from being computed.

A relatively uncontrolled source of position inaccuracy is multipath noise, caused by reflections of the GPS signals from nearby buildings and flat surfaces. For best accuracy, mount the GPS antenna so it has a clear view of the sky. Accuracy is best when operating away from buildings and trees.

7.2 Intermittent GPS Loss

When GPS lock is intermittent, the antenna cable may be disconnected. Check that all connections are secured properly. Protect the antenna cable/antenna connection with the coax tape seal. If the coax tape is not properly placed, water may enter the cable connection and cause intermittent loss of GPS satellite lock. If you do not have the coax tape, disconnect the cables and let them dry. Reconnect the antenna cable and apply coax tape.

If the antenna is connected properly, make sure that it is mounted on the highest point of the vehicle, so that no GPS signals are blocked. Depending on the orientation of the vehicle, the satellites and the possible obstruction, one or more satellites may be blocked. Sometimes blocking shows up when traveling one direction, but not while traveling other directions.

If the antenna seems fine, check the configuration masks. If the PDOP or SNR Masks are set to extreme levels, the receiver could possibly ignore valid satellite data. The default SNR Mask is 6. The default PDOP Mask is 6.

7.3 Power Lines and Strong Magnetic Fields

In North America, the energy from power lines is 60 Hz (50 Hz in Europe). The harmonic energy falls off rapidly as the frequency increases. Thus, power lines have very little effect on the GPS signal. However, noise radiation from power lines may cause interference to the beacon DGPS signal. The interference, if any, is usually localized, up to a half mile from the power line.

Strong magnetic fields have no effect on GPS signals. Some computers and other electric equipment radiate electromagnetic energy that can interfere with a GPS receiver or with the differential radiobeacon data link. If you suspect interference from a local magnetic field, move the antenna away from, or turn off the suspect electronics while observing the GPS receiver’s readings.

7.4 Choosing an Antenna Location

The antenna must be mounted so that it has a clear view of the sky, on the center line of the vehicle, away from any sources of interference like electric motors. See Choosing a Location, page 2-5.

7.5 Checking for Antenna Cable Failure

To check the antenna cable for a short, use an ohmmeter. The resistance of a good cable between the inner and outer conductor is infinite and the resistance between each end of the cable, inner conductor to inner conductor, is zero.

If the cable checks out fine, but you are confident it is the cable causing the errors, move the cable and try again. Cables sometimes work only when bent in certain ways.

If the cable is defective, contact your local Trimble representative.

7.6 Why Beacon DGPS Works In Some Places But Not Others

The radio signals from the DGPS broadcast transmitters sometimes get blocked or encounter interference. For example, the range of the Coast Guard radio navigation beacon transmitters is 100 to 250 miles, depending on the strength of the transmitter and efficiency of the transmitting antenna. If you are outside of the range of these broadcasts or have local interference, for instance, from power lines, you may not receive the beacon DGPS corrections. High voltage power lines can be a severe source of noise, especially if there is a leaky insulator or other source of corona discharge.

During the night at longer distances from the beacon stations (150 to 300 miles), the beacon skywave (reflected off the ionosphere) can interfere with the ground wave beacon signal. This phenomenon of self-jamming at night may be a problem with stronger beacon stations.

7.7 Reducing Engine Noise

An unshielded ignition system can radiate enough noise to block reception of the beacon signal. To solve this problem, use resistor spark plug wires. Sometimes an alternator generates noise that interferes with the beacon. Use bypass capacitors, commonly available in automotive stores for cleaning up interference to CB and other radios. If the problem persists, engine components can be shielded with aluminum foil.

Before purchasing new engine parts, make sure that there is not a PC computer or power source near the *Ag*GPS receiver. Some PCs and their power sources generate noise that is disruptive to the beacon signal.

7.8 Determining if the Beacon is Operable

In the USA, call 1-703-313-5900 for Coast Guard GPS support. Or use the web site at http://www.navcen.uscg.mil/gps/status.txt for the operational status of the beacon stations. For non-U.S. beacons, contact the local beacon provider.

7.9 Losing the Beacon Signal at Night

Some stations at about 170 to 230 miles are received during the day with good signal strengths. However, at night, a station jams itself because of the presence of sky waves. The sky wave in the day passes through the ionosphere and is lost in space, while at night the ionosphere becomes reflective and allows the sky wave to be received. The sky wave signal being received at the receiver causes deep fades when combined with the ground wave signal.

The only solution is to set the receiver to use a different beacon signal. The sky wave fading may last many minutes and constantly change as the ionosphere alters its height and reflectivity characteristics. The same phenomenon can be seen on the AM radio band when listening to distant stations.

7.10 Using the Optional TSIP Talker Software

Only a few of the special functions available with the TSIP Talker software can not be programmed on the *Ag*GPS 124 or 132 front panel. The most important feature is the FFT display. This display is important when searching out noise sources that interfere with the reception of the beacon signal.

7.11 Why Satellite DGPS Works in Some Places But Not Others

Local canopy cover in the direction of the differential satellite can reduce the correction signal strength to unusable levels. Wet canopy reduces signals even more. The same local environmental factors that affect GPS signals, such as radar sets, microwave transmitters, and the like can interfere with the differential satellite signals.

Differential satellite signals are line-of-sight. This complicates the use of satellite corrections in mountainous regions, especially at higher latitudes when the satellite view angle is closer to the horizon.

7.12 Interfacing the Receiver With Other RTCM Sources

Use the power/data cable (P/N 32015), which allows separate RTCM input and NMEA output. The default baud for external RTCM input is 9600-N-8-1. The external source of RTCM overrides any beacon or satellite DGPS.

7.13 Verifying the RTCM Source is Outputting Messages

The vendor of the RTCM decoder usually has a PC program that decodes the RTCM messages. If this program is not available, then connect the *Ag*GPS receiver to the external RTCM source and monitor the GGA NMEA message. If the DGPS Mode = 2, then the positions are being generated with RTCM corrections. Disconnect the external RTCM source and verify the DGPS Mode =1.

7.14 Verifying the Unit is Outputting NMEA Messages

Connect the *Ag*GPS receiver to a PC with the Standard Data/Power Cable (P/N 30945) and use a Windows terminal program to view the NMEA messages. The default NMEA parameters are 4800-N-8-1. View the lat/long changes on your yield monitor.

7.15 Losing Configuration Settings When the Receiver is Powered Off

The *Ag*GPS receiver configuration parameter settings are stored in battery-backed RAM (random access memory). The Lithium battery has a 10-year life span. You can assume the Lithium battery has failed when the receiver no longer retains configuration parameter setting changes.

Note – The receiver can continue to use the default configuration parameters, but does not retain any changes to the default settings after it is powered off.

Contact Trimble Navigation Customer Service or an Authorized Trimble Servicing Dealer to arrange for replacement of Lithium batteries.

7.16 The Receiver Front Bulges Out

The *Ag*GPS receiver front panel may bulge if pressure inside the receiver is greater than outdoor air pressure. To reduce front panel bulge, loosen the screw to the left of Port A on the receiver back panel. When the pressure has been released, tighten the screw.

7.17 Restoring the Receiver to Factory Defaults

To restore the receiver configurations to factory defaults:

1. Turn the receiver off.
2. Simultaneously press ∧ and >.
3. Power the receiver.

   The receiver asks if you want to “Clear BB Ram”.
4. Press the up or down arrow until the display reads yes.
5. Press ↵.

   The receiver returns to factory defaults. DGPS provider activation remains valid.

Troubleshooting Guides

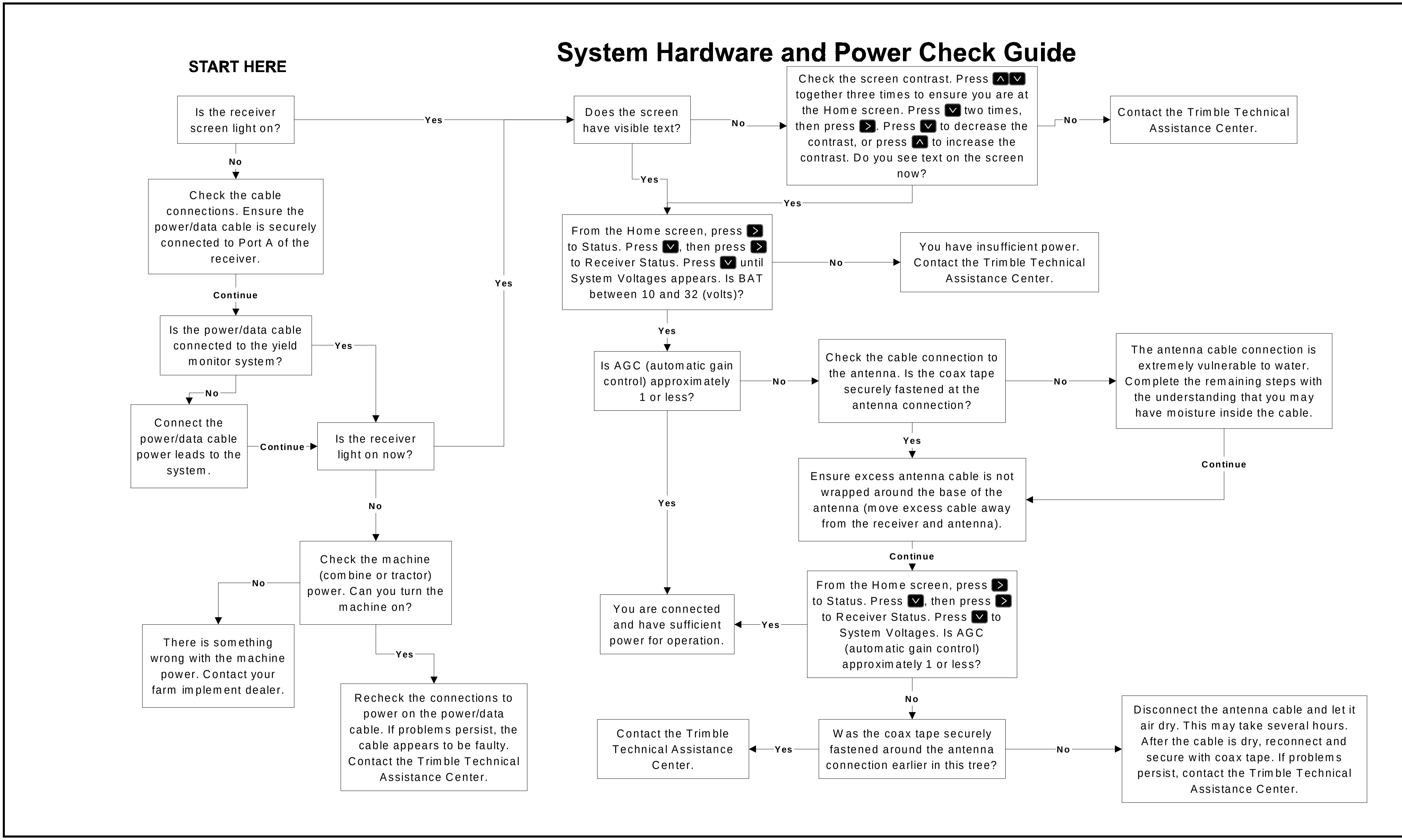


Figure 7-1 System Hardware and Power Check Guide

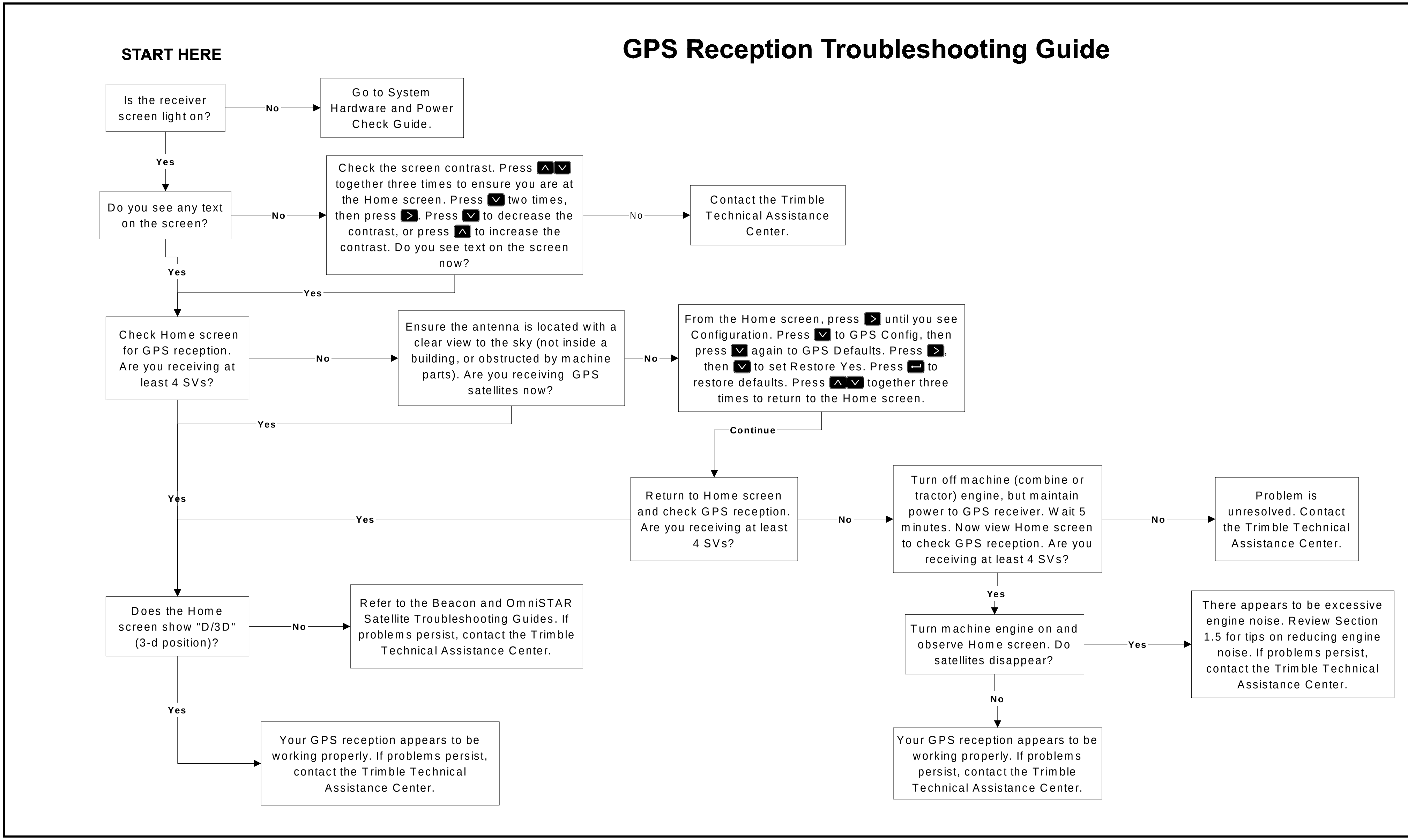


Figure 7-2 GPS Reception Troubleshooting Guide

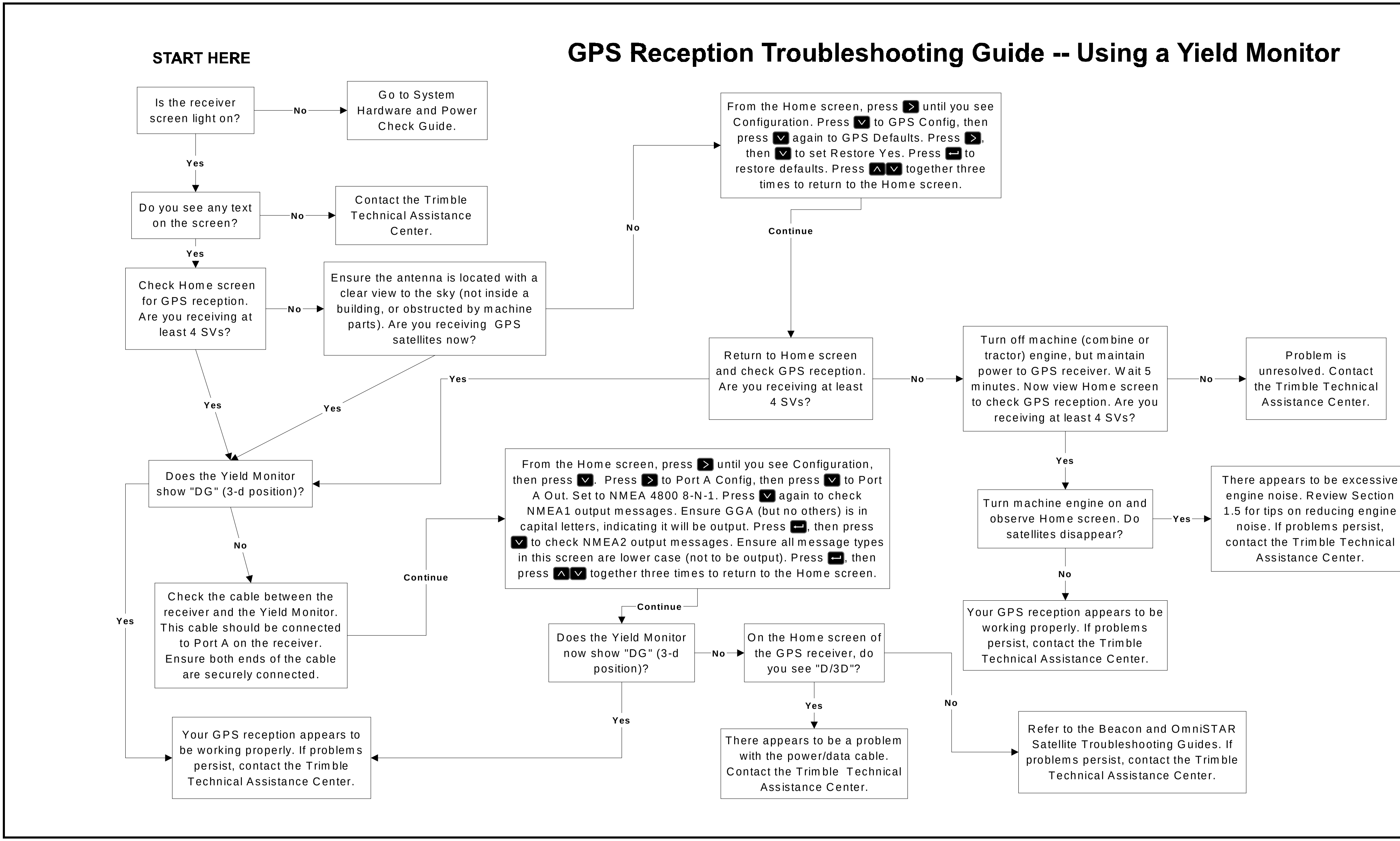


Figure 7-3 GPS Reception Troubleshooting Guide - Using a Yield Monitor

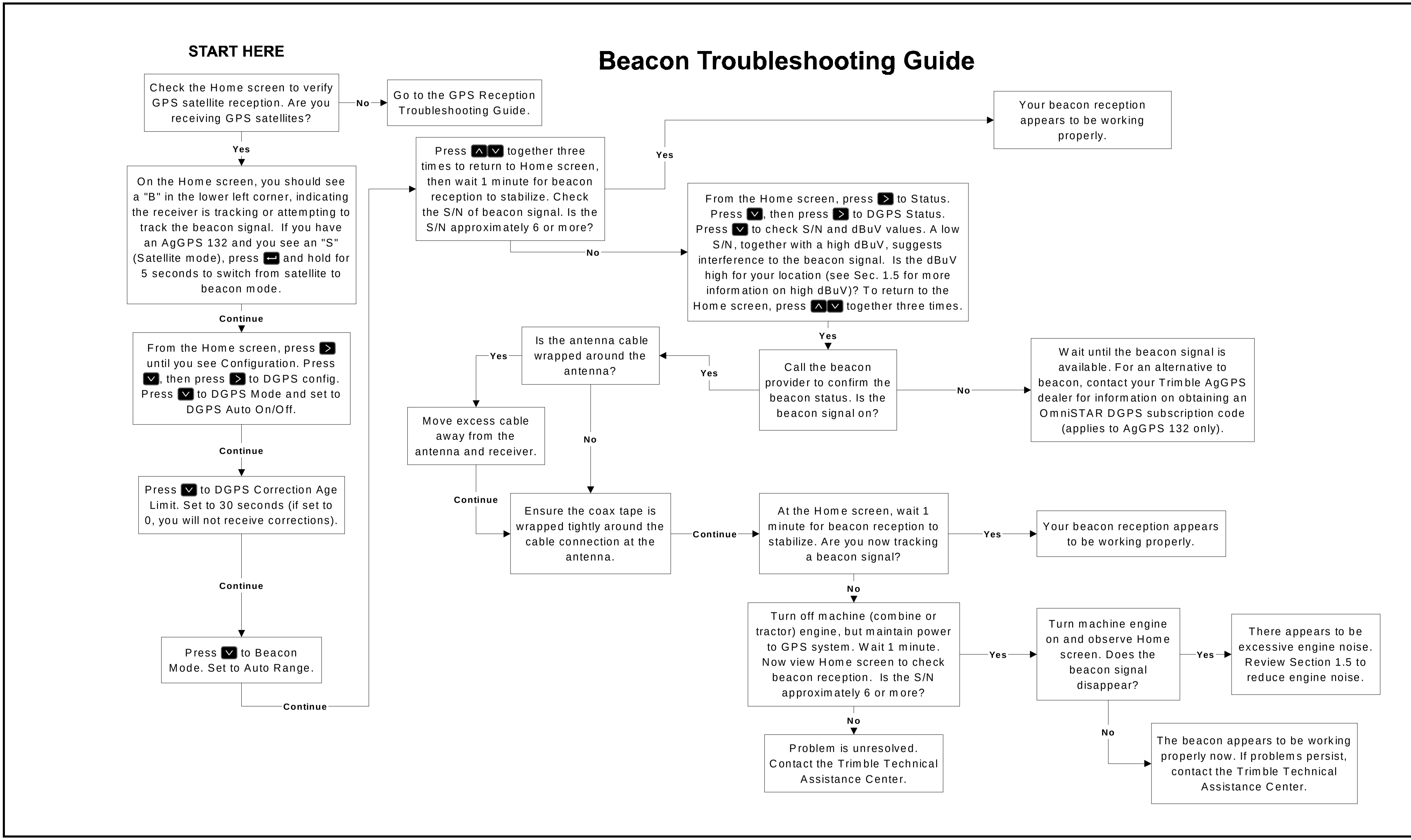


Figure 7-4 Beacon Troubleshooting Guide

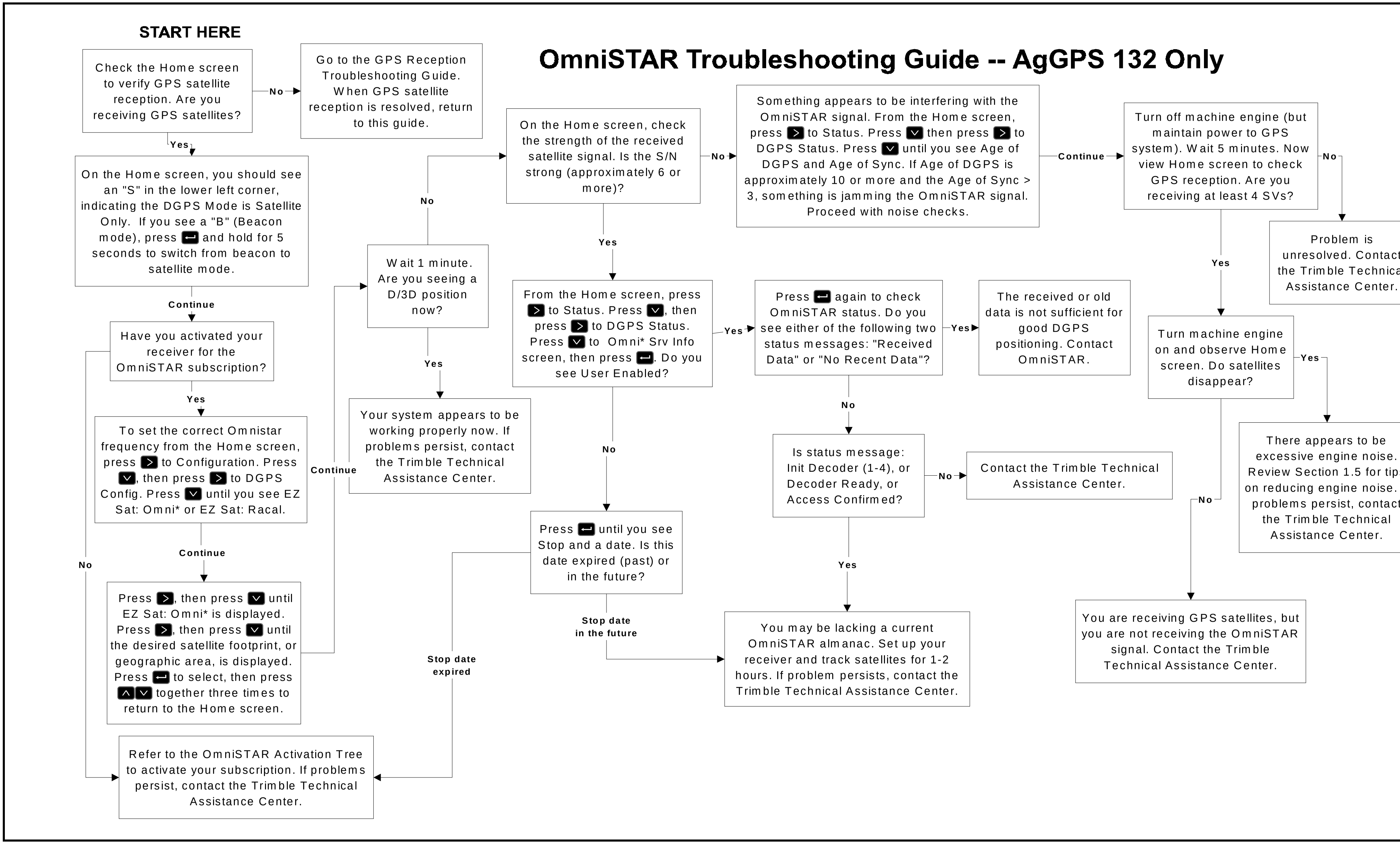


Figure 7-5 OmniSTAR Troubleshooting Guide

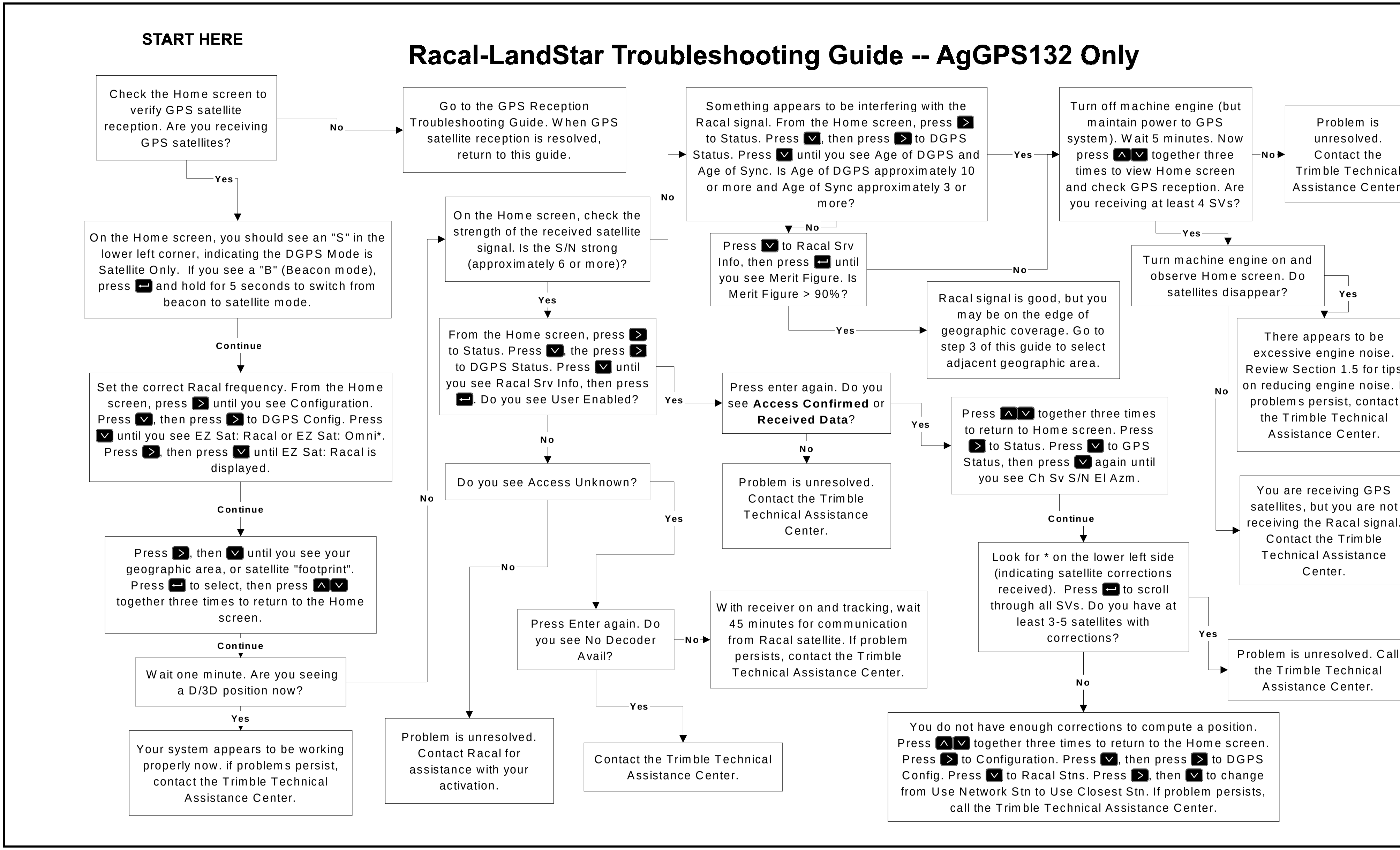


Figure 7-6 Racal-LandStar Troubleshooting Guide

A Specifications

Table A-1 and Table A-2 list the physical characteristics of the *Ag*GPS 124/132 reciever and the combined antenna.

Table A-1 *Ag*GPS 124 and 132 Receiver

Size	14.5 cm W x 5.1 cm H x 19.5 cm D (5.7 in. W x 2.0 in. H x 7.7 in. D)
Weight	0.76 Kg (1.68 lb.)
Power	7 Watts (max), 10–32 VDC
Operating Temperature	–20°C to +65°C
Storage Temperature	–30°C to +80°C
Humidity	100% condensing, unit fully sealed
Casing	Dust-proof, waterproof, shock resistant

Table A-2 Combined Antenna

	124	**132**
Size	15.5 cm D x 10.8 cm H (6.1 in. D x 4.3 in. H)	15.5 cm D x 14.0 cm H (6.1 in. D x 5.5 in. H)
Weight	0.49 kg (1.08 lb.)	0.55 Kg (1.2 lb.)
Operating Temperature	–30°C to +65°C	–30°C to +65°C
Storage Temperature	–40°C to +80°C	–40°C to +80°C
Humidity	100% condensing, unit fully sealed	100% condensing, unit fully sealed
Casing	Dust-proof, waterproof, shock resistant	Dust-proof, waterproof, shock resistant

Table A-3 and Table A-4 list the performance characteristics of GPS and beacon channels.

Table A-3 GPS Channels

General	12-channel, parallel tracking L1 C/A code and carrier phase filtered measurements and multi-bit digitizer
Update Rate	1 Hz standard; 10 Hz optional
Differential Speed Accuracy	0.1 MPH (0.16 KPH)
Differential Position Accuracy	Less than 1 meter horizontal RMS; At least 5 satellites, PDOP < 4 and RTCM SC-104 standard format broadcast from Trimble 4000RSi or equivalent reference station
Time to First Fix	< 30 seconds, typical
NMEA Messages	ALM, GGA,[†] GLL, GSA,[†] GSV, MSS, RMC,[†] VTG,[†] ZDA

[†] *By default, the AgGPS 124/132 reciever is configured to output GGA, GSA, VTG, and RMC messages.*

Table A-4 Beacon Channels

Frequency Range	283.5 kHz to 325.0 kHz
Channel Spacing	500 Hz
Beacon Modulation	50, 100, and 200 bits/second
Signal Strength	10 µV/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

Table A-5 lists the characteristics of the L-Band Satellite Differential Correction Receiver with Multiple Vendor Support.

Table A-5 L-Band Satellite Differential Correction Receiver with Multiple Vendor Support (*Ag*GPS 132 only)

Bit Error Rate	10^{-5} for Eb/N of >5.5 dB
Acquisition and Re-acquisition Time	<2 seconds, typical
Frequency Band	1525–1560 MHz
Channel Spacing	.5 kHz

B Receiver Defaults

Table B-1 lists the default settings for the *Ag*GPS 124 and 132 receivers.

Table B-1 Receiver Defaults

DGPS Source	Beacon
Beacon Mode	Auto-range
Dynamics	Auto
Elevation Mask	8°
SNR Mask	6
PDOP Mask	12
PDOP Switch	8
DGPS Mode	Auto
DGPS Age Limit	30 sec
Pos Fix Rate	1 Hz

C Cables and Connectors

The tables in this appendix give pin-out information for the *Ag*GPS 124 and 132 standard and optional cables. This information can be used to prepare special cables for interfacing the *Ag*GPS 124 and 132 recievers with devices and instruments not supported by the *standard* and optional cables.

C.1 Port A and Port B Connectors

Table C-1 gives pin-out requirements for the *Ag*GPS 124 and 132 Port A and Port B connectors.

Table C-1 Connector Pin-out for *Ag*GPS 124 and 132 Port A and Port B

Pin	Port A Connector	Port B Connector
1	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
5	Ground	Ground
6	RTS Out	RTS Out
7	Power On/Off	Power On/Off
8	CTS In	CTS In
9	CAN Low	CAN Low
10	Battery +V	Battery +V
11	Battery –V	Battery –V
12	1 PPS Output	1 PPS Output

C.2 Standard Data/Power Cable

Table C-2 gives pin-out information for the Standard Data/Power Cable (P/N 30945).

Table C-2 Standard Data/Power Cable Pin-out (P/N 30945)

CONXALL Conn		Direction	DE9-F Conn			Power Leads	
12 Pin			7 Cond			2 Cond	
Pin	Signal		Pin	Color	Signal	Color	Signal
1	EVENT IN	←	4	—	DTR		
2	TXD	→	2	ORN	RXD		
3	RXD	←	3	BLU	TXD		
4	CHG CTRL	←	—	—	—		
5	SIG GND	↔	5	SHIELD	SIG GND		
6	RTS	→	8	YEL	RTS		
8	CTS	←	7	GRN	CTS		
9	CHARGE	→	—	—	—		
7	PWR ON	← jumper				RED	V+ IN
10	V+ IN						
11	V– IN	←				BLK	V– OUT
12	PPS	→	9	BLU	PPS		

C.3 Ag Leader Interface Cable

Table C-3 gives pin-out information for the Ag Leader Yield Monitor Interface Cable (P/N 30660).

Table C-3 Ag Leader Yield Monitor Cable Pin-out (P/N 30660)

CONXALL Connector		7-Wire Conductor		DE9-M Connector	
Pin	**Signal**	**Color**	**Direction**	**Pin**	**Signal**
1	EVENT IN	—	←	—	—
2	TX –	ORN	→	3	RXD (to Ag Leader device)
3	RX –	BLU	←	2	TXD (data not used by *Ag*GPS 124 and 132 reciever)
4	CHG CTRL	—	←	—	—
5	SIG GND	SHIELD	↔	5	SIG GND
6	RTS	—	→	—	—
7	PWR ON	BRN	←	1	+5 (from Ag Leader device)
8	CTS	—	←	—	—
9	CHARGE	—	→	—	—
10	V+ IN	RED	←	4	+12 V (from Ag Leader device)
11	V– IN	BLK	←	6	PGND
12	PPS	—	→	—	—

C.4 Dual Data Interface Cable

Table C-4 gives pin-out information for the Dual Data Interface Cable (P/N 32015).

Table C-4 Dual Data Interface Cable Pin-out (P/N 32015)

CONXALL		Dir	DE9-M Conn		DE9-F Conn		Power
12 Pin			7 Cond		7 Cond		2 Cond
Pin	Signal		Pin	Signal	Pin	Signal	Signal
1	EVENT IN	←	–	–	–	–	
2	TX–	→			2	TXD	
3	RX–	←	2	RXD			
4	CHG CTRL	←	–	–	–	–	
5	SIG GND (Sheild)	↔	5	SIG GND	5	SIG GND	
6	TX+	→	–	–	–	–	
8	CTS	←	–	–	–	–	
9	CHARGE	→	–	–	–	–	
7	PWR ON	← jumper					V+ IN (Red)
10	V+ IN						
11	V– IN	←					V– OUT (Blk)
12	PPS	→	–	–	–	–	

C.5 Case AFS Cable

Table C-5 gives pin-out information for the Case AFS Dual Data Interface Cable (P/N 32609).

Table C-5 Case AFS Cable Pin-out (P/N 32609)

12-Pin CONXALL Conn			5-Pin MetroPack Conn	
Pin	**Signal**	**Direction**	**Pin**	**Signal**
2	NMEA OUT	→	D	RXD
3	YIELD DATA	←	B	TXD
5	DATA GND	↔	C	DATA GND
10	PWR IN	←	A	+12 VDC
11	PWR GND	←	E	PWR GND

C.6 John Deere GreenStar Data Cable

Table C-6 gives pin-out information for the John Deere GreenStar Data Cable (P/N 34189).

Table C-6 John Deere GreenStar Data Cable Pin-out (P/N 34189)

DE9-M Connector				3-Pin Metropack Connector	
Pin	**Signal**	**Direction**	**Color**	**Pin**	**Signal**
2	TXD	→	RED	A	RXD
3	RXD	←	BLK	B	TXD
5	GND	↔	BLU	C	GND

C.7 RDS Data Power Cable

Table C-7 gives pin-out information for the RDS power data cable (P/N 35142).

Table C-7 RDS Data Power Cable Pin-out (P/N 35142)

12-Pin CONXALL Connector			7 Cond Cable #1	DE9-M Connector (P2)	
Pin	**Signal**	**Direction**	**Color**	**Pin**	**Signal**
1	Event In	←			
2	TX– (232)	→	ORN	3	RXD
3	RX– (232)	←			
4	CHG CTRL	←			
5	SIG GND	↔	Shield	5	SIG GND
6	TX+ (422)	→			
7	PWR ON				
8	CTS	←			
9	CHARGE	→			
10	V+ IN	←	RED	8	V+
11	V– IN	←	BLK	7	PGND
12	PPS	→			

C.8 Windows CE Cable

Table C-8 gives pin-out information for the optional Windows CE cable (P/N 35283).

Table C-8 Windows CE Cable Pin-out (P/N 35283)

CONN P1			7 COND Cable #1	DE9-M CONN P2		CONN P3 CIG Lighter
Pin	**Signal**	**Direction**	**Color**	**Pin**	**Signal**	
1	Event In	←				
2	TX– (232)	→	ORN	3	RXD	
3	RX– (232)	←	BLUE	2	TXD	
4	CHG CTRL	←				
5	SIG GND	↔	SHIELD	5	SIG GND	
6	TX+ (422)	→				
7	PWER ON					
8	CTS	←				
9	CHARGE	→				
10	V+ IN	←				TIP
11	V– IN	←				BODY
12	PPS	→				

D NMEA-0183 Sentences

Trimble receivers can output a selection of NMEA-0183 sentences. NMEA-0183 sentences are normally generated and output to Port A, allowing the receiver to interface with external instruments. Only the NMEA-0183 standard and Trimble proprietary sentences configured using TSIP command packets are described here. Some Trimble products support additional NMEA-0183 standard sentences and Trimble proprietary sentences which cannot be configured using TSIP command packets. These are described separately in the receiver's operation manual.

D.1 NMEA-0183 Sentence Structure

NMEA-0183 sentences are strings of comma-delimited text. Figure D-1 shows the structure of an NMEA-0183 sentence.

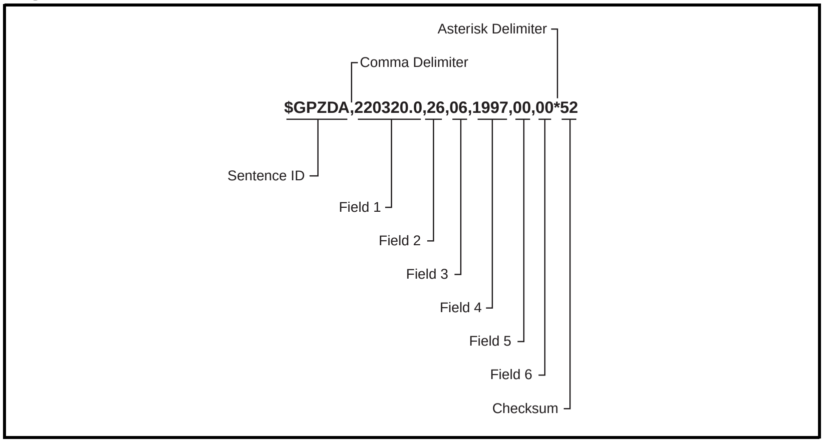


Figure D-1 Sample ZDA Sentence Structure

Each NMEA sentence includes a sentence ID to distinguish the sentence from other NMEA sentences in the data stream. The actual data included in NMEA-0183 sentences is placed in fields. An NMEA sentence contains several fields, and each field is preceded by a comma character. The sample sentence in Figure D-1 contains six fields. The NMEA sentences include a checksum value which is useful for checking the integrity of the data included in the sentence.

The sentence structure of the sample ZDA sentence, shown below and the sentence fields are described in Table D-1.

$GPZDA,220320.0,26,06,1997,00,00*52

Table D-1 Sample ZDA Sentence Structure

Field	Description
1	Time, in UTC. (220320.0 in the sample sentence)
2	Day, 01 to 31. (26 in the sample sentence)
3	Month, 01 to 12. (06 in the sample sentence)
4	Year. (1997 in the sample sentence)
5	Local time zone offset from GMT, 00 to ±13 hours. (00 in the sample sentence)
6	Local time zone offset from GMT, minutes. Fields 5 and 6, together, yield the total offset. For example, if field 5 is '-5' and field 6 is '15', local time is 5 hours and 15 minutes earlier than GMT. (00 in the sample sentence)

The NMEA-0183 sentence examples in this chapter are presented in the format shown in Table D-1. The structure of each sample sentence is shown in the paragraphs preceding the sentence structure table.

The numbers in the Field column represent the sentence fields in left-to-right order. Field 1 is the first field following the first comma delimiter. In the sample sentence, field 1 contains the UTC Time value (220320.0). The last field in the sentence is preceded by the last comma in the sentence (00 in the sample sentence).

D.1.1 Symbols and Delimiters

All sentences conform to the NMEA-0183 Version 2.1 format. Symbols and delimiters are used to identify or separate the various kinds of data included in the sentence.

NMEA-0183 sentences always begin with a dollar sign character ($) followed by a talker ID code and a sentence ID code. For the sample ZDA sentence, GP IS THE TALKER ID, AND ZDA is the sentence ID.

The string of comma delimited text immediately following the sentence ID code is composed of fields containing data. Each field is followed by a comma character (,). For the sample sentence, the data fields are shown below:

220320.0,26,06,1997,00,00

The first field contains the UTC time value (220320.0), the second field contains the Day value (26), and so on.

NMEA-0183 sentences include a checksum value which is preceded by an asterisk character (*). For more information about checksum values, see Checksum Values, page D-4.

NMEA-0183 sentences are always terminated with a carriage return and line feed. The carriage return and line feed pair marks the end of the sentence.

D.1.2 Checksum Values

Newer Trimble receivers conform to NMEA-0183 Version 2.1 which states that checksums are mandatory for all sentences. Checksum values are always included in output sentences, but are optional for input sentences.

Checksum values are used to verify the integrity of the data included in the sentence. The sample sentence, shown in Table D-1, includes a checksum value. An asterisk character (*) is used to delimit the last data field from the checksum value (52 in the sample sentence).

The checksum is the 8-bit exclusive OR of all characters in the sentence, between but not including the '$' and '*' delimiters. Commas are also included. The hexadecimal result is converted to two ASCII characters (0-9, A-F). The most significant character appears first.

D.1.3 Field Formats

The data values included in fields meet the format specifications established for the NMEA-0183, Version 2.1 standard.

D.1.4 Null Fields

Null fields are included in some NMEA sentences when no data is available for a particular field. Null fields are empty and are usually reserved for transmitting data on a periodic or irregular basis. The comma delimiter for the Null field is immediately followed by the comma delimiter for the next field in the sentence string.

The inclusion of Null fields in a sentence is important because many NMEA sentences contain a fixed number of fields. NMEA sentence interpreters (software for processing NMEA sentences) expect to find a fixed number of fields in these sentences, and specific kinds of data in each field. The sentence processing software assumes that no data is available for a particular field when a Null field is encountered while interpreting a sentence.

D.1.5 Talker ID Codes

The Talker ID code identifies the source of the data (GPS, Loran C, Sounder, etc.). The NMEA-0183 standard defines 35 Talker ID codes. The Talker ID codes available for NMEA-0183 output from the most Trimble receivers are described in Table D-2.

Table D-2 Supported Talker ID Codes

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

D.1.6 Latitude and Longitude Values

The latitude and longitude values included in NMEA sentences are presented in degrees, minutes, and decimal minutes. Latitude is presented as ddmm.mmmm in a single field, and longitude is presented as dddmm.mmmm in a single field. Within the field, degree values are in *dd* or *ddd* format, and minutes and fractions of minutes are in *mm.mmmm* format.

Latitude and longitude direction values (north, south, east, or west) are placed in a separate field. Direction is a single character: ‘N’, ‘S’, ‘E’, or ‘W’ for *North, South, East*, or *West.*

D.1.7 Time Values

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

D.1.8 Other Values

The NMEA-0183 standard established the format of the data included in sentence fields.

D.1.9 Reading NMEA String Format

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

D.2 NMEA Sentence Summary

Table D-3 describes the NMEA-0183 sentence set supported by various receivers and identifies the page number where you can find detailed information about each sentence. Some sentences are only supported when specific Trimble options are installed on the receiver. Sentences beginning with PTNL are Trimble proprietary sentences.

Table D-3 Supported NMEA-0183 Sentences

Sentence	Sentence Contents
ALM	GPS week number, SV health, and complete almanac data for one SV. One sentence per SV, up to a maximum of 32
GBS Sentence	GNSS Satellite Fault Detection
GGA Sentence	Time, position, and fix related data
GLL Sentence	Position fix, time of position fix, and status
GRS Sentence	GPS Range Residuals
GSA Sentence	GPS position fix mode, SVs used for navigation and DOP values
GST Sentence	GPS Pseudorange Noise Statistics
GSV Sentence	Number of SVs visible, PRN numbers, elevation, azimuth and SNR values
MSS Sentence	Signal strength, signal-to-noise ratio, beacon frequency, and beacon bit rate
RMC Sentence	UTC time, status, latitude, longitude, speed over ground (SOG), date, and magnetic variation of the position fix
VTG Sentence	Actual track made good and speed over ground
XTE Sentence	Cross-track error
ZDA Sentence	UTC time, day, month, and year, local zone number and local zone minutes.
PTNLAG001 Proprietary Sentence	66 character sentence available when TEXTA or TEXTB are selected as the port input protocol.
PTNLID Proprietary Sentence	Receiver machine ID, product ID, major and minor release numbers, and firmware release date.
PTNLDG Proprietary Sentence	Beacon channel strength, channel SNR, channel frequency, channel bit rate, channel number, channel tracking status, RTCM source, and channel performance indicator.
PTNL,GGK	Time, Position, Position Type and DOP Values
PTNLSM	Reference Station Number ID and the contents of the Special Message included in valid RTCM Type 16 records.

D.3 ALM Sentence

(GPS Almanac Data)

The ALM sentence identifies the GPS week, SV health, and contains the almanac for one satellite. The sentence structure is shown below:

```
$GPALM,1,1,03,698,00,6ae6,1d,779f,fdef,a10d
68,6469a6,7c1f62,5f5839,*43
```

Table D-4 identifies the ALM sentence fields.

Table D-4 ALM Sentence Fields

Field	Description
1	Total number of ALM sentences for this cycle
2	Sentence sequence number
3	SV PRN number, 01 to 32
4	GPS week number
5	SV health status
6	Eccentricity
7	Almanac reference time
8	Inclination angle
9	Rate of right ascension
10	Root of semi-major axis
11	Argument of perigee
12	Longitude of ascension node
13	Mean anomaly
14	A f0, clock parameter
15	A f1, clock parameter

D.4 GBS Sentence

(GNSS Satellite Fault Detection)

The GBS sentence is used to support Receiver Autonomous Integrity Monitoring (RAIM). The data structure is shown below:

```
$GBS,183059.30,0.0,0.0,0.0,0.0,0.0,0.0*6F
```

Table D-5 describes the GBS sentence fields.

Table D-5 GBS Sentence Fields

Field	Description
1	UTC time of the GGA or GNS fix associated with this sentence.
2	Expected error in latitude.†
3	Expected error in longitude.†
4	Expected error in altitude.†
5	ID number of most likely failed satellite.
6	Probability of missed detection for most likely failed satellite.
7	Estimate of bias, in meters, on most likely failed satellite.
8	Standard deviation of bias estimate.

† Expected error in meters due to bias with noise equals 0.

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

D.5 GGA Sentence

(GPS Fix Data)

The GGA sentence contains the time, position, and fix related data. The sentence structure is shown below:

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

Table D-6 identifies the GGA sentence fields.

Table D-6 GGA Sentence 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

D.6 GLL Sentence

(Position Data)

The GLL sentence specifies the position fix, time of position fix, and status. The sentence structure is shown below:

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

Table D-7 identifies the GLL sentence fields.

Table D-7 GLL Sentence Fields

Field	Description
1	Latitude in DD MM,MMMM format (0-7 decimal places)
2	Direction of latitude N: North S: South
3	Longitude in DDD MM,MMMM format (0-7 decimal places)
4	Direction of longitude E: East W: West
5	UTC of position in HHMMSS.SS format
6	Fixed text ‘A’ shows that data is valid
7	See RMC Sentence, page D-17, row 12.

D.7 GRS Sentence

(GPS Range Residuals)

The GRS sentence is used to support the Receiver Autonomous Integrity Monitoring (RAIM). The sentence structure is shown below:

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

Table D-8 describes the GRS sentence fields.

Table D-8 GRS Sentence Fields

Field	Description
1	UTC time of GGA position fix
2	Residuals 0: 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 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

D.8 GSA Sentence

(GPS DOP and Active Satellites)

The GPS sentence identifies the GPS position fix mode, the SVs used for navigation, and the DOP values. The sentence structure is shown below:

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

Table D-9 identifies the GSA sentence fields.

Table D-9 GSA Sentence 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	ID's of SVs used in position fix (null for unused fields)
15	PDOP
16	HDOP
17	VDOP

D.9 GST Sentence

(GPS Pseudorange Noise Statistics)

The GST sentence is used to support Receiver Autonomous Integrity Monitoring (RAIM). The sentence structure is shown below:

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

Table D-10 describes the GST sentence fields.

Table D-10 GST Sentence 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 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

D.10 GSV Sentence

(GPS Satellites in View)

The GSV sentence identifies the number of SVs in view, the PRN numbers, elevation, azimuth and SNR values. The sentence structure is shown below:

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

Table D-11 identifies the GSV sentence fields.

Table D-11 GSV Sentence Fields

Field	Description
1	Total number of sentences of this type in this cycle
2	Sentence number
3	Total number of SVs visible
4	SV PRN number
5	Elevation in degrees, 90½ maximum
6	Azimuth, degrees from true north, 000½ to 359½
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 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

D.11 MSS Sentence

(Beacon Receiver Signal Status)

The MSS sentence 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 sentence structure is shown below:

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

Table D-12 describes the MSS sentence fields.

Table D-12 MSS Sentence Fields

Field	Description
1	Signal Strength (SS), dB ref: 1 υV/m
2	Signal-to-Noise Ratio (SNR), dB
3	Beacon Frequency, 283.5 to 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 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

D.12 RMC Sentence

(Recommended Minimum Specific GPS Data)

The RMC sentence identifies the UTC time, status, latitude, longitude, speed over ground (SOG), date, and magnetic variation of the position fix. The sentence structure is shown below:

```
$GPRMC,184804.00,A,3723.476543,N,12202.2397
45,W,000.0,0.0,051196,15.6,E*7C
```

Table D-13 describes the RMC sentence fields.

Table D-13 RMC Sentence Fields

Field	Description
1	Time: UTC time of the position fix in hhmmss.ss format
2	Status A: 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 sentence)
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 sentence)
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 D-13 RMC Sentence 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

D.13 VTG Sentence

(Course Over Ground and Ground Speed)

The VTG sentence identifies the actual track made good and speed over ground. The sentence structure is shown below:

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

Table D-14 identifies the VTG sentence fields.

Table D-14 VTG Sentence 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 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

D.14 XTE Sentence

(Cross-Track Error)

The XTE sentence reports the vessel's cross-track error. The sentence structure is shown below:

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

Table D-15 describes the XTE sentence fields.

Table D-15 XTE Sentence Fields

Field	Description
1	A: Valid (fixed)
2	A: Valid (fixed)
3	Cross-track Error, in nautical miles
4	Direction to Steer L: Left R: Right
5	N:Nautical mile units

Note – For the NT300D, steering direction in XTE is opposite of the direction shown on the display. The display shows which side on the track you are on

D.15 ZDA Sentence

(Time and Date)

The ZDA sentence identifies UTC time, day, month, and year, local zone number and local zone minutes. The sentence structure is shown below:

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

Table D-16 identifies the ZDA sentence fields.

Table D-16 ZDA Sentence 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 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

D.16 PTNLAG001 Proprietary Sentence

(Text Message)

The PTNLAG001 sentence is a proprietary Trimble NMEA sentence which sets the 66 character sentence string output when TEXTA or TEXTB are selected as port input options. The sentence structure is shown below:

```
$PTNLAG001,XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX*XX
```

Table D-17 identifies the PTNLAG001 sentence fields.

Table D-17 PTNLAG001 Sentence Fields

Field	Description
1	66 character text string received when TEXTA or TEXTB is enabled as a port input option

D.17 PTNLID Proprietary Sentence

(Trimble Receiver Identity)

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

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

Table D-18 identifies the PTNLID sentence fields.

Table D-18 PTNLID Sentence 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 sentence is enabled using TSIP. If enabled, the sentence is output every 30 seconds.

D.18 PTNLDG Proprietary Sentence

(Trimble DGPS Receiver Status)

The PTNLDG sentence is a Trimble proprietary sentence 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 sentence structure is shown below:

```
$PTNLDG,XXX.X,XX.X,XXXXXXX.X,XXXXX,XX,X,X,X
XX*XX
```

The PTNLDG sentence fields are defined in free format with the maximum number of characters in the field indicated in above (i.e. 25 bps displayed as xxx,25,xxx instead of xxx,00025,xxx). Additionally, if a channel is disabled, the channel fields may be null fields (commas only). If more than one channel is available, the sentence should be repeated for each channel. Table D-19 identifies the sentence fields.

Table D-19 PTNLDG Sentence 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.

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 1-second interval, the receiver outputs this message at a maximum rate of 1 Hz.

D.19 PTNL,GGK Sentence

(Time, Position, Position Type and DOP Values)

The PTNL,GGK message string is shown below:

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

Table D-20 describes the PTNL,GGK sentence fields.

Table D-20 PTNL,GGK Sentence 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 (e.g. dddmm.mmmmmmm)
4	Direction of latitude: N: North S: South
5	Longitude, in degrees and decimal minutes (e.g. 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

D.20 PTNLSM Proprietary Sentence

(RTCM Special Message)

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

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

Table D-21 describes the PTNLSM sentence fields.

Table D-21 PTNLSM Sentence Fields

Field	Description
1	Reference Station ID number, ranging from 0 to 1023. Leading zeros must be added to fill 4-digit field.
2	ASCII text message sentence contained within the Type 16 RTCM message.

E Flash Loader 100

Flash Loader 100 makes updating the Trimble *Ag*GPS receiver firmware quick and trouble-free. You can also use this utility to review your receiver's configuration, add purchased receiver enhancement options, and, if technical assistance is needed, collect troubleshooting information.

☞ **Tip –** Flash Loader 100 and the latest *Ag*GPS firmware can be downloaded from Trimble's FTP site. The address is FTP://FTP.TRIMBLE.COM. You can also access the FTP site from the Trimble World Wide Web site (WWW.TRIMBLE.COM/SUPPORT.HTM).

E.1 Connecting to the Flash Loader Software

To install the Flash Loader software, do the following:

1. Turn on the computer and run Windows 95 or Windows NT.
2. Select *Run* from the **Start** menu.
3. In the *Run* window, type the following:

   ```
   C:\<Flash Loader file name>
   ```

   If you are using a different drive or folder, the pathname may be different.
4. Click 

.
5. Follow the instructions provided by the Flash Loader 100 Setup program.

To update receiver firmware, do the following:

1. Using the Standard Data/Power Cable (P/N 30945), connect the *Ag*GPS receiver to the PC’s serial port (usually COM1 or COM2).
2. From **Start**, select the Flash Loader 100 software.
3. Click 

.

   The Flash Loader 100 software detects the receiver and automatically selects the correct port. A message box indicates on which port the receiver is found.

If Flash Loader 100 is unable to detect the receiver, try the following:

- Make sure that the receiver is connected to an available power source.
- Switch the cable from receiver port A to port B (or vice versa).
- Check all cable connections between the receiver and PC.

Click 

again.

E.2 Using Flash Loader 100

The main window in the Flash Loader 100 software displays an options checklist. Once the receiver has been successfully detected, select one or more of the available options. Table E-1 describes each option.

Table E-1 Flash Loader 100 Options

Options	Description
Update Receiver with Password	Enables the *Enter Password* screen to appear. Enter Trimble supplied passwords to activate receiver enhancements such as Fast Rate, Everest, and the Base Station option.
Download Configuration	Enables two radio button options that determine how the downloaded information is processed. Read into file: Configuration data is written to a specified text file. Review on-screen: The receiver’s configuration settings are detailed on the PC computer screen.
Upload New Firmware	When selecting the Upload New Firmware checkbox for the first time, a file dialog appears. In the file dialog: Navigate to the directory where the new receiver firmware file is stored. Only files that have the TNR (Trimble Navigation ROM) extension are displayed. Select the appropriate file and click Open. Flash Loader 100 checks the firmware file to make sure that it is valid. If the file is found invalid, a warning message appears. The Upload New Firmware checkbox is automatically deselected.
Read Error Log	Writes the error log data, stored in the receiver, to a file for use by Trimble technical support personnel. Use the dialog to change the filename or storage folder.

E.3 Running Flash Loader 100

After checking the appropriate options, click 

.

Once the process is complete, a message box indicates a successful completion.

If a warning message appears, disconnect the receiver and try again. If the problem persists, contact Trimble Technical Support.

F Activating a Satellite DGPS Service

This appendix provides step-by-step instructions for activating both OmniSTAR and Racal-LandStar DGPS services.

OmniSTAR Activation

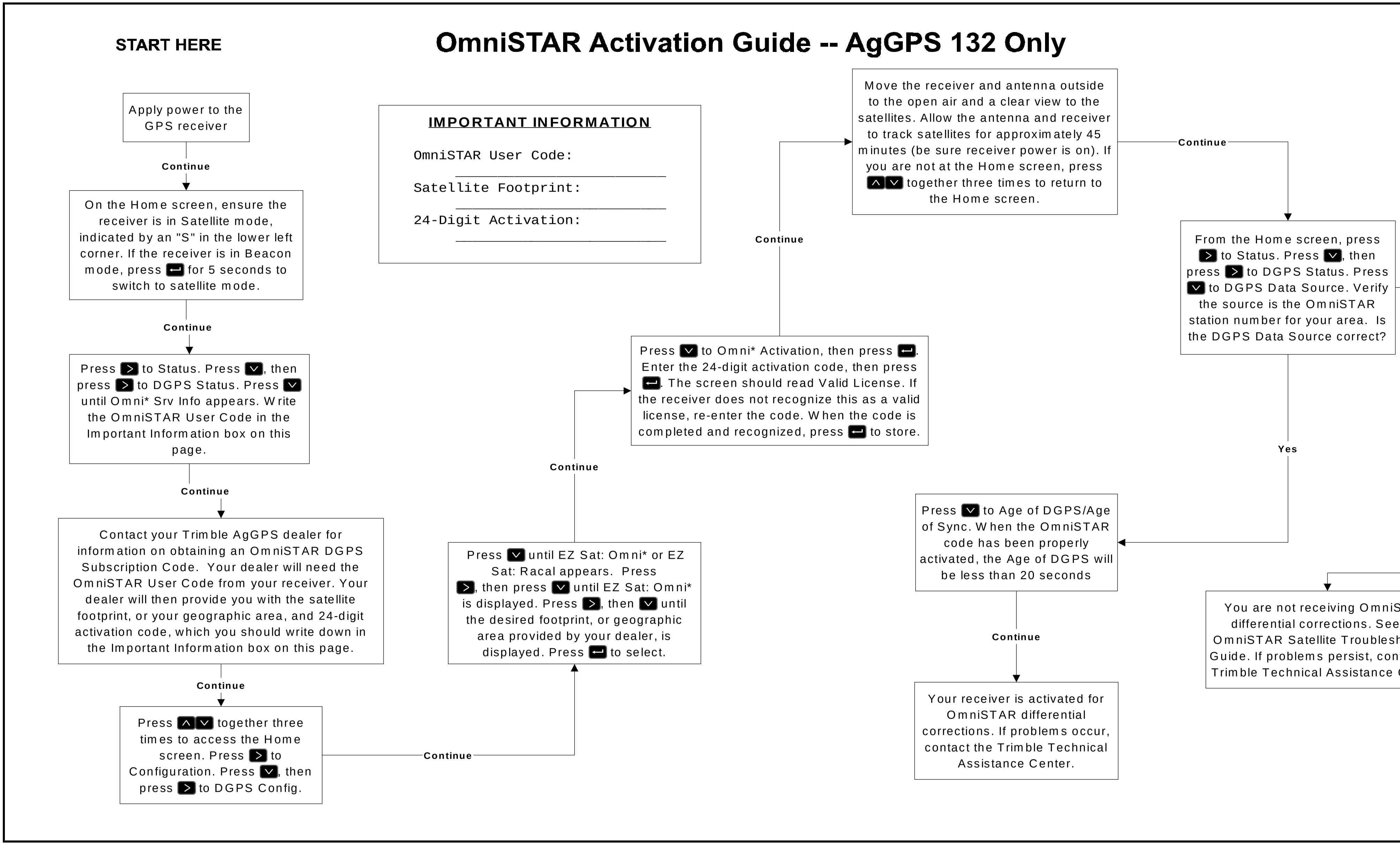


Figure F-1 OmniSTAR Activation Guide

Racal Activation

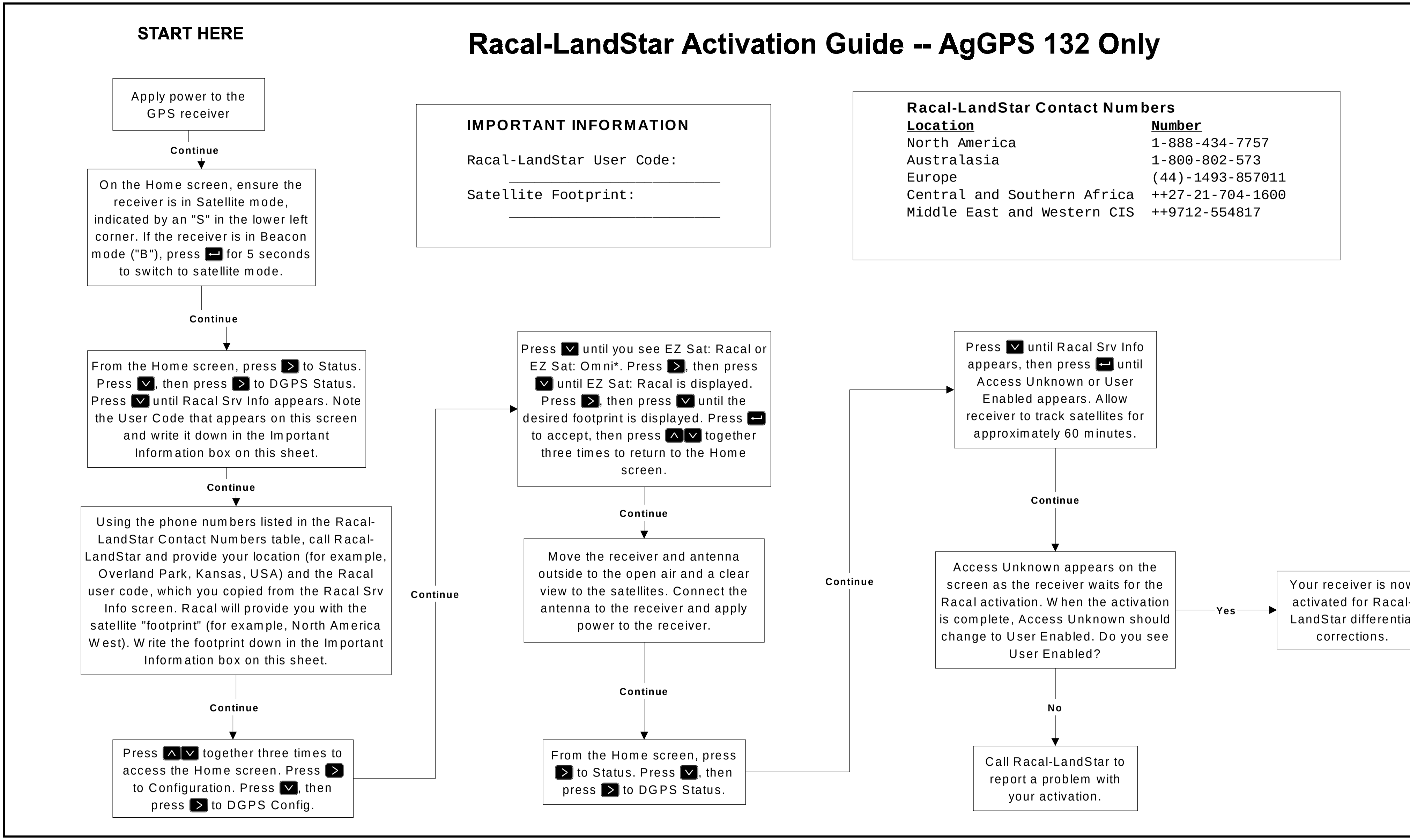


Figure F-2 Racal-LandStar Activation Guide

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Reader Comment Form

***Ag*GPS 124/132 Operation Manual** — **February 1999**
P/N: 38747-00 — **Revision A**

We appreciate your comments and suggestions for improving this publication. Contributors of particularly helpful evaluations will receive a thank-you gift.

I use the following Trimble product____

for ____

Please circle a response for each of the statements below:

1 = Strongly Agree   2 = Agree   3 = Neutral   4 = Disagree   5 = Strongly Disagree

The manual is well organized	1	2	3	4	5
I can find the information I want.	1	2	3	4	5
The information in the manual is accurate.	1	2	3	4	5
I can easily understand the instructions.	1	2	3	4	5
The manual contains enough examples.	1	2	3	4	5
The examples are appropriate and helpful.	1	2	3	4	5
The layout and format are attractive and useful.	1	2	3	4	5
The illustrations are clear and helpful.	1	2	3	4	5

The manual is: too long   just right   too short

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