# GPS 5100 Receiver

## User Guide

**Version 1.00**
**Revision A**
**Part Number 55510-45-ENG**
**January 2005**

Ag Leader Technology

### Contact Information

Ag Leader Technology
2202 South Riverside Drive
P.O.Box 2348
Ames, Iowa 50010

+1-515-232-5363 Phone

support@agleader.com
www.agleader.com

### Copyright and Trademarks



Trimble and *Ag*GPS are trademarks of Trimble Navigation Limited, registered in the United States Patent and Trademark Office and other countries. Autopilot, EVEREST, MS750, and SiteNet are trademarks of Trimble Navigation Limited.

Microsoft and ActiveSync are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. All other trademarks are the property of their respective owners.

### Release Notice

This is the January 2005 release (Revision A) of the *GPS 5100 Receiver User Guide*, part number 55510-45-ENG. It applies to version 1.00 of the GPS 5100 receiver.

The following limited warranties give you specific legal rights. You may have others, which vary from state/jurisdiction to state/jurisdiction.

### Hardware Limited Warranty

Ag Leader warrants that this hardware product (the "Product") will perform substantially in accordance with published specifications and be substantially free of defects in material and workmanship for a period of two (2) years starting from the date of delivery. The warranty set forth in this paragraph shall not apply to software products.

### Software License, Limited Warranty

This Ag Leader software product, whether provided as a stand-alone computer software product, built into hardware circuitry as firmware, embedded in flash memory, or stored on magnetic or other media, (the "Software") is licensed and not sold, and its use is governed by the terms of the relevant End User License Agreement ("EULA") included with the Software. In the absence of a separate EULA included with the Software providing different limited warranty terms, exclusions and limitations, the following terms and conditions shall apply. Ag Leader warrants that this Ag Leader Technology Software product will substantially conform to Ag Leader's applicable published specifications for the Software for a period of ninety (90) days, starting from the date of delivery.

### Warranty Remedies

Ag Leader's sole liability and your exclusive remedy under the warranties set forth above shall be, at Ag Leader's option, to repair or replace any Product or Software that fails to conform to such warranty ("Nonconforming Product") or refund the purchase price paid by you for any such Nonconforming Product, upon your return of any Nonconforming Product to Ag Leader in accordance with Ag Leader's standard return material authorization procedures.

### Warranty Exclusions and Disclaimer

These warranties shall be applied only in the event and to the extent that (i) the Products and Software are properly and correctly installed, configured, interfaced, maintained, stored, and operated in accordance with Ag Leader's relevant operator's manual and specifications, and; (ii) the Products and Software are not modified or misused. The preceding warranties shall not apply to, and Ag Leader shall not be responsible for defects or performance problems resulting from (i) the combination or utilization of the Product or Software with hardware or software products, information, data, systems, interfaces or devices not made, supplied or specified by Ag Leader; (ii) the operation of the Product or Software under any specification other than, or in addition to, Ag Leader's standard specifications for its products; (iii) the unauthorized, installation, modification, or use of the Product or Software; (iv) damage caused by accident, lightning or other electrical discharge, fresh or salt water immersion or spray; or (v) normal wear and tear on consumable parts (e.g., batteries). Ag Leader does not warrant or guarantee the results obtained through the use of the Product.

THE WARRANTIES ABOVE STATE AG LEADER'S ENTIRE LIABILITY, AND YOUR EXCLUSIVE REMEDIES, RELATING TO PERFORMANCE OF THE PRODUCTS AND SOFTWARE. EXCEPT AS OTHERWISE EXPRESSLY PROVIDED HEREIN, THE PRODUCTS, SOFTWARE, AND ACCOMPANYING DOCUMENTATION AND MATERIALS ARE PROVIDED "AS-IS" AND WITHOUT EXPRESS OR IMPLIED WARRANTY OF ANY KIND BY EITHER AG LEADER TECHNOLOGY OR ANYONE WHO HAS BEEN INVOLVED IN ITS CREATION, PRODUCTION, INSTALLATION, OR DISTRIBUTION INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, TITLE, AND NONINFRINGEMENT. THE STATED EXPRESS WARRANTIES ARE IN LIEU OF ALL OBLIGATIONS OR LIABILITIES ON THE PART OF AG LEADER ARISING OUT OF, OR IN CONNECTION WITH, ANY PRODUCTS OR SOFTWARE. SOME STATES AND JURISDICTIONS DO NOT ALLOW LIMITATIONS ON DURATION OR THE EXCLUSION OF AN IMPLIED WARRANTY, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU. AG LEADER TECHNOLOGY IS NOT RESPONSIBLE

FOR THE OPERATION OR FAILURE OF OPERATION OF GPS SATELLITES OR THE AVAILABILITY OF GPS SATELLITE SIGNALS.

### Limitation of Liability

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

NOTE: THE ABOVE LIMITED WARRANTY PROVISIONS MAY NOT APPLY TO PRODUCTS OR SOFTWARE PURCHASED IN THE EUROPEAN UNION. PLEASE CONTACT YOUR AG LEADER DEALER FOR APPLICABLE WARRANTY INFORMATION.

### Notices

### USA

***NOTE – FCC Part 15 rules; paragraph 15.105***

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case, you, the user, will be required to correct the interference at your own expense.

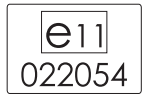
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

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

### Europe

This product has been tested and found to comply with the requirements for the European Directive 75/322/EEC as amended by 2000/2/EC thereby satisfying the requirements for e-mark compliance for use in agricultural vehicles in the European Economic Area (EEA).




This product has been tested and found to comply with the requirements for a Class A device pursuant to European Council Directive 89/336/EEC on EMC, thereby satisfying the requirements for CE Marking and sale within the European Economic Area (EEA).

CE

**Warning –** This is a Class A product. In a domestic environment this product may cause radio interference in which case you may be required to take adequate measures.

### Declaration of Conformity

This product conforms to the following standards, and therefore complies with the requirements of the R&TTE Directive 1999/5/EC, which specifies compliance with the essential requirements of EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC.

| | |
|---|---|
| EMC Emissions | BSEN 55022:1998 (W/A1:00) Class A |
| EMC Immunity | EN 55024:1998 |
| Safety | EN 60950:2000 |
| Mark First Applied | 03 |

The technical file is maintained at Trimble Navigation Limited, 749 North Mary Avenue, PO Box 3642, Sunnyvale, CA 94088-3642, USA.

# Contents

CHAPTER

1

# Introduction

Welcome to the *GPS 5100 Receiver User Guide*. This manual:

- Describes how to install and configure the Ag Leader® 5100 GPS receiver.
- Provides guidelines for connecting the receiver to an external device.
- Provides guidelines for using the AgRemote utility to view and configure the receiver correction sources and other operating parameters.

Even if you have used other Global Positioning System (GPS) products before, Ag Leader recommends that you spend some time reading this manual to learn about the special features of this product.

If you are not familiar with GPS, go to the Trimble® website at www.trimble.com for an interactive look at GPS.

## Warnings

Always follow the instructions that accompany a warning.

**Warning –** Indicates a potential hazard or unsafe practice that could result in injury or property damage.

## Related Information

Release notes describe new features, provide information that is not included in the manuals, and identify changes to the manuals.

## Technical Assistance

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

CHAPTER

2

# Overview

**In this chapter:**

- Introduction
- Standard Features of the GPS 5100 Receiver
- Receiver Connections
- Receiver Input/Output
- LED Indicator
- GPS Positioning Methods
- Sources of Error in GPS Positioning

## Introduction

This chapter describes the GPS 5100 receiver and gives an overview of GPS, DGPS, and related information. When used with a Real-Time Kinematic (RTK) base station, the GPS 5100 receiver provides RTK positioning for high-accuracy, centimeter-level applications. For physical specifications, see Appendix A, Specifications.

## Standard Features of the GPS 5100 Receiver

A standard GPS 5100 receiver provides the following features:

- 12 GPS (C/A-code) tracking channels, code carrier channels
- Horizontal RTK positioning accuracy 2.5 cm (0.98 in) + 2 ppm, 2 sigma; vertical RTK positioning accuracy 3.7 cm (1.46 in) + 2 ppm, 2 sigma
- Submeter differential accuracy (RMS), assuming at least five satellites and a PDOP of less than four
- Combined GPS/DGPS receiver and antenna
- System level cable
- *AgRemote* utility with four-button keypad to configure and view system properties (download from the Ag Leader website at www.agleader.com)
- LED status indicator
- The receiver outputs a 1 PPS (pulse per second) strobe signal on both ports. This signal enables an external instrument to synchronize its internal time with a time derived from the very accurate GPS system time.
- WAAS differential correction compatibility
- Field computer compatibility
- EVEREST™ multipath rejection technology
- OmniSTAR VBS and HP positioning compatibility

- Two ports that support both CAN 2.0B and RS-232:

  **CAN**

  – J1939 and NMEA 2000 messages

  ***Note –*** *The GPS 5100 receiver is ISO 11783 compliant. It supports some ISO 11783 messages.*

  **RS-232**

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

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

  – RTCM SC-104 output

  – Trimble Standard Interface Protocol (TSIP) input and output

## Receiver Connections

Figure 2.1 shows the connector ports and the LED indicator on the GPS 5100 receiver.

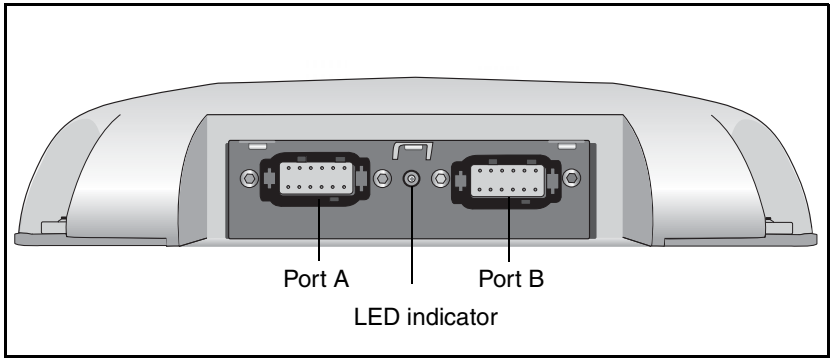



Figure 2.1 GPS 5100 receiver connector ports

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

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

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

## Receiver Input/Output

The GPS 5100 receiver data/power cable connects to a receiver connector port to supply power. It also enables the following data exchanges:

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

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

- CMR input from an external device

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

- TSIP and NMEA output to an external device

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

  TSIP is input/output when communicating with AgRemote.

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

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

– www.nmea.org

– www.rtcm.org

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

- 1 PPS output

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

- J1939 (CAN) bus

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

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

- ISO 11783 messages

  Both CAN ports support some ISO 11783 messages.

### Position output format

The GPS 5100 receiver outputs positions in Degrees, Minutes, and Decimal Minutes (DDD°MM.m'). This is the NMEA standard format and is commonly used worldwide for data transfer between electronic equipment.

## LED Indicator

The GPS 5100 receiver has an LED light that shows the status of the receiver. The following tables describe the light sequences for each positioning method.

**Table 2.1 LED sequences with Satellite Differential GPS or Autonomous positioning**

| LED color | LED flash | Status |
|---|---|---|
| Off | Off | No power |
| Green | Solid | Normal operation: computing DGPS positions |
| Green | Slow | No DGPS corrections: computing DGPS positions using old corrections |
| Green | Fast | No DGPS corrections approaching DGPS age limit: computing DGPS positions using old corrections |
| Yellow | Solid | DGPS corrections being received but DGPS positions not yet being computed: computing autonomous GPS positions |
| Yellow | Slow | No DGPS corrections: computing autonomous GPS positions |
| Yellow | Fast | Not enough GPS signals: not tracking enough satellites to compute position |

***Note –*** *WAAS/EGNOS and OmniSTAR VBS use the Satellite Differential GPS positioning method.*

**Table 2.2 LED sequences with RTK positioning**

| LED color | LED flash | Status |
|---|---|---|
| Off | Off | No power |
| Green | Solid | Normal operation: computing fixed RTK positions |
| Green | Slow | Receiving CMR corrections but not initialized: computing float RTK positions |
| Green | Fast | No CMR corrections: computing RTK position using old corrections |
| Yellow | Solid | Receiving CMR corrections but unable to calculate RTK position: computing DGPS (if WAAS/EGNOS is unavailable) or autonomous position |
| Yellow | Slow | No CMR corrections: computing DGPS or autonomous position |
| Yellow | Fast | Not receiving CMR corrections: not computing positions |

**Table 2.3 LED sequences with OmniSTAR HP positioning**

| LED color | LED flash | Status |
|---|---|---|
| Off | Off | No power |
| Green | Solid | Normal operation: computing converged OmniSTAR HP positions |
| Green | Slow | Receiving OmniSTAR HP corrections, but only able to compute unconverged position |
| Green | Fast | Receiving OmniSTAR HP corrections, but an HP error occurred |
| Yellow | Solid | Receiving OmniSTAR HP corrections but unable to calculate a position: computing DGPS or autonomous solution |
| Yellow | Slow | No OmniSTAR HP corrections: computing DGPS or autonomous position |
| Yellow | Fast | Not tracking OmniSTAR HP corrections: no positions |

# GPS Positioning Methods

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

Table 2.4 summarizes the GPS positioning methods. Imperial units in this table are rounded to two decimal places. The values shown are 2 sigma.

**Table 2.4 Absolute accuracy of GPS positioning methods**

| GPS positioning method | Corrections used | Approximate absolute accuracy |
|---|---|---|
| Real-Time Kinematic (RTK) GPS | Trimble CMR corrections broadcast by a local base station | 2.5 cm (0.98 in) + 2 ppm horizontal accuracy,<br>3.7 cm (1.46 in) + 2 ppm vertical accuracy |
| Satellite Differential GPS | OmniSTAR VBS | 78 cm (30.71 in) |
| Satellite Differential GPS | WAAS/EGNOS | 95 cm (37.40 in) |
| OmniSTAR HP Differential GPS | OmniSTAR HP | 10 cm (3.94 in) after the signal has fully converged[1] |

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

For more information about each positioning method, see below.

## RTK GPS positioning

The GPS 5100 receiver uses the RTK positioning method to achieve centimeter-level accuracy. To use the RTK method, you must first set up a base station. The base station uses a radio link to broadcast RTK corrections to one or more rover receivers. The GPS 5100 receiver is a rover receiver, so another compatible receiver, such as a Trimble MS750™ or Trimble *Ag*GPS® 214 GPS receiver, must be used as the base station.

The rover receiver uses RTK corrections from the base station to calculate its position to centimeter-level accuracy. As part of this process, the rover receiver must calculate an initialization. This takes a few seconds. While the receiver is initializing, an RTK Float solution is generated. Once initialized, an RTK Fixed solution is generated. It is the RTK Fixed solution that provides centimeter-level accuracy.

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

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

## Differential GPS positioning (DGPS)

For differential positioning, the GPS 5100 receiver uses corrections from WAAS/EGNOS satellites or from OmniSTAR VBS or HP satellites.

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

### Free corrections

WAAS/EGNOS corrections are free in North America and Europe. For more information about WAAS, go to the Federal Aviation Administration website at http://gps.faa.gov/Programs/WAAS/waas.htm.

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

### Subscription-based corrections

The GPS 5100 receiver uses OmniSTAR HP or OmniSTAR VBS differential corrections in the same way that it uses WAAS/EGNOS corrections.

OmniSTAR corrections are provided on a subscription basis.

The corrections that are produced by OmniSTAR HP algorithms are more accurate than the corrections that are produced by OmniSTAR VBS algorithms. The accuracy of the positions reported using OmniSTAR HP increases with the time that has elapsed since the instrument was turned on. This process is called ***convergence***. Convergence to where the error is estimated to be below 30 cm (approximate 12 inches) typically takes around 20 minutes. Factors that influence the time to convergence include the environment, the geographical location, and the distance to the closest OmniSTAR corrections base station. OmniSTAR is continually improving the service.

For more information about OmniSTAR, go to the OmniSTAR website at www.omnistar.com. For information about activating an OmniSTAR subscription, see OmniSTAR, page 31.

## Autonomous GPS positioning

Autonomous GPS positioning uses no corrections. The rover receiver calculates its position using only the GPS signals it receives. This method does not have high absolute accuracy, but the relative accuracy is comparable to the other methods.

# Sources of Error in GPS Positioning

The GPS positioning method influences the accuracy of the GPS position that is output by the GPS 5100 receiver. The factors described in Table 2.5 also affect GPS accuracy.

**Table 2.5 Factors that influence the accuracy of GPS positions**

| Condition | Optimum value | Description |
|---|---|---|
| Atmospheric effects | | GPS signals are degraded as they travel through the ionosphere. The error introduced is in the range of 10 meters.<br>The error is removed by using a differential or RTK positioning method. |
| Number of satellites used | > 5 | To calculate a 3D position (latitude and longitude, altitude, and time), four or more satellites must be visible. To calculate a 2D position (latitude and longitude, and time), three or more satellites must be visible. For RTK positioning, five satellites are needed for initialization. Once initialized, four or more satellites provide RTK positions. The number of visible satellites constantly changes and is typically in the range 5 through 9. The GPS 5100 receiver can track up to 12 satellites simultaneously.<br>***Note –*** *To see when the maximum number of GPS satellites are available, use the planning software and a current ephemeris (satellite history) file. Both files are available free from the Trimble website at www.trimble.com.* |
| Maximum PDOP | < 4 | Position Dilution of Precision (PDOP) is a unitless, computed measurement of the geometry of satellites above the current location of the receiver. A low PDOP means that the positioning of satellites in the sky is good, and therefore good positional accuracy is obtained. |

**Table 2.5 Factors that influence the accuracy of GPS positions (continued)**

| Condition | Optimum value | Description |
|---|---|---|
| Signal-to-noise ratio | > 6 | Signal-to-noise ratio (SNR) is a measure of the signal strength against electrical background noise. A high SNR gives better accuracy.<br>Normal values are:<br>• GPS 6<br>• WAAS 3+<br>• OmniSTAR HP/VBS 6+ |
| Minimum elevation | > 10 | Satellites that are low on the horizon typically produce weak and noisy signals and are more difficult for the receiver to track. Satellites below the minimum elevation angle are not tracked. |
| Multipath environment | Low | Multipath errors are caused when GPS signals are reflected off nearby objects and reach the receiver by two or more different paths. The receiver incorporates the EVEREST multipath rejection option. |
| RTCM-compatible corrections | | These corrections are broadcast from a Trimble *Ag*GPS 214, MS750, or equivalent reference station. |
| RTK Base station coordinate accuracy | | For RTK positioning, it is important to know the base station coordinates accurately. Any error in the position of the base station affects the position of the rover; every 10 m of error in a base station coordinate can introduce up to 1 ppm scale error on every measured baseline. For example, an error of 10 m in the base station position produces an error of 10 mm over a 10 km baseline to the rover.<br>For more information about how to make sure the position of your base station is accurate, refer to the manual for your base station receiver. |
| Multiple RTK base stations | | If you are using several base stations to provide RTK corrections to a large site area, all base stations must be coordinated relative to one another. If they are not, the absolute positions at the rover will be in error. |

## Coordinate systems

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

The GPS 5100 receiver outputs position coordinates in several datums and ellipsoids depending on the GPS positioning method being used. See Table 2.6.

**Table 2.6 DGPS coordinate systems**

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

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

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

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

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

CHAPTER

3

# Installing the Receiver

**In this chapter:**

- Introduction
- System Components
- Mounting the Receiver
- Connecting to an External Device
- Connectors and Pinouts

# Introduction

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

# System Components

Check that you have received all components for the Ag Leader system that you have purchased. If any containers or components are damaged, immediately notify the shipping carrier. Components are listed in the following tables.

**Table 3.1 GPS 5100 receiver**

| Quantity | Description |
|---|---|
| 1 | GPS 5100 receiver |
| 1 | System level cable |
| 1 | Mounting assembly |
| 1 | Port B plug |
| 1 | *GPS 5100 Receiver User Guide* (this manual) |
| 1 | Warranty Activation Card |
| 1 | OmniSTAR Activation Card |

## Optional extra

You may also have ordered the following item:

**Table 3.2 Receiver option**

| Quantity | Description |
|---|---|
| 1 | RTK capability |

# Mounting the Receiver

Secure the GPS 5100 with the mounting solution provided. Mounting solution may differ depending on application.

**Warning –** For continued protection against the risk of fire, the power source (lead) to the model GPS 5100 receiver should be provided with a 10 A (maximum) fuse.

## Choosing a location

When choosing a location, consider the following:

Mount the receiver:

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

  ***Note –*** *If you are using a Trimble AgGPS Autopilot™ system, please refer to the installation instructions that are provided with the Autopilot.*

- at the highest point on the vehicle, with no metal surfaces blocking the receiver's view of the sky
- in such a way that it is not damaged when you drive the machine into a shed or storage area

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

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

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

## Environmental conditions

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

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

## Electrical interference

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

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

## Connecting to an External Device

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

| To connect the GPS 5100 receiver to ... | use the cable ... |
|---|---|
| an Autopilot system | Trimble P/N 50165<br>(this cable has no DB9 connector) |
| a Field computer | Cable included |
| a Yield monitor | Cable included |
| a Trimble SiteNet™ radio, for RTK positioning | Trimble P/N 49801 |

To convert the GPS 5100 receiver to a Trimble 12-pin conxall cable, use the adapter cable (Trimble P/N 50581).

| Plug the ... | into ... |
|---|---|
| Deutsch 12-pin connector | Port A on the back of the receiver |
| straight DB9-pin connector | the external device |
| power connectors | a power supply |

***Note –*** *Do not bend the cable at the Deutsch connector. When you secure the cable, use the supplied P-Clip. The P-Clip provides additional support to the connectors and reduces the risk of damage.*

Figure 3.1 shows how to connect the receiver to an external device using the system level cable.

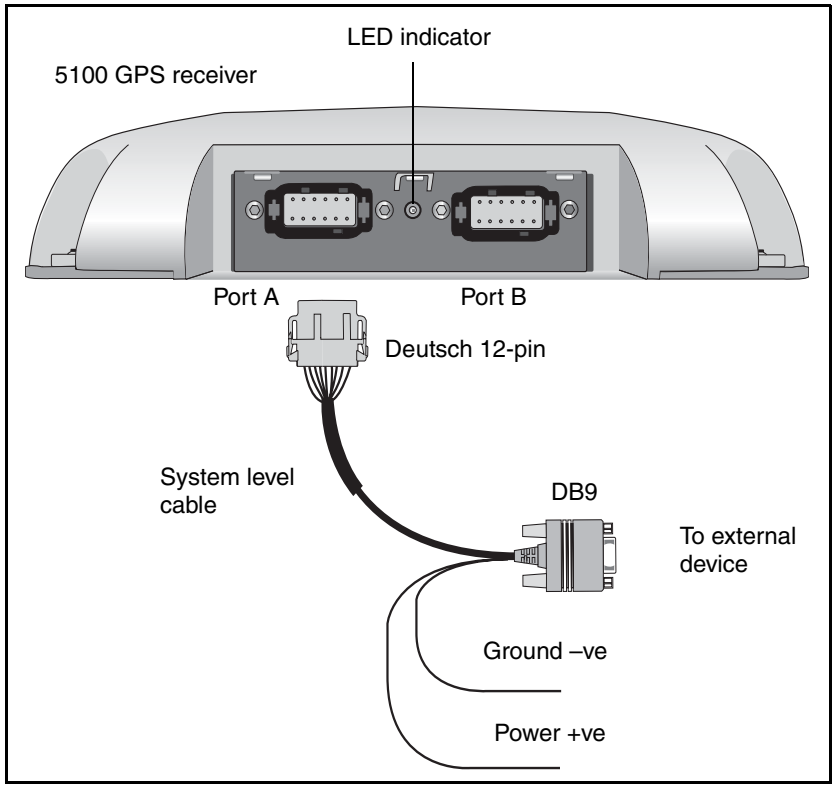



Figure 3.1 Standard power/data cable connections

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

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

***Note –*** *Do not bend the cable at the Deutsch connector. When you secure the cable, use the supplied P-Clip. The P-Clip provides additional support to the connectors and reduces the risk of damage.*

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

The external device may have to be configured to work with the GPS 5100 receiver. The configuration tools for the external device should be provided with the device. For more information about configuring the receiver, see Chapter 4. For information about connecting a particular external device, refer to the manual for that device or contact your local Ag Leader Reseller.

***Note –*** *Use a connector plug to cover Port B when that port is not in use. For example, cover Port B when you are using the receiver in a non-RTK mode.*

## Connectors and Pinouts

Use the following pinout information if you need to wire a cable for use with the GPS 5100 receiver.

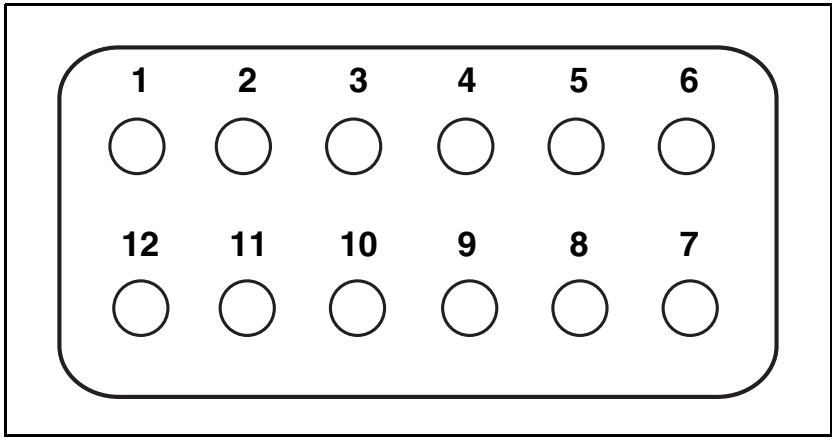



Figure 3.2 GPS 5100 receiver port pinout

## Port A

Port A on the receiver has a 12-pin Deutsch DTM connector. For cables, use the mating connector, Deutsch part number DTM06-12SA.

Viewed from outside the receiver, the Port A connector is on the left. It is the port that is typically used to connect to an Autopilot system.

**Table 3.3 Port A pinout**

| Pin | Name/Function | Comments |
|---|---|---|
| 1 | CAN A High I/O | |
| 2 | Port 1 RS232 Tx OUT | When held to ground during power up, puts unit into Monitor mode |
| 3 | Port 1 RS232 Rx IN | |
| 4 | PPS OUT | |
| 5 | Signal GND | Used for RS232 and other signals. Should not be connected to V– (battery negative) |
| 6 | Port 1 RTS OUT | |
| 7 | Event OUT / Alarm OUT | |
| 8 | Port 1 CTS IN | |
| 9 | Event IN | |
| 10 | V+ IN | |
| 11 | V- IN | |
| 12 | CAN A Low I/O | |

## Port B

This port has the same connector as Port A, see above. Viewed from outside the receiver, the Port B connector is on the right.

**Table 3.4 Port B pinout**

| Pin | Name/Function | Comments |
|---|---|---|
| 1 | CAN B High I/O | |
| 2 | Port 2 RS232 Tx OUT | |
| 3 | Port 2 RS232 Rx IN | |
| 4 | PPS OUT | |
| 5 | Signal GND | Used for RS232 and other signals. Should not be connected to V– (battery negative) |
| 6 | Port 2 RTS OUT<br>or Port 3 RS232 Tx OUT | |
| 7 | Event OUT / Alarm OUT | |
| 8 | Port 2 CTS IN or Port 3 RS232 Rx IN | |
| 9 | Event IN | |
| 10 | V+ IN / OUT | Maximum output current = 1.25 A |
| 11 | V– IN / OUT | Maximum output current = 1.25 A |
| 12 | CAN B Low I/O | |

CHAPTER

4

# Configuring the Receiver

**In this chapter:**

- Introduction
- AgRemote Home Screen
- Configuring Differential GPS
- Configuring the GPS 5100 Receiver to Operate in RTK Mode
- Configuring the Communication Ports

# Introduction

Use either the Autopilot interface or the AgRemote utility to change configuration settings in the GPS 5100 receiver. You will need to configure the receiver if you connect to a third-party device, for example.

- If a Trimble *Ag*GPS Autopilot system is configured to use a GPS 5100 receiver, and the port on the receiver is set to 8-N-1 38.4 K, the Autopilot system automatically configures the receiver.
- The AgRemote utility is available from the Ag Leader website (www.agleader.com). This chapter describes how to use the utility to perform some common configurations.

***Note –*** *OmniSTAR VBS and HP are subscriber services that need to be activated. For more information, see OmniSTAR, page 31.*

# AgRemote Home Screen

Figure 4.1 shows the AgRemote *Home* screen when WAAS corrections are being received.

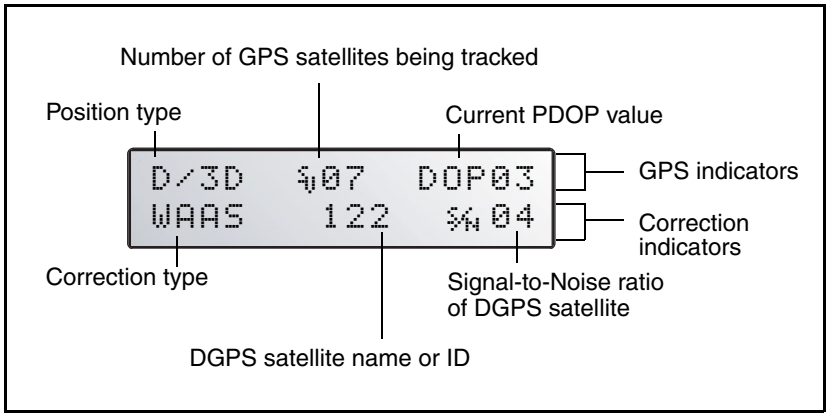



Figure 4.1 AgRemote Home screen

For more information about these fields and how they change as you change GPS mode, refer to the document called *AgRemote Software* on the Ag Leader website (www.agleader.com) or contact your local Ag Leader Reseller.

## Configuring Differential GPS

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

- WAAS/EGNOS – free service, limited availability

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

- OmniSTAR – paid subscription, available worldwide

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

For more information, see Differential GPS positioning (DGPS), page 11.

## OmniSTAR

The GPS 5100 receiver can use OmniSTAR corrections. To do this, you need to configure the receiver and purchase an OmniSTAR subscription.

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

To use the AgRemote utility to activate an OmniSTAR subscription:

1. Connect the GPS 5100 receiver to the computer. Turn on the receiver and start the AgRemote utility. For instructions on how to use AgRemote, refer to the AgRemote documentation.
2. In AgRemote, select *Configuration* / *DGPS Config*.
3. Set the *Source Select* field to one of the following:
   - Omnistar HP
   - Omnistar VBS
4. Set the *EZ Sat: Omni** field to the area you are operating in. For example, if you are working in California, select N. America West.
5. Press ↵ then Esc to complete the procedure.
6. Obtain an OmniSTAR licence from OmniSTAR. All licenses are activated over the air. Contact OmniSTAR on 1-888-883-8476 (USA or Canada) and provide the following details:
   - your billing information
   - serial number
   - satellite beam name

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

## WAAS/EGNOS

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

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

1. Connect the GPS 5100 receiver to the computer. Turn on the receiver and start the AgRemote utility.
2. In AgRemote, select *Configuration* / *DGPS Config*.
3. Set the *Source Select* field to WAAS.
4. Press ↵ then Esc to complete the procedure.

To enable WAAS reception in the field:

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

## Configuring the GPS 5100 Receiver to Operate in RTK Mode

Use the AgRemote utility to configure the GPS 5100 receiver for operation in RTK mode. To configure the receiver:

1. Connect the GPS 5100 receiver to the computer. Turn on the receiver and start the AgRemote utility.
2. In AgRemote, select *Configuration* / *DGPS Config*.
3. Set the *Source Select* field to RTK.
4. Press ↵ then Esc to complete this part of the procedure.
5. For RTK operation, connect the radio to a port. Change the port input settings for that port to RtkLnk.

## Configuring the Communication Ports

If the GPS 5100 receiver is to be connected to an external device, configure Ports A and B so that the proper data type is input to and output from the receiver.

To configure Port A:

1. Connect the GPS 5100 receiver to the computer. Turn on the receiver and start the AgRemote utility.
2. In AgRemote, select *Configuration* / *Port A Config*.
3. Use the menu commands to configure the communication ports. Ensure that the receiver outputs the correct GPS position data type for the hardware device or software program that is connected to the receiver.

To configure Port B:

- Repeat the above steps but in Step 2 select *Configuration* / *Port B Config*.

## Configuring input/output communication

The port input and output settings appear in the first screen. In Figure 4.2, the port is set to accept TSIP inputs at a baud rate of 115,000 with a parity of 8-Odd-1. The outputs are TSIP, also at a baud rate of 115,000.

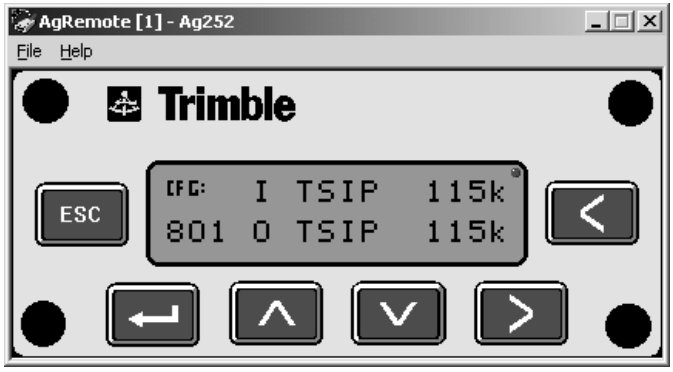



Figure 4.2 Communication settings

Configure the Port Input/Output communication settings for communicating with the *Ag*GPS Autopilot, other external hardware devices, and software programs. Table 4.1 describes the input settings.

**Table 4.1 Port input settings**

| Setting | Description |
|---|---|
| None | Inputs nothing to the receiver. |
| TEXTB | The receiver can accept ASCII data from an external device, such as a chlorophyll meter, on Port A, merge it with NMEA GPS data, and output the combined data on Port B. The incoming data must be limited to 66 ASCII characters and terminated by a carriage return and line feed (hex characters 0x0D 0x0A). The NMEA string outputs as $PTNLAG001,<up to 66 ASCII characters>*<2 digit checksum><CR><LF>. For the receiver to output the combined NMEA string, NMEA must be selected as the output protocol on Port B. |

**Table 4.1 Port input settings (continued)**

| Setting | Description |
|---|---|
| TEXTA | See the description for the TEXTB setting (above). TEXTA input outputs text on Port A. The default port settings are 8-N-1 TSIP 38.4 K. These may vary by product. |
| RTCM | The receiver can accept RTCM data from an external DGPS device, such as an external radio. |
| TSIP | The receiver can accept or output TSIP data packets from the port when using the optional AgRemote program or using a field computer. |
| RtkLnk | The receiver can accept real-time corrections (CMR data) from an external device such as a Trimble radio. |

The default port settings are:

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

***Note –*** *The AgRemote utility, when connected to an GPS 5100 receiver receiver, automatically resets the receiver port communication settings to 8-O-1 TSIP 115 K. This enables optimal communication with an office computer. If the receiver is to work with an Autopilot system, however, the receiver port communication settings must be 8-N-1 TSIP 38.4 K. To work with some other devices and software programs, the receiver port communication settings must be 8-N-1 NMEA 4800. If AgRemote has changed the settings, you will need to change them back manually.*

When using a Trimble SiteNet 900 radio, make sure that the communication settings are correct in the receiver.

The default settings to use with the SiteNet radio are:

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

### Changing the input or output port settings

1. From the *Port A Config* screen, press ⌄ until the *Port-A Input/Output* screen appears:


2. Press > to activate the cursor.
3. Press ^ or ⌄ to change the value.
4. Press >.
5. Repeat Steps 3 and 4 until you have set all the required values.
6. Press ↵ to save all the changes.
7. Press ⌄ to move to the next screen.

### NMEA settings

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

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

### Port output rate

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

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

CHAPTER

5

# Troubleshooting

**In this chapter:**

- Introduction
- Problems and Solutions
- Troubleshooting Flowcharts

## Introduction

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

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

## Problems and Solutions

Should problems arise, try the following solutions.

## Global Positioning System (GPS)

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

| Problem | Possible solution |
|---|---|
| **Tracking but not receiving a differential signal** | |
| The receiver is tracking satellites and tracking an OmniSTAR satellite beam, but is not receiving DGPS signals. The *Home* screen indicates how many satellites are being tracked, and whether a differential source is being tracked.<br>You see:<br>h-3D for HP not converged<br>H-3D for HP converged<br>r-3D for RTK float<br>R-3D for RTK fixed<br>D-3D for DGPS<br>HP and RTK also give an indication of positional accuracy on the *Home* screen (AgRemote). | Check that your DGPS service subscription is still current and enabled.<br>For OmniSTAR service:<br>1. Use the AgRemote utility to navigate to one of the following screens, depending on what you are using:<br>• the *Omni HP Info* screen<br>• the *Omni VBS Info* screen.<br>2. Press ↵ until *Stop Date* appears.<br>If the message Access Unknown appears, contact OmniSTAR to reactivate your subscription. For more information, see OmniSTAR, page 31.<br>The receiver must be switched on and configured to track the correct satellite coverage beam before it can be reactivated.<br>The receiver automatically tracks the correct beam based on receiver geographic location. If the receiver is manually changed, automatic tracking is deactivated until you perform a hard reset or firmware flash.<br>When a satellite subscription is activated, the *Home* screen displays D/3D. |

| Problem | Possible solution |
|---|---|
| **No GPS position output from the receiver after connecting to AgRemote** | |
| When the receiver is connected to the AgRemote utility, AgRemote automatically resets the port communication settings on the receiver to 8-O-1 TSIP 115 K for both input and output. This enables optimal communication with an office computer.<br>If the receiver is to work with an Autopilot system, however, the receiver port communication settings must be 8-N-1 TSIP 38.4 K. To work with some other devices and software programs, the receiver port communication settings must be 8-N-1 NMEA 4800. If AgRemote has changed the settings, you will need to change them back manually. | Connect AgRemote. Then reset the port communication settings to NMEA output. For more information, see Configuring the Communication Ports, page 33. |
| **Long time to initialize** | |
| In RTK mode, longer baselines require longer initialization times. (The baseline is the distance between the base receiver and the rover receivers.) | Wait for the receiver to initialize or consider repositioning the base receiver to shorten the baseline. Make sure the rover is in a clear area. |
| **Loss of initialization** | |
| In RTK mode initialization can be lost when the rover receiver is close to trees or buildings and the number of satellites falls below four. Additionally, initialization may be lost if the receiver has not been tracking RTK corrections for some time. For more information, see the next item. | Move away from trees and obstructions to initialize. Once initialized, approach the obstructed area again. If the obstructions are severe, GPS positioning may not work in that area.<br>Because the GPS satellites move, there may be times of the day when you are working in an area with obstructions. For more information, see the planning software on the Trimble website (www.trimble.com). |

| Problem | Possible solution |
|---|---|
| **Not tracking RTK corrections** | |
| The radio link is down or intermittent. | • Ensure that the line-of-sight between the base and rover receivers is not obstructed.<br>• Ensure that the rover receiver is within range of the radio.<br>• Ensure that the radio power supply is on. |

## Interference

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

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

## GPS receiver

| Problem | Possible solution |
|---|---|
| **Mounting location** | |
| The receiver is not picking up a clear signal. | Mount the receiver on the centerline of the vehicle, away from any sources of interference and with a clear view of the sky (see Choosing a location, page 19). |
| **Cables** | |
| One of the cables seems faulty. | Use an ohmmeter to check the cable. The resistance of a good cable between connector pins at each end of the cable is zero.<br>If the cable is sound, but the problem persists, try exchanging the cable with one that you know is working.<br>If the cable is defective, contact your local Ag Leader Reseller for an RMA number (if the Ag Leader product is still under warranty), or to purchase a replacement cable. |

| Problem | Possible solution |
|---|---|
| **Real-time clock battery** | |
| A lithium-ion battery in the receiver powers the internal real-time clock and so enables the receiver to get a first fix faster. The battery has a life of 7.5 years. When the battery fails, the internal clock cannot keep accurate time and the receiver may take longer to output GPS positions. | Please ***contact your local Ag Leader Reseller*** to get the batteries replaced. You cannot replace the battery yourself. |
| **Factory defaults** | |
| You need to restore the receiver factory defaults. | To restore receiver factory default settings:<br>1. Connect the receiver to a computer. Turn on the receiver.<br>2. Run the AgRemote utility.<br>3. Navigate to the *Clear BB RAM* screen.<br>4. Press ▽ until *Yes* appears.<br>5. Press ↵.<br>The factory default settings are restored. The DGPS service subscription is not lost. |

## AgRemote utility

| Problem | Possible solution |
|---|---|
| AgRemote cannot communicate with the receiver. All you see is a blank screen. | 1. Make sure that:<br>• the receiver is connected to a 12–32 V DC power source<br>• all cable connections between the receiver and the computer are secure<br>• you are using the correct COM port<br>2. Turn off the receiver then turn it on again.<br>3. Select *File* / *Connect*. |

## FlashLoader 200 upgrade utility

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

## Troubleshooting Flowcharts

These flowcharts describe how to troubleshoot problems in the following areas:

- system hardware and power
- GPS reception (no third-party device attached)
- GPS reception (third-party device attached)
- OmniSTAR positioning
- RTK (using the AgRemote utility)

In addition, you may find it useful to review Chapter 3, Installing the Receiver.

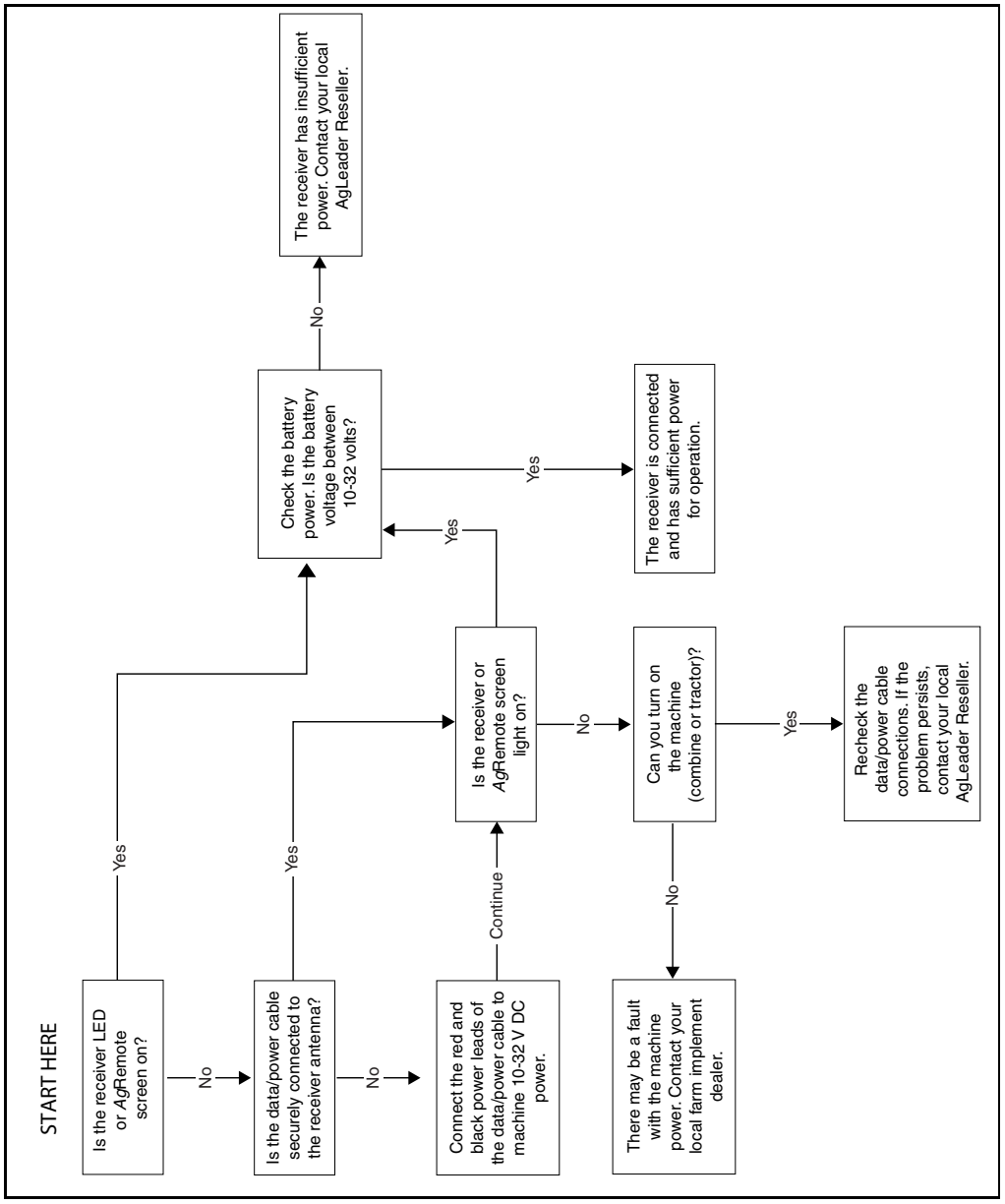



Figure 5.1 Troubleshooting system hardware and power

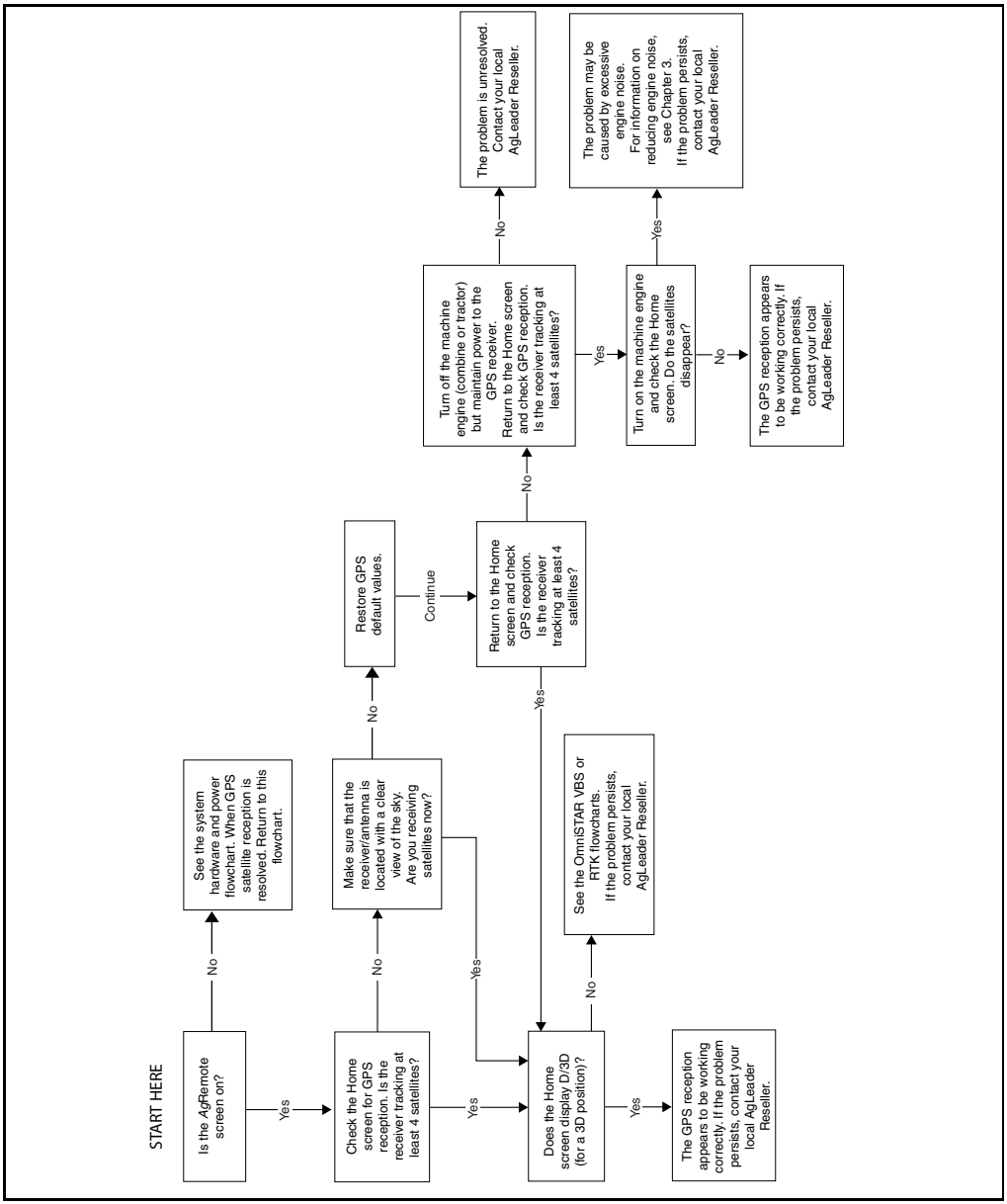



Figure 5.2 Using AgRemote to troubleshoot GPS reception (no third-party device attached)

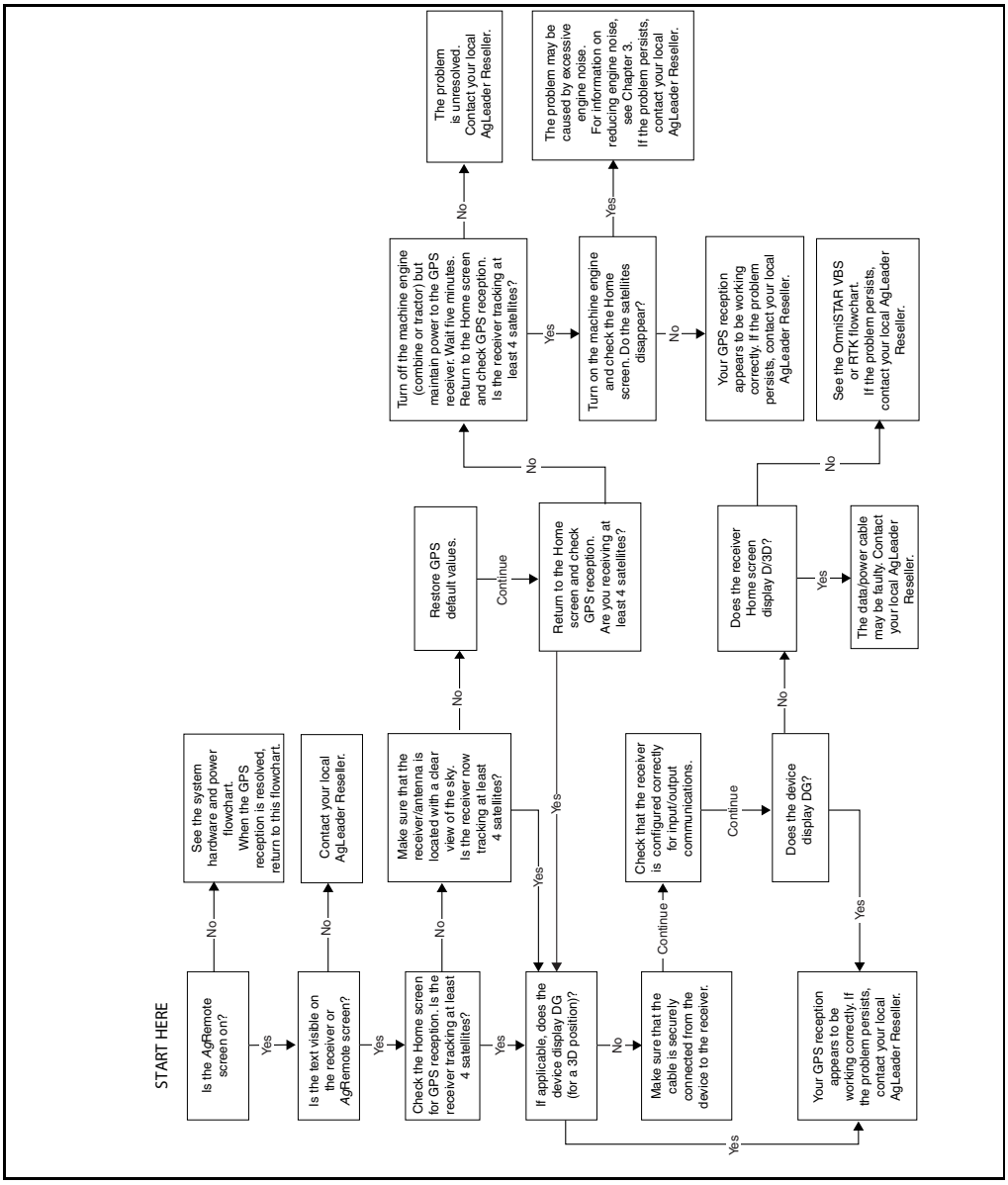



Figure 5.3 Using AgRemote to troubleshoot GPS reception (third-party device attached)

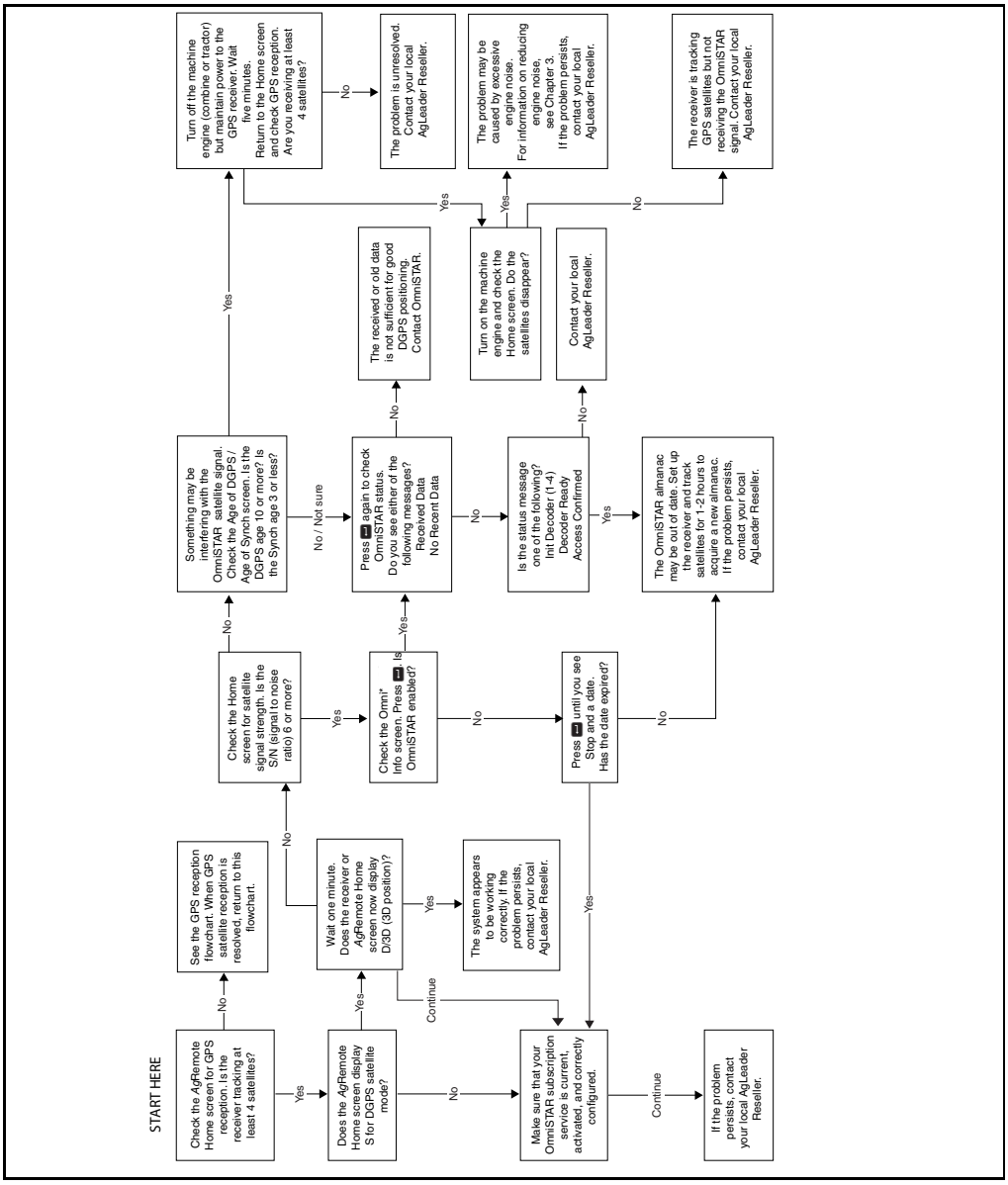



Figure 5.4 Using AgRemote to troubleshoot OmniSTAR positioning

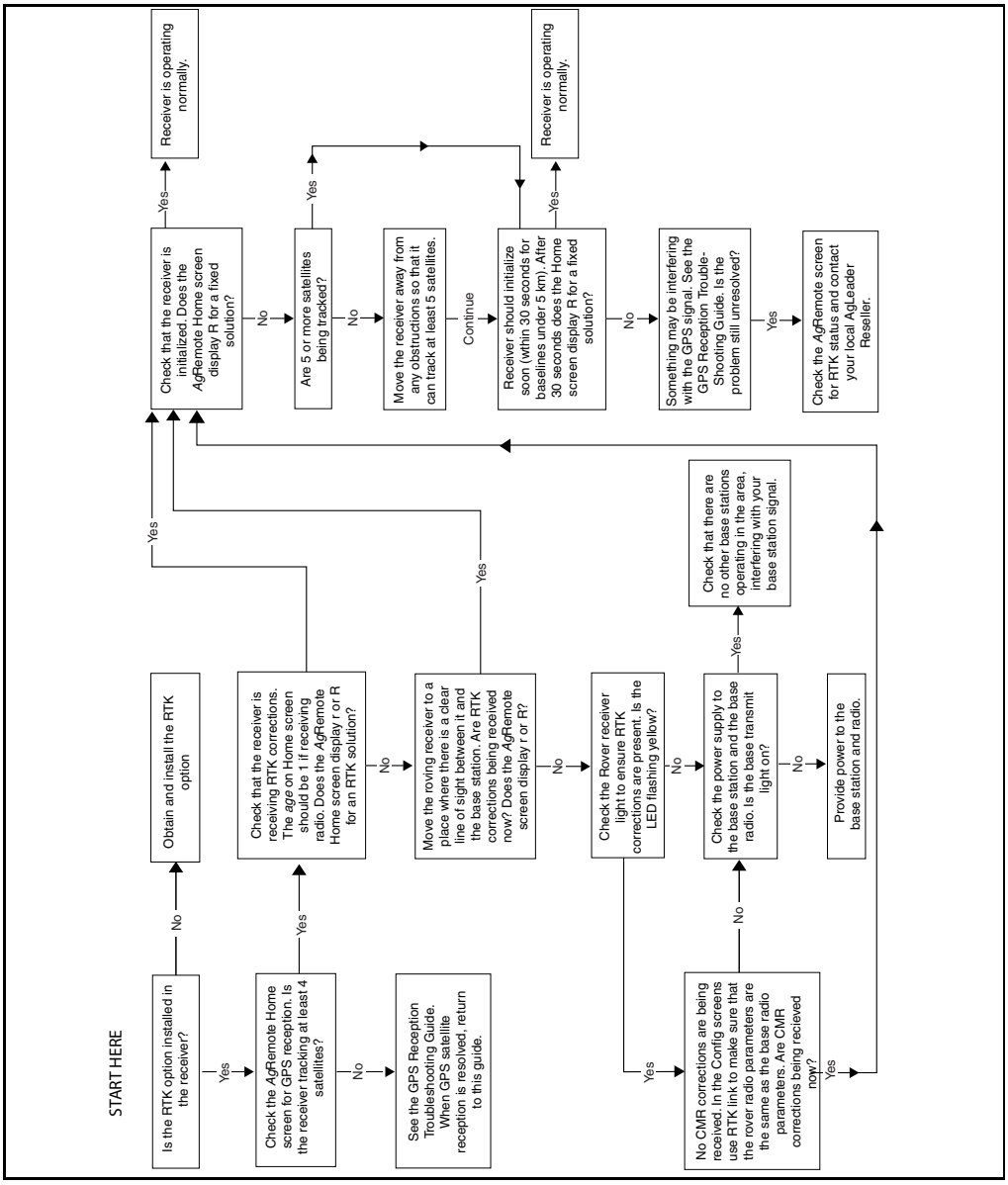



Figure 5.5 Using AgRemote to troubleshoot RTK

APPENDIX

A

# Specifications

## GPS 5100 Receiver

Table A.1 lists the physical characteristics of the GPS 5100 combined GPS/DGPS receiver and antenna.

**Table A.1 GPS 5100 receiver**

| Item | Description |
|---|---|
| Size | 300 mm (11.7 in) wide x 309 mm (12.05 in) deep x 70 mm (2.73 in) high |
| Weight | 2.1 kg |
| Power | Nominal 350 mA at 12 V DC |
| Operating temperature | –30 °C (–22 °F) through +70 °C (+158 °F) |
| Storage temperature | –40 °C (–40 °F) through +85 °C (+185 °F) |
| Humidity | Complies with Mil 810E Method 507.3 Procedure III Aggravated Cyclic Humidity.<br>Ten 24 hour cycles of constant 95% RH, with cycling temperature and dwells +30 °C (+86 °F) and +60 °C (140 °F). Unit sealed to +/- 5 PSID |
| Casing | Low-profile UV-resistant plastic. Dust-proof, waterproof, shock resistant, with recessed protected connectors. |

**Table A.1 GPS 5100 receiver (continued)**

| | |
|---|---|
| Connectors | 12-pin Deutsch connectors |
| Ports | Two connection ports, both of which support RS-232 and CAN |
| Mounting | Three holes for 10 mm (0.39 in) bolts |
| Compliance | FCC Part 15 Class A, C-Tick, E-mark, CE-mark |

## GPS Channels

Table A.2 lists the performance characteristics of GPS channels.

**Table A.2 GPS channels performance**

| Item | Description |
|---|---|
| General | 12-channel, parallel tracking L1 1571.42 MHz and L2 1227.60 MHz. C/A code and carrier phase filtered measurement. |
| Update rate | 1, 5, 10 Hz |
| RTK speed accuracy | 0.16 kph (0.10 mph) |
| RTK position accuracy | Horizontal 2.5 cm (0.98 in) + 2 ppm, 2 sigma, and vertical 3.7 cm (1.46 in) + 2 ppm, 2 sigma, if all of the following criteria are met:<br>• At least 5 satellites<br>• PDOP <4<br>• CMR corrections<br>• Standard format broadcast from a Trimble MS750, *Ag*GPS 214, or equivalent reference station |
| Differential speed accuracy | 0.16 kph (0.1 mph) |

**Table A.2 GPS channels performance (continued)**

| | |
|---|---|
| Differential position accuracy | Less than 1 m (3.28 ft) horizontal if all of the following criteria are met:<br>• At least 5 satellites<br>• PDOP <4<br>• RTCM SC-104 corrections<br>• Standard format broadcast from a Trimble MS750, *Ag*GPS 214, or equivalent reference station |
| OmniSTAR HP speed accuracy | 0.16 kph (0.1 mph) |
| OmniSTAR HP position accuracy | 10 cm (3.94 in) after convergence, 2 sigma, if all the following criteria are met:<br>• At least 5 satellites<br>• PDOP <4<br>• OmniSTAR HP corrections<br>Convergence time can vary, depending on the environment. Time to the first fix (submeter accuracy) is typically <30 seconds; time to the first useable fix (<10 cm accuracy) is typically <30 minutes. |
| Time to first fix | <30 seconds, typical |
| Multipath mitigation | EVEREST technology |
| Satellite differential compatibility | OmniSTAR, WAAS, and EGNOS |
| NMEA messages | GGA 1 1[1], GLL, GSA1, GST, GSV, GST, MSS, PTNLDG, PTNL PJK, PTNL PJT, PTNL VGK, PTNL VHD, PTNLEV, PTNLID, PTNLSM, RMC1, VGK, VTG1, XTE, ZDA |

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

## L-Band Satellite Differential Correction Receiver

Table A.3 lists the characteristics of the L-band satellite differential correction receiver with OmniSTAR support.

**Table A.3 L-Band satellite differential correction receiver with OmniSTAR support**

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

## Receiver Default Settings

Table A.4 lists the receiver default settings.

**Table A.4 Receiver default settings**

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

APPENDIX

# B

# Additional Equipment Interface Requirements

## Ag Leader Hardware

Table B.1 lists the interface requirements for connecting a GPS 5100 receiver to additional Ag Leader hardware.

**Table B.1 Ag leader hardware requirements**

| Hardware | Protocol | NMEA messages | Baud | Other | Pos rate |
|---|---|---|---|---|---|
| YM2000 Yield Monitor | NMEA | GGA, VTG | 4800 | 8-N-1 | 1 Hz |
| PF3000 Yield Monitor [1] | NMEA | GGA, VTG | 4800 | 8-N-1 | 1 Hz |
| PF3000Pro Monitor without internal GPS [1] | NMEA | GGA, VTG | 4800 | 8-N-1 | 1 Hz |
| *PFadvantage* | NMEA | GGA, VTG | 4800 | 8-N-1 | 1 Hz |
| INSIGHT | NMEA | GGA, VTG | 4800 | 8-N-1 | 1 Hz |

[1] Connect to Aux port.

# Third-Party Software

Table B.2 lists the interface requirements for connecting a GPS 5100 receiver to third-party software..

**Table B.2 Third-party software interface requirements**

| Software | Company | Protocol | NMEA messages | Baud | Other | Pos rate |
|---|---|---|---|---|---|---|
| AgView | GIS Solutions | NMEA | VTG, GLL | 4800 | 8-N-1 | 1Hz |
| FarmGPS | Red Hen | NMEA | GGA, GSA, VTG | 4800 | 8-N-1 | 1Hz |
| Field Rover | SST Dev Group | NMEA | GGA, GSA, GSV, VTG | 4800 | 8-N-1 | 1Hz |
| FieldLink DOS | Agris | NMEA | GGA, GSA, VTG | 4800 or 9600 | 8-N-1 | 1Hz |
| FieldLink Windows | Agris | NMEA | GGA, GSA, VTG | 4800 or 9600 | 8-N-1 | 1Hz |
| Field Worker Pro | Field Worker | NMEA | GGA, GLL, RMC, VTG | 4800 or 9600 | 8-N-1 | 1Hz |
| HGIS | Starpal | NMEA | GGA, RMC | 4800 or 9600 | 8-N-1 | 1Hz |
| Instant Survey | Agrilogic (Case-IH) | NMEA | GGA, GSA, RMC | 4800 | 8-N-1 | 1Hz |
| Pocket Survey | Agrilogic (Case-IH) | NMEA | GGA, GSA, RMC | 4800 | 8-N-1 | 1Hz |
| Sitemate | Farmworks | NMEA | GGA, VTG | 4800 | 8-N-1 | 1Hz |

# Third-Party Hardware

Table B.3 lists the interface requirements for connecting a GPS 5100 receiver to third-party hardware.

**Table B.3 Third-party hardware interface requirements**

| Hardware | Company | Protocol | NMEA messages | Baud | Other | Pos rate |
|---|---|---|---|---|---|---|
| AMS | Raven | NMEA | GGA, VTG | 9600 | 8-N-1 | 1Hz |
| Ag Navigator | Springhill | RTCM | | 9600 | 8-N-1 | 10Hz |
| Aim Navigator | Case Tyler | NMEA | GGA | 19200 | 8-N-1 | 5Hz |
| Contour | Position Inc. | NMEA | GGA | 19200 | 8-N-1 | 5Hz |
| Marker | RDS or Position Inc. | NMEA | GGA | 19200 | 8-N-1 | 5Hz |
| Falcon | Ag Chem | NMEA | GGA, VTG | 4800 | 8-N-1 | 1Hz |
| Falcon w/ Falcon Track LBAR | Ag Chem | NMEA | GGA, VTG | 19200 | 8-N-1 | 10Hz |
| Swath Smart or RGL 500 (LB-5 for Raven) | Raven, Starlink manufactured | NMEA | GGA, VTG or RMC | 19200 | 8-N-1 | 10hz |
| LB-3, LB-4, and LB-5 | Starlink | NMEA | GGA, VTG or RMC | 19200 | 8-N-1 | 10hz |
| GreenStar Yield Monitor [1] | John Deere | NMEA | GGA, GSA, RMC | 4800 | 8-N-1 | 1 Hz |
| VCD (Vision Display Controller) | Rockwell | NMEA | GGA, GLL, VTG, ZDA | 4800 | 8-N-1 | 1 Hz |
| Swath XL | Midtech | NMEA | GGA | 19200 | 8-N-1 | 5 Hz |
| Caterpillar Cebis Yield Monitor | Claus | NMEA | GGA | 4800 or 9600 | 8-N-1 | 1 Hz |
| AGCO FieldStar Yield Monitor [2] | AGCO | NMEA | GGA, VTG, GSV, GSA | 4800 | 8-N-1 | 1 Hz |

**Table B.3 Third-party hardware interface requirements (continued)**

| Hardware | Company | Protocol | NMEA messages | Baud | Other | Pos rate |
|---|---|---|---|---|---|---|
| AFS Yield Monitor | Case-IH (Ag Leader YM2000) | NMEA | GGA, VTG | 4800 | 8-N-1 | 1 Hz |
| AFS Yield Monitor | Case-IH YMIU (yield monitor interface unit) manufactured by Ag Leader for Case-IH | NMEA | GGA, VTG | 4800 | 8-N-1 | 1 Hz |
| New Holland Yield Monitor | New Holland (Ag Leader PF3000) | NMEA | GGA, VTG | 4800 | 8-N-1 | 1 Hz |

[1] Older GreenStars with version 5.3P mapping processor software require 9600 baud. Older GreenStars with version 5.3R mapping processor software require 4800 baud.

[2] AGCO unit requires a null modem RS-232 connection. Ag Leader cable P/N 39903 is wired correctly for connection.

# Index

## Numerics



## A



## B



## C

## D



## E



## F



## G

## H



## I



## J



## L



## M



## N



## O

## P



## R

## S



## T



## U



## V



## W

## Y