Ag Leader®

GPS 7500

User Guide

PN 2006260—ENG Rev. B

GPS 7500 User Guide

Warranty

Ag Leader warrants that its GNSS products are free from defects in materials and workmanship, subject to the conditions set forth on our web site: www.agleader.com and for the following time periods:

GPS 7500 Receiver   2 years

Proprietary Notice

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Manufactured and protected under U.S. Patent:

#5,390,207	#5,495,499	#5,734,674	#5,736,961	#5,809,064
#6,184,822 B1	#6,211,821 B1	#6,243,409 B1	#6,445,354 B1	#6,452,560 B2
#6,608,998 B1	#6,664,923 B1	#6,728,637 B2	#6,922,167 B2	#7,250,916
#7,738,536 B2	#7,738,606 B2	#7,885,317 B2	#8,467,433 B2	#8,442,097 B2

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Notice

The following notices apply to the GPS 7500.

WARNING!: Changes or modifications to this equipment not expressly approved by NovAtel Inc. could result in violation of FCC, Industry Canada and CE Marking rules and void the user's authority to operate this equipment.

FCC Notices

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

GPS 7500 has been tested and found to comply with the emission limits for a Class B digital device, pursuant to part 15 of the FCC Rules. The Class B limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the GPS 7500

- Increase the separation between the equipment and the GPS 7500

- Connect the equipment to an outlet on a circuit different from that to which the GPS 7500 is connected

- Consult the dealer or an experienced radio/TV technician for help

CAUTION!: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

CAUTION!: In order to maintain compliance as a Class "B" digital device, shielded cables should be used for the RS-232 serial data ports (Belden 1036A or equivalent) and twisted pair cable should be used for the CAN port (shielded twisted pair will improve CAN performance in electrically harsh environments). I/O signals should be referred to signal ground (connector pin 5) and not power ground (connector pin 9). If I/O signals route to different areas of the vehicle, dedicated signal grounds for I/O should be spliced into a common connection to connector pin 5 at a point close to the GPS 7500.

Wi-Fi

GPS 7500 contains a Wi-Fi radio with the following approvals:

• FCC ID: UTU-01019715

Innovation, Science and Economic Development (ISED) Canada

GPS 7500 Class B digital device complies with Canadian ICES-003.

GPS 7500 appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

This device complies with ISED license-exempt RSS-GEN and RSS-247. Operation is subject to the following two conditions: (1) this device may not cause interference and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme à la norme ISED RSS-GEN et RSS-247. Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne doit pas provoquer d'interférences et (2) cet appareil doit accepter toute interférence, y compris les interférences pouvant entraîner un fonctionnement indésirable de l'appareil.

WARNING!: The GPS 7500 has been authorized for use in Mobile applications. At least 20 cm (8 inches) of separation between the GPS 7500 and the User must be maintained at all times.

WARNING!: GPS 7500 a été autorisé pour une utilisation dans les applications mobiles. Au moins 20 cm (8 pouces) de séparation entre le GPS 7500 et l'utilisateur doit être maintenue à tous fois.

Wi-Fi

GPS 7500 contains a Wi-Fi radio with the following approvals:

• IC: 129A-01019715

Industry Canada

GPS 7500 Class B digital apparatuses comply with Canadian ICES-003.

GPS 7500 appareils numérique de la classe B sont conforme à la norme NMB-003 du Canada.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

European Union (EU)

GPS 7500 Wi-Fi

NovAtel Inc. declares that the GPS 7500 Wi-Fi transceiver is in compliance with Directive 2014/53/EU (Radio Equipment).

The full text of the EU Declaration of Conformity may be obtained from the NovAtel web site at:

www.novatel.com/products/compliance/eu-declaration-of-conformity

Radio Information

Description of Service: Wi-Fi (802.11b/g/n)

Operational Frequency: 2400 MHz to 2480 MHz
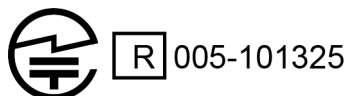
Modulation: OFDM

Rated Power: 13.4 dBm e.i.r.p

The full text of the EU Declaration of Conformity may be obtained from the NovAtel web site at:

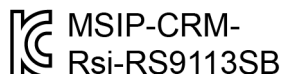www.novatel.com/products/compliance/eu-declaration-of-conformity

Japan

Wi-Fi

GPS 7500 contains a Wi-Fi radio with the following approvals:

R 005-101325

Korea

Wi-Fi

GPS 7500 contains a Wi-Fi radio with the following approvals:

MSIP-CRM-
Rsi-RS9113SB

CE

The enclosures carry the CE mark.

"Hereby, NovAtel Inc. declares that this GPS 7500 is in compliance with the essential requirements and other relevant provisions of the R&TTE Directive 1999/5/EC, EMC Directive 2004/108/EC and the RoHS Recast Directive 2011/65/EU."

WEEE

If you purchased your GPS 7500 in Europe, please return it to your dealer or supplier at the end of its life. The objectives of the European Community's environment policy are, in particular, to preserve, protect and improve the quality of the environment, protect human health and utilize natural resources prudently and rationally. Sustainable development advocates the reduction of wasteful consumption of natural resources and the prevention of pollution. Waste electrical and electronic equipment (WEEE) is a regulated area. Where the generation of waste cannot be avoided, it should be reused or recovered for its material or energy.

WEEE products may be recognized by their wheeled bin label ().

REACH

NovAtel® strives to comply with the EU Directive EC 1907/2006 on chemicals and their safe use as per the Registration, Evaluation, Authorization and Restriction of Chemical substances (REACH) for its products, including the GPS 7500 product. Since REACH SVHC lists are updated occasionally, please contact NovAtel Customer Support if you require further information.

TERRASTAR SERVICE ACCESS

By installing or using the TerraStar® subscription, by Ag Leader sending the subscription activation to you, or by the payment of the subscription fee, you are agreeing to be legally bound by the related TerraStar terms and conditions (found here: http://www.agleader.com/products/guidance-steering/gps-receiver-systems/). If you do not agree to these terms, do not use the subscription or obtain the subscription activation code from Ag Leader. All subsequent subscriptions shall be governed by the latest version of the terms and conditions then available on the Ag Leader web site.

WARNING!: Cables may contain DEHP (CAS Number 117-81-7) in concentrations above 0.1% w/w.

Customer Support

Contact Information

Use one of the following methods to contact Ag Leader Support:

ph: (515) 232-5363

fax: (515) 232-3595

e-mail: support@agleader.com

Service

There are no user-serviceable parts inside the receiver. Contact the manufacturer for a Return Material Authorization (RMA).

ph: (515) 232-5363

fax: (515) 232-3595

e-mail: support@agleader.com

Conventions Used In This Manual

Cautions and Warnings

The operators manual uses the following text formatting schemes to call attention to information related to simplifying system operation and proper operating practices to prevent accidental data loss. If in doubt about the results of performing an action or deleting an item from the system, back up all system files to the USB external drive prior to proceeding with the action.

NOTE!: Provides informative tips to assist with system setup, calibration, and operation.

CAUTION!: Indicates specific settings, calibrations, and procedures that must be followed for proper system performance and operation.

WARNING!: Indicates specific instructions to avoid accidental loss of data and system configurations settings.

Cross-references and Web Links

Throughout this manual, numerous cross-references are provided to other pages or sections. These cross-references are always shown in blue, italic text; and list the title and page number as in the following example: Refer to "Conventions Used In This Manual" on page 6. If you are viewing this manual in PDF format, you can click on this blue text and go directly to the link.

Links to web sites are shown in blue, italicized, and underlined text, as in the following example: To view the web site, go to: www.agleader.com.

Viewing this Manual Online

This operators manual can be viewed online at Ag Leader's Web site. To view and/or print the Operators Manual online, you will need the Adobe Acrobat or Adobe Reader. The Adobe Reader software comes pre-installed on most personal computers. If Adobe Reader is not installed on your computer the program is available for download at no charge. A link to the Adobe download site is located at the Ag Leader Web site.

Product Registration

Contact your AutoFarm dealer for technical support.

When registering your Ag Leader Technology products by one of the following methods, you can elect to receive notice of any new product updates or features.

Register by mail: Ag Leader Technology

2202 South Riverside Dr.

Ames, IA 50010

Register by Fax: 515-232-3595

Register at the Ag Leader Web site at http://www.agleader.com

Ethernet Port

The Ethernet port is a safety extra-low voltage (SELV) circuit only and is suitable for connection to another SELV circuit. Do not connect to Telecommunications Network Voltage (TNV) circuits.

WEEE Notice

If you purchased your receiver in Europe, please return it to your dealer or supplier at the end of its life. The objectives of the European Community's environment policy are, in particular, to preserve, protect and improve the quality of the environment, protect human health and utilise natural resources prudently and rationally. Sustainable development advocates the reduction of wasteful consumption of natural resources and the prevention of pollution. Waste electrical and electronic equipment (WEEE) is a regulated area. Where the generation of waste cannot be avoided, it should be reused or recovered for its material or energy. WEEE products may be recognized by their wheeled bin label ( ).

See www.novatel.com/products/compliance/environmental-compliance for more information.

RoHS

The GPS 7500 is in conformity with Directive 2011/65/EU of the European Parliament and of the council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

REACH

The GPS 7500 is compliant with Regulation (EC) No. 1907/2006 of the European Parliament and the Council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). The candidate list of Substances of Very High Concern (SVHC) published by the European Chemical Agency (ECHA) is available at: https://echa.europa.eu/candidate-list-table

Introduction

The GPS 7500 is a high performance GNSS receiver and antenna, capable of receiving and tracking different combinations of GNSS L1/L2 code and carrier signals on a maximum of 555 channels. SBAS (Satellite Based Augmentation Systems) includes WAAS (North America), EGNOS (Europe) and MSAS (Japan). SBAS support is standard. The GPS 7500 side panel also features Light Emitting Diodes (LEDs) for status indication.

Once properly powered, the GPS 7500 begins operating as a fully functional GNSS system.

Features and Models

The main features of the GPS 7500 are:

- an enhanced high performance multi-frequency, multi-constellation receiver

- a CAN port

- Emulated Radar Output

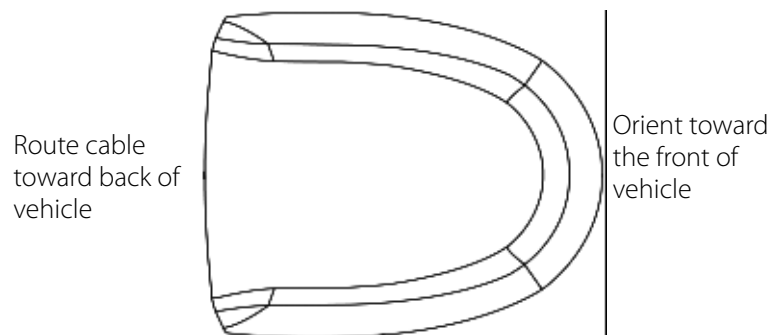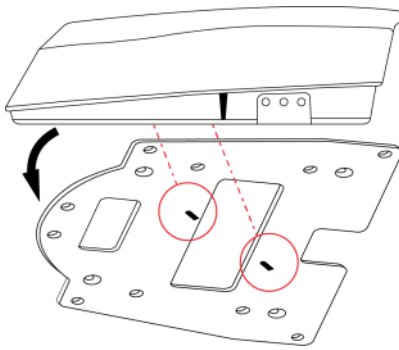- Three RS-232 COM ports

- LED status indicators

- a water and dust tight enclosure

- enhanced interference mitigation

- Wi-Fi interface

- Ethernet port

- Integrated SPAN GNSS+INS functionality

- Web UI

Installation and SetupPhysical Installation

GPS 7500 Screw
Mounting Holes x4

Integrated
Magnetic
Mounts X3
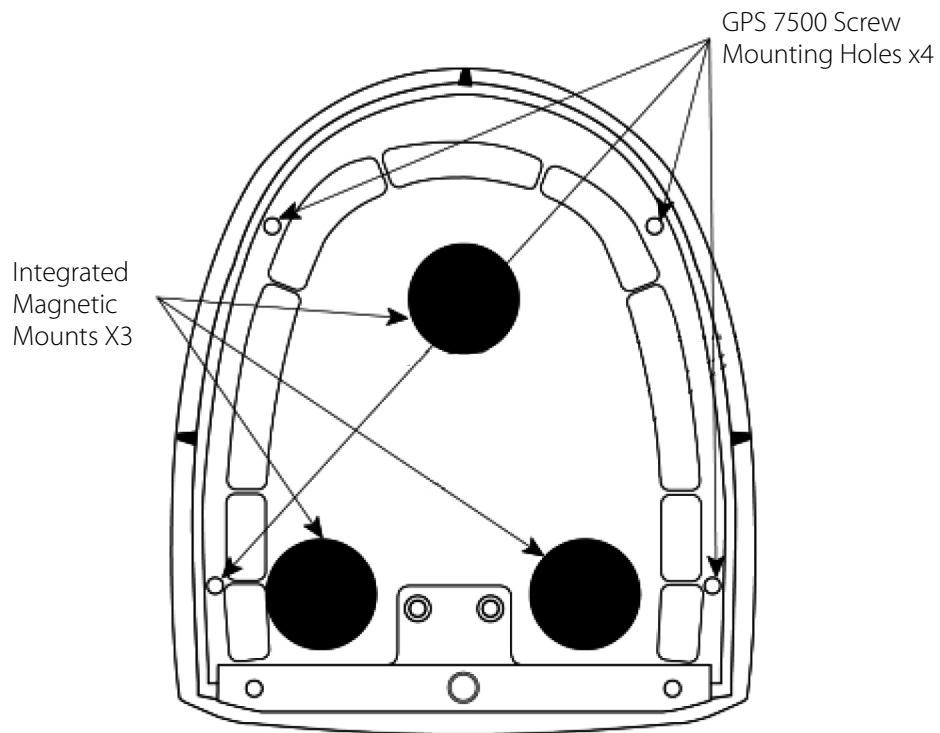
The GPS 7500 must be mounted with the connector facing the side of the vehicle.

Route cable
toward back of
vehicle

Orient toward
the front of
vehicle

Mount on a secure, stable structure capable of safe operation in the specific environment.

If installing on a vehicle, mount the receiver on the vehicle roof, ideally close to the pivot point of the vehicle. The receiver must be mounted with the connector facing the side of the vehicle.

The receiver must be rigidly secured to the vehicle to avoid errors caused by vibration and motion.

If installing in a stationary location, mount the receiver in a location that has a clear view of the sky so that each satellite above the horizon can be tracked without obstruction. For more information, refer to An Introduction to GNSS.

Connector Pin-Out
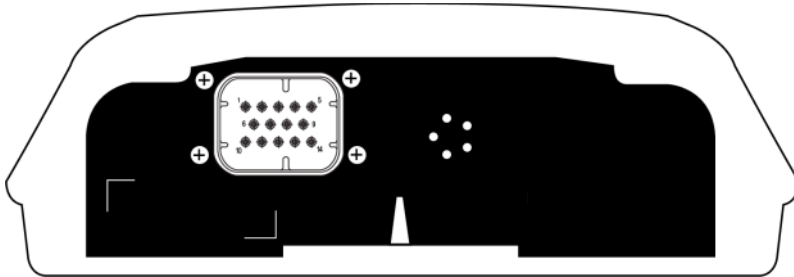
Pin	Use	Pin	Use
1	COM1 TxD	8	COM3TxD
2	COM1 RxD	9	Power Negative/Return
3	COM2 TxD	10	RESERVED (Do not connect)
4	COM2 RxD	11	MKI (Mark Input)
5	Signal Ground (COM/ER/MKI/PPS)	12	PPS (Pulse Per Second) Output
6	CAN+	13	COM3RxD
7	CAN-	14	Power Positive/Source
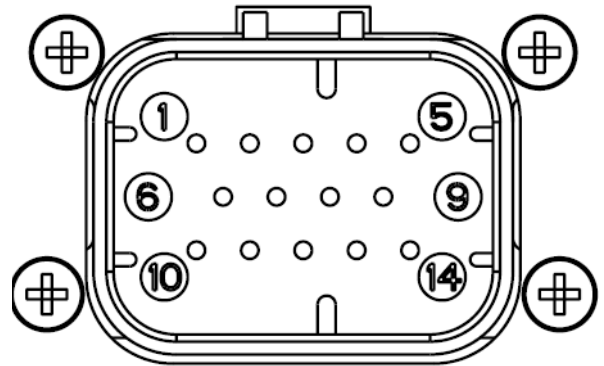
WARNING!: Minimum conductor size for all wiring is 0.5 mm/20 AWG. Ag Leader recommends tying to ground any floating input lines.

Power Supply Requirements

The GPS 7500 requires +7 to +30 VDC input power.

WARNING!: The GPS 7500 power source must be protected by a 5 A Fast Blow Fuse or damage to wiring may result (not covered by warranty).

Mounting the GPS 7500

Mount on a secure, stable structure capable of safe operation in the specific environment. Typical installation is a vehicle roof, ideally close to the pivot point of the vehicle.
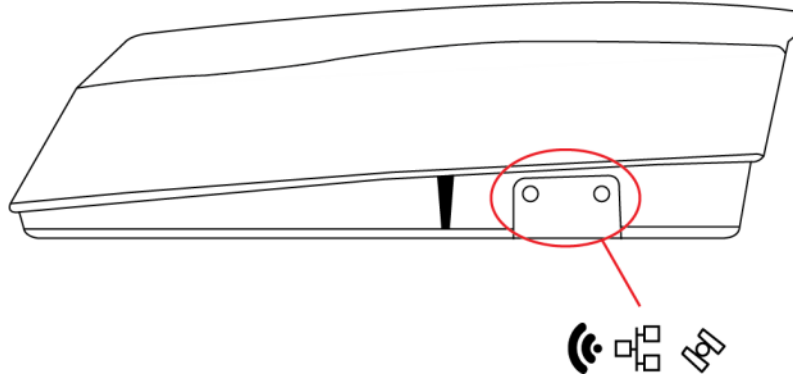
WARNING!: To install the mounting plate, use the adhesive tape or the mounting holes at each corner of the plate.

CAUTION!: The GPS 7500 must be rigidly secured to the vehicle to avoid errors caused by vibration and motion.

LEDs

((Wi-Fi mode (AP, Concurrent or Client)

Status (Power/GNSS)

Wi-Fi LED

State	Description
Green Solid	Configured as an Access Point (default)
Green Slow Flash	Configured as an Access Point with at least one client connection
Blue Solid	Configured as both an Access Point and a Client concurrently
Blue Slow Flash	Configured as both an Access Point and a Client concurrently, with at least one Client connected to the concurrent Access point or with the concurrent Client connected to an Access Point
White Solid	Configured as a Client
While Slow Flash	Configured as a Client and connected to an Access Point
Yellow Slow Flash	Wi-Fi Firmware Upgrade
Red Solid	No Configuration
Red Fast Flash	Error State

Status LED

State	Description
Green Solid	RTK/PPP Solution good or RTK/PPP/INS Solution good
Green Slow Flash	PPP or RTK Converging
Yellow Solid	WAAS/Single Point
Yellow Slow Flash (1 Hz)	Tracking at least one satellite but no valid position
Yellow Fast Flash (3 Hz)	Initialized and ready for communication
Red Solid	Power On/Error/Reset
Red Slow Flash (1 Hz)	Position Error
Red Fash Flash (3 Hz)	Solution Error

Wi-Fi

The GPS 7500 has a Wi-Fi Access Point that is enabled by default. This provides for easy connection to any laptop/tablet/smartphone with Wi-Fi capability and a web browser.

1. Once the receiver is installed and powered, use a Wi-Fi capable laptop/tablet/smartphone to locate the GPS 7500 in the list of detected Wi-Fi Networks and establish a connection.

   The GPS 7500 PSN of the receiver (SSID) is printed on a label located by the connector. The format of the PSN is GPS 7500-<Receiver PSN>, e.g. "GPS 7500-ABCDEF1234567".

2. A prompt for a password will appear. The default password is printed on a label on the bottom of the GPS 7500. The default password is specific to that GPS 7500 receiver.

3. Open up a web browser and enter **192.168.19.1** . The GPS 7500 automatically redirects you to the Web User Interface which is hosted on the GPS 7500.

Web User Interface is compatible with recent versions of Chrome, Firefox, Internet Explorer and Safari.

Cookies should always be on and never blocked on the browser being used to connect to the Wi-Fi network.

Operation
Transmitting and Receiving Corrections

RTK or DGPS corrections can be transmitted from a base station to a rover station to improve position accuracy. The base station is the GNSS receiver, which is acting as the stationary reference. It has a known position and transmits correction messages to the rover station. The rover station is the GNSS receiver which does not know its exact position and can be sent correction messages from a base station to calculate differential GNSS positions. The GPS 7500 can be used as a base receiver to transmit RTK or DGPS corrections or a rover to receive the same corrections.

Firmware and Software

Download the most recent versions of the firmware and receiver software from http://www.agleader.com/support/.

Firmware Updates

Firmware updates are firmware releases that include fixes and enhancements to the receiver functionality. Firmware updates are released on the web site as they become available.

Authorization Code

An authorization code, commonly known as an auth-code, is required to upgrade a GPS 7500 receiver. Auth-codes are obtained by contacting Ag Leader Sales.

Support requires:

- model number
- serial number
- firmware version

Updating or Upgrading Using the WinLoad Utility

WinLoad is the simplest and most common way to update or upgrade an GPS 7500 receiver.

Transferring Firmware Files

To proceed with an update or possibly an upgrade, obtain the latest version of firmware from the Ag Leader Website.

Types of Firmware Files

OEM Version - Use the OEM version if the receiver or model upgrade was purchased after the cut- off date. When the OEM version is used, Ag Leader sales must generate and provide the required authorization code. Authorization codes are obtained by contacting Ag Leader sales.

The OEM version is named OEMXXXX.EXE, where XXXX is the firmware version.

Application Software

The GPS 7500 receiver has two types of software loaded, the OEMStar firmware and the GPS 7500 Application Software. The OEMStar firmware provides the features that are common to all OEMStar receiver.

The Application Software provides the special features available on the GPS 7500, such as Emulated Radar.

The Application Software is available at http://www.agleader.com/support/ and is loaded onto the GPS 7500 receiver using the same procedures used for the OEMStar firmware. An authorization code is not required for Application Software updates.
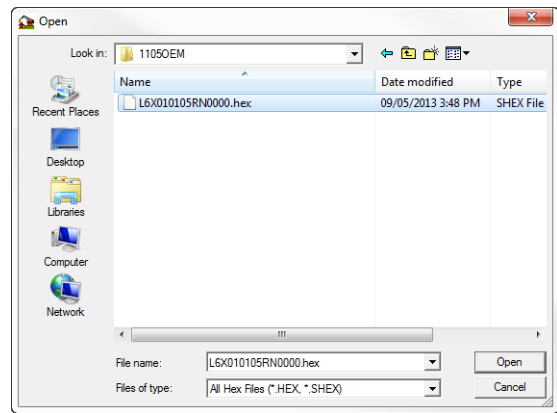
Using the WinLoad Utility

If opening WinLoad for the first time, ensure the file and communications settings are correct.
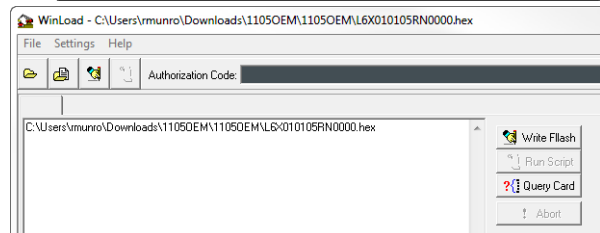
Open a File to Download

Select File. Open. Navigate to the file to open.

WinLoad's Open Window

When a file is selected, the filename appears in the main WinLoad display area and in the title bar

Open File in WinLoad

Communications Settings

To set the communications port and baud rate, select Settings COM Settings. Choose the computer port to use from the Com Port drop down list and the baud rate from the Download Baudrate drop down list. Set the baud rate as high as possible (the default of 115200 is preferred).
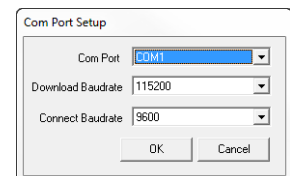
Downloading Firmware

1. Select the file to download.

2. Ensure the file path and name are displayed in main display area.

3. Click Write Flash to download the firmware.

4. When Searching for card appears in the main display, power cycle the receiver.
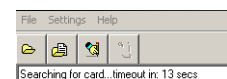
5. If the Authorization Code window appears, enter the auth-code and click OK.

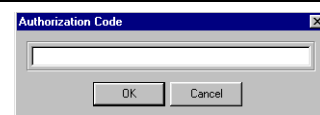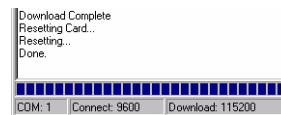6. The receiver finishes the download and then resets. The process is complete when Done appears in the main display area.

7. Close WinLoad. Upgrade Process Complete

Upgrading Using the AUTH Command

The AUTH command authorizes the enabling (unlocking) of model features. The AUTH command is used to upgrade a new receiver model, available with the same firmware version as the current model. This command only functions with a valid auth-code assigned by Ag Leader.

The upgrade can be performed directly through the Ag Leader display.

Upgrade Procedure

Example:

7WBMBK,887CB6,K5J3FH,5DF5P2,42PW8G,D1SB0GTT0,121211

When the AUTH command is executed, the receiver reboots.

Troubleshooting

There are simple ways to diagnose and resolve problems. In many cases, the issue can be resolved within a few minutes, avoiding the inconvenience and loss of productivity that results from having to return the receiver for repair. This section discusses troubleshooting issues and includes cross-references to other sections of the manual that may help resolve problems.

If unsure of the symptoms or if the symptoms do not match any of those listed, use the RXSTATUS log to check the receiver status and error words.

Try to resolve the problem using the troubleshooting guide below, then try our Knowledge Base at AgLeader.com/knowledgebase. If you are still not able to resolve the problem, see Customer Support for troubleshooting logs and contact information.

Troubleshooting Based on Symptoms

Symptom	Related Section
The receiver is not properly powered	Check the power cable. Replace if faulty.
The receiver cannot establish communication	Check the serial cables and ports. Replace if faulty
The receiver is not tracking satellites	Ensure that the antenna has an unobstructed view of the sky from horizon to horizon.
No data is being logged	Check CAN Bus and Communications with the Receiver on Display
Random data is being output by the receiver or binary data is streaming	Check the baud rate.
Overload and overrun problems. Either the CPU or port buffers are overloaded	Reduce the amount of logging or increase the baud rate.
The receiver is being affected by jamming	Move the receiver away from any possible jamming sources
The receiver is being affected by interference	Move the GNSS antenna away from the source of the interference signal.

Performance Specifications

Channel Configuration

Signals Tracked	555 Channels	
	GPS	L1, L2, L2C
	GPS (optional)	L5
	GLONASS	L1, L2
	GLONASS (optional)	L1 CDMA, L2 CDMA
	BeiDou (optional)	B1I, B1C, B2I, B2a
	Galileo (optional)	E1, E5 AltBOC, E5a, E5b
	SBAS	L1
	QZSS	L1, L2
	L-Band	Up to 5 channels

Minimum Satellites Tracked		>44
Minimum Satellite Used in Computing Position		>52
Maximum Data Rate	Measurements	up to 20 Hz
	Position	up to 20 Hz
Time to First Fix	Hot: <20 s typical (Almanac and recent ephemeris saved and approximate position and time entered)	
	Cold: <40 s typical (No almanac or ephemeris and no approximate position or time)	
Signal Reacquisition	L1	0.5 s typical
	L2	<1.0 s typical
Time Accuracy	20 ns RMS	
Velocity Accuracy	<0.03 m/s RMS	

Environmental Specifications

Operating Temperature	-40°C to +70°C
Storage Temperature	-45°C to +80°C
Humidity	MIL-STD-810G(CH1), Method 507.6
Immersion	MIL-STD-810G(CH1), Method 512.6
Ingress Protection Rating	IP69
Shock	MIL-STD-810G(CH1), Method 516.7
Solar Radiation	EN60950-22 8.2, ISO 9022-9, Method 20, Severity Degree 03
Salt Fog	IEC 60068-2-11
Sand and Dust	MIL-STD-810G(CH1), Method 510.5
Random Vibration	MIL-STD-810G(CH1), Method 514.7

Power Requirements

Voltage	+7 to +30 VDC

Data Communications Interfaces

COM1, COM2, COM3	
Electrical format	RS-232
Data rates	2400, 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400 bit/s
Signals supported	COM1_Tx, COM1_Rx, COM2_Tx, COM2_Rx, COM3_Tx, COM3_Rx
GPS 7500 port	14-Pin Tyco Ampseal

CAN Bus

Electrical Format	ISO 11898-2
Data rates	1 Mbps maximum CAN Bus throughput is determined by slowest device on the bus
GPS 7500 port	14-Pin Tyco Ampseal

Wi-Fi Access Point

Security	WPA2
Encryption	AES

Wi-Fi Client Point

Security	OPEN, WPA, WPA2
Encryption	TKIP, AES CCMP

GPS 7500A.5   Strobe Specifications

All of the GPS 7500 strobe signals are available on the 14-Pin Interface connector. Pulse Per Second (PPS) strobes provide synchronization signal.

Refer to GPS 7500 Interface Cable for pin out details.

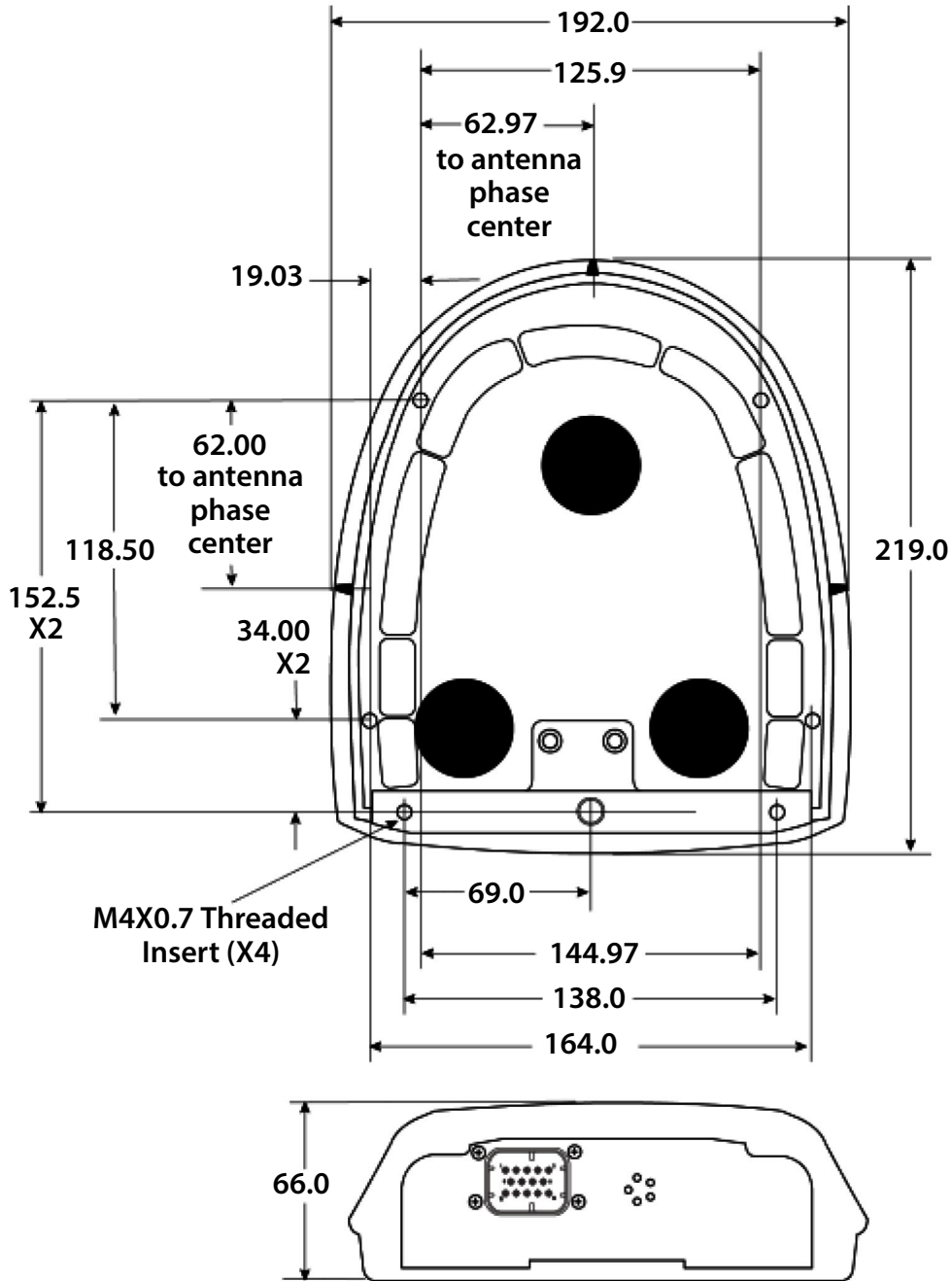| Strobes	Input/Output	Comment
Emulated Radar (ER)	Output	0VDC to VBATT+ (also refer to GPS 7500 Interface Cable)
PPS	Output	3.3V CMOS A time synchronization output. This is a pulse where the leading edge is synchronized to receiver calculated GNSS Time. The polarity, period and pulse width can be configured using the PPSCONTROL command

Controller Area Network (CAN)

The GPS 7500 supports the following NMEA2000 Parameter Group Messages (PGN):

- PGN 129029 GNSSPositionData (1 Hz)
- PGN 129025 GNSSPositionRapidUpdate (10 Hz)
- PGN 129026 COGandSOGRapidUpdate (10 Hz) .

Available CAN Signals on the GPS 7500

CAN	Pins
CAN+	Pin 6
CAN—	Pin 7

192.0

125.9

62.97
to antenna phase center

19.03

62.00 to antenna phase center

118.50

152.5 X2

34.00 X2

219.0

69.0

M4X0.7 Threaded Insert (X4)

144.97

138.0

164.0

66.0

Center of Navigation

31.50
from antenna phase
center to IMU Y Center
of Nav

36.39
from antenna phase
center to IMU X Center
of Nav

28.52
from base button to
IMU Z Center of Nav
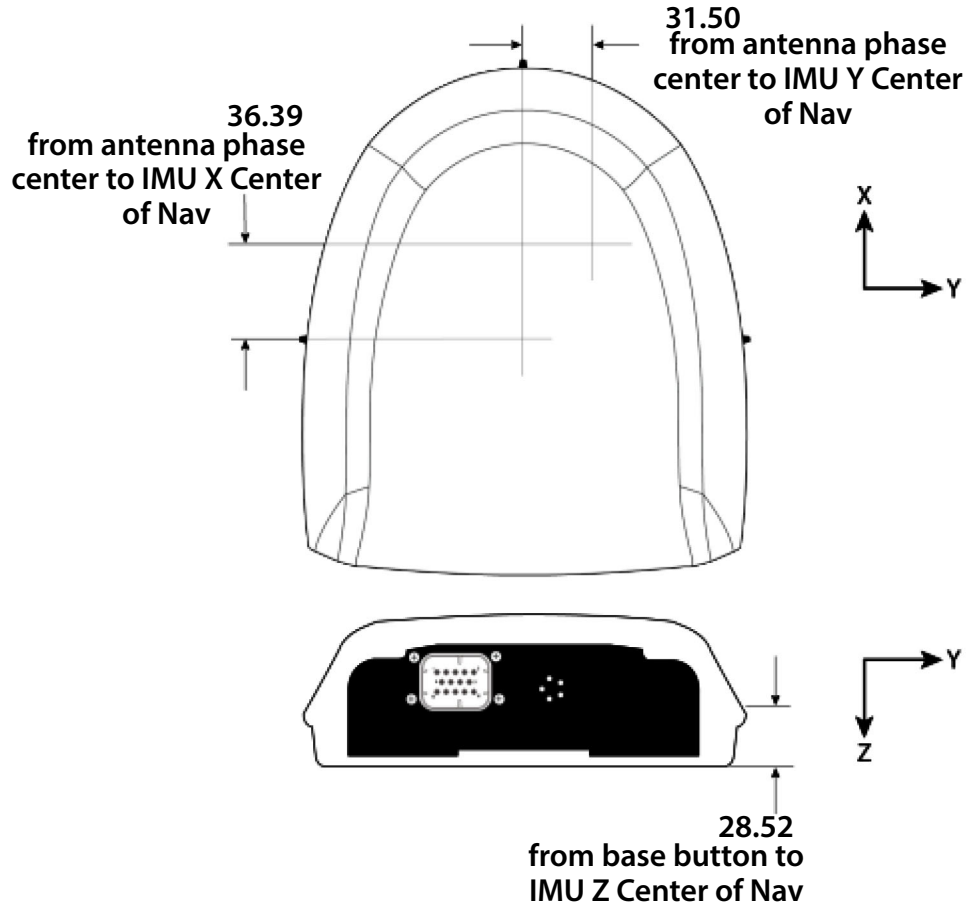
Replacement Parts

The following are a list of the replacement parts available for the Ag Leader GPS 7500 receiver. Should assistance be required or need to order additional components, please contact your local Ag Leader dealer or Customer Service representative.

GPS 7500 kit

Part Description	Ag Leader Part
GPS 7500	4005749
Cable: 14-pin socket to DB-9 connectors	4004175-18
Mounting Plate Kit	4005762
Operators Manual	2006260