

Ag Leader[®]



GPS 7000
User Guide
PN 2006649—ENG Rev. B

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GPS 7000 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 7000 Receiver 2 years

Proprietary Notice

Information in this document is subject to change without notice and does not represent a commitment on the part of Ag Leader. The software described in this document is furnished under a licence agreement or non-disclosure agreement. The software may be used or copied only in accordance with the terms of the agreement. It is against the law to copy the software on any medium except as specifically allowed in the license or non-disclosure agreement.

No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, for any purpose without the express written permission of a duly authorized representative of Ag Leader.

The information contained within this manual is believed to be true and correct at the time of publication. NovAtel, and OEMStar are registered trademarks of NovAtel Inc.

NovAtel CORRECT and NovAtel Connect are trademarks of NovAtel Inc. Manufactured and protected under U.S. Patent:

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 7000.



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 7000 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 7000
- Increase the separation between the equipment and the GPS 7000
- Connect the equipment to an outlet on a circuit different from that to which the GPS 7000 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 7000.

Innovation, Science and Economic Development (ISED) Canada

GPS 7000 Class B digital device complies with Canadian ICES-003.

GPS 7000 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 7000 has been authorized for use in Mobile applications. At least 20 cm (8 inches) of separation between the GPS 7000 and the User must be maintained at all times.



WARNING!: GPS 7000 a été autorisé pour une utilisation dans les applications mobiles. Au moins 20 cm (8 pouces) de séparation entre le GPS 7000 et l'utilisateur doit être maintenue à tous fois.

European Union (EU) SMART2-B

NovAtel Inc. declares that the SMART2-B transceivers are 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: novatel.com/products/novatel-compliance/eu-declaration-of-conformity

RoHS

The SMART2 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.

WEEE Notice

If you purchased your SMART2 product in Europe, please return it to your dealer or supplier at the end of its life.

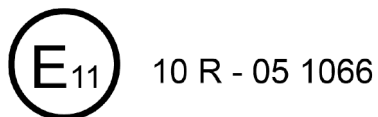
The objectives of the European Community's environment policy are, in particular, to preserve, protect and improve the quality of the environment, protect human health and utilise natural resources prudently and rationally. Sustainable development advocates the reduction of wasteful consumption of natural 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 novatel.com/products/novatel-compliance/novatel-environmental-compliance for more information.

E-Mark

The SMART2 has been granted EC type approval of an electric/electronic subassembly with respect to electromagnetic

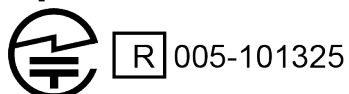
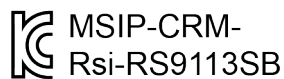
compatibility ECE Regulation 10.05. Therefore the equipment is labeled with the following approval marks.

**SSMART2 International Type Approval****Australia and New Zealand****Brazil**

04841-18-03402

Eurasian Economic Community

Armenia, Belarus, Kazakhstan, Kyrgyzstan and Russia

Japan**Korea****Serbia**

V005 19

Ukraine**Uruguay**

Contiene módulo : BT121

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 7000 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) 735-7000

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) 735-7000

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

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.

Introduction

The GPS 7000 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 7000 side panel also features Light Emitting Diodes (LEDs) for status indication.

Once properly powered, the GPS 7000 begins operating as a fully functional GNSS system.

Features and Models

The main features of the GPS 7000 are:

- high performance, dual-frequency GNSS receiver
- high performance GNSS dual-frequency antenna
- CAN port
- three RS-232 COM ports
- one LED status indicator
- PPS output
- Mark Input (MKI) (Event1)
- water and dust tight enclosure
- Emulated Radar output
- support for TerraStar-L and TerraStar-C PRO correction services



GPS 7000

- Single Frequency
- SBAS

GPS 7000 with TerraStar-L Unlock

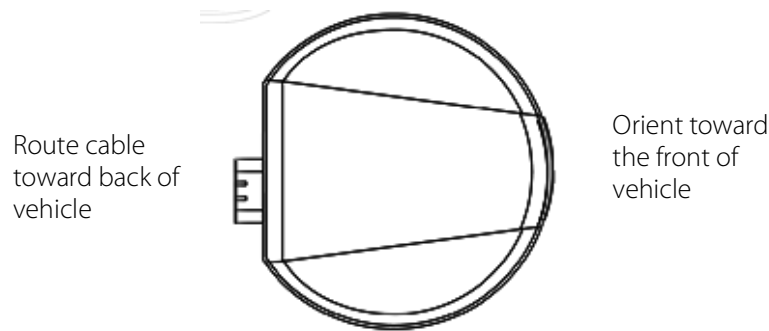
- Dual Frequency
- SBAS
- TerraStar-L

GPS 7000 with TerraStar-C Pro Unlock

- Dual Frequency
- SBAS
- TerraStar-L,
- TerraStar-C Pro

Installation and Setup Physical Installation

The GPS 7000 must be mounted with the connector facing the side of the vehicle.



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

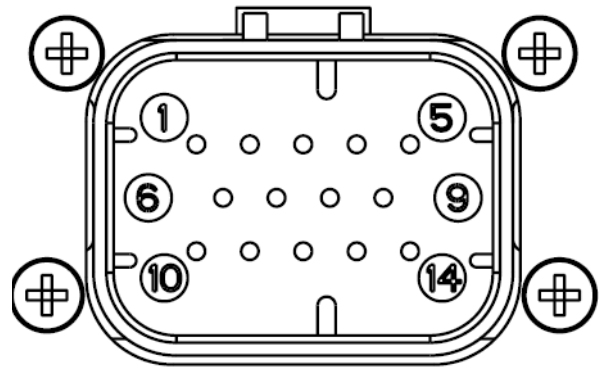
If installing on a vehicle, mount the receiver on the vehicle roof, ideally close to the pivot point of the vehicle. The receiver must be mounted with the connector facing the side of the vehicle.


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 7000 requires +7 to +30 VDC input power.

 **WARNING!:** The GPS 7000 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 7000

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.

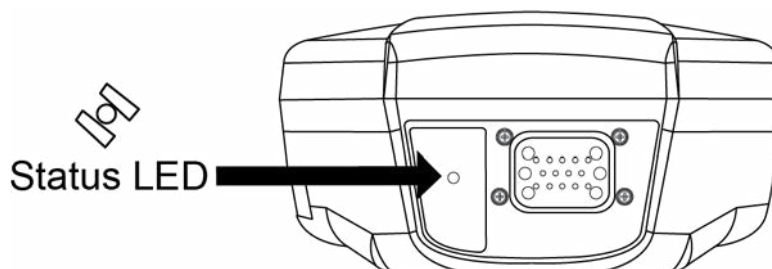


WARNING!: To install the mounting plate, use the adhesive tape or the mounting holes at each corner of the plate.



CAUTION!: The GPS 7000 must be rigidly secured to the vehicle to avoid errors caused by vibration and motion.

LEDs



Status LED

State	Description
Green Solid	Precise solution good (PPP, Fixed or PPP+INS)
Green Slow Flash (1 Hz)	Precise solution converging
Yellow Solid	Basic solution (Single Point/SBAS/DGPS)
Yellow Slow Flash (1 Hz)	Tracking satellites and calculating initial position solution
Yellow Fast Flash (3 Hz)	Initialized and ready for communication
Red Solid	Power On/Reset (for about 10 seconds after power-on or reset)
Red Slow Flash (1 Hz)	Position quality warning (unreliable/high error)
Red Fast Flash (3 Hz)	Position unavailable (unusable)

Operation

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 7000 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 7000 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 7000 receiver has two types of software loaded, the OEMStar firmware and the GPS 7000 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 7000, such as Emulated Radar.

The Application Software is available at <http://www.agleader.com/support/> and is loaded onto the GPS 7000 receiver using the same procedures used for the OEMStar firmware. An authorization code is not required for Application Software updates.

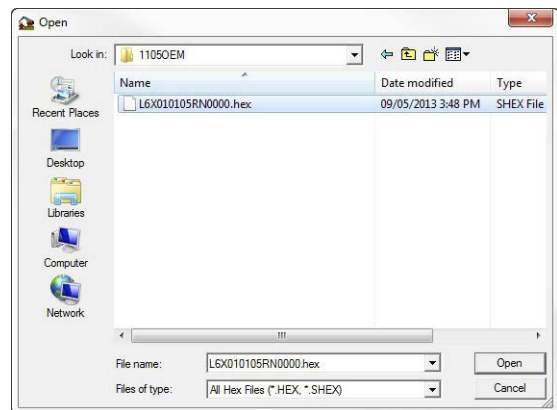
Using the WinLoad Utility

If opening WinLoad for the first time, ensure the file and communications settings are correct.

Open a File to Download

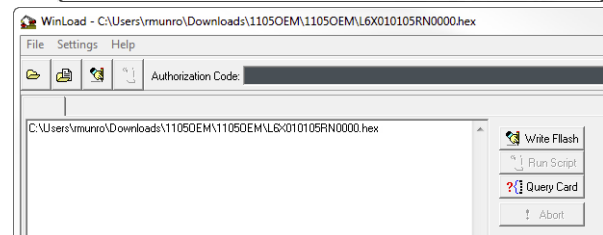
Select File. Open. Navigate to the file to open.

WinLoad's Open Window



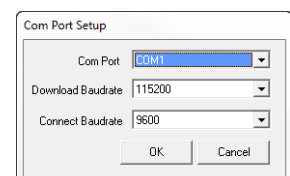
When a file is selected, the filename appears in the main WinLoad display area and in the title bar

Open File in WinLoad



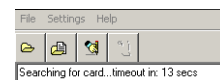
Communications Settings

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).

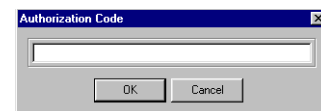


Downloading Firmware

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
	GLONASS (optional)	L1, L2
	BeiDou (optional)	B1I, B2I, B2b
	Galileo (optional)	E1, E5b
	SBAS	L1
	QZSS	L1, L2

Maximum Data Rate	Measurements	up to 20 Hz
	Position	up to 20 Hz
Time to First Fix	Hot: <35 s typical (Almanac and recent ephemeris saved and approximate position and time entered)	
	Cold: <50 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 +75°C
Humidity	MIL-STD-810G(CH1), Method 507.6
Immersion	MIL-STD-810G(CH1), Method 512.6
Ingress Protection Rating	IP67 and IP69 per IEC 60529 IP67 and IP69 ratings require that the cable is connected to the SMART2.
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
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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 7000 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 7000 port	14-Pin Tyco Ampseal

GPS 7000A.5 Strobe Specifications

All of the GPS 7000 strobe signals are available on the 14-Pin Interface connector. Pulse Per Second (PPS) strobes provide synchronization signal.

Refer to GPS 7000 Interface Cable for pin out details.

Strobes	Input/Output	Comment
Emulated Radar (ER)	Output	0VDC to VBATT+ (also refer to GPS 7000 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 7000 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 7000

CAN	Pins
CAN+	Pin 6
CAN—	Pin 7

Dimensions are in millimeters

