

# **Ag Leader<sup>®</sup>** **Technology**



## **GPS 6000**

Operator Manual  
Ag Leader PN 2006238 Rev. A

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Ames, Iowa 50010 USA  
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# GPS 6000 USER MANUAL

## 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](http://www.agleader.com) and for the following time periods:

GPS 6000 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.

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Manufactured and protected under U.S. Patent:

#5,101,416*	#5,734,674	#6,243,409 B1
#5,390,207*	#5,736,961	#6,608,988 B1
#5,414,729*	#5,809,064	#6,664,923 B1
#5,495,499*	#6,184,822 B1	#6,728,637 B2

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# NOTICE

The following notices apply to the GPS 6000.



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**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 6000 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 6000
- Increase the separation between the equipment and the GPS 6000
- Connect the equipment to an outlet on a circuit different from that to which the GPS 6000 is connected
- Consult the dealer or an experienced radio/TV technician for help



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

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**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 6000.

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## INDUSTRY CANADA

GPS 6000 Class B digital apparatuses comply with Canadian ICES-003.

GPS 6000 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.

## CE

The enclosures carry the CE mark.

"Hereby, NovAtel Inc. declares that this GPS 6000 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 6000 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 6000 product. Since REACH SVHC lists are updated occasionally, please contact NovAtel Customer Support if you require further information.



**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](mailto: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.

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

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

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## 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: To find the information you're looking for, see *["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](http://www.agleader.com)*.

## VIEWING THIS MANUAL ONLINE

This operators manual can be viewed online at Ag Leader's Web site. To view an online version, go to the Ag Leader Web site and click the Customer Support link. You will see a page titled "Product Manuals."

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>

## INTRODUCTION



The GPS 6000 is a high-performance GNSS receiver and antenna, capable of receiving and tracking different combinations of GPS L1 and GLONASS L1 code and carrier signals on a maximum of 14 channels. SBAS (Satellite Based Augmentation Systems) support, which includes WAAS, EGNOS, and MSAS, is standard. The GPS 6000 rear panel also features light emitting diodes (LEDs) for status indication.

Once properly powered, the GPS 6000 begins operating as a fully functional GNSS system.

## MODELS AND FEATURES

The main features of the GPS 6000 are:

- a high performance GPS+GLONASS L1 receiver
- a high performance GPS+GLONASS L1 antenna
- emulated radar output
- a CAN port
- two (2) RS-232 COM ports
- three (3) LED status indicators
- a water and dust tight enclosure

## SCOPE

This manual contains information about the installation and operation of the GPS 6000 system. It is beyond the scope of this manual to provide details on service or repair. Contact your local Ag Leader dealer for any customer-service related inquiries.

The following conventions are used in this manual:



**Note:** Information that supplements or clarifies text.

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**CAUTION:** A caution that actions, operation or configuration may lead to incorrect or improper use of the hardware.



**WARNING:** A warning that actions, operation or configuration may result in regulatory noncompliance, safety issues or equipment damage.

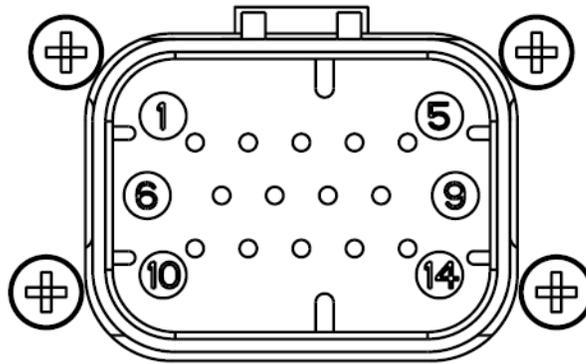
# INSTALLATION AND SETUP

This chapter contains instructions and tips to set up your GPS 6000 to create a GNSS receiver system.

## GPS 6000 SETUP

Complete the following steps to connect and power the GPS 6000.

1. Mount the GPS 6000 on a secure, stable structure with an unobstructed view of the sky from horizon to horizon.
2. Connect the Ag Leader interface cable to the COM and Power port on the back of the GPS 6000.



Pin	Use	Pin	Use
1	COM1 TxD	8	RESERVED (Do not connect)
2	COM1 RxD	9	Power Negative/Return
3	COM2 TxD	10	Emulated Radar Output
4	COM2 RxD	11	MKI (Mark Input)
5	Signal Ground (COM/ER/MKI/PPS)	12	PPS (Pulse Per Second) Output
6	CAN+	13	RESERVED (Do not connect)
7	CAN-	14	Power Positive/Source

3. Connect the serial port to your display.



**Note:** Minimum conductor size for all wiring is 0.5 mm / 20 AWG.

## POWER SUPPLY REQUIREMENTS

The GPS 6000 requires +8 to +36 VDC for the input power to the receiver. See [“GPS 6000 Specifications” on page 16](#) for additional power supply specifications.

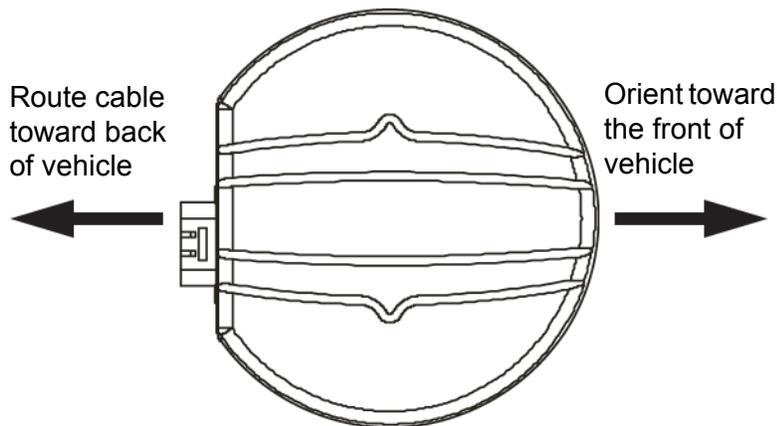


**WARNING:** The GPS 6000 power source must be protected by a 5A fast blow fuse (user supplied) or damage to wiring may result (not covered by warranty).

## MOUNTING THE GPS 6000

Mount the GPS 6000 on a secure, stable structure capable of safe operation in the specific environment.

- If installing on a vehicle, mount the GPS 6000 on the vehicle roof, ideally close to the pivot point of the vehicle. The GPS 6000 must be mounted with the connector facing the rear of the vehicle.



**Note:** The GPS 6000 must be rigidly secured to the vehicle to avoid errors caused by vibration and motion.

- If installing in a stationary location, mount the GPS 6000 in a location that has a clear view of the sky so that each satellite above the horizon can be tracked without obstruction.

## ADDITIONAL FEATURES AND INFORMATION

This section contains information on the additional features of the GPS 6000, which may affect the overall design of your receiver system.

## STATUS INDICATORS

GPS 6000 LED Status Indicators provide the status of the receiver. The table below shows the meaning of the LED states in the expected sequence after power is applied.

Red 	Yellow 	Green 	Condition
Off	Off	Off	Power is not available.
On	Off	Off	Power is available but no satellites are being tracked yet
On	Flashing	Off	Tracking at least one satellite but not a valid position.
On	On	Off	Position valid in basic autonomous mode.
On	On	Flashing	SBAS tracking, but not enough data for enhanced solution.
On	On	On	Position valid in an enhanced accuracy mode (WAAS/EGNOS/MSAS/DGPS).



**Note:** Flashing means that the LED is turning on and off at a 1 Hz rate - 0.5 seconds on and 0.5 seconds off.

### Troubleshooting:

- If the power is on but the yellow LED does not flash within one minute, then no satellites are being tracked. There may be excessive blockage or the GPS 6000 may be defective. Make sure the GPS 6000 has an unobstructed view of the sky. Try power cycling the GPS 6000.
- If the yellow LED is flashing but doesn't progress to solid yellow within one minute, then insufficient satellites are being tracked or the signal quality is poor and ephemeris data cannot be received. Normally, four satellites are sufficient for a valid position as long as they are widely distributed in the sky. If LED is stuck on blinking yellow, there may be excessive signal blockage or the GPS 6000 may be defective. Make sure the GPS 6000 has an unobstructed view of the sky. Try power cycling the GPS 6000.
- If the yellow LED is on, but the green doesn't turn on within five minutes than no SBAS or DGPS positions are available. If you are using SBAS, make sure SBAS is available in your area and that the GPS 6000 is configured to enable SBAS positions (SBASCONTROL ENABLE and SELECTCHANCONFIG). For DGPS, make sure the GPS 6000 is configured with the correct serial port parameters and to accept the DGPS protocol your area is using and that your data modem is connected and working.
- The green LED blinks when SBAS is detected then it comes on solid when SBAS is enabled. The LED will stay dark if SBAS is not detected.

## EMULATED RADAR (ER)

The GPS 6000 outputs an emulated RADAR signal on the GPS 6000 cable.

The ER outputs a logic high of supply voltage minus 0.5 V minimum and logic low of 0.5 V maximum with a rise and fall time of less than 1 ms. The ER output references signal GND and provides logic low output until the receiver's speed is greater than 1 km/Hr. ER can be configured to operate at one of three distinct frequencies (26.11, 28.12 or 36.11 Hz/km/Hr, with 26.11 Hz/km/Hr being the default value) and with an effective range from 1 km/Hr to 55 km/Hr for near-horizontal applications.

See “*Emulated Radar (ER)*” on page 11 for more information.

## CONTROLLER AREA NETWORK (CAN)

NMEA 2000 is a CAN standard created by the National Marine Electronics Association and designed to support networking in marine applications. It functions over a longer physical distance, and supports more physical nodes than ISO 11783. The relationship between NMEA2000 and SAE J1939 is that J1939 is the standard, while the NMEA 2000 group has added some new messages (called PGNs or Parameter Group Numbers) and added a new, additional transport protocol called FastPacket. NMEA2000 compliant, for all intents and purposes, means J1939 compliant plus support for new NMEA2000 messages. J1939 is additionally “harmonized” with ISO 11783, a standard for the agriculture industry.

The CAN module is generally not user-interactive. The module supports the following NMEA2000 Parameter Group Number (PGN) message:

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



**Note:** Details about the PGN messages are found in the NMEA2000 specification which can be purchased directly from the National Marine Electronics Association ([www.nmea.org/](http://www.nmea.org/)).

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Available CAN Signals on the GPS 6000

CAN	Pins
CAN+	Pin 6
CAN-	Pin 7

## GETTING STARTED

### STARTING THE RECEIVER

When first powered, the GPS 6000 undergoes a complete self-test.

## EMULATED RADAR (ER)

A typical radar sensor emits radio beams that bounce off the ground and computes ground speed based on the speed at which objects are passing in front of the sensor. The output of the sensor is a digital pulse, the frequency of which is proportional to the vehicle’s ground speed. This is often used in agricultural applications such as planting and spraying. The GPS 6000 eliminates the need for separate ground-sensing radar equipment by converting the GPS-derived velocity to proportional frequency output.

## FIRMWARE UPDATES

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

firmware must be loaded into the receiver through the Ag Leader display. Once loaded, the receiver reboots and begins operating with the new firmware.



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**Note:** Direct access to a serial COM port on the GPS 6000 is required.

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## AUTHORIZATION CODE

An authorization code, commonly known as an auth-code, is required to upgrade and possibly update an GPS 6000 receiver. Auth-codes are obtained by contacting Ag Leader sales.

## UPDATING OR UPGRADING USING THE WINLOAD UTILITY

WinLoad is the simplest and most common way to update or upgrade an GPS 6000 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.

## GPS 6000 APPLICATION SOFTWARE

The GPS 6000 receiver has two types of software loaded, the OEMStar firmware and the GPS 6000 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 6000, such as Emulated Radar.

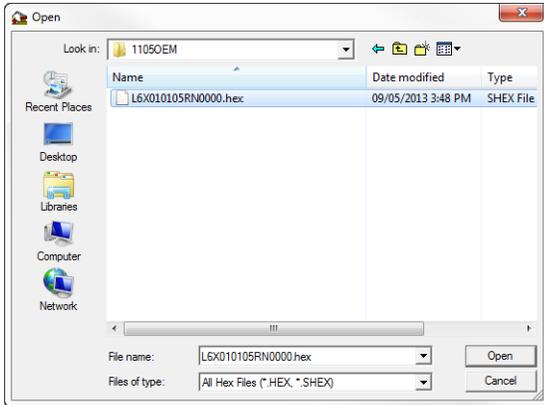
The Application Software is available from the Ag Leader website at <http://www.agleader.com/>.

It is loaded onto the GPS 6000 receiver using the same procedures used for the OEMStar firmware. An authorization code is not required for Application Software updates.

## USING THE WINLOAD UTILITY

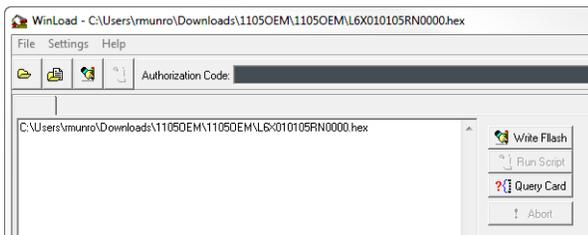
If opening WinLoad for the first time, ensure the file and communications settings are correct.

## Open a File to Download



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

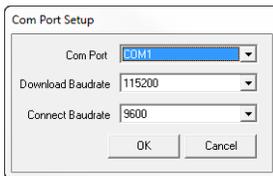
WinLoad's Open Window



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

Open File in WinLoad

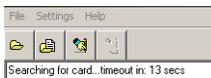
## Communications Settings



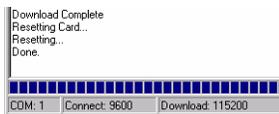
To set the communications port and baud rate, select Settings COM Settings. Choose the computer port to use from the Com Port drop down list and the baud rate from the Download Baudrate drop down list. Set the baud rate as high as possible (the default of 115200 is preferred).

## 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.

# TECHNICAL SPECIFICATIONS

## GPS 6000 RECEIVER PERFORMANCE

PERFORMANCE			
Channel Configuration	14 GPS L1 12 GPS L1 + 2 SBAS <sup>a</sup> 10 GPS L1 + 4 GLONASS L1 8 GPS L1 + 6 GLONASS L1 8 GPS L1 + 4 GLONASS L1 + 2 SBAS <sup>a</sup> 10 GPS L1 + 2 GLONASS L1 + 2 SBAS <sup>a</sup> 7 GPS L1 + 7 GLONASS L1 14 GLO L1		
Horizontal Position Accuracy (RMS) <sup>b</sup>	Absolute Autonomous 1.5 m SBAS <sup>a</sup> 0.9 m DGPS 0.5 m		
Measurement Precision (RMS)		GPS	GLONASS
	L1 C/A Code	5 cm	35 cm
	L1 Carrier Phase	0.6 mm	1.5 mm
Maximum Data Rate	Measurements	10 Hz	Position 10 Hz
Time to First Fix	Cold Start <sup>c</sup>	85 s	Hot Start <sup>d</sup> 55 s
Signal Reacquisition	L1 <1.0 s (typical)		
Time Accuracy (RMS)	GPS 20 ns	GLONASS	40 ns
Velocity Accuracy <sup>e</sup> (RMS)	0.05 m/s		

a. Satellite Based Augmentation Systems (SBAS) include WAAS (North America), EGNOS (Europe) and MSAS (Japan).

b. Typical values. Performance specifications subject to GPS system characteristics, US DOD operational degradation, ionospheric and tropospheric conditions, satellite geometry, baseline length, multipath effects and the presence of intentional or unintentional interference sources.

c. Typical value. No almanac or ephemerides and no approximate position or time.

d. Typical value. Almanac and recent ephemerides saved and approximate time entered.

e. Export licensing restricts operation to a maximum velocity of 515 metres per second.

# GPS 6000 SPECIFICATIONS

INPUT/OUTPUT CONNECTORS	
GPS 6000 COM/PWR	+8 to +36 V DC at 2.5 W (typical while logging) <sup>a</sup>
Serial Com Ports	RS-232 F Compliant (Rx and Tx signals only)
CAN	SAE J1939/ ISO 11783/ ISO 11898 Compatible
Emulated Radar Output	High = Supply Voltage -0.5V Minimum Low = 0.5V Maximum Load ≥ 3k Ohm
PPS Output	3.3V CMOS Logic Compatible
MKI Input	3.3V CMOS Logic / 5V Tolerant

INPUT/OUTPUT CONNECTOR PROTECTION	
Electrical Conducted/ Coupled disturbance tolerance	ISO 7637-2:2004 Functional Class A: Pulses 2a, 3a, 3b, 4 Functional Class C: Pulses 1, 2b

LED INDICATORS	
See <i>"Status Indicators" on page 10</i>	

PHYSICAL	
Size	155.3 x 66.8 x Φ155 mm <sup>b</sup>
Weight	495 g maximum

ENVIRONMENTAL	
Operating Temperature	-40C to +75C
Storage Temperature	-55C to +90C
Humidity	MIL-STD-810G-Method 507.5
Immersion	MIL-STD-810G Method 512.5
Vibration <sup>c</sup>	Random MIL-STD-810G 514.6E-1 Sinusoidal ASAE EP455, Section 5.15.2 Level 1 & 2 Shock MIL-STD-810-G Method 516.6

a. When tracking GPS satellites.

b. Φ denotes diameter

c. See *"Notice" on page 4.*

## GPS 6000 STROBES

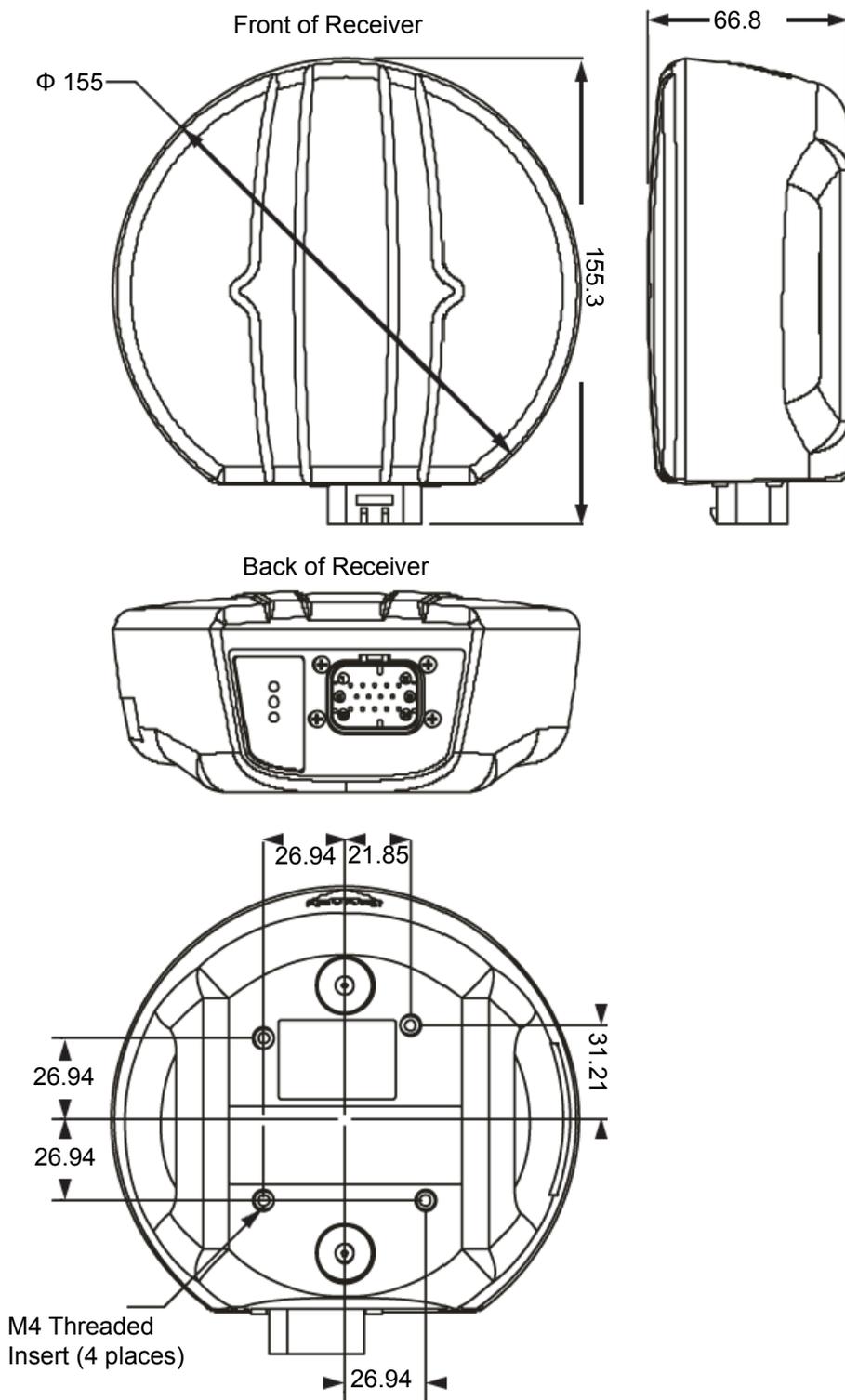
Strobes	Default Behavior	Input/Output	Factory Default	Comment
Event Mark In (MKI)	Dedicated pin	Input Leading edge triggered	Active low	An input mark for which a pulse greater than 150 ns triggers certain logs to be generated.
PPS	Dedicated pin	Output	Active low	A time synchronization output. This is a pulse where the leading edge is synchronized to receiver-calculated GPS time.

## GPS 6000 INPUT/OUTPUT ELECTRICAL SPECIFICATIONS

I/O Line	Sym	Minimum (V)	Typical (V)	Maximum (V)	Current (mA)	Conditions <sup>a</sup>
PPS	V <sub>OL</sub>			0.8 V	-4 mA	With on-board I/O supply, VDDIO=3.3V
	V <sub>OH</sub>	2.3 V			-8 mA	
MKI	V <sub>IL</sub>			0.8 V	0.25 mA	
	V <sub>IH</sub>	2.0 V			0.30 mA	

a. The above characteristics are applicable over the operating temperature range.

# DIMENSIONS



All dimension are in millimeters.

# REPLACEMENT PARTS

The following are lists of the replacement parts available for your Ag Leader GPS 6000 receiver. Should you require assistance, or need to order additional components, contact your local dealer or Customer Service representative.

## GPS 6000 PRODUCT

Part Description	Part Number
GPS 6000	4004230
Cable: Single Port, 14-pin socket to DB-9 connector, 18 ft (5.5 m)	4004173-18
Mounting Plate	4004258
GPS 6000 Installation and Operation User Manual	2006238

