Ag Leader® Technology


# GPS 6500

Operator Manual

Ag Leader PN 2006239 Rev. A

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## Specifications



## Replacement Parts

# GPS 6500 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 and for the following time periods:

GPS 6500 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 |

# NOTICE

The following notices apply to the GPS 6500.

**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 6500 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 6500
- Increase the separation between the equipment and the GPS 6500
- Connect the equipment to an outlet on a circuit different from that to which the GPS 6500 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 6500.

# INDUSTRY CANADA

GPS 6500 Class B digital apparatuses comply with Canadian ICES-003.

GPS 6500 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 6500 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 6500 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 6500 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

# 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: 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*.

# 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*

# Introduction


The GPS 6500 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 120 channels. SBAS (Satellite Based Augmentation Systems) includes WAAS (North America), EGNOS (Europe) and MSAS (Japan). SBAS support is standard. The GPS 6500 rear panel also features Light Emitting Diodes (LEDs) for status indication.

Once properly powered, the GPS 6500 begins operating as a fully functional GNSS system.

## Features and Models

The main features of the GPS 6500 are:

- an enhanced high performance GNSS L1/L2 receiver
- a high performance GNSS L1/L2 antenna
- a CAN port
- three (3) RS-232 COM ports
- three (3) LED status indicators
- a water and dust tight enclosure

# Installation and Setup

## GPS 6500 Setup

Complete the following steps to connect and power the GPS 6500.

1. Mount the GPS 6500 on a secure, stable part of a vehicle (i.e., cab roof) with an unobstructed view of the sky from horizon to horizon.

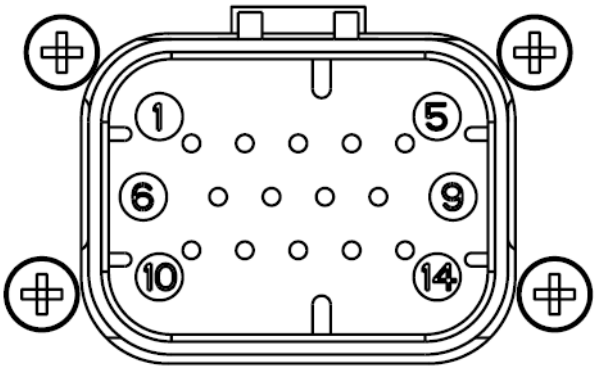



**Table 1:** GPS 6500 Connector Pin-Out

| 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 |

***CAUTION:*** 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 6500 requires +8 to +36 VDC input power.

**WARNING:** The GPS 6500 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 6500

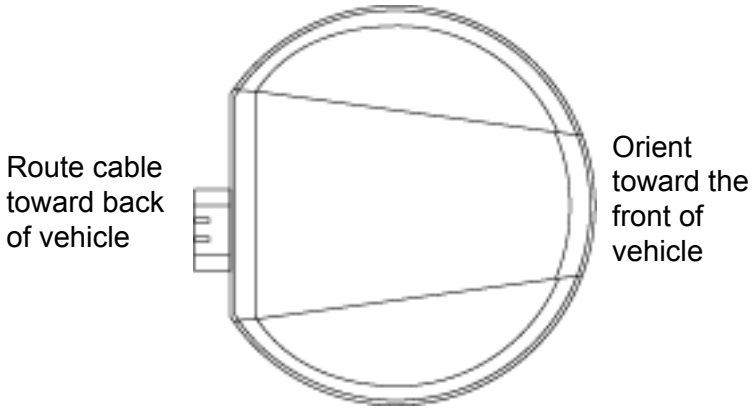
Mount on a secure, stable structure capable of safe operation in the specific environment. Typical installation is a vehicle roof, ideally close to the pivot point of the vehicle.

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

***CAUTION:*** The GPS 6500 must be rigidly secured to the vehicle to avoid errors caused by vibration and motion.

## Physical Installation

The GPS 6500 must be mounted with the connector facing the rear of the vehicle.




# Additional Features and Information

This section contains information on the additional features of the GPS 6500, which may affect the overall design of the receiver system.

## Status Indicators

LED indicators on the GPS 6500 provide the status of the receiver. The table below shows the meaning of the LEDs.

| Icon | LED Color | State | Description |
|---|---|---|---|
|  | Green | Position Valid | Indicates a valid GNSS position solution is available |
|  | Yellow | Error | - Receiver is in the error state and tracking is disabled Possible cause:<br>a fatal error<br>an unusual receiver status indicator, setup to act like a fatal error Note: Error status remains until the cause of the error is corrected and the receiver is reset |
| [  | Red | Power | Power is on |

## Controller Area Network (CAN)

The GPS 6500 supports the following NMEA2000 Parameter Group Messages (PGN):

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

• PGN 129026 COGandSOGRapidUpdate (10 Hz)

**Table 2:** Available CAN Signals on the GPS 6500

| CAN | Pins |
|---|---|
| CAN+ | Pin 6 |
| CAN- | Pin 7 |

# 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 6500 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 6500 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 6500 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 6500 receiver has two types of software loaded, the OEMStar firmware and the GPS 6500 Application Software. The OEMStar firmware provides the features that are common to all OEMStar receiver.

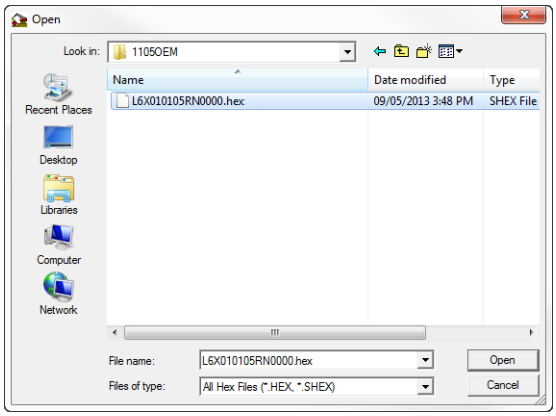
The Application Software provides the special features available on the GPS 6500, such as Emulated Radar.

The Application Software is available at *http://www.agleader.com/support/* and is loaded onto the GPS 6500 receiver using the same procedures used for the OEMStar firmware. An authorization code is not required for Application Software updates.

# Using the WinLoad Utility

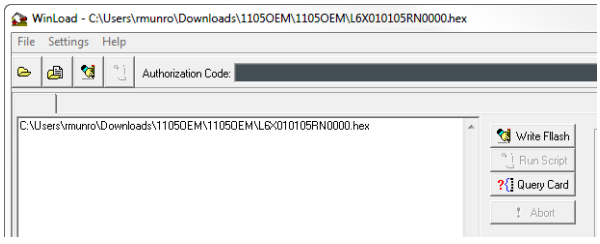
If opening WinLoad for the first time, ensure the file and communications settings are correct.

## Open a File to Download




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

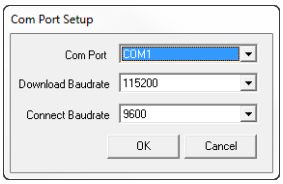
WinLoad's Open Window




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

Open File in WinLoad

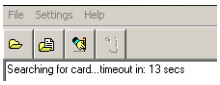
## Communications Settings



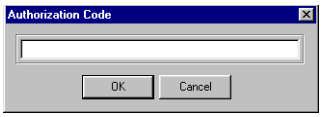

To set the communications port and baud rate, select Settings COM Settings. Choose the computer port to use from the Com Port drop down list and the baud rate from the Download Baudrate drop down list. Set the baud rate as high as possible (the default of 115200 is preferred).

## Downloading Firmware

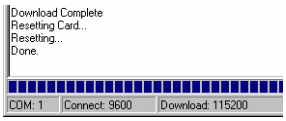
1. Select the file to download.
2. Ensure the file path and name are displayed in main display area.
3. Click Write Flash to download the firmware.




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.

# SPECIFICATIONS

## GPS 6500 RECEIVER PERFORMANCE

A.1 GPS 6500 Receiver Performance

| | PERFORMANCE[a] | | |
|---|---|---|---|
| Channel Configuration | 120 Channels can be configured to track: | | |
| | L1 GPS | | |
| | L2 GPS (optional) | | |
| | L2C GPS (optional) | | |
| | L1 GLONASS (optional) | | |
| | L2 GLONASS (optional) | | |
| | Galileo E1 (optional) | | |
| | BeiDou B1 (optional) | | |
| | SBAS[b] | | |
| | L-Band (optional) | | |
| Horizontal Position Accuracy (RMS)[c] | Single Point | 1.5 m | |
| | Single Point L1/L2 | 1.2 m | |
| | SBAS[c] | 0.6 m | |
| | DGPS | 0.4 m | |
| | NovAtel CORRECT™ | TERRASTAR-D[d] | 6 cm |
| | | RT-2® | 1 cm + 1ppm |
| Measurement Precision (RMS) | | GPS | GLO |
| | L1 C/A code | 4 cm | 15 cm |
| | L1 carrier phase | 0.5 mm | 1.5 mm |
| | L2 P(Y) code[f] | 8 cm | 8 cm |
| | L2 carrier phase[d] | 1.0 mm | 1.5 mm |
| | L2C code[g] | 8 cm | 8 cm |
| | L2C carrier phase[e] | 1.0 mm | 1.5 mm |
| Maximum Data Rate[h] | Measurements up to 50 Hz | | |
| | Position up to 50 Hz | | |

| | PERFORMANCE[a] | | |
|---|---|---|---|
| Time to First Fix | Cold Start[i] | <50 s | |
| | Hot Start[j] | <35 s | |
| Signal Reacquisition | L1 0.5 s (typical) | | |
| | L2 1.0 s (typical) | | |
| Time Accuracy | 20 ns RMS | | |
| Velocity Accuracy[k] | 0.03 m/s RMS | | |

a. 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.

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

c. GPS only.

d. TERRASTAR-D subscriptions are available from Ag Leader

f. L2 P for GLONASS.

g. L2 C/A for GLONASS.

h. Model specific.

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

j. Typical value. Almanac and recent ephemerides saved and approximate time entered. For more information.

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

# GPS 6500 SPECIFICATIONS

| | PHYSICAL |
|---|---|
| Size | 80.9 x Φ 155 mm[a] |
| Weight | <550 g |
| Mounting | 2 x magnetic mount |
| | 4 x M4 screw inserts |
| | Optional mounting plate |

| | ENVIRONMENTAL[b] |
|---|---|
| Operating Temperature | -40C to +75C |
| Storage Temperature | -55C to +90C |
| Humidity | Not to exceed 95% non-condensing |
| Immersion | MIL-STD-810G Method 512.5 Procedure 1 |
| Solar Radiation | EN60950-22 8.2<br>MIL-STD-810G Method 505.5 |
| Salt Fog | MIL-STD-810G, 509.5 |
| Sand and Dust | MIL-STD-810G, 510.5 |
| Vibration | Random: MIL-STD-810G, Method 514.6E-1 |
| | Sinusoidal: IE 68-2-6 ASAE ER455, 5.15.2 Level 1 & 2 |
| Shock | MIL-STD-810G Method 516.6 |
| Compliance | FCC, IC, CE |
| Ingress Protection Rating | IP67 |

| | POWER REQUIREMENTS |
|---|---|
| Input Voltage | +8 to +36 V DC |
| Power Consumption | 2.9 W [c] |

| | 14-PIN INPUT/OUTPUT CONNECTOR |
|---|---|
| Power | +8 to +36 V DC<br>For the cable pin-outs and drawings, see *"GPS 6500 Setup" on page 7*. |
| Serial Com Ports | RS-232 F Compliant (Rx and Tx signals only) |
| CAN | SAE J1939/ ISO 11783/ ISO 11898 Compatible |
| PPS Output | 3.3 V CMOS Logic Compatible |
| MKI Input | 3.3 V CMOS Logic/5 V 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 |
|---|---|
| Power,<br>Error<br>Position Valid | Refer to *"Status Indicators" on page 9* for details. |

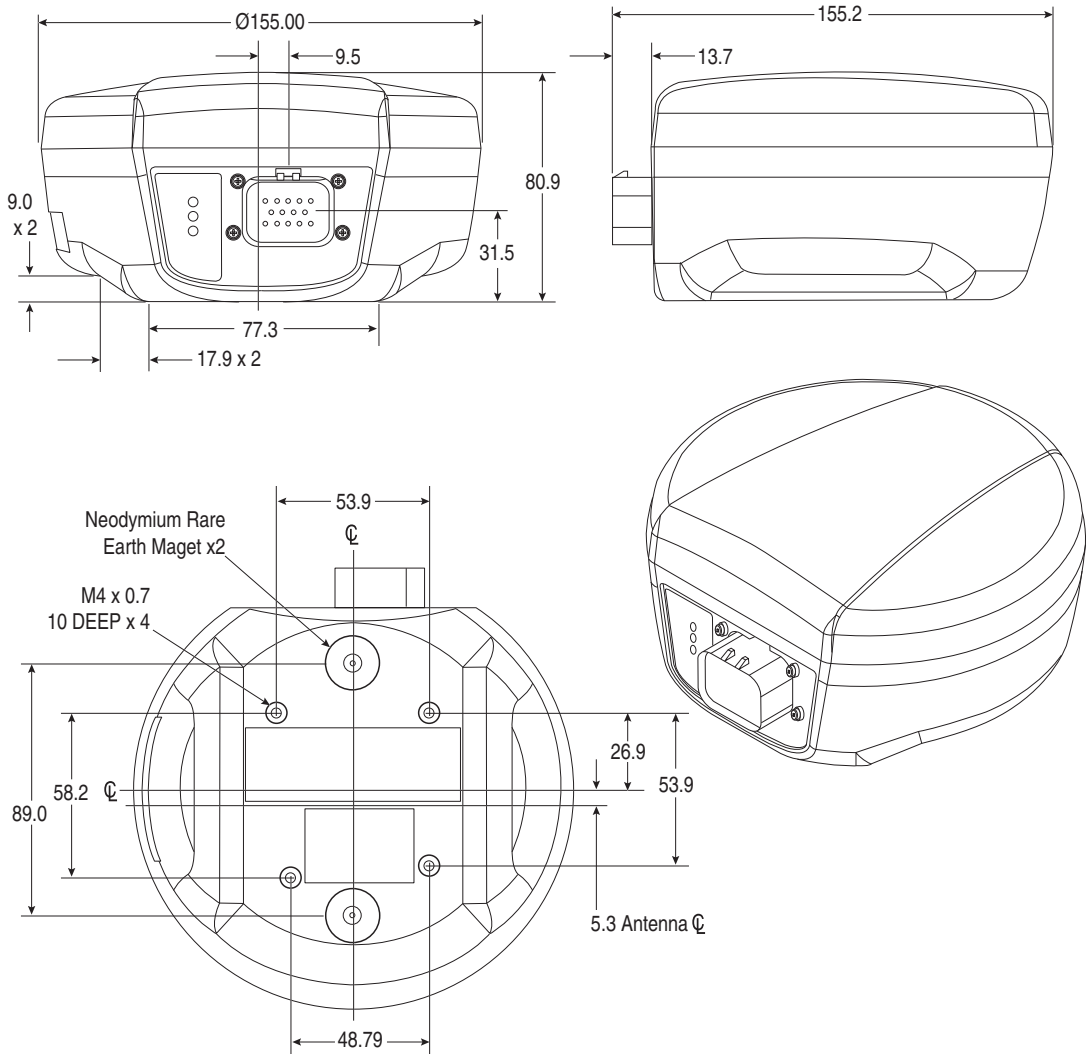
a. Φ denotes diameter, here and in *"GPS 6500 Dimensions" on page 17*.

b. See also the Notice section of this manual starting on *"Notice" on page 4*.

c. Power consumption values for GPS L1/L2.

# GPS 6500 DIMENSIONS

Dimensions are in millimeters



# REPLACEMENT PARTS

The following are a list of the replacement parts available for the Ag Leader GPS 6500 receiver. Should assistance be required or need to order additional components, please contact your local Ag Leader dealer or Customer Service representative.

Table 3: GPS 6500 kit

| Part Description | NovAtel Part |
|---|---|
| GPS 6500 | 4004231 |
| Cable: 14-pin socket to DB-9 connectors | 4004175-18 |
| Mounting Plate Kit | 4004159 |
| Operators Manual | 2006239 |