



AG-Star User Manual

AG-Star User Manual

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AG-Star Receiver	One (1) Year
Cables and Accessories	Ninety (90) Days
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#5,101,416*	#5,734,674	#6,243,409 B1
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Notices

The following notices apply to the AG-Star.



Changes or modifications to this equipment not expressly approved by NovAtel Inc. could void the user's authority to operate this equipment.

FCC

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.

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



In order to maintain compliance as a Class B digital device, you must use shielded interface cables.

Bluetooth

AG-Star-B contains a Bluetooth radio with the following approvals:

- FCC ID: UTU01019126

Innovation, Science and Economic Development Canada (ISED)

AG-Star Class B digital device complies with Canadian ICES-003.

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

This device complies with ISED licence-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.

Bluetooth

AG-Star-B contains a Bluetooth radio with the following approvals

- IC: 129A-01019126

European Union (EU)

NovAtel Inc. declares that the AG-Star Bluetooth 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:

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

Radio Information

Description of Service: Bluetooth 2.0

Operational Frequency: 2400 MHz to 2480 MHz

Modulation: 4-DQPSK/8DPSK

Rated Power: 3.8 dBm e.i.r.p

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

WEEE Notice

If you purchased your AG-Star 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.

RoHS

The AG-Star 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 AG-Star 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>.

E-mark

The AG-Star has been granted EC type approval of an electric/electronic subassembly with respect to electromagnetic compatibility ECE Regulation 10.04. Therefore the equipment is labeled with the following approval marks.



10 R - 04 8644

International Type Approvals

Brazil



05515-18-04537

Eurasian Economic Community

Armenia, Belarus, Kazakhstan, Kyrgyzstan and Russia



Customer Support

NovAtel Knowledge Base

If you have a technical issue, browse to the NovAtel Web site at novatel.com then select Support | Search and Browse Support Materials. Through this page, you can search for information about SMART® antennas and other technologies, information about NovAtel hardware and software, and installation and operation issues.

Before Contacting Customer Support

Before contacting NovAtel Customer Support about a software problem perform the following steps:

1. Issue the following logging commands to collect data to a file on your computer for 15 minutes:

```
LOG VERSIONA ONCE
LOG RXSTATUSA ONCHANGED
LOG RXCONFIGA ONCE
LOG RAWEPHEMA ONNEW
LOG BESTPOSA ONTIME 1
LOG RANGEA ONTIME 1
LOG GLORAWEPHEMB ONCHANGED1
```

2. Send the file containing the logs to NovAtel Customer Support, through the support@novatel.com e-mail address.
3. You can also issue a FRESET command to the receiver to clear any unknown settings.



The FRESET command will erase all user settings. You should know your configuration and be able to reconfigure the receiver before you send the FRESET command.

If you are having a hardware problem, send a list of the troubleshooting steps taken and results.

Contact Information

Log a support request with NovAtel Customer Support using one of the following methods:

Log a Case and Search Knowledge:

Website: www.novatel.com/support

Log a Case, Search Knowledge and View Your Case History: (login access required)

Web Portal: <https://novatelsupport.force.com/community/login>

E-mail:

support@novatel.com

Telephone:

U.S. and Canada: 1-800-NOVATEL (1-800-668-2835)

International: +1-403-295-4900

1. For GLONASS channel configuration.

The AG-Star 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. Refer to *An Introduction to GNSS*, available from our web site at novatel.com/an-introduction-to-gnss/ for an overview of each of the above signal types. The AG-Star rear panel also features light emitting diodes (LEDs) for status indication.

Once properly powered, the AG-Star begins operating as a fully functional GNSS system. *Figure 1, AG-Star Receiver* shows the AG-Star without connecting cables.

Figure 1: AG-Star Receiver



1.1 Models and Features

The main features of the AG-Star 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 or one (1) RS-232 COM port and Bluetooth®
- three (3) LED status indicators
- a water and dust tight enclosure
- Bluetooth wireless technology (optional)

The AG-Star is available in several different firmware models whose configurations may include other additional features. Some possible configurations can be seen in *Table 1, AG-Star Models*.

Table 1: AG-Star Models

Model Name	NovAtel Part #	Firmware Features
AG-Star	01019131	GPS L1, GLONASS L1, SBAS and emulated radar output
AG-Star-B with Bluetooth	01019129	GPS L1, GLONASS L1, SBAS, emulated radar output and Bluetooth

Refer also to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) for information on receiver communications and operation.

1.2 Scope

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

An AG-Star system requires the addition of accessories and a power supply.

The AG-Star utilizes a comprehensive user-interface command structure, which requires communications through its communications ports. This manual describes the AG-Star specific commands and logs, see *Appendix B, Commands* on page 50 and *Appendix C, Logs* on page 61. For descriptions of other commands and logs available for AG-Star, refer to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) available from the NovAtel web site (novatel.com/support/smart-antennas/ag-star). It is recommended that these documents be kept together for easy reference.

AG-Star output is compatible with Waypoint post-processing software from NovAtel. Visit our web site at novatel.com for details.

1.3 Conventions

The following conventions are used in this manual:



Information that supplements or clarifies text.



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



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

- The letter H in the *Offset* columns of the commands and logs tables represents the header length for that command or log. Refer to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) for ASCII and binary header details.
- The number following 0x is a hexadecimal number.
- Command descriptions' brackets, [], indicate optional parameters.
- In tables where values are missing they are assumed to be reserved for future use.
- Status words are output as hexadecimal numbers and must be converted to binary format (and in some cases then also to decimal). For an example of this type of conversion, refer to the RANGE log in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#).
- Conversions and their binary or decimal results are always read from right to left. For a complete list of hexadecimal, binary and decimal equivalents, search our support materials for novatel.com/support/knowledge-and-learning/unit-conversions on the NovAtel web site.

See also *Syntax Conventions* on page 50 for more syntax when entering commands.

This chapter contains instructions and tips to set up your AG-Star to create a GNSS receiver system.

2.1 Additional Equipment Required

In order for the receiver to perform optimally, the following additional equipment is required:

- A cable harness for powering and communicating with the AG-Star.
You can use a NovAtel cable (such as part number 01018256) or a custom cable. See *Appendix A, Technical Specifications* on page 43 for information about the AG-Star connector pinout and NovAtel cables.
- A fused power supply (user-supplied)
- A computer (user-supplied)

2.1.1 AG-Star Setup

Complete the following steps to connect and power the AG-Star.

1. Mount the AG-Star on a secure, stable structure with an unobstructed view of the sky from horizon to horizon. Refer to *Section 2.1.4, Mounting the AG-Star* on page 17 for details.
2. Connect the NovAtel interface cable, or custom interface cable, to the *COM and Power* port on the back of the AG-Star, see *Figure 2, AG-Star Connector*.

Figure 2: AG-Star Connector

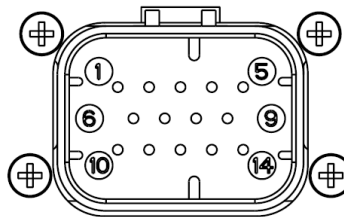



Table 2: AG-Star Connector Pin-Out

Pin	Use	Pin	Use
1	COM1 TxD	8	RESERVED (Do not connect)
2	COM1 RxD	9	Power Negative/Return
3	COM2 TxD ^a	10	Emulated Radar Output
4	COM2 RxD ^a	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

a. On Bluetooth models, COM2 is not available.

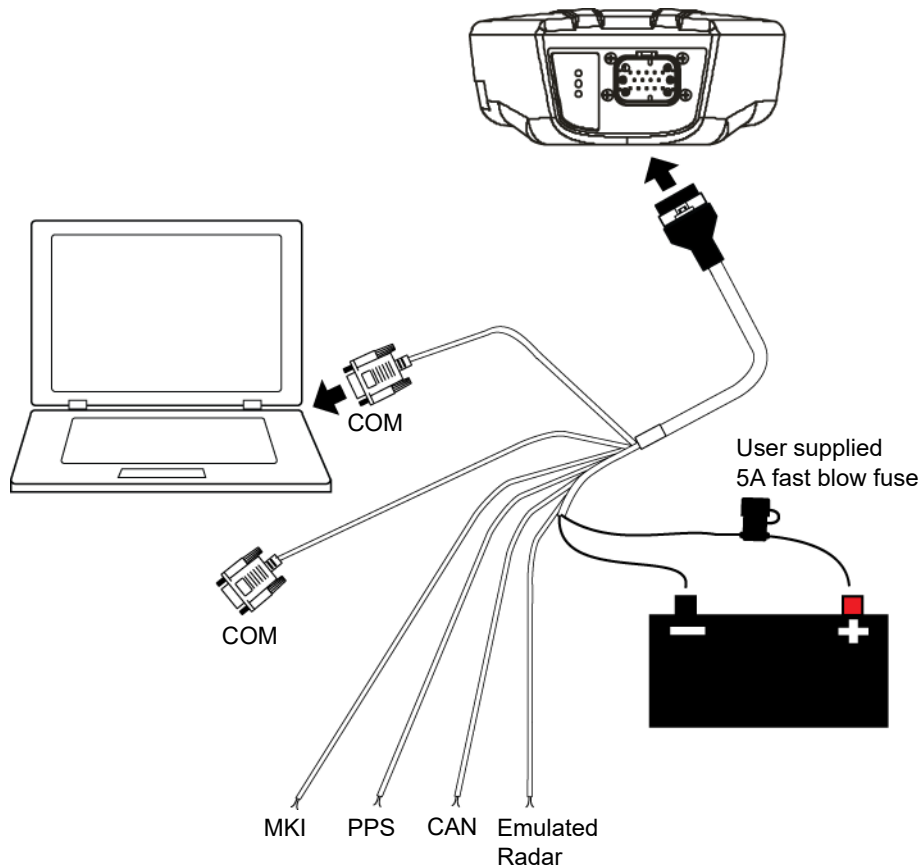
3. Connect the NovAtel or custom cable to a DB-9 serial port on a computer or other data storage device.

4. Connect the NovAtel or custom cable to the power supply and turn on the power supply. The power LED  on the receiver glows red when the AG-Star is properly powered.



Fuse/holder recommendations can be found in *Table 9, Recommended Fuse and Fuse Holders* on page 49.

Figure 3: Simplified AG-Star Setup



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

2.1.2 Power Supply Requirements

The AG-Star requires +8 to +36 VDC for the input power to the receiver. See *Section A.2, AG-Star Specifications* on page 44 for additional power supply specifications.

The AG-Star cable provides power in (labeled BATT+) and power ground (labeled BATT-) bare wires for connections from the AG-Star to a vehicular power system (or equivalent). For cable details see *Section A.2.3, AG-Star Connector and Cable Requirements* on page 49.

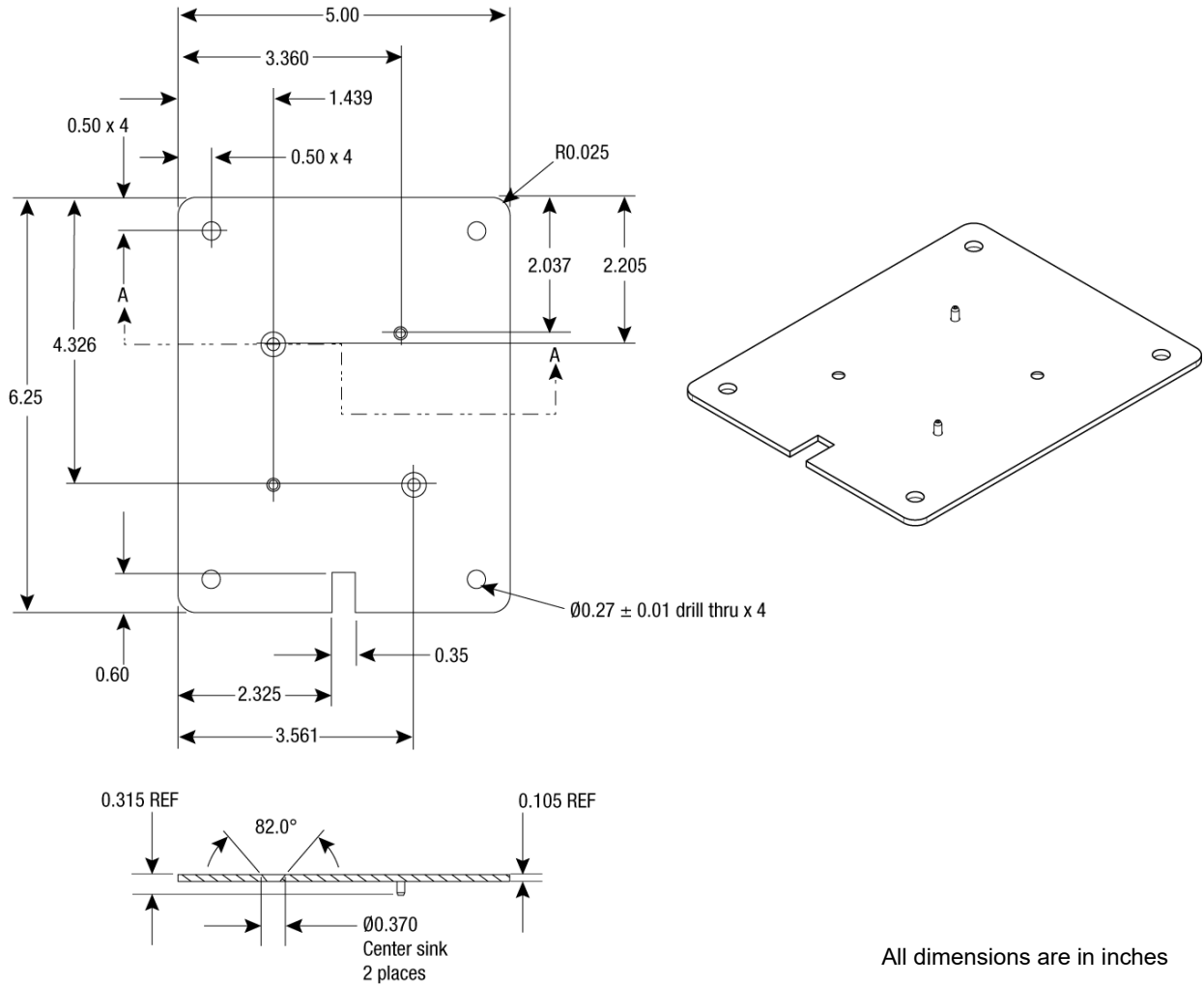


The AG-Star power source must be protected by a 5A fast blow fuse (user supplied) or damage to wiring may result (not covered by warranty).

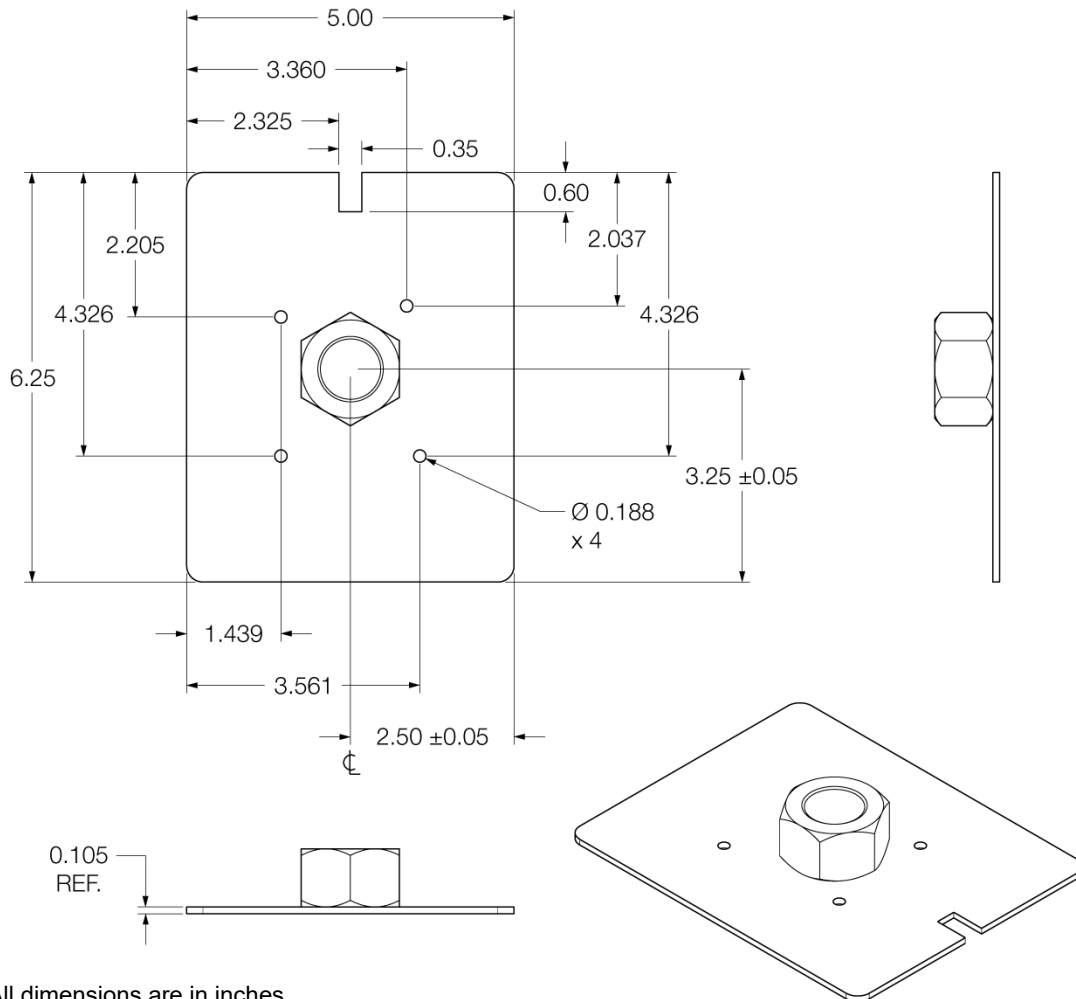
2.1.3 Mounting Plate

Two mounting plates are available to facilitate mounting the receiver: a surface mounting plate and a pole mounting plate.

Figure 4: AG-Star Surface Mounting Plate (01018317)



To install the surface mounting plate provided with the AG-Star Development Kit, use the adhesive tape provided or the mounting holes at each corner of the plate.

Figure 5: AG-Star Pole Mounting Plate (01019142)

All dimensions are in inches



To install the pole mounting plate:

1. Use four M4 screws to connect the mounting plate to the AG-Star.
2. Screw the mounting plate onto a mount, such as a range pole, tribrach, or tripod, with a 1" x 14 thread.
A 5/8" to 1" bushing adapter is available (part number 12023275).

2.1.4 Mounting the AG-Star

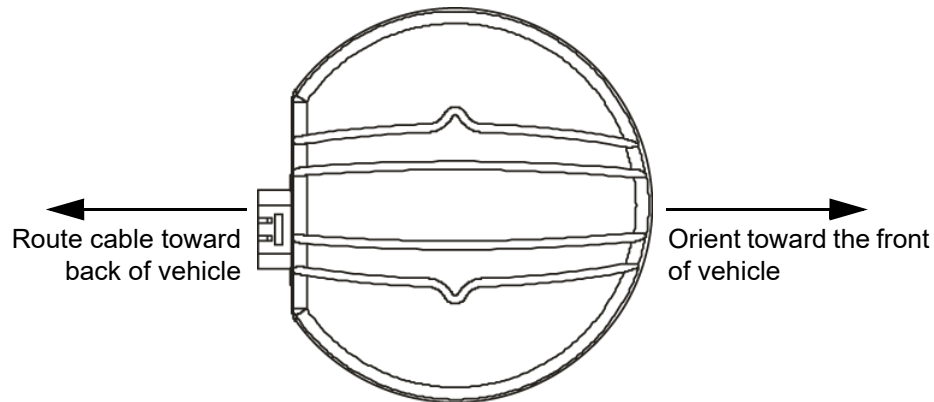
Mount the AG-Star on a secure, stable structure capable of safe operation in the specific environment.

- If installing on a vehicle, mount the AG-Star on the vehicle roof, ideally close to the pivot point of the vehicle. The AG-Star must be mounted with the connector facing the rear of the vehicle (see *Figure 6, AG-Star Orientation*).



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

Figure 6: AG-Star Orientation



The optimal screw penetration into the AG-Star mounting holes is 6 mm (± 1 mm) deep. When selecting screws for mounting the AG-Star ensure the screw penetration does not exceed this specification. Using excessively long screws can damage the AG-Star enclosure.

- If installing in a stationary location, mount the AG-Star 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* found at novatel.com/an-introduction-to-gnss/.

2.1.5 Connecting Data Communications Equipment

To communicate with the receiver by sending commands and obtaining logs, a connection to data communications equipment is required. See *Table 7, AG-Star Communication/Power Cable Pinouts* on page 48 for more information.




2.2 Additional Features and Information

This section contains information on the additional features of the AG-Star, which may affect the overall design of your receiver system.

2.2.1 Status Indicators

LED indicators on the AG-Star provide the status of the receiver. *Table 3, AG-Star LED Status Indicators* shows the meaning of the LED states in the expected sequence after power is applied.

Table 3: AG-Star LED Status Indicators

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).



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 AG-Star may be defective. Make sure the AG-Star has an unobstructed view of the sky. Try power cycling the AG-Star.
- 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 AG-Star may be defective. Make sure the AG-Star has an unobstructed view of the sky. Try power cycling the AG-Star.
- 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 AG-Star is configured to enable SBAS positions (SBASCONTROL ENABLE and SELECTCHANCONFIG). For DGPS, make sure the AG-Star 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.

2.2.2 MKI and PPS Strokes

The Mark Input (MKI) and Pulse Per Second (PPS) strobes provide status and synchronization signals. PPS is a 3.3V CMOS output; MKI is a 5V logic tolerant input. For more information about the PPS and MKI signals, see *Section A.2, AG-Star Specifications* on page 44.

Pin-out information can be found in *Table 7, AG-Star Communication/Power Cable Pinouts* on page 48.

2.2.3 Emulated Radar (ER)

The AG-Star outputs an emulated RADAR signal via the bare wires labeled *ER_GND* and *ER_OUT* on the AG-Star cable. See *Table 7, AG-Star Communication/Power Cable Pinouts* on page 48 for the pin-out details of this 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 *Section B.5, RADARCFG Configure the ER Output* on page 57 for more information.

2.2.4 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. It is activated when a SETCANNAME command (see page 60) is entered, and after a SAVECONFIG, the CAN module is activated immediately on all subsequent start-ups. The module supports the following NMEA2000 Parameter Group Message (PGN):

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



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/).

Table 4: Available CAN Signals on the AG-Star

CAN	Pins
CAN+	Pin 6
CAN-	Pin 7

Before operating the AG-Star for the first time, ensure that you have followed the installation instructions in *Chapter 2, Installation and Setup* on page 13. It is assumed that a computer is used during initial operation and testing for greater ease and versatility.

3.1 Communications with the Receiver

Communication with the receiver typically consists of issuing commands through the communication ports from an external serial communications device. This could be either a terminal or computer that is directly connected to the receiver serial port using a DB-9 connector on the AG-Star multi-cable. If you are using a radio, it connects to another DB-9 connector on the same multi-cable by means of the radio serial cable supplied with the radio. It is recommended that you become thoroughly familiar with the commands and logs detailed in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) to ensure maximum utilization of the receiver's capabilities.



When power is applied to the AG-Star, the Power LED lights and the AG-Star begins a self test and the boot up process. After the self test and boot up have completed, the command prompt becomes available on the serial port.

3.1.1 Serial Port Default Settings

The receiver communicates with your computer or terminal via an RS-232 serial port. For communication to occur, both the receiver and the computer or terminal have to be configured properly. The receiver's COM1 and COM2 default port settings are as follows:

- 9600 bps, no parity, 8 data bits, 1 stop bit, no handshaking, echo off

Changing the default settings requires using the *COM* command. See *Section B.2, COM Configure COM Port* on page 51 for details.

The data transfer rate you choose determines how fast information is transmitted. For example, outputting a log whose message byte count is 96. The default port settings allows 10 bits/byte (8 data bits + 1 stop bit + 1 framing bit). It therefore takes 960 bits per message. To get 10 messages per second then requires 9600 bps. Also remember that even if you set the bps to 9600, the actual data transfer rate is lower and depends on the number of satellites being tracked, data filters in use and idle time. It is suggested that you leave yourself a margin when choosing a data rate (115200 is recommended for most applications).



Although the receiver can operate at data transfer rates as low as 300 bps, this is not desirable. For example, if several data logs are active (that is, a significant amount of information needs to be transmitted every second) but the bit rate is set too low, data will overflow the serial port buffers, causing an error condition in the receiver status and loss of data.

3.1.2 Communicating Using a Remote Terminal

One method of communicating with the receiver is through a remote terminal. The receiver is pre-wired to allow proper RS-232 interface with a data terminal. To communicate with the terminal, the receiver only requires the RX, TX and GND lines to be used. Request to Send (RTS)/ Clear to Send (CTS) hardware handshaking is not available. Ensure the terminal's communications set-up matches the receiver's RS-232 protocol.

3.1.3 Communicating Using a Computer

A computer can be set up to emulate a remote terminal as well as provide the added flexibility of creating multiple command batch files and data logging storage files. Any standard communications software package that emulates a terminal can be used to establish bidirectional communications with the receiver. For example, HyperTerminal or NovAtel's Graphic User Interface (GUI) program NovAtel Connect. All data is sent as raw 8-bit binary or ASCII characters.

3.2 Getting Started

3.2.1 Starting the Receiver

When first powered, the AG-Star undergoes a complete self-test. The results of this test can be viewed by connecting to the receiver and requesting the RXSTATUS log. Refer to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) for more information.

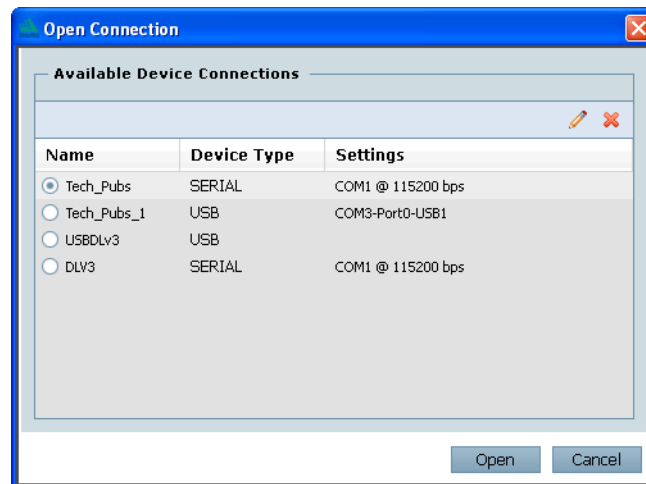
If a persistent error develops, contact your local NovAtel dealer first. If the problem is still unresolved, contact NovAtel directly through any of the methods listed in *Customer Support* on page 10.

3.2.2 Communicating with the Receiver Using NovAtel Connect

NovAtel Connect is a Windows-based GUI used to access the receiver's many features. The Convert utility is a Windows-based utility that converts between file formats and strips unwanted records for data file compilation. Both are included in the NovAtel Connect PC Utilities bundle available from: novatel.com/support/firmware-options-pc-software/novatel-connect.

Launch the NovAtel Connect program and select *Device | Open* from its main menu. The *Open Configuration* window appears.

Figure 7: Open Configuration Window



Refer to the NovAtel Connect help file by selecting the *Help | Contents* menu or pressing F1 while the cursor is in a NovAtel Connect window. Ensure the *Console* and *ASCII Messages* windows are open by selecting them from the *View* menu.

When the receiver is first turned on, no data is transmitted from the COM ports except for the port prompt. The console window displays a port name:

[COM1] if connected to COM1 port

or

[COM2] if connected to COM2 port or through Bluetooth

Any of these prompts indicate that the receiver is ready and waiting for command input.



1. You may also have to wait for output from receiver self tests. For example, on start-up, the AG-Star receiver is set to log the RXSTATUSEVENTA log ONNEW on all ports. Refer to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) for more details.
2. If you find that NovAtel Connect is unable to locate your AG-Star receiver, try using a different COM port to communicate to the receiver. Once communication has been established, issue the command FRESET STANDARD. You should now be able to use your original communication port again.

Commands are typed at the interfacing computing device's keyboard and executed after sending a carriage return character which is usually the same as pressing the <Enter> key.

An example of a response to an input command is the FIX POSITION command. It can be as:

```
[COM2] FIX POSITION 51.11635 -114.0383 1048.2 [carriage return]
<OK>
```

where [COM2] is the port prompt, followed by the command entered and [carriage return] is a prompt to press the <Enter> key.

The example above illustrates the command input to the base receiver's COM2 port, which sets the position of the base station receiver for differential operation. Confirmation that the command was actually accepted is the appearance of <OK>.

If a command is entered incorrectly, the receiver responds with:

```
<Invalid Message ID                (or a more detailed message)
```



Ensure the Control Panel Power Settings on your computer are not set to go into Hibernate or Standby modes. Data will be lost if one of these modes occurs during a logging session.

3.3 Channel Configuration

The 14 channels available on the AG-Star are configured by selecting one of eight predefined channel configuration sets using the SELECTCHANCONFIG command. For information about the SELECTCHANCONFIG command, see page 58.

3.4 Transmitting and Receiving Corrections

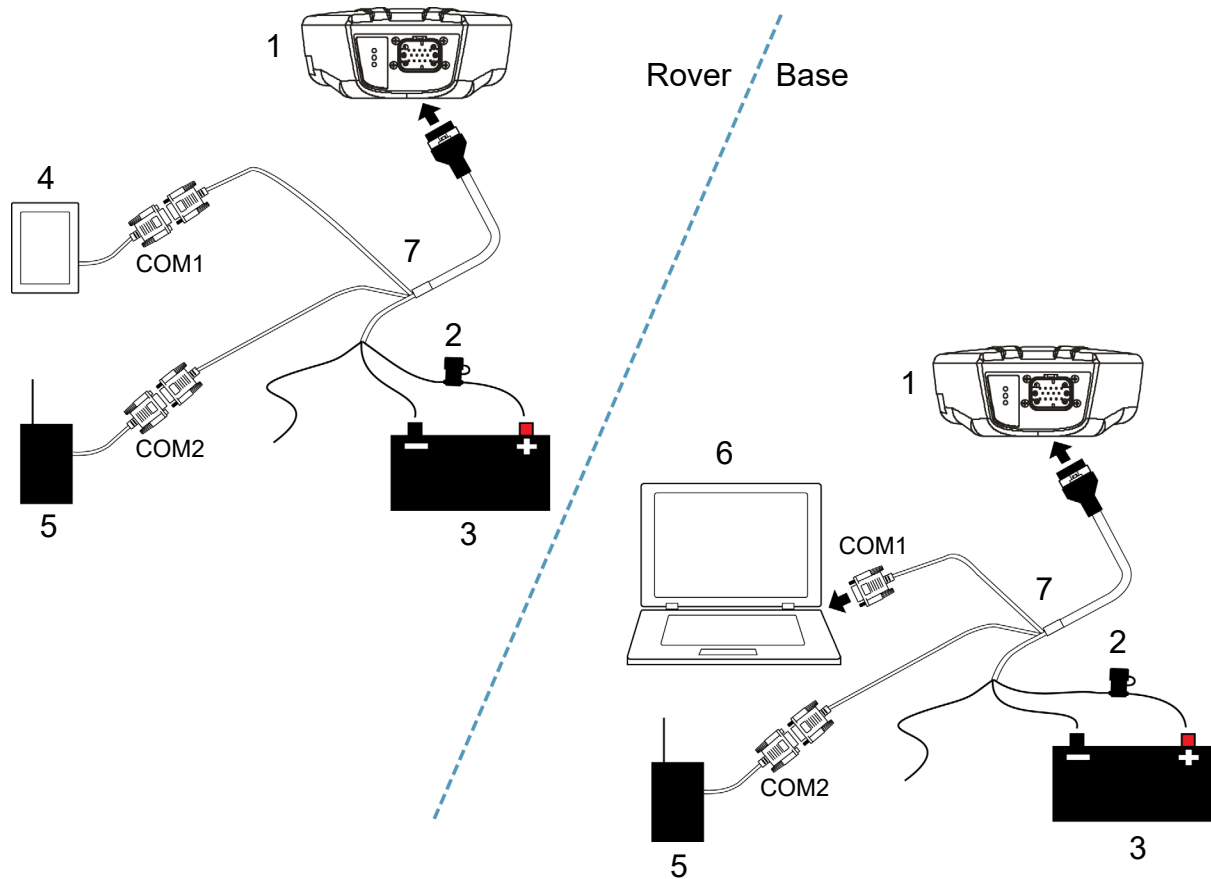
DGPS corrections can be transmitted from a base station to a rover station to improve position accuracy.



The AG-Star can receive RTCM, RTCA, CMR, CMR+, RTCM 2.3 and RTCM 3.0 corrections to resolve DGPS solutions. With the DGPS_TX model upgrade, the AG-Star can transmit non-carrier phase RTCM and RTCA corrections. Contact your local NovAtel dealer for more information. To locate a dealer in your area contact NovAtel Inc.

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 AG-Star can be used as a base receiver to transmit DGPS corrections or a rover to receive the same corrections. An example of a differential setup is given in *Figure 8, Basic Differential Setup* on page 23.

Figure 8: Basic Differential Setup



Reference	Description
1	AG-Star receiver
2	User-supplied 5A fast blow fuse
3	User-supplied power supply, for example a battery
4	User-supplied device to COM1
5	User-supplied radio device to COM2
6	User-supplied computer, for setting up and monitoring, to COM1
7	User-supplied cable or NovAtel 01018256 Communication/Power cable



The configuration shown in *Figure 8, Basic Differential Setup* is valid for AG-Star receivers without optional Bluetooth.

For an AG-Star-B receiver with Bluetooth, one of the serial devices connects through COM1 and the other devices must connect through Bluetooth.

System biases can introduce errors, refer to *An Introduction to GNSS* found on our web site at novatel.com/an-introduction-to-gnss/ for more information. In most cases, a data link between the base station and rover station (two NovAtel receivers) is needed in order to receive corrections. SBAS corrections can be accomplished with one receiver and are exceptions to the base/rover concept. Generally a link capable of data throughput at a rate of 9600 bits per second, and less than 4.0 seconds latency, is recommended.

Once the base and rover are set up, configure them as shown in the configuration examples that follow in *Section 3.4.1, Base Station Configuration* on page 24 and *Section 3.4.2, Rover Station Configuration* on page 25.

3.4.1 Base Station Configuration

At the base station, enter the following commands:

```
COM [port] bps [parity[ databits[stopbits[handshake[echo[break]]]]]]]
interfacemode port rx_type tx_type [responses]
fix position latitude longitude height
log port message [trigger [period]]
saveconfig (optional, save configuration to non-volatile memory)
```

Examples of these commands include the following:

```
RTCA pdpfilter disable
com com2 115200 N 8 1 N off
interfacemode com2 none rtca off
fix position 51.11358042 -114.04358013 1059.4105 (enter your own lat, lon, hgt)
log com2 rtca1 ontime 5
log com2 rtcaephem ontime 10 1 (optional)
saveconfig (optional, save configuration to non-volatile memory)
```

```
RTCM pdpfilter disable
com com2 115200 N 8 1 N off
interfacemode com2 none rtc off
fix position 51.11358042 -114.04358013 1059.4105 (enter your own lat, lon, hgt)
log com2 rtc1 ontime 5
saveconfig (optional, save configuration to non-volatile memory)
```

```
RTCMV3 pdpfilter disable
com com2 9600 N 8 1 N off
interfacemode com2 none rtcmv3 off
fix position 51.11358042 -114.04358013 1059.4105
log com2 rtc1006 ontime 10
log com2 rtc1003 ontime 1
saveconfig (optional, save configuration to non-volatile memory)
```

```
CMR+ pdpfilter disable
com com2 9600 N 8 1 N off
interfacemode com2 none cmr off
fix position 51.11358042 -114.04358013 1059.4105
log com2 cmrobs ontime 1
log com2 cmrplus ontime 1 (Important to use ontime 1 with cmrplus)
saveconfig (optional, save configuration to non-volatile memory)
```

```
CMR pdpfilter disable
com com2 9600 N 8 1 N off
interfacemode com2 none cmr off
fix position 51.11358042 -114.04358013 1059.4105
log com2 cmrobs ontime 1
log com2 cmrref ontime 10
log com2 cmrdesc ontime 10 1
saveconfig (optional, save configuration to non-volatile memory)
```


3.4.2 Rover Station Configuration

At the rover station, enter:

```
COM [port] bps [parity[databits[stopbits[handshake[echo[break]]]]]]
interfacemode port rx_type tx_type [responses]
saveconfig (optional, save configuration to non-volatile memory)
```

For example:

```
RTCA com com2 115200 N 8 1 N off
interfacemode com2 rtca none off

RTCM com com2 115200 N 8 1 N off
interfacemode com2 rtcm none off

RTCMV3 com com2 115200 N 8 1 N off
interfacemode com2 rtcmv3 none off

CMR+ com com2 115200 N 8 1 N off
interfacemode com2 cmr none off

CMR com com2 115200 N 8 1 N off
interfacemode com2 cmr none off (same as CMR+)
```

3.4.3 GPS + GLONASS Base and Rover Configuration

This section shows you how to set up base and rover AG-Star GPS + GLONASS enabled receivers for GPS + GLONASS DGPS corrections operation:

3.4.3.1 Base Station:

```
pdpfilter disable
fix position lat lon hgt (enter your own lat, lon, and hgt values)
com com2 115200 N 8 1 N off
interfacemode com2 none rtcm off
log com2 rtcm1 ontime 5
log com2 rtcm31 ontime 5 1
saveconfig (optional, save configuration to non-volatile memory)
```

3.4.3.2 Rover Station (DGPS positions):

```
com com2 115200 N 8 1 N off
interfacemode com2 rtcm none off
log com1 bestposa ontime 1 (optional, view position information)
saveconfig (optional, save configuration to non-volatile memory)
```

3.4.4 Configuration Notes

For compatibility with other GNSS receivers, and to minimize message size, it is recommended that you use the standard form of RTCA, RTCM, RTCMV3 or CMR corrections as shown in the previous base and rover examples. This requires using the INTERFACEMODE command to dedicate one direction of a serial port to only that message type. When the INTERFACEMODE command is used to change the mode from the default, NOVATEL, you can no longer use NovAtel format messages.

If you wish to mix NovAtel format messages and RTCA, RTCM, RTCMV3 or CMR messages on the same port, you can leave the INTERFACEMODE set to NOVATEL and log out variants of the standard correction messages with a NovAtel header. ASCII or binary variants can be requested by simply appending an "A" or "B" to the standard message name. For example on the base station:

```
interfacemode com2 novatel novatel
fix position 51.11358042 -114.04358013 1059.4105
log com2 rtcmlb ontime 2
```

Using the receiver in this mode consumes more CPU bandwidth than using the native differential messages as shown in *Section 3.4.1, Base Station Configuration* on page 24.

At the rover station you can leave the INTERFACEMODE default settings (interfacemode com2 novatel novatel). The rover receiver recognizes the default and uses the corrections it receives with a NovAtel header.

The PSRDIFFSOURCE command sets the station ID values which identify the base stations from which to accept pseudorange corrections. This is a useful command when the rover station is receiving corrections from multiple base stations. Refer to *An Introduction to GNSS* for more information on SBAS, available from our web site at: novatel.com/an-introduction-to-gnss/.

All PSRDIFFSOURCE entries fall back to SBAS (even NONE) for backwards compatibility.

At the base station it is also possible to log out the contents of the standard corrections in a form that is easier to read or process. These larger variants have the correction fields broken out into standard types within the log, rather than compressed into bit fields. This can be useful to modify the format of the corrections for a non-standard application or to look at the corrections for system debugging purposes. These variants have "DATA" as part of their names (for example, RTCADATA1, RTCMDATA1, CMRDATAOBS, and more). Refer to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) for detailed descriptions of the various message formats.

Information on how to send multiple commands and log requests using Windows, can be found on our web site at novatel.com/support/known-solutions/.

3.5 GLIDE



GLIDE is an optional feature on the AG-Star. You must order a GLIDE capable model to use this feature.

NovAtel's *GLIDE* is an optional feature on the AG-Star. *GLIDE* is a positioning algorithm for single frequency GPS and GPS/GLONASS applications. *GLIDE* produces a smooth position output tuned for applications where optimal time relative (pass to pass) accuracy is more important than absolute accuracy. Because of this, it is well suited for agricultural applications.

Multipath signals tend to induce time-varying biases and increase the measurement noise on the L1 pseudorange measurements. Carrier phase measurements are much less susceptible to the effects of multipath. The *GLIDE* algorithm fuses the information from the L1 code and the L1 phase measurements into a Position-Time-Velocity (PVT) solution.

GLIDE includes settings for a dynamic mode, a static mode, and an “auto” mode, where the filtering parameters are automatically adjusted as vehicle velocity varies between stationary and dynamic states.

Refer to the NovAtel white papers at novatel.com/support/support-materials/white-paper for more information on *GLIDE*. Refer also to application note “APN-038 Pseudorange/Delta-Phase (PDP) and *GLIDE* Filters” at novatel.com/support/support-materials/application-notes.

3.6 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 AG-Star eliminates the need for separate ground-sensing radar equipment by converting the GPS-derived velocity to proportional frequency output. The following emulated radar signal parameters can be configured by the customer:

- Frequency Step: Specifies how the frequency output relates to the vehicle speed.
- Signal Update Rate: Specifies how often the frequency output is updated to match the vehicle speed.
- Response Mode: Specifies how quickly changes in velocity are reflected in the frequency output. Setting a slower response mode reduces spikes (noise) in the velocity but increases latency. Setting a higher response mode reduces latency, but may result in noisier frequency output. Refer to *Section B.5, RADARCFG Configure the ER Output* on page 57 for more detailed information.

After it is configured using the `RADARCFG` command, Emulated Radar (ER) pulses are output through the AG-Star cables (see *Table 7, AG-Star Communication/Power Cable Pinouts* on page 48) and the `RADARSIGNAL` log (see page 63).

3.7 Recommended Configuration

The following command is recommended to enable CAN:

```
setcanname 305
```

The following command is recommended to enable SBAS (WAAS/EGNOS/MSAS) corrections:

```
sbascontrol enable
```

The following commands are recommended to enable *GLIDE*:

```
pdpfilter enable  
pdpmode relative auto
```

NovAtel has registered manufactured ID code 305 with J1939. When complete, your configuration can be saved with the `SAVECONFIG` command. For more information about these commands, refer to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#), available from our web site and APN-050 SMART-AG Firmware Release, available at novatel.com/support/support-materials/application-notes.

Bluetooth is a wireless radio communication standard designed for use over short ranges (within 10 m). This chapter describes how to use the Bluetooth interface on the AG-Star-B.



The AG-Star-B supports the Bluetooth 2.0 protocol and the Serial Port Profile (SPP). Bluetooth products that support later versions of the protocol and may not support the Serial Port Profile. It is recommended that customers check that the AG-Star-B product works with their selected Bluetooth products to confirm compatibility.



The AG-Star-B incorporates a radio transceiver meeting the Bluetooth 2.0 specification, power class 2. Actual performance can vary including data throughput rate, operating range and coverage area. Performance depends on many factors, conditions and variables including distance between connected Bluetooth devices, radio interference from other 2.4 GHz devices such as Wi-Fi devices and microwave ovens, building materials and construction, proximity to metal structures, the compatibility of the computer operating system and Bluetooth interface drivers, and other adverse conditions.

4.1 Bluetooth Wireless Technology on the AG-Star-B Receiver

Bluetooth wireless technology is configured on the AG-Star-B's internal COM2 port. After your computer is configured for *Bluetooth* operation, use HyperTerminal or NovAtel Connect to communicate through COM2. To log data over the *Bluetooth* port, specify COM2 as the output port (e.g. `log com2 bestposa ontime 1`).

4.2 Pairing with a new AG-Star-B



Ensure that your computer is equipped with a built-in, or external plug-in, *Bluetooth* adapter and is already configured with the appropriate *Bluetooth* driver.



The information in this section is specific to pairing an AG-Star-B with a Windows 7 based computer.

For information about pairing the AG-Star-B with other Bluetooth capable devices, refer to the device's user documentation.

To pair with an AG-Star-B in range:

1. Power on the AG-Star-B.
2. On the computer, double-click the *Bluetooth* icon in the notification area, see *Figure 9, Bluetooth Icon*. The *Bluetooth Devices* window opens, see *Figure 10* on page 29.

Figure 9: Bluetooth Icon

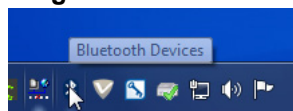
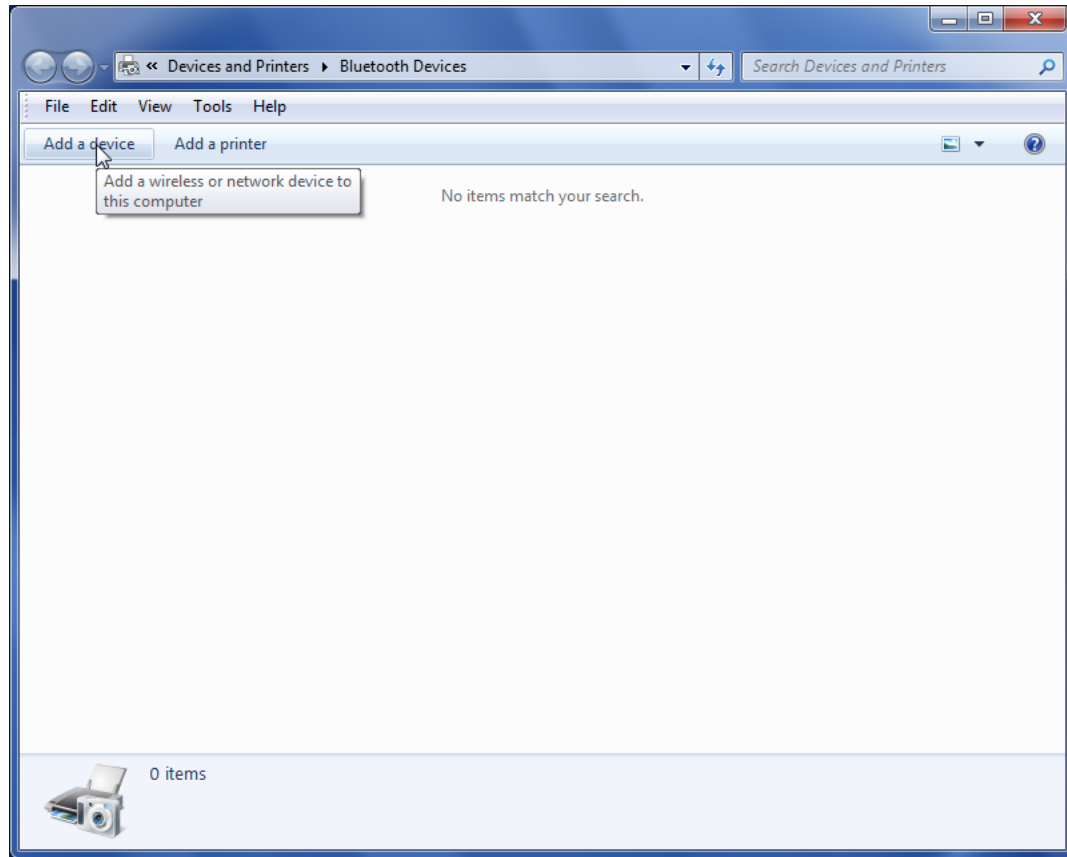
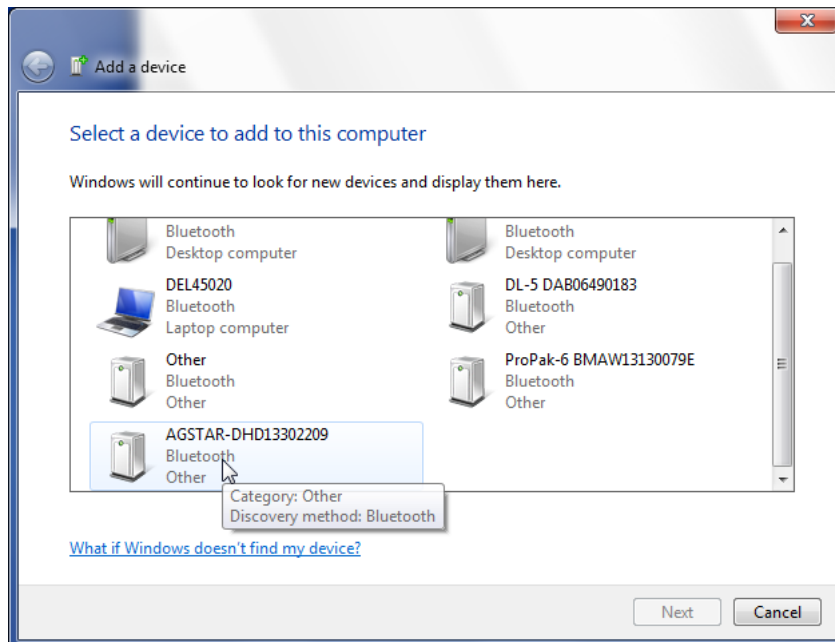


Figure 10: Bluetooth Devices Window



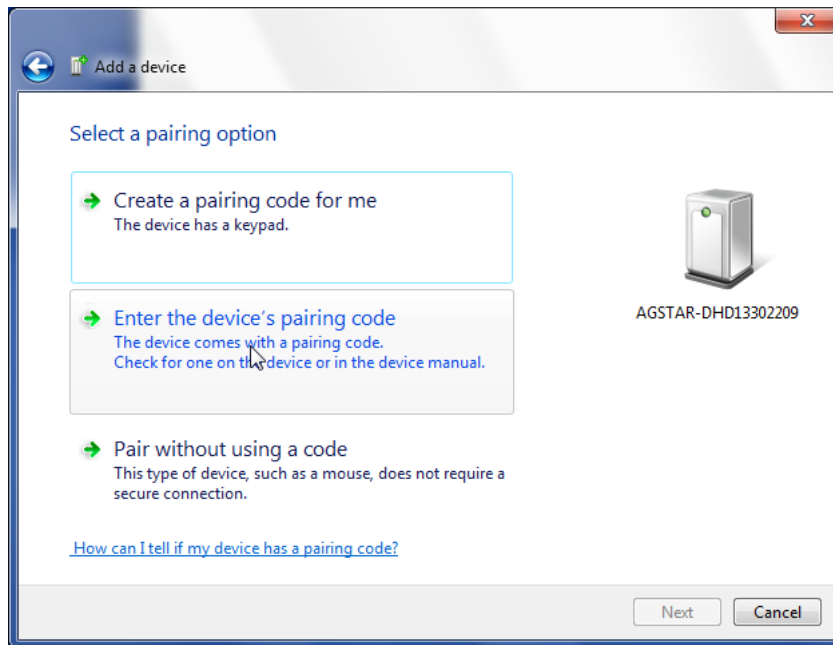
3. On the Bluetooth Devices window, click the *Add a device* button. The *Add a device* window appears. The computer searches for any Bluetooth device in range and displays the devices found on the window, see *Figure 11* on page 29.

Figure 11: Add a Device Window



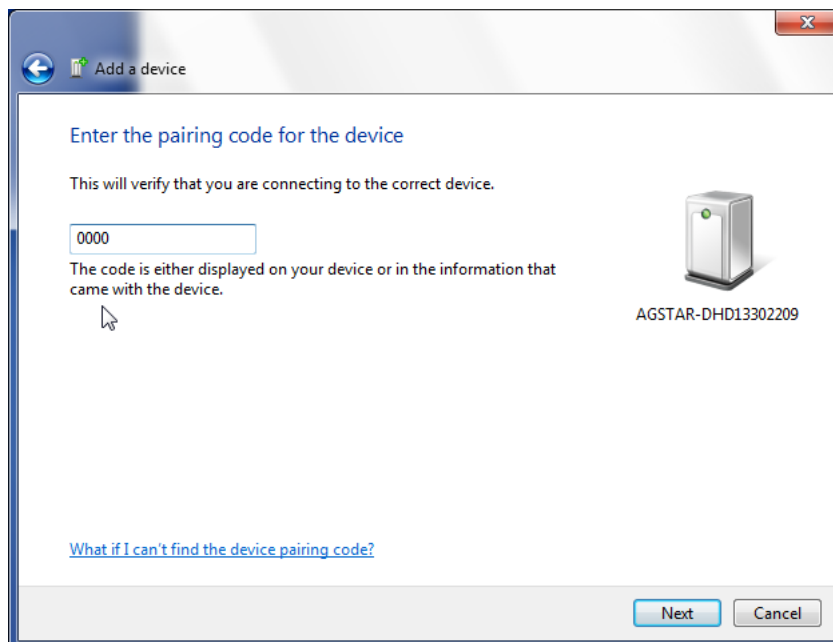
4. Select the AG-Star-B system and click the *Next* button. The *Select a pairing option* window appears, see *Figure 12* on page 30.

Figure 12: Add a Device - Select a Pairing Option

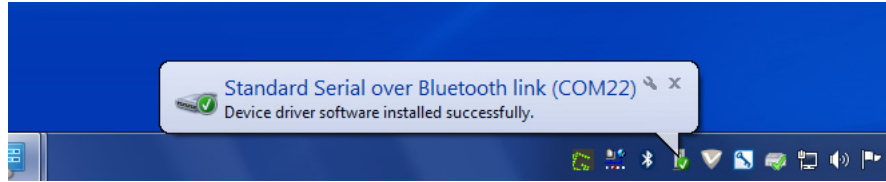
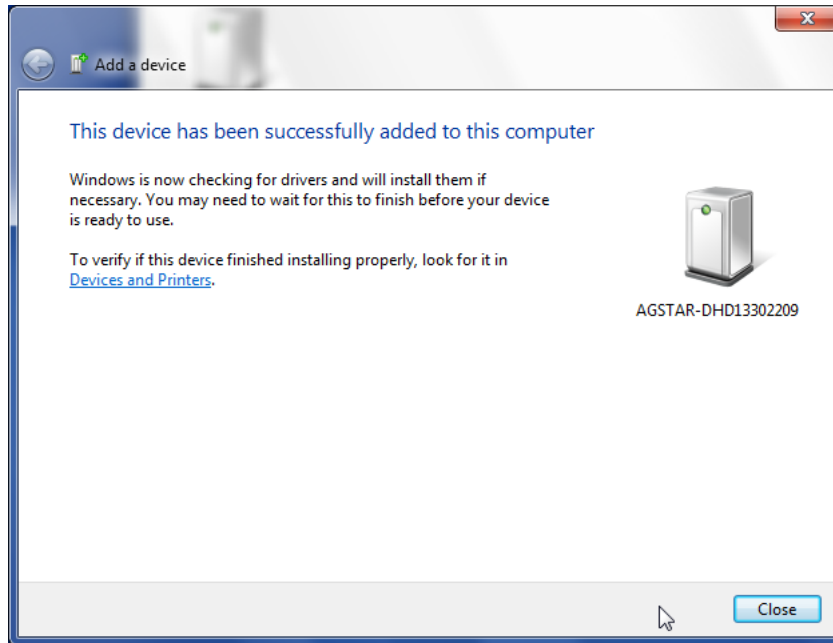


5. Click the *Enter the device's pairing code* button. The *Enter the pairing code for the device* window appears, see *Figure 13* on page 30.

Figure 13: Add a Device - Enter Pairing Code



6. Type the AG-Star-B pairing code, **0000**, and click the *Next* button. Windows installs the serial port driver and assigns a serial port number to the Bluetooth link. Make a note of the serial port number assigned. See *Figure 14, Bluetooth Link Serial Port* on page 31 and *Figure 15, Add a Device - Successful* on page 31.

Figure 14: Bluetooth Link Serial Port**Figure 15: Add a Device - Successful**

On some operating systems, the AG-Star-B must be re-paired every time it is restarted. To re-pair in Windows 7, click the Bluetooth icon in the notification area and enter the pairing code when prompted. For instructions on re-pairing in other operating systems, see the user documentation that came with the operating system.

4.3 Determining the Bluetooth Serial Port

To determine the serial port associated with the Bluetooth link to the AG-Star-B:

1. Double-click the *Bluetooth* icon in the notification area, see *Figure 16, Bluetooth Icon*. The *Bluetooth Devices* window opens, see *Figure 17* on page 32.

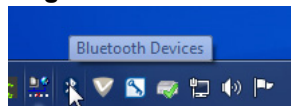
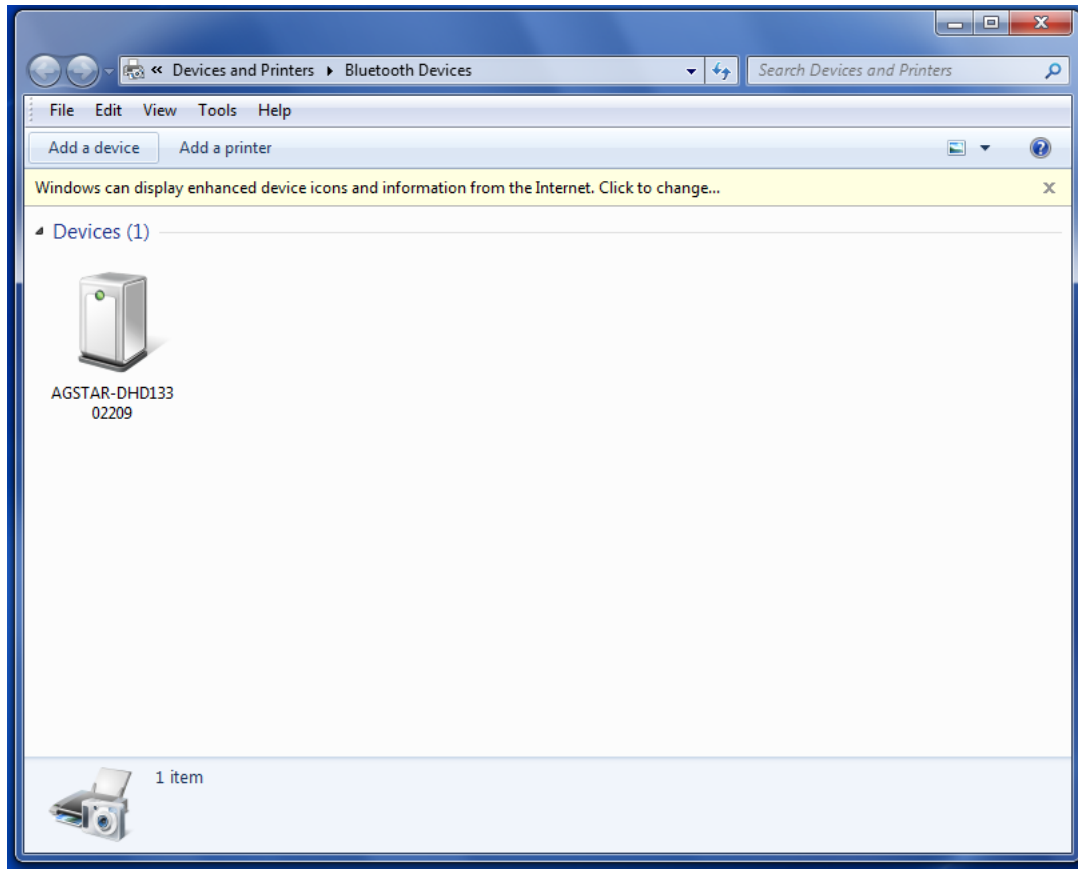
Figure 16: Bluetooth Icon

Figure 17: Bluetooth Devices Window



2. In the *Bluetooth Devices* window, right-click the AG-Star-B device and select *Properties*, see *Figure 18* on page 33.
The *Properties* window for the AG-Star-B appears, see *Figure 19* on page 33.

Figure 18: Bluetooth Devices Window - Device Menu

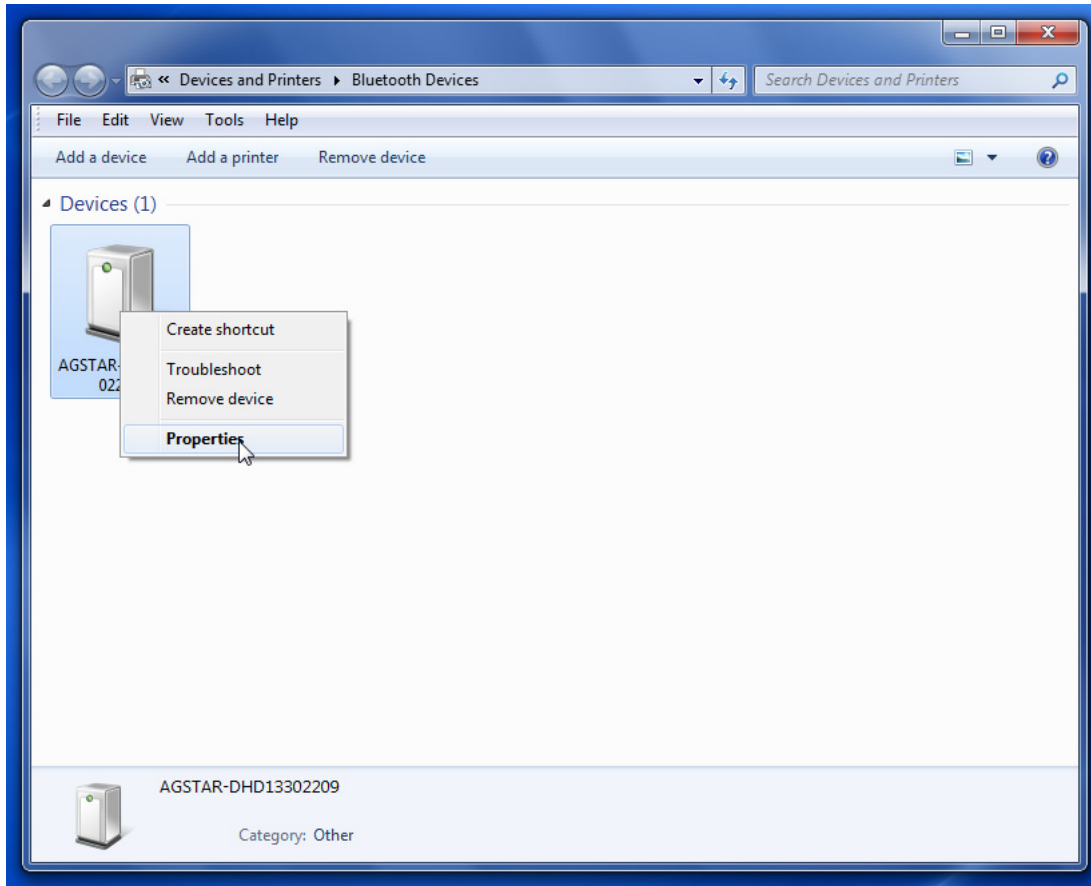
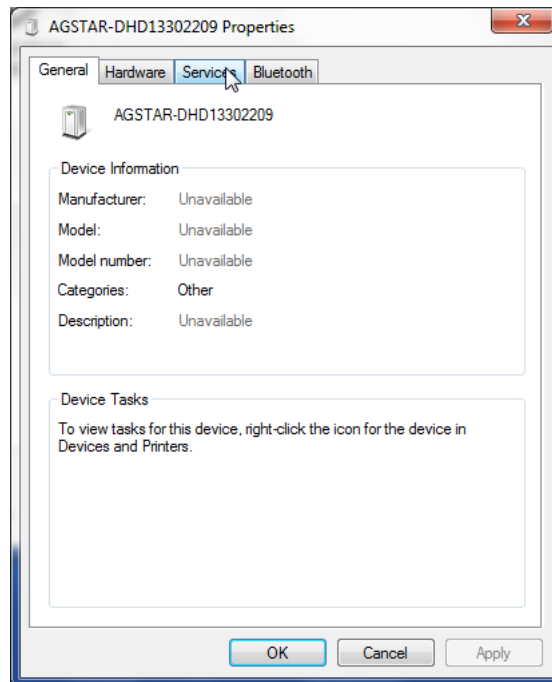
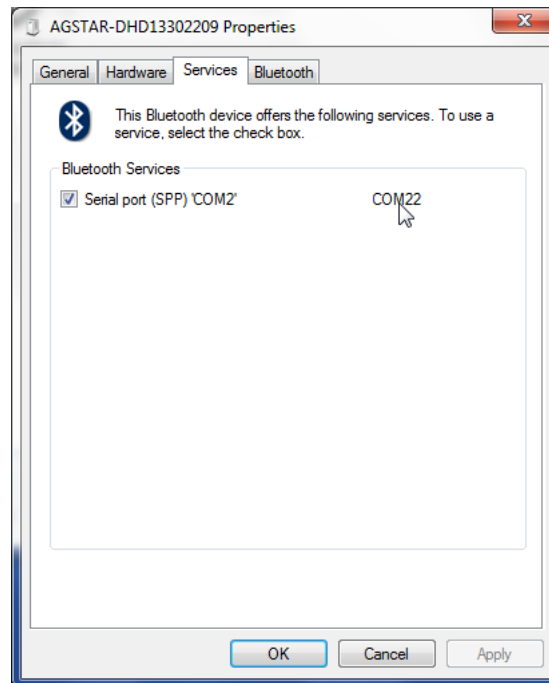


Figure 19: Bluetooth Devices Window - Properties



3. Click the *Services* tab. The Services tab displays the serial port information about the Bluetooth link to the AG-Star-B. See *Figure 20* on page 34.

Figure 20: Properties - Services Tab



4.4 Communicate with the AG-Star-B Using Bluetooth Wireless Technology

1. Open a terminal program (HyperTerminal, for example) and configure it to the serial port assigned to the Bluetooth link. If you do not know the serial port information, see *Section 4.3, Determining the Bluetooth Serial Port* on page 31.
2. Configure the port settings as follows:
9600 bps, no parity, 8 data bits, 1 stop bit, no handshaking, echo off
3. Through the terminal program, connect to the Bluetooth serial port and verify the connection.
4. Type the following VERSION log request into the command prompt to ensure that the connection works:

```
log version
```

Download the most recent versions of the NovAtel firmware and receiver software from the NovAtel website at novatel.com/support/smart-antennas/ag-star.

AG-Star Firmware and Software



Refer to *Transferring Firmware Files* on page 37 for descriptions of the Update and OEM versions.

NovAtel Connect PC Utilities Software Bundle

Bundled PC Utilities software includes:

- NovAtel Connect (an interface for monitoring and configuring the receiver)
- Connection Import (imports connection profiles from previous versions of NovAtel Connect)
- Convert (converts receiver data logs into different formats)
- USB Drivers and Window Signing



The NovAtel Connect PC Utilities bundle can be download from our web site: novatel.com/support/firmware-options-pc-software/novatel-connect.

Firmware and Software included

- SoftLoad firmware
- WinLoad software utility



WinLoad and SoftLoad instructions follow.

5.1 Firmware Updates and Model Upgrades

A local NovAtel dealer can provide all the information needed to upgrade or update a receiver. Refer to novatel.com/contactus/sales-offices for contact information or contact sales@novatel.com or support@novatel.com directly.

5.1.1 Firmware Updates

Firmware updates are firmware releases that include fixes and enhancements to the receiver functionality. Firmware updates are released on the NovAtel web site as they become available. New firmware must be loaded into the receiver through one of the COM ports. Once loaded, the receiver reboots and begins operating with the new firmware.



Direct access to a serial COM port on the AG-Star is required.

5.1.2 Model Upgrades

Model upgrades enable purchased receiver features.

Contact a local NovAtel dealer to assist in selecting the upgrade options that best suit your GNSS needs at novatel.com/contactus/sales-offices. Contact [NovAtel Customer Support](#) or [NovAtel Sales](#) to request a temporary upgrade authorization code for trial purposes.

The receiver stores the firmware in Non-Volatile Memory (NVM), which allows model upgrades to be performed without returning the receiver to the dealer. Model upgrades can be applied to the receiver with an authorization code and the AUTH command.

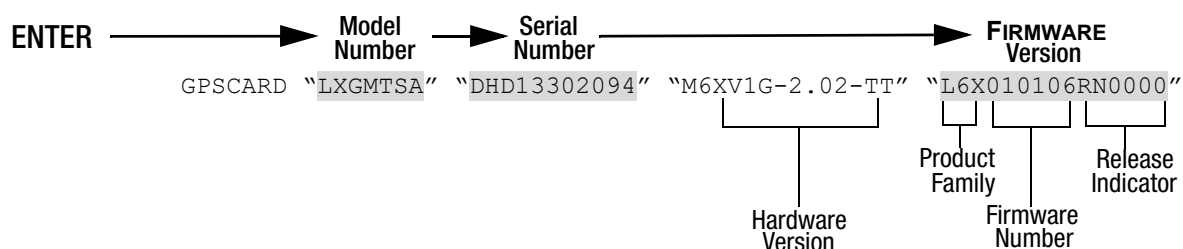
5.2 Authorization Code

An authorization code, commonly known as an auth-code, is required to upgrade and possibly update an AG-Star receiver. Auth-codes are obtained by contacting [NovAtel Customer Support](#). Upon contact, NovAtel Customer Support requires:

- the receiver model number
- the receiver serial number
- the receiver firmware version

Enter the LOG VERSION command to determine the receiver model, serial number and firmware version.

Example:



After determining the appropriate model and firmware version the authorization code (auth-code) is issued. The auth-code is required to unlock the features on the new model type.

To upgrade to a new model with the same firmware version, use the AUTH command with the issued auth-code (if required), as outlined in *Upgrading Using the AUTH Command* on page 41.

To upgrade to a new model with a higher firmware version, the new firmware .HEX file needs to be loaded into the AG-Star receiver using the WinLoad utility program. WinLoad and the firmware .HEX files can be found at novatel.com/support/smart-antennas/ag-star. Refer to *Section 5.3, Updating or Upgrading Using the WinLoad Utility* on page 37 for use instructions.



The procedure for loading firmware is the same. Refer to *Section 5.5, Upgrading Using the AUTH Command* on page 41.



An authorization code is still required if the software model changes for temporary trial upgrades or purchased permanent upgrades.

5.3 Updating or Upgrading Using the WinLoad Utility

WinLoad is the simplest and most common way to update or upgrade an AG-Star receiver.

5.3.1 Transferring Firmware Files

To proceed with an update or possibly an upgrade, obtain the latest version of firmware from the NovAtel website at novatel.com/support/smart-antennas/ag-star.

5.3.1.1 Types of Firmware Files

The firmware update or upgrade file is one of two types:

- **Update Version (UPDT)** - The update version includes the authorization codes for all AG-Star receivers and receiver model upgrades purchased before the cut-off date. The update version is named UPDTXXXX.EXE, where XXXX is the firmware version. If the receiver or model upgrade was purchased after the cut-off date, the authorization code does not appear in the UPDT file and the OEM version must be used.
- **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, NovAtel Customer Service must generate and provide the required authorization code. Authorization codes are obtained by contacting support@novatel.com or at novatel.com/contactus/contact-support.

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

For convenience, copy the update file to a GNSS sub-directory (for example, C:\GNSS\LOADER).

If the firmware update file is password protected, NovAtel Customer Support provides the required password. After copying the file to a computer, perform the following steps to extract the files:

Syntax: [filename] [password] (if required)

where filename is the name of the compressed file (but not including the .EXE extension) and password is the password if required for extraction.

Example: L6X010202RN0000.hex

In the above example, a window appears asking for a password.

The self-extracting archive produces the following files:

winload.exe	WinLoad utility program
howto.txt	Instructions on how to use the WinLoad utility
whatsnew.rtf	Information on the changes made in the firmware since the last revision
x..x.hex	Firmware version upgrade file, where x..x defines the product name and release (e.g., L6X010202RN0000.hex)

The files are extracted to unzip/program files/NovAtel Inc/x.xxx Full Update Disk, where x.xxx is the firmware version.



NovAtel has an online video tutorial that explains firmware uploading at novatel.com/support/training-videos-and-events.

AG-Star Application Software

The AG-Star receiver has two types of software loaded, the OEM-Star firmware and the AG-Star Application Software. The OEM-Star firmware provides the features that are common to all OEM-Star receivers. The Application Software provides the special features available on the AG-Star.

The Application Software is available from the NovAtel website at novatel.com/support/smart-antennas/ag-star and is loaded onto the AG-Star receiver using the same procedures used for the OEM-Star firmware. An authorization code is not required for Application Software updates.

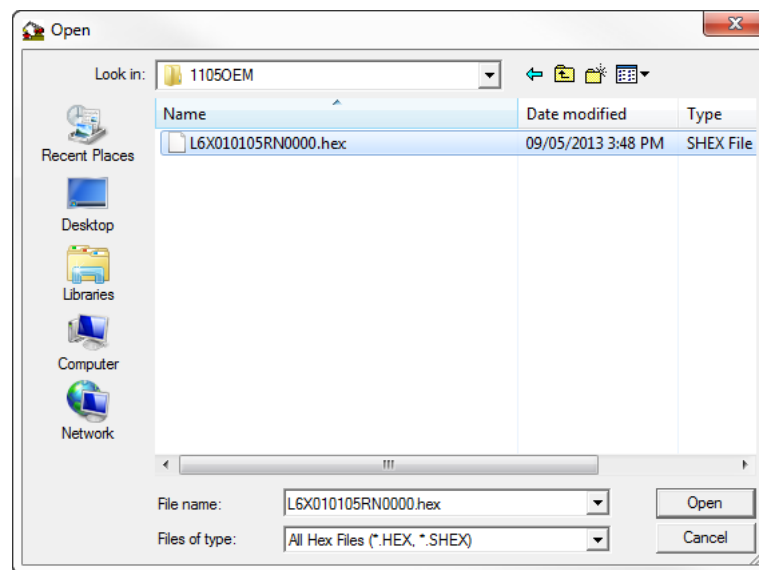
5.3.2 Using the WinLoad Utility

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

5.3.2.1 Open a File to Download

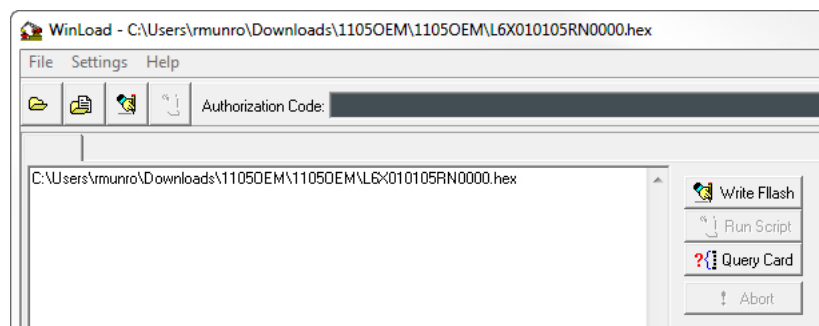
Select File | Open. Navigate to the file to open (*Figure 21*).

Figure 21: WinLoad Open Window



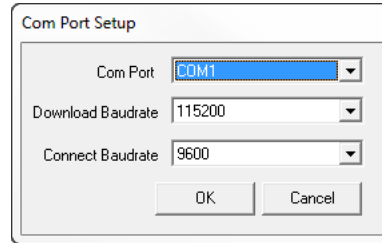
When a file is selected, the filename appears in the main WinLoad display area and in the title bar (*Figure 22*).

Figure 22: Open File in WinLoad



5.3.2.2 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 and is preferred).

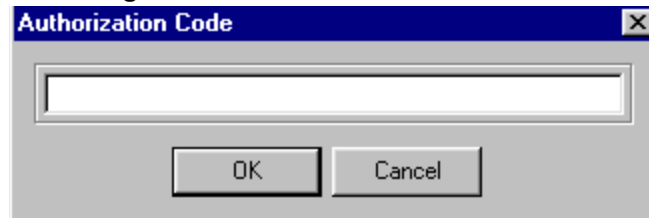
Figure 23: COM Port Setup

5.3.2.3 Downloading Firmware

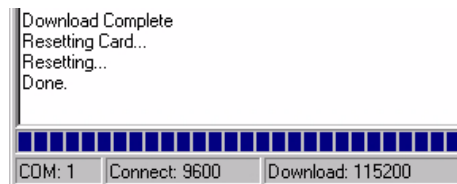
1. Select the file to download according to *Section 5.3.2.1, Open a File to Download* on page 38.
2. Ensure the file path and name are displayed in main display area (see *Figure 22, Open File in WinLoad* on page 38).
3. Click **Write Flash** to download the firmware.
4. When Searching for card appears in the main display, power cycle the receiver.

Figure 24: Searching for Card

5. If the Authorization Code window appears, enter the auth-code and click **OK**. See *Section 5.2, Authorization Code* on page 36 for further information about the Authorization Code.

Figure 25: Authorization Code Window

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

Figure 26: Upgrade Process Complete

7. Close WinLoad.

5.4 Updating using SoftLoad Commands

Use SoftLoad to update a receiver.



Use SoftLoad if automated loading is required or the platform used to communicate with the receiver is not supported by WinLoad.



Refer to *Section 5.3.1.1, Types of Firmware Files* on page 37 for details on **updating** versus **upgrading**.

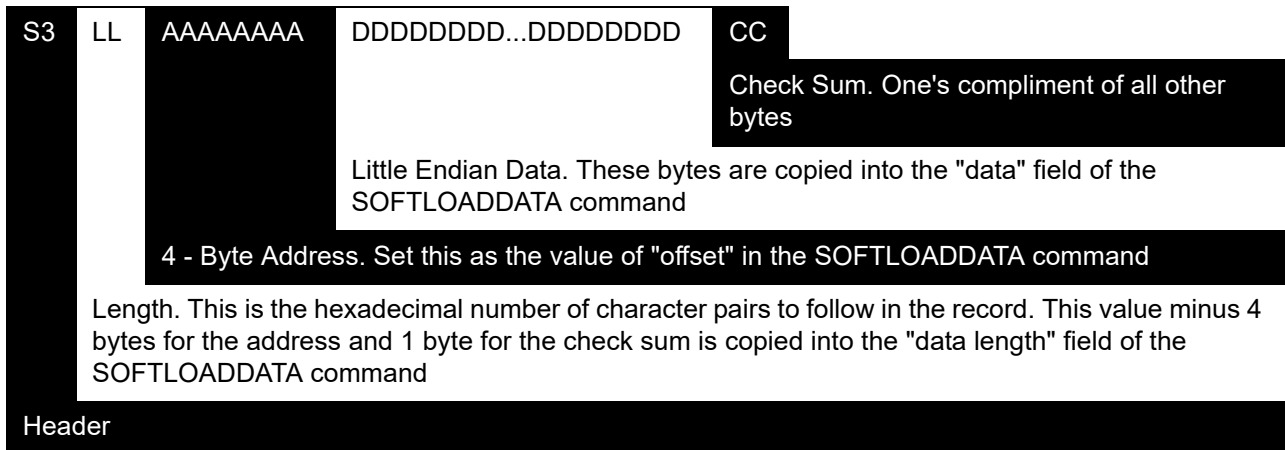
1. Open a connection to any port on the receiver.
2. Request the SOFTLOADSTATUSA log using the following command:
`LOG SOFTLOADSTATUSA ONCHANGED.`
3. Initialize SoftLoad with a SOFTLOADRESET command. This command stops all tracking on the receiver to ensure sufficient memory is available for the loading process. A RXSTATUSEVENTA log reports a SoftLoad In Progress status.
4. Open the *.HEX firmware file.
5. Send each line of the *.HEX file to the receiver in a SOFTLOADSREC command. The S-Records must be enclosed by quotation marks:
`SOFTLOADSREC "<S-RECORD>"`
6. Send the SOFTLOADCOMMIT command.
7. During the loading process, SOFTLOADSTATUSA logs report the load status. Wait for the SOFTLOADSTATUSA to indicate loading is COMPLETE.
8. Send the new auth-code for the receiver with the following special case of the AUTH command:
`AUTH ADD_DOWNLOAD <auth-code>`
9. Reset the receiver by entering RESET, FRESET or power cycling.
10. Once the receiver resets, the new version of firmware is active.



The SoftLoad process can be canceled safely at any time during the process using the RESET command.

5.4.1 Working with S-Records

- Records beginning with S0, S5 and S7 should be passed to the receiver directly using the SOFTLOADSREC command. These records contain meta data about the firmware image.
- Records beginning with S3 form the actual firmware image and can be converted to SOFTLOADDATA binary commands. Aside from the header, each pair of characters forms the ASCII representation of binary byte. The format is as follows:



- Multiple S3 records can be packaged into a single SOFTLOADDATA command as long as the data from one S3 record follows immediately after the previous record, up to a maximum of 4096 bytes of data. That is, the address must equal the previous address plus the previous data length. The "offset" field remains the address of the first S3 record and the "data" and "data length" are updated to include the new data.
- The hex file data may contain many gaps and jumps. For example, in most NovAtel hex files data for address 0x000_00000 is stored near the very end of the file.

5.5 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 [NovAtel Customer Support](#).

The upgrade can be performed directly through the NovAtel Connect command line or from any other communications program.



Refer to *Section 5.3.1.1, Types of Firmware Files* on page 37 for details on **updating** versus **upgrading**.

5.5.1 Upgrade Procedure

- Power up the receiver and establish communications.
- Issue the LOG VERSION command to verify the current model, firmware version and serial number (refer to *Section 5.2, Authorization Code* on page 36 for instructions on obtaining).

3. Issue the `AUTH` command, followed by the auth-code and model type (refer to *Section 5.2, Authorization Code* on page 36 for details on obtaining any auth-code). The syntax is as follows:

```
auth <your auth-code here>
```

where `auth` is a command that enables model upgrades and `auth-code` is the upgrade authorization code, expressed as follows:

```
XXXXXX,XXXXXX,XXXXXX,XXXXXX,XXXXXX,MODEL,EXPDATE
```

where:

1. Each X character is a case-insensitive ASCII character.
2. The MODEL string is a maximum of 15 characters long and represents the model enabled by the auth-code.
3. The EXPDATE string is the auth-code's expiry date, in YYMMDD format

Example:

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

When the `AUTH` command is executed, the receiver reboots. Issuing the `LOG VERSION` command confirms the new upgrade model type and firmware version number.

If communicating using NovAtel Connect, the communication path must be closed and reopened using the Device menu.

A.1 AG-Star Receiver Performance

PERFORMANCE			
Channel Configuration	14 GPS L1 12 GPS L1 + 2 SBAS ^a 10 GPS L1 + 4 GLONASS L1 8 GPS L1 + 6 GLONASS L1 8 GPS L1 + 4 GLONASS L1 + 2 SBAS ^a 10 GPS L1 + 2 GLONASS L1 + 2 SBAS ^a 7 GPS L1 + 7 GLONASS L1 14 GLO L1		
Horizontal Position Accuracy (RMS)^b	Autonomous	1.5 m	
	NovAtel CORRECT	SBAS ^a	0.9 m
		DGPS	0.5 m
Measurement Precision (RMS)	L1 C/A Code	GPS 5 cm	GLONASS 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 ^c	85 s	
	Hot Start ^d	55 s	
Signal Reacquisition	L1	<1.0 s (typical)	
Time Accuracy (RMS)	GPS	20 ns	
	GLONASS	40 ns	
Velocity Accuracy^b (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.

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

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. For more information, refer to the "SETAPPROXTIME" command in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#).

A.2 AG-Star Specifications

INPUT/OUTPUT CONNECTORS	
AG-Star COM/PWR	+8 to +36 V DC at 2.5 W (typical while logging) ^a For the cable pinouts and drawings, see <i>Section A.2.2, AG-Star Communications/ Power Cable (01018256)</i> on page 47.
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	
More details can also be found in <i>Section 2.2.1, Status Indicators</i> on page 18.	
PHYSICAL	
Size	155.3 x 66.8 x ϕ 155 mm ^b
Weight	<510 g maximum
ENVIRONMENTAL	
Operating Temperature	-40°C to +75°C
Storage Temperature	-55°C to +90°C
Humidity	MIL-STD-810G-Method 507.5
Immersion	MIL-STD-810G Method 512.5
Solar Radiation	EN60950-22, Clause 8.2 MIL-STD-810G Method 505.5
Salt Fog	MIL-STD-810G, Method 509.5
Sand and Dust	MIL-STD-810G, Method 510.5
Vibration	Random MIL-STD-810G, Method 514.6, Category 24 Sinusoidal ASAE EP455, Section 5.15.2 Level 1 & 2 Shock MIL-STD-810-G Method 516.6
Ingress Protection Rating	IP67 ^c
REGULATORY	
Compliance	FCC, Industry Canada, CE Marking, E-mark

a. When tracking GPS satellites.

b. ϕ denotes diameter, here and in *Figure 27, AG-Star Dimensions* on page 46.

c. IP67 rating requires that the cable is connected to the antenna.

Table 5: AG-Star Strobes

Strobes	Default Behavior	Input/Output	Factory Default	Comment ^a
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. (Refer to the MARKPOS and MARKTIME logs and ONMARK trigger.) Polarity is configurable using the MARKCONTROL command.
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. The polarity and period can be configured using the PPSCONTROL command.

a. The commands and logs shown in capital letters (for example, MARKCONTROL) are discussed in further detail in the *OEMStar Family Firmware Reference Manual*.

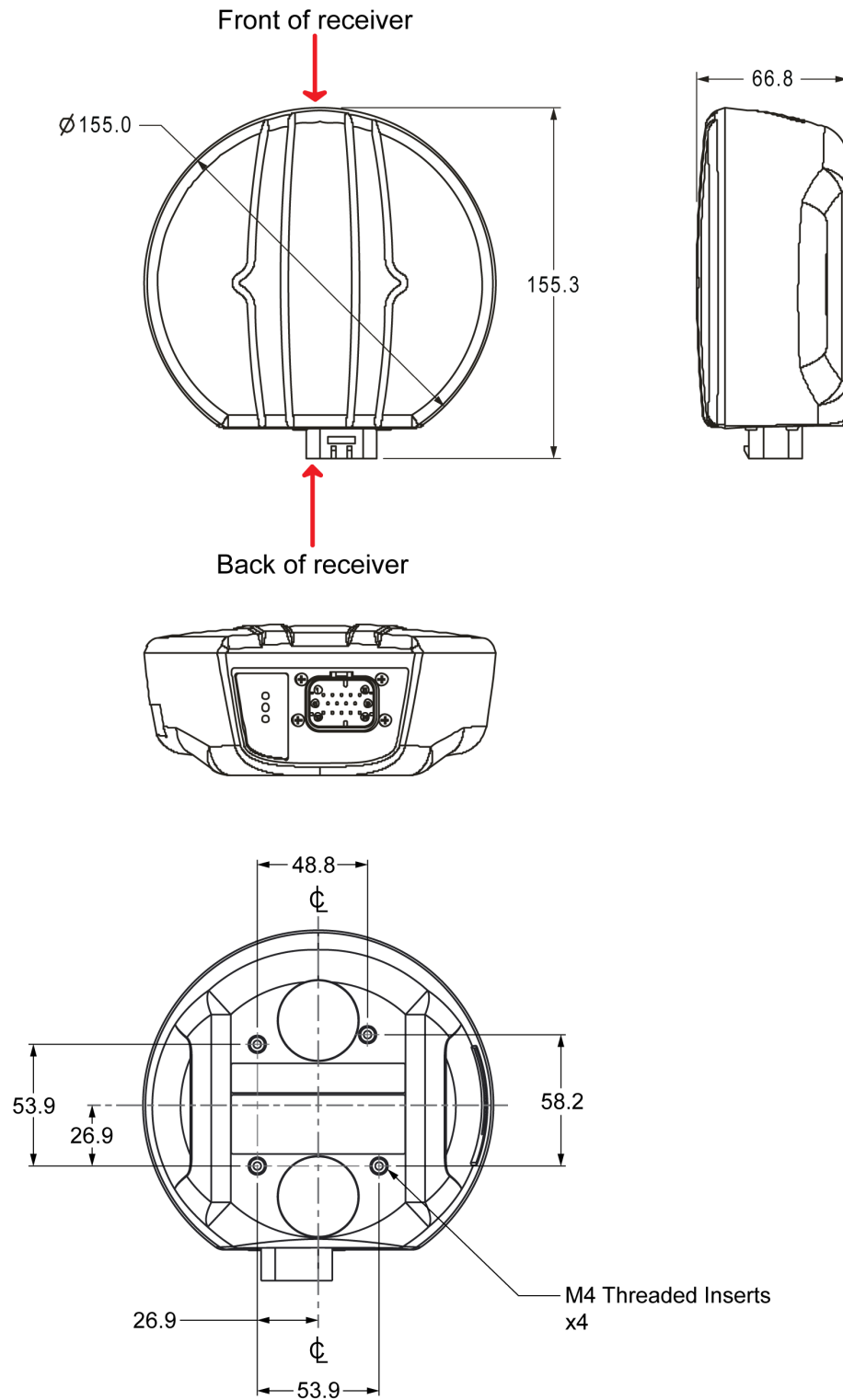
Table 6: AG-Star Input/Output Electrical Specifications

I/O Line	Symbol	Minimum (V)	Typical (V)	Maximum (V)	Current (mA)	Conditions ^a
PPS	V _{OL}			0.8 V	-4 mA	With on-board I/O supply, VDDIO=3.3V
	V _{OH}	2.3 V			-8 mA	
MKI	V _{IL}			0.8 V	0.25 mA	
	V _{IH}	2.0 V			0.30 mA	

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

A.2.1 Dimensions

Figure 27: AG-Star Dimensions



All dimension are in millimeters. Use the Unit Conversions page found at novatel.com/support/knowledge-and-learning/unit-conversions for conversion to other measurements.

A.2.2 AG-Star Communications/Power Cable (01018256)

The AG-Star cable that accompanies the AG-Star Development Kit, see *Figure 28, AG-Star Communication/Power Cable*, provides a means of supplying power from a battery while operating in the field. The exposed wires (red for positive and black for negative) can then be connected to a vehicular power circuit (or equivalent) protected by a 5A fast blow fuse (user supplied). The cable also has two DB-9 connectors. One can accommodate a computer serial (RS-232) communication port and the other can connect to a modem or radio transmitter to propagate differential corrections (refer to your user-supplied modem or radio transmitter user guide for more information on its connectors).



Bluetooth wireless technology uses the COM2 port. When Bluetooth wireless technology is enabled, COM2 is not available on the AG-Star connector or the cable.

In addition, there are a number of bare wires where the outer insulation is cut away but the wires beneath are intact. See *Table 7, AG-Star Communication/Power Cable Pinouts* on page 48 for their pinouts. For more information on mating connectors and part numbers, see *Table 8, AG-Star Mating Connectors* on page 49.

This cable is RoHS compliant.

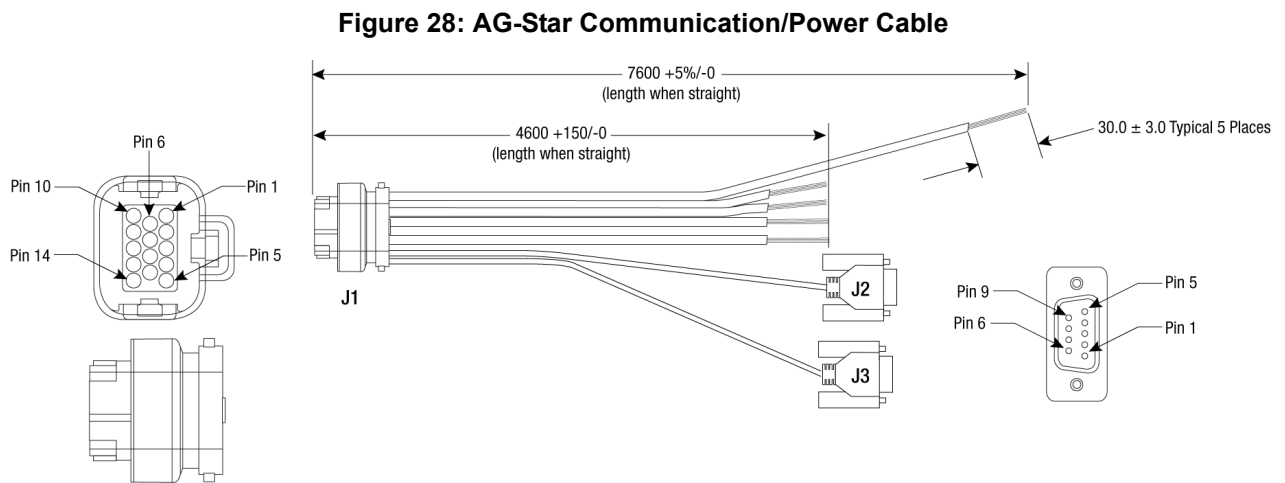


Table 7: AG-Star Communication/Power Cable Pinouts

Signal Name	J1	J2	J3	Label
COM1_TXD	1	2		
COM1_RXD	2	3		
COM2_TXD	3		2	
COM2_RXD	4		3	
COM1 GND	5	5		
COM2 GND			5	
MKI GND				MKI GND
ER GND				ER GND
PPS GND				PULSE PER SECOND GND
CAN+	6			CANI +
CAN-	7			CANI -
RESERVED	8			
PWR RET (GND)	9			BATT -
EMULATED RADAR OUT	10			ER_OUT
EVENT MARK IN	11			MKI
PPS	12			PPS
RESERVED	13			
PWR INPUT	14			BATT +

A.2.3 AG-Star Connector and Cable Requirements

Custom cables for installing your AG-Star can be created using the following guidelines:

- Wire size: must be 0.5 mm-1.25 mm (20-16 AWG)
- Batt + connection must be protected by 5A fast blow fuse
- Serial data signals (TxD, RxD, signal ground) must be run in shielded cable.



Connect shields to ground at the AG-Star end only.

- CAN signal conductors must be twisted (40 twists/m, 12 twists/ft)
- Use only the recommended mating connectors listed below. Use only gold plated pins



Failure to observe the given cable construction guidelines in this section will result in damage to the wiring (not covered by warranty).

The connector used in the AG-Star is an “AMPSEAL” dust and water sealed type produced by Tyco. The following part numbers pertain to the mating connector required to make connections to the AG-Star. These numbers are provided for information only and are not available from NovAtel as separate parts.

Table 8: AG-Star Mating Connectors

Product	Part Description	Company	Part Number
AG-Star mating connector (<i>Figure 28, AG-Star Communication/Power Cable on page 47</i>)	14-pin sealed receptacle housing-black	Tyco/AMP	776273-1
Gold plated pins for AG-Star connector/loose	Pins, loose piece	Tyco/AMP	770854-3
Gold plated pins for AG-Star connector/strip	Pins, strip (reel)	Tyco/AMP	770520-3
Seal Plug for unused pins on mating connector	Seal Plug	Tyco/AMP	770678-1

Table 9, Recommended Fuse and Fuse Holders on page 49 details the part numbers for recommended fuses and fuse holders. These numbers are provided for information only and are not available from NovAtel as separate parts.

Table 9: Recommended Fuse and Fuse Holders

Fuse	Recommended Fuse/Fuse Holder		
12 V System Fuse (standard size blade)	ATO Silver Blade Fuse 5 A (32 V)	Littelfuse	0287005
	Or Equivalent		
12 V System Fuse (mini size blade)	Mini Blade Fuse 5A (32 V)	Littelfuse	0297005
	Or Equivalent		
24 V System Fuse High Reliability, Harsh Environment (standard size blade)	FKS ATO Blade Fuse 5A (80 V)	Littelfuse	166.7000.450
	Or Equivalent		
Inline Fuse Holder (for standard size blade)	Waterproof ATO Fuse Holder	Littelfuse	FHAC0001
	Or Equivalent		
Inline Fuse Holder (for mini size blade)	Waterproof Mini Fuse Holder	Littelfuse	0FHM0001
	Or Equivalent		

The AG-Star firmware implements the OEMStar family command set, documented in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#). Commonly used AG-Star commands are summarized in *Table 10, AG-Star Commands in Alphabetical Order* and documented in this appendix.

Table 10: AG-Star Commands in Alphabetical Order

ASCII Command	Message ID	Description
COM	4	Configure the receiver serial port.
FRESET	20	Factory reset (Existing OEMStar command extended to AG-Star)
LOG	1	Request logs from the receiver
RADARCFG	8192	Configure the ER signal output (New AG-Star command)
RESET	18	Perform a hardware reset
SETCANNAME	1091	Set the CAN name fields.

The arguments for each of these commands are described in the following sections.

For a complete listing and description of the other commands that the AG-Star, an OEMStar-based receiver, is capable of processing, refer to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#).

B.1 Syntax Conventions

The following rules apply when entering commands, at the command prompt, from a keyboard.

1. `Courier` font is used to illustrate program output or user input.
2. References to other commands, logs or any of their fields are shown in *italics*.
3. The commands are not case sensitive. For example, you could type either `RESET` or `reset`.
4. Except where noted, either a space or a comma can separate commands and their required entries. For example, you could type either `fix position 51.11358042 -114.04358013 1059.4105` or `fix position 51.11358042, -114.04358013, 1059.4105`.
5. At the end of a command, a carriage return is required. For example, press <Enter> or <Return> on your keyboard.
6. Responses are provided to indicate whether or not an entered command was accepted. The format of the response depends on the format of the command. Refer to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) for more information.
7. Optional parameters are indicated by square brackets (`[]`). For commands that contain optional parameters, the value used if the optional parameter is not specified is given in the syntax table for the command.
8. Data format definitions, as specified in the “Format” field, are detailed in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#). Note that all binary data is little-endian byte-ordered.

B.2 COM Configure COM Port

This command permits you to configure the receiver's asynchronous serial port communications drivers.

The current COM port configuration can be reset to its default state at any time by sending it two hardware break signals of 250 milliseconds each, spaced by fifteen hundred milliseconds (1.5 seconds) with a pause of at least 250 milliseconds following the second break. This will:

- Stop the logging of data on the current port (see UNLOGALL command in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#)).
- Clear the transmit and receive buffers on the current port.
- Return the current port to its default settings (see Factory Defaults section in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#)).
- Set the interface mode to NovAtel for both input and output (see INTERFACEMODE command in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#)).



Baud rates higher than 115,200 bps are not supported by standard computer hardware. Special hardware may be required for higher rates, including 230400 bps, 460800 bps and 921600 bps. Also, some computers have trouble with baud rates beyond 57600 bps.

Message ID: 4

Abbreviated ASCII Syntax:

```
COM [port] bps [parity[databits[stopbits[handshake[echo[break]]]]]]]
```

Factory Default:

```
COM COM1 9600 N 8 1 N OFF ON
```

```
COM COM2 9600 N 8 1 N OFF ON
```



On AG-Star receivers with Bluetooth wireless technology, the default settings for COM2 are:

```
com2 115200 n 8 1 cts off off
```

Changing the COM2 serial port settings could interfere with the ability to communicate using Bluetooth wireless technology.

ASCII Example:

```
COM COM1,57600,N,8,1,N,OFF,ON
```



Use the COM command before using the *INTERFACEMODE* command on each port.



Watch for situations where the COM ports of two receivers are connected together and the baud rates do not match. Data transmitted through a port operating at a slower baud rate may be misinterpreted as break signals by the receiving port if it is operating at a higher baud rate. This is because data transmitted at the lower baud rate is stretched relative to the higher baud rate. In this case, configure the receiving port to have break detection disabled using the COM command.

Field	Field Type	ASCII Value	Binary Value	Description	Binary Format	Binary Bytes	Binary Offset
1	COM header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary.	-	H	0
2	port	1	COM1	Select COM port 1 to configure	Enum	4	H
		2	COM2	Select COM port 2 to configure			
		6	THISPORT	Select the current COM port (default)			
		8	ALL	Select all COM ports			
3	bps/ baud	300, 600, 900, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, or 230400		Communication baud rate (bps).	ULong	4	H+4
4	parity	0	N	No parity (default)	Enum	4	H+8
		1	E	Even parity			
		2	O	Odd parity			
5	databits	7 or 8		Number of data bits (default = 8)	ULong	4	H+12
6	stopbits	1 or 2		Number of stop bits (default = 1)	ULong	4	H+16
7	handshake	0	N	No handshaking (default)	Enum	4	H+20
		1	XON	XON/XOFF software handshaking			
		2	CTS	CTS/RTS hardware handshaking ^a			
8	echo	OFF	0	No echo (default)	Enum	4	H+24
		ON	1	Transmit any input characters as they are received			
9	break	OFF	0	Disable break detection	Enum	4	H+28
		ON	1	Enable break detection (default)			

a. Although the standard command for the receiver card within the AG-Star accepts the CTS option for hardware handshaking, the physical lines for hardware flow control are not available on the AG-Star connector.

B.3 FRESET Clear Selected Data from NVM and Reset

The OEMStar *freset* command is extended to include AG-Star features. An additional target field, *userdata* (value = 10), resets only the AG-Star user data NVM, thereby resetting all parameters indicated in this document as “Stored in NVM” to factory defaults. Issuing the *freset* command with the “target” field set to *standard*, resets the userdata NVM as well as OEMStar parameters as indicated in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#).



If you issue the FRESET command without any parameters, it is the same as issuing a FRESET STANDARD command.

Field	Field Type	ASCII Value	Binary Value	Description	Binary Format	Binary Bytes	Binary Offset
1	FRESET header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary.	-	H	0
2	target	See Table 11, <i>FRESET Target</i> on page 53		Data to be reset by the receiver	Enum	4	H

Table 11: FRESET Target

Binary	ASCII	Description
0	STANDARD	Resets commands, ephemeris, and almanac (default).
1	COMMAND	Resets the stored commands (saved configuration)
2	GPSALMANAC	Resets the stored GPS almanac
3	GPSEPHEM	Resets the stored GPS ephemeris
4	GLOEPHEM	Resets the stored GLONASS ephemeris
5	MODEL	Resets the currently selected model
10	USERDATA	Reset AG-Star only commands
11	CLKCALIBRATION	Resets the parameters entered using the CLOCKCALIBRATE command
20	SBASALMANAC	Resets the stored SBAS almanac
21	LAST_POSITION	Resets the position using the last stored position
31	GLOALMANAC	Resets the stored GLONASS almanac

B.4 LOG Request Logs from the Receiver

Many different types of data can be logged using several different methods of triggering the log events. Every log element can be directed to any combination of the two COM ports. The ONTIME trigger option requires the addition of the *period* parameter. See the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) for further information and a complete list of data log structures. The LOG command tables in this section show the ASCII command format.

The optional parameter [hold] prevents a log from being removed when the UNLOGALL command, with its defaults, is issued. To remove a log that was invoked using the [hold] parameter requires the specific use of the UNLOG command. To remove all logs that have the [hold] parameter, use the UNLOGALL command with the *held* field set to 1.

The [port] parameter is optional. If [port] is not specified, [port] is defaulted to the port that the command was received on.



1. The OEMStar family of receivers can handle 30 logs at a time. If you attempt to log more than 30 logs at a time, the receiver responds with an Insufficient Resources error.
2. Maximum flexibility for logging data is provided to the user by these logs. The user is cautioned, however, to recognize that each log requested requires additional CPU time and memory buffer space. Too many logs may result in lost data and degraded CPU performance. Receiver overload can be monitored using the idle-time field and buffer overload bits of the Receiver Status in any log header.
3. Polled log types do not allow fractional offsets or ONTIME rates faster than 1Hz.
4. Use the ONNEW trigger with the MARKTIME or MARKPOS logs.
5. Only the MARKPOS or MARKTIME logs, and 'polled' log types are generated 'on the fly' at the exact time of the mark. Synchronous and asynchronous logs output the most recently available data.
6. If you do use the ONTIME trigger with asynchronous logs, the time stamp in the log does not necessarily represent the time the data was generated, but rather the time when the log is being transmitted.

Message ID: 1

Abbreviated ASCII Syntax:

```
LOG [port] message [trigger [period [offset [hold]]]]
```

Factory Default:

```
LOG COM1 RXSTATUSEVENTA ONNEW 0 0 HOLD
LOG COM2 RXSTATUSEVENTA ONNEW 0 0 HOLD
```

Abbreviated ASCII Example 1:

```
LOG COM1 BESTPOS ONTIME 7 0.5 HOLD
```

The above example shows BESTPOS logging to COM port 1 at 7 second intervals and offset by 0.5 seconds (output at 0.5, 7.5, 14.5 seconds and so on). The [hold] parameter is set so that logging is not disrupted by the UNLOGALL command.

To send a log only one time, the trigger option can be ignored.

Abbreviated ASCII Example 2:

```
LOG COM1 BESTPOS ONCE 0.000000 0.000000 NOHOLD
```

Refer to the *Command Formats* section of the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) for additional examples.



1. In NovAtel Connect there are two ways to initiate data logging to the receiver's serial ports. You can either enter the LOG command in the *Console* window, or use the interface provided in the *Logging Control* window. Ensure the Power Settings on your computer are not set to go into Hibernate or Standby modes. Data is lost if one of these modes occurs during a logging session.
2. Only the ASCII/Abbreviated ASCII log table is included in this manual. Refer to the LOG command in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#) for binary log details.

Field	Field Name	ASCII Value	Description	Field Type
1	LOG (ASCII) header	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII or ASCII respectively.	-
2	port	See <i>Table 12, Detailed Serial Port Identifiers</i> on page 56	Output port (default = THISPORT)	Enum
3	message	Any valid message name, with an optional A or B suffix.	Message name of log to output	Char []
4	trigger	ONNEW	Output when the message is updated (not necessarily changed)	Enum
		ONCHANGED	Output when the message is changed	
		ONTIME	Output on a time interval	
		ONNEXT	Output only the next message	
		ONCE	Output only the current message. (default)	
		ONMARK	Output when a pulse is detected on the mark 1 input, MK1I	
5	period	Any positive double value larger than the receiver's minimum raw measurement period	Log period (for ONTIME trigger) in seconds (default = 0)	Double
6	offset	Any positive double value smaller than the period.	Offset for period (ONTIME trigger) in seconds. If you wished to log data at 1 second after every minute you would set the period to 60 and the offset to 1 (default = 0)	Double
7	hold	NOHOLD	Allow log to be removed by the UNLOGALL command (default)	Enum
		HOLD	Prevent log from being removed by the UNLOGALL command	

Table 12: Detailed Serial Port Identifiers

ASCII Port Name	Hex Port Value	Decimal Port Value	Description
NO_PORTS	0	0	No ports specified
COM1	1	1	COM port 1
COM2	2	2	COM port 2
THISPORT	6	6	The current COM port
ALL	8	8	All COM ports

B.5 RADARCFG Configure the ER Output

Use this command to configure the Emulated Radar (ER) output. ER is available through the AG-Star Communication/Power cable, see *Table 7, AG-Star Communication/Power Cable Pinouts* on page 48 for pin-out details.

Message ID: 8192

Syntax

```
radarcfg switch freq_step update_rate resp_mode threshold
```

Field	Data	Description	Binary Format	Binary Bytes	Binary Offset
1	RADARCFG header	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary.	-	-	0
2	switch	Enable or disable radar emulation 0 = ENABLE 1 = DISABLE (default = enable)	Enum	4	H
3	freq_step	Frequency step per kilometer per hour (Hz/kph). Range: 26.11, 28.12 or 36.11 (default = 26.11)	Double	8	H+4
4	update_rate	Specify how often to update radar output (in Hz) Range: 1, 2, 5, 10, 20 (default = 10) ^a	Integer	4	H+12
5	resp_mode	Specify the time, response mode, over which to average velocity samples, see <i>Table 13, Response Modes</i> on page 57. (Default = 500) ^a	Integer	4	H+16
6	threshold	The threshold is only applicable when the response mode is set to 2. The response time is 1000 ms when the velocity is greater than this value, otherwise, it is 500 ms. Range: 2-50 kph (default = 5 kph)	Double	8	H+20

- a. The number of samples used for smoothing depends on both the update_rate and resp_mode parameters. For instance, if the update_rate is 5 Hz and the resp_mode is 2000ms, the number of samples used will be 10.

Table 13: Response Modes

Mode	Description
2000	2000 ms
1000	1000 ms
500	500 ms (default)
2	Automatically switches between 1000 and 500 ms
1	Performs no smoothing

Example 1 to disable radar emulation:

```
radarcfg disable 26.11 1 1 2
```

Example 2 to set the frequency step to 36.11 Hz/kph, update rate to 1 Hz and no smoothing:

```
radarcfg enable 36.11 1 1 2
```

B.6 SELECTCHANCONFIG Set channel configuration



The SELECTCHANCONFIG command should only be used by advanced users.

This command changes the channel configuration used on the AG-Star receiver. It causes an immediate software reset. See *Table 14, AG-Star Channel Configuration Sets* on page 59 for a list of available channel configurations.



Configurations containing GLONASS channels are only available when the AG-Star has the GLONASS option enabled in the model.

Message ID: 1149

Abbreviated ASCII Syntax:

```
SELECTCHANCONFIG [set]
```

Factory Default (without GLONASS option):

```
selectchanconfig 2
```

Factory Default (with GLONASS option):

```
selectchanconfig 3
```

Abbreviated ASCII Example:

```
selectchanconfig 2
```

Field	Field Type	ASCII Value	Binary Value	Description	Binary Format	Binary Bytes	Binary Offset
1	SELECTCHANCONFIG header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary.	-	H	0
2	target	See <i>Table 14, AG-Star Channel Configuration Sets</i> on page 59		Channel configuration set	Ulong	4	H

Table 14: AG-Star Channel Configuration Sets

Binary	ASCII	Description
1	1	14 GPS L1 channels
2	2	12 GPS L1 channels 2 SBAS L1 channels
3	3	10 GPS L1 channels 4 GLONASS L1 channels
4	4	8 GPS L1 channels 6 GLONASS L1 channels
5	5	8 GPS L1 channels 4 GLONASS L1 channels 2 SBAS L1 channels
6	6	10 GPS L1 channels 2 GLONASS L1 channels 2 SBAS L1 channels
7	7	7 GPS L1 channels 7 GLONASS L1 channels
8	8	14 GLONASS L1 channels



7 GPS L1 + 7 GLONASS L1 channel configuration is recommended for timing-only applications.

Table 15: OEMStar Channel Configurations

Configurations	Set	Description
GPS	1	0 to 13 for GPS L1 channels
GPS/SBAS	2	0 to 11 for GPS L1 channels 12 to 13 for SBAS L1 channels
GPS/GLONASS	3	0 to 9 for GPS L1 channels 10 to 13 for GLONASS L1 channels
GPS/GLONASS	4	0 to 7 for GPS L1 channels 8 to 13 for GLONASS L1 channels
GPS/GLONASS/SBAS	5	0 to 7 for GPS L1 channels 8 to 11 for GLONASS L1 channels 12 to 13 for SBAS L1 channels
GPS/GLONASS/SBAS	6	0 to 9 for GPS L1 channels 10 to 11 for GLONASS L1 channels 12 to 13 for SBAS L1 channels
GPS/GLONASS	7	0 to 6 for GPS L1 channels 7 to 13 for GLONASS L1 channels
GLONASS	8	0 to 13 GLONASS L1 channels

B.7 SETCANNAME Sets the CAN name fields

This commands sets the CAN device name fields.

Message ID: 1091

Abbreviated ASCII Syntax:

```
SETCANNAME ManufacturerCode [IndustryGroup] [DeviceClass]
[DeviceClassInstance] [Function] [FunctionInstance] [ECUInstance]
[PreferredAddress]
```

ASCII Example:

```
SETCANNAME 305
```

Field	Field Type	ASCII Value	Binary Value	Description	Binary Format	Binary Bytes	Binary Offset
1	SETCANNAME header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary.	-	H	0
2	ManufacturerCode			CAN module's Manufacturer Code	ULong	4	H
3	IndustryGroup			Industry group number (default = 2)	ULong	4	H+4
4	DeviceClass			11783-5 Device class (default = 0)	ULong	4	H+8
5	DeviceClassInstance			11783-5 Device class instance (default = 0)	ULong	4	H+12
6	Function			11783-5 Function (default = 23)	ULong	4	H+16
7	FunctionInstance			11783-5 Function instance (default = 0)	ULong	4	H+20
8	ECUInstance			11783-5 ECU Instance (default = 0)	ULong	4	H+24
9	PreferredAddress			Device default address on start up (default=28)	ULong	4	H+28
10	Reserved				ULong	4	H+32

C.1 Position Logs

C.1.1 NMEA Logs

The NMEA logs (receiver outputs) supported by the AG-Star are summarized in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#). The available logs include:

- GPGGA, which outputs a log of position system fix data and undulation. There are variants of GPGGA, specifically:
 - GPGGALONG, which has both greater precision and the undulation field
- GPVTG, which outputs track made good and ground speed

The steps for configuring the receiver output, through the command line are:

1. Configure the communication port using the COM command, described in *Section B.2, COM Configure COM Port* on page 51. To set COM port 2 as follows:

Bit Rate	9600
Parity	none
Data Bits	8
Stop Bits	1
Handshaking	None
Echo	Off
Break	On

enter the following string:

```
com com2 9600 n 8 1 n off on
```

2. Select and configure the NMEA string that you want to output. For example, to log gpgga (position system fix data and undulation) at 2 Hz, enter the following string:

```
log gpgga ontime 0.5
```

You can configure the log to output at various frequencies, as described in *Section B.4, LOG Request Logs from the Receiver* on page 54.

The above command line operations can also be carried out through NovAtel Connect. Information about configuring the communication port can be found in the NovAtel Connect online help. The procedure for adding a NMEA log through NovAtel Connect is summarized as follows:

1. In the **Logging control** window, click *Logging to one or more of the receiver's serial ports*. The **Add Log** window displays.
2. Beside **Select list**, select *Complete List* or *NMEA List*.
3. Beside **Log to file**, select the NMEA log you want to add.
4. Select the port.
5. Configure the remaining fields then click *Add*.

C.1.2 NovAtel Position Logs

In addition to NMEA logs, NovAtel supports a range of non-NMEA position logs, described in the [OEMStar Firmware Reference Manual \(OM-20000127\)](#), including:

- **BESTPOS:** This log contains the best available position computed by the receiver, for example:

```
log bestposa ontime 0.5
```
- **BESTXYZ:** This log contains the receiver's best available position and velocity in ECEF coordinates, for example:

```
log bestxyza ontime 1
```

C.2 Other Logs

The AG-Star firmware generates the logs in *Table 16, AG-Star Logs in Alphabetical Order*, in addition to those of the OEMStar family log set. Refer to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#), which also contains procedures and explanations related to data logging.

Table 16: AG-Star Logs in Alphabetical Order

Message ID	ASCII Log	Description
8193	RADARSIGNAL	Radar signal and position information (AG-Star log)
37	VERSION	Hardware versions, software versions, and serial numbers (Existing OEMStar log extended to AG-Star)

C.2.1 RADARSIGNAL ER Signal and Position Information

This log contains position and Emulated Radar (ER) signal information.

Message ID: 8193

Log Type: Asynch

Recommended Input:

```
log radarsignala onchanged
```

ASCII Example 1 (stationary AG-Star):

```
#RADARSIGNALA,COM1,0,61.5,FINESTEERING,1501,248381.628,00000000,8a1c,3723;  
SOL_COMPUTED,WAAS,0.0139,0.00,0.00*f0d580ca
```

ASCII Example 2 (moving AG-Star):

```
#RADARSIGNALA,COM1,0,45.0,FINESTEERING,1755,1475.442,00000000,f81d,12614;  
SOL_COMPUTED,WAAS,2.8010,4214.075011,263.379688*cca8853d
```

Field	Field type	Data Description	Format	Binary Bytes	Binary Offset
1	RADARSIGNAL header	Log header		H	0
2	sol status	Solution status, see <i>Table 18, Solution Status</i> on page 64	Enum	4	H
3	vel type	Velocity type, see <i>Table 17, Position or Velocity Type</i> on page 63	Enum	4	H+4
4	speed	Speed over ground (m/s)	Double	8	H+8
4	varf freq	External VARF output frequency (Hz)	Double	8	H+16
5	radar freq	Radar signal frequency (Hz) as output by the Emulated Radar Out signal.	Double	8	H+24
6	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	H+32
7	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 17: Position or Velocity Type

Type (binary)	Type (ASCII)	Description
0	NONE	No solution
1	FIXEDPOS ^a	Position has been fixed by the FIX POSITION command
2	FIXEDHEIGHT ^a	Position has been fixed by the FIX HEIGHT/AUTO command
8	DOPPLER_VELOCITY	Velocity computed using instantaneous Doppler
16	SINGLE	Single point position
17	PSRDIFF	Pseudorange differential solution
18	WAAS	Solution calculated using corrections from an SBAS
19	PROPAGATED	Propagated by a Kalman filter without new observations

a. With default PDPFILTER ENABLE, the bestpos will no longer show that the position has been fixed, unless PDPFILTER is DISABLED.

Table 18: Solution Status

Solution Status		Description
Binary	ASCII	
0	SOL_COMPUTED	Solution computed
1	INSUFFICIENT_OBS	Insufficient observations
2	NO_CONVERGENCE	No convergence
3	SINGULARITY	Singularity at parameters matrix
4	COV_TRACE	Covariance trace exceeds maximum (trace > 1000 m)
5	TEST_DIST	Test distance exceeded (maximum of 3 rejections if distance > 10 km)
6	COLD_START	Not yet converged from cold start
7	V_H_LIMIT	Height or velocity limits exceeded (in accordance with export licensing restrictions)
8	VARIANCE	Variance exceeds limits
9	RESIDUALS	Residuals are too large
10	DELTA_POS	Delta position is too large
11	NEGATIVE_VAR	Negative variance
12	Reserved	
13	INTEGRITY_WARNING	Large residuals make position unreliable
14-17	Reserved for SPAN-capable receivers	
18	PENDING	When a FIX POSITION command is entered, the receiver computes its own position and determines if the fixed position is valid ^a
19	INVALID_FIX	The fixed position, entered using the FIX POSITION command, is not valid
20	UNAUTHORIZED	Position type is unauthorized - HP or XP on a receiver not authorized for it

- a. PENDING implies there are not enough satellites being tracked to verify if the FIX POSITION entered into the receiver is valid. The receiver needs to be tracking two or more GNSS satellites to perform this check. Under normal conditions PENDING should appear for a few seconds on power up before the GNSS receiver has locked onto its first few satellites. If your antenna is obstructed and you have entered a FIX POSITION command, then you may see PENDING indefinitely.

C.2.2 VERSION Hardware and Software Versions and Serial Numbers

The Component Type of the VERSION log, refer to the [OEMStar Firmware Reference Manual \(OM-20000127\)](#), is extended to include AG-Star information as in *Table 19, Component Type*.

Table 19: Component Type

Binary Value ^a	ASCII Value	Description
0	UNKNOWN	Unknown Component
1	GPSCARD	OEMStar GPSCard Component
3	ENCLOSURE	AG-Star Receiver
8	USERINFO	User-application information component
981073925 (0x3A7A0005)	DB_USERAPPAUTO	Auto-starting user-application firmware

a. Unused numbers are reserved for future use.

For the AG-Star, the BT MAC address field has been added, in hexadecimal format, to the USERINFO block.

```
<VERSION COM1 0 85.0 UNKNOWN 0 11.971 004c0000 3681 12362
< 4
< GPSCARD "LXGMTSA" "DHD13302094" "M6XV1G-2.02-TT" "L6X010106RN0000"
  "L6X010100RB0000" "2013/Aug/14" "11:10:30"
< DB_USERAPPAUTO "SmartApp" "0x0" "" "EAGST0200RN0000" ""
  "2013/Sep/11" "14:28:32"
< ENCLOSURE "AgStarBT" "NMEE13330008L" "0" "0" "0" "0" "0"
< USERINFO "LMX9830" "0212" "AGSTAR" "" "" "" ""
```

In the above example, the firmware is shown as L6X010106RN0000 and the AG-Star application is shown as EAGST0200RN0000.

The following are lists of the replacement parts available for your NovAtel AG-Star receiver. Should you require assistance, or need to order additional components, contact your local NovAtel dealer or Customer Service representative.

D.1 AG-Star

Table 20: AG-Star Product

Part Description	NovAtel Part
AG-Star	01019131
AG-Star-B with Bluetooth	01019129
AG-Star Communications/Power Cable 14-pin socket to 2 DB-9 connectors, twisted CAN I/O pair, and other bare wire connectors (see <i>Section A.2.2, AG-Star Communications/Power Cable (01018256)</i> on page 47)	01018256
Mounting Plate	01018317
Pole Mount Kit	01019142

D.2 User Manuals

Table 21: Reference User Manuals

Part Description	NovAtel Part
OEMStar Installation and Operation User Manual	OM-20000126
OEMStar Firmware Reference Manual	OM-20000127



The accessories above are also available from novatel.com

