Hemisphere®

875-0444-10

A631
GNSS Smart Antenna

User Guide
Revision: A5
May 23, 2023

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Device Compliance, License and Patents

Device Compliance

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

This product complies with the essential requirements and other relevant provisions of Directive 2014/53/EU. The declaration of conformity may be consulted at HTTPS://HEMISPHEREGNSS.COM/ABOUT-US/QUALITY-COMMITMENT.

E-Mark Statement: This product is not to be used for driverless/autonomous driving.

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Patents			
6111549	6876920	7400956	8000381
6397147	7142956	7429952	8018376
6469663	7162348	7437230	8085196
6501346	7277792	7460942	8102325
6539303	7292185	7689354	8138970
6549091	7292186	7808428	8140223
6711501	7373231	7835832	8174437
6744404	7388539	7885745	8184050
6865465	7400294	7948769	8190337
8214111	8217833	8265826	8271194
8307535	8311696	8334804	RE41358

Australia Patents	
2002244539	2002325645
2004320401	

Continued on next page

Device Compliance, License and Patents, Continued

Notice to Customers

Contact your local dealer for technical assistance. To find the authorized dealer near you:

Hemisphere GNSS, Inc
8515 East Anderson Drive
Scottsdale, AZ 85255 USA
Phone: (480) 348-6380
Fax: (480) 270-5070
PRECISION@HGNSS.COM
HTTPS://WWW.HEMISPHEREGNSS.COM/

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If you need to contact Hemisphere GNSS Technical Support:

Hemisphere GNSS, Inc.
8515 East Anderson Drive
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Terms and Definitions

Introduction

The following table lists the terms and definitions used in this document.

A631 terms & definitions

Term	Definition
Activation	Activation refers to a feature added through a one-time purchase.
Atlas	Atlas® is a subscription-based service provided by Hemisphere that enables the A631 to achieve sub-decimeter accuracy without a base station or datalink.
BeiDou	BeiDou is the global satellite system deployed and maintained by China.
DGPS/DGNSS	Differential GPS/GNSS refers to a receiver using Differential Corrections.
Elevation Mask	Elevation Mask is the minimum angle between a satellite and the horizon for the receiver to use that satellite in the solution.
Firmware	Firmware is the software loaded into the receiver that controls the functionality of the receiver and runs the GNSS engine.
GALILEO	Galileo is a global navigation satellite system implemented by the European Union and the European Space Agency.
GLONASS	Global Orbiting Navigation Satellite System (GLONASS) is a Global Navigation Satellite System deployed and maintained by Russia.
GPS	Global Position System (GPS) is a global navigation satellite system implemented by the United States.

Continued on next page

A631 terms & definitions, continued

Term	Definition
RTCM	Radio Technical Commission for Maritime Services (RTCM) is a standard used to define RTK message formats so that receivers from any manufacturer can be used together.
RTK	Real-Time-Kinematic (RTK) is a real-time differential GPS method that provides better accuracy than differential corrections.
SBAS	Satellite Based Augmentation System (SBAS) is a system that provides differential corrections over satellite throughout a wide area or region.
Subscription	A subscription is a feature that is enabled for a limited time. Once the end-date of the subscription has been reached, the feature will turn off until the subscription is renewed.
WAAS	Wide Area Augmentation System (WAAS) is a satellite-based augmentation system (SBAS) that provides free differential corrections over satellite in parts of North America.

Chapter 1: Introduction

Overview

Introduction

This User Guide provides information to help you quickly set up your A631 GNSS Smart Antenna. You can download this manual from the Hemisphere GNSS website at WWW.HGNSS.COM.

Contents

Product Overview

Product overview

Hemisphere GNSS' scalable A631 GNSS Smart Antenna was designed to excel in challenging environments, and is ideal for use with various applications, including precision agriculture, machine control, construction, mining, and marine.

The A631 GNSS Smart Antenna is a multi-GNSS RTK and L-band capable, high-accuracy Smart Antenna that allows you to work quickly and accurately. Built on Hemisphere GNSS' Lyra™ II Digital Asic Technology with Cygnus™ Interference Mitigation Technology and Aquila™ Wideband RF ASIC Technology , the A631 GNSS Smart Antenna boasts the latest GNSS patented technology and offers quick startup and reacquisition times.

The A631 GNSS Smart Antenna can be updated by adding multi-frequency and RTK activations and subscriptions for the Hemisphere GNSS Atlas® L-band services. Athena™ RTK is Hemisphere's most advanced RTK processing software that comes with the A631 GNSS Smart Antenna.

Note: Throughout the rest of this manual, the A631 GNSS Smart Antenna is referred to simply as the A631.

Figure 1-1: A631 GNSS Smart Antenna

Continued on next page

Product overview, continued

The A631 is a versatile Smart Antenna with numerous first-class features:

- Uses Hemisphere's Athena GNSS engine
- Atlas support for L-band corrections
- Environment-proven enclosure for the most aggressive user scenarios

Athena RTK

Athena RTK has the following benefits:

- Improved Initialization time. Performing initializations in less than 15 seconds at better than 99.9% of the time.
- Robustness in difficult operating environments.
- Extremely high productivity under the most aggressive of geographic and landscape-oriented environments.
- Performance on long baselines.
- Industry-leading position stability for long baseline applications.
- Sustained accuracy under ionospheric scintillation activities, in high scintillation-affected areas.

Atlas L-band

Atlas L-band is Hemisphere's industry leading correction service, which can be added to the A631 as an activation or subscription. Atlas L-band has the following benefits:

- **Positioning accuracy -** Competitive positioning accuracies down to 4 cm RMS in certain applications.
- **Positioning sustainability -** Cutting edge position quality maintenance in the absence of correction signals, using Hemisphere's patented technology.
- **Scalable service levels** - Capable of providing virtually any accuracy, precision and repeatability level in the 4 to 100 cm range.
- **Convergence time** – Industry leading convergence times of 10-40 minutes.

Continued on next page

For more information	For more information about Athena RTK and Atlas, see: Our Technology - Hemisphere GNSS | Advanced GNSS Technology to Empower Your Applications

Key Features

A631 Key features

Key features of the A631 include:

- Centimeter-level accuracy using Atlas[1] or Athena[2] technology in a rugged, all-in-one enclosure
- Improved GNSS performance—particularly with RTK and/or L-band applications
- Very fast RTK fix and reacquisition times
- Supports NMEA 0183, NMEA 2000[3], for communication with external devices
- Wide operating voltage range of 7-32 VDC, providing high transient protection for any power source

The A631 supports a variety of protocols for communicating with navigation systems, CAN systems, and other devices.

[1] Requires subscription
[2] Requires activation
[3] Requires NMEA2000 certification

What's Included in Your Kit

A631 Parts list

The following parts and accessory items are included with your A631. Table 1-1 provides the part name and description, quantity, and part number for each part in your kit.

Table 1-1: A631 Parts list/accessory items

Part No.	Description	Qty
804-0167-XX	A631 GNSS Smart Antenna	1
710-0130-0	Pole Mount	Optional
710-0129-0	Surface Mount Kit	Optional
Note: Your kit will include one of the above mounting adapters, depending on your order.		
The following accessory items are available for purchase separately for your A631.		
051-0129-002	Power/data cable (single DB9), 3 m	1
051-0130-003	Power/data cable (two DB9), 3 m	1
051-0168-20	Power/data cable (unterminated) 4.6 m	1
051-0168-000	Power/data cable (unterminated),15 m	1
051-0470-10	NMEA 2000 cable	1

Product support

If you have questions regarding the setup, configuration, or operation of the A631, contact your local dealer. For additional support information see **Technical Support**.

Firmware Upgrades

Overview

Periodically, Hemisphere GNSS releases firmware upgrades to improve performance, fix bugs, or add new features to a product.

To update the firmware on the A631 download the latest version of Hemisphere GNSS RightArm from the following link: HTTPS://HGNSS.COM/RESOURCES-SUPPORT/SOFTWARE.

RightArm updates

Connect the A631 to a computer over a serial port. Firmware can be loaded over Port A or Port B. Set the baud rate of the serial port you are using to 19200.

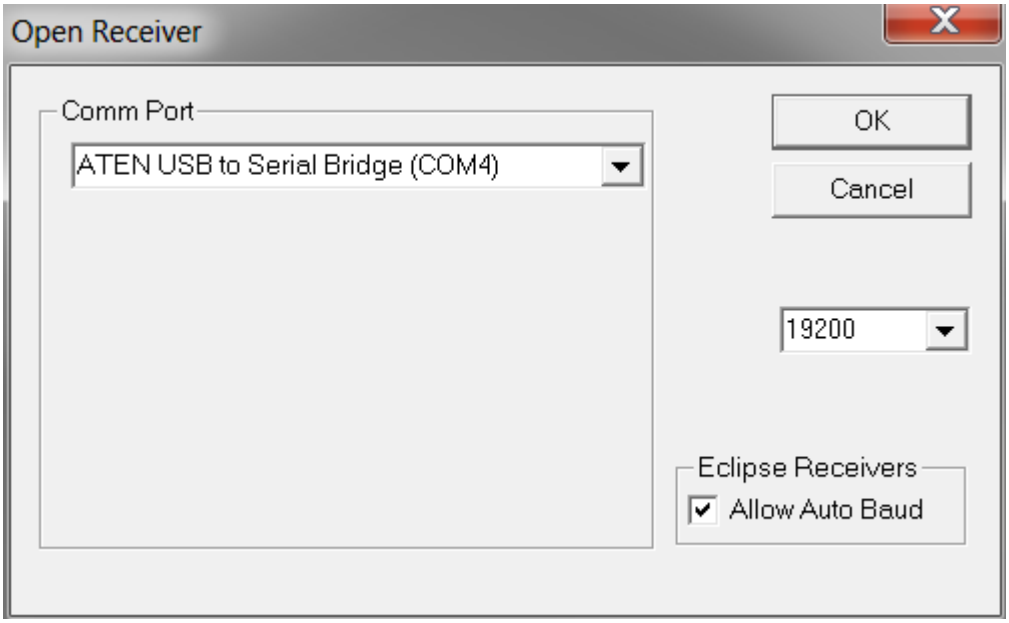
Launch RightArm.

Click the **Connect** button or navigate to Receiver -> Connect.

Continued on next page

RightArm updates, continued

Choose the COM port connected to the A631 and click **OK**.



Note: The baud rate of the serial port should be set to 19200 bps. Select "**Allow Auto Baud**" to change the baud rate during the firmware upgrade for a faster update.

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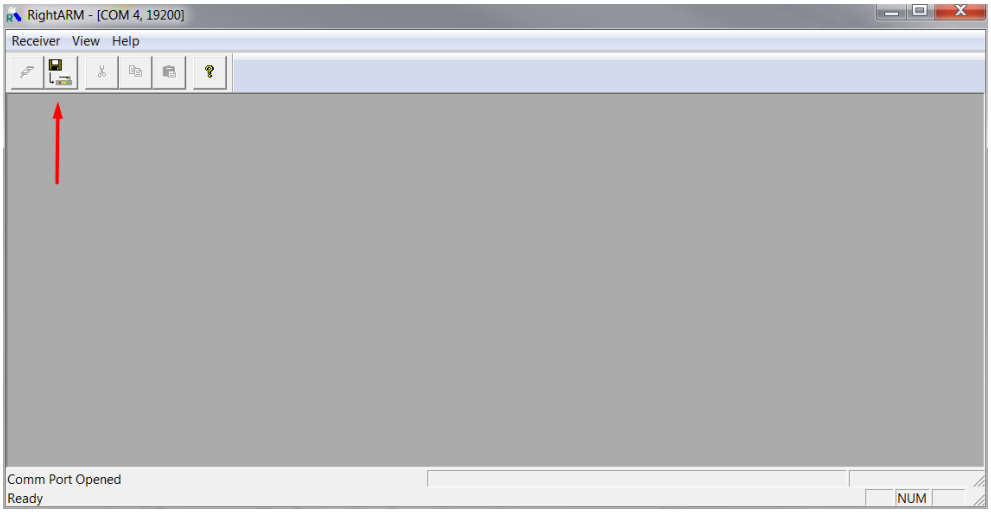
RightArm updates, continued

Click the **Programming** button.



Select a **Program Type**.

The A631 has two firmware applications, allowing two different versions of GNSS firmware. Hemisphere GNSS suggests loading the new firmware onto both applications.

After the firmware update is completed, check the current GNSS firmware.

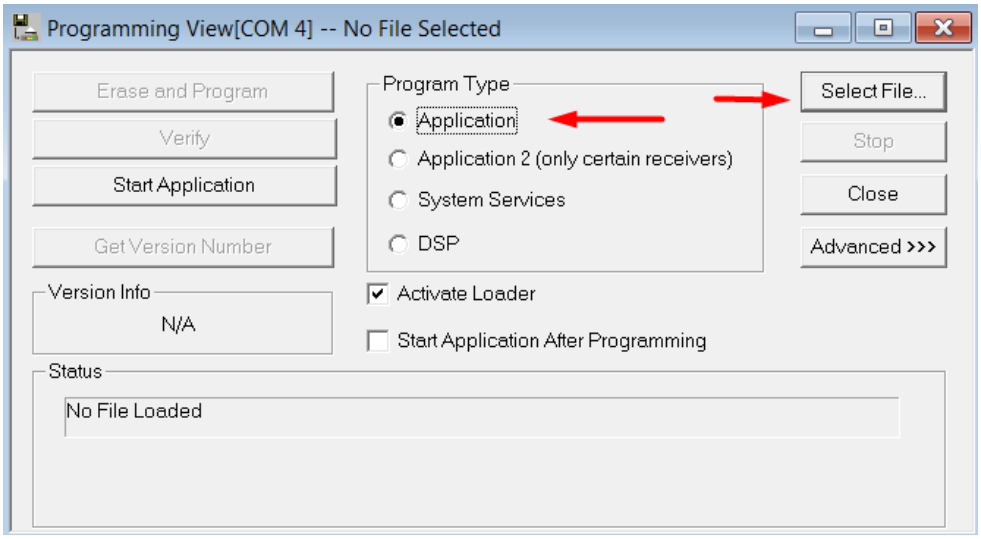
If the current firmware is not the same as the newly loaded firmware, the A631 could be using the other application. You can switch applications by sending the following command:

$JAPP,OTHER

Choose the Application, and press **Select File** to select the firmware file.

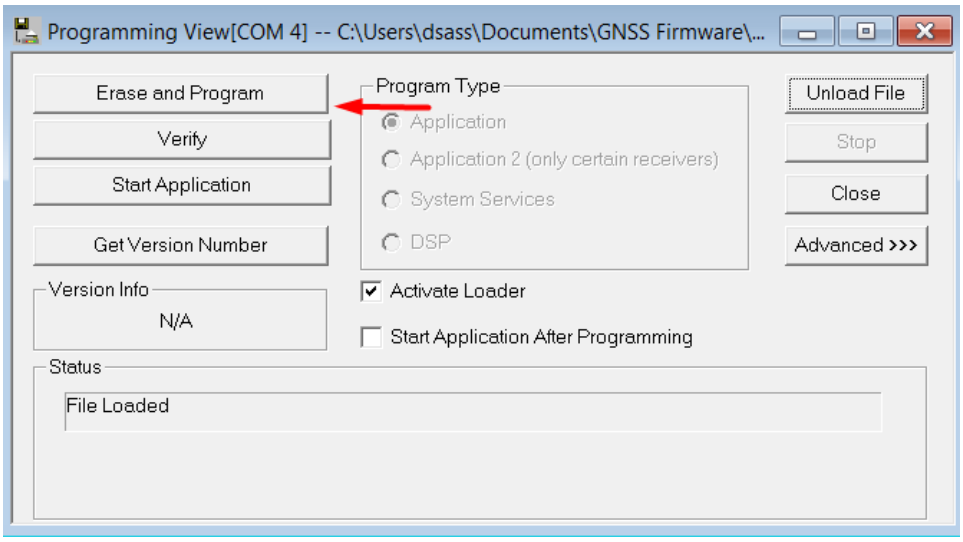
Continued on next page

RightArm updates, continued



Choose the firmware, and click **Erase and Program**.

The **Activate Loader** checkbox in the **Programming View** window is selected. After pressing the **Erase and Program** button, this checkbox will de-select, and the **Status** field indicates the receiver is in loader mode (ready to receive the new firmware file).

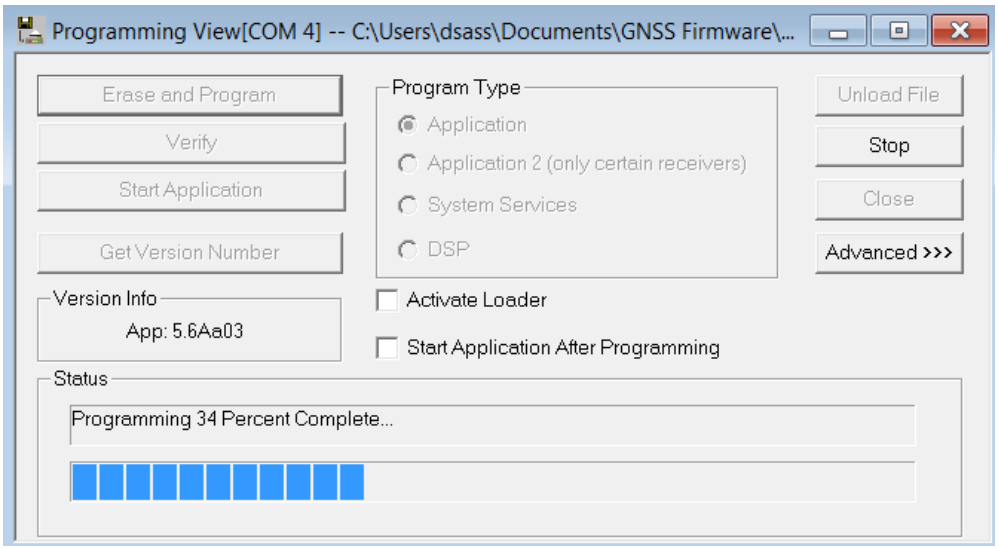


Continued on next page

RightArm updates, continued

Note: If the **Activate Loader** check box remains selected, power the receiver off and on. When the receiver powers back on, the **Activate Loader** box should be de-selected.

⚠WARNING:
Do not interrupt the power supply to the receiver, and do not interrupt the communication link between the PC and the receiver until programming is complete. Failure to do so may cause the receiver to become inoperable and will require factory repair.



Note: After completing the firmware update, Hemisphere GNSS suggests repeating this process for the other application.

Chapter 2: Installing the A631

Overview

Introduction

This chapter provides instructions on how to install and mount your A631 antenna.

Contents

Installing the A631

Introduction

This section provides information on installing the A631.

Display, mounting and connectors

All connections and ports are located on the bottom of the unit, as shown in Figure 2-1. Table 2-1 provides additional information about each port/connection.

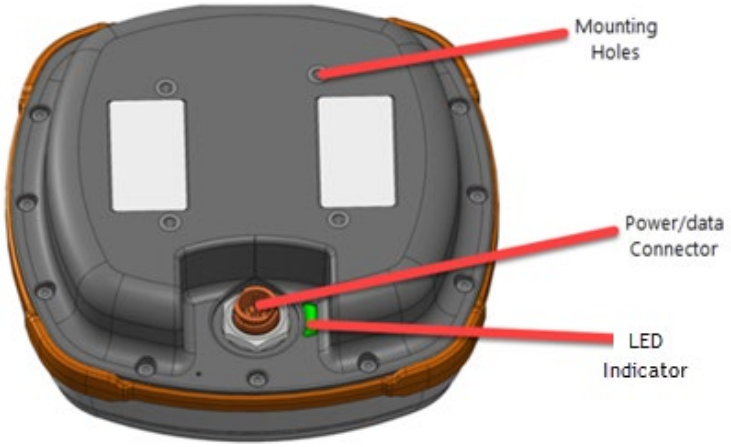


Figure 2-1: A631 connections and ports

Continued on next page

Display, mounting and connectors, continued

Table 2-1: A631 Ports and Connections

Port/Connection	Description
Mounting holes	Four off set mounting holes. Two adapters are available, the first includes a marine 1” standard, adaptable to 5/8”. The second adaptor allows for flush-mounting the unit.
Power, data port (12-pin)	External power/data cable; allows you to supply power to the A631 and communicate with external devices via NMEA 0183 serial, CAN (NMEA 2000) and binary.

Power/data cable considerations

Before mounting the A631, consider the following regarding power/data cable routing:

Do	Do not
Ensure cable reaches an appropriate power source.	Run cables in areas of excessive heat.
Keep cable away from corrosive chemicals.	Run cables through a door or window jams.
Connect to a data storage device, computer, or other device that accepts GNSS data.	Crimp or excessively bend the cable.
Keep cable away from rotating machinery.	Place tension on the cable.
Remove unwanted slack from the cable at the A631 end.	
Secure along the cable route using plastic wrapping.	

⚠WARNING:
Improperly installed cable near machinery can be dangerous.

LED Indicator

LED Indicator

The A631 uses a single LED that provides system information based on the color of the LED as follows:

- Blinking Red - Power on
- Blinking Amber - GNSS position available, including RTK float and Atlas
- Blinking Green - RTK-fixed or Atlas-converged position available
- Blinking any color - Receiver operational

⚠WARNING: If at any time the LED turns to a solid color for an extended period of time, the receiver has malfunctioned.

Mounting the A631

Overview

This section provides information on where to mount your antenna and the different mounting options available with the A631.

Selecting the proper antenna location

Proper antenna placement is critical to positioning accuracy. To select the proper antenna location:

- Place the antenna with an unobstructed view of the sky. An obstructed view of the sky may impair system performance. The GNSS engine computes a position based on measurements from each satellite to the internal GNSS receiver.
- Mount the antenna on, or as close as possible to, the center of your point of measurement. For example, ideal antenna placement on a vehicle is the center of the cab roof, assuming there is a clear view of the sky.
- Position the antenna as high as possible.

Mounting options

The A631 allows for the following mounting options:

- Surface-mount
- Pole-mount

Continued on next page

Mounting the A631, Continued

Surface-mount

You can surface-mount the A631 using four machine screws (no. 8-32).

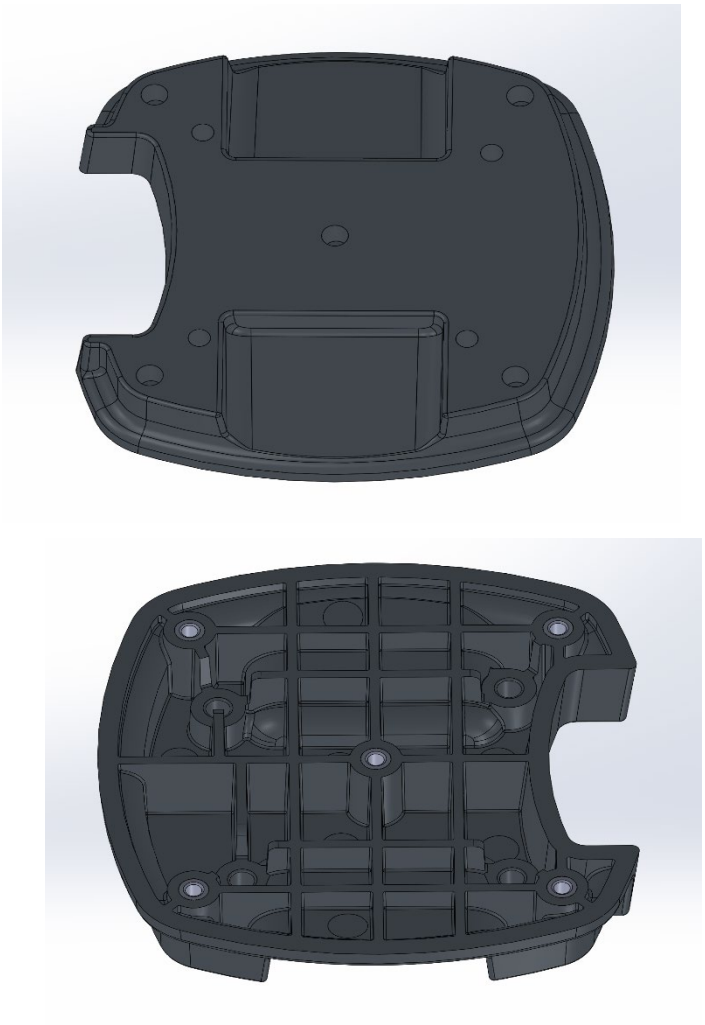


Figure 2-2: A631 top/bottom

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Surface-mount, continued

To surface-mount the A631 use the following steps:

Table 2-2: Surface-mount the A631

Step	Action
1	Determine the desired location for the A631 (see Selecting the Proper Antenna Location).
2	Mark the mounting hole centers on the mounting surface.
3	Place the A631 surface mount over the marks to ensure the planned hole centers align with the true hole centers (adjusting as necessary).
4	Use a center punch to mark the hole centers.
5	Drill the mounting holes with a 5mm bit appropriate for the surface.
6	Use four machine screws (no. 8-32) to attach the A631 to the surface mount adapter before securing the complete unit to the intended area.
7	Place the A631 surface mount over the mounting holes and insert the mounting screws through the bottom of the mounting surface into the A631 surface mount adapter.

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Surface-mount, continued

Refer to Figure 2-3 for measurements to mount the A631 Smart Antenna.

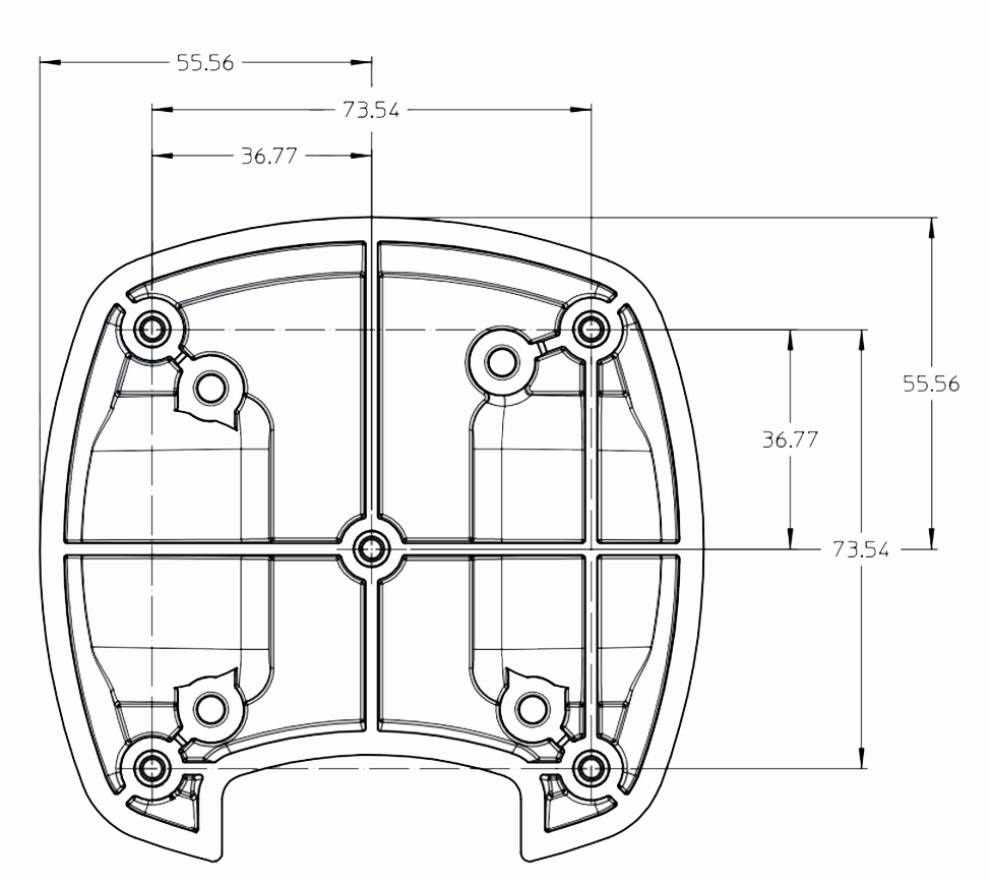

Figure 2-3: A631 mount dimensions

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Surface-mount, continued

Figure 2-4 shows the A631 with the surface-mount accessory.

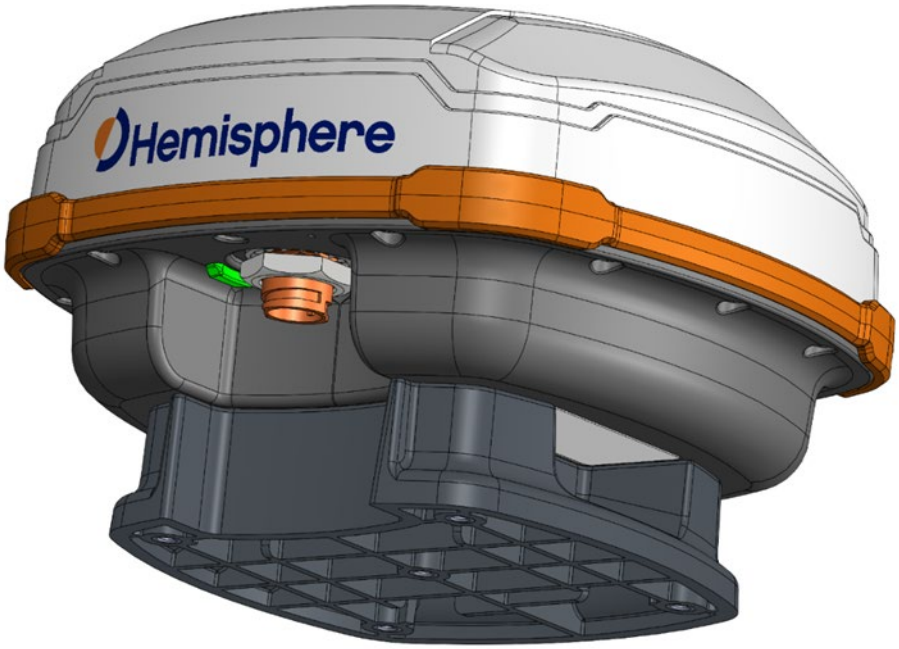

Figure 2-4: A631 with surface-mount accessory

WARNING: Hand-tighten only (10 to 12 in-lbs.). Damage resulting from over-tightening is not covered by the warranty.

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Mounting the A631, Continued

Pole-mount

The center thread on the bottom of the A631 is 1-14 UNS. The mounting assembly included with the A631 includes a 5/8-11 UNC adapter. Simply thread the riser/pole into the antenna until snug.

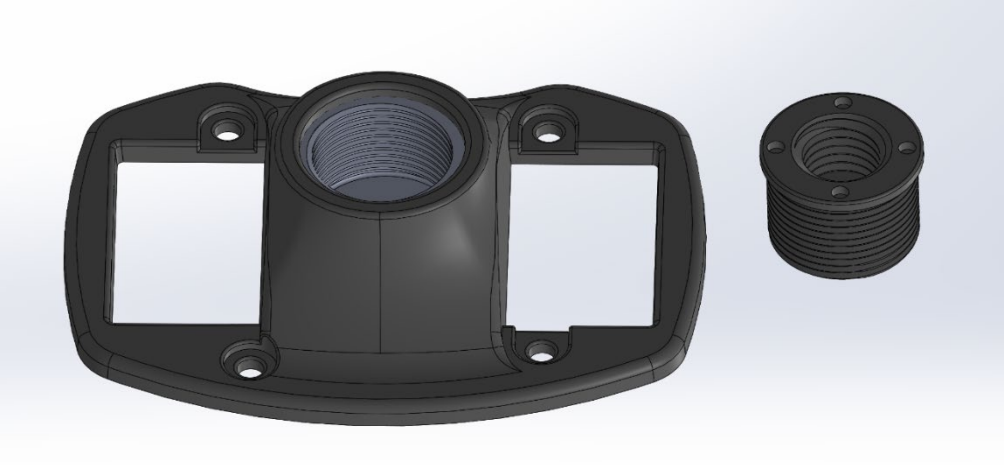

Figure 2-5: Pole-mount

WARNING: Hand-tighten only (screws 10-12 in-lbs; pole 35-40 in-lbs.). Damage resulting from over-tightening is not covered by the warranty.

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Pole-mount, continued

Refer to Figure 2-6 for dimensions when connecting the pole-mount to the A631.

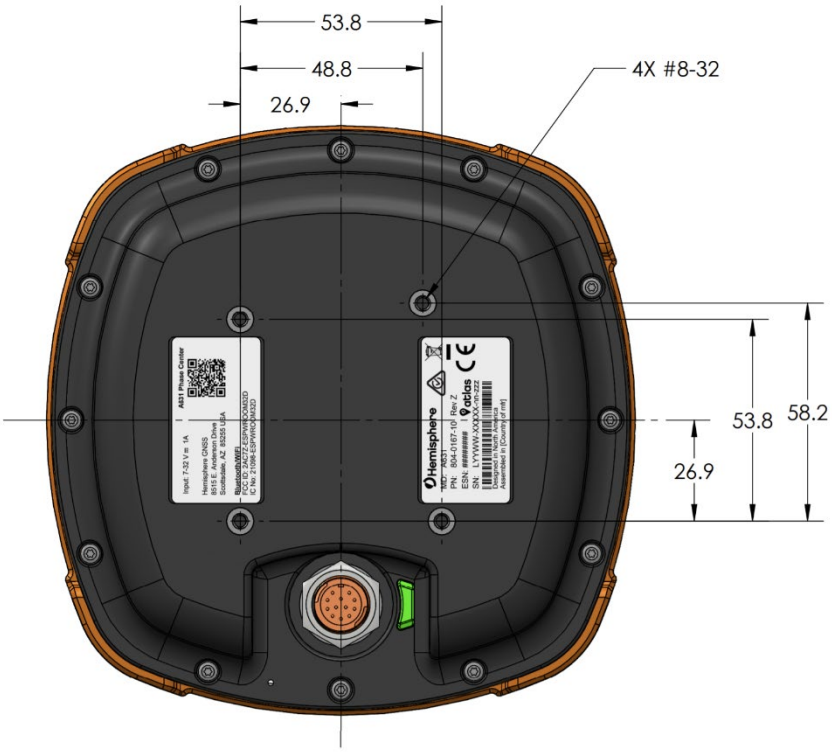


Figure 2-6: A631 pole-mount dimensions

Powering the A631

Power considerations

The A631 accepts an input voltage of 7-32 VDC. For best performance, use a clean and continuous power supply. When applying 13.8 VDC, the A631 will draw approximately 1.7 W.

Connecting to a power source

The A631 uses a single cable for power and data input/output.

Note: A power/data cable is not supplied with the A631, but one is available as an accessory item. See Table 1-1 for a list of accessory items.

Note: The following information refers to using the accessory item cables available from Hemisphere GNSS.

The antenna end of the cable is terminated with an environmentally sealed 12-pin connector and the opposite end is either DB9 or unterminated (requires field stripping and tinning).

To power A631 connect to a 12 VDC System.

Note: Selecting the right power connector will depend on your specific installation requirements.

WARNING: Do not apply a voltage higher than 32 VDC. This will damage the receiver and void the warranty.

The A631 features reverse polarity protection to prevent excessive damage if the power leads are accidentally reversed. With the application of power, the A631 automatically proceeds through an internal startup sequence; however, it is ready to communicate immediately.

Continued on next page

Power/data connector

Figure 2-7 shows the 12-pin power/data connector pinout assignments and Table 2-3 provides the pinout specifications.

Note: The **Wire Color** column in Table 2-3 refers to the color of the wires at the unterminated end of accessory item 051-0169-000 (4.6 m unterminated power/data cable).

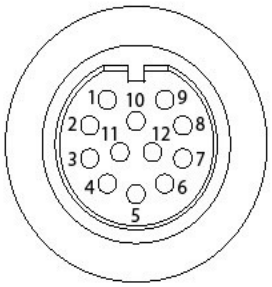


Figure 2-7: Pin-out assignments

Table 2-3: Pin-out specifications

Pin	Description	Wire Color
1	Manual mark in	White
2	Port B Tx	Brown
3	Port B Rx	Blue
4	CAN high	Orange
5	Signal ground	Yellow
6	Port A Tx	Violet
7	PPS	Gray
8	Port A Rx	Pink
9	CAN low	Tan
10	Power in (12 V)	Red
11	Power ground	Black
12	Speed out	Green

Note: For successful communication, the baud rate of the A631 serial ports (Port A and Port B) must be set to match that of the connected devices.

Chapter 3: Operating the A631

Overview

Introduction

This chapter explains the operations used in tracking with the A631.

Contents

Using A631

Overview

For your convenience, both the GNSS and differential correction of the A631 are preconfigured. The receiver will work out-of-the-box, and for most applications, little user setup is necessary.

When powered for the first time, the A631 will perform a “cold start,” which involves acquiring the available GNSS satellites in view and the SBAS differential service.

Differential and RTK Operation

Differential (DGNSS) and RTK operation

The purpose of Differential GNSS (DGNSS) and RTK is to remove the effects of atmospheric errors, timing errors and satellite orbit errors, while enhancing system integrity.

Autonomous positioning capabilities of the A631 will result in positioning accuracies of 2.5 m 95% of the time.

To improve positioning quality, the A631 can receive DGNSS corrections over SBAS, L-band corrections with Hemisphere GNSS' Atlas L-band technology, or RTK corrections over serial.

For more information on the differential services and the associated commands refer to the Hemisphere GNSS Technical Reference Manual (TRM).

SBAS Tracking

SBAS tracking

SBAS is a standard feature on the A631 and does not require an activation or subscription code.

The A631 automatically scans and tracks SBAS signals without the need to tune the receiver.

The A631 features two-channel tracking that provides an enhanced ability to maintain a lock on an SBAS satellite when more than one satellite is in view.

This redundant tracking approach results in more consistent tracking of an SBAS signal in areas where signal blockage of a satellite is possible.

Athena RTK

Athena RTK

Athena RTK requires the use of two separate receivers: a stationary base station (primary receiver) that broadcasts corrections over a wireless link to the rover (secondary receiver).

The A631 can use RTK through Port A or Port B. The receiver uses any RTK message coming in over a serial port if the RTK message type is included in the list of available differential sources.

If you do not know which RTK message type is being sent by the base station, you can include RTCM3, ROX, and CMR. Refer to the HGNSS Technical Reference Manual (TRM) for a complete list of supported message types.

Only one differential correction source can be used at a time. If you include extra differential sources, this will not affect the receiver if those differential sources are not being received.

After setting the differential source, configure the baud rate of the serial port receiving the RTK corrections. Ensure that the serial port configuration of the external device (such as radio or modem) is 8 bits/byte, 1 stop bit, no parity, and no flow control.

Connect the external device to the serial port of the A631. Some cables may require the use of a gender changer and/or null modem adapter.

Supported Constellations

Supported constellations	The A631 is available in its base form with L1 GPS, G1 GLONASS, E1 Galileo, B1 BeiDou, and L1 QZSS support. By adding a multi-frequency activation, the number of available signals increases, which improves RTK robustness.

System Parameters

System parameters

The following table lists the A631 system parameters:

Table 3-1: System Parameters

Setting	Description
DGNSS	**Application**: Latest GNSS FW found at WWW.HGNSS.COM
Serial ports A and B	**Baud rate**: 4800, 9600, 19200 (default), 57600, 115200, 230400 and 460800 **Data bits:** 8 Parity: None Stop bit: 1 **Interface level:** RS-232
GNSS messages	**Type:** Hemisphere GNSS binary, NMEA 0183, NMEA 2000 **Update rate:** 1 Hz, 10Hz (default), 20 Hz***** **Elevation mask**: 5° *****With activation code

Configuring the A631

Overview

You can configure the A631 through the serial port using Hemisphere GNSS commands. For example, you can select:

- Baud rate
- NMEA data message (To output on the dual serial ports and the update rate of each message.)

Note: Use the **$JSAVE** command to save changes you make to the A631's configuration for the changes to be present in subsequent power cycles.

For information on Hemisphere GNSS commands refer to the Hemisphere GNSS Technical Reference Manual (TRM).

Auto-seed

Auto-seed allows the end user to shut down their device in a static position for an extended period of time. If the antenna remains stationary at shut down, the position status and Atlas convergence will remain in the device memory and resume upon start-up. This enables the Atlas solution to regain its accurate position within two minutes of start-up.

Auto-seed provides quick response positioning and enables the customer to get to work faster and with confidence in the GNSS solution.

NMEA 2000 Messages

Overview

Tables 3-2 through 3-4 list NMEA 2000 messages. These messages are available by default as part of the NMEA standard integration.

A631 NMEA 2000 received messages

Table 3-2: NMEA 2000 messages received based on a request

PGN	Description	Default Update Rate (msec)	Freq (Hz)
059392	ISO Acknowledgement Used to acknowledge the status of certain requests addressed to a specific ECU.	On Request	On Request
059904	ISO Request Request the transmission of a specific PGN, addressed or broadcast.	On Request	On Request
060928	ISO Address Claim Used to identify to other ECUs the address claimed by an ECU.	On Request	On Request
126996	Product Information NMEA 2000 database version supported, manufacturer's product code, NMEA 2000 certification level, load equivalency number, and other product- specific information.	On Request	On Request
126464	Receive/Transmit PGNs group function The Transmit / Receive PGN List Group type of function is defined by the first field.	On Request	On Request

Continued on next page

A631 NMEA 2000 received messages, continued

Table 3-2: NMEA 2000 messages received based on a request (continued)

PGN	Description	Default Update Rate (msec)	Freq (Hz)
129545	GNSS RAIM Output Used to provide the output from a GNSS receiver's Receiver Autonomous Integrity Monitoring (RAIM) process. The Integrity field value is based on the parameters set in PGN 129546 GNSS RAIM Settings.	On Request	On Request
129546	GNSS RAIM Settings Used to report the control parameters for a GNSS Receiver Autonomous Integrity Monitoring (RAIM) process.	On Request	On Request

Continued on next page

A631 NMEA 2000 transmitted messages

Table 3-3: NMEA 2000 transmitted messages

PGN	Description	Default Update Rate (msec)	Freq (Hz)
126992	System Time The purpose of this PGN is twofold: 1) To provide a regular transmission of UTC time and date, and 2) To provide synchronism for measurement data	1000	1
126993	Heartbeat Confirms a device is still present on the network.	60000	1/60

Continued on next page

A631 NMEA 2000 transmitted messages, continued

Table 3-3: NMEA 2000 transmitted messages (continued)

PGN	Description	Default Update Rate (msec)	Freq (Hz)
127257	Altitude Provides a single transmission that describes the position of a vessel relative to both horizontal and vertical planes. Altitude can be used for vessel stabilization, vessel control and onboard platform stabilization.	1000	1
127258	Magnetic Variation Message for transmitting variation. The message contains a sequence number to synchronize other messages such as Heading or Course over Ground. The quality of service and age of service are provided to determine appropriate level of service if multiple transmissions exist.	1000	1

Continued on next page

A631 NMEA 2000 transmitted messages, continued

Table 3-3: NMEA 2000 transmitted messages (continued)

PGN	Description	Default Update Rate (msec)	Freq (Hz)
129025	Position, Rapid Update Provides latitude and longitude referenced to WGS84. A single frame message (opposed to other PGNs that include latitude and longitude and are defined as fast or multi-packet), this PGN lends itself to more frequent transmission without using excessive bandwidth.	100	10
129026	COG & SOG, Rapid Update Single frame PGN that provides Course Over Ground (COG) and Speed Over Ground (SOG).	250	4

Continued on next page

A631 NMEA 2000 transmitted messages, continued

Table 3-3: NMEA 2000 transmitted messages (continued)

PGN	Description	Default Update Rate (msec)	Freq (Hz)
129027	Position Delta, High Precision Rapid Update The 'Position Delta, High Precision Rapid Update' Parameter Group is for applications requiring high precision and very fast update rates for position data. This PGN provides delta position changes down to 1 mm with a delta time period accurate to 5 msec.	100	10
129028	Altitude Delta, High Precision Rapid Update The 'Altitude Delta, High Precision Rapid Update' Parameter Group is intended for applications requiring high precision and fast update rates are needed for altitude and course over ground data. This PGN can provide delta altitude changes down to 1 millimeter, a change in direction as small as 0.0057°, and with a delta time period accurate to 5 msec.	100	10

Continued on next page

A631 NMEA 2000 transmitted messages, continued

Table 3-3: NMEA 2000 transmitted messages (continued)

PGN	Description	Default Update Rate (msec)	Freq (Hz)
129029	GNSS Position Data Conveys a comprehensive set of Global Navigation Satellite System (GNSS) parameters, including position information.	1000	1
129033	Time & Date Single transmission that provides UTC time, UTC Date, and Local Offset.	1000	1
129539	GNSS DOPs Provides a single transmission containing GNSS status and dilution of precision components (DOP) that indicate the contribution of satellite geometry to the overall positioning error. Three DOP parameters are reported: horizontal (HDOP), Vertical (VDOP), and time (TDOP).	1000	1

Continued on next page

A631 NMEA 2000 transmitted messages, continued

Table 3-3: NMEA 2000 transmitted messages (continued)

PGN	Description	Default Update Rate (msec)	Freq (Hz)
129540	GNSS Sats in View GNSS information on current satellites in view tagged by sequence ID. Information includes PRN, elevation, azimuth, SNR, defines the number of satellites; defines the satellite number and the information.	1000	1
126993	Heartbeat Periodically announces presence on the CAN bus.	60000	0.016667

Continued on next page

A631 NMEA 2000 transmitted messages, continued

Table 3-3: NMEA 2000 transmitted messages (continued)

PGN	Description	Default Update Rate (msec)	Freq (Hz)
129033	Local Time Offset Indicates offset between a configured local time and UTC. As of currently we do not support a local time, so this always reports no offset.	On Request	On Request
126998	Configuration Information Used for returning fields describing an installation. Currently always returns blank.	On Request	On Request

NMEA 2000 Proprietary Messages

NMEA 2000 proprietary messages

The following table lists the NMEA 2000 proprietary messages via CAN for tasks such as receiver configuration.

Table 3-4: NMEA 2000 proprietary messages

NMEA 2000 proprietary messages
Single Frame packet definition - PGN: EFXX (Destination addressable)
MSGID 0x0001 - N2K,MCODE
MSGID 0x0002 - N2K,PCODE
MSGID 0x0003 - N2K,LOAD
MSGID 0x0004 - N2K,CERT
MSGID 0x0005 - JVERSION
MSGID 0x0006 - N2K,RESET
MSGID 0x0007 - N2K,ADDRESS
MSGID 0x0008 - JDIFF
MSGID 0x0009 - JDIFF,INCLUDE
MSGID 0x000A - JMODES
MSGID 0x000B - JSBASPRN
MSGID 0x000C - JBAUD,PORTx
MSGID 0x000D - JMASK
MSGID 0x000E - JATT,TILTAID
MSGID 0x000F - JATT,TILTCAL
MSGID 0x0010 - JATT,HBIAS
MSGID 0x0011 - JATT,PBIAS
MSGID 0x0012 - JATT,GYROAID
MSGID 0x0013 - JRESET
MSGID 0x0014 - JI, serial number
MSGID 0x0015 - JRAIM
MSGID 0x0016 - JATT,HIGHMP
MSGID 0x0017 - JAPP
MSGID 0x0018 - JAGE
MSGID 0x0019 - BIN1, stdev residuals
MSGID 0x001A - RD1
MSGID 0x001B - JK (read)
MSGID 0x001D - JWCONF,12

Continued on next page

NMEA 2000 proprietary messages, continued

Table 3-4: NMEA proprietary messages (continued)

NMEA 2000 proprietary message
Single Frame packet definition - PGN: EFXX (Destination addressable)
MSGID 0x001F - JI, application version
MSGID 0x0020 - JSYSVER
MSGID 0x0021 - JT
MSGID 0x0022 - JATT,MSEP
MSGID 0x0023 - JATT,CSEP
MSGID 0x0025 – NMEA 2000 Message Control
MSGID 0x0026 - JNP
MSGID 0x0027 - JSMOOTH
MSGID 0x0028 - JATT,HTAU
MSGID 0x0029 - JATT,HRTAU
MSGID 0x002A - JATT,COGTAU
MSGID 0x002C - JATT,NEGTILT
MSGID 0x002E - JATT,LEVEL
MSGID 0x002F - JATT,MOVEBAS
MSGID 0x0031 - GPHEV Heave
MSGID 0x0032 - JSAVE
MSGID 0x0034 - INTLT Raw Tilt Values
MSGID 0x0037 - Distance to Base
MSGID 0x0038 - JFREQ
MSGID 0x0039 - JLIMIT
MSGID 0x003A - JAIR
MSGID 0x003B - JATT,EXACT
MSGID 0x003C - JATT,PTAU
MSGID 0x003D - JATT,ROLL
MSGID 0x003E - JPOS
MSGID 0x003F - Serial Messages
MSGID 0x0040 - HPR StdDev
MSGID 0x0045 - JGEO

Continued on next page

NMEA 2000 proprietary messages, continued

Table 3-4: NMEA proprietary messages (continued)

NMEA 2000 proprietary message
Multi-Frame Fast-Packet definition – PGN: 1EFXX (Destination addressable)
MSGID 0x8001 - N2K,VERSION
MSGID 0x8003 - JPOSOFFSET
MSGID 0x8004 - JVERSION
MSGID 0x8005 - JAUTH
MSGID 0x8008 - Generic GNSS Serial Command
MSGID 0x8009 - RAW data transfer for differential
MSGID 0x800A - JI, Extended info
MSGID 0x800B - N2K,MODEL
MSGID 0x800D - RTKSTAT
MSGID 0x800E - ATTSTAT

Chapter 4: Using the A631 WebUI

Overview

Introduction

This chapter contains information about the screens and functions of the A631 WebUI.

Contents

WebUI

Introduction

The WebUI functionality of the HGNSS A631 allows the user to configure the receiver and radio with a WiFi capable computer or mobile device.

It allows for easy product status review, configuration and GNSS Firmware updates without the need for a wired cable connection.

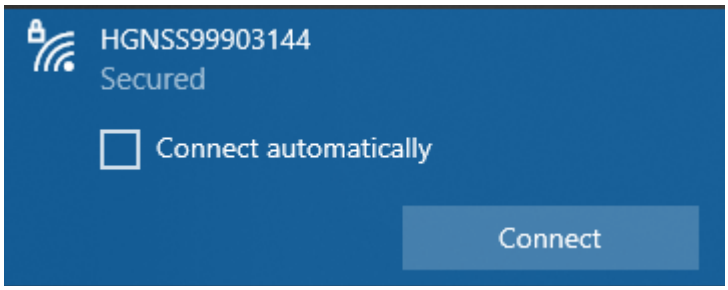
Note: The typical WiFi range is expected to be up to 30 feet (10m). Ideally the user should be in close range to the receiver.

WiFi Connection

To use the WebUI, a WiFi connection must be established with the HGNSS A631 receiver.

Connect the mobile device to the receiver over WiFi:

- Ensure WiFi is enabled on the mobile device
- Identify the SSID of the A631 receiver as [HGNSS+8digit ESN]
- Connect to the WiFi network
- The default WiFi password is “hgnss1234”



Access WebUI

The WebUI utilizes an IP address with a standard internet browser:

- Open the internet browser
- Enter http://192.168.100.1/
- Access the start page of the A631 WebUI

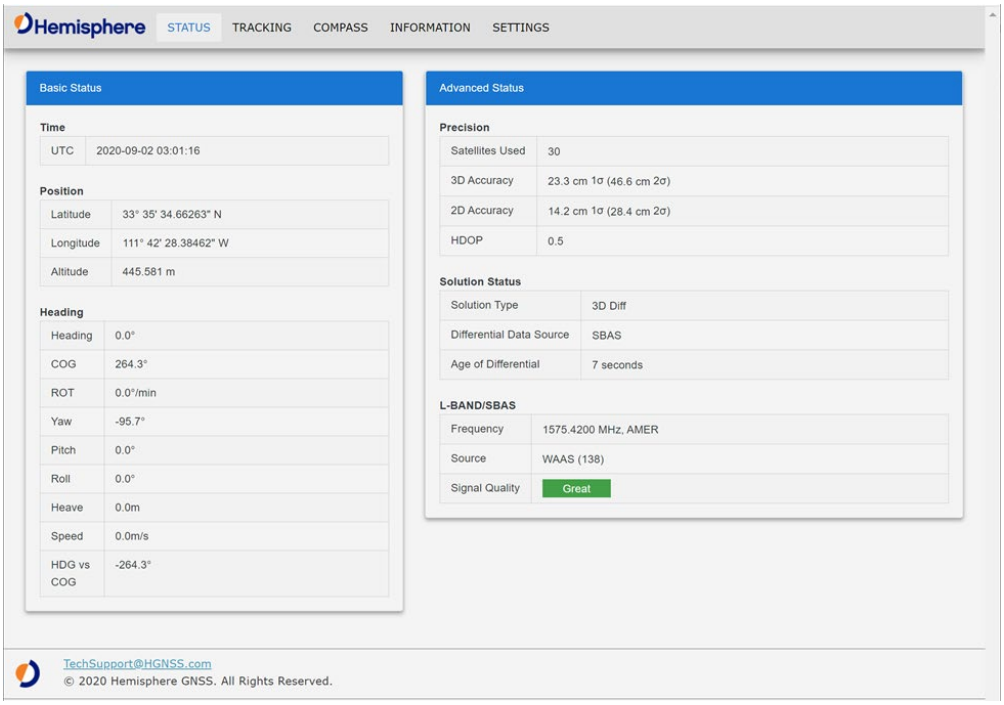
Note: All standard internet browsers can be used to operate the WebUI (i.e., Google Chrome, Firefox, Microsoft Edge).

Continued on next page

Status page

The **Status** page of the A631 WebUI provides a quick overview over the status of the receiver.

It includes information for **Time**, **Position**, **Heading**, **Precision**, **Solution Status** and **L-Band/SBAS**.



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Tracking page

The **Tracking** page of the WebUI provides an overview of the tracked signals for the A631 Smart Antenna.

The **Sky View** graphic shows the tracked satellites for the GPS, GLONASS, and BeiDou system and their current orientation.

The **Signal Chart** visualizes the SNR for each tracked signal with the help of a bar graph.

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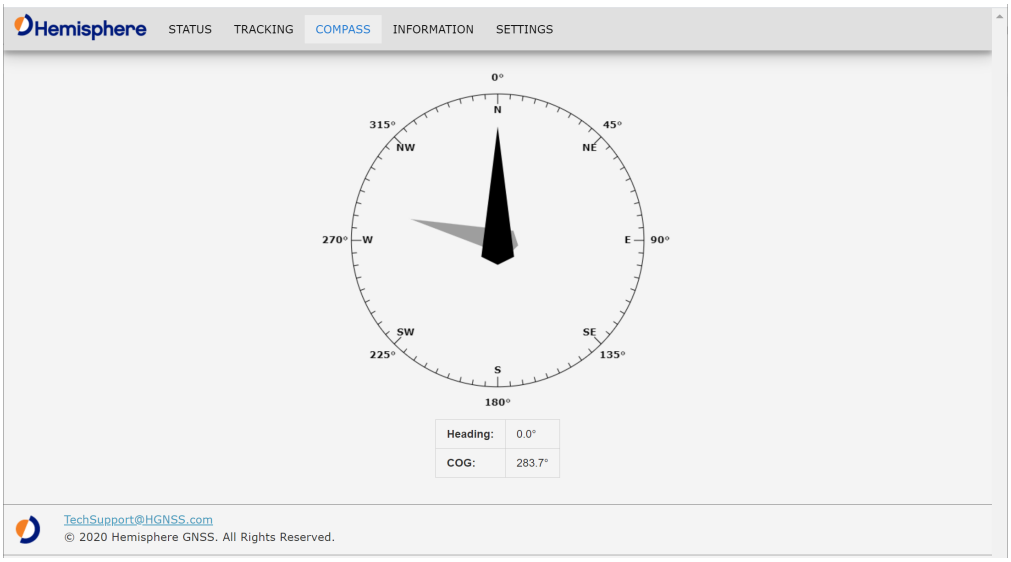
Compass page

The **Compass** page visualizes the GNSS heading of the A631 Smart Antenna while moving.



Note: The provided A631 Smart Antenna heading will only provide a stable indication if the receiver is moving.

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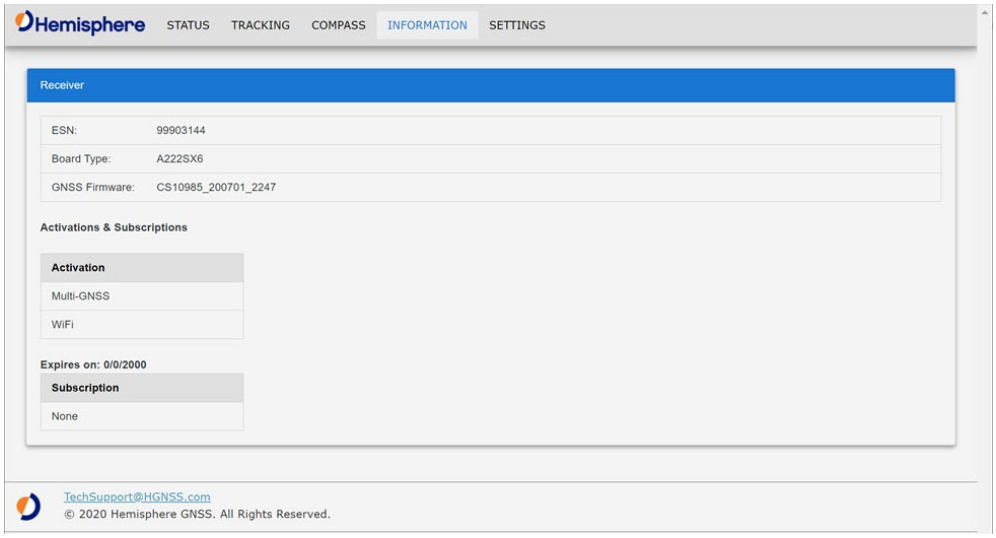
Information page

The WebUI **Information** page includes a general overview of the most important receiver information, including the **Electrical Serial Number (ESN)** of the receiver, **Board Type** and the installed **GNSS Firmware**.

The installed **Activations & Subscriptions** are shown. For the time-based subscriptions this includes the expiration date.



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Settings page

The **Settings** page has different tabs that include information for the following:

- System
- RTK Mode*
- Radio
- WiFi**
- Serial
- Logging
- File System
- Atlas

*The **RTK Mode** tab contains RTK Mode for **Mobile Base**, **Rover**, **Fixed Base**, **BaseLink**, and **SmartLink**.

The **WIFI tab within the **Settings** page includes the **WiFI and Bluetooth Configuration** settings.

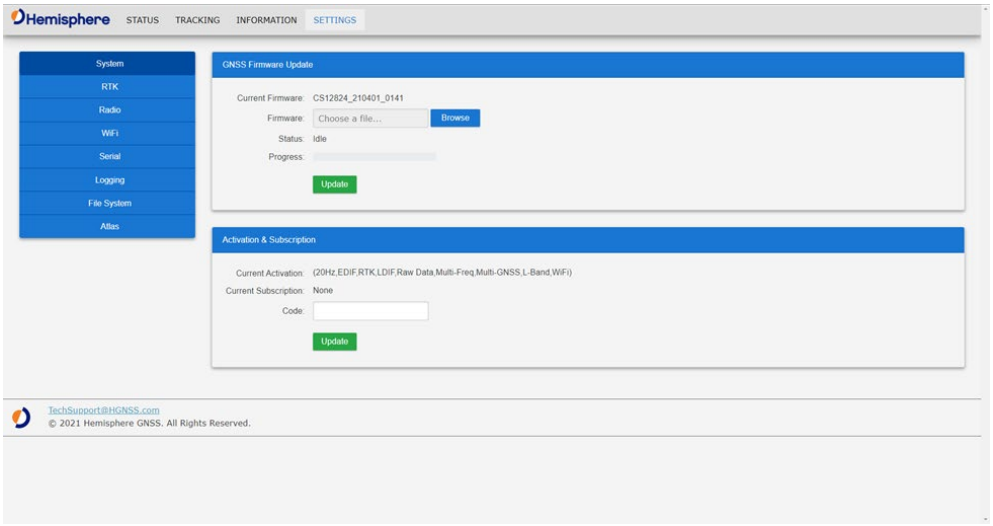
Continued on next page

Settings page, System

The **System** tab within the **Settings** page of the WebUI allows the user to update GNSS Firmware and submit **Activation** & **Subscription** licenses.

To update the receiver GNSS firmware, the SW file can be selected using **GNSS Firmware Update** menu. The update can be initiated by pressing the **Update** button. The **Status** and **Progress** information is available during the update process.

The **Activation & Subscription** menu can be used to enter new activation or subscription license codes and submit them to the receiver by pushing the **Update** button.



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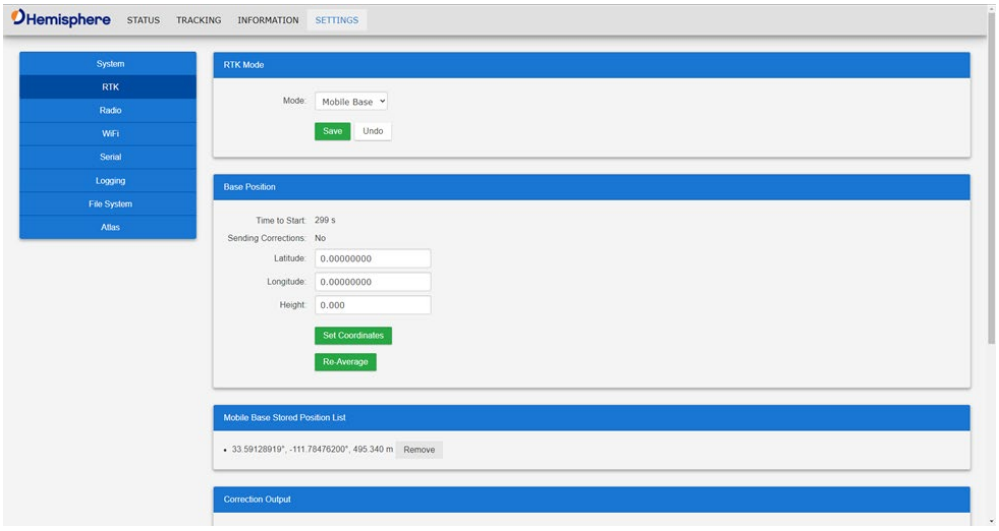
Settings page, RTK

The **RTK** mode tab allows you to select between five different modes: **Rover**, **Fixed Base**, **Mobile Base**, **BaseLink**, and **SmartLink**.



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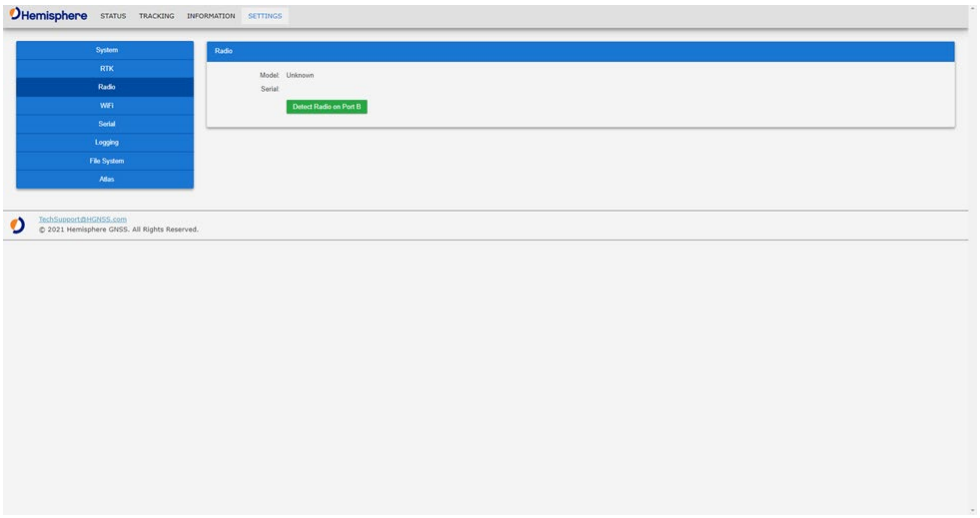
Settings page, Radio

The **Radio** tab allows you to automatically detect known models of radios connected to the A631. Click **Detect Radio on Port B** to initiate radio search.



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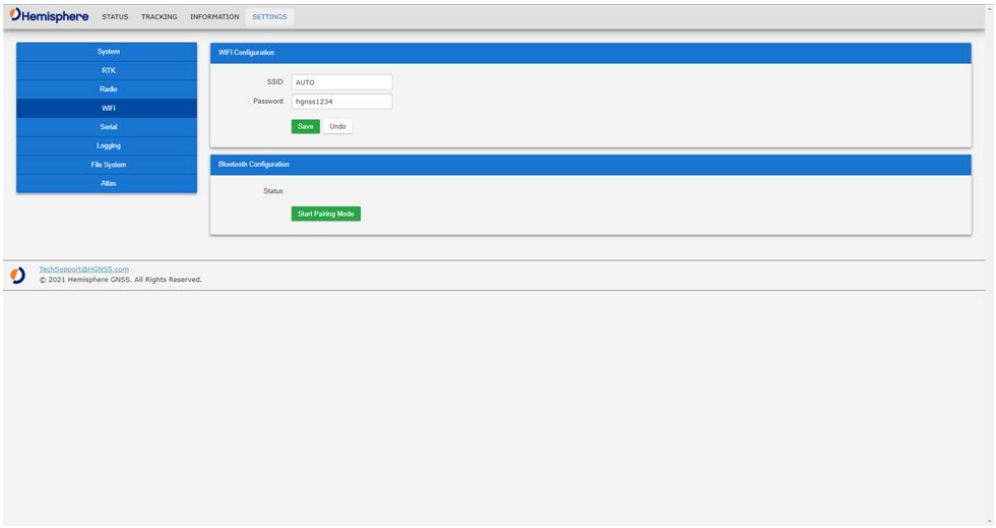
Settings page, Wi-Fi

The **Wi-Fi** tab allows you to adjust the **SSID** and create your own password.

To configure your Bluetooth device to the A631, use the following steps:

Step	Action
1	Power on the A631.
2	Connect the A631 via Wi-Fi (WebUI) or Terminal Program.
3	Enable Bluetooth pairing via the WebUI (WiFi tab under **Settings**) or enter the command “$JBLUETOOTH,PAIR,ON”.
4	Search for the A631 on the available Bluetooth devices list on the PC or tablet.
5	Connect to the correct A631 and enter the default pin “1234”.



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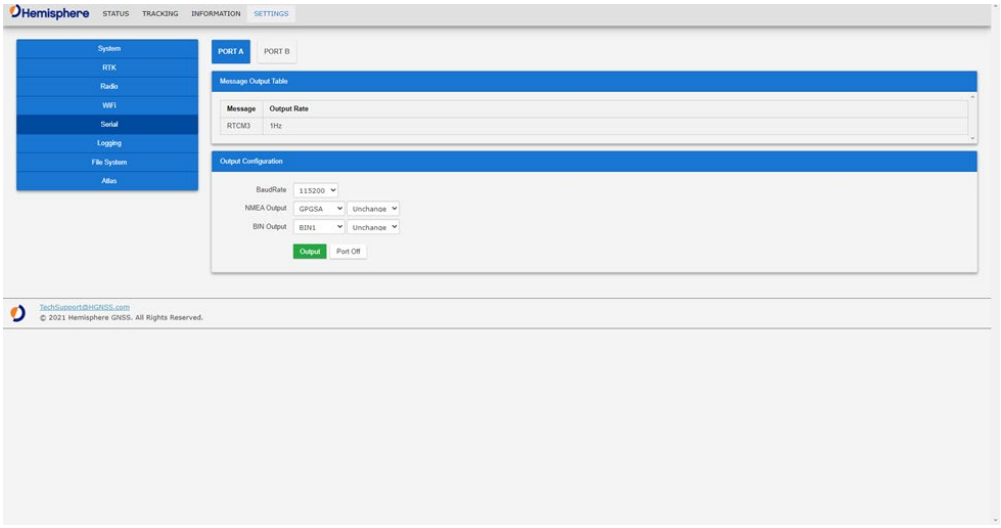
Settings page, Serial

The **Serial** tab within the **Settings** page allows the user to review and configure the serial settings for Port A and Port B of the A631 Smart Antenna.

The **Message Output Table** provides a list of the enabled messages and the according Output Rate per port.

The **Output Configuration** section allows the user to configure the desired NMEA or BIN message to output on the selected port. This menu also provides the option to turn off the serial communication completely for this port with the **Port Off** button.



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Settings page, Logging

The **Logging** tab shows the current messages being output through the output table.

Output Configuration-Different NMEA and Binary messages can be turned on by selecting the message from the available drop-down list. The message output rates can be adjusted by using the drop-down list to the right of the selected message.

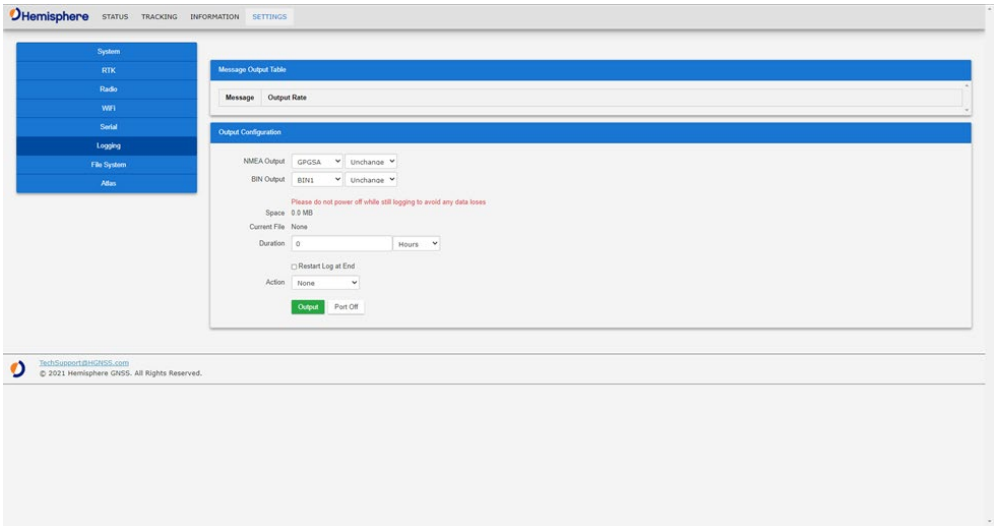
Space -The available space is shown in the table below to indicate open space on the internal storage.

Current File - Shows the current file in use or the selected file.

Duration-Logging duration can be adjusted based on the length of time desired.

Restart Log -When this box is checked, the log will automatically restart when it has ended.

Action -Allows the user to start a new file or add to the existing file. When all categories have been addressed, click the **Output** button to begin the log. If you wish to stop the log, select **Port Off**.



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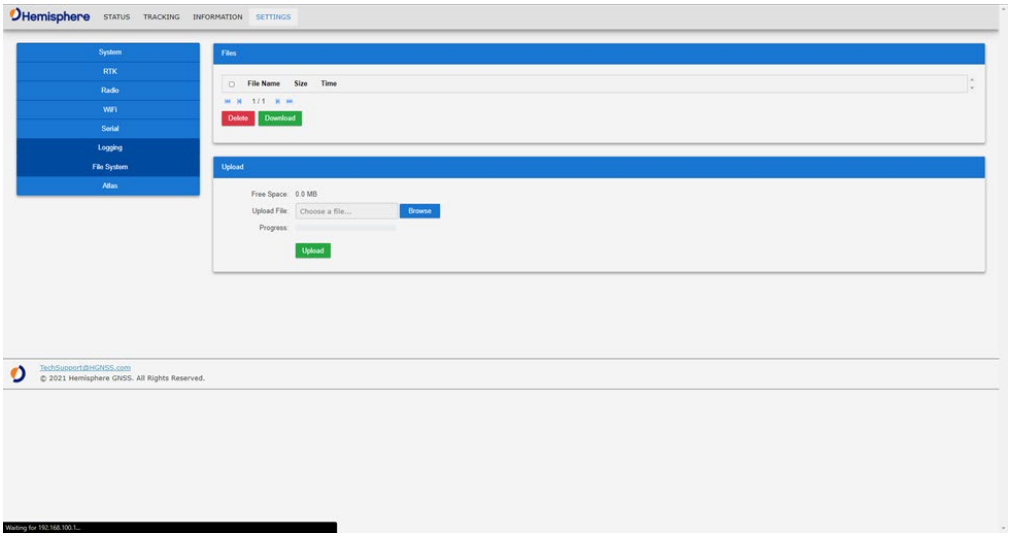
Settings page, File System

The **File System** tab allows you to download and upload logs for the A631. This can be done by selecting the log from the files table and clicking the **Download** button.

To upload files, click the **Browse** button, select the file you wish to upload, and click the **Upload** button.



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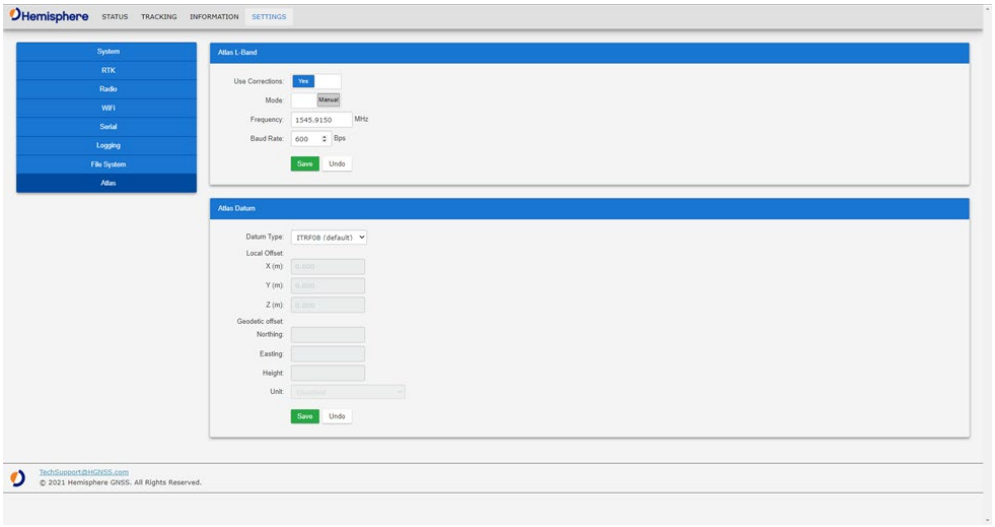
Settings page, File System continued

The **Atlas** tab within the **Settings** page of the WebUI allows users to configure the A631 receiver for the Atlas L-band correction service.

The Atlas L-band main menu supports configurations for **Use Corrections**, **Mode**, **Frequency** and **Baud Rate**. The desired changes can be saved by using the **Save** button or disregarded with the **Undo** button.

The **Atlas Datum** menu supports configurations for **Datum Type**, **Local Offset** and **Geodetic Offset**. The desired changes can be saved by using the **Save** button or disregarded with the **Undo** button.



Appendix A: Troubleshooting

Overview

Introduction

Appendix A contains helpful hints for identifying common issues when using the A631 GNSS Smart Antenna.

Contents

Appendix A troubleshooting

Table A-1: Troubleshooting

Symptom	Possible Solution
Receiver fails to power	• Verify polarity of power leads • Check integrity of power cable connectors • Check power input voltage (8 to 32 VDC) • Check current restrictions imposed by power source (maximum is 300 mA at 12 VDC)
No data from the A631	• Check receiver power status • Check integrity and connectivity of power and data cable connections • Verify the baud rate settings match • Verify receiver responds to valid $J Command ($JI) • Verify it is locked to a valid DGNSS signal • Verify it is locked to 4 or more GNSS satellites
Random binary data from the A631	• Verify the RTCM or the BIN messages are not being accidentally output • Verify the baud rate settings match • Potentially, the volume of data requested to be output could be higher than the current baud rate supports. Try either using a higher baud rate for communications or decreasing the number of messages and/or baud rates
No GNSS lock	• Check the integrity of the antenna's power/data cable • Verify the antenna is outdoors with a clear a view of the sky • Verify the lock status and signal-to-noise ratio (SNR) of GNSS satellites

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Appendix A troubleshooting, continued

Table A-1: Troubleshooting (continued)

Symptom	Possible Solution
No GNSS position	• Verify the antenna is outdoors with a clear view of the sky
The A631 LED not blinking after connection to power	• Verify polarity of power leads • Check integrity of power cable connections • Check power input voltage (8 - 32 VDC)
The A631 LED indicator solid color (not blinking)	• Power-cycle the receiver • Contact Technical Support

Appendix B: Technical Specifications

Overview

Introduction

Appendix B provides the technical specifications for the A631 GNSS Smart Antenna.

Contents

A631 Technical Specifications

Overview

Table B-1 through Table B-7 provide the GNSS sensor, horizontal accuracy, L-band sensor, communication, power, environmental, and mechanical specifications for the A631.

A631 technical specifications

Table B-1: A631 sensor

Item	Specification
Receiver type	Multi-Frequency GPS, GLONASS, BeiDou, Galileo, QZSS, NavIC (IRNSS), and Atlas
Signals received	**GPS** L1CA/L1P/L1C/L2P/L2C/L5 **GLONASS** G1/G2/G3/P1/P2 **BeiDou** B1i/B2i/B3i/B10C/B2A/B2B/ACEBOC **Galileo** E1BC/E5a/E5b/E6BC/ALTBOC QZSS L1CA/L2C/L5/L1C/LEX **NavIC (IRNSS)** L5 **Atlas**
Channels	800+
GNSS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	10 Hz standard, 20 Hz optional (with activation)
Timing (PPS) accuracy	20 ns
Cold start	60 s typical (no almanac or RTC)
Warm start	30 s typical (almanac and RTC)
Hot start	10 s typical (almanac, RTC, and position)
Maximum speed	1,850 kph (999 kts)
Maximum altitude	18,288 m (60,000 ft)

Continued on next page

A631 technical specifications, continued

Table B-2: Horizontal accuracy

Item	Specification	
	RMS (67%)	2RDMS (95%)
RTK[1,2]	8 mm + 1 ppm	15 mm + 2 ppm
Atlas H10[1,3]	0.04 m	0.08 m
Atlas H30[1,3]	0.15 m	0.3 m
Atlas Basic[1,3]	0.50 m	1.0 m
SBAS (WAAS)[1]	0.3 m	0.6 m
Autonomous	1.2 m	2.5 m

Table B-3: L-band sensor specifications

Item	Specification
Receiver type	Single channel
Channels	1530 to 1560 MHz
Sensitivity	-130 dBm
Channel spacing	5.0 kHz
Satellite selection	Manual or automatic
Reacquisition time	15 seconds (typical)

Table B-4: Communication specifications

Item	Specification
Serial ports	2 full-duplex RS-232
CAN port	1 port
Baud rates	4800-460800 (Serial), 250000 (CAN)
Data I/O protocol	NMEA 0183, NMEA 2000, and Hemisphere GNSS binary.
Correction I/O protocol	Hemisphere GNSS proprietary (ROX), RTCM v2.3 (DGNSS), RTCM v3 (RTK), CMR, CMR+
Timing output	PPS CMOS, active low, falling edge sync, 10 kΩ, 10 pF load
Event marker input	CMOS, active low, falling edge sync, 10 kΩ, 10 pF load

Continued on next page

A631 technical specifications, continued

Table B-5: Power specifications

Item	Specification
Input voltage	7- 32 VDC
Power consumption	1.7W nominal GNSS (L1/L2), GLONASS (L1/L2) and L-band
Current consumption	0.120 A nominal GNSS (L1/L2), GLONASS (L1/L2) and L-band
Power isolation	No
Reverse polarity protection	Yes
Antenna voltage	Internal antenna

Table B-6: Environmental specifications

Item	Specification
Operating temperature	-40° C to +70° C (-40° F to +158° F)
Storage temperature	-40° C to +85° C (-40° F to +185° F)
Humidity	95% non-condensing
Shock and Vibration	**Mechanical Shock**: MIL-STD-810H, Method 516.8 Procedure I, Operational, 50G half sine 11ms Operational **Vibration**: MIL-STD-810H, Method 514.8, Procedure I, General vibration Category 24 E1
EMC	CE (ISO 14982, ISO 13766-1, IEC 60945), FCC Part 15, Subpart B, CISPR 32
Enclosure	IP67

Continued on next page

A631 technical specifications, continued

Table B-7: Mechanical specifications

Item	Specification
Dimensions	15.8 L x 15.8 W x 7.9 H (cm) 6.2 L x 6.2 W x 3.2 H (in)
Weight	<1.05 kg (<2.30 lbs.)
Status indicators (LED)	• Blinking Red - Power on • Blinking Amber - GNSS position available, including RTK float and Atlas • Blinking Green - RTK-fixed or Atlas-converged position available • Blinking any color - Receiver operational
Power/data connector	12-pin male (metal)
Antenna mounting	1-14 UNS-2A female adapter, 5/8-11 UNC 2B adapter, flat mount available

References:
[1] Depends on multipath environment, number of satellites in view, satellite geometry and ionospheric activity
[2] Depends also on baseline length
[3]Hemisphere GNSS Proprietary

Index

End User License Agreement

End User license agreement

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Warranty notice

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