875-0394-10

V200-2
Vector™ GNSS Compass

User Guide Revision: A7 March 2, 2022

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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:

1. This device may not cause harmful interference, and
2. 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.

Trademarks

Hemisphere GNSS®, theSI-TEXGNSS logo, TRACERTM, Crescent®, EclipseTM, e-Dif®, L-DifTM, PocketMaxTM, S320TM, SBX-4TM, VectorTM , Vega™, Phantom™, Cygnus™, Atlas™, aRTK, SureFix™, and Athena™ are proprietary trademarks ofSI-TEXGNSS, Inc. Other trademarks are the properties of their respective owners.

Patents

Hemisphere GNSS products may be covered by one or more of the following patents:

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:

Customer Service
If you encounter problems during the installation or operation of this product, or cannot find the information you need, please contact Sitex Customer Service.
The contact numbers and e-mail address for Sitex Customer Service are:
Sitex Main Office……………..+1-631-996-2690
Sitex Fax……………………….+1-631-996-2693
Sitex Customer Support E-mail address: customerservice@si-tex.com

Sitex Main Office Address:
25 Enterprise Zone Drive, Ste 2
Riverhead, NY 11901

Technical Support is available from 9:00 AM to 5:00 PM Eastern Standard Time, Monday through Friday.

Technical Support

If you need to contact Technical Support:

Customer Service
If you encounter problems during the installation or operation of this product, or cannot find the information you need, please contact Sitex Customer Service.
The contact numbers and e-mail address for Sitex Customer Service are:
Sitex Main Office……………..+1-631-996-2690
Sitex Fax……………………….+1-631-996-2693
Sitex Customer Support E-mail address: customerservice@si-tex.com

Documentation Feedback

Hemisphere GNSS is committed to the quality and continuous improvement of our products and services. We urge you to provideSI-TEXGNSS with any feedback regarding this guide by opening a support case at the following website: HGNSS.COM

Terms and Definitions

Introduction

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

V200-2 terms & definitions

Term	Definition
Activation	Activation refers to a feature added through a one-time purchase. For features that require recurring fees, see **Subscription**.
Atlas	Atlas is a subscription-based service provided by Hemisphere GNSS.
BeiDou	BeiDou is a global navigation satellite system deployed and maintained by China.
DGPS/DGNSS	Differential GPS/GNSS refers to a receiver using Differential Corrections.
Differential Corrections	A method of improving precision of a GNSS rover. Two GNSS receivers placed in a nearby area will have similar error. A base station is placed over a known point.
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 deployed and maintained by the European Union and European Space Agency.
GLONASS	Global Orbiting Navigation Satellite System (GLONASS) is a Global Navigation Satellite System deployed and maintained by Russia.
GNSS	Global Navigation Satellite System (GNSS) is a system that provides autonomous 3D position (latitude, longitude, and altitude) and accurate timing globally by using satellites. Current GNSS providers are GPS, GLONASS and Galileo.
GPS	Global Positioning System (GPS) is a global navigation satellite system deployed and maintained by the United States.

Continued on next page

Terms and Definitions, Continued

V200-2 terms & definitions, continued

Term	Definition
Heading	The vector created from the primary to secondary antenna. It points to the direction that the receiver is facing.
I/O	Input/Output
NMEA	National Marine Electronics Association (NMEA) is a marine electronics organization that sets standards for communication between marine electronics.
QZSS	Quasi-Zenith Satellite System (QZSS) is a regional satellite navigation system deployed and maintained by Japan.
RMS	Root mean square
RTK	Real-Time-Kinematic (RTK) is a real-time differential GPS method that supplies better accuracy than differential corrections.
SBAS	Satellite Based Augmentation System (SBAS) is a system that supplies differential corrections over satellite throughout a wide area or region.
SNR	Signal-to-Noise ratio
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.
Vector Receiver	A Hemisphere GNSS receiver capable of providing. heading.

Chapter 1: Introduction

Overview

Introduction

This User Guide provides information to help you quickly set up your V200-2 GNSS Compass. You can download this manual from theSI-TEXGNSS website at WWW.SI-TEX.COM

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Product Overview

Product overview

The V200-2 Vector™ GNSS Compass is capable of tracking and using GPS, GLONASS, Galileo, BeiDou, QZSS satellites.

Note: When referring to the V200-2 Vector™ GNSS Compass, this manual uses the term V200-2.

The multi-GNSS V200-2 offers world-wide 30 cm (RMS) accuracy via Hemisphere's Atlas GNSS global correction service.

The V200-2 offers an incredible combination of simple installation, small form factor, and amazing performance. The compass - measuring only 35 cm in length - mounts easily to a flat surface or pole. The stability and maintenance-free design of the V200-2 provides simple integration into autopilots, chart plotters, and AIS systems.

There are no mechanical parts such as gimbals or a rotating motor, so the V200-2 is free from routine maintenance. Heading is determined from GNSS, and there is no need to wait for settling time, gyrocompass calibration and speed corrections. Vector performance is not affected by geomagnetism, making it the perfect solution for any marine application.

The V200-2 is an integrated system that houses the following:
- Dual mGNSS, multipath-resistant antennas
- Power supply
- Six-axis sensor

The sensor is present to improve system performance and to provide backup heading information if a GNSS heading is not available due to signal blockage. The sensor provides a substitute heading, accurate to within 1º per minute for up to three minutes.

Continued on next page

Product Overview, Continued

Product overview, continued

The V200-2's GNSS antennas are separated by 20 cm between phase centers, resulting in a heading performance of better than 0.75° RMS (with High Accuracy Heading activated). The V200-2 can provide heading and positioning updates of up to 50 Hz and delivers positioning accuracy of 0.6 m 95% of the time when using differential GPS corrections from Satellite Based Augmentation Systems (SBAS) or Atlas.

If you are new to GNSS and SBAS, refer to the Hemisphere GNSS Technical Reference Manual for further information on these services and technologies before proceeding.

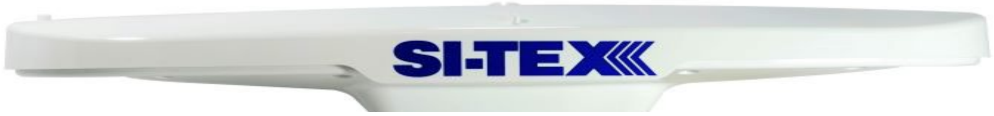

Figure 1-1: V200-2 GNSS Compass

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Athena RTK

Athena RTK is Hemisphere's next-generation RTK engine designed to support all available constellations and take advantage of available new signals. Athena was designed to seamlessly integrate into existing product portfolios and supports all major industry correction formats and standards.

Athena RTK can be added to the V200-2 as an activation.

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.

For more information about Athena RTK, see: HTTPS://WWW.HEMISPHEREGNSS.COM/TECHNOLOGY/#ATHENA

Atlas L-band

Atlas L-band is Hemisphere's industry leading correction service, which can be added as a 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 cm to 50 cm range.
- **Convergence time -** Industry-leading convergence times of 10-40 minutes
- **Global Ionospheric Model** - Real-time ionospheric activity and data is sent to the receiver and allows Atlas-capable devices to adjust accordingly, providing excellent convergence performance.

For more information about Atlas L-band, see: HTTP://HGNSS.COM/ATLAS

Key Features

V200-2 key features

Key features of the V200-2 include:

- L1 GPS, GLONASS, Galileo, BeiDou, QZSS
- 30 cm RMS world-wide positioning accuracy with Atlas corrections
- Standard 1.5° and optional 0.75° heading accuracy in small form factor
- Excellent in-band and out-of-band interference rejection
- Integrated gyro and tilt sensors help deliver fast start-up times and provide heading updates during temporary loss of satellites
- Provides heading, positioning, heave, pitch, and roll

What's Included in Your Kit

V200-2 kit

Table 1-1 lists the parts included with your V200-2 Compass. The V200-2 GNSS Compass and a NMEA 2000 cable are the only two required components.

Note: The V200-2's parts comply with IEC 60945 Section 4.4: "Exposed to the weather."

V200-2 Parts list

The following table lists the part numbers with description of the V200-2.

Table 1-1: V200-2 Parts list

Part No.	Description
940-3140-11	HGNSS SA V200-2 SX6
804-0166-20	V200-2, SX6, HGNSS
940-3151-11	HGNSS SA V200-2 (OEM - Unbranded)
804-0166-10	V200-2, SX6, OEM

All of the following are accessory items available for purchase separately from your V200-2.

Table 1-2: V200-2 Accessory list

Part No.	Description
710-0162-10	V200 Surface Mounting Kit
710-0166-10	V200 Pole Mounting Kit
710-0167-10	V200 Complete Mounting Kit

Using PocketMax to Communicate with the V200-2

Using PocketMax to communicate with the V200-2

Hemisphere's PocketMax is a free utility program that runs on your Windows PC or Windows mobile device. Simply connect your Windows device to the V200-2 via the COM port and open PocketMax.

The screens in PocketMax easily interface with the V200-2:

- configure GNSS message output and port settings
- configure the receiver
- record various types of data
- monitor the V200-2's status and function

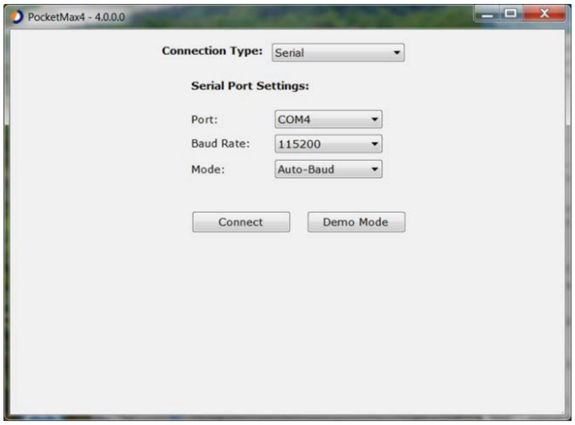
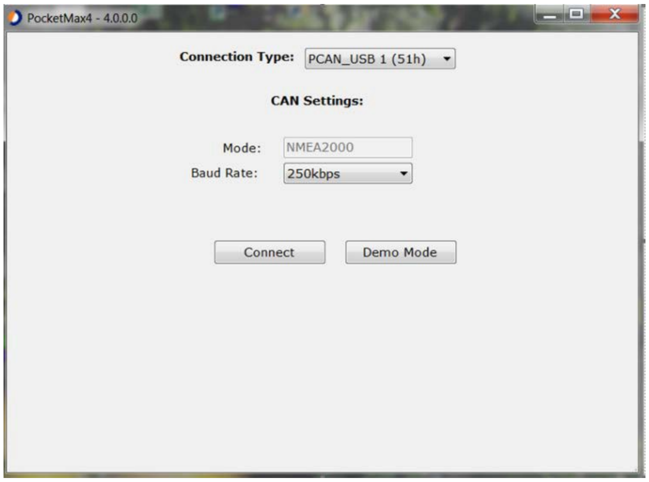
PocketMax is available for download from the Hemisphere GNSS website. Use the following steps to set up the V200-2 communication with PocketMax.

Continued on next page

Using PocketMax to Communicate with the V200-2, Continued

Using PocketMax to communicate with the V200-2, continued

Table 1-3: PocketMax Communication

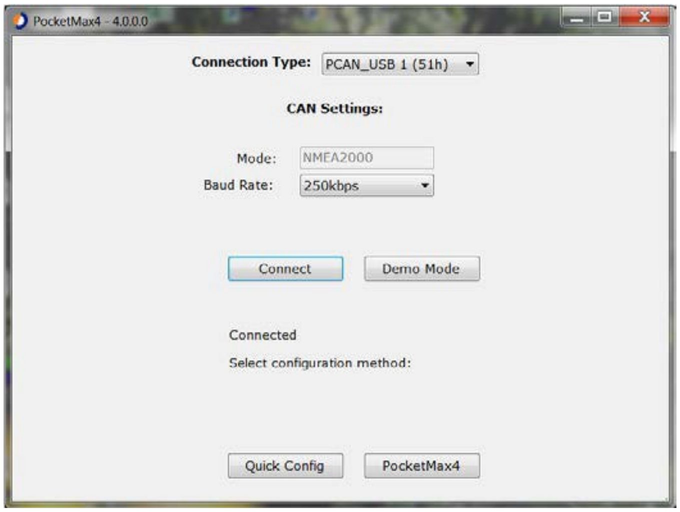
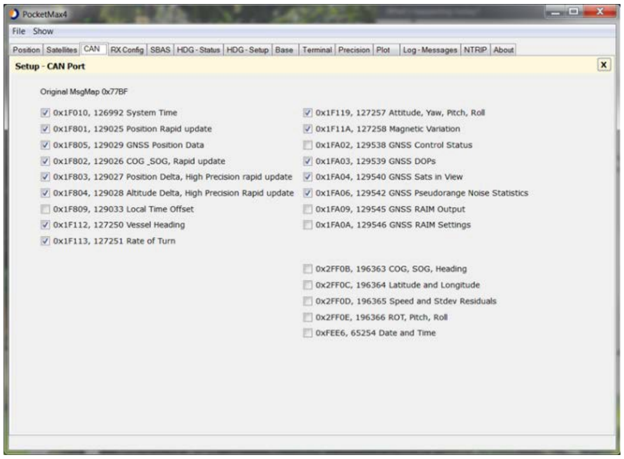
Step	Action
1	Open PocketMax.  PocketMax4 - 4.0.0.0 Connection Type: Serial Serial Port Settings: Port: COM4 Baud Rate: 115200 Mode: Auto-Baud
2	Change **Connection Type** from **Serial** CAN using the drop-down arrow and set the baud rate to 250kbps.  PocketMax4 - 4.0.0.0 Connection Type: PCAN_USB 1 (51h) CAN Settings: Mode: NMEA2000 Baud Rate: 250kbps

Continued on next page

Using PocketMax to Communicate with the V200-2, Continued

Using PocketMax to communicate with the V200-2, continued

Table 1-3: PocketMax Communication (continued)

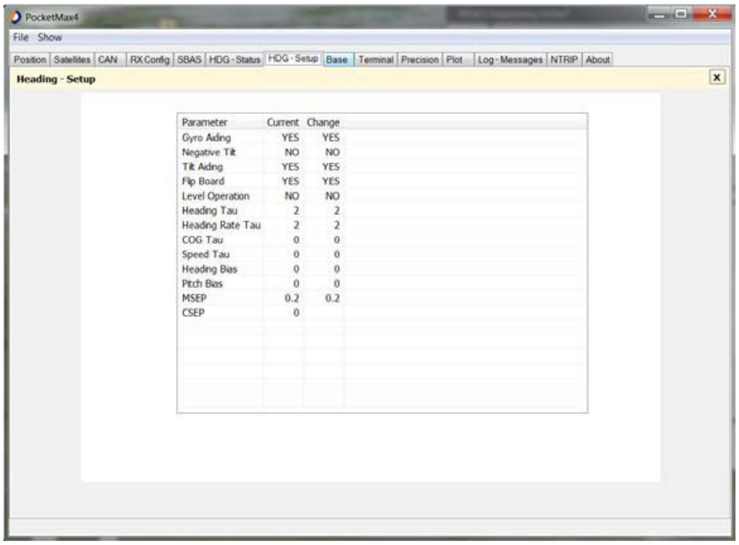
Step	Action
3	Click **Connect**.  PocketMax4 - 4.0.0.0 Connect Demo Mode Quick Config PocketMax4 Connection Type: PCAN_USB 1 (51h) CAN Settings: Mode: NMEA2000 Baud Rate: 250kbps Connected Select configuration method: **Quick Config** configures your receiver only. **PocketMax** configures the receiver and shows your position and heading status.
4	Turn **ON/OFF** messages in the **CAN** tab.  PocketMax4 File Show Position Satellites CAN RX Config SBAS HDG - Status HDG - Setup Base Terminal Precision Plot Log - Messages NTRIP About X Setup - CAN Port Original MsgMap 0x77BF ☑ 0x1F010, 126992 System Time ☑ 0x1F801, 129025 Position Rapid update ☑ 0x1F805, 129029 GNSS Position Data ☑ 0x1F802, 129026 COG _SOG, Rapid update ☑ 0x1F803, 129027 Position Delta, High Precision rapid update ☑ 0x1F804, 129028 Altitude Delta, High Precision Rapid update ☐ 0x1F809, 129033 Local Time Offset ☑ 0x1F112, 127250 Vessel Heading ☑ 0x1F113, 127251 Rate of Turn ☑ 0x1F119, 127257 Attitude, Yaw, Pitch, Roll ☑ 0x1F11A, 127258 Magnetic Variation ☐ 0x1FA02, 129538 GNSS Control Status ☑ 0x1FA03, 129539 GNSS DOPs ☑ 0x1FA04, 129540 GNSS Sats in View ☑ 0x1FA06, 129542 GNSS Pseudorange Noise Statistics ☐ 0x1FA09, 129545 GNSS RAIM Output ☐ 0x1FA0A, 129546 GNSS RAIM Settings ☐ 0x2FF0B, 196363 COG, SOG, Heading ☐ 0x2FF0C, 196364 Latitude and Longitude ☐ 0x2FF0D, 196365 Speed and Stdev Residuals ☐ 0x2FF0E, 196366 ROT, Pitch, Roll ☐ 0xFEE6, 65254 Date and Time

Continued on next page

Using PocketMax to Communicate with the V200-2, Continued

Using PocketMax to communicate with the V200-2, continued

Table 1-3: PocketMax Communication (continued)

Step	Action
5	The **Heading-Setup** screen features the following tabs: • **Position**-displays your position • **Satellites**-displays satellites tracking • **HDG-Status**-displays your heading • **HDG-Setup**-adjust your TAU values 

PocketMax4
File Show
Position
Satellites
CAN
RX Config
SBAS
HDG - Status
HDG - Setup
Base
Terminal
Precision
Plot
Log - Messages
NTRIP
About
Heading - Setup
X

Parameter	Current	Change
Gyro Aiding	YES	YES
Negative Tilt	NO	NO
Tilt Aiding	YES	YES
Flip Board	YES	YES
Level Operation	NO	NO
Heading Tau	2	2
Heading Rate Tau	2	2
COG Tau	0	0
Speed Tau	0	0
Heading Bias	0	0
Pitch Bias	0	0
MSEP	0.2	0.2
CSEP	0	

Firmware Upgrades

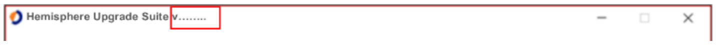
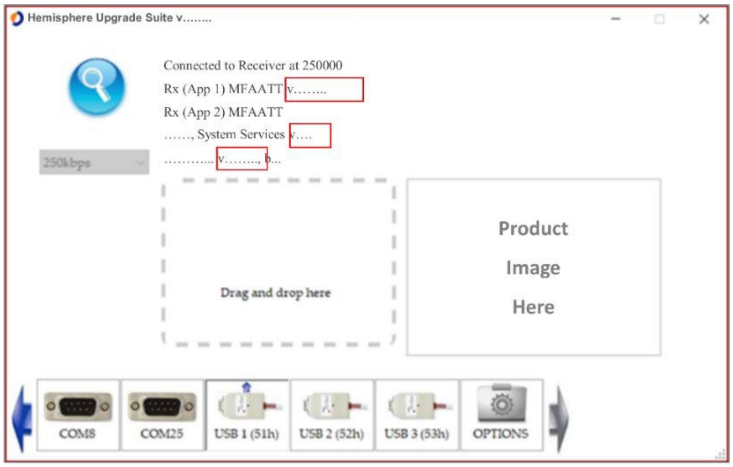
Overview

Periodically,SI-TEXGNSS releases firmware updates to improve performance, fix bugs, or add new features to a product. To update the firmware on the V200-2, use theSI-TEXUpgrade Suite.

Hemisphere Upgrade Suite

UseSI-TEXUpgrade Suite by performing the following steps:

Table 1-4:S I - T E X Upgrade Suite

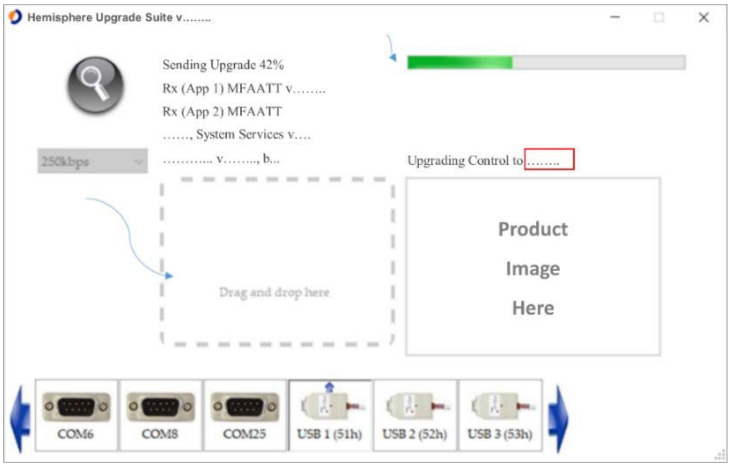
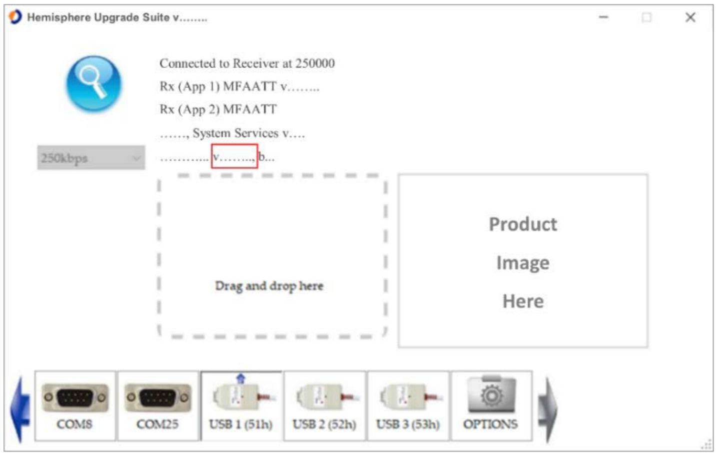
Step	Action
1	Connect the V200-2 to your computer with either a GridConnect PCAN-USB adapter or a Kvaser CAN to USB adapter.
2	Open Upgrade Suite. and verify that the version is **v. 99.1.3.10** or later.  Hemisphere Upgrade Suite v........
3	Ensure the baud rate is set to 250kbps, then click the “USB 1 (51h)” icon to open the USB port.  Hemisphere Upgrade Suite v........ Connected to Receiver at 250000 Rx (App 1) MFAATT v........ Rx (App 2) MFAATT ......, System Services v.... ....v........, b... 250kbps Drag and drop here Product Image Here COM8 COM25 USB 1 (51h) USB 2 (52h) USB 3 (53h) OPTIONS

Continued on next page

Firmware Upgrades, Continued

Hemisphere Upgrade Suite, continued

Table 1-4:S I - T E X Upgrade Suite (continued)

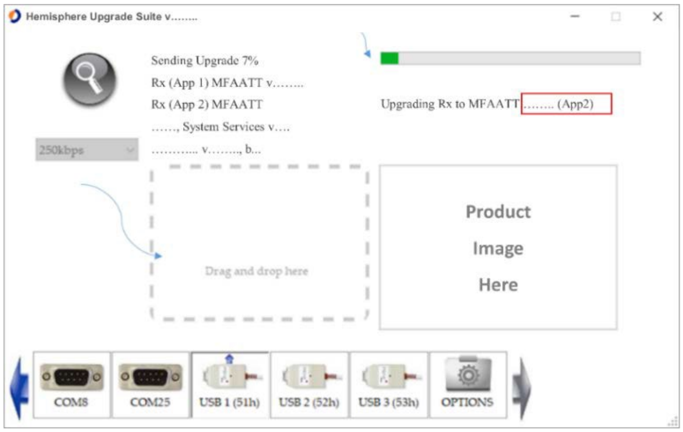
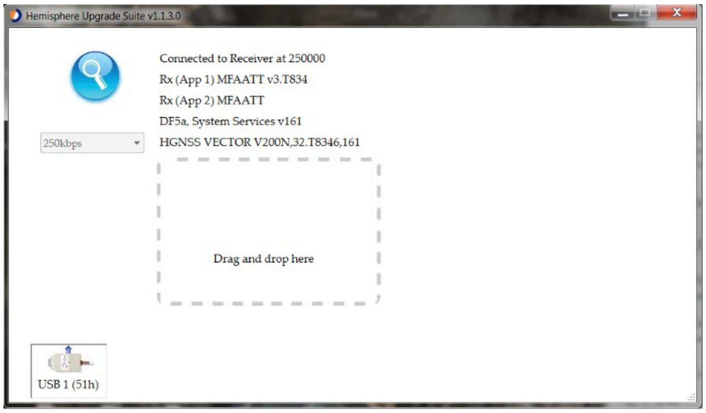
Step	Action
4	If you need to update the **N2K/Menu firmware**, click on the magnifying glass to find and select the **N2K/Menu firmware file**, then drag and drop the file into the “Drag and drop here” section. The progress bar and text below will indicate the status of the upload.  Hemisphere Upgrade Suite v........ Sending Upgrade 42% Rx (App 1) MFAATT v........ Rx (App 2) MFAATT ......, System Services v.... .... v........, b... 250kbps Upgrading Control to .... Drag and drop here Product Image Here COM6 COM8 COM25 USB 1 (51h) USB 2 (52h) USB 3 (53h)
5	Verify the right **N2K/Menu firmware** has been loaded in the last line of text above the “Drag and drop here” section.  Hemisphere Upgrade Suite v........ Connected to Receiver at 250000 Rx (App 1) MFAATT v........ Rx (App 2) MFAATT ......, System Services v.... .... v........, b... 250kbps Drag and drop here Product Image Here COM8 COM25 USB 1 (51h) USB 2 (52h) USB 3 (53h) OPTIONS

Continued on next page

Firmware Upgrades, Continued

Hemisphere Upgrade Suite, continued

Table 1-4:S I - T E X Upgrade Suite (continued)

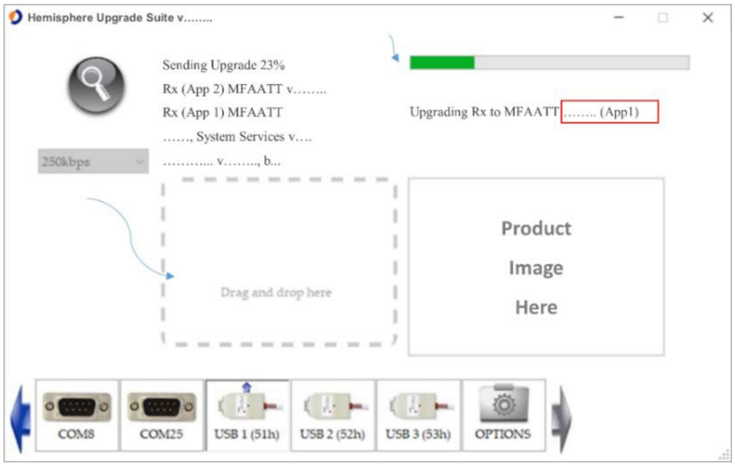
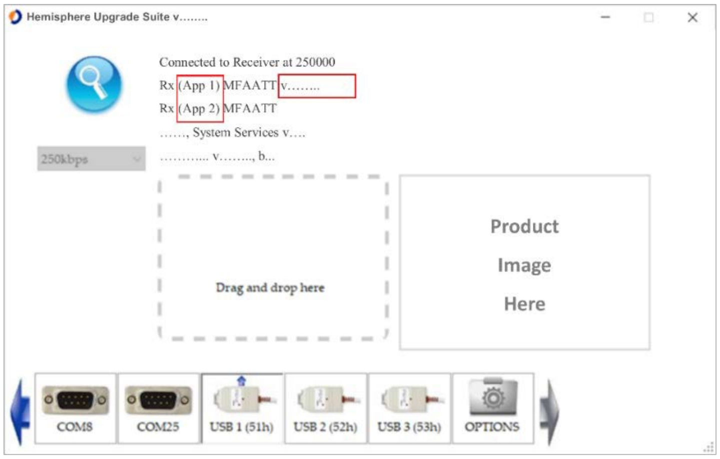
Step	Action
6	If you need to update the **GNSS firmware**, click on the magnifying glass to find and select the **GNSS firmware file**, then drag and drop the file into the "Drag and drop here" section. The progress bar and text below will indicate the status of the upload.  Hemisphere Upgrade Suite v........ Sending Upgrade 7% Rx (App 1) MFAATT v........ Rx (App 2) MFAATT ...., System Services v.... .... v........, b... Upgrading Rx to MFAATT........ (App2) 250kbps Drag and drop here Product Image Here COM8 COM25 USB 1 (51h) USB 2 (52h) USB 3 (53h) OPTIONS Once completed, the "Rx (App1)" will be listed below "Rx (App2)", and "Rx (App2)" will indicate that App2 still needs to be updated to the correct GNSS firmware version. Drag and drop the FW file to the box.  Hemisphere Upgrade Suite v1.1.3.0 Connected to Receiver at 250000 Rx (App 1) MFAATT v3.T834 Rx (App 2) MFAATT DF5a, System Services v161 HGNSS VECTOR V200N,32.T8346,161 250kbps Drag and drop here USB 1 (51h)

Continued on next page

Firmware Upgrades, Continued, Continued

Hemisphere Upgrade Suite, continued

Table 1-4:S I - T E X Upgrade Suite (continued)

Step	Action
7	If the App1 update doesn’t automatically start, after the app swap, again drag and drop the **GNSS firmware** file into the “Drag and drop here” section. The progress bar and text below indicate the status of the upload.  Hemisphere Upgrade Suite v........ Sending Upgrade 23% Rx (App 2) MFAATT v........ Rx (App 1) MFAATT ......, System Services v.... .... v........, b... Upgrading Rx to MFAATT........ (App1) 250kbps Drag and drop here Product Image Here COM8 COM25 USB 1 (51h) USB 2 (52h) USB 3 (53h) OPTIONS
8	Once completed, the “Rx (App1)” is again listed above “Rx (App2)” and shows the correct firmware version.  Hemisphere Upgrade Suite v........ Connected to Receiver at 250000 Rx (App 1) MFAATT v........ Rx (App 2) MFAATT ......, System Services v.... .... v........, b... 250kbps Drag and drop here Product Image Here COM8 COM25 USB 1 (51h) USB 2 (52h) USB 3 (53h) OPTIONS

Chapter 2: Mounting the V200-2

Overview

Introduction This chapter provides instructions on how to mount your V200-2 Compass.

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Pole-mounting the V200-2	40

Mounting the V200-2

Introduction

This section provides information on mounting the V200-2 in the optimal location, orientation considerations, environmental considerations, and other mounting options.

GNSS satellite reception

When deciding where to mount the V200-2, consider the following satellite reception recommendations:

- Ensure there is a clear view of the sky available to the V200-2, so the GNSS and L-band satellites are not masked by obstructions that may reduce system performance.
- Position is based off the primary GNSS antenna located on located on the end opposite the recessed arrow on the underside of the enclosure.
- Locate any transmitting antennas away from the V200-2 by at least a few meters to ensure tracking performance is not compromised.
- Ensure cable length is adequate to route into the vessel to reach a breakout box or terminal strip.
- Do not locate the antenna where environmental conditions exceed those specified in Appendix B, Technical Specifications of this document.

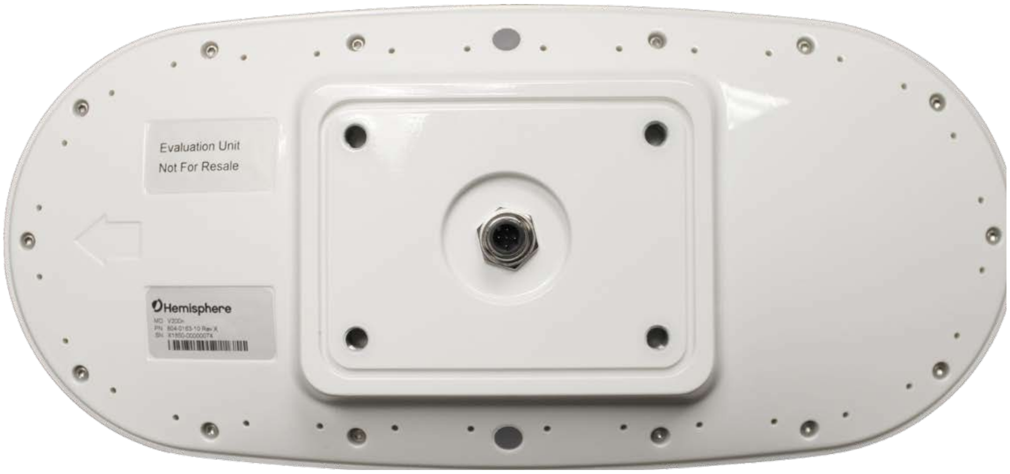


Figure 2-1: V200-2 Underside with recessed arrow

Continued on next page

Mounting the V200-2,

VHF interference

VHF interference from such devices as cellular phones and radio transmitters may interfere with GPS operation, however the Vector compass can still track other constellations, maintaining heading and position.

For example, if installing the V200-2 near marine radios, consider the following:

- VHF marine radio working frequencies (Channels 1 to 28 and 84 to 88) range from 156.05 to 157.40 MHz. The L1 GPS working center frequency is 1575.42 MHz. The bandwidth is +/- 2MHz to +/- 10 MHz, which is dependent on the GNSS antenna and receiver design.
- VHF marine radios emit strong harmonics. The 10th harmonic of VHF radio, in some channels, falls into the GPS working frequency band, which may cause the Signal-to-Noise Ratio (SNR) of GNSS to degrade significantly.
- The radiated harmonic signal strength of assorted brands/models varies.
- Follow VHF radio manufacturers' recommendations on how to mount their radios and what devices to keep a safe distance away.
- Handheld 5W VHF radios may not provide suitable filtering and may interfere with the V200-2's operation if too close.

Before installing the Vector Compass, use the following diagram to ensure there are no nearby devices that may cause VHF interference.

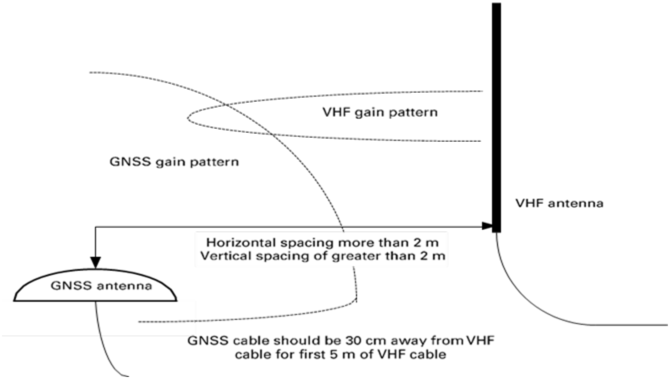

VHF gain pattern
GNSS gain pattern
VHF antenna
Horizontal spacing more than 2 m
Vertical spacing of greater than 2 m
GNSS antenna
GNSS cable should be 30 cm away from VHF cable for first 5 m of VHF cable

Figure 2-2: V200-2 distance from nearby VHF radios

Continued on next page

Mounting the V200-2,

Environmental considerations

Hemisphere Vector Compasses are designed to withstand harsh environmental conditions. Adhere to the following limits when storing and using the V200-2:

- Operating temperature: -30°C to +70°C (-22°F to +158°F)
- Storage temperature: -40°C to +85°C (-40°F to +185°F)
- Humidity: 95% non-condensing

Mounting orientation

The V200-2 outputs heading, pitch, and roll readings regardless of the orientation of the antennas. The relation of the antennas to the vessel's axis determines if you need to enter a heading, pitch, or roll bias. The primary antenna is used for positioning and the primary and secondary antennas, working in conjunction, output heading, pitch, and roll values.

The top of the V200-2 enclosure incorporates a sight design feature to help you align the enclosure on your vessel. Alignment accuracy is approximately +/- 2°.

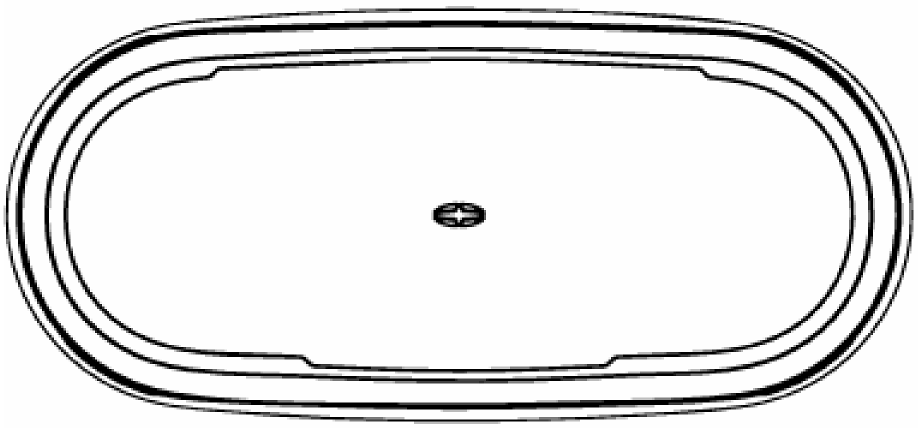


Figure 2-3: Shorter design element

Note: Regardless of which mounting orientation you use, the V200-2 provides the ability to output the heave of the vessel. This output is available using either MSGID 0x0031 (NMEA 2000) or **$GPHEV** (using the PocketMax Terminal window). For more information on this message refer to the Hemisphere GNSS Technical Reference Manual.

Continued on next page

Mounting the V200-2,

Parallel orientation

Parallel installation orients the V200-2 parallel to, and along the centerline of, the axis of the vessel. **This provides a true heading**. In this orientation:

- If you use a gyrocompass and there is a need to align the Vector Compass, you can enter a heading bias in the V200-2 to calibrate the physical heading to the true heading of the vessel.
- You may need to adjust the pitch/roll output to calibrate the measurement if the Vector is not installed in a horizontal plane.

Perpendicular orientation

You can also install the antennas, so they are oriented perpendicular to the centerline of the vessel’s axis. In this orientation:

- Enter a heading bias of +90° if the primary antenna is on the starboard side of the vessel and -90° if the primary antenna is on the port side of the vessel.
- Configure the receiver to specify the GNSS Compass is measuring the roll axis using either MSGID 0x003D (NMEA 2000) or **$JATT,ROLL,YES** (using the PocketMax Terminal window).
- Enter a roll bias to properly output the pitch and roll values.
- You may need to adjust the pitch/roll output to calibrate the measurement if the Vector is not installed in a horizontal plane.

Continued on next page

Mounting the V200-2,

Mounting orientation example

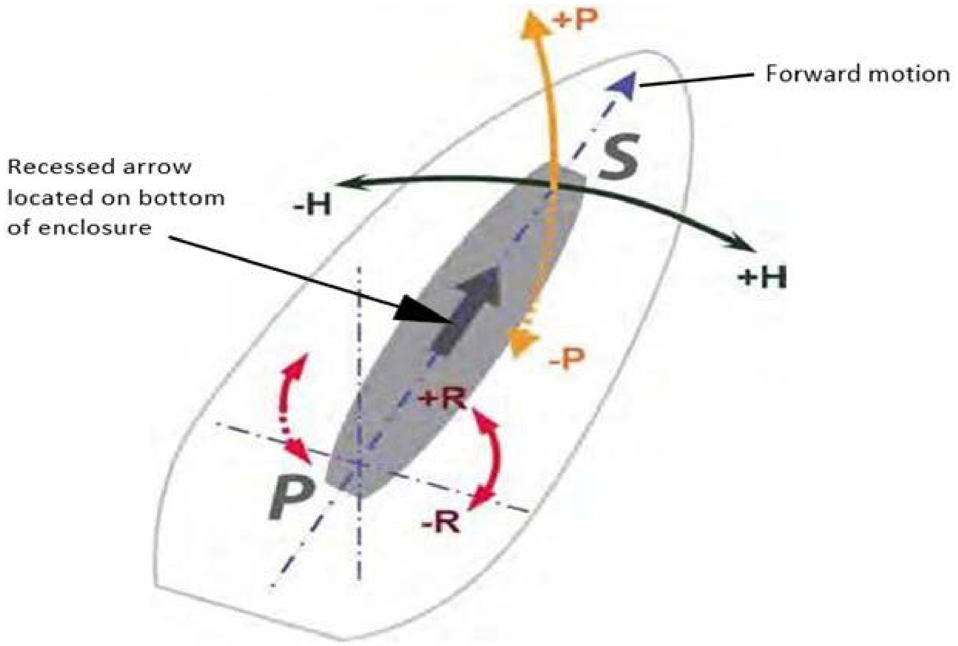

+P
Forward motion
S
Recessed arrow located on bottom of enclosure
-H
+H
-P
+R
P
-R

Figure 2-4: Recommended orientation and resulting signs of HPR values

Continued on next page

Mounting orientation example, continued

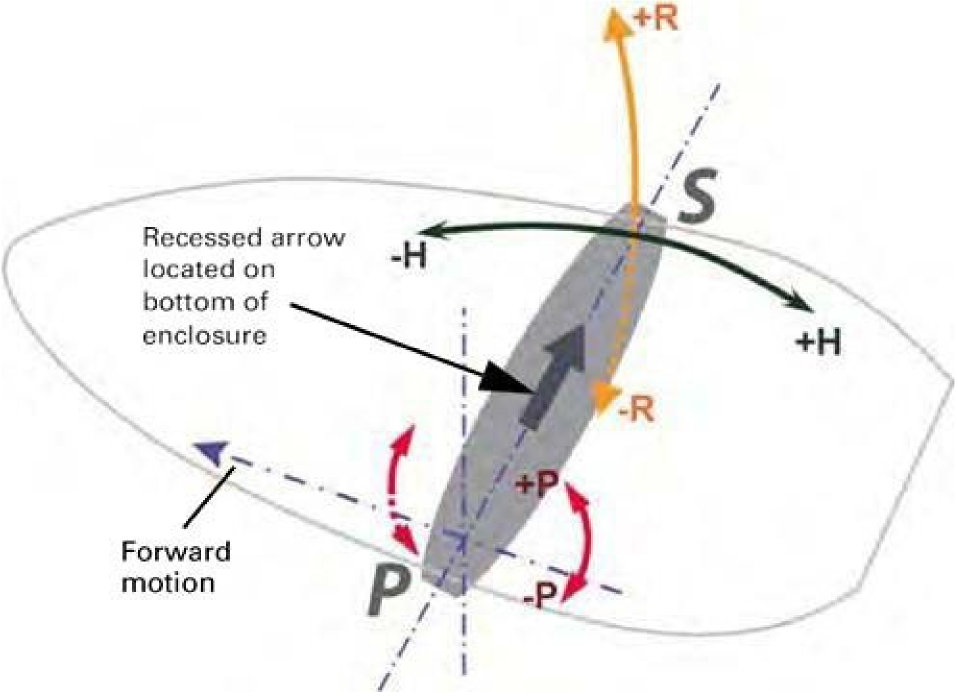

+R
S
Recessed arrow located on bottom of enclosure
-H
+H
-R
+P
Forward motion
P
-P

Figure 2-5: Alternate orientation and resulting signs of HPR values

Continued on next page

Mounting the V200-2,

V200-2 dimensions

Figure 2-6 illustrates the physical dimensions of the V200-2 GNSS Compass.

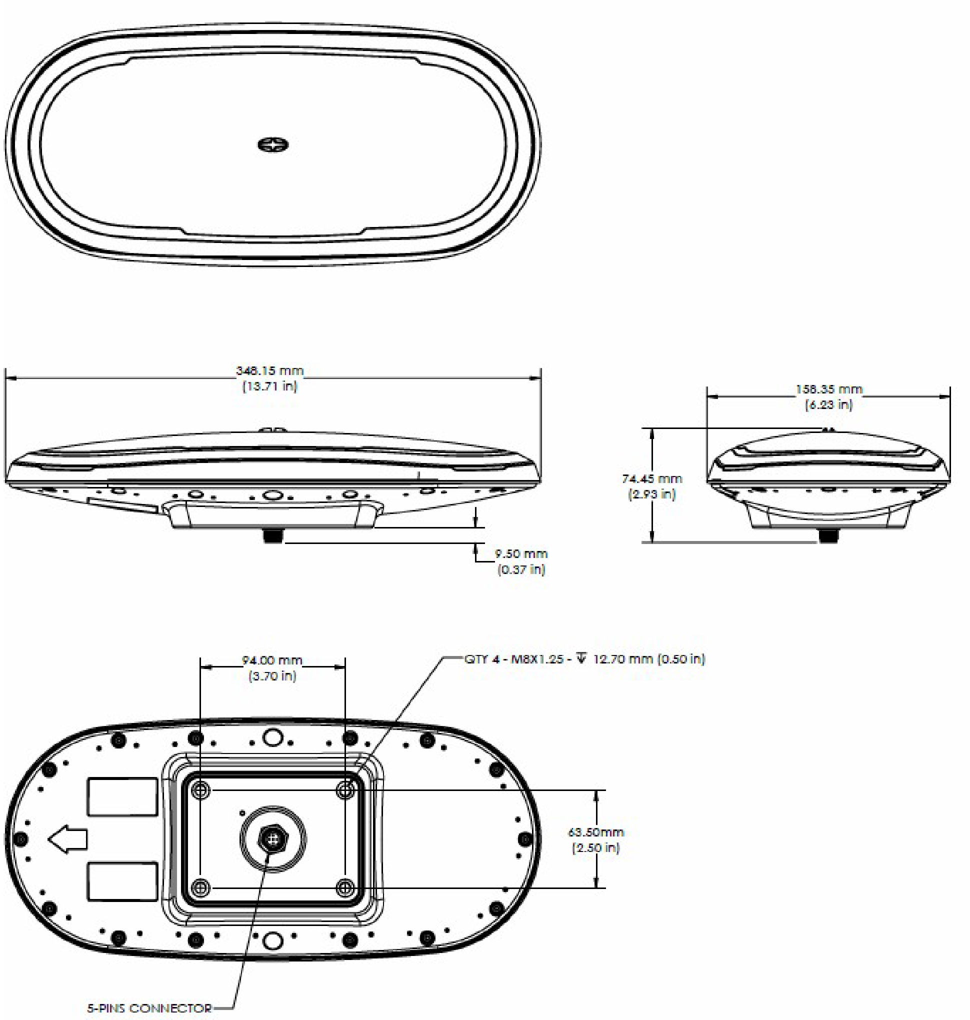

348.15 mm
(13.71 in)
158.35 mm
(6.23 in)
74.45 mm
(2.93 in)
9.50 mm
(0.37 in)
94.00 mm
(3.70 in)
QTY 4 - M8X1.25 - ↧ 12.70 mm (0.50 in)
63.50mm
(2.50 in)
5-PINS CONNECTOR

Figure 2-6: V200-2 dimensions

Continued on next page

Mounting the V200-2,

V200-2 mounting with pole mount accessory

Figure 2-7 illustrates the physical dimensions of the V200-2 GNSS Compass when mounted using the pole mount accessory.

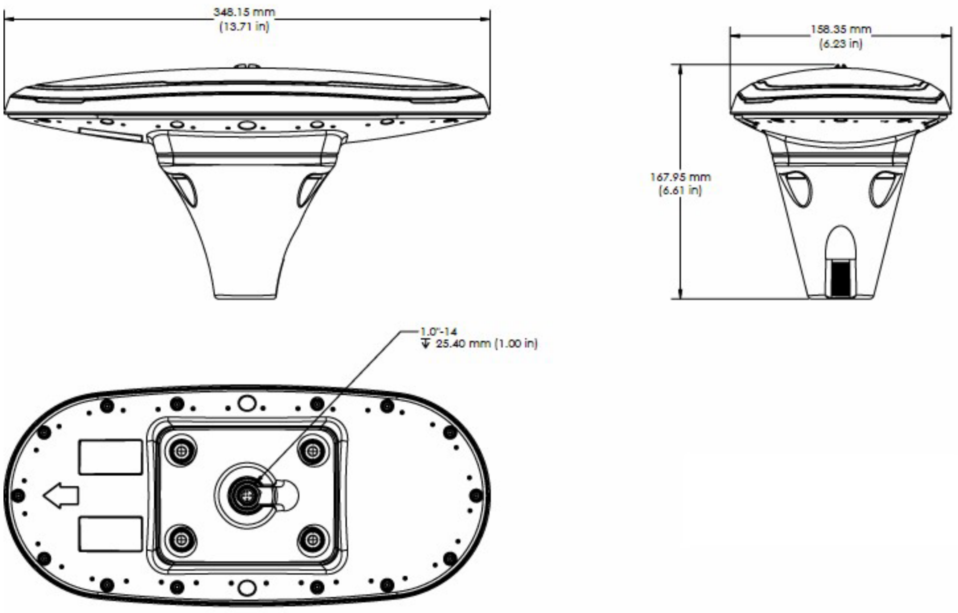

348.15 mm
(13.71 in)
158.35 mm
(6.23 in)
167.95 mm
(6.61 in)
1.0"-14
⊽ 25.40 mm (1.00 in)

Figure 2-7: V200-2 with pole mount accessory

Continued on next page

Mounting the V200-2,

V200-2 mounting with low-profile surface mount accessory

Figure 2-8 illustrates the physical dimensions of the V200-2 GNSS Compass when mounted using the low-profile mount accessory.

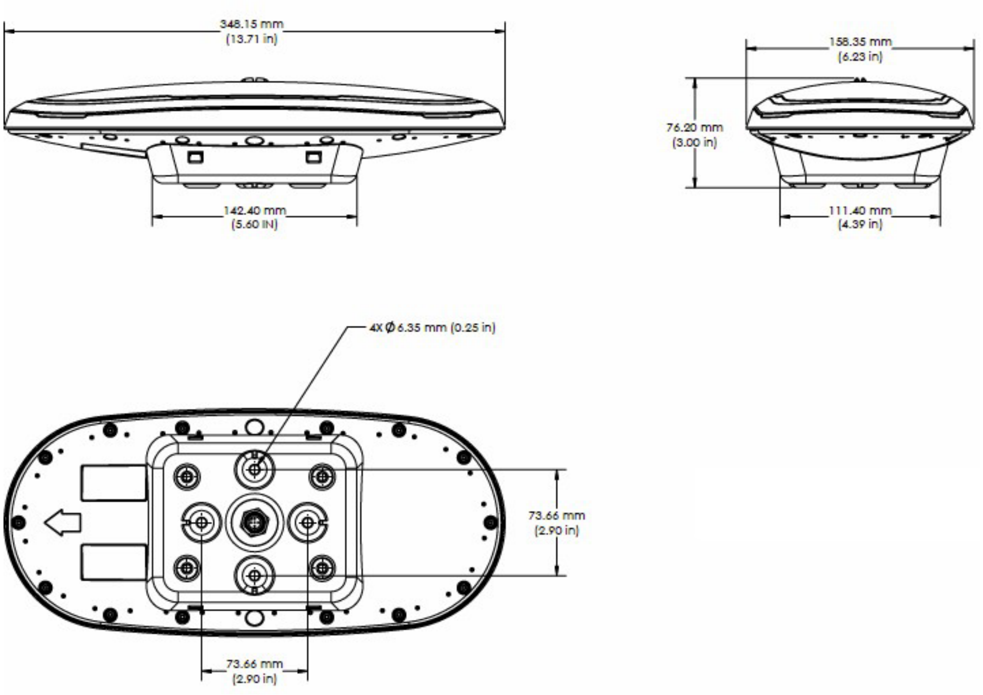

348.15 mm
(13.71 in)
142.40 mm
(5.60 IN)
158.35 mm
(6.23 in)
76.20 mm
(3.00 in)
111.40 mm
(4.39 in)
4X Ø 6.35 mm (0.25 in)
73.66 mm
(2.90 in)
73.66 mm
(2.90 in)

Figure 2-8: V200-2 with low-profile surface mount accessory

Continued on next page

Mounting the V200-2,

V200-2 mounting with high-profile surface mount accessory

Figure 2-9 illustrates the physical dimensions of the V200-2 GNSS Compass when mounted using the high-profile mount accessory.

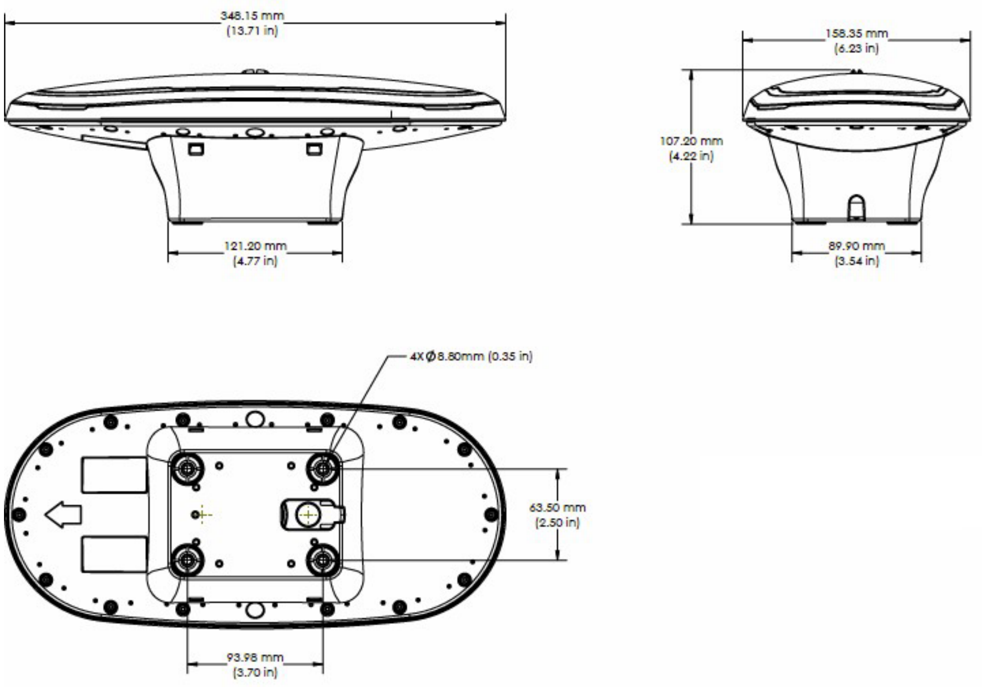

348.15 mm
(13.71 in)
158.35 mm
(6.23 in)
107.20 mm
(4.22 in)
121.20 mm
(4.77 in)
89.90 mm
(3.54 in)
4X Ø8.80mm (0.35 in)
63.50 mm
(2.50 in)
93.98 mm
(3.70 in)

Figure 2-9: V200-2 with high-profile mount accessory

Mounting alignment

If you have another accurate source of heading data on your vessel, such as a gyrocompass, you may use its data to correct for a bias in V200-2 alignment within the V200-2 software configuration.

Alternatively, you can physically adjust the heading of the V200-2 so that it renders the correct heading measurement or add a software offset.

Continued on next page

Mounting the V200-2,

NMEA 2000 cable considerations

Before mounting the V200-2, consider the following regarding NMEA 2000 cable routing:

Do	Do not
Ensure cable reaches 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 V200-2 end.	
Secure along the cable route using plastic wrapping.	

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

Continued on next page

Mounting the V200-2,

NMEA 2000 cable considerations, continued

Use the following steps to connect the NMEA 2000 cable.

Table 2-1: Connect NMEA 2000 cable

Step	Action
1	Align the cable connector keyway with the V200-2 connector key.
2	Rotate the cable ring clockwise, hand-tightening until it is firmly secured to the unit (see Figure 3-1).

⚠WARNING: When installing the V200-2, hand-tighten only. Damage resulting from over-tightening is not covered by the warranty.

Note: V200-2 performance is subject to the unit being installed in a location and environment as specified in this User Guide and using a NMEA 2000 certified cable.

Mounting options

The V200-2 offers four different mounting options:

- Bottom-up Surface Mounting for straight cable
- Top-down Surface Mounting for straight cable
- Top-down Surface Mounting for right-angle cable
- Pole Mounting

Note:SI-TEXGNSS does not supply mounting surface hardware or a mounting pole. You must supply the appropriate mounting hardware required to complete V200-2 installation.

Surface-mounting the V200-

Surface-mounting the V200-2

Be mindful of the following when planning your installation:

- If you need the GNSS-assisted roll measurement, install the V200-2 perpendicular to the vessel's axis. If you do not need this measurement, install the V200-2 parallel with the vessel's axis.
- Hemisphere GNSS does not supply mounting surface hardware or a mounting pole. You must supply the appropriate hardware or mounting pole required to complete V200-2 installation.
- You can enter a software offset to accommodate for a heading measurement bias due to installation.
- The flat surface may be fabricated per your installation, an off-the-shelf item (such as a radar mounting plate), or an existing surface on your vessel.

Surface-mounting the V200-2 from the bottom up for straight cable

Complete the following steps to surface-mount the V200-2 from the bottom up.

Table 2-2: Bottom-up, Surface-mounting the V200-2

Step	Action
1	Determine the desired location and proper orientation for the V200-2. See Mounting Orientation for information on determining the desired orientation.
2	Go to the HGNSS website/Technical Documentation/V200 Mounting Template.
3	Use the supplied V200 Mounting Template drawing (from Step 2) or photocopy the bottom of the V200-2 to plan the mounting hole locations. If using a photocopy, make sure it is scaled one-to-one with the mounting holes on the bottom of the V200-2.
4	If required, use a center punch to mark the hole centers on the mounting surface, then drill the mounting holes with a 9mm (.35 in) bit appropriate for the surface.

Continued on next page

Surface-mounting the V200-2,

Surface-mounting the V200-2, continued

Table 2-2: Bottom-up, Surface-mounting the V200-2 (continued)

Step	Action
5	Place the V200-2 over the mounting holes and insert the mounting screws through the bottom of the mounting surface into the V200-2.
6	Tighten to a torque of 8 - 10 lbs.-ft. The maximum thread depth engagement must be no more than 0.50 in! ⚠WARNING: **Damage resulting from over-tightening is not covered by the warranty.**

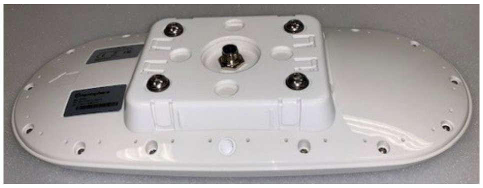
Continued on next page

Surface-mounting the V200-2,

Surface-mounting the V200-2 from the top down for straight cable and for right- angle cable

Complete the following steps to surface-mount the V200-2 from the top down.

Table 2-3: Top down, Surface-mounting the V200-2

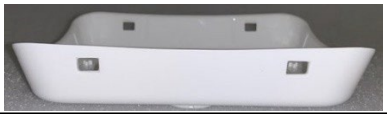
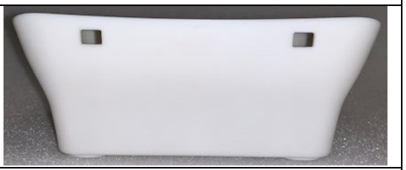
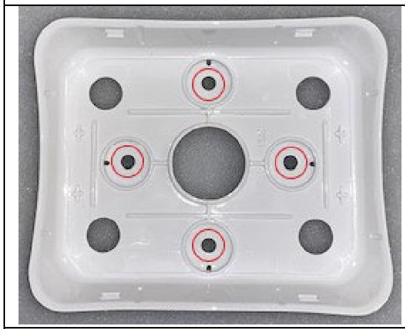
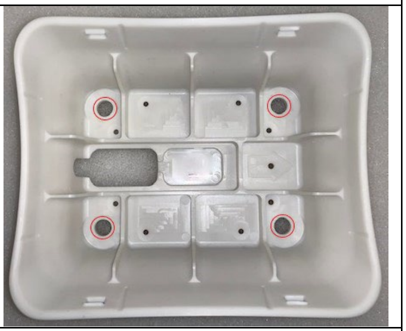
Step	Action
1	Secure the Surface Mount Adapter (676-0043-10) to the V200-2 using the supplied mounting hardware. Tighten to a torque of 8 - 10 lbs.-ft. The maximum thread depth engagement must be no more than 0.50 in! **Figure 2-10: Surface Mount Adapter (676-0043-10)**  **Figure 2-11: Surface Mount Adapter secured to V200-2**
2	Determine the desired location and proper orientation for the V200-2. See Mounting Orientation for information on determining the desired orientation.

Continued on next page

Surface-mounting the V200-2,

Surface-mounting the V200-2 from the top down for straight cable and for right- angle cable, continued

Table 2-3: Top down, Surface-mounting the V200-2 (continued)

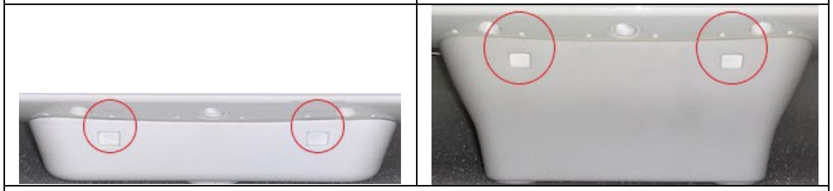
<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td rowspan="4">3</td><td colspan="2">Select the applicable surface mount:</td></tr>
<tr><td>Select this surface mount if you will thread the cable straight down.</td><td>Select this surface mount if you will thread the cable towards the back of the unit.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Figure 2-12: V200 Low-Profile Surface Mount (676-0041-10)</td><td>Figure 2-13: V200 Right-Angle Surface Mount (676-0042-10)</td></tr>
<tr><td>4</td><td colspan="2">Place the surface mount in the desired location on the installation surface.</td></tr>
<tr><td rowspan="4">5</td><td colspan="2">If required, use a center punch to mark the hole centers, then drill the mounting holes with bit appropriate for the surface.</td></tr>
<tr><td>Note: The diameter of the 676-0041-10 mounting holes is 6.4 mm (.25 in)</td><td>Note: The diameter of the 676-0042-10 mounting holes is 9 mm (.35 in)</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Figure 2-14: 676-0041-10 Mounting Holes</td><td>Figure 2-15: 676-0042-10 Mounting Holes</td></tr>
<tr><td>6</td><td colspan="2">Secure the mount to the installation surface. Tighten to a maximum torque of 10 lbs.-ft.</td></tr>
</table>

Continued on next page

Surface-mounting the V200-2,

Surface-mounting the V200-2 from the top down for straight cable and for right- angle cable, continued

Table 2-3: Top down, Surface-mounting the V200-2 (continued)

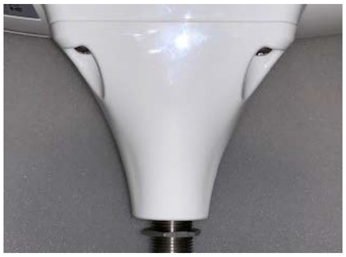
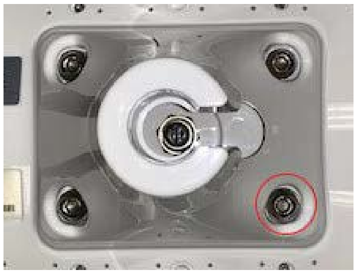
Step	Action
7	Thread the cable into through the surface mount, then connect the cable to the unit.
8	Carefully secure the mount to the V200-2 by placing it into the surface mount until the four latches snap into place, first on one side, and then the other. **Low-Profile** **Right-Angle**  **Figure 2-16: Adapters with both sides secured**
	Note: To remove the V200-2, simply reverse the process by pushing in the clips on one side, at which point the V200-2 can easily be removed.

Pole-mounting the V200-

Pole-mounting the V200-2

Complete the following steps to pole-mount the V200-2:

Table 2-4: Pole-mounting the V200-2

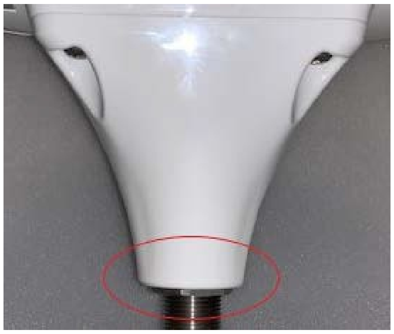
Step	Action
1	Determine the desired location and proper orientation for the V200-2. See Mounting Orientation for information on determining the desired orientation.
2	Thread the jam nut onto the 1-inch pole, then thread the pole mount.  **Figure 2-17: Pole mount with jam nut loosely threaded** ⚠WARNING: **Do not tighten the pole mount to more than 4 lbs.-ft.**
3	Thread the cable either through the hollow pole or through the opening in the pole mount.
4	Connect the cable to the V200-2, then secure the pole mount to the V200-2 using the supplied mounting hardware. Tighten to a torque of 8 - 10 lbs.-ft. The maximum thread depth engagement must be no more than 0.50 in!  **Figure 2-18: Pole mount secured to V200-2**

Continued on next page

Pole-mounting the V200-2, Continued

Pole-mounting the V200-2, continued

Table 2-4: Pole-mounting the V200-2 (continued)

Step	Action
5	Verify the orientation of the unit, then tighten the jam nut to the bottom of the pole mount to a torque of 8 – 10 lbs.-ft.  **Figure 2-19: Pole mount with jam nut tightly threaded to secure V200-2 orientation**

Chapter 3: Connecting the V200-2 Compass

Overview

Introduction

This chapter provides instructions on how to connect your V200-2 GNSS compass.

Contents

Topic	See Page
Ports	43
WebUI	44
Connecting the V200-2 to External Devices	57

Ports

Overview	The V200-2 offers NMEA 2000 functionality.
NMEA 2000 port	Refer to Appendix C for details regarding supported NMEA 2000 messages.

WebUI

Introduction

The WebUI of the HGNSS V200-2 allows the user to configure the receiver and radio with a WiFi-capable computer or mobile device.

Note: WebUI functionality applies only to V200-2 and V200s units that are Bluetooth/WiFi-capable and Bluetooth/WiFi-activated.

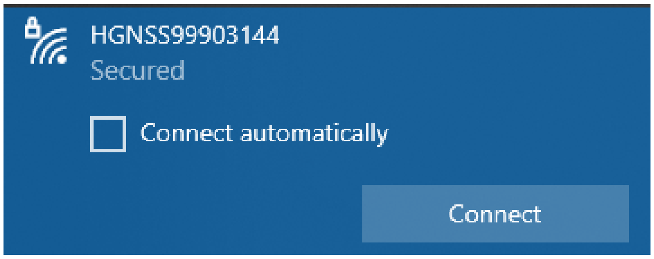
The typical WiFi range is expected to be up to 30 feet (10m). Ideally the user should be in close range to the receiver.

The WebUI offers easy product status review, configuration, and GNSS Firmware updates without the need for a wired cable connection.

WiFi Connection

To use the WebUI, a WiFi connection must be established with the HGNSS V200-2 receiver. To connect the mobile device to the receiver over WiFi:

1. Ensure WiFi is enabled on the mobile device
2. Identify the SSID of the V200-2 receiver as [HGNSS+8digit ESN]
3. Connect to the WiFi network
4. The default WiFi password is “hgnss1234”



Access WebUI

The WebUI utilizes an IP address with a standard internet browser. To access the V200-2 WebUI start page:

1. Open the internet browser
2. Enter http://192.168.100.1/
3. Access the start page of the V200-2 WebUI

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

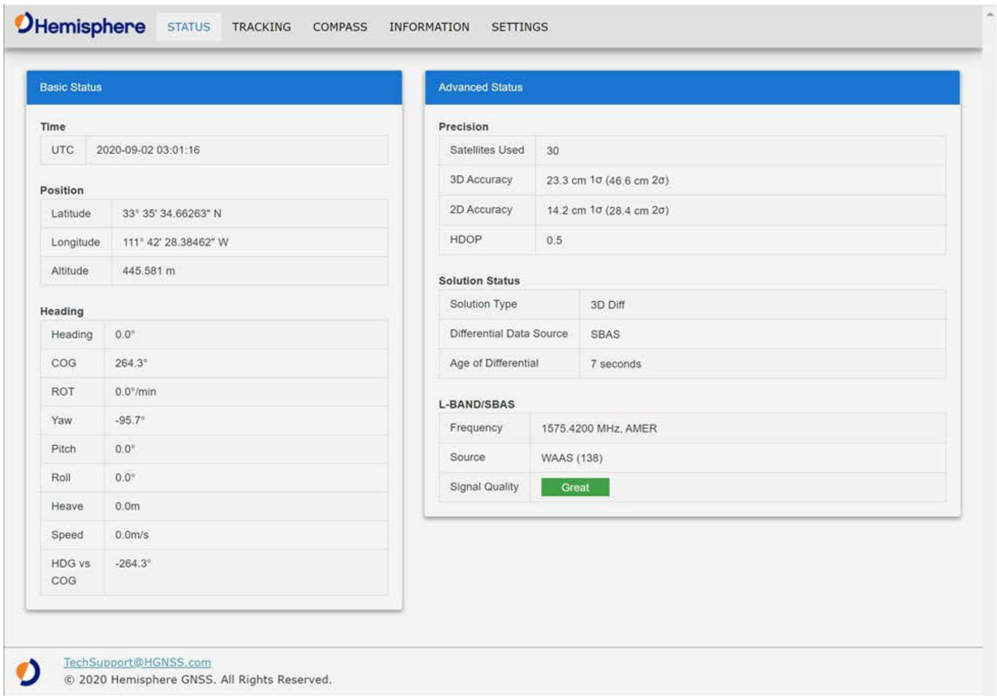
Continued on next page

WebUI, Continued

Status page

The **Status** page of the V200-2 WebUI provides a quick overview of the status of the receiver.

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



Basic Status

Time

UTC	2020-09-02 03:01:16

Position

Latitude	33° 35' 34.66263" N
Longitude	111° 42' 28.38462" W
Altitude	445.581 m

Heading

Heading	0.0°
COG	264.3°
ROT	0.0°/min
Yaw	-95.7°
Pitch	0.0°
Roll	0.0°
Heave	0.0m
Speed	0.0m/s
HDG vs COG	-264.3°

Advanced Status

Precision

Satellites Used	30
3D Accuracy	23.3 cm 1σ (46.6 cm 2σ)
2D Accuracy	14.2 cm 1σ (28.4 cm 2σ)
HDOP	0.5

Solution Status

Solution Type	3D Diff
Differential Data Source	SBAS
Age of Differential	7 seconds

L-BAND/SBAS

Frequency	1575.4200 MHz, AMER
Source	WAAS (138)
Signal Quality	Great

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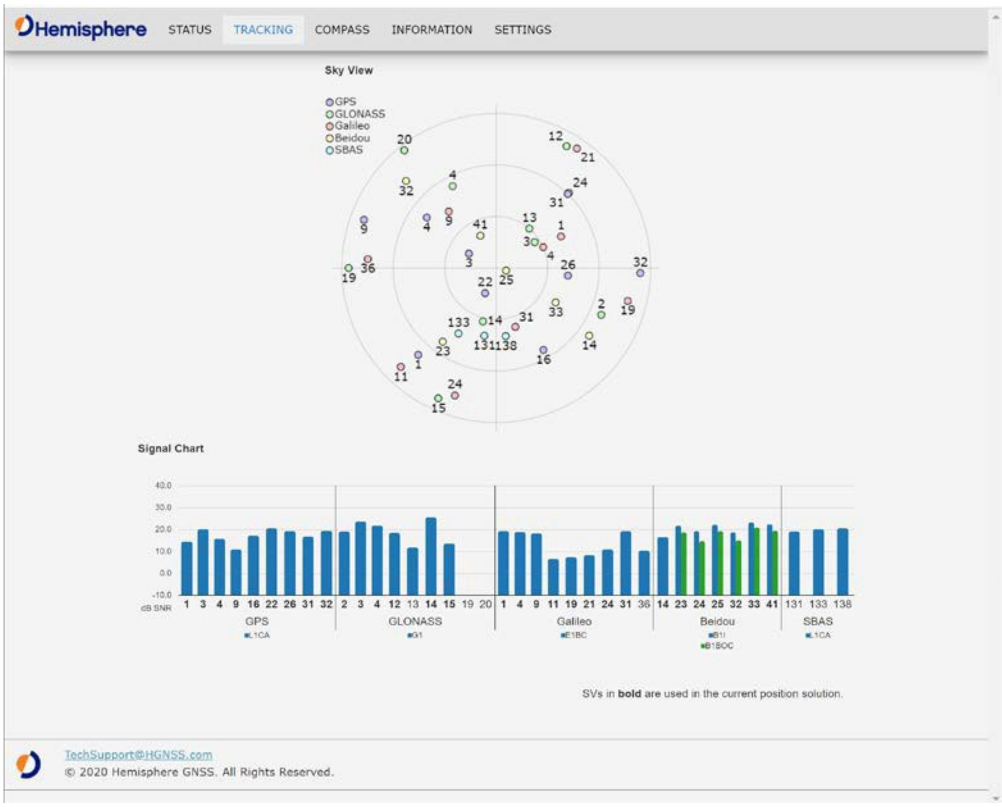
WebUI, Continued

Tracking page

The **Tracking** page of the WebUI provides an overview of the tracked signals for the V200-2 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.


Hemisphere
STATUS
TRACKING
COMPASS
INFORMATION
SETTINGS
Sky View
○GPS
○GLONASS
○Galileo
○Beidou
○SBAS
20
12
21
4
32
24
31
9
4
9
41
13
1
30
4
3
26
32
19
36
22
25
2
19
33
133
14
31
23
131
138
14
16
1
11
24
15
Signal Chart
40.0
30.0
20.0
10.0
0.0
-10.0
dB SNR
1 3 4 9 16 22 26 31 32
GPS
L1CA
2 3 4 12 13 14 15 19 20
GLONASS
G1
1 4 9 11 19 21 24 31 36
Galileo
E1BC
14 23 24 25 32 33 41
Beidou
B1I
B1BOC
131 133 138
SBAS
L1CA

SVs in **bold** are used in the current position solution.

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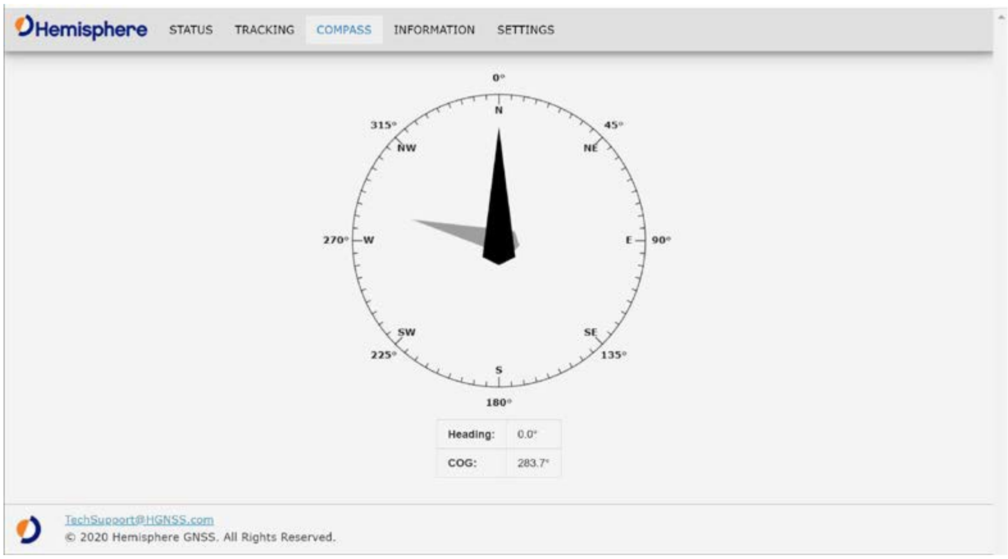
Continued on next page

WebUI, Continued

Compass page

The **Compass** page visualizes the GNSS heading of the V200-2 Smart Antenna while in motion.


Hemisphere
STATUS
TRACKING
COMPASS
INFORMATION
SETTINGS
0°
N
45°
NE
90°
E
135°
SE
S
180°
225°
SW
270°
W
315°
NW

Heading: 0.0°

COG: 283.7°

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Note: The provided V200-2 Smart Antenna heading will only provide a stable indication if the receiver is moving.

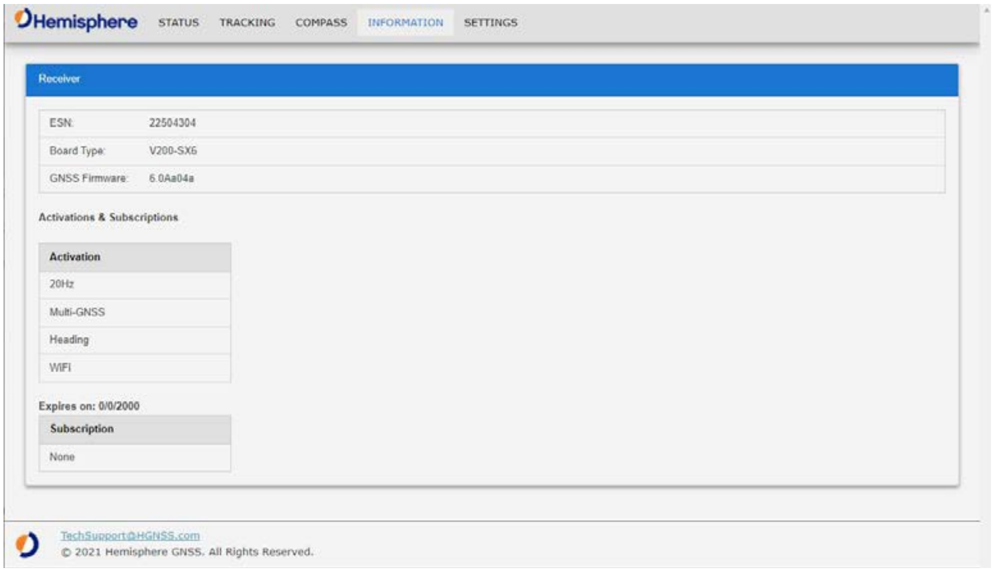
Continued on next page

WebUI, Continued

Information page

The WebUI **Information** page includes a general overview of the essential 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 time-based subscriptions, this includes the expiration date.



ESN:	22504304
Board Type:	V200-SX6
GNSS Firmware:	6.0Aa04a

Activations & Subscriptions

Activation
20Hz
Multi-GNSS
Heading
WIFI

Expires on: 0/0/2000

Subscription
None

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Continued on next page

Settings page

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

- System
- WiFi*
- Heading
- Serial
- USB
- File System
- Atlas

*The **WiFi** tab includes the **WiFi and Bluetooth Configuration** settings.

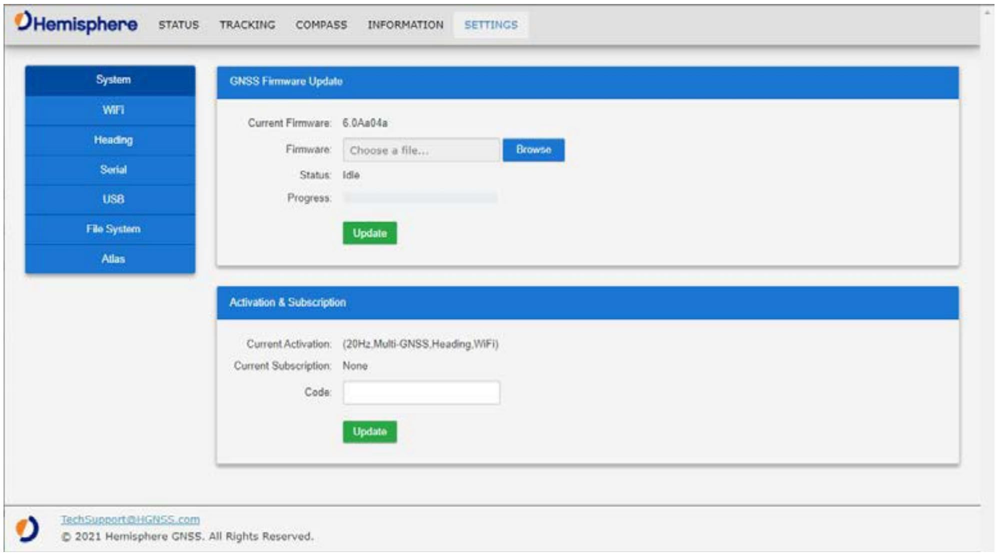
Continued on next page

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 the **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.


Hemisphere
STATUS
TRACKING
COMPASS
INFORMATION
SETTINGS
System
WiFi
Heading
Serial
USB
File System
Atlas
GNSS Firmware Update
Choose a file...
Browse
Update
Activation & Subscription
Update

Current Firmware: 6.0Aa04a
Firmware:
Status: Idle
Progress:

Current Activation: (20Hz,Multi-GNSS,Heading,WiFi)
Current Subscription: None
Code:

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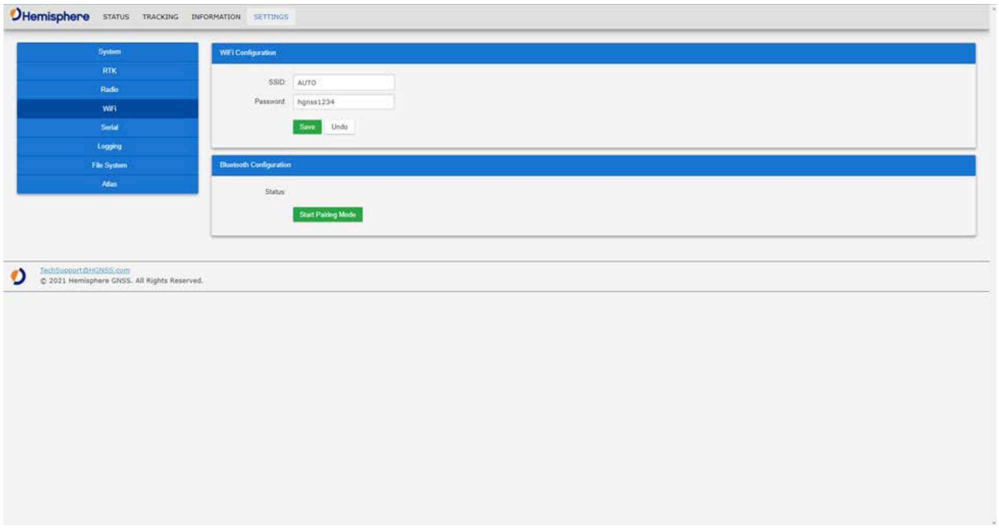
Continued on next page

Settings page, Wi-Fi

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

Use the **Start Pairing Mode** to connect and configure your Bluetooth device to the V200-2.


Hemisphere
STATUS
TRACKING
INFORMATION
SETTINGS
System
RTK
Radio
WiFi
Serial
Logging
File System
Atlas
WiFi Configuration
Save
Undo
Bluetooth Configuration
Start Pairing Mode

SSID: AUTO

Password: hgnss1234

Status:

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Continued on next page

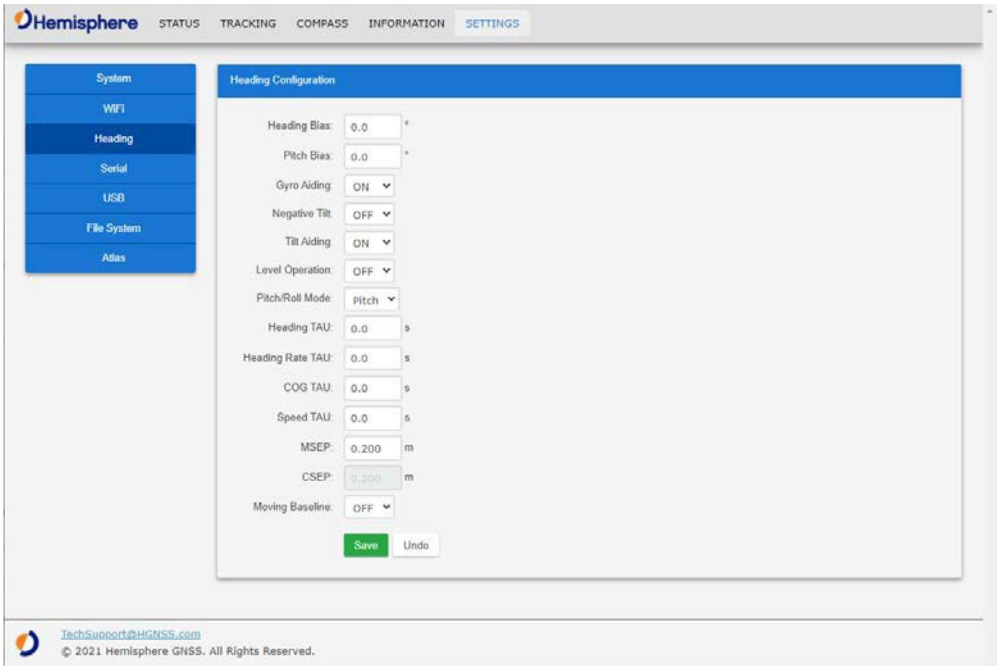
WebUI, Continued

Settings page, Heading

The **Heading** tab within the **Settings** page allows the user to review and configure the Heading settings for the V200-2 Smart Antenna.

The **Heading Configuration Table** provides a list of the messages and settings: Heading Bias, Pitch Bias, Gyro Aiding, Neg Tilt, tilt Aiding, Level operation, Pitch/Roll Mode, Heading TAU, Heading Rate TAU, Course Over Ground (COG) TAU, Speed TAU, MSEP, CSEP, and Moving Baseline.

The **Heading Configuration** section allows the user to configure the desired Bias, Aiding, or TAU.


Hemisphere
STATUS
TRACKING
COMPASS
INFORMATION
SETTINGS
System
WIFI
Heading
Serial
USB
File System
Atlas
Heading Configuration
Save
Undo
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Heading Bias: 0.0 °
Pitch Bias: 0.0 °
Gyro Aiding: ON
Negative Tilt: OFF
Tilt Aiding: ON
Level Operation: OFF
Pitch/Roll Mode: Pitch
Heading TAU: 0.0 s
Heading Rate TAU: 0.0 s
COG TAU: 0.0 s
Speed TAU: 0.0 s
MSEP: 0.200 m
CSEP: 0.200 m
Moving Baseline: OFF

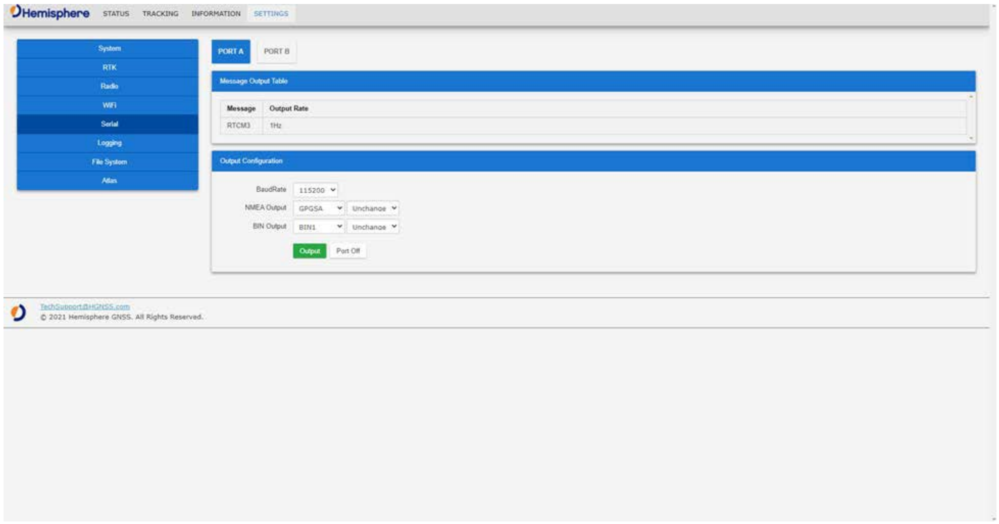
WebUI, Continued

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 V200-2 Smart Antenna.

The **Message Output Table** lists the enabled messages according to the 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.


Hemisphere
STATUS
TRACKING
INFORMATION
SETTINGS
System
RTK
Radio
WiFi
Serial
Logging
File System
Atlas
PORT A
PORT B
Message Output Table
Output Configuration
Output
Port Off
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Message	Output Rate
RTCM3	1Hz

BaudRate: 115200
NMEA Output: GPGSA, Unchange
BIN Output: BIN1, Unchange

Continued on next page

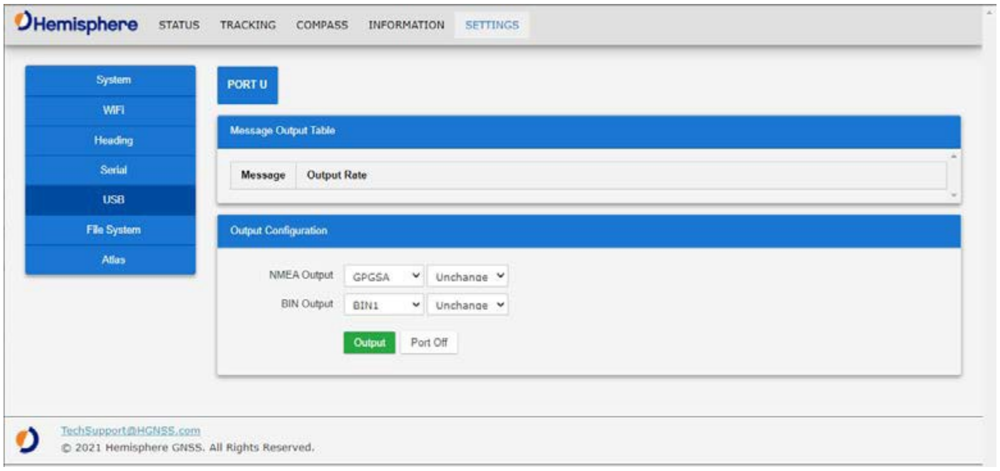
WebUI, Continued

Settings page, USB

The **USB** tab within the **Settings** page allows the user to review and configure the serial settings for Port U of the V200-2 Smart Antenna.

The **Message Output Table** lists the enabled messages according to Output Rate per port.

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


Hemisphere
STATUS
TRACKING
COMPASS
INFORMATION
SETTINGS
System
WiFi
Heading
Serial
USB
File System
Atlas
PORT U
Message Output Table
Output Configuration
Output
Port Off
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Message	Output Rate

NMEA Output: GPGSA, Unchange

BIN Output: BIN1, Unchange

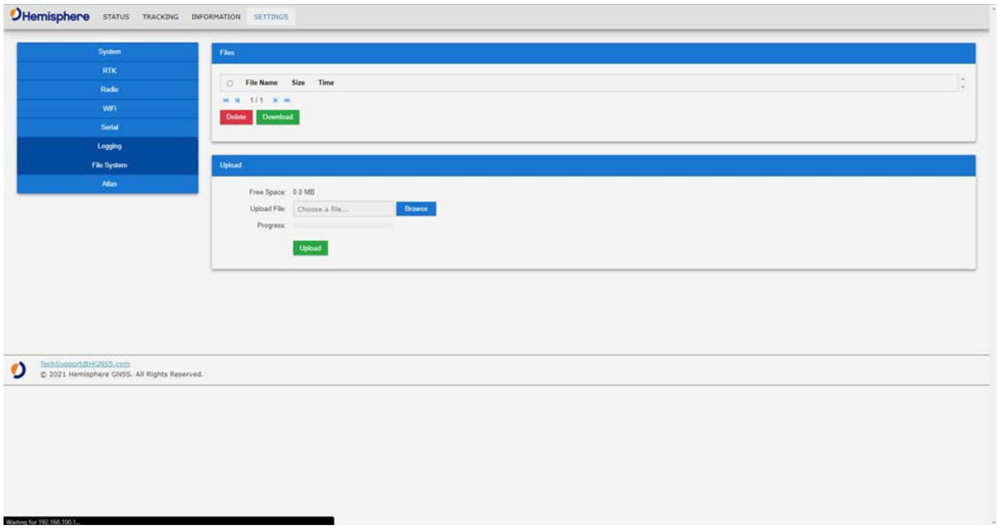
Continued on next page

WebUI, Continued

Settings page, File System

The **File System** tab allows you to download and upload logs for the V200-2. 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.


Hemisphere
STATUS
TRACKING
INFORMATION
SETTINGS
System
RTK
Radio
WiFi
Serial
Logging
File System
Atlas
Files
☐ File Name
Size
Time
1 / 1
Delete
Download
Upload
Upload File:
Choose a file...
Browse
Progress:
Upload
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Waiting for 192.168.100.1...

Free Space: 0.0 MB

Continued on next page

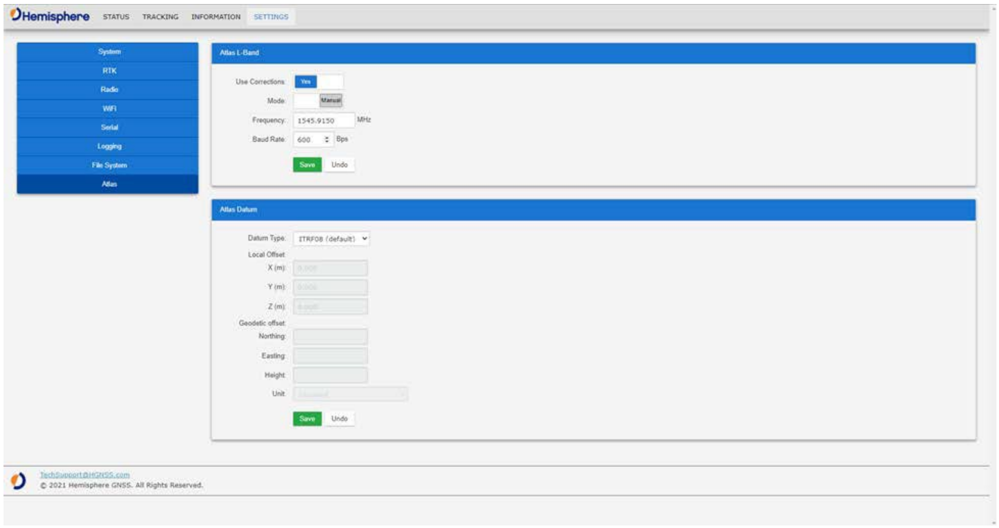
WebUI, Continued

Settings page, Atlas

The **Atlas** tab within the **Settings** page of the WebUI allows users to configure the V200-2 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.


Hemisphere
STATUS
TRACKING
INFORMATION
SETTINGS
System
RTK
Radio
WiFi
Serial
Logging
File System
Atlas
Atlas L-Band
Save
Undo
Atlas Datum
Local Offset
X (m)
Y (m)
Z (m)
Geodetic offset
Northing
Easting
Height
Unit
Save
Undo
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Use Corrections: Yes

Mode: Manual

Frequency: 1545.9150 MHz

Baud Rate: 600 Bps

Datum Type: ITRF08 (default)

Connecting the V200-2 to External Devices

NMEA 2000 cable pin-out specifications

The V200-2 uses a standard NMEA 2000 5-pin connector and does not include internal CAN termination.

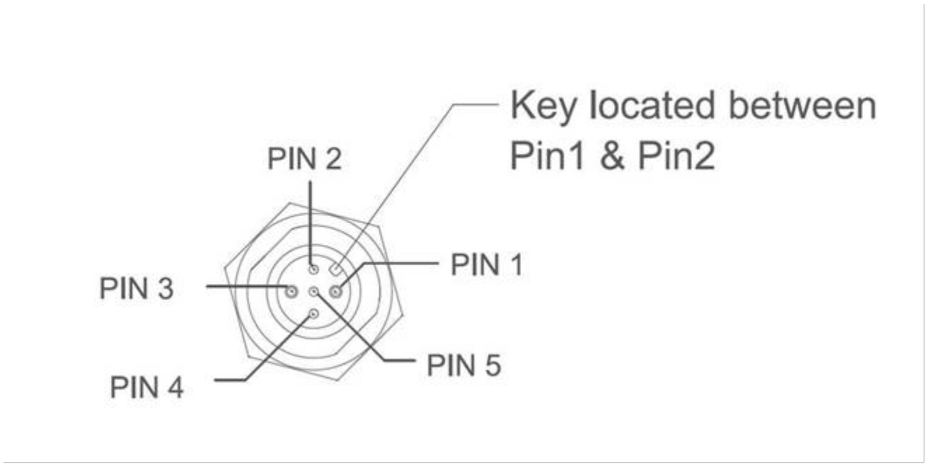

Figure 3-1: V200-2 pin-out assignments

Table 3-1 shows the cable pin-out specifications.

Table 3-1: V200-2 Pin-out (Device Out)

Pin	NMEA 2000 Mode (Device Out)
1	Shield
2	Power In
3	Power Ground
4	CAN Hi
5	CAN Lo

Electrical isolation

The V200-2's power supply is isolated from the communication lines and the PC-ABS plastic enclosure isolates the electronics mechanically from the vessel (addressing the issue of vessel hull electrolysis).

Chapter 4: Understanding the V200-2

Overview

Introduction

The GNSS receiver begins tracking satellites when it powers up and is placed outside in an open area. Position and heading accuracy vary depending upon location and environment. Position performance can be improved with RTK or DGNSS.

The following sections provide the steps to configure your V200-2 to use Atlas, SBAS, or RTK.

Note: Differential source and RTK status impact only positioning and heave. There is no impact to heading, pitch, or roll.

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Topic	See Page
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Differential Operation	60
SBAS XE "SBAS" Tracking	61
Atlas L-band	62
Supplemental Sensors	63
Time Constants	66

GNSS Overview

GNSS operation

The GNSS receiver is always operating, regardless of the DGNSS mode of operation. The following sections describe the general operation of the V200-2's internal GNSS receiver.

Note: Differential source and status have no impact on heading, pitch, or roll. They only have an impact on positioning and heave.

The V200-2 provides accurate and reliable heading and position information at high update rates. To accomplish this task, the V200-2 uses a high performance GNSS receiver and two antennas for GNSS signal processing.

One antenna is designated as the primary GNSS antenna, and the other is the secondary GNSS antenna. Positions computed by the V200-2 are referenced to the phase center of the primary GNSS antenna. Heading data references the Vector formed from the primary GNSS antenna phase center to the secondary GNSS antenna phase center.

The heading arrow located on the bottom of the V200-2 enclosure defines system orientation. The arrow points in the direction the heading measurement is computed (when the antenna is installed parallel to the fore-aft line of the vessel). The secondary antenna is directly above the arrow.

Differential Operation

Differential (DGNSS) operation	The V200-2 delivers positioning accuracies of 2.5 m 95% and provides positioning quality to better than 0.6 m 95% using differential corrections received through the internal SBAS demodulator or through Atlas L-band.

SBAS Tracking

SBAS tracking	The V200-2 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.

Atlas L-band

Atlas L-band	Atlas L-band corrections are available worldwide. With Atlas, the positioning accuracy does not degrade as a function of distance to a base station, as the data content is not composed of a single base station's information, but an entire network's information. The V200-2 can calculate a position with 30 cm RMS (horizontal) accuracy. To configure the receiver to use Atlas L-band, a subscription must be purchased.

Supplemental Sensors

Overview

The V200-2 has an integrated supplemental sensor that is enabled by default. You can enable/disable the sensor.

The sensor acts to reduce the RTK search volume, which improves heading startup and reacquisition times. This improves the reliability and accuracy of selecting the correct heading solution by eliminating other possible erroneous solutions.

The Hemisphere GNSS Technical Reference Manual describes the commands and methodology required to recalibrate, query, or change the sensor status.

Tilt aiding

The V200-2' s internal sensor is factory calibrated and enabled by default and constrains the RTK heading solution beyond the volume associated with a fixed antenna separation.

The V200-2 knows the approximate inclination of the secondary antenna with respect to the primary antenna. The search space defined by the sensor is reduced to a horizontal ring on the sphere's surface by reducing the search volume and decreases startup and reacquisition times (Figure 4-1).

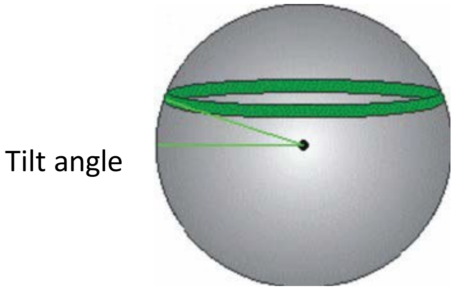

Figure 4-1: V200-2 tilt aiding

Continued on next page

Supplemental Sensors, Continued

Gyro aiding

The V200-2's internal sensor reduces reacquisition times when a GNSS heading is lost due to blocked satellite signals.

The sensor provides a relative change in angle since the last computed heading and defines the search space as a wedge-shaped location (see Figure 4-2).

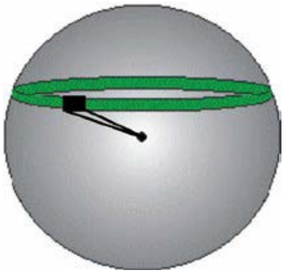

Figure 4-2: V200-2 gyro aiding

The gyro aiding accurately smooths the heading output and the ROT. The sensor also provides an alternate source of heading, accurate to within 1º per minute for up to three minutes in times of GNSS loss for either antenna. If the outage lasts longer than three minutes, the sensor will have drifted too far and the V200-2 begins outputting null fields in the heading output messages. There is no user control over the timeout period of the sensor.

The sensor initializes itself at power up and during initialization, or you can calibrate it as outlined in the Hemisphere GNSS Technical Reference Manual.

For optimal performance, when the sensor is first initializing, the dynamics the sensor experiences during this warm-up period are similar to the regular operating dynamics.

Continued on next page

Supplemental Sensors, Continued

Gyro aiding, continued

Gyro-aiding updates the post HTAU-smoothed heading. As a result, if the HTAU value is increased while gyro aiding is enabled, there will be little to no lag in heading output due to vessel maneuvers.

The Hemisphere GNSS Technical Reference Manual includes information on setting an appropriate HTAU value for the application.

Time Constants

Overview

The V200-2 incorporates user-configurable time constants that can provide a degree of smoothing to the heading, pitch, Rate-of-Turn (ROT), Course-over-Ground (COG), and speed measurements.

You can adjust these parameters depending on the expected dynamics of the vessel. For example, increasing the time is reasonable if the vessel is very large and is not able to turn quickly or would not pitch quickly. The resulting values would have reduced “noise,” resulting in consistent values with time.

If the vessel is quick and nimble, increasing this value can create a lag in measurements.

If you are unsure on how to set this value, it is best to be conservative and leave it at the default setting.

Note: For heading and rate of turn there is no lag once the sensor is calibrated and enabled.

Formulas for determining the level of smoothing are located in the Hemisphere GNSS Technical Reference Manual. If you are unsure how to set this value, it is best to be conservative and leave the default setting.

Heading

Use either MSGID 0x0028 (NMEA 2000) or the $JATT,HTAU command (using the PocketMax Terminal window) to adjust the level of responsiveness of the true heading measurement. The default value of this constant is 0.1 seconds of smoothing when gyro-aid is enabled.

By disabling gyro-aid, the equivalent default value of the heading time constant should be 0.5 seconds of smoothing. This is not automatic, and therefore it must be manually entered.

Note: Increasing the time constant increases the level of heading smoothing and increases lag (with gyro-aid disabled).

Continued on next page

Time Constants, Continued

Pitch

Use either MSGID 0x003C (NMEA 2000) or the **$JATT,PTAU** command (using the PocketMax Terminal window) to adjust the level of responsiveness of the pitch measurement. The default value of this constant is 0.5 seconds of smoothing.

Note: Increasing the time constant increases the level of pitch smoothing and increases lag.

Rate-of-Turn (ROT)

Use either MSGID 0x0029 (NMEA 2000) or the **$JATT,HRTAU** command (using the PocketMax Terminal window) to adjust the level of responsiveness of the ROT measurement. The default value of this constant is 2.0 seconds of smoothing.

Note: Increasing the time constant increases the level of ROT smoothing.

Course-Over-Ground (COG)

Use either MSGID 0x002A (NMEA 2000) or the **$JATT,COGTAU** command (using the PocketMax Terminal window) to adjust the level of responsiveness of the COG measurement. The default value of this constant is 0.0 seconds of smoothing.

Note: Increasing the time constant increases the level of COG smoothing.

COG is computed using only the primary GNSS antenna and its accuracy depends upon the speed of the vessel (noise is proportional to 1/speed). This value is invalid when the vessel is stationary, as tiny movements due to calculation inaccuracies are not representative of a vessel's movement.

Speed

Use the **$JATT,SPDTAU** command (using the PocketMax Terminal window) to adjust the level of responsiveness of the speed measurement provided. The default value of this parameter is 0.0 seconds of smoothing.

Note: Increasing the time constant increases the level of speed measurement smoothing.

Appendix A: Troubleshooting

Overview

Introduction Appendix A provides troubleshooting for common problems.

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Troubleshooting

Appendix A troubleshooting

Symptom	Possible Solution
Receiver fails to power	• Verify polarity of power leads • Check integrity of power cable connectors • Check power input voltage (9 to 36 VDC) • Check the voltage coming out of the connector at the end of the cable • Check current restrictions imposed by power source (minimum available should be > 1.0 A)
No data from V200-2	• Check receiver power status to ensure the receiver is powered • Verify desired messages are activated using the **$JSHOW** command (in the PocketMax Terminal window) • Check integrity and connectivity of cable connections
No GNSS lock	• Verify the V200-2 has a clear view of the sky • Use PocketMax to check how many satellites are in view and the SNR values

Continued on next page

Troubleshooting, Continued

Appendix A troubleshooting, continued

Symptom	Possible Solution
No SBAS lock	• Verify the V200-2 has a clear view of the sky • Set SBAS mode to automatic with the **$JWAASPRN,AUTO** command **Note:** SBAS lock is only possible if you are in an appropriate SBAS region; currently, there is limited SBAS availability in the southern hemisphere.
No Atlas	• First, check to see for an Atlas Basic subscription by sending **$JK,SHOW** in the PocketMax Terminal window to see which commands are listed. Or connect to PocketMax, go to the About tab, and check the listed activations • Ensure you are tracking the correct Atlas satellite or set the receiver to 'Auto-Tune' by sending **$JFREQ,AUTO** in the PocketMax Terminal window.

Continued on next page

Troubleshooting, Continued

Appendix A troubleshooting, continued

Symptom	Possible Solution
No heading or incorrect heading value	• Check CSEP value is constant without varying more than 1 cm (0.39 in)—larger variations may indicate a high multipath environment and require moving the receiver location • Heading is from primary GNSS antenna to secondary GNSS antenna, so the arrow on the underside of the V200-2 is directed to the bow side • Sending the **$JATT,SEARCH** command (in the PocketMax Terminal window) forces the V200-2 to acquire a new heading solution (unless gyro is enabled) • Enable GYROAID to provide heading for up to three minutes during GNSS signal loss • Enable TILTAID to reduce heading search times • Monitor the number of satellites and SNR values for both antennas within PocketMax—at least four satellites should have strong SNR values • The volume of data requested for output by the V200-2 could be higher than the current

Appendix B: Technical Specifications

Introduction

Appendix B provides the V200-2 technical specifications, and the V200-2 certification information.

Contents

Topic	See Page
V200-2 Technical Specifications	73

V200-2 Technical

V200-2 technical specifications

Table B-1: V200-2 sensor and positioning accuracy

Item	Specification
Receiver type	Vector sFreq GNSS Compass
Signals Received	GPS, GLONASS, BeiDou, Galileo, QZSS[1], and Atlas
Channels	424
GPS sensitivity	-142 dBm
SBAS tracking	2-channel, parallel tracking
Update rate (position and heading)	10 Hz standard, 20 Hz optional
Positioning accuracy (Standard)	1.2 m RMS (Autonomous, no SA) [1] 0.30 m RMS (SBAS) [2]
Positioning accuracy (Optional)	0.50 m RMS (Atlas) [3]
Heading accuracy (Standard)	1.5° RMS [1]
Heading accuracy (Optional)	0.75° RMS [1]
Heave accuracy (GNSS)	30 cm [4]
Pitch/Roll accuracy	1.5° RMS
Rate of turn	90°/s maximum
Cold start	60 s typical (no almanac or RTC)
Warm start	20 s typical (almanac and RTC)
Hot start	1 s typical (almanac, RTC, and position)
Heading fix	10 s typical (valid position)
Maximum speed	1,850 kph (999 kts)
Maximum altitude	18,288m (60,000 ft)
Compass safe distance	50 cm [5]
Differential options	Atlas, SBAS

Continued on next page

V200-2 Technical Specifications,

V200-2 technical specifications, continued

Table B-2: Communication

Item	Specification
Connector ports	5-pin
Ports	NMEA 2000
Data I/O Protocol	NMEA 2000

Table B-3: Power

Item	Specification
Input voltage	6 to 36 VDC
Power consumption	(multi-GNSS, typical continuous draw @ 12V)
SBAS	3.2 W
Atlas	3.6 W
Power isolation	Isolated to enclosure
Reverse polarity protection	Yes

Continued on next page

V200-2 technical specifications, continued

Table B-4: Mechanical

Item	Specification
Dimensions	
No Mount:	34.8 L x 15.8 W x 6.5 H (cm)
LP Flat Mount:	34.8 L x 15.8 W x 7.6 H (cm)
HP Flat Mount:	34.8 L x 15.8 W x 10.7 H (cm)
Pole Mount:	34.8 L x 15.8 W x 16.8 H (cm)
Notes:	Tolerances for the above measurements are -0/+0.25 cm. Please refer to drawings in the Mounting the V200-2 section of this document for details.
Weight (no mount)	0.75 kg
Power/data connector	5-pin
Aiding Devices	
Gyro:	Provides smooth heading, fast heading reacquisition and reliable 1˚ per minute heading for periods up to 3 minutes when loss of GPS has occurred [2]
Tilt Sensor:	Provides pitch and roll data and assist in fast start-up and reacquisition of heading solution

Table B-5: Environmental

Item	Specification
Operating temperature	-40°C to + 70°C (-22°F to + 158°F)
Storage temperature	-40°C to + 85°C (-40°F to + 185°F)
Humidity	95% non-condensing
Enclosure	ISO 60529:2013 for IPx6/IPx7/IPx9
Vibration	IEC 60945:2002 Section 8.7 Vibration
EMC	IEC60945:2002 EN 301 489-1 V2.1.1 EN 301 489-5 V2.1.1 EN 301 489-19 V2.1.0 EN 303 413 V1.1.1

Continued on next page

V200-2 technical specifications, continued

Table B-6: Certifications

Certification
NMEA 2000
RCM (Australia)

1 Depends on multipath environment, number of satellites in view, satellite geometry, no SA, and ionospheric activity
2 Depends on multipath environment, number of satellites in view, SBAS coverage and satellite geometry
3 Depends on multipath environment, number of satellites in view, and satellite geometry
4 Based on a 40 second time constant
5 This is the minimum safe distance measured when the product is placed in the vicinity of the steering magnetic compass. The ISO 694 defines "vicinity" relative to the compass as within 5 m (16.4 ft) separation

Appendix C: Common Commands and Messages

Overview

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NMEA 2000 Messages

V200-2 NMEA 2000 received messages

Table C-1: 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

V200-2 NMEA 2000 received messages, continued

Table C-1: 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

V200-2 NMEA 2000 transmitted messages

Table C-2: 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
127250	Vessel Heading Heading sensor value with a flag for True or Magnetic. If the sensor value is Magnetic, the deviation field can be used to produce a Magnetic heading, and the variation field can be used to correct the Magnetic heading to produce a True heading.	100	10
127251	Rate of Turn Rate of change of heading.	100	10

Continued on next page

V200-2 NMEA 2000 transmitted messages, continued

Table C-2: 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

V200-2 NMEA 2000 transmitted messages, continued

Table C-2: 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

V200-2 NMEA 2000 transmitted messages, continued

Table C-2: 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

NMEA 2000 Messages, Continued

V200-2 NMEA 2000 transmitted messages, continued

Table C-2: 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

V200-2 NMEA 2000 transmitted messages, continued

Table C-2: 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

NMEA 2000 Messages, Continued

V200-2 NMEA 2000 transmitted messages, continued

Table C-2: 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

For NMEA 2000 proprietary messages via CAN for tasks such as receiver configuration, please refer to theSI-TEXGNSS website/Resources & Support/Technical Documentation/NMEA Proprietary Messages Reference Manual.

Continued on next page

NMEA 2000 Proprietary Messages, Continued

NMEA 2000 proprietary messages

The following lists NMEA 2000 proprietary messages.

Table C-3: 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

NMEA 2000 proprietary messages, continued

Table C-3: 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

NMEA 2000 proprietary messages, continued

Table C-3: 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

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