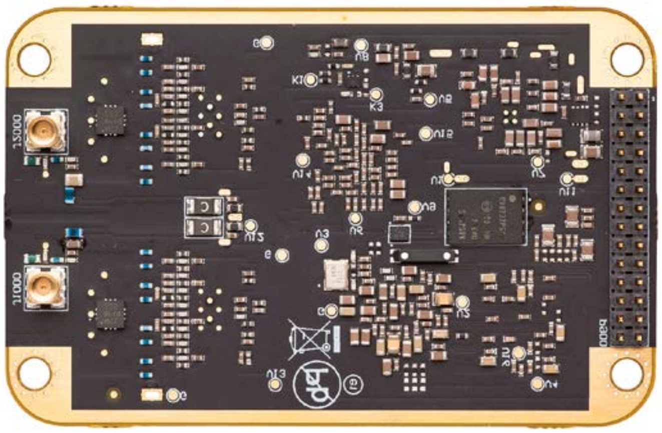

875-0428-10

Vega™ 28 GNSS OEM Board

Integrator Guide

Revision: A1

December 13, 2019

Table of Contents

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.

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

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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

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

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Vega 28 Terms & Definitions

Introduction

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

Vega 28 terms & definitions

Term	Definition
1PPS	1 pulse-per-second is a pulse output by the receiver precisely once per second and is used for hardware synchronization.
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 Chinese satellite-based navigation system.
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 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 implemented by the United States.
IRNSS	Indian Regional Navigation Satellite System
Multipath	Multipath occurs when the GNSS signal reaches the antenna by two or more paths. This causes incorrect pseudo-range measurements and leads to less precise GNSS solutions.

Continued on next page

Vega 28 Terms & Definitions, Continued

Vega 28 terms & definitions, continued

Term	Definition
NMEA	National Marine Electronics Association (NMEA) is a marine electronics organization that sets standards for communication between marine electronics.
QZSS	Quasi-Zenith Satellite System
ROX	ROX is a Hemisphere GNSS propriety RTK message format that can be used as an alternative to RTCM3 when both the base and rover are Hemisphere branded.
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 Integrator Guide helps you integrate your Vega 28 GNSS OEM board with your heading and positioning product. You can download this manual from the Hemisphere GNSS website.

This manual does not cover receiver operation, the PocketMax utility, or commands and messages (NMEA 0183, NMEA 2000® or HGNSS proprietary). For information on these subjects refer to the Hemisphere GNSS Technical Reference Manual.

Contents

Product Overview

Product overview

The Vega 28 GNSS OEM board is one of our most advanced GNSS heading and positioning boards. The Vega 28 uses dual antenna ports to create a series of additional capabilities; including fast, high-accuracy heading over short baselines, RTK positioning, onboard Atlas L-band, RTK-enabled heave, low-power consumption, and precise timing.

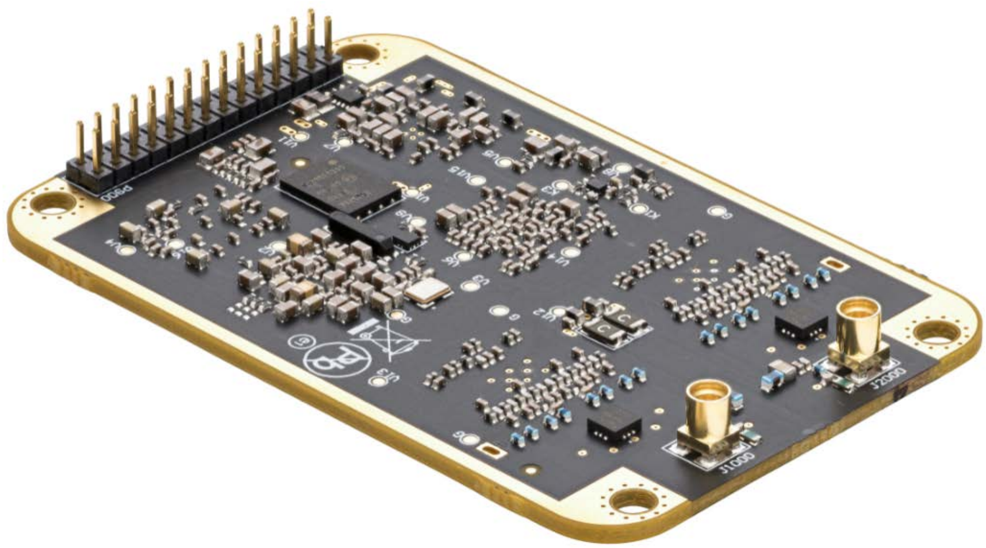


Figure 1-1: Vega 28 GNSS OEM Board

The Vega 28, positioning is scalable and field upgradeable with all Hemisphere software and service options. Use the same centimeter-level accuracy in either single frequency mode, or employ the full performance and fast RTK initialization times over long distances with multi-frequency multi-constellation GNSS signals. High-accuracy L-band positioning from meter to sub-decimeter levels available via Atlas correction service.

Leverage the industry standard form factor for easy upgradeability from other manufacturers' modules.

Continued on next page

Product Overview, continued

The Vega 28 GNSS board is available in the hardware configuration shown in Table 1-1.

Table 1-1: Vega 28 board options

Model	GNSS Systems	L-band
Vega 28	• 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 * • IRNSS* • Atlas *Future firmware update	Yes

Key Features

Vega 28 key features

The Vega 28 small form factor, low power consumption, and simple on-board firmware, make it an ideal solution for integrators, offering scalability and expandability from L1 GPS with SBAS to multi- frequency GPS, GLONASS, BeiDou, Galileo, IRNSS, and QZSS (with RTK capability).

Vega 28 is in the common industry form factor (100L x 60W mm) with integrated L-band. The reliable positioning performance of Vega 28 is further enhanced by Athena RTK, Atlas corrections, and aRTK technology.

The dual antenna Vega 28 provides accurate heading with an on-board gyro and tilt sensor that provides heading during short GNSS outages.

With the Vega 28, RTK performance is scalable. The Vega 28 uses the same centimeter-level accuracy in L1- only mode or employs the full performance of fast RTK convergence over long distances with L1/L2/L5 GPS signals. Vega 28 benefits from fewer RTK dropouts in congested environments, faster reacquisition, and more robust solutions due to better cycle slip detection.

For complete specifications of the Vega 28 board, see Appendix B Technical Specifications**.**

Key features of the Vega 28 include:

• Extremely accurate heading with long baselines	• Multi-frequency position, dual-frequency heading supporting GPS, GLONASS, BeiDou, Galileo, QZSS, and L-band
• Atlas® L-band capable to 4 cm RMS	• Athena™ GNSS engine providing best-in- class RTK performance
• Excellent coasting performance	• 5 cm RMS RTK-enabled heave accuracy
• Strong multipath mitigation and interference rejection	• New multi-axis gyro and tilt sensor for reliable coverage during short GNSS outages

What's Included in Your Kit

Kit contents

The Vega 28 is available in two configurations:

- Vega 28 GNSS OEM board only (P/N 725-1582-11)
- Vega 28 OEM board and Vega 28 adapter board (by request only).

For more information on requesting the Vega 28 adapter board, go to the HGNSS OEM Products page, or contact your local dealer.

Firmware

Firmware

The software that runs the Vega 28 is often referred to as firmware since it operates at a low level. You can upgrade the firmware in the field through Ports A, B, or C as new versions become available.

The Vega 28 currently ships with the Athena based firmware. Refer to the Hemisphere GNSS Technical Reference Manual for information on querying and communicating with the Vega 28 board.

Using PocketMax to Communicate with the Vega 28

PocketMax

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 Vega 28 via the COM port and open PocketMax.

The screens within PocketMax allow you to easily interface with the Vega 28 to:

- Select the internal SBAS, external beacon, or RTCM correction source and monitor reception (beacon optional)
- Configure GPS message output and port settings
- Record various types of data
- Monitor the Vega 28's status and function

PocketMax is available for download from the Hemisphere GNSS website.

Athena RTK and Atlas L-band

Athena RTK

Athena RTK (Real Time Kinematic) technology is available on Eclipse-based GNSS receivers. This is Hemisphere's most advanced RTK software and can be added to the Vega 28 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.

Atlas L-band

Atlas L-band is Hemisphere's industry leading correction service, which can be added to the Vega 28 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.

For more information about Athena RTK, see: HTTP://HGNSS.COM/TECHNOLOGY

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

aRTK Position Aiding

aRTK position aiding	aRTK is an innovative feature available in Hemisphere's Vega 28 that greatly mitigates the impact of land-based communication instability. Powered by Hemisphere's Atlas L-band system service, aRTK augments the ability to maintain an RTK solution when the original RTK data link is lost or interrupted. The aRTK provides an additional layer of communication redundancy to RTK users, assuring that productivity is not impacted by intermittent data connectivity. Vega 28 receives aRTK augmentation correction data over satellite, while also receiving the land- based RTK correction data. The receiver internally operates with two sources of RTK correction, creating one additional layer of correction redundancy as compared to typical RTK systems. After a few seconds of RTK correction loss aRTK is established. The receiver uses Atlas corrections in the absence of RTK. This allows for a slower degradation of accuracy until RTK corrections resume.

Chapter 2: Integrating the Vega 28 OEM Board

Overview

Introduction

This chapter provides instructions on how to integrate your Vega 28 board with your positioning product.

Contents

Vega 28 Integration

Introduction

Successful integration of the Vega 28 within a system requires electronics expertise that includes:

- Power supply design knowledge
- Serial port level translation
- Reasonable radio frequency competency
- An understanding of electromagnetic compatibility
- Circuit design and layout

Vega 28 integration requirements

The Vega 28 is a low-level module intended for custom integration with the following general requirements:

- Regulated power supply input: 3.3 VDC ± 3% @ 1.9A maximum continuous
- 3 x 3.3V CMOS UART serial ports, 1x ethernet port and USB host/device dual-role port
- Radio frequency (RF) input to the engine from a GNSS antenna is required to be amplified (10 to 35 dB gain)
- Antenna input impedance is 50 Ω capable of supplying 5VDC @ 75ma for amplified antenna

Message interface

The Vega 28 can be configured (message output and receiver configuration) over serial (3.3V UART), or USB with ASCII commands published in the HGNSS Technical Reference Manual (TRM). Additionally, you can configure the receiver over CAN. Refer to the Hemisphere GNSS NMEA 2000 manual.

You can output standard NMEA 0183 messages over serial and USB proprietary Hemisphere ASCII and binary messages.

You can output NMEA 2000 and some Hemisphere proprietary messages over CAN.

For more information on NMEA 0183 commands and messages as well as binary messages, refer to the HGNSS Technical Reference Manual.

Mechanical Layout

Vega 28 mechanical layout

Figure 2-1 shows the mechanical layout for the Vega 28 OEM board. Dimensions are in millimeters (inches) for all layouts.

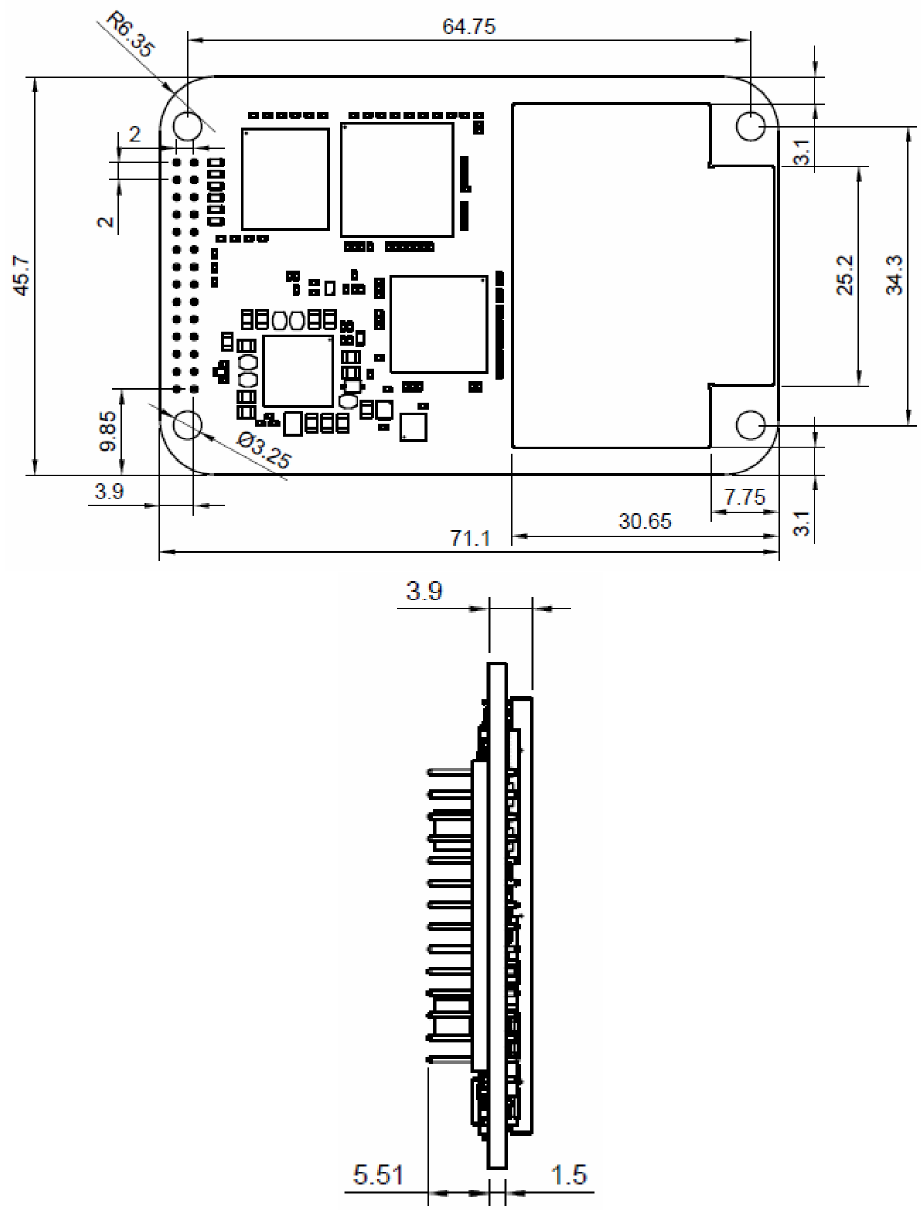


Figure 2-1: Vega 28 mechanical layout

Connectors

Vega 28 connectors

Table 2-1 describes Vega 28 connectors and mating connectors. You can use different compatible connectors; however, the requirements may be different. The antenna input impedance is 50 Ω.

Table 2-1: Vega 28 connectors

GNSS Board and Connector Type		Through-Hole Connector	Mating Connector
Vega 28	RF	MMCX, female straight jack Molex 734152063	MMCX, male straight plug
	Power / data	28-pin (14x2) male header, 0.0787 in (2 mm) pitch Samtec TMM-114-03-G-D	Samtec SQW-114-01-F-D 2mm Pitch 2 x 14 Socket

Mounting Options

Overview

There are two options for mounting the Vega 28:

- Direct Electrical Connection method
- Indirect Electrical Connection (cable) method

Direct electrical connection

Place an RF connector, header connector, and mounting holes on the carrier board and then mount the Vega 28 on the standoffs and RF and header connectors. This method is very cost effective as it does not use cable assemblies to interface the Vega 28.

Note: Be aware of the GPS RF signals present on the carrier board and ensure the correct standoff height to avoid any stress on the board when fastening.

The Vega 28 uses a standoff height of 7.0 mm (0.2756 in). With this height, there should be no washers between either the standoff and the Vega 28, or the standoff and the carrier board. You may need to change the standoff height if you select a different header connector.

If you want to use a right angle MMCX connector, use a taller header connector than the Samtec part number suggested in this guide. This provides clearance to have a right-angle cable-mount connector and eliminates the need for the carrier board to handle the RF signals. See Table 2-1 for Vega 28 connector information.

The mounting holes of the Vega 28 have a standard inner diameter of 3.50 mm (0.138 in).

Indirect electrical connection (cable) method

The second method is to mount the Vega 28 mechanically, so you can connect a ribbon power/data cable to the Vega 28. This requires cable assemblies and there is a reliability factor present with cable assemblies in addition to increased expense.

Header Layouts and Pin-outs

Overview

The Vega 28 uses a dual-row header connector to interface with power, communications, and other signals.

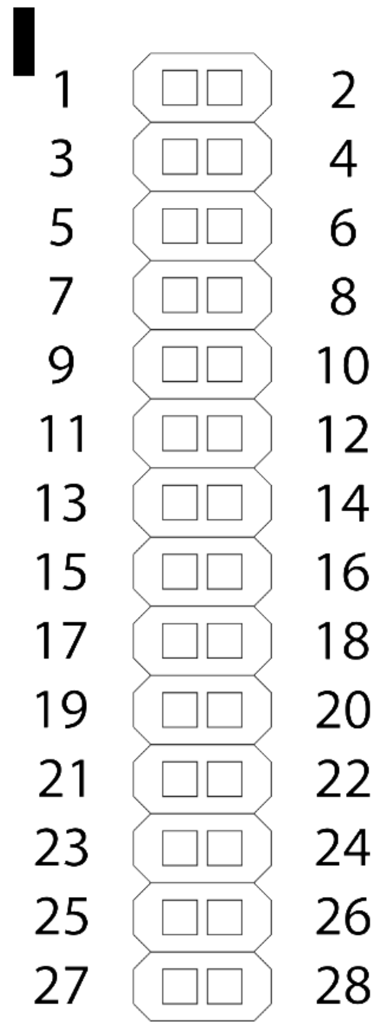


Figure 2-2: Identifying the first pin on the header connector

To identify the first header pin, orient the board so the bar is to the upper left of the pins; the first pin is on the left directly below the bar. The pins are then sequentially numbered per row from top to bottom.

Continued on next page

Header Layouts and Pin-outs, Continued

Overview, continued

Table 2-2 provides the 28-pin header pin-out.

Note: Pins are not 5 V tolerant. The pin voltage range is 0 to 3.3 VDC, unless otherwise noted. Leave any data or I/O pins that will not be used unconnected.

Table 2-2: Vega 28 28-Pin header pin-out

Pin	Name	Type	Description
1	USB ID	Input	USB ID (N/C for device mode, pull low for host mode)
2	USB VBUS	Power	USB bus voltage
3	ETH LINK LED	Ethernet	Ethernet LED
4	ETH BIAS	Ethernet	Ethernet Bias
5	N/C		
6	3.3V	Power	Receiver power supply, 3.3V
7	USB D- -	I/O	USB device or host data -
8	USB D+ / PCRX	I/O	USB device or host data +, or Port C Receive
9	Reset	Input	Reset, 3.3 V typical, not required
10	VARF/CAN RX Port A	3.3 V CMOS	VARF: Variable Frequency Output (Rising or falling edge active), or CAN Port A Receive
11	Event2/CAN TX Port A	3.3 V CMOS	Event 2 (Rising edge triggered), or CAN Port A Transmit
12	CAN RX Port B	3.3V CMOS	CAN Port B Receive
13	Event1/TX COM3	3.3V CMOS	Event 1 (Falling edge triggered), or Port C Transmit
14	Ground	Power	Receiver ground
15	PATX	3.3V CMOS	Port A Transmit
16	PARX	3.3V CMOS	Port A Receive
17	Ground	Power	Receiver ground
18	PBTX	3.3V CMOS	Port B Transmit

Continued on next page

Header Layouts and Pin-outs, Continued

Overview, continued

Table 2-2: Vega 28 28-Pin header pin-out (continued)

Pin	Name	Type	Description
19	PBRX	3.3V CMOS	Port B Receive
20	Ground	Power	Receiver ground
21	PValid	3.3 CMOS	Active High. Position Valid Indicator. Indicates the receiver has computed a position. Active High output.
22	Ground	Power	Receiver ground
23	1PPS	Output	Active high, rising edge, 3.3 V CMOS
24	CAN TX Port B	3.3V CMOS	CAN Port B Transmit
25	ENET TX+	Ethernet	Ethernet Transmit +
26	ENET RX+	Ethernet	Ethernet Receive +
27	ENET TX-	Ethernet	Ethernet Transmit -
28	ENET RX-	Ethernet	Ethernet Transmit +

Signals

Overview

This section provides information on the signals available via connectors.

RF Input

The Vega 28 is designed to work with active GNSS antennas with an LNA gain range of 10 to 35 dB.

The purpose of the range is to accommodate for losses in the cable system. There is a maximum cable loss budget of 25dB for a 35dB gain antenna. Depending on the chosen antenna, the loss budget may be lower.

When designing the internal and external cable assemblies and choosing the RF connectors, do not exceed the loss budget.

Ports

Serial ports

The Vega 28 has three serial communication ports:

Port A- RS-232
Pin 15 (TX), Pin 16 (RX)

Port B- RS-232/RS-422
Pin 18 (TX), Pin 19 (RX)

Port C- RS-232 (multiplexed with USB+, and event 1)
Pin 13 (TX), Pin 8 (RX)

Continued on next page

USB ports

The Vega 28 USB device port serves as a high-speed data communications port.

The Vega 28 USB data line is bi-directional. The USB data lines should be laid out on printed circuit board (PCB) with 90 Ω±15% differential impedance.

The traces should be over a solid continuous ground plane to maintain parallel traces and symmetry. There shall be no traces or breaks in the ground plane underneath the D+ and D- traces.

It is recommended to leave a minimum 20 mil spacing between USB signals and other signals. Treat the data lines as if they are RF signals. USB Transient Voltage Suppressors (TVS's) should be considered on D+ and D- for transient and electrostatic discharge protection.

CAN port

A CAN transceiver is required. The Vega 28 CAN RX and CAN TX are 3.3V CMOS signals. TheVega 28 connects to the transceiver on the single-ended CMOS port. CANH and CANL are CAN standard pins on the physical bus side of the transceiver, (the Vega 28 does not connect to this portion of the transceiver).

Note: Resistor values can vary based on application.

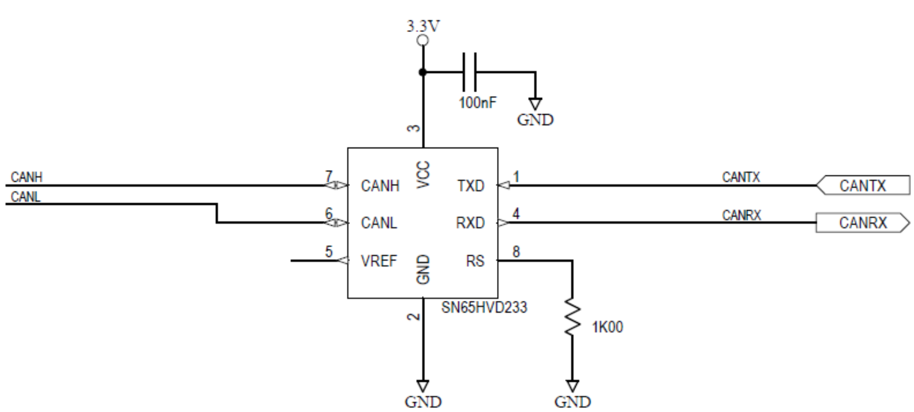


Figure 2-3: Vega 28 CAN design example

Continued on next page

Ports, Continued

Ethernet port overview

The Hemisphere Vega 28 receiver board has ethernet support. It is disabled by default, but may be enabled.

The Vega 28 is connected to a carrier board or enclosure which connects the Vega 28's ethernet pins to a standard RJ-45 jack (with integrated magnetics as appropriate).

Enabling / disabling ethernet

Some receivers have support for ethernet. It is disabled by default but may be enabled with the $JETHERNET serial command.

To start, the full current state of ethernet configuration may be checked with the command "$JETHERNET". When ethernet is disabled, the following is displayed:

```
$JETHERNET
$>JETHERNET,MAC,8C-B7-F7-F0-00-01
$>JETHERNET,MODE,OFF
$>JETHERNET,PORTI,OFF
$>JETHERNET,PORTUDP,OFF
$>JETHERNET,NTRIPCLIENT,OFF
$>JETHERNET,IPADDRESS,NONE
```

To enable ethernet, you first need to know if you are going to allow the receiver to be assigned an IP address automatically via DHCP, or statically assigned. If you are unsure, please contact the administrator of the network you wish to connect it to.

To enable ethernet support with a DHCP-assigned IP address, simply use the command "$JETHERNET,MODE,DHCP". The receiver will attempt to get an address from the DHCP server on the network. You should be able to see the current IP address reported by a "$JETHERNET" query change.

Continued on next page

Ports, Continued

Enabling / disabling ethernet, continued

To enable ethernet support with a statically assigned IP address, use the command “$JETHERNET,MODE,STATIC,ip,subnet,gateway,dns” where ip/subnet/gateway/dns are each replaced with the relevant IP address.

The gateway and dns parameters are optional, and only useful for allowing outgoing connections from the P328, which are not currently supported.

The following is an example command:
“$JETHERNET,MODE,STATIC,192.168.0.42,255.255.255.0”

If one wishes to disable Ethernet use the command:
“$JETHERNET,MODE,OFF”

Chapter 3: Understanding the Vega 28 OEM Board

Overview

Introduction

This chapter provides information you need to understand the Vega 28 OEM board and functions.

Contents

Timing Signal

1PPS timing signal

The one pulse per second (1 PPS) timing signal is used in applications where devices require time synchronization.

Note: 1 PPS is typical of most GPS boards but not essential to normal receiver operation. Do not connect this pin if you do not need this function.

The 1 PPS signal is 3.3 V CMOS, active high with rising edge synchronization. The 1 PPS signal is capable of driving a load impedance greater than 10 kΩ in parallel with 10 pF. The pulse is approximately 1 ms. The pulse width can be adjusted by 100 ns.

The Vega 28 supports a programmable PPS. Users can select the frequency to 1,2,5 or 10Hz. The Vega 28 can support widths up to 900ms.

The width command parameter is in µs (microseconds).

$JPPS,RATE,<Rate_In_Hz (limited to 1.0 ,2.0 ,5.0 ,10.0 >,[SAVE]

or if you prefer to work with the period (inverse of RATE)

$JPPS,PERIOD,<Period in seconds (limited to 1.0, 0.5, 0.2, 0.1)

PPS Width can be controlled using

$JPPS,WIDTH,<width in µs (microseconds)>,[SAVE]

Note: $JSAVE does NOT save the JPPS configuration so the desired 1PPS configuration settings must be applied every time the receiver is powered on. Each parameter must be individually saved as it is entered (by adding the optional SAVE at the end of the command).

Event Marker Input

Event marker input	Depending on the application, a GPS solution may need to be forced and not synchronized with GPS time. **Note:** Event marker input is typical of most GPS boards but not essential to normal receiver operation. Do not connect this pin if you do not need this function. The event marker input is 3.3 V CMOS, active low with falling edge synchronization. The input impedance and capacitance is higher than 10 kΩ and 10 pF respectively, with a threshold of lower than 0.7 V required to recognize the input.

Grounds

Grounds	You must connect all grounds together when connecting the ground pins of the Vega 28. These are not separate analog and digital grounds which require separate attention. Refer to Table 2-2 for Vega 28 pin-out ground information.

Shielding

Shielding	The Vega 28 is a sensitive instrument. When integrated into an enclosure, the Vega 28 requires shielding from other electronics to ensure optimal operation. The Vega 28 shield design consists of a thin piece of metal, preventing harmful interference from penetrating.

Receiver Mounting

Receiver mounting

The Vega 28 is a precision instrument. To ensure optimal operation, mount the receiver to minimize vibration and shock.

When mounting the Vega 28 immediately adjacent to the GPS antenna, Hemisphere GNSS highly recommends shielding the board from the LNA of the antenna.

Note: This step can be more complex than some integrators initially estimate. Confirm the operation in your application as early in the project as possible.

Antenna Mounting

Antenna mounting

The Vega 28 is compatible with the following Hemisphere GNSS single and dual frequency antennas:

- **Single frequency:** A21 and A31 (beacon)
- **Dual frequency:** A45 and A43 (beacon)

When mounting the antennas, consider the following:

- Mounting orientation (pitch or roll)
- Proper antenna placement

Mounting Orientation

Mounting orientation

The Vega 28 outputs heading, pitch, and roll readings regardless of the orientation of the antennas.

Heading is calculated from the vector created between the primary and secondary antenna.

A heading, pitch, or roll bias may need to be set after installing the antennas so the heading, pitch, and roll are correctly calibrated. The primary antenna is used for positioning and the primary and secondary antennas, working in conjunction, output heading, pitch, and roll values.

Pitch orientation

If the angle calculated between the primary and secondary antenna is the pitch, send $JATT,ROLL,NO, $JATT,NEGTILT,NO, and $JATT,HBIAS,0 to the receiver to tell the receiver the antennas are calculating pitch instead of roll ($JATT,ROLL,NO) and that a heading bias is not necessary.

If the pitch is calculated from the secondary to the primary antenna, send $JATT,ROLL,NO, $JATT,NEGTILT,YES, and $JATT,HBIAS,180 to the receiver to tell the receiver the antennas are calculating pitch.

Pitch is calculated from the primary to the secondary antenna, but needs to be calculated from the secondary to the primary antenna. Swap the sign of the angle with $JATT,NEGTILT,YES.

Heading is calculated from the primary to secondary antenna, it will be out by 180 degrees. Therefore, send $JATT,HBIAS,180.

Continued on next page

Mounting Orientation, Continued

Roll orientation

If the angle calculated between the primary and secondary antenna is the roll, send $JATT,ROLL,YES, $JATT,NEGTILT,NO, and $JATT,HBIAS,-90 to the receiver. This tells the receiver the antennas are calculating roll instead of pitch ($JATT,ROLL,NO).

When heading should be 0 degrees, the heading output will be 90 (since the antennas are calculating roll). Therefore, set the heading bias to -90 with $JATT,HBIAS,-90.

If the roll is calculated from the secondary to the primary antenna, send $JATT,ROLL,YES, $JATT,NEGTILT,YES, and $JATT,HBIAS,90 to the receiver. This tells the receiver the antennas are calculating roll.

Roll is calculated from the primary to the secondary antenna. Swap the sign of the angle with $JATT,NEGTILT,YES.

Heading is also calculated from the primary to secondary antenna, it will show as 270 degrees when it should be 0. Add a heading bias of 90 with $JATT,HBIAS,90.

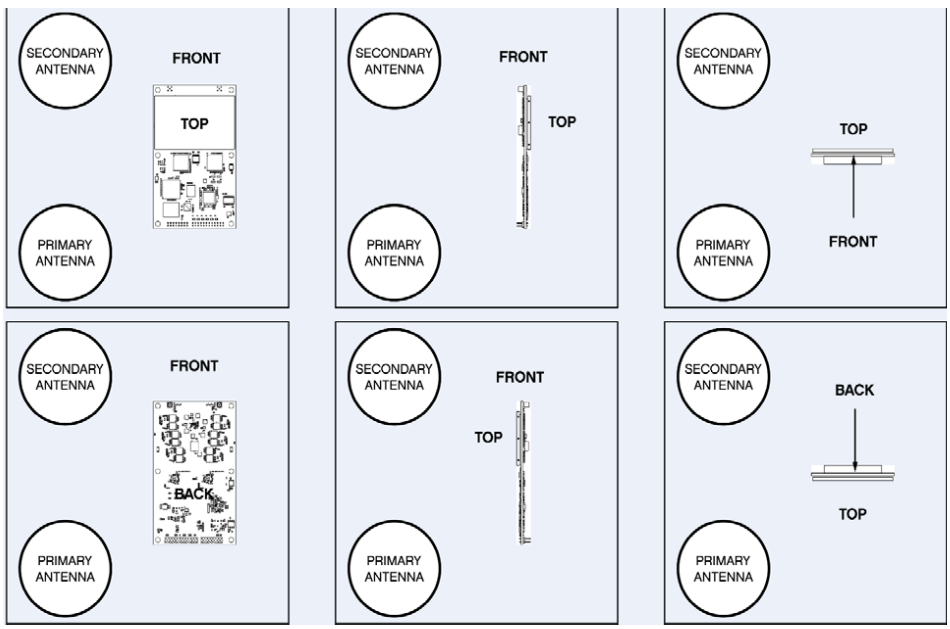
Note: Regardless of which mounting orientation you use, the Vega 28 provides the ability to output the heave of the machine via the $GPHEV message. For more information on this message refer to the Hemisphere GNSS Technical Reference Manual.

Vega 28 Orientation and Sensor Calibration

Vega 28 orientation and sensor calibration

The Vega 28 can determine mounting orientation in 90-degree steps using integrated inertial sensors. This allows the receiver to be installed in various orientations without affecting performance. A simple one-time calibration procedure is required to complete the orientation and sensor calibration:

1. Determine which of Group A, B, C or D the installation matches
2. Send the appropriate $JATT,ACC180,YES/NO and
3. $JATT,ACC90,YES/NO commands which match the installation
4. Send the command $JATT,TILTCAL to finalize the calibration



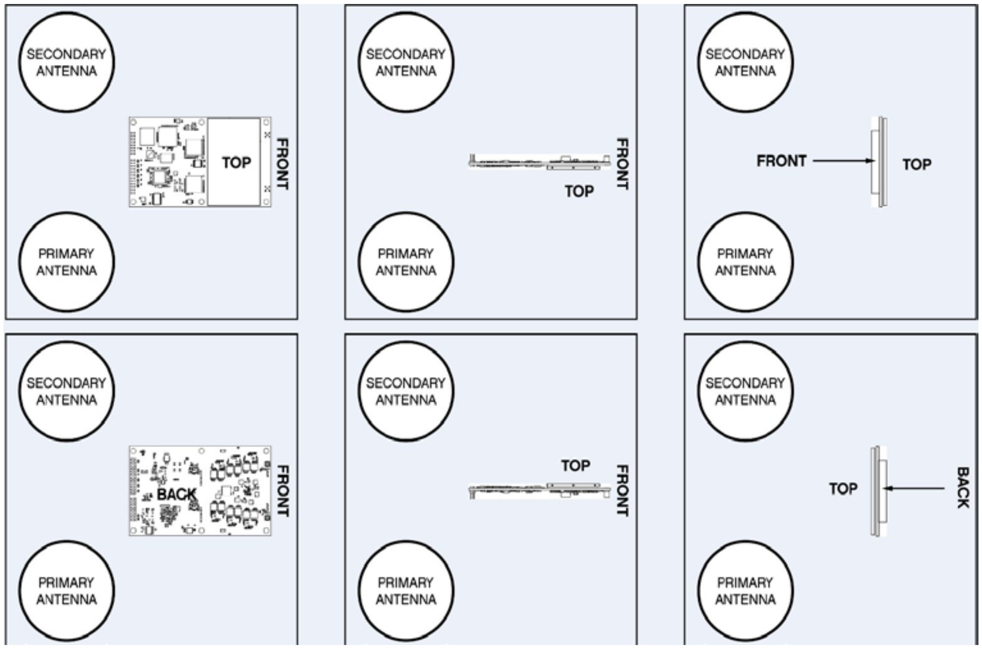
$JATT,ACC90,NO
$JATT,ACC180,NO

Figure 3-1: Group A

Continued on next page

Vega 28 Orientation and Sensor Calibration, Continued

Vega 28 orientation and sensor calibration, continued

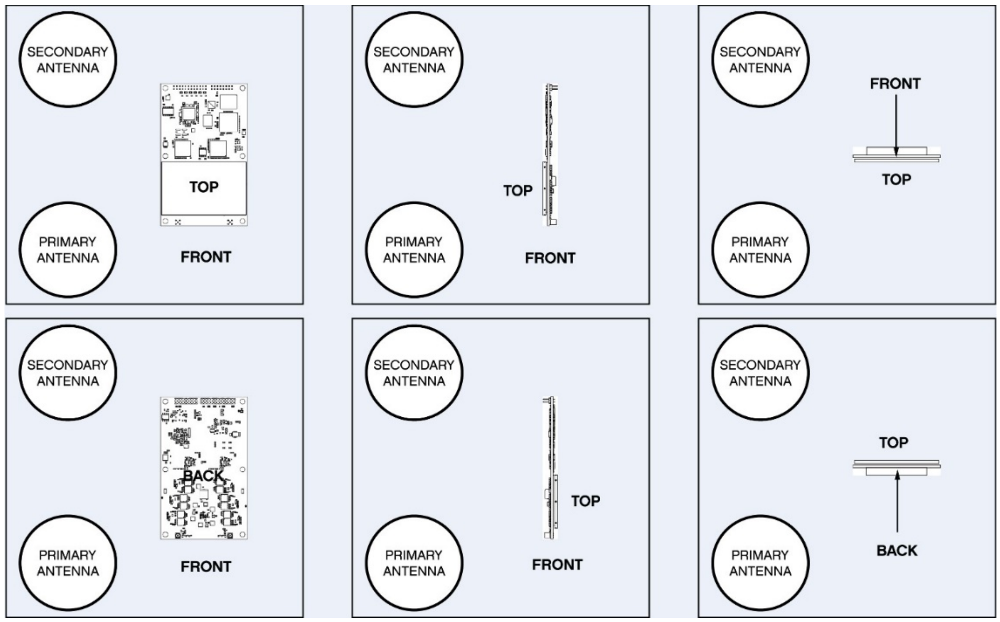


$JATT,ACC90,YES
$JATT,ACC180,NO

Figure 3-2: Group B

Continued on next page

Vega 28 orientation and sensor calibration, continued



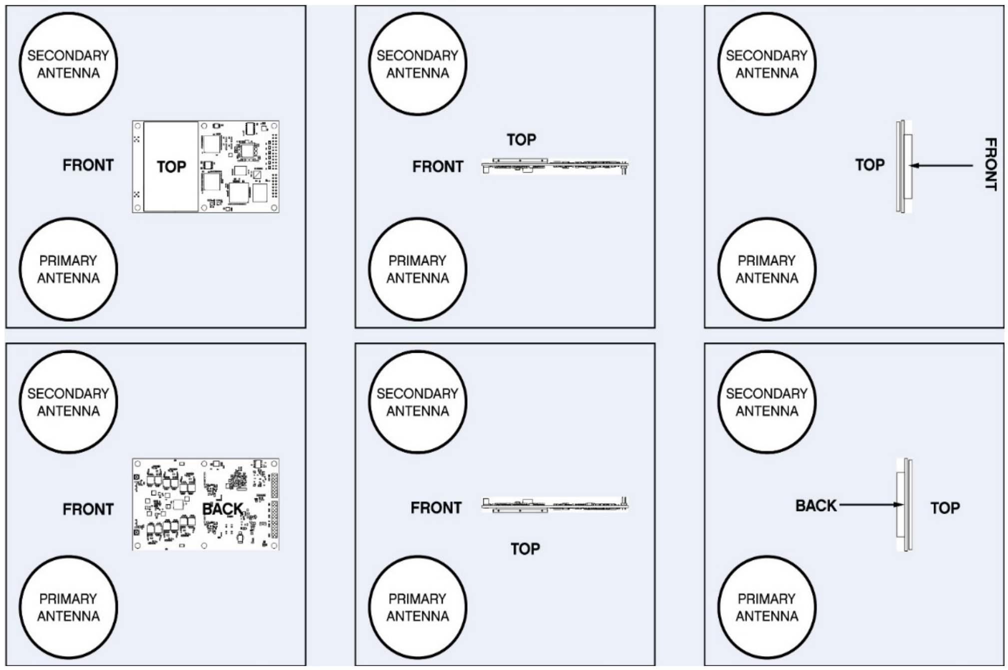
$JATT,ACC90,NO
$JATT,ACC180,YES

Figure 3-3: Group C

Continued on next page

Vega 28 Orientation and Sensor Calibration, Continued

Vega 28 orientation and sensor calibration, continued



$JATT,ACC90,YES
$JATT,ACC180,YES

Figure 3-4: Group D

Planning the Optimal Antenna Placement

Planning the optimal antenna placement

Proper antenna placement is important to obtain a high-precision GNSS reading.

Place the antennas:

- With a clear view of the horizon
- Away from other electronics and antennas
- Along the vessel's centerline

You must install the primary antenna along the vessel's centerline; you cannot adjust the position readings if the primary antenna is installed off the centerline. Positions are computed for the primary antenna.

Install on a level plane with a 20.0 m* maximum separation (default of 1.0 m) away from radio frequencies as high as possible. For optimal performance, orient the antennas so the antennas' connectors face the same direction.

Note: *A multi-frequency activation is necessary if using a baseline greater than 5m.

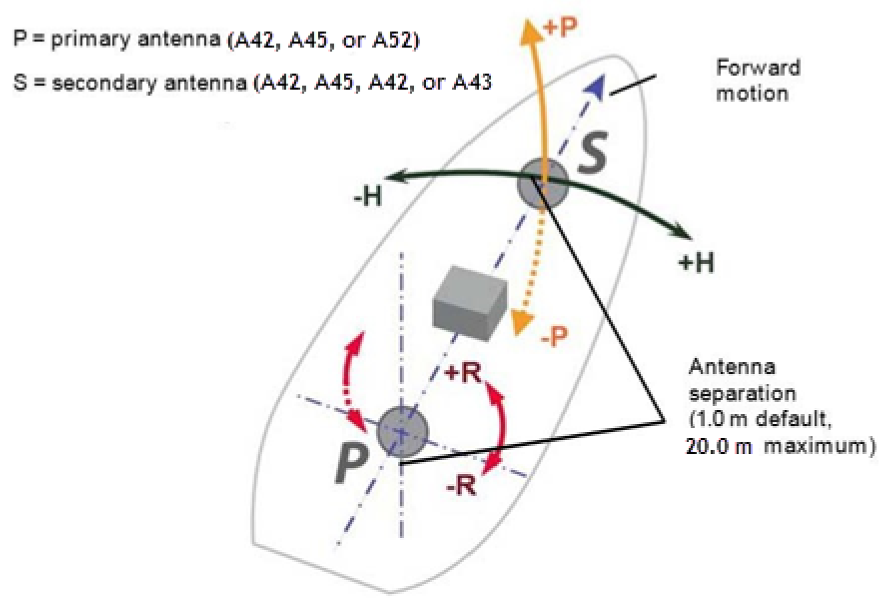


Figure 3-5: Recommended orientation and resulting signs of HPR values

Continued on next page

Planning the Optimal Antenna Placement, Continued

Planning the optimal antenna placement, continued

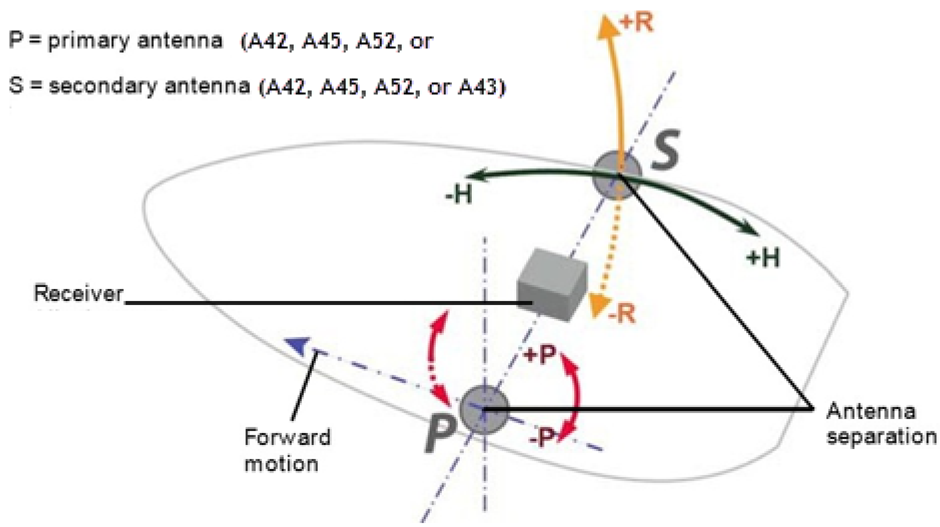


Figure 3-6: Alternate orientation and resulting signs of HPR values

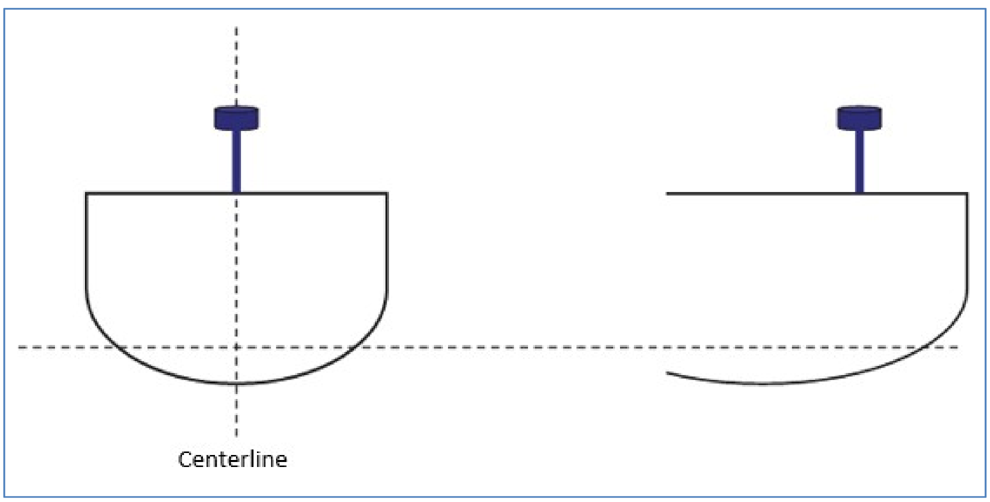


Figure 3-7: Antenna installation: cross-section of boat

Chapter 4: Operating the Vega 28 OEM Board

Overview

Introduction

This chapter provides Vega 28 operation information, such as communicating with the Vega 28, firmware, and configuration defaults.

Contents

Powering the Vega 28 On/Off

Powering the Vega 28

The Vega 28 is powered by a 3.3 VDC power source. After you connect appropriate power, the Vega 28 is active.

The antenna ports provide 5 V of power. You do not need to source power separately.

Communicating with the Vega 28

Communicating with the Vega 28

The Vega 28 features three primary serial ports (Port A, Port B, Port C), which can be configured independently. You can configure the ports for any combination of NMEA 0183, binary, and RTCM SC- 104 data. The default data output is limited to NMEA data messages (industry standard).

Configuring the Vega 28

Configuring the Vega 28

You can configure all aspects of Vega 28 operation through any serial port using proprietary commands. For information on these commands refer to the Hemisphere GNSS Technical Reference Manual.

You can configure the following:

- Select one of the two firmware applications
- Set communication port baud rates
- Select which messages to output on the serial ports and the update message rate
- Set various receiver operating parameters

For a complete list of commands and messages refer to the Hemisphere GNSS Technical Reference Manual.

To issue commands to the Vega 28 you will need to connect it to a terminal program or Hemisphere GNSS' software applications (SLXMon or PocketMax).

LED Indicators

Overview

The Vega 28 features the following surface-mounted diagnostic LEDs to indicate board status (see Figure 4-1).

Table 2-3: Vega 28 LED Indicators

LED Indicator	Light	Board Status
PWR-Power	Red	The board is powered on.
PGNSS-GNSS lock	Orange	Primary GNSS lock
SGNSS	Orange	Secondary GNSS lock
DIFF-Differential lock	Orange	Indicates the receiver has locked onto the differential source.
DGNSS-DGNSS position	Green	Indicates the user is receiving corrections.
HDG	Green	Heading

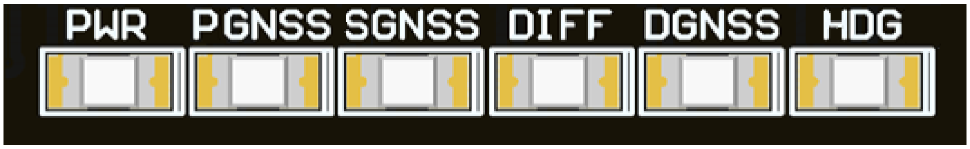


Figure 4-1: Onboard LEDs

Configuring the Data Message Output

Overview

The Vega 28 features three primary bi-directional ports (Ports A, B and C. You can configure messages for all ports by sending proprietary commands to the Vega 28 through any port. For a complete list of commands and messages refer to the Hemisphere GNSS Technical Reference Manual.

‘THIS’ Port and the ‘OTHER’ Port

Overview

Both Port A and Port B use the phrases “THIS” and “OTHER” when referring to themselves and each other in NMEA messages.

‘THIS’ port

‘THIS’ port is the port you are currently connected to for inputting commands.

To output data through the same port (‘THIS’ port) you do not need to specify 'THIS' port. For example, when using Port A to request the GPGGA data message be output at 5 Hz on the same port (Port A), issue the following command:

$JASC,GPGGA,5<CR><LF>

Continued on next page

‘THIS’ Port and the ‘OTHER’ Port, Continued

‘OTHER’ port

The ‘OTHER’ port is either Port A or Port B, whichever one you are not using to issue commands.

If you are using Port A to issue commands, then Port B is the ‘OTHER’ port, and vice versa. To specify the ‘OTHER’ port for the data output you need to include 'OTHER' in the command.

For example, if you use Port A to request the GPGGA data message be output at 5 Hz on Port B, issue the following command:

$JASC,GPGGA,5,OTHER<CR><LF>

When using Port A or Port B to request message be output on Port C, you must specifically indicate (by name) you want the output on Port C. For example, if you use Port A to request the GPGLL data message be output at 10 Hz on Port C, issue the following command:

$JASC,GPGLL,10,PORTC<CR><LF>

When using Port A or Port B to request message output on Port C, you must specifically indicate (by name) you want the output on Port C. For example, if you use Port A to request the GPGLL data message be output at 10 Hz on Port C, issue the following command:

$JASC,GPGLL,10,PORTC<CR><LF>

Saving the Vega 28 Configuration

Saving the Vega 28 configuration

Each time you change the Vega 28 configuration should save the configuration to avoid re-configuring the receiver each time you power it on.

To save the configuration, issue the $JSAVE command to the Vega 28 using a terminal program or Hemisphere GNSS' applications (SLXMon or PocketMax).

The Vega 28 saves the configuration to non-volatile memory and indicates (after several seconds) when the configuration has been saved. Refer to the Hemisphere GNSS Technical Reference Manual.

Configuration Defaults

Configuration defaults

Below is the standard configuration for the Vega 28. For more information on these commands refer to the Hemisphere GNSS Technical Reference Manual.

$JOFF,ALL
$JOFF,PORTA
$JOFF,PORTB
$JOFF,PORTC
$JOFF,PORTD

$JAGE,2700
$JLIMIT,10
$JMASK,5
$JNP,8
$JWAASPRN,AUTO
$JDIFF,WAAS
$JPOS,51.0,-114.0
$JSMOOTH,LONG
$JTAU,COG,0.00
$JTAU,SPEED,0.00
$JAIR,AUTO
$JALT,NEVER
$JFREQ,AUTO

$JATT,HTAU,0.1
$JATT,HRTAU,2.0
$JATT,COGTAU,0.0
$JATT,MSEP,1.0
$JATT,GYROAID,YES
$JATT,TILTAID,YES
$JATT,LEVEL,NO
$JATT,EXACT,NO
$JATT,HIGHMP,YES
$JATT,FLIPBRD,NO
$JATT,HBIAS,0.0
$JATT,NEGTILT,NO
$JATT,NMEAHE,0
$JATT,PBIAS,0.0

Continued on next page

Configuration Defaults, Continued

Configuration defaults, continued	**$JATT,PTAU,0.5** **$JATT,ROLL,NO** **$JATT,SPDTAU,0.0** **$JASC,GPGGA,1,PORTA** **$JASC,GPHDT,10,PORTA** **$JASC,GPROT,10,PORTA** **$JASC,GPHPR,1,PORTA** **$JASC,GPGGA,1,PORTB** **$JASC,GPHDT,10,PORTB** **$JASC,GPROT,10,PORTB** **$JASC,GPHPR,1,PORTB** **$JBAUD,19200,PORTA,SAVE** **$JBAUD,19200,PORTB,SAVE** **$JSAVE**

Appendix A: Troubleshooting

Overview

Introduction

Appendix A provides troubleshooting for Vega 28 operation.

Note: It is important to review each category in detail to eliminate it as a problem.

Contents

Troubleshooting

Vega 28 troubleshooting

Table A-1: Vega 28 Troubleshooting

Issue	Possible Solution
What is the first thing to check if I have a problem with the operation of the Vega 28?	Try to isolate the source of the problem. Problems are likely to fall within one of the following categories: • Power, communication, and configuration • GPS reception and performance • Beacon reception and performance • SBAS reception and performance • External corrections • Installation • Shielding and isolating interference
• No data from the Vega 28 • No communication	• Check receiver power status (use a Multimeter) • Confirm communication with Vega 28 via Hemisphere query command $JI, $JSHOW • Verify the Vega 28 is locked to GPS satellites (this can often be done on the receiving device or by using SLXMon) • Check integrity and connectivity of power and data cable connections

Continued on next page

Vega 28 troubleshooting, continued

Table A-1: Vega 28 Troubleshooting (continued)

Issue	Possible Solution
Random binary data from the Vega 28	• Verify the RTCM or Bin messages are not being accidentally output (send a $JSHOW command). • Verify the baud rate settings of Vega 28 and remote device match. • Potentially, the volume of data requested to be output by the Vega 28 could be higher than the current baud rate supports. Try using 19200 or higher for the baud rate for all devices.
No GPS Lock	• Check integrity of antenna cable • Verify antenna's view of the sky • Verify the lock status and signal to noise ratio of GPS satellites (this can often be done on the receiving device or by using SLXMon)
No SBAS	• Check antenna cable integrity • Verify antenna's view of the sky, especially towards the SBAS satellites, south in the northern hemisphere. • Verify the bit error rate and lock status of SBAS satellites (this can often be done on the receiving device or by using SLXMon - monitor BER value). • SBAS corrections are only applied to the position, not to the heading. If SBAS lock is lost, you will still have the same heading accuracy, but your position accuracy may be degraded.

Continued on next page

Vega 28 troubleshooting, continued

Table A-1: Vega 28 Troubleshooting (continued)

Issue	Possible Solution
No DGPS position in external RTCM mode	• Verify the baud rate of the RTCM input port matches the baud rate of the external source. • Verify the pinout between the RTCM source and the RTCM input port (the "ground" pin and pin-out must be connected, and from the "transmit" from the source must connect to the "receiver" of the RTCM input port).
Non-DGPS output	• Verify Vega 28 SBAS and lock status (or external source is locked). • Confirm baud rates match an external source correctly • Issue a $JDIFF command and see if the expected differential mode is in fact the current mode. • Differential corrections are only applied to the position, not to the heading. If differential lock is lost, you will still have the same heading accuracy, but your position accuracy may be degraded.

Continued on next page

Vega 28 troubleshooting, continued

Table A-1: Vega 28 Troubleshooting (continued)

Issue	Possible Solution
No heading or incorrect heading values	• Ensure the antennas are connected to the proper ports: J1000 and J2000 are for the primary and secondary antennas. • Heading is from primary to secondary antenna, so the secondary antenna should be toward the bow and primary toward the stern. • Check the measurement of the antenna separation. • The Measured (MSEP) and Calculated (CSEP) values are in meters and should agree to within 1 cm. CSEP continuously changes, so average this reading over several minutes to obtain an approximate value. • Check CSEP value is fairly constant without varying more than 1 cm. Larger variations may indicate a high multipath environment and require moving the antenna locations. • Reduce antenna separation - Hemisphere GNSS recommends the separation between the antennas remain below 5 m for accurate and timely heading reading output • $JATT,SEARCH command forces the Vega 28 to acquire a new heading solution. This should also be used after entering a new MSEP value • $JATT, GYROAID, YES Enable gyro aid as this will give heading for up to 3 minutes in times of GNSS signal loss • Enable tilt aid to reduce heading search times • Check the applications receiver using the $JAPP query; the receiver should answer $JAPP, MFAATT, 1,2 • Monitor the number of satellites and SNR values for both antennas within SLXMON; at least 3 satellites should have SNR values > 20 • Antenna connectors should both be facing the same direction

Appendix B: Technical Specifications

Introduction

Appendix B provides the Vega 28 GNSS board technical specifications.

Contents

Vega 28 Technical Specifications

Vega 28 specifications

Tables B1-B6 provide the technical specifications for the Vega 28 GNSS board.

Vega 28 receiver specifications

Table B-1: Vega 28 receiver specifications

Item	Specification
Receiver type	Multi-Frequency GPS, GLONASS, BeiDou, Galileo, QZSS, 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 IRNSS L5 Atlas
Channels	1,100+
GPS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	10 Hz standard, 1 Hz or 20 Hz optional (with activation)
Timing (1 PPS) Accuracy	20 ns
Rate of Turn	100°/s maximum
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)
Heading Fix	10 s typical (Hot Start)
Antenna Input Impedance	50 Ω
Maximum Speed	1,850 mph (999 kts)
Maximum Altitude	18,288 m (60,000 ft)

Continued on next page

Vega 28 receiver specifications, continued

Table B-1: Vega 28 receiver specifications (continued)

Item	Specification		
Horizontal accuracy		**RMS (67%)**	**2DMRS (95%)**
	RTK[1]	8 mm + 1 ppm	15 mm + 2 ppm
	SBAS[1]	0.3 m	0.6 m
	Autonomous, no SA[1]	1.2 m	2.5 m
	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
Heading (RMS)	8 mm + 1 ppm 15 mm + 2 ppm 0.16° rms @ 0.5 m antenna separation 0.08° rms @ 1.0 m antenna separation 0.04° rms @ 2.0 m antenna separation 0.02° rms @ 5.0 m antenna separation		
Pitch/roll (RMS)	0.5°		
Heave (RMS)[1]	30 cm rms (DGNSS) , 5 cm rms (RTK)		

Continued on next page

Vega 28 Technical Specifications, Continued

Vega 28 communication specifications

Table B-2: Vega 28 communication specifications

Item	Specification
Ports	3 x 3.3V CMOS UART 1 x USB Host/Device 1 x Ethernet 10/100Mbps 2 x CAN (NMEA2000, ISO 11783)
Interface Level	3.3V CMOS
UART Baud Rates	4800 – 460,800
Correction I/O Protocol	Hemisphere GNSS proprietary ROX format, RTCM v2.3, RTCM v3.2, CMR[5], CMR+[5]
Data I/O Protocol	NMEA 0183, Crescent binary
Timing Output	1 PPS, CMOS, active high, rising edge sync, 10 kΩ, 10 pF load
Event Marker Input	CMOS, active low, falling edge sync, 10 kΩ, 10 pF load

Vega 28 power specifications

Table B-3: Vega 28 power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5%
Power consumption	< 2.5 W all signals + L-band
Current consumption	757 mA all signals + L-band
Antenna voltage input	5 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 35 dB

Continued on next page

Vega 28 Technical Specifications, Continued

Vega 28 environmental specifications

Table B-4: Vega 28 environmental specifications

Item	Specification
Operating temperature	-40°C to +85°C (-40°F to +185°F)
Storage temperature	-40°C to +85°C (-40°F to +185°F)
Humidity	95% non-condensing (when in an enclosure)
Mechanical Shock	EP455 Section 5.14.1 Operational (when mounted in an enclosure with screw mounting holes utilized)
Vibration	EP455 Section 5.15.1 Random
EMC	CE (IEC 60945 Emissions and Immunity) FCC Part 15, Subpart B CISPR 22

Vega 28 mechanical specifications

Table B-5: Vega 28 mechanical specifications

Item	Specification
Dimensions	71 L x 45 W x 10 H (mm) 2.8 L x 1.8 W x 0.4 (in)
Weight	24 g (0.85 oz)
Status indication (LED)	Power, Primary and Secondary GNSS lock, Differential lock, DGNSS position, Heading
Power/Data connector	2 x 14-pin male header
Antenna connector	MMCX, female, straight

Continued on next page

Vega 28 Technical Specifications, Continued

Vega 28 L-band receiver specifications

Table B-7: Vega 28 L-band receiver specifications

Item	Specification
Receiver Type	Single Channel
Channels	1525 to 1560 MHz
Sensitivity	-130 dBm
Channel Spacing	5.0 kHz
Satellite Selection	Manual and Automatic
Reacquisition Time	15 seconds (typical)

Vega 28 aiding devices

Table B-8: Vega 28 aiding devices

Device	Description
Gyro	Provides smooth and fast heading reacquisition. During loss of GNSS signals heading stability is degraded by < 1° per minute for up to 3 minutes.
Tilt Sensor	Provide pitch, roll data and assist in fast start-up and reacquisition of heading solution.

[1] Depends on multi-path environment, number of satellites in view, satellite geometry, and ionospheric activity
[2] Depends on multipath environment, number of satellites in view, SBAS coverage, satellite geometry, and ionospheric activity
[3]Hemisphere GNSS proprietary
[4]With future firmware upgrade and activation
[5]CMR and CMR+ do not cover proprietary messages outside of the typical standard

Appendix C: Frequently Asked Questions

FAQ

Contents

Appendix C: Frequently Asked Questions (FAQ)

Integration

The following is a list of common questions and solutions when integrating the Vega 28 OEM board.

Question	Solution
Do I need to use the 1 PPS and event marker?	No, these are not necessary for Vega 28 operation.
What should I do with the 1 PPS signal if I do not want to use it?	We recommend you tie to ground through a 1k resistor.
What should I do with the manual mark input if I am not going to use it?	Do not connect the pin because this signal is active low.
Do I need to use the lock indicators?	No, these are present for applications where it is desirable to have an LED visible to the user. These signals need to be transistor-buffered, as these lines can only offer 1 mA. Depending on the product and the application, LEDs can be very useful to the end user. These signals are active low.
Do I need to use a shield-can for the Vega 28?	Not necessarily, but you may need to if there are RF interference issues, such as if the Vega 28 interferes with other devices. A shield-can is a good start in terms of investigating the benefit. If you are designing a smart antenna system, a shield-can is likely needed. Hemisphere GNSS recommends you always conduct an RF pre- scan when integrating OEM boards.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Integration, continued

Question	Solution
If my company wishes to integrate this product, what type of engineering resources will I need to do this successfully?	Hemisphere GNSS recommends you have sufficient engineering resources with the appropriate skills in and understanding of the following: • Electronic design (including power supplies and level translation) • RF implications of working with GPS equipment • Circuit design and layout • Mechanical design and layout As an integrator, you are responsible for ensuring the correct resources are in place to technically complete integration. Hemisphere GNSS makes every effort to provide adequate support, but you should expect to have reasonable expertise to use this Integrator's Guide.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Support and repair

Question	Solution
How do I solve a problem I cannot isolate?	Hemisphere GNSS recommends contacting the dealer first. With their experience with this product, and other products from Hemisphere GNSS, they should be able to help isolate a problem. If the issue is beyond the capability or experience of the dealer. Hemisphere GNSS Technical Support is available from 8:00 AM to 5:00 PM Mountain Standard Time, Monday through Friday. See "Technical Support" for Technical Support contact information.
What if I cannot resolve a problem after trying to diagnose it myself?	Contact your dealer to see if they have any information which may help to solve the problem. They may be able to provide some in-person assistance. If this is not viable, or does not solve the problem, Hemisphere GNSS Technical Support is available from 8:00 AM to 5:00 PM Mountain Standard Time, Monday through Friday. See "Technical Support" for Technical Support contact information.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Support and repair, continued

Question	Solution
Can I contact Hemisphere GNSS Technical Support directly regarding technical problems?	Yes, however, Hemisphere GNSS recommends speaking to the dealer first as they are the local support. They may be able to solve the problem quickly, due to proximity and experience with HGNSS equipment.

Continued on next page

Power, communication, and configuration

Question	Solution
My Vega 28 system does not appear to be communicating.	This could be one of a few issues: • Examine the Vega 28 cables and connectors for signs of damage or offset. • Ensure the Vega 28 system is properly powered with the correct voltage. • Ensure there is a good connection to the power supply since it is required to terminate the power input with the connector. • Check the documentation of the receiving device, if not a PC, to ensure the transmit line from the Vega 28 is connected to the receive line of the other device. Also, ensure the signal grounds are connected. • If the Vega 28 is connected to a custom or special device, ensure the serial connection to it does not have any incompatible signal lines present which prevent proper communication. • Make sure the baud rate of the Vega 28 matches the other device. The other device must also support an 8-data bit, 1 stop bit, no parity port configuration (8-N-1). Some devices support different settings, and may be user configurable. Ensure the settings match. • Consult the troubleshooting section of the other device's documentation to determine if there may be a problem with the equipment.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Power, communication, and configuration, continued

Question	Solution
Am I able to configure two serial ports with different baud rates?	Yes, all the ports are independent. For example, you may set one port to 4800 and another port to 19200.
Am I able to have the Vega 28 output different NMEA messages through multiple ports?	Yes, different NMEA messages can be sent to the serial ports you choose. These NMEA messages may also be at different update rates. A high enough baud rate is needed to transmit all the data; otherwise, some data may not be transmitted.
How can I determine the current configuration of the Vega 28?	The $JSHOW command will request the configuration information from the Vega 28. The response will be similar to: $>JSHOW,BAUD,19200 $>JSHOW,BIN,1,5.0 $>JSHOW,BAUD,4800,OTHER $>JSHOW,ASC,GPGGA,1.0,OTHER $>JSHOW,ASC,GPVTG,1.0,OTHER $>JSHOW,ASC,GPGSA,1.0,OTHER
How can I be sure the configuration will be saved for the subsequent power cycle?	Query the receiver to make sure the current configuration is correct by issuing a $JSHOW command. If not, make the necessary changes and reissue the $JSHOW command. Once the current configuration is acceptable, issue a $JSAVE command and wait for the receiver to indicate the save is complete. Do not power off the receiver until the “save complete” message appears.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Power, communication, and configuration, continued

Question	Solution
How do I change the baud rate of a port from that port?	Connect at the current baud rate of the Vega 28 port and then issue a $JBAUD command to change the port baud rate to the desired rate. Now change the baud rate in your application to the desired rate.
What is the best software tool to use to communicate with the Vega 28 and configure it?	Hemisphere GNSS uses three different software applications: • SLXMon - Available at www.hgnss.com. This application is a very useful tool for graphically viewing tracking performance and position accuracy, and for recording data. It can also configure message output and port settings. SLXMon runs on Windows 95 or higher. • PocketMax - Available at www.hgnss.com. Similar to SLXMon, you can use this application to graphically view tracking performance and position accuracy, record data, and configure message output and port settings. PocketMax runs on multiple Windows platforms using the Windows .NET framework.

Continued on next page

GNSS reception and performance

Question	Solution
How do I know what the Vega 28 is doing?	The Vega 28 supports standard NMEA data messages. The $GPGSV and Bin99 data messages contain satellite tracking and SNR information. If available, the contained in the $GPGGA message. Additionally, the Vega 28 has surface-mounted status LEDs indicating receiver status.
Do I have to be careful when using the Vega 28 to ensure it tracks properly?	For best performance, the Vega 28 antenna must have a clear view of the sky for satellite tracking. The Vega 28 can tolerate a certain amount of signal blockage because redundant satellites are often available. Only four satellites are required for a position; however, the more satellites are used, the greater the positioning accuracy.
How do I know if the Vega 28 has acquired an SBAS signal?	The Vega 28 outputs the $RD1 message which contains the SBAS Bit Error Rate (BER) for each SBAS channel. The BER value describes the rate of errors received from SBAS. Ideally, this should be zero. However, the Vega 28 performs well up to 150 BER. The SLXMon and PocketMax utilities provide this information without needing to use NMEA commands.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

SBAS reception and performance

Question	Solution
How do I know if the Vega 28 is offering a differentially-corrected or RTK- corrected position?	The Vega 28 outputs the $GPGGA message as the main positioning data message. This message contains a quality fix value which describes the GPS status. If this value is 2, the position is differentially corrected; if this value is 4 or 5, the position is RTK (or Atlas)-corrected. The SLXMon and PocketMax utilities provide this information without needing to use NMEA commands.
How do I select an SBAS satellite?	By default, the Vega 28 will automatically attempt to track the appropriate SBAS satellites. If multiple satellites are available, the one with the lowest BER value is selected to be used to decode the corrections. You can manually select which SBAS satellites to track (not recommended).
Do I need a dual frequency antenna for SBAS?	Hemisphere GNSS recommends using a dual frequency antenna with the Vega 28. While some receiver function is possible with an L1-only antenna, full receiver performance will only be realized with a dual frequency antenna.

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External corrections

Question	Solution
My Vega 28 system does not appear to be using DGPS or RTK corrections from an external correction source. What could be the problem?	This could be due to several factors. To isolate the issue: • Make sure DGPS corrections are RTCM v2.3 protocol. • Make sure RTK corrections are either ROX, RTCM v3, CMR, or CMR+ protocol. • Verify the baud rates used by the Vega 28 match the external correction source. • The external correction should be using an 8-data bit, no parity, 1 stop bit (8-N-1) serial port configuration. • Inspect the cable connection to ensure there is no damage. • Check the pin-out information for the cables to ensure the transmit line of the external correction source is connected to the receive line of the Vega 28's serial port and the signal grounds are connected. • Make sure the Vega 28 has been set to receive external corrections by issuing the $JDIFF command. Refer to the Hemisphere GNSS Technical Reference Manual.

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Installation

Question	Solution
How will the antenna selection and mounting affect Vega 28 performance?	For best results select a multipath-resistant antenna. Ensure the antenna tracks all the available signals for the receiver. Mount the antenna: • With the best possible view of the sky • In a location with the lowest possible multipath • Using a magnetic mount for the antenna

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Installation, continued

Question	Solution
I could not install my antennas at the same height. How do I calibrate for the height offset?	You may enter a non-level bias calculation which adjusts the pitch/roll output to calibrate the measurement if the antenna array is not installed on a horizontal plane. To calibrate the pitch/roll reading, send the following command: **$JATT,PBIAS,x<CR><LF>** where x is a bias (in degrees) which will be added to the pitch/roll measurement. The acceptable pitch bias range is -15.0º to 15.0º (default is 0.0º). To determine the current pitch compensation angle, send the following command: **$JATT,PBIAS<CR><LF>** The pitch/roll bias is added after the negation of the pitch/roll measurement (if so invoked with the **$JATT,NEGTILT** command).

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