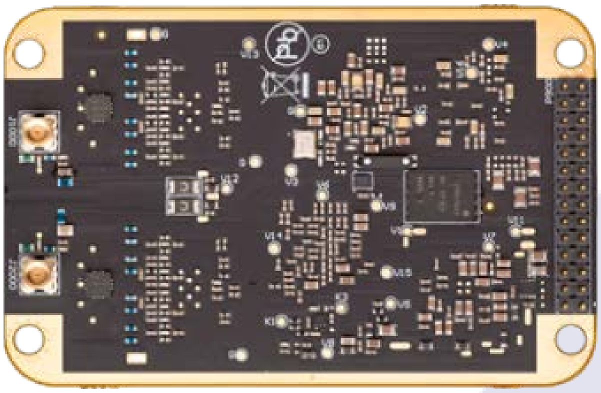

875-0428-10

Vega™ 28/34/60 GNSS OEM Boards

Integrator Guide

Revision: A5

February 1, 2022

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

Australia Patents	
2002244539	2002325645
2004320401	

Continued on next page

Device Compliance, License and Patents, Continued

Notice to Customers	Contact your local dealer for technical assistance. To find the authorized dealer near you: Hemisphere GNSS, Inc 8515 East Anderson Drive Scottsdale, AZ 85255 USA Phone: (480) 348-6380 Fax: (480) 270-5070 PRECISION@HGNSS.COM WWW.HGNSS.COM
Technical Support	If you need to contact Hemisphere GNSS Technical Support: Hemisphere GNSS, Inc. 8515 East Anderson Drive Scottsdale, AZ 85255 USA Phone: (480) 348-6380 Fax: (480) 270-5070 SUPPORT.HGNSS.COM
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Vega Terms & Definitions

Introduction

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

Vega terms & definitions, continued

Term	Definition
Activation	Activation refers to a feature added through a one-time purchase. For features that require recurring fees, see **Subscription**.
ASCII	American Standard Code for Information Interchange
Atlas	Atlas is a subscription-based service provided by Hemisphere GNSS.
BeiDou	BeiDou is a global navigation satellite system deployed and maintained by China.
BIN message	Binary message
CAN	Controller Area Network
COG	Course Over Ground – The cardinal direction of travel of the primary antenna. This differs from heading, which is the direction of the vector created from the primary to secondary antenna.
CSEP	The distance in meters that the receiver has calculated between the primary and secondary antenna. This value should always be accurate to within 2 cm.
dB	Decibel. The unit of measurement used to express signal-to-noise ratio (SNR).
DGNSS	Differential GNSS refers to a receiver using differential corrections.
ESN	Electronic Serial Number
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.

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Vega Terms & Definitions, Continued

Vega terms & definitions, continued

Term	Definition
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, Galileo, BeiDou, NavIC (IRNSS), and QZSS.
GPIO	General Purpose Input/Output
GPS	Global Positioning System (GPS) is a global navigation satellite system deployed and maintained by the United States.
I/O	Input/Output
LED	Light Emitting Diode
MSEP	This is the distance in meters between the primary and secondary antenna. This differs from CSEP in that the user measures this value and inputs it into the receiver.
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.
NavIC (IRNSS)	Navigation with Indian Constellation and Indian Regional Navigational Satellite System (IRNSS) is a regional navigation satellite system deployed and maintained by India.
NMEA	National Marine Electronics Association (NMEA) is a marine electronics organization that sets standards for communication between marine electronics.
NTRIP	Networked Transport of RTCM via Internet Protocol – a protocol for transmitting differential GNSS or RTK over the internet.
PCB	Printed Circuit Board
PPS	Pulse-per-second is a pulse output by the receiver precisely aligned to the GNSS time. Default output is every one second.
QZSS	Quasi-Zenith Satellite System (QZSS) is a regional satellite navigation system deployed and maintained by Japan.

Continued on next page

Vega Terms & Definitions, Continued

Vega terms & definitions, continued

Term	Definition
RF	Radio Frequency
RMS	Root mean square
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 GNSS differential method that provides better accuracy compared to other differential corrections.
SBAS	Satellite Based Augmentation System (SBAS) is a system that provides differential corrections over satellite throughout a wide area or region.
SNR	Signal-to-Noise ratio
Subnet Mask	The technique used by the TCP/IP communications protocol that identifies which network segment a packet belongs to. The subnet mask is a binary pattern, and the default mask found in small local networks indicates that all the machines are in the same network.
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.
TVS	Transient Voltage Suppressors
UART	Universal Asynchronous Receiver/Transmitter (UART) is the electronic circuit that makes up the serial port.
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 GNSS OEM boards with your heading and positioning products. You can download this manual from the Hemisphere GNSS website at https://www.hemispheregnss.com.

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

Contents

Product Overview

Vega product overview

The Vega GNSS OEM boards are some of Hemisphere's most advanced GNSS heading and positioning boards. The Vega boards use dual antenna ports to create a series of functions, including fast, high-accuracy heading over short baselines, RTK positioning, onboard Atlas® L-band, RTK-enabled heave, low-power consumption, and precise timing.

With the Vega OEM boards, positioning is scalable and field upgradeable with all Hemisphere software and service options. Use centimeter-level accuracy in 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 are available via the Hemisphere Atlas correction service. Figure 1-1 shows the Vega 28 GNSS OEM board. The Vega 28 offers ethernet and has 3 serial ports and 2 CAN ports.

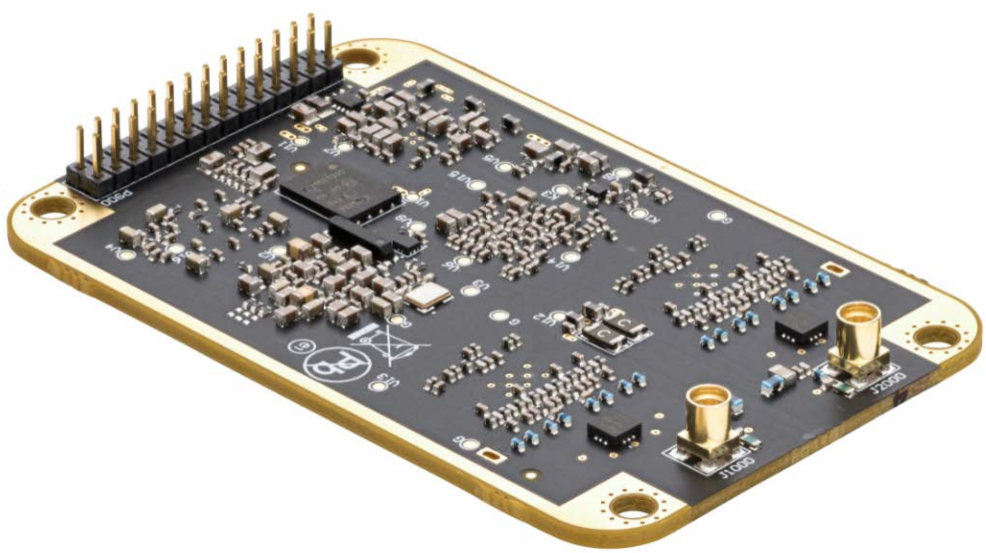

Figure 1-1: Vega 28 GNSS OEM Board

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Product Overview, Continued

Vega product overview, continued

Figure 1-2 shows the Vega 34 GNSS OEM board. The Vega 34 board has 4 serial ports and 2 CAN ports (ethernet not included).

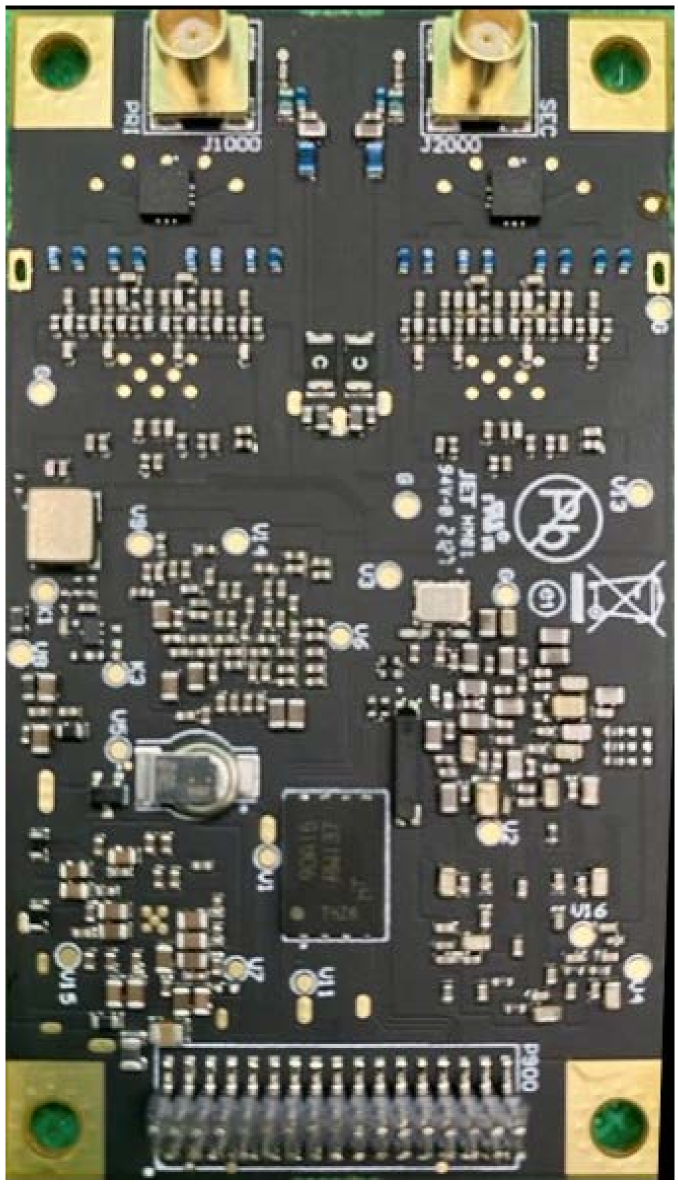

Figure 1-2: Vega 34 GNSS OEM Board

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Vega product overview, continued

Figure 1-3 shows the Vega 60 GNSS OEM board. The Vega 60 board offers ethernet and has 5 serial and 2 CAN ports.

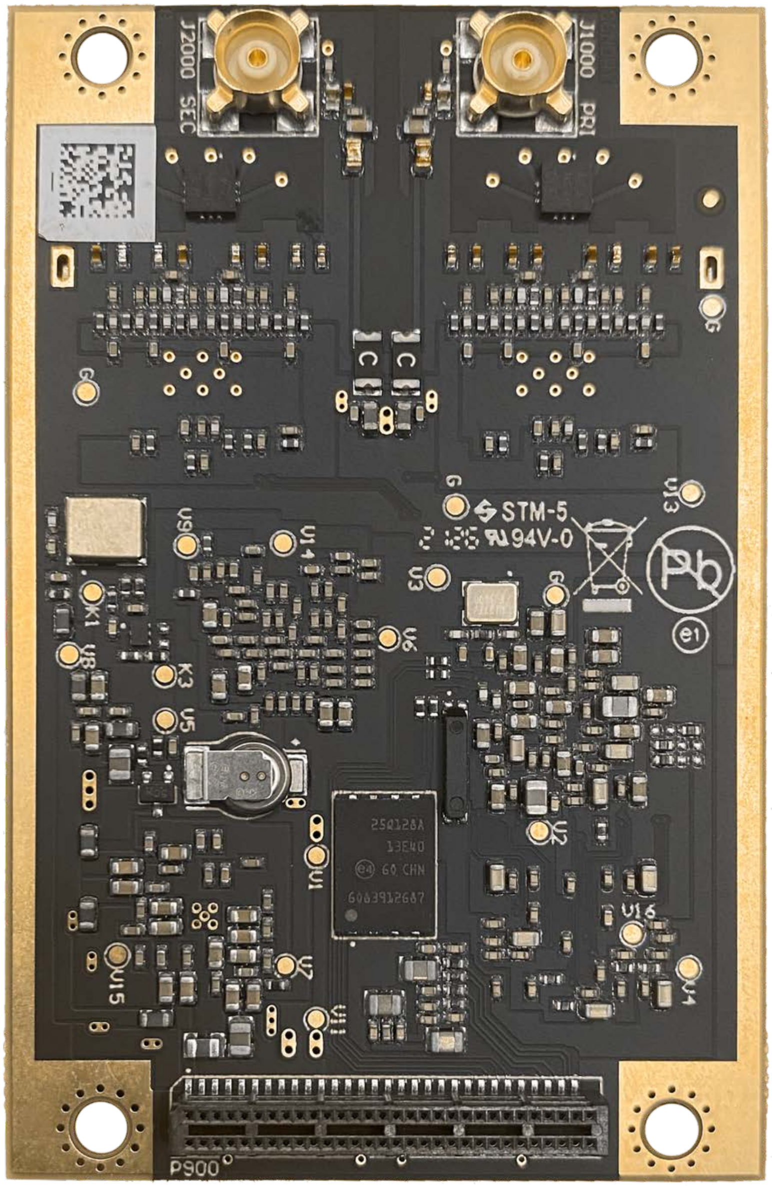

Figure 1-3: Vega 60 GNSS OEM Board

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Key Features

Vega OEM board key features

The Vega OEM GNSS board series features low power consumption and simple on-board firmware with integrated L-band. Athena enhances the reliable positioning performance of the Vega series™ using RTK, Atlas corrections, aRTK™, SureFix, and TRACER™ technology.

The Vega 28 and the Vega 34 are offered in Hemisphere common form factor (71 L x 45 W x 10 H mm). The dual antenna Vega 28 provides accurate heading with an on-board gyro and a tilt sensor that provides heading during short GNSS outages.

The Vega 60 OEM GNSS board is offered in the industry common form factor (71 L x 46 W x 10 H mm).

Vega OEM GNSS boards are an ideal solution for integrators offering scalability and expandability from L1 GPS with SBAS to multi-frequency GPS, GLONASS, BeiDou, Galileo, NavIC (IRNSS), and QZSS (with RTK capability).

Continued on next page

Key Features, Continued

Vega OEM board key features, continued

Key features of the Vega OEM GMSS boards include:

- Extremely accurate heading with long baselines
- Multi-frequency position, dual-frequency heading supporting GPS, GLONASS, BeiDou, Galileo, QZSS, NavIC (IRNSS), 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 Cygnus™ interference rejection
- New multi-axis gyro and tilt sensor for reliable coverage during short GNSS outages

For complete specifications of the Vega OEM boards, see Appendix B Technical Specifications.

Continued on next page

What's Included in Your Kit

Vega kit contents

The Vega board series is available in two configurations:

1. Vega GNSS OEM board only -designed for integrators who are familiar with Hemisphere board integration
   - Vega 28 (P/N 725-1582-11)
   - Vega 34 (P/N 725-1604-10)
   - Vega 60 (P/N 726-1168-10)
2. Vega series OEM board and the Universal Development Kit ST- designed to provide integrators with a platform to instantly begin working with their Vega OEM board, providing smooth access to all hardware features in a convenient easy-open enclosure.

For more information on requesting the Vega series with the Universal Development Kit ST, go to the HGNSS OEM Products page, or contact your local dealer.

Firmware

Firmware	The software that runs the Vega boards is often referred to as firmware since it operates at a low level. The Vega series currently ships with the Athena-based firmware. Refer to the HGNSS TRM for information on querying and communicating with the Vega boards. You can upgrade the firmware when in the field through any serial port as new versions become available.

Using PocketMax to Communicate with Vega Boards

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 a Vega board via the COM port and open PocketMax.

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

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

PocketMax is available for download from the Hemisphere GNSS website (HTTPS://WWW.HEMISPHEREGNSS.COM).

Athena RTK and Atlas L-band

Athena RTK

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

Athena RTK can be added to the Vega series 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 to the Vega series 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 -** 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

aRTK Position Aiding

aRTK position aiding

aRTK is an innovative feature available in Hemisphere's Vega series that 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 boards receive 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 OEM Boards

Overview

Introduction

This chapter provides instructions on how to integrate your Vega OEM boards with your positioning product.

Contents

Vega Board Integration

Introduction

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

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

Vega integration requirements

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

- Regulated power supply input: (3.3 VDC ± 3%) and 850 mA continuous maximum.
- 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 @ 100 mA total for amplified antennas.

Message interface

You can output standard NMEA 0183 messages and proprietary Hemisphere ASCII and binary messages over serial, USB, and Ethernet. For more information on NMEA 0183 commands and messages and binary messages, refer to the HGNSS TRM.

You can output NMEA 2000 and some Hemisphere proprietary messages over CAN. Refer to the Hemisphere GNSS NMEA 2000 manual.

Mechanical Layout Vega Boards

Overview

This section contains the mechanical layout drawings for the Vega 28, the Vega 34, and the Vega 60 GNSS OEM boards.

Vega 28 mechanical layout

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

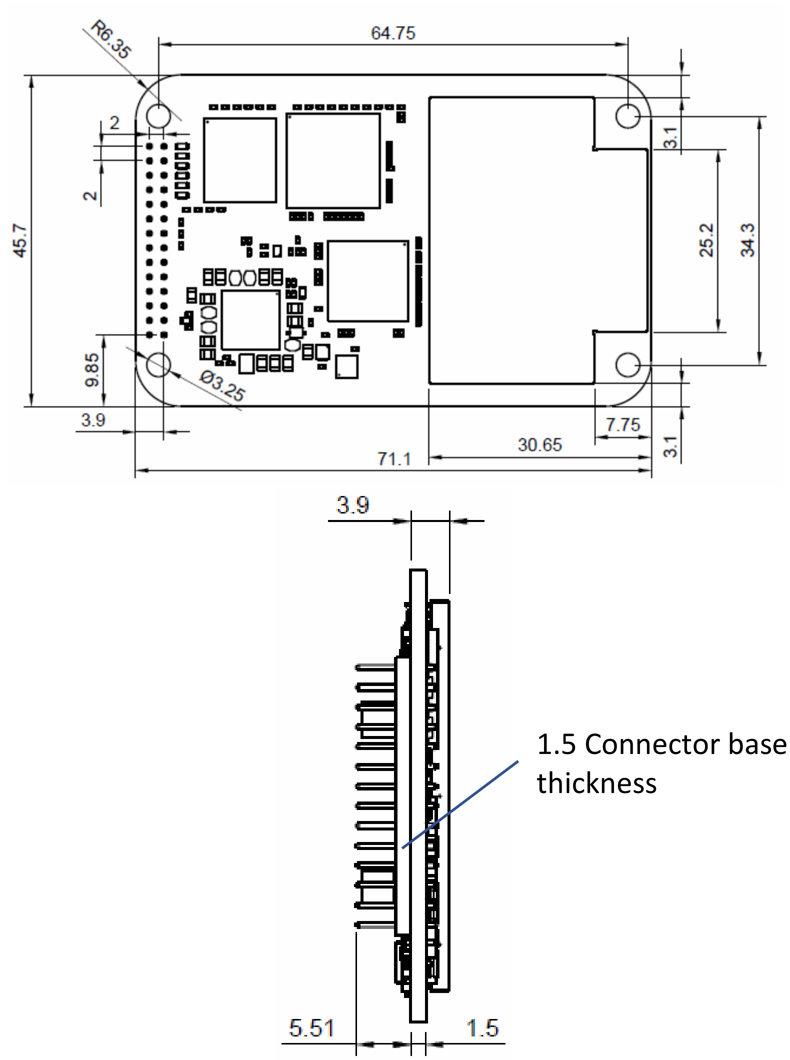

Figure 2-1: Vega 28 mechanical layout

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Mechanical Layout Vega Boards, Continued

Vega 34 mechanical layout

Figure 2-2 shows the mechanical layout for the Vega 34 OEM board. Dimensions are in millimeters for all layouts.

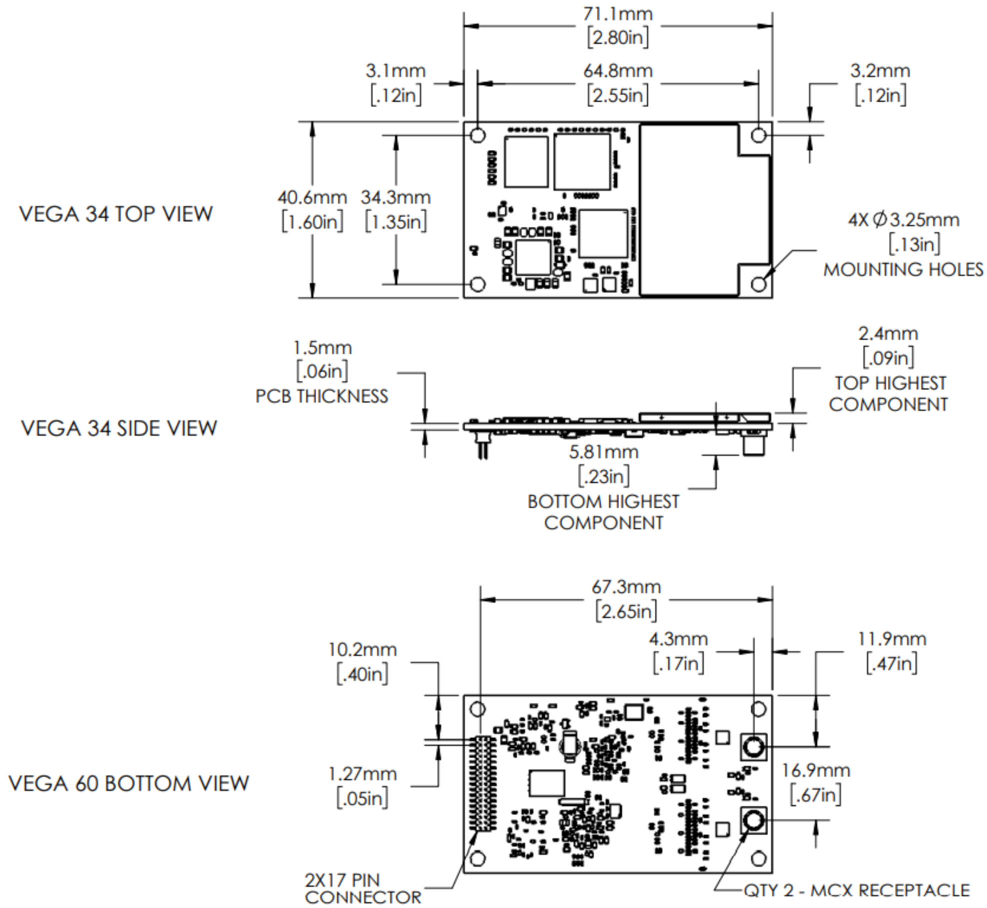

Figure 2-2: Vega 34 mechanical layout

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Mechanical Layout Vega Boards, Continued

Vega 60 mechanical layout

Figure 2-3 shows the mechanical layout for the Vega 60 OEM board. Dimensions are in millimeters for all layouts.

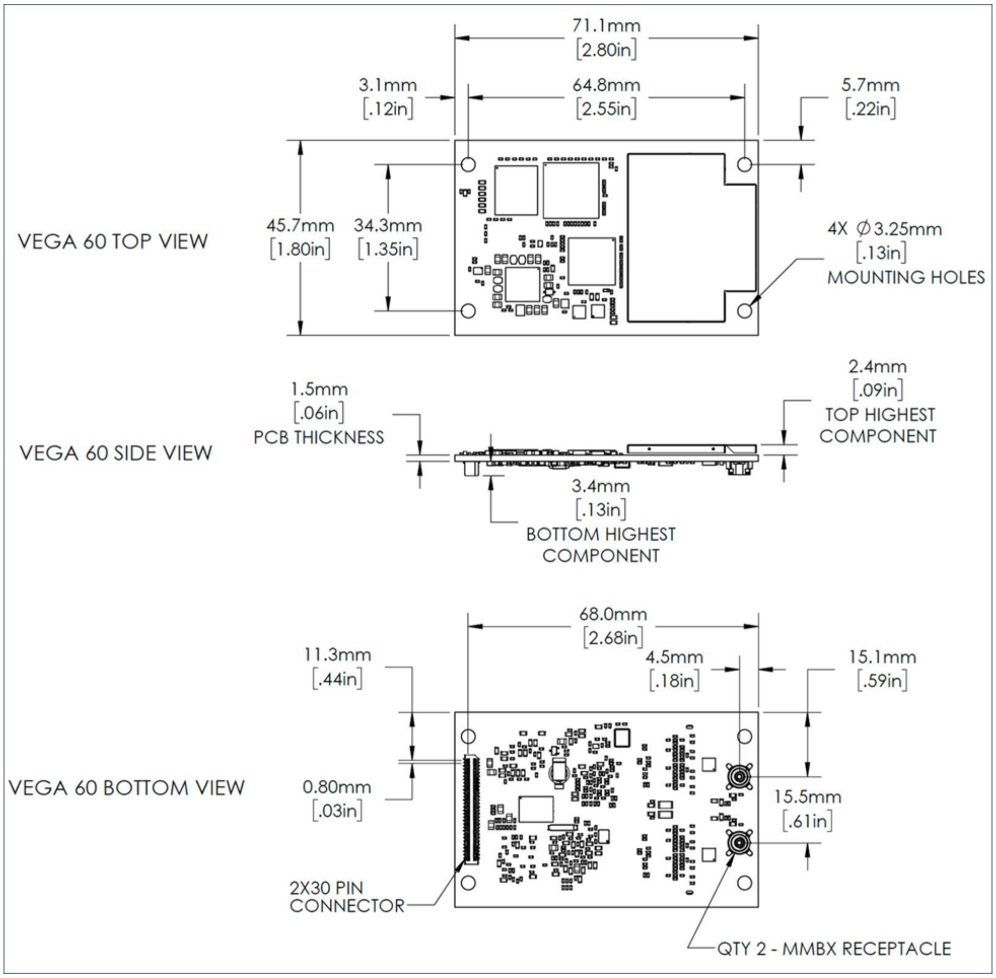

Figure 2-3: Vega 60 mechanical layout

Connectors

Overview

This section contains the connectors needed for the Vega board series.

Vega 28 connectors

Table 2-1 lists the 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

To reduce fatigue of the MMCX connectors on the Vega 28, please use the following recommendations:

- When connecting the Vega 28 to another board, a cable should be used. The recommended cable is either the RG-316 or the RG-174, which provide a more flexible sheathing, and result in reduced strain on the MMCX connectors.
- Use caution when connecting and/or disconnecting the Vega 28 board within an assembly. Vega 28 MMCX connectors are intended for a one-time insertion. Multiple connections to the MMCX connectors can result in fatigue at the solder joints and could cause detachment from the Vega 28 board.
- When disconnecting an RF cable from the Vega 28, hold the board and pull the mating MMCX cable straight up to protect the integrity of the MMCX connectors.
- Significant force is required to disconnect the MMCX cable.

Continued on next page

Connectors, Continued

Vega 34 connectors

Table 2-2 lists the Vega 34 connectors and mating connectors. You can use different compatible connectors; however, the requirements may be different. The antenna input impedance is 50 Ω.

Table 2-2: Vega 34 connectors

GNSS Board and Connector Type		GNSS Connector	Mating Connector
Vega 34	RF	MCX, female straight jack Emerson (Johnson) 133-3711-202	MCX, male straight plug Würth Elektronik 60614003121504, requires 5/16-inch board gap
	Power/ data	34-pin (17x2) male header, 0.05 inch (1.27 mm) pitch, 0.150" posts Samtec FTSH-117-04-L-DV	17x2 female SMT header socket, 0.05-inch (1.27 mm) pitch Samtec FLE-117-01-G-DV, requires 5/16-inch board gap

Continued on next page

Connectors, Continued

Vega 60 connectors

Table 2-3 lists the Vega 60 connectors and mating connectors. You can use different compatible connectors; however, the requirements may be different. The antenna input impedance is 50 Ω.

Table 2-3: Vega 60 connectors

GNSS Board and Connector Type		GNSS Connector	Mating Connector
Vega 60	RF	MMBX, Jack Receptacle Radiall R223424000	MMBX Plug Receptacle (SMT) Radiall R223434000
	Power/ data	2 x 30 Header, 0.8mm pitch Samtec, Inc SEMS-130-02-03.0-H-D-K-TR	2 x 30 Socket, 0.8mm pitch Samtec, Inc TEMS-130-02-03.0-H-D-K-TR (Requires 6mm board gap, 1/4-inch board gap is also acceptable.)

Mounting Options

Overview

When mounting the Vega series, use metal standoffs, bolts, nuts, or screws. Plastic or nylon standoffs are not appropriate for vibration concerns. PCB snap-in place standoffs should be avoided. The pressure and snapping action put undue stress on the board and compromises solder integrity. In addition, metal standoffs help heat dissipate off the GNSS board.

There are two options for mounting the Vega OEM boards:

1. Direct Electrical Connection method (Vega 28 / 34 / 60)
2. Indirect Electrical Connection (cable) method (Vega 28 / 34 only)

Direct electrical connection

Place the RF connectors, the header connector, and the mounting holes on the carrier board, and then mount the Vega 34 / 60 OEM board on the standoffs and RF and header connectors. Vega 28 uses MMCX connectors which are not recommended for board-to-board connections, and therefore RF cables are recommended for installation.

> **Note:** Use care when routing RF traces. Trace impedance shall be 50 ohms. Ensure the trace has no breaks in the ground plane beneath it and that the RF trace does not cross or run adjacent to power or data traces.

Be aware of the relationship between the gap between boards. The power-data connector, the RF connector and the standoffs all need to function properly at the selected board gap spacing.

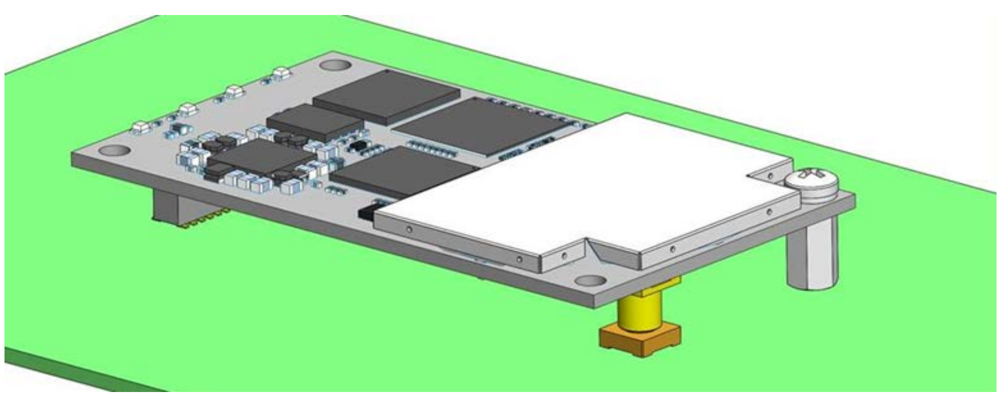

Figure 2-4: Connector selections

Continued on next page

Mounting Options, Continued

Direct electrical connection, continued

Use metal standoffs, bolts, nuts, or screws. Plastic or nylon standoffs are not appropriate for vibration concerns. Avoid PCB snap-in place standoffs. The pressure and snapping action add undue stress on the board and compromises solder integrity. Metal standoffs help heat dissipate from the GNSS board*.* The Vega OEM boards use multiple standoff heights. Refer to the table below for a listing of the Vega board standoff heights.

Vega Board	Standoff Height
Vega 28	5/16” or 13/32”
Vega 34	5/16”
Vega 60	¼” or 6 mm

There are two common methods to create a hybrid direct electrical connection on Vega 28 / 34, using a combination of headers and RF cables:

1. Use right-angle RF cable connectors. You may require a taller header than the part numbers suggested in this guide. This will provide clearance to for a right-angle cable-mount connectors and eliminate the need for the carrier board to handle the RF signals.
2. Use the standard headers and create a PCB cutout for the antenna connectors.

Note: This method is not recommended for Vega 60, as the MMBX RF connectors are intended for board-to-board connections. Vega 60 integrators using RF cables may need to take additional precautions to ensure a robust RF connection.

Note: See Table 2-1 through Table 2-3 for Vega connector information.

Indirect electrical connection (cable) method

The second method is to mount the Vega 28 / 34 board mechanically, so you can connect a ribbon power/data cable to the Vega board. This requires cable assemblies and there is a reliability factor present with cable assemblies in addition to increased expense. Vega 60 is not intended to be mounted with RF cables due to the MMBX connector design.

Header Layouts and Pinouts

Overview

This section contains the header layouts and pinouts for the Vega 28, Vega 34, and Vega 60 GNSS OEM boards.

Vega 28 Header layouts and pinouts

The Vega 28 uses a dual-row header connector to interface with power, communications, and other signals. The mounting holes of the Vega 28 have a standard inner diameter of 3.50 mm (0.138 in).

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 (see Figure 2-6). The pins are then sequentially numbered per row from top to bottom.

Figure 2-5 shows the Vega 28 pin header layout.

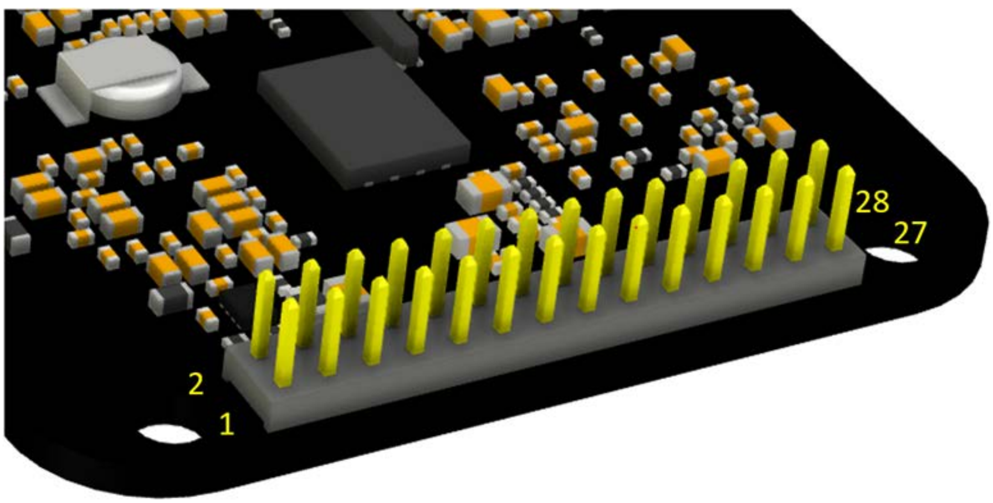

Figure 2-5: Vega 28 pin layout

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Header Layouts and Pin-outs, Continued

Vega 28 Header layouts and pinouts, continued

The Vega 28 board has a 28-pin header. Table 2-4 provides the 28-pin header pin-out signals and descriptions.

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 2-4: Vega 28 28-Pin header pin-out

Pin	Signal Name	Signal Type	Signal Direction	Description
1	USB ID	3.3 V CMOS	Input	USB ID (N/C for device mode, pull low for host mode)
2	USB VBUS	Power	-	USB bus voltage
3	ETH LINK LED	3.3 V CMOS	Output	Ethernet LED
4	ETH BIAS	Ethernet	-	Ethernet Bias
5	N/C			
6	3.3V	Power	-	Receiver power supply, 3.3 V
7	USB D- -	I/O	Input / Output	USB device or host data -
8	USB D+ (default) / PCRX Port C	I/O	Input / Output	Dual use pin: Default: USB device or host data + PCRX Port C: Port C Receive

Continued on next page

Header Layouts and Pinouts, Continued

Vega 28 Header layouts and pinouts, continued

Table 2-4: Vega 28 28-Pin header pin-out (continued)

Pin	Signal Name	Signal Type	Signal Direction	Description
9	Reset	3.3 V CMOS	Input	Active Low. Resets the receiver card. This pin must be held low for a minimum of 100 microseconds to guarantee operation. Internal 10 kΩ pullup.
10	VARF (default)/ CAN RX Port A	3.3 V CMOS	Output / Input*	Dual use pin: Default: VARF: Variable Frequency Output (Rising or falling edge active) CAN Tx Port A: CAN Port A Receive
11	Event2 (default)/ CAN TX Port A	3.3 V CMOS	Input / Output*	Dual use pin: Default: Event 2 (Rising edge triggered) CAN TX Port A CAN Port A Transmit
12	CAN RX Port B	3.3V CMOS	Input	CAN Port B Receive
13	Event1 (default) /PCTX Port C	3.3V CMOS	Input / Output*	Dual use pin: Default: Event 1 (Falling edge triggered) PCTX Port C Transmit

Continued on next page

Vega 28 Header layouts and pinouts, continued

Table 2-4: Vega 28 28-Pin header pin-out (continued)

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

**Selectable pin with input/output option*

Continued on next page

Vega 34 Header layouts and pinouts

The Vega 34 boards have a 34-pin header. Figure 2-6 shows the Vega 34 pin header layout.

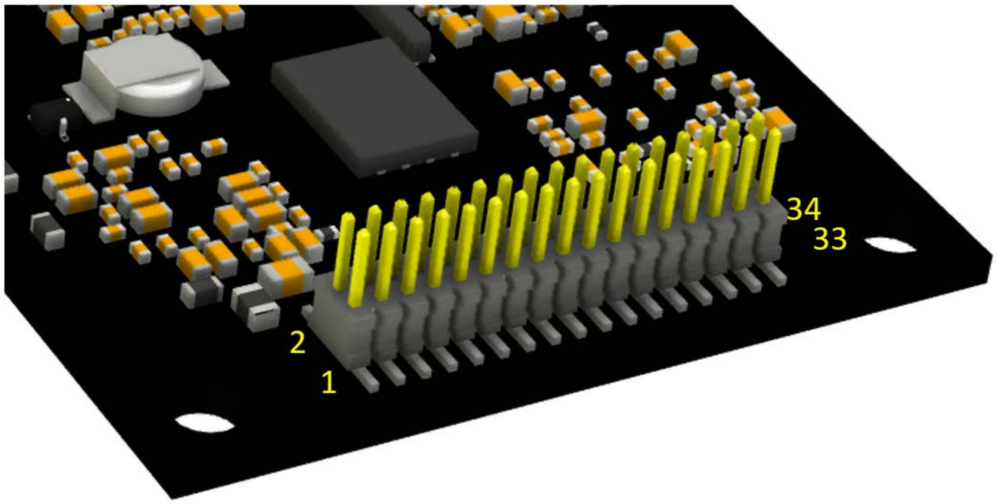


Figure 2-6: Vega 34 - 34-pin header layout

Continued on next page

Header Layouts and Pinouts, Continued

Vega 34 Header layouts and pinouts, continued

Table 2-5 provides the Vega 34 34-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 2-5: Vega 34 34-pin header pin-out

Pin	Signal Name	Signal type	Signal Direction	Description
1	3.3 V	Power	-	Receiver power supply, 3.3 V
2	3.3 V	Power	-	Receiver power supply, 3.3 V
3	Antenna Pwr	Power	-	Antenna power, DC, 15 V max
4	N/C			This pin is not connected on the Vega 34 board
5	USB DEV+	I/O	Input/ Output	USB device data +
6	USB DEV–	I/O	Input/ Output	USB device data -
7	GND	Power	-	Receiver ground
8	GND	Power	-	Receiver ground
9	TXPA	3.3V CMOS	Output	Port A serial output, 3.3 V CMOS, idle high
10	RXPA	3.3V CMOS	Input	Port A serial input, 3.3 V CMOS, idle high
11	TXPB	3.3V CMOS	Output	Port B serial output, 3.3 V CMOS, idle high
12	RXPB	3.3V CMOS	Input	Port B serial input, 3.3 V CMOS, idle high
13	TXPD	3.3V CMOS	Output	Port D serial output, 3.3 V CMOS, idle high

Continued on next page

Header Layouts and Pinouts, Continued

Vega 34 Header layouts and pinouts, continued

Table 2-5: Vega 34 34-pin header pin-out (continued)

Pin	Signal Name	Signal type	Signal Direction	Description
14	RXPD	3.3V CMOS	Input	Port D serial input, 3.3 V CMOS, idle high
15	PPS	3.3V CMOS	Output	Pulse Per Second output. (1, 2, 5, or 10Hz, programmable width, rising or falling edge) This signal defaults to one pulse per second but may be altered across a wide range of frequencies using software commands. Edges can be synchronized to GNSS time reference.
16	Manual Mark	3.3V CMOS	Input	Rising or falling edge triggered. This input is used to provide a position or time data log based on an external trigger. Internal 10 kΩ pullup.
17	GPS Lock (primary)	3.3V CMOS	Output	Status indicator, 3.3 V CMOS, active low
18	Diff Lock	3.3V CMOS	Output	Status indicator, 3.3 V CMOS, active low
19	DGPS Lock	3.3V CMOS	Output	Status indicator, 3.3 V CMOS, active low
20	Alarm	3.3V CMOS	Output	Alarm signal goes high when position solution is lost, low when position is valid, 3.3 V CMOS

Continued on next page

Vega 34 Header layouts and pinouts, continued

Table 2-5: Vega 34 34-pin header pin-out (continued)

Pin	Signal Name	Signal type	Signal Direction	Description
21*	TX CAN A (default) /GPIO0	3.3V CMOS	Output	CAN Selectable between, CAN A transmit (default)/ General purpose (input/output)
22*	Secondary Antenna Lock (default with Heading Activation) / TX CAN B	3.3V CMOS	Output	CAN With a Heading Activation, Status indicator (S-GPS LED), 3.3 V CMOS, active low, 1 mA max / Without Heading Activation, CAN B transmit
23*	RX CAN A (default) /GPIO2	3.3V CMOS	Input*	Dual use pin Selectable between CAN A receive (default)/ General purpose (input/output)
24*	Heading Lock (default with Heading Activation) / RX CAN B	3.3V CMOS	Input/ Output*	Dual use pin With a Heading Activation, Status indicator (HDG LED), 3.3 V CMOS, active low, 1 mA max / Without Heading Activation, CAN B receive
25	Speed Output	3.3V CMOS	Output	0 - 3 V variable clock output
26	Speed Ready	3.3V CMOS	Output	Active low, speed valid indicator, 3.3 V CMOS

Continued on next page

Header Layouts and Pinouts, Continued

Vega 34 Header layouts and pinouts, continued

Table 2-5: Vega 34 34-pin header pin-out (continued)

Pin	Signal Name	Signal type	Signal Direction	Description
27	GND	Power	-	Receiver ground
28	GND	Power	-	Receiver ground
29	USB HOST D+	I/O	Input/ Output	USB HOST data +
30	USB HOST D-	I/O	Input/ Output	USB HOST data -
31	TXPC	3.3V CMOS	Output	Port C serial output, 3.3 V CMOS, idle high
32	RXPC	3.3V CMOS	Input	Port C serial input, 3.3 V CMOS, idle high
33	n/c	n/c	n/c	n/c
34	Reset	3.3V CMOS	Input	Reset, 3.3 V typical, not required, Active Low, This pin must be held low for a minimum of 100 microseconds to guarantee operation. Internal 10 kΩ pullup.

**Selectable pin with input/output option*

Continued on next page

Header Layouts and Pinouts, Continued

Vega 60 Header layouts and pinouts

The Vega 60 boards have a 60-pin dual row header. Figure 2-7 shows the Vega 60 pin header layout. Table 2-6 lists the Vega 60 pin-out.

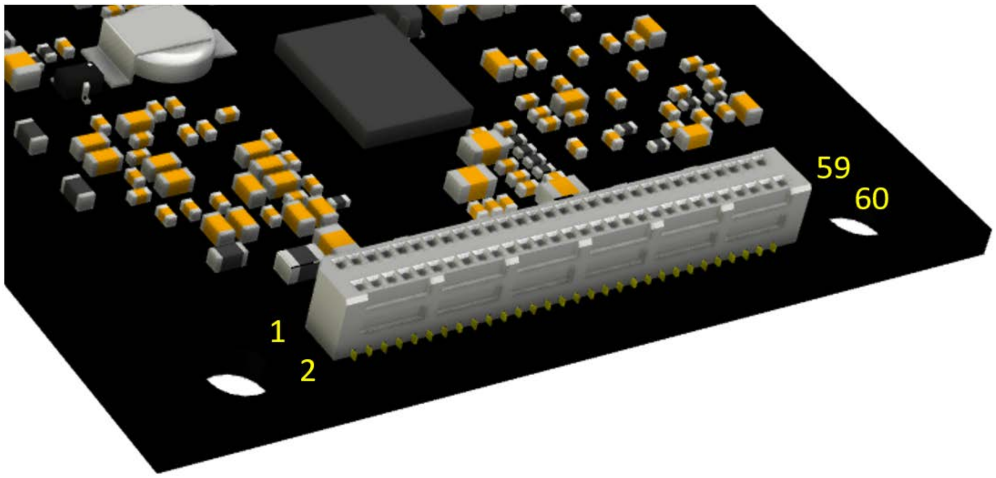


Figure 2-7: Vega 60 60-pin layout

Continued on next page

Header Layouts and Pinouts, Continued

Vega 60 Header layouts and pinouts, continued

Table 2-6: Vega 60 60-pin header pin out

Pin	Signal Name	Signal type	Signal Direction	Description
1	3.3V CMOS	Power	Input Power	3.3V +-5% Input power
2	3.3V CMOS	Power	Input Power	3.3V +-5% Input power
3	TXPB	3.3V CMOS	Output	Transmit, Port B, Serial Communications Port
4	TXPA	3.3V CMOS	Output	Transmit, Port A, Serial Communications Port
5	TXPE / RTSPB	3.3V CMOS	Output	Multiplexed through Software, Transmit Port E / RTS Port B
6	RTSPA	3.3V CMOS	Output	Request To Send (RTS) Port A, Serial Communications Control
7	GROUND	Power	Ground	Ground
8	GROUND	Power	Ground	Ground
9	RXPB	3.3V CMOS	Input	Receive, Port B, Serial Communications Port
10	RXPA	3.3V CMOS	Input	Receive, Port A, Serial Communications Port
11	RXPE / CTSPB	3.3V CMOS	Input	Multiplexed through Software, Receive Port E / CTS Port B
12	CTSPA	3.3V CMOS	Input	Clear To Send (CTS) Port A, Serial Communications Control
13	RXPD	3.3V CMOS	Input	Receive Port D, Serial Communications Port

Continued on next page

Header Layouts and Pinouts, Continued

Vega 60 Header layouts and pinouts, continued

Table 2-6: Vega 60 60-pin header pin out (continued)

Pin	Signal Name	Signal type	Signal Direction	Description
14	RXPC	3.3V CMOS	Input	Receive Port C, Serial Communications Port
15	STAT GREEN	3.3V CMOS	Output	Logic Indicator, Green LED, Active High
16	STAT RED	3.3V CMOS	Output	Logic Indicator, Red LED, Active High
17	EVENT OUT 1	3.3V CMOS	Output	Event Out 1, Timer
18	ME RDY	3.3V CMOS	Output	Logic Indicator, Receiver Ready Indicator, Active High
19	TXPD	3.3V CMOS	Output	Transmit, Port D, Serial Communications Port
20	TXPC	3.3V CMOS	Output	Transmit, Port C, Serial Communications Port
21	ERROR	3.3V CMOS	Output	Logic Indicator, Receiver Error Indicator, Active High
22	PVALID	3.3V CMOS	Output	Logic Indicator, Position Valid, Active High
23	EVENT OUT 3	3.3V CMOS	Output	Event Out 3, Timer
24	PPS	3.3V CMOS	Output	Pulse Per Second, Active High (default)
25	EVENT OUT 4	3.3V CMOS	Output	Event Out 4, Timer
26	EVENT OUT 2	3.3V CMOS	Output	Event Out 2, Timer
27	GROUND	Power	Ground	Ground
28	GROUND	Power	Ground	Ground

Continued on next page

Header Layouts and Pinouts, Continued

Vega 60 Header layouts and pinouts, continued

Table 2-6: Vega 60 60-pin header pin out (continued)

Pin	Signal Name	Signal type	Signal Direction	Description
29	EVENT IN 2	3.3V CMOS	Input	Event In 2, Trigger
30	EVENT IN 1	3.3V CMOS	Input	Event In 1, Trigger
31	EVENT IN 4	3.3V CMOS	Input	Event In 4, Trigger
32	EVENT IN 3	3.3V CMOS	Input	*Event In 3, Trigger
33	GROUND	Power	Ground	Ground
34	GROUND	Power	Ground	
35	RX CAN B	3.3V CMOS	Input	Receive CAN Port B, Serial CAN Communications
36	TX CAN A	3.3V CMOS	Output	Transmit CAN Port A, Serial CAN Communications
37	TX CAN B	3.3V CMOS	Output	Transmit CAN Port B, Serial CAN Communications
38	RX CAN A	3.3V CMOS	Input	Receive CAN Port A, Serial CAN Communications
39				Reserved, No Connect
40				Reserved, No Connect
41				Reserved, No Connect
42				Reserved, No Connect
43				Reserved, No Connect
44				Reserved, No Connect
45	GROUND	Power	Ground	Ground
46	GROUND	Power	Ground	Ground
47	USB1 DR-	I/O	Diff. IO	USB1 Dual Role 1 D-, Pair with USB1 DR+
48	USB0 DR+	I/O	Diff. IO	USB0 Dual Role 0 D+, Pair with USB0 DR-

Continued on next page

Header Layouts and Pinouts, Continued

Vega 60 Header layouts and pinouts, continued

Table 2-6: Vega 60 60-pin header pin out (continued)

Pin	Signal Name	Signal type	Signal Direction	Description
49	USB1 DR+	I/O	Diff. IO	USB1 Dual Role 1 D+, Pair with USB1 DR-
50	USB0 DR-	I/O	Diff. IO	USB0 Dual Role 0 D-, Pair with USB0 DR+
51	USB ID0	3.3V CMOS	Input	Floating USB0 Device USB1 Host, Grounded USB0 Host USB1 Device
52	USB0 VBUS	Power	Power	5V output when USB0 Host Mode, 5V input when USB0 Device Mode
53	nRESET	3.3V CMOS	I/O	RESET, Active Low, Input / Output
54	GROUND	Power	Ground	Ground
55	ENET LED	3.3V CMOS	Output	Ethernet Activity Logic Indicator
56	ENET BIAS	ETHER NET	Analog	Ethernet DC Magnetic Bias
57	ENET RX+	ETHER NET	Diff. IO	Ethernet Receive+, Pair with Receive-
58	ENET TX+	ETHER NET	Diff. IO	Ethernet Transmit+, Pair with Transmit-
59	ENET RX-	ETHER NET	Diff. IO	Ethernet Receive-, Pair with Receive+
60	ENET TX-	ETHER NET	Diff. IO	Ethernet Transmit-, Pair with Transmit+

Signals

Overview

This section provides information on the signals available on the Vega board series via connectors.

RF Input

The Vega series is designed to work with active GNSS antennas with an LNA gain range of 10 to 35 dB. While the on-board Automatic Gain Control (AGC) circuitry will compensate for variations in signal level, system designers should try to have the antenna's gain offset the cable's loss with a 10-15dB margin. For example, a cable with a signal loss of 10 dB @ 1575 MHz should be used with a 25 dB gain antenna. Cable losses of more than 20 dB should be avoided and may require special system design.

Hemisphere's antennas typically have a 25 to 30 dB gain. They are designed to be paired with our 1 m to 30 m antenna cables which have between 2 dB and 12 dB loss. This still allows a few dB margin for additional interconnection items and short interface cables in integrated products.

Hemisphere recommends using the same type of antenna on both antenna ports. Orient the antennas the same way for the best heading performance.

Vega 28 Ports

Vega 28 Serial ports

The Vega 28 has three serial communication ports:

Port A- 3.3V CMOS UART
Pin 15 (TX), Pin 16 (RX)

Port B- 3.3V CMOS UART
Pin 18 (TX), Pin 19 (RX)

Port C- 3.3V CMOS UART (multiplexed with USB+, and Event 1)
Pin 8 (RX), Pin 13 (TX)

A transceiver is required if serial ports A, B, or C (UART 3.3V CMOS) are used for external devices that use RS-232.

Vega 28 USB ports

The Vega 28 USB device port serves as a high-speed data communications port. The Vega 28 USB data lines are bi-directional. The USB data lines should be laid out on printed circuit board (PCB) as a differential pair 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.

Continued on next page

Vega 28 CAN port

A CAN transceiver is required. The Vega 28 CAN RX and CAN TX are 3.3V CMOS signals. The Vega 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.

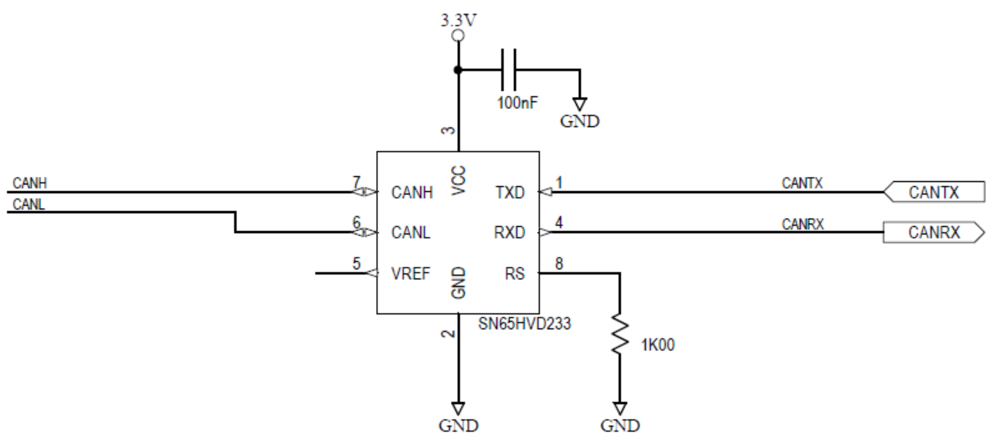


Figure 2-8: Vega 28 CAN design example

Vega 28 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).

Continued on next page

Vega 28 Enabling / disabling ethernet

The full current state of Ethernet configuration may be checked with the command "**$JETHERNET**." When Ethernet is disabled, the following response displays:

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

To enable Ethernet, determine if the receiver is allowed to be assigned an IP address automatically via DHCP, or statically assigned. If you are unsure, please contact the network administrator.

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

Vega 28 Ports, Continued

Vega 28 Enabling / disabling ethernet, continued

To enable Ethernet support with a statically assigned IP address, use the command:
$JETHERNET,MODE,STATIC,ip,subnet,gateway,dns

In the previous command, 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 Vega 28 (not currently supported). The following is an example command:
$JETHERNET,MODE,STATIC,192.168.0.42,255.255.255.0.

To disable Ethernet, use the command:
$JETHERNET,MODE,OFF

With Ethernet enabled, you can test sending an Internet Control Message Protocol (ICMP) ping to the Vega 28 receiver from a PC on the same network. No actual services are enabled on Ethernet by default, so to make practical use of Ethernet support, enable a service.

The only Ethernet service implemented is the PORTI virtual serial port. Additional types of Ethernet services may be implemented in future firmware versions. The PORTI virtual serial port allows a listening TCP port to be opened, acting like a local serial port of the receiver. Only one TCP client may be connected at a time.

Note: Enabling "PORTI" on Ethernet should only be done with the Vega 28 connected to a trusted network, since it gives full access to the receiver as a local serial port and has no authentication or security mechanisms.

To enable the PORTI service, use the command **$JETHERNET,PORTI, port** where port is replaced with the desired TCP port number. Any port in the range 1 to 65535 is allowable, but it is recommended to consider which TCP port numbers are typically reserved for various common protocols and avoid those port numbers.

To disable the PORTI service, use the command **$JETHERNET,PORTI,OFF**

Vega 34 Ports

Vega 34 serial ports

The Vega 34 boards have four serial communication ports:

- Port A, Port B, Port C - main ports
- Port D – Functions as the other ports but also is the recommended port to interface with a beacon board. See "Communication Port D" below for more information on Port D.

The Vega 34 serial ports' 3.3 V CMOS signal level can be translated to interface to other devices.

Vega 34 Communication Port D

Communication Port D will automatically detect if Hemisphere GNSS' SBX beacon board is connected. Simply ensure the port is set to 9600 baud. When communicating into either Port A, B, or C, a virtual connection may be established to the SBX board on Port D using the **$JCONN** command.

Vega 34 USB ports

The Vega 34 has both a USB host port and a USB device port.

The USB data lines are bi-directional and are differential pairs. The USB data lines should be laid out on printed wire board (PWB) with 90 Ω ±15% differential impedance.

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

It is also recommended to leave a minimum 20 mil spacing between USB signals and other signals. Treat the data lines as if they are RF signals. A device can use USB Type-B or Mini-B connectors. If Mini-B is used, "ID" pin 4 is NOT CONNECTED.

Continued on next page

Vega 34 Ports, Continued

Vega 34 CAN transceiver

A CAN transceiver is required. The Vega 34 CAN RX and CAN TX are 3.3 V CMOS signals. The Vega 34 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 34 does not connect to this portion of the transceiver.

Note: Resistor values can vary based on application.

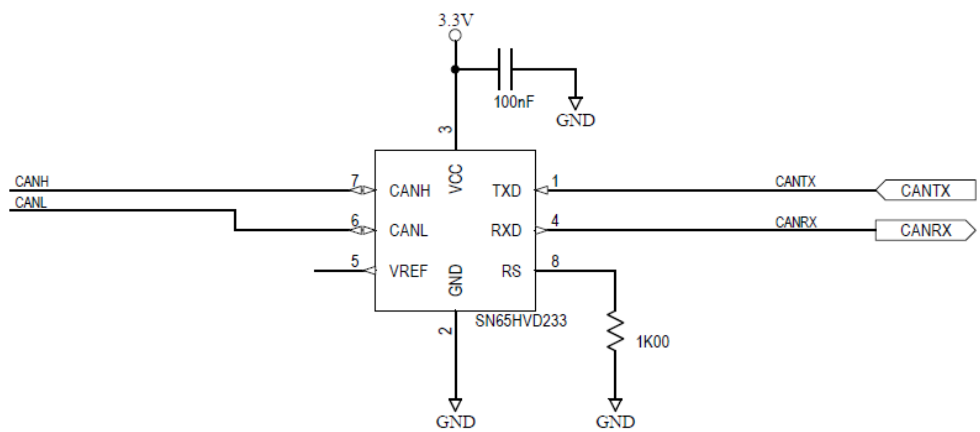


Figure 2-9: CAN design example

Vega 60 Ports

Vega 60 CAN ports

A CAN transceiver is required. The Vega 60 CAN RX and CAN TX are 3.3V CMOS signals. The Vega 60 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 60 does not connect to this portion of the transceiver.

Note: Resistor values can vary based on application.

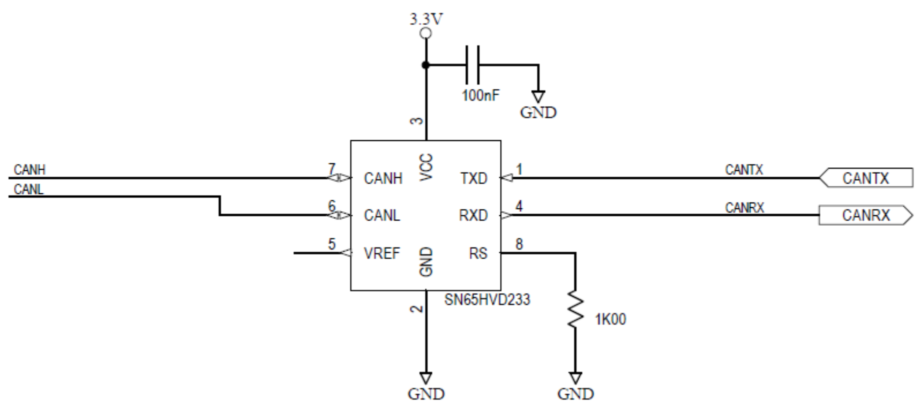


Figure 2-10: Vega 60 CAN design example

Vega 60 Ethernet port overview

The Hemisphere Vega 60 receiver board has ethernet support. It is disabled by default but may be enabled.

The Vega 60 is connected to a carrier board or enclosure which connects the Vega 60's ethernet pins to a standard RJ-45 jack (with integrated magnetics as appropriate).

Continued on next page

Vega 60 Ports, Continued

Vega 60 Enabling / disabling ethernet

The full current state of Ethernet configuration may be checked with the command "**$JETHERNET**." When Ethernet is disabled, the following response displays:

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

To enable Ethernet, determine if the receiver is allowed to be assigned an IP address automatically via DHCP, or statically assigned. If you are unsure, please contact the network administrator.

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

Vega 60 Ports, Continued

Vega 60 Enabling / disabling ethernet, continued

To enable Ethernet support with a statically assigned IP address, use the command:
$JETHERNET,MODE,STATIC,ip,subnet,gateway,dns

In the previous command, 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 Vega 60 (not currently supported). The following is an example command:
$JETHERNET,MODE,STATIC,192.168.0.42,255.255.255.0.

To disable Ethernet, use the command:
$JETHERNET,MODE,OFF

With Ethernet enabled, you can test sending an Internet Control Message Protocol (ICMP) ping to the Vega 60 receiver from a PC on the same network. No actual services are enabled on Ethernet by default, so to make practical use of Ethernet support, enable a service.

The only Ethernet service implemented is the PORTI virtual serial port. Additional types of Ethernet services may be implemented in future firmware versions. The PORTI virtual serial port allows a listening TCP port to be opened, acting like a local serial port of the receiver. Only one TCP client may be connected at a time.

Note: Enabling "PORTI" on Ethernet should only be done with the Vega 60 connected to a trusted network, since it gives full access to the receiver as a local serial port and has no authentication or security mechanisms.

To enable the PORTI service, use the command **$JETHERNET,PORTI, port** where port is replaced with the desired TCP port number. Any port in the range 1 to 65535 is allowable, but it is recommended to consider which TCP port numbers are typically reserved for various common protocols and avoid those port numbers.

To disable the PORTI service, use the command **$JETHERNET,PORTI,OFF**

Continued on next page

Vega 60 Ports, Continued

Vega 60 serial ports

The Vega 60 boards have five serial communication ports:

- Port A, Port B, Port C, Port E - main ports
- Port D - Functions as the other ports but also is the recommended port to interface with a beacon board. See "Communication Port D" below for more information on Port D.

The Vega 60 serial ports' 3.3 V CMOS signal level can be translated to interface to other devices.

Vega 60 Communication Port D

Communication Port D will automatically detect if Hemisphere GNSS' SBX beacon board is connected. Simply ensure the port is set to 9600 baud. When communicating into either Port A, B, or C, a virtual connection may be established to the SBX board on Port D using the **$JCONN** command.

Vega 60 USB ports

The Vega 60 has both a USB host port and a USB device port.

The USB data lines are bi-directional and are differential pairs. The USB data lines should be laid out on printed wire board (PWB) with 90 Ω ±15% differential impedance.

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

It is also recommended to leave a minimum 20 mil spacing between USB signals and other signals. Treat the data lines as if they are RF signals. A device can use USB Type-B or Mini-B connectors. If Mini-B is used, "ID" pin 4 is NOT CONNECTED.

Chapter 3: Understanding the Vega Board Series

Overview

Introduction

This chapter provides information you need to understand the Vega series OEM boards and functions.

Contents

Timing Signal

PPS timing signal

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

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

The PPS is a 3.3 V CMOS signal. By default, the PPS is a rising edge synchronized pulse occurring once per second with a width of approximately 1ms.

The Vega series support a programmable PPS. Users can select the frequency to 1, 2, 5 or 10Hz. The pulse can be programmed as either active high (rising edge synchronized) or active low (falling edge synchronized). The Vega series can support pulse widths as wide as 900 ms.

$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) >,[SAVE]

PPS Width can be controlled using

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

The width command parameter is in µs (microseconds).

Note: $JSAVE does NOT save the JPPS configuration. The optional **SAVE** argument in the commands above may be included to save the settings to non-volatile memory, or the desired PPS 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 GNSS solution may need to be forced and not synchronized with GPS time. **Note:** Event marker input is typical of most GNSS 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 and can be programmed as active low with falling edge synchronization, or active high with rising edge synchronization. The input impedance and capacitance are 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 series. These are not separate analog and digital grounds which require separate attention. Refer to Tables 2-4 through 2-6 for Vega pin-out ground information.

Shielding

Shielding	The Vega board series are sensitive instruments. When integrated into an enclosure, the Vega board requires shielding from other electronics to ensure optimal operation. The Vega board shield design consists of a thin piece of metal which prevents interference.

Receiver Mounting

Receiver mounting	The Vega boards are precision instruments. To ensure optimal operation, mount the receiver to minimize vibration and shock. When mounting the Vega board 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. Use the RTKSTAT and ATTSTAT messages to ensure the signal grades includes as many A's as possible.

Antenna Mounting

Antenna mounting	The Vega board series is compatible with the following Hemisphere GNSS single and dual frequency antennas: • Single frequency: A21, A25, and A31 (beacon) • Dual frequency: A42, A43 (beacon), and A45 When mounting the antennas, consider mounting orientation (pitch or roll) and proper antenna placement.

Mounting Orientation

Mounting orientation

The Vega series 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 to correctly calibrate the heading, pitch, and roll. The primary antenna is used for positioning and works in conjunction with output heading, pitch, and roll values.

Pitch orientation

If the vertical angle calculated between the primary and secondary antenna is the pitch, send **$JATT,ROLL,NO** and **$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.

Roll orientation

If the vertical angle calculated between the primary and secondary antenna is the roll, send **$JATT,ROLL,YES** and **$JATT,HBIAS,-90** to the receiver. This tells the receiver the antennas are calculating roll instead of pitch (**$JATT,ROLL,NO**). This assumes the primary antenna is on the left. If it is on the right, use **$JATT,HBIAS,90**.

When heading should be 0 degrees and the primary antenna is on the left, the heading output will be 90 (since the antennas are calculating roll). Therefore, set the heading bias to -90 with **$JATT,HBIAS,-90**. Similarly, if the primary antenna is on the right, set the heading bias to +90 with **$JATT,HBIAS,90**.

Note: Regardless of which mounting orientation you use, the Vega series provide the ability to output the heave measurement via the **$GPHEV** message. For more information on this message refer to the HGNSS TRM.

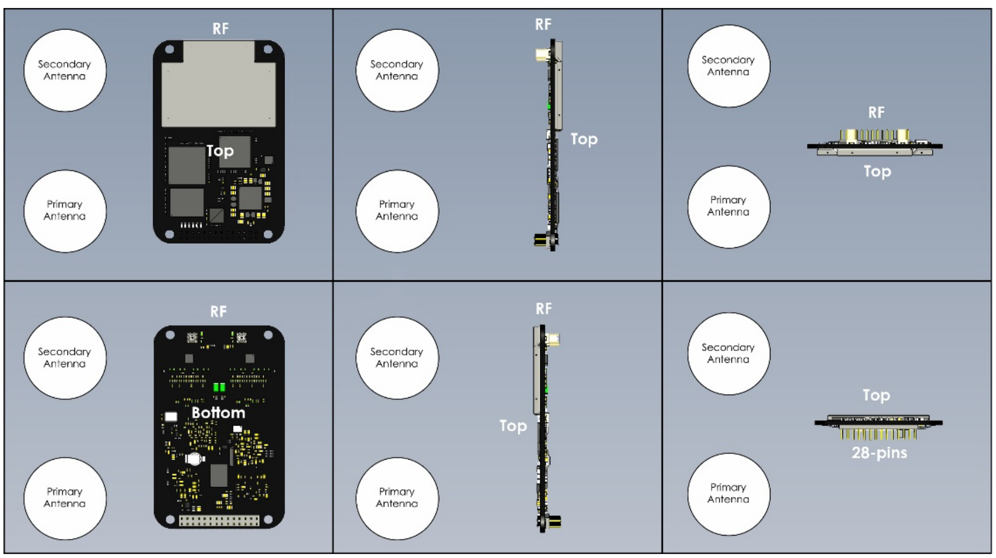
Vega Orientation and Sensor Calibration

Vega orientation and sensor calibration

The Vega OEM boards 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 **$JATT,ACC180,YES/NO** and **$JATT,ACC90,YES/NO** commands which match the installation.
3. Send the command **$JATT,TILTCAL** to finalize the calibration.

Note: Figure Groups A, B, C, and D are shown using the Vega 28 board.



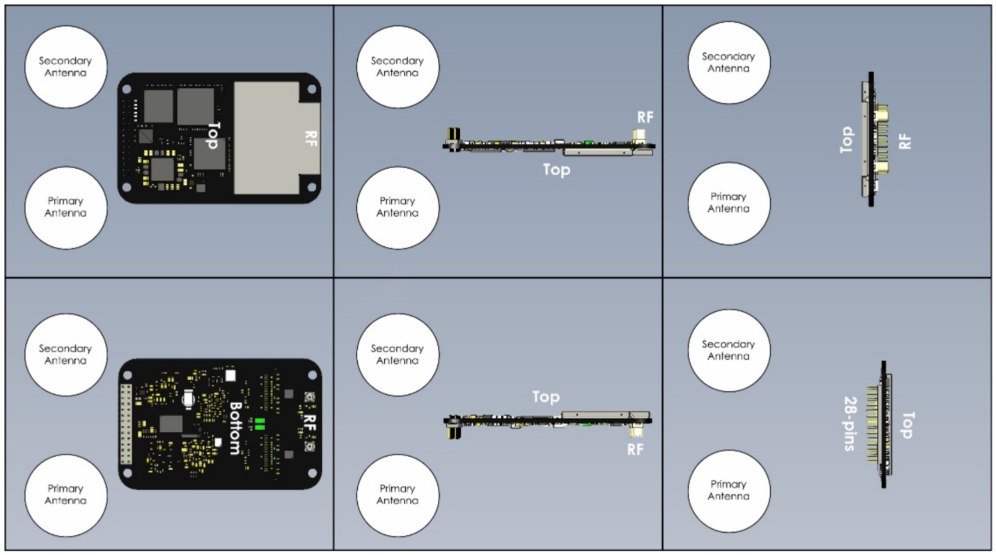
$JATT,ACC90,NO
$JATT,ACC180,NO

Figure 3-1: Group A

Continued on next page

Vega Orientation and Sensor Calibration, Continued

Vega orientation and sensor calibration, continued

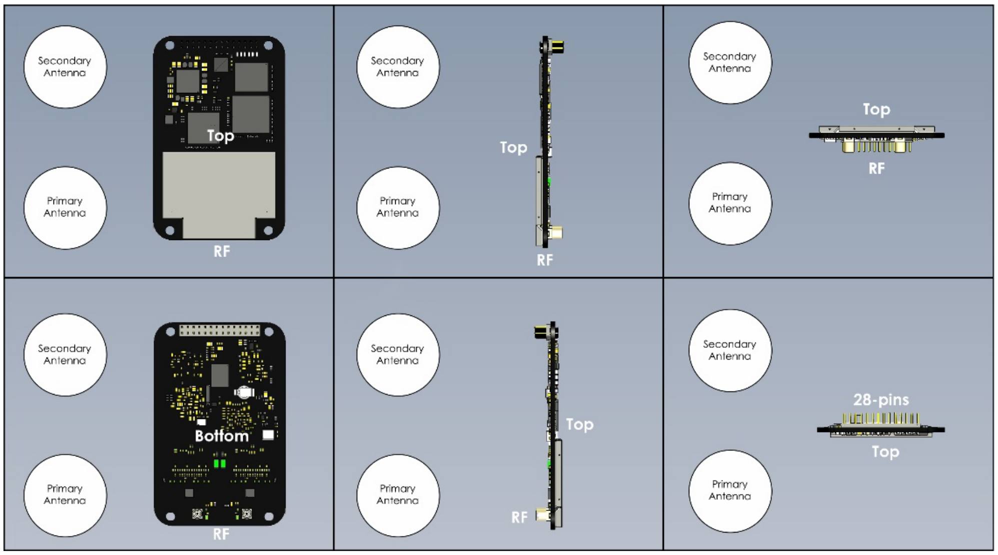


$JATT,ACC90,YES
$JATT,ACC180,NO

Figure 3-2: Group B

Continued on next page

Vega orientation and sensor calibration, continued

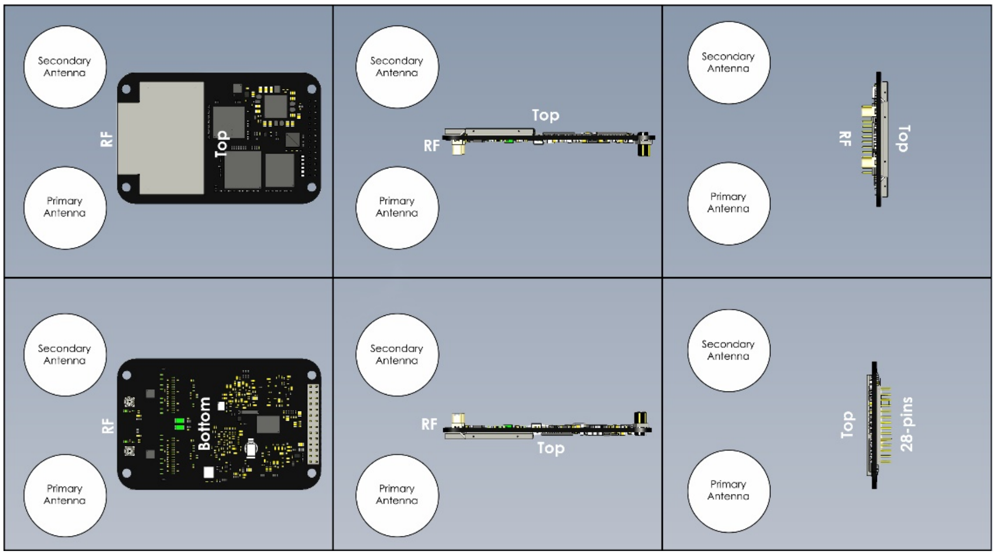


$JATT,ACC90,NO
$JATT,ACC180,YES

Figure 3-3: Group C

Continued on next page

Vega 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, and along the machine or 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 other radio antennas, as high as possible. For optimal performance, orient GNSS antennas so the antennas' connectors face the same direction.

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

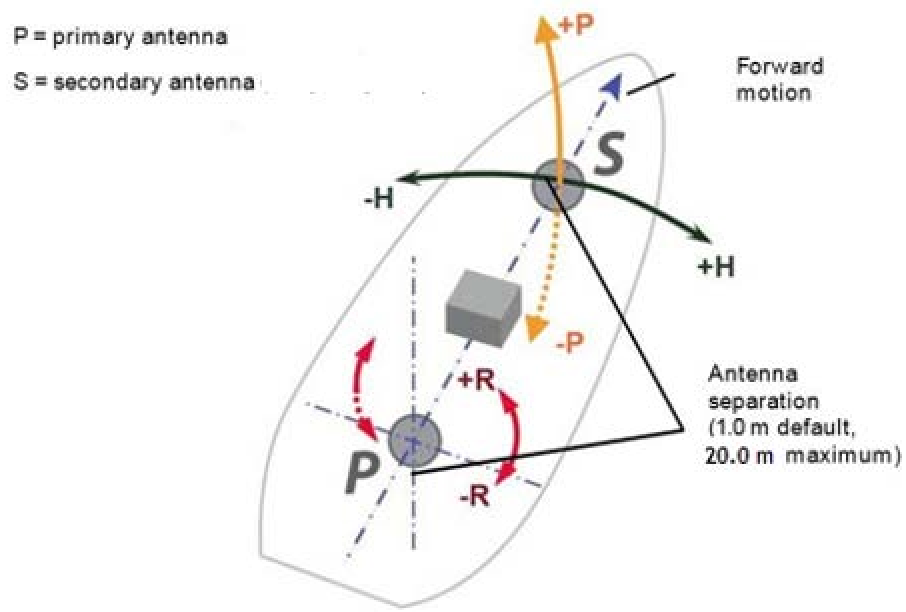


Figure 3-5: Recommended orientation and resulting signs of HPR values

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Planning the optimal antenna placement, continued

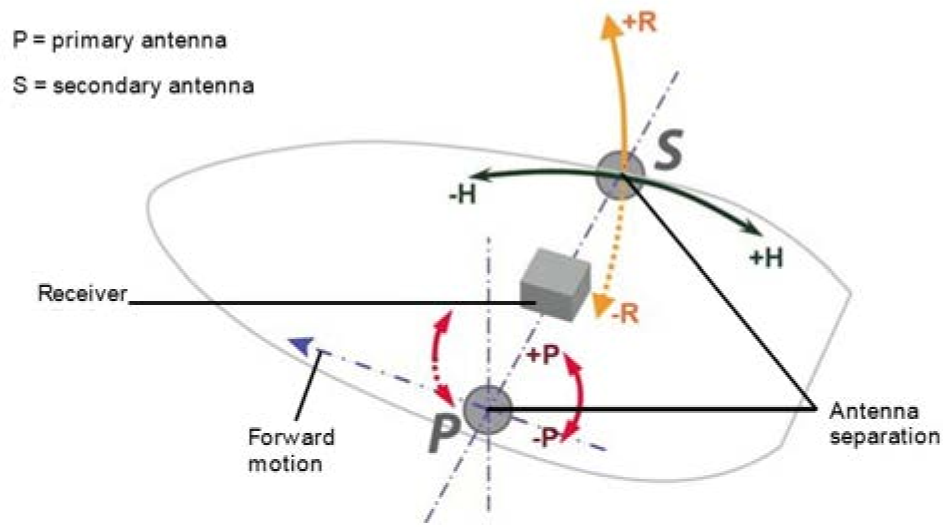


Figure 3-6: Alternate orientation and resulting signs of HPR values

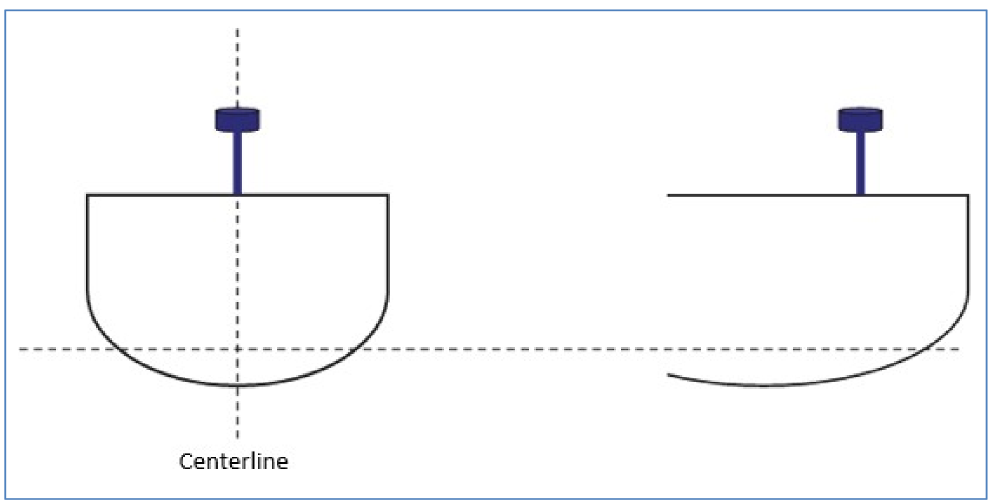


Figure 3-7: Antenna installation: cross-section of boat

Chapter 4: Operating the Vega OEM Boards

Overview

Introduction

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

Contents

Powering the Vega OEM Board On/Off

Powering the Vega OEM board	The Vega series is powered by a 3.3 VDC power source. After you connect appropriate power, the Vega OEM board is active.

Communicating with the Vega OEM Board Series

Communicating with the Vega OEM board series	The Vega board series features serial ports that can be configured independently from one another. • Vega 28 (Port A, Port B, Port C) • Vega 34 (Port A, Port B, Port C, Port D) • Vega 60 (Port A, Port B, Port C, Port D, Port E) The ports can be configured for NMEA 0183 output, Hemisphere proprietary ASCII and binary messages output, and RTK input/output. You can configure the receiver through any of these ports with Hemisphere GNSS commands (see the HGNSS TRM).

Configuring the Vega OEM Board Series

Configuring the Vega OEM board series

You can configure all aspects of Vega board series operations through any serial port using proprietary commands. For information on these commands refer to the HGNSS TRM .

You can configure 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, and set various receiver operating parameters.

To issue commands to the Vega board, connect to a terminal program or Hemisphere GNSS' software applications (SLXMon or PocketMax).

LED Indicators

Vega LED Indicators

The Vega boards feature the following surface-mounted diagnostic LEDs to indicate board status (see Figure 4-1). These indicators are the same for all Vega boards.

LED Indicator	LED name	Color	Board Status
PWR	Power	Red	Power is on
PGNSS	GNSS lock	Orange	Primary GNSS lock, receiver has a position solution
SGNSS	Secondary GNSS	Orange	Secondary GNSS lock
DIFF	Differential lock	Orange	**Blinking:** acquiring position **Solid:** the receiver has locked onto the differential source
DGNSS	Differential Position	Green	**Blinking:** estimated position accuracy does not meet threshold configured in **$JLIMIT** command. **Solid:** receiving and using corrections
HDG	Heading	Green	Heading solution

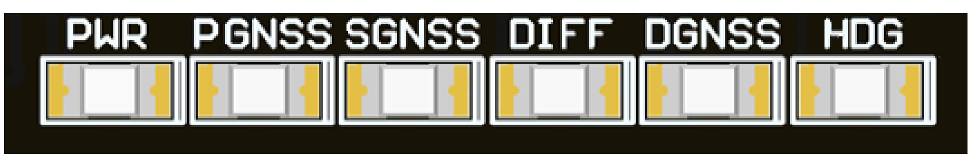


Figure 4-1: Onboard LEDs for Vega 28

Configuring the Data Message Output

Configuring the Data Message Output	The Vega boards feature primary bi-directional ports (Ports A, B, C (all Vega boards), Port D (Vega 34 and Vega 60), and Port E (Vega 60 only)). You can configure messages for all ports by sending proprietary commands to the Vega boards through any port. For a complete list of commands and messages refer to the HGNSS TRM.

‘THIS’ Port and the ‘OTHER’ Port

Overview

When using Port A and Port B, you can optionally use the phrases “THIS” and “OTHER” when referring to themselves and each other in NMEA messages, in place of using the PORTA and PORTB phrases.

‘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>

‘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 Ports C, D (Vega 34 and Vega 60), or E (Vega 60 only) you must specifically indicate (by name) you want the output on the desired port.

Continued on next page

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

‘OTHER’ port, continued

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>

Port A or Port B are interchangeable to ‘THIS’ and ‘OTHER.’ When entering a command for GLL message on Port B while on Port A, use the following command:

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

This can also be done using Port B for Port A.

Using Port D for RTCM Input (Vega 34 and Vega 60 Boards Only)

Using Port D for RTCM input

In addition to normal serial port functions, Port D has been optimized to interface with the Hemisphere GNSS' SBX-4 beacon board and operates at 9600 bauds (8 data bits, no parity and 1 stop bit – 8-N-1).

To configure the Vega board to use Port D, issue the following command:

$JDIFF,BEACON<CR><LF>

To return to using SBAS as the correction source, send the following command to the Vega board:

$JDIFF,WAAS<CR><LF>

For a complete list of commands and messages, refer to the online HGNSS Technical Reference Manual (TRM).

Atlas L-band Message/Commands

Atlas L-band messages/ commands

To configure the Vega boards to automatically set the L-band frequency parameters, by using the following command:

$JFREQ,AUTO<CR><LF>

The L-band frequency can also be tuned manually with the command:

$JFREQ,freq,symb<CR><LF>

where ‘freq’ is the frequency in kHz and ‘symb’ is the symbol baud rate.

To enable L-band mode for tracking the Atlas communication satellites, issue the following command:

$JDIFF,LBAND,SAVE<CR><LF>

To ensure that the Atlas solution is enabled, send the following command:

$JDIFF,INCLUDE,ATLAS<CR><LF>

Output of the L-band diagnostic message can be enabled by issuing the command:

$JASC,RD1,1

Saving the Configuration

Saving the configuration	Each time you change the Vega configuration, you 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 OEM board using a terminal program or Hemisphere GNSS' applications (SLXMon or PocketMax). The Vega OEM board takes approximately five seconds to save the configuration to non-volatile memory and indicates when the configuration has been saved. Refer to the HGNSS TRM for more information.

Configuration Defaults

Configuration defaults	$JOFF,ALL $JAGE,2700 $JLIMIT,10 $JMASK,5 $JNP,8 $JWAASPRN,AUTO $JDIFF,WAAS $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,MOVEBASE,NO $JATT,HBIAS,0.0 $JATT,NMEAHE,0 $JATT,PBIAS,0.0 $JATT,PTAU,0.5 $JATT,ROLL,NO $JATT,SPDTAU,0.0

Continued on next page

Configuration Defaults, Continued

Configuration defaults, continued

```
$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
```

Using the WebUI (Vega 28 and Vega 60 Only)

Overview

The Vega 28 and the Vega 60 come equipped with a WebUI interface which may be accessed via the Ethernet interface.

To enable the Ethernet interface in DHCP mode (where the receiver will automatically get an IP address), check the receiver's assigned IP address, and enable the WebUI, use the following steps:

Step	Action
1	Establish a serial connection to the board.
2	Enable the Ethernet interface with a DHCP-assigned IP address using the following command: **$JETHERNET,MODE,DHCP** The receiver will attempt to retrieve an address from the DHCP server on the network.
3	Enable the WebUI on the Ethernet interface using the following command: **$JETHERNET,WEBUI,ON**
4	Send the command **$JETHERNET** to check the receiver's assigned IP address.

Alternatively, in place of Step 3, you may enable Ethernet support with a statically assigned IP address by sending the command: **$JETHERNET,MODE,STATIC,IP,SUBNET,GATEWAY,DNS** where IP/subnet/gateway/DNS are each replaced with the relevant IP address for the network configuration. The gateway and DNS parameters are optional.

Open a web browser window and type the IP address reported in the **$JETHERNET** command.

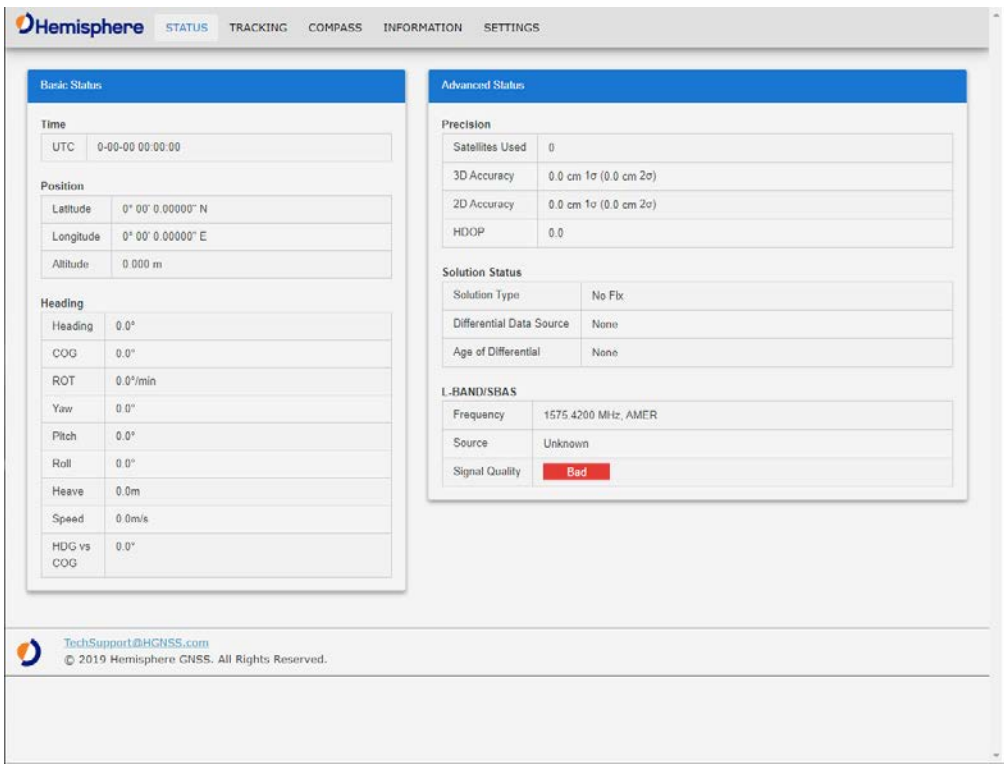
Continued on next page

Using the WebUI (Vega 28 and Vega 60 Only), Continued

Overview, continued

The Vega **Status** window displays. Click the tabs at the top of each screen to navigate throughout the WebUI.

Note: WebUI screens shown as examples in this manual is the Vega 28 WebUI.



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Using the WebUI (Vega 28 and Vega 60 Only), Continued

Status

The **Status** window displays **Basic Status** and **Advanced Status**.

Under the left column **Basic Status**, real time data is displayed for the following:

- Time (UTC and Local)
- Position (Latitude, Longitude, Altitude)
- Heading

Basic Status

Time

UTC	2019-08-19 18:54:44
Local	2019-08-19 18:54:44

Position

Latitude	33° 38' 36.05002" N
Longitude	111° 53' 45.44882" W
Altitude	454.944 m

Heading

Heading	196.1°
COG	208.5°
ROT	0.8°/min
Yaw	12.4°
Pitch	6.1°
Roll	2.5°
Heave	-0.0m
Speed	0.0m/s
HDG vs COG	-12.4°

Continued on next page

Using the WebUI (Vega 28 and Vega 60 Only), Continued

Status , continued

The right column of the **Status** screen displays **Advanced Status** information:

- Precision (Satellites Used, 3D Accuracy, 2D Accuracy, HDOP)
- Solution Status (Solution Type, Differential Data Source, Age of Differential)
- L-band/SBAS (Frequency, Source, Signal Quality)

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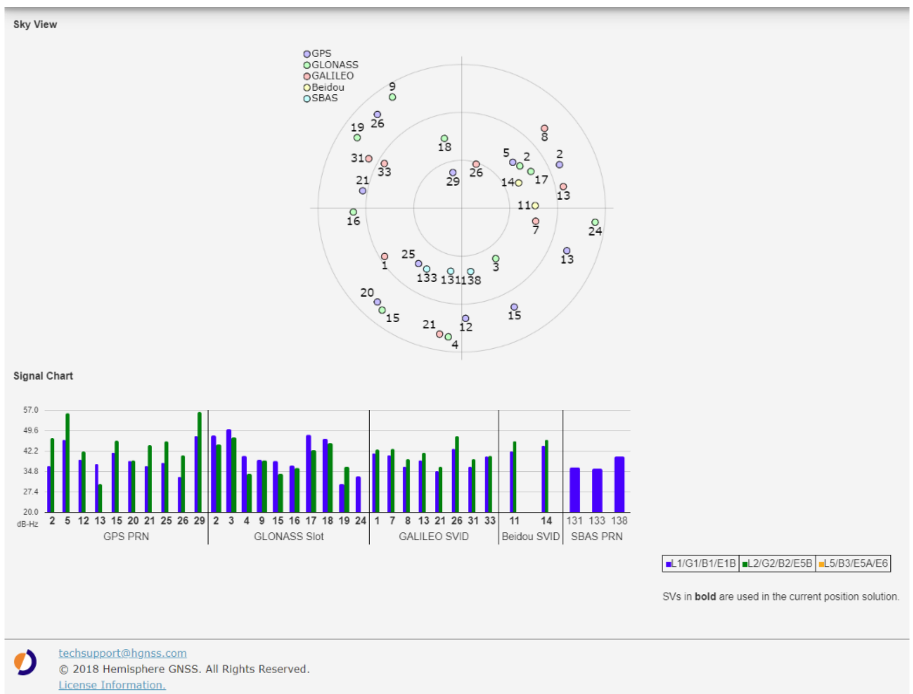
Tracking

The **Tracking** window displays the **Sky View** and the **Signal Chart**.

The **Sky View** plots the azimuth, elevation and SNR values of all tracked satellites (GPS, GLONASS, GALILEO, BeiDou, QZSS, and SBAS).

Note: Sky View plots in **bold** are used in the solution.



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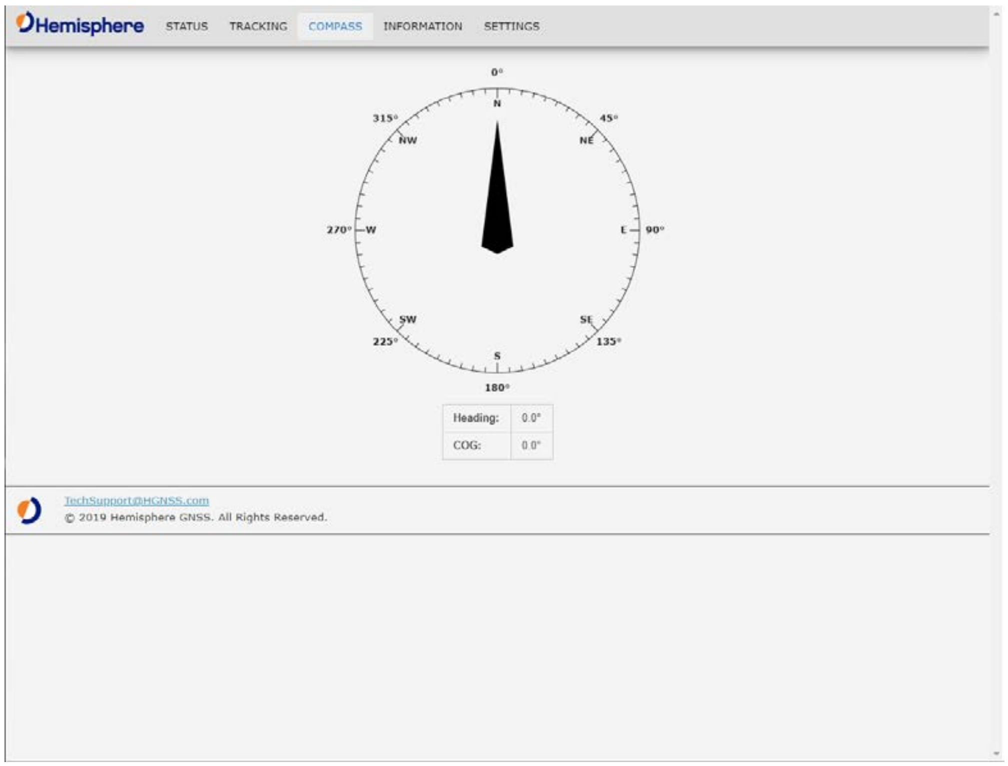
Compass

Use the **Compass** to read the Heading and COG data displayed in real time.



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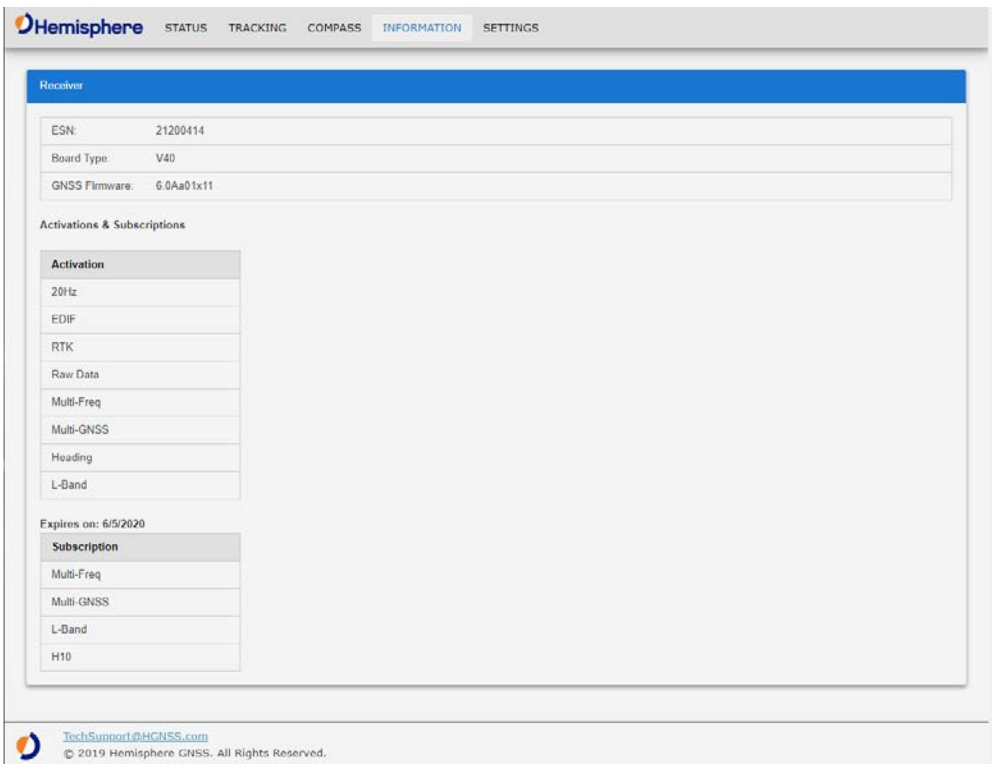
Using the WebUI (Vega 28 and Vega 60 Only), Continued

Information

The **Information** window displays the Vega board Receiver and Subscriptions information.

You can find the **ESN**, **Board Type**, and **GNSS Firmware** versions listed at the top of the screen. The **Subscriptions** expiration date is displayed along with your active subscriptions (in green).

Note: If you need to apply an activation or subscription code, go to **Settings -> System**.



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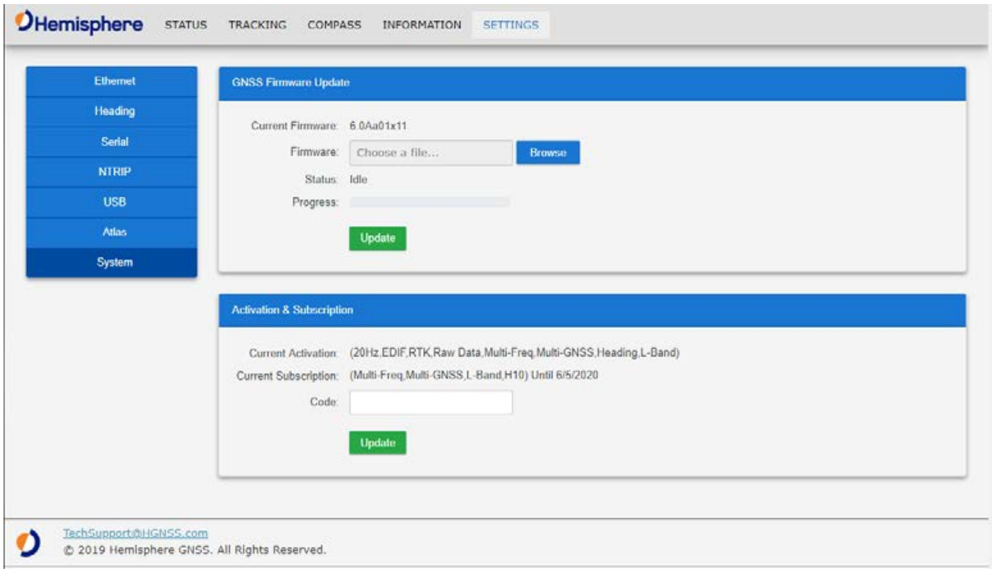
Settings

In the **Settings** window, you can configure the settings for the **Ethernet**, **Serial**, **NTRIP**, **Atlas**, and **System**.



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Settings-Ethernet

The Ethernet properties displayed are:
- IP Address
- Subnet Mask
- Gateway
- Mode

Next to **Mode**, you can click the down-arrow to select from **DHCP** or **Static**. Click **Save** to save your changes, or **Undo** to cancel your changes.

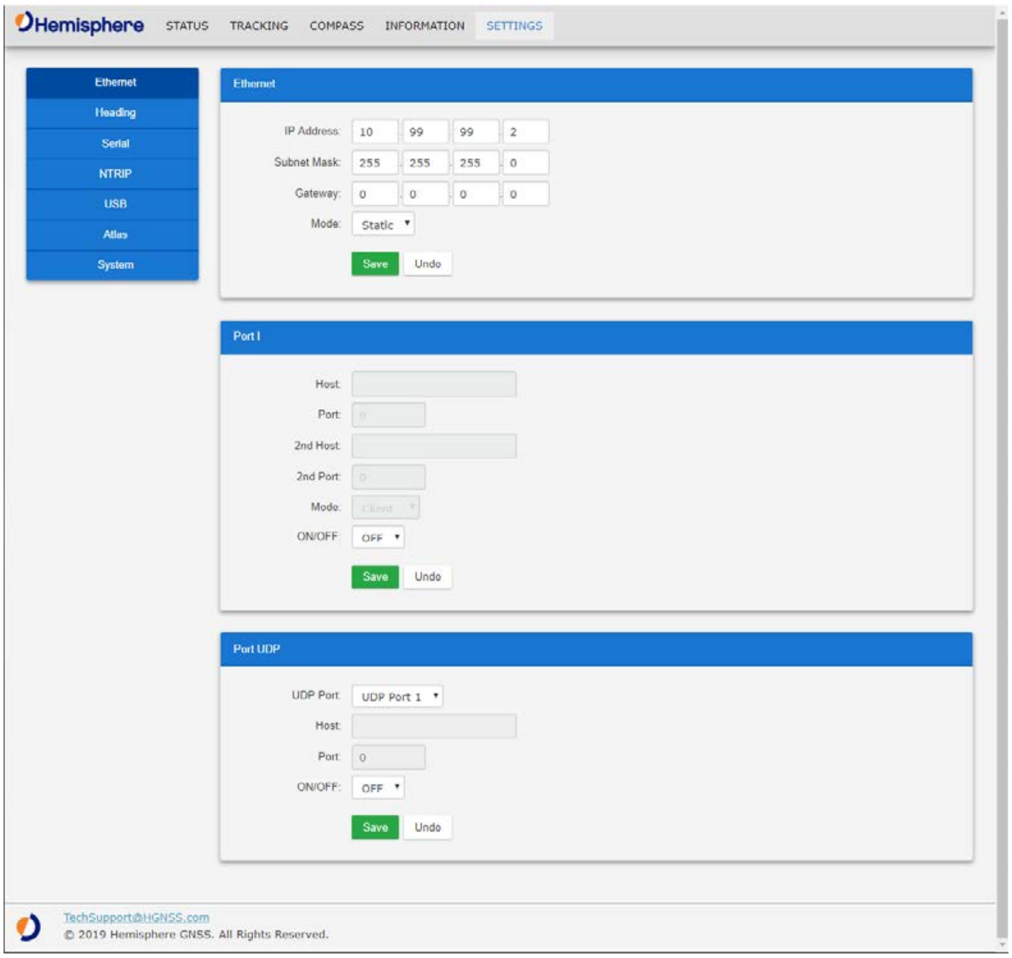
Port I is a TCP/IP port that can be used as either a **Server** mode or **Client** mode. When choosing **Client**, Port I is configured to act as a TCP client, which will connect out to the specified server on the specified port number.

When Port I is set to **Server**, the receiver will act as a TCP server, listening for incoming connections via the specified port number. In both modes this port behaves just like one of the serial port interfaces, and can be used to send or receive corrections, log data, or issue any normal serial commands.

Continued on next page

Settings-Ethernet, continued

Using Port UDP (User Datagram Protocol) provides output of corrections or other messages to be sent in the form of raw UDP packets to a specified **host** and **port**. Individual messages will not be fragmented across UDP packets. The receiver will not respond to any replies via UDP.



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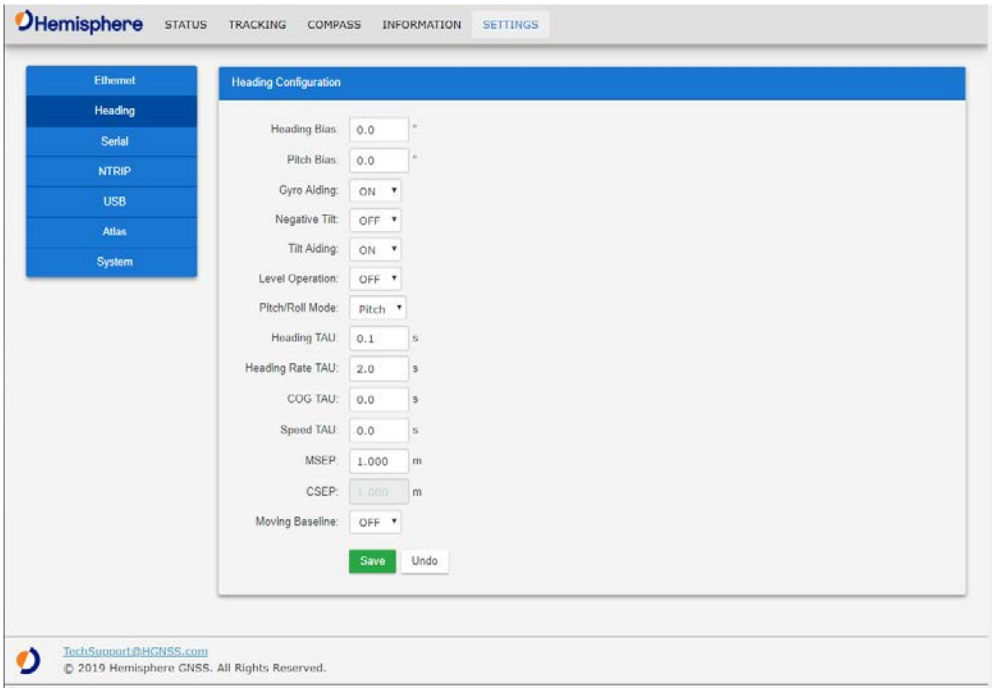
Settings-Heading

Note: Default settings can be changed to set the time constants to smooth heading, Course-over-Ground (COG), and speed measurements.

Click **Save** to save your changes or click **Undo** to cancel your changes.



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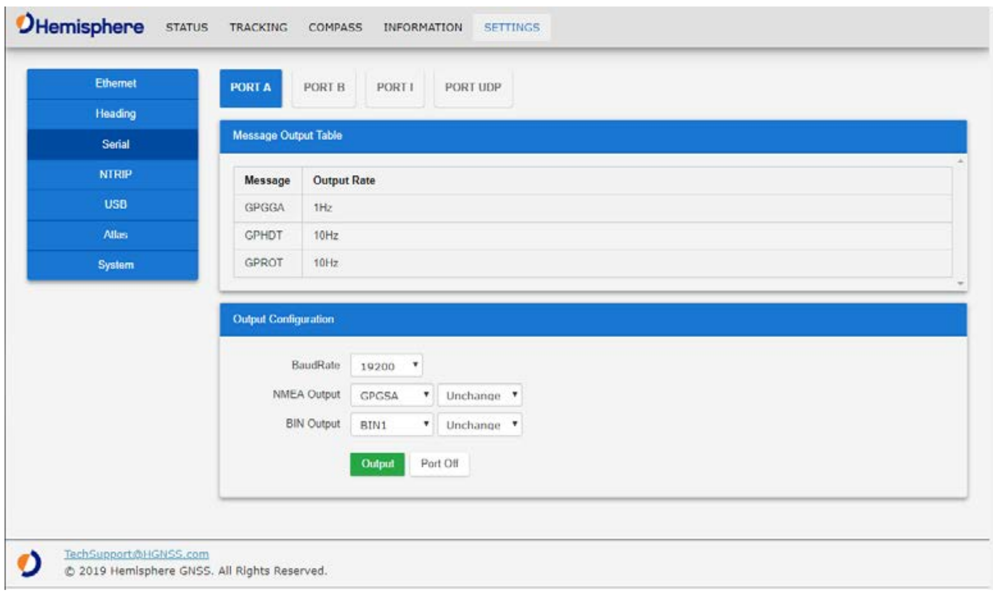
Settings, Serial

Use **Serial Output** to configure the baud rate of each serial port (Port A, Port B, Port I, and Port UDP) and turn off/on specific NMEA 0183 messages and proprietary Hemisphere BIN messages.



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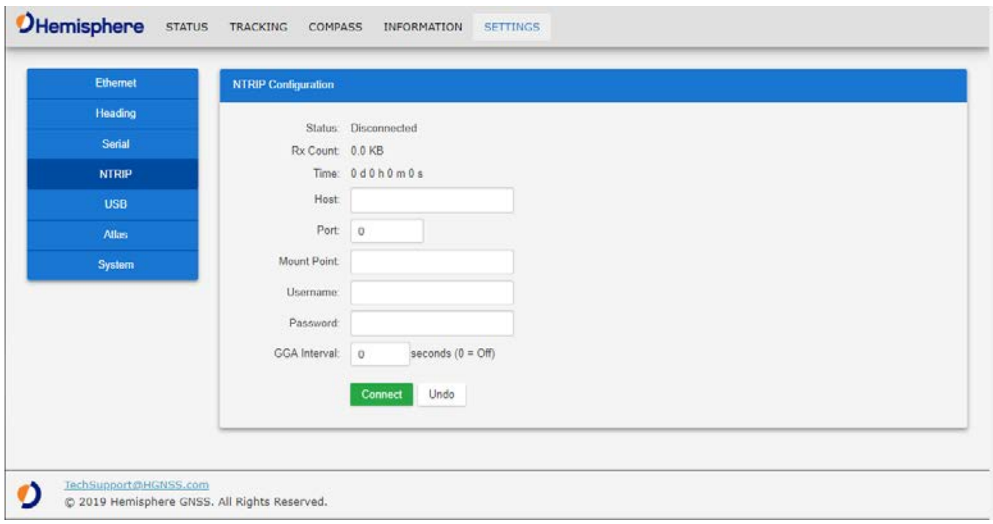
Settings, NTRIP

If your Vega board is on a network that has access to the internet, you can use the built-in NTRIP client and enter credentials for an NTRIP caster.



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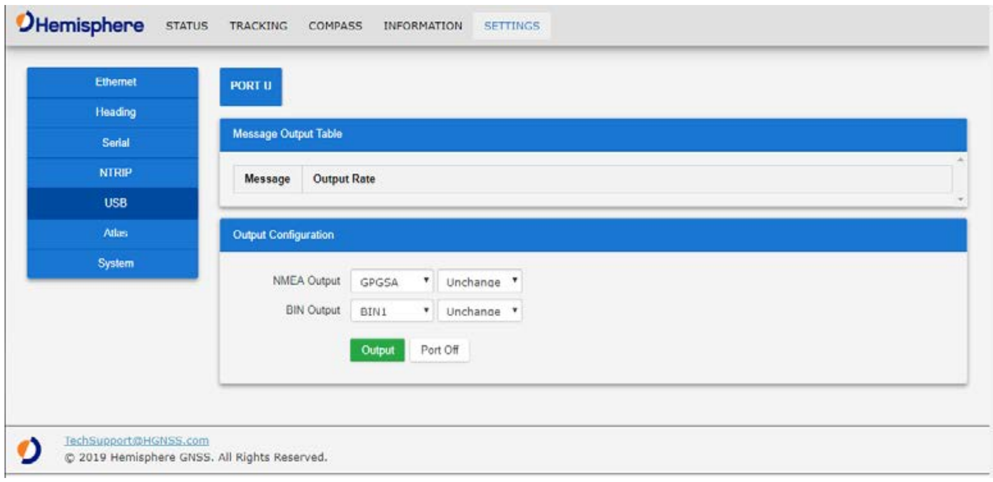
Settings, USB

The **USB** window is used for connecting and logging via Port U. Standard NMEA and Binary messages can be selected with various update rates.



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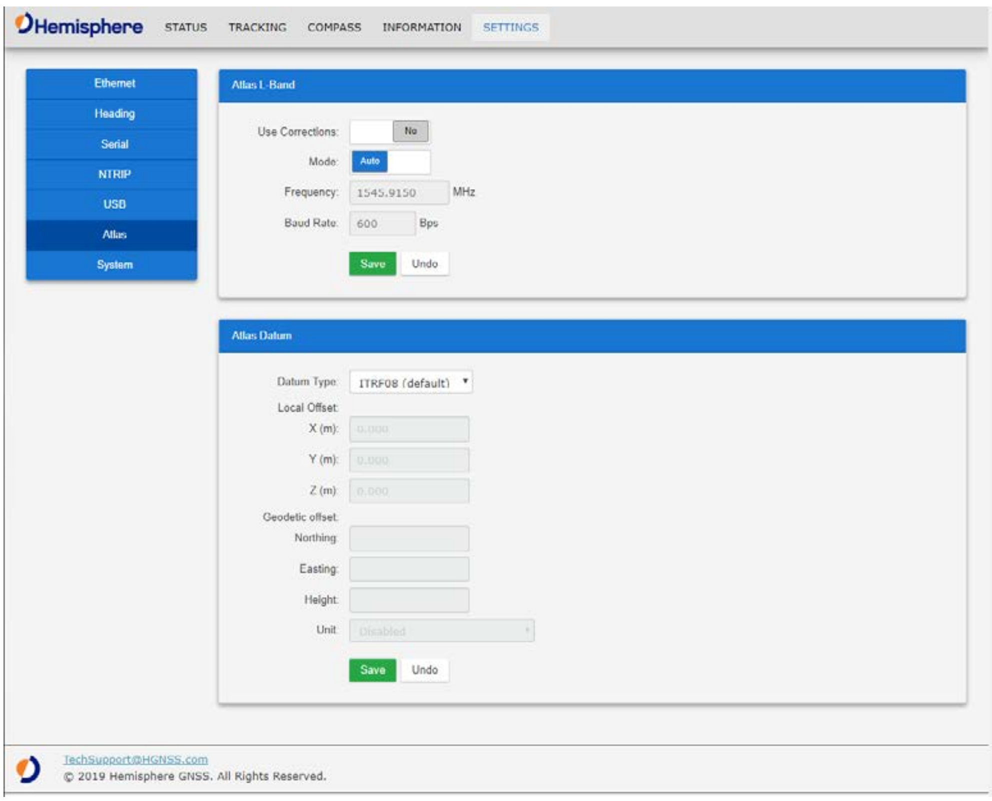
Using the WebUI (Vega 28 and Vega 60 Only), Continued

Settings, Atlas

You can configure the receiver to automatically tune to the correct Atlas satellite for your region (suggested), or manually tune to the satellite of your choice.

For datum, you can choose **ITRF08**, **GDA94**, or you can enter custom **X, Y, Z** ECEF Cartesian offsets (from ITRF08).



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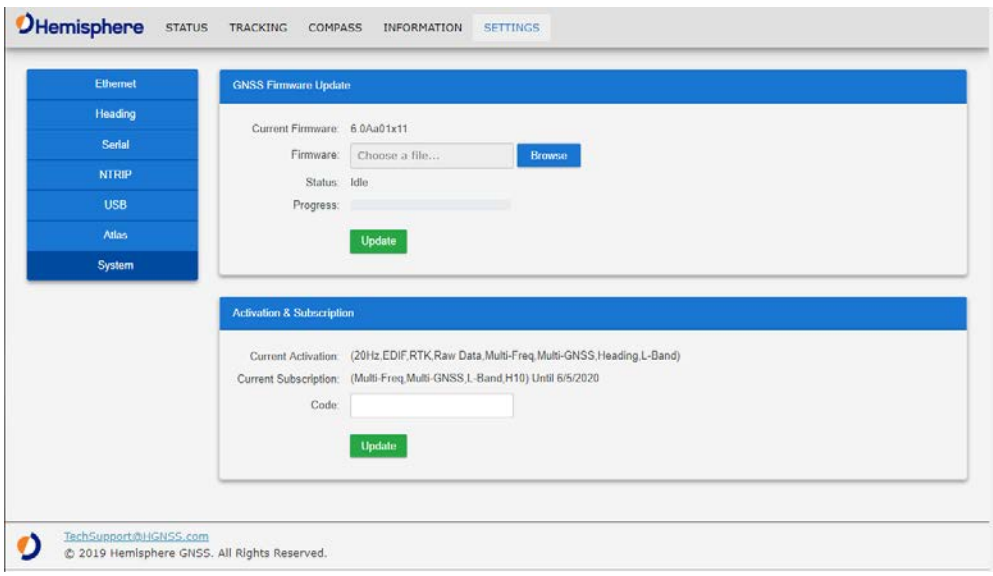
Settings, System

To update firmware, click **Browse**. Choose the file. Click **Update**.

To add an activation or subscription, type the code, and click **Update**.



Appendix A: Troubleshooting

Overview

Introduction

Appendix A provides troubleshooting for frequent questions when operating the Vega boards.

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

Contents

Troubleshooting

Vega troubleshooting

Table A-1: Vega Troubleshooting

Issue	Possible Solution
What is the first thing to check if I have a problem with the operation of the Vega board?	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 board • No communication	• Check receiver power status (this may be done with a multimeter) • Confirm communication with Vega board via Hemisphere query commands: – $JI – $JSHOW – Verify the Vega board is locked to GPS satellites (this can often be done on the receiving device) – Check integrity and connectivity of power and data cable connections

Continued on next page

Troubleshooting, Continued

Vega troubleshooting, continued

Table A-1: Vega Troubleshooting (continued)

Issue	Possible Solution
Random binary data from the Vega board	• Verify the RTCM or Bin messages are not being accidentally output (send a **$JSHOW** command). • Verify that the baud rate settings of Vega board and remote device match. • Potentially, the volume of data requested to be output by the Vega board could be higher than the current baud rate supports. Try using 19200 or higher for the baud rate for all devices.
No GNSS 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 troubleshooting, continued

Table A-1: Vega 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 board 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 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

Troubleshooting, Continued

Vega troubleshooting, continued

Table A-1: Vega 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 on L1-only systems. • **$JATT,SEARCH** command forces the Vega board to acquire a new heading solution. This should also be used after entering a new MSEP value. • **$JATT, GYROAID, YES** Enables 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 series GNSS OEM board technical specifications.

Contents

Vega 28 Technical Specifications

Vega 28 specifications

Tables B1-B7 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, NavIC (IRNSS) and Atlas
Signals Received	**GPS** L1CA/L1P/L1C/L2P/L2C/L5 **GLONASS** G1/G2/G3, P1/P2 **BeiDou** B1i/B2i/B3i/B1C/B2a/B2b/ACEBOC **GALILEO** E1BC/E5a/E5b/E5-AltBOC/E6BC **QZSS** L1CA/L1C/L2C/L5/LEX(L6D and L6E) **NavIC** (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 (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 km/h (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)

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Horizontal accuracy</td><td><table>
<tr><th></th><th>RMS (67%)</th><th>2DMRS (95%)</th></tr>
<tr><td>RTK[1]</td><td>8 mm + 1 ppm</td><td>15 mm + 2 ppm</td></tr>
<tr><td>SBAS[2]</td><td>0.3 m</td><td>0.6 m</td></tr>
<tr><td>Autonomous, no SA[1]</td><td>1.2 m</td><td>2.5 m</td></tr>
<tr><td>Atlas H10 [1, 3]</td><td>0.04 m</td><td>0.08 m</td></tr>
<tr><td>Atlas H30 [1, 3]</td><td>0.15 m</td><td>0.3 m</td></tr>
<tr><td>Atlas Basic [1, 3]</td><td>0.50 m</td><td>1.0 m</td></tr>
</table></td></tr>
<tr><td>Heading (RMS)</td><td>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</td></tr>
<tr><td>Pitch/roll (RMS)</td><td>0.5° RMS</td></tr>
<tr><td>Heave (RMS)[1]</td><td>30 cm RMS (DGNSS) , 5 cm RMS (RTK)</td></tr>
</table>

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 3.3 V CMOS UART 1 x USB Host/Device 1 x Ethernet 10/100Mbps 2 x CAN (NMEA 2000, ISO 11783) 1 x PPS Output 2 x Event input
Interface Level	3.3 V CMOS
UART Baud Rates	4800 – 460,800
Correction I/O Protocol	Hemisphere GNSS proprietary ROX format, RTCM v2.3, RTCM v3.2, CM[4], CMR+[4]
Data I/O Protocol	NMEA 0183, NMEA 2000, Hemisphere proprietary ASCII and Binary
Timing Output	PPS, CMOS, active high, rising edge sync by default, but can be programmed to active low, falling edge sync. Load and capacitance 10K Ω/10 pF
Event Marker Input	CMOS, programmable rising or falling edge sync

Vega 28 Power specifications

Table B-3: Vega 28 Power specifications

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

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	71.1 L x 45.7 W x 10 H (mm) 2.80 L x 1.80 W x 0.40 (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, 2 mm pitch
Antenna connectors (2)	MMCX, female, straight

Continued on next page

Vega 28 Technical Specifications, Continued

Vega 28 L-band receiver specifications

Table B-6: Vega 28 L-band receiver specifications

Item	Specification
Receiver Type	Dual Channel
Channels	1525 to 1560 MHz
Satellite Selection	Manual and Automatic
Reacquisition Time	15 seconds (typical)

Vega 28 Aiding devices

Table B-7: 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 multipath 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]CMR and CMR+ do not cover proprietary messages outside of the typical standard.

Vega 34 Technical Specifications

Vega 34 specifications

Tables B8-B14 provide the technical specifications for the Vega 34 GNSS board.

Vega 34 Receiver specifications

Table B-8: Vega 34 Receiver specifications

Item	Specification
Receiver type	Multi-Frequency GPS, GLONASS, BeiDou, Galileo, QZSS, NavIC (IRNSS) and Atlas
Signals Received	**GPS** L1CA/L1P/L1C/L2P/L2C/L5 **GLONASS** G1/G2/G3, P1/P2 **BeiDou** B1i/B2i/B3i/B1C/B2a/B2b/ACEBOC **GALILEO** E1BC/E5a/E5b/E5-AltBOC/E6BC **QZSS** L1CA/L1C/L2C/L5/LEX (L6D and L6E) **NavIC** (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 (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 km/h (999 kts)
Maximum Altitude	18,288 m (60,000 ft)

Continued on next page

Vega 34 Technical Specifications, Continued

Vega 34 Receiver specifications, continued

Table B-8: Vega 34 Receiver specifications (continued)

Item	Specification		
Horizontal accuracy		**RMS (67%)**	**2DMRS (95%)**
	RTK[1]	8 mm + 1 ppm	15 mm + 2 ppm
	SBAS[2]	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° RMS		
Heave (RMS)[1]	30 cm RMS (DGNSS) , 5 cm RMS (RTK)		

Continued on next page

Vega 34 Technical Specifications, Continued

Vega 34 Communication specifications

Table B-9: Vega 34 Communication specifications

Item	Specification
Ports	4 x full-duplex 3.3V CMOS 2 x USB (1 Host, 1 Device) 2 x CAN (NMEA2000, ISO 11783) 1 x PPS output 2 x Event input
Interface Level	3.3 V CMOS
UART Baud Rates	4800 – 460,800
Correction I/O Protocol	Hemisphere GNSS proprietary ROX format, RTCM v2.3, RTCM v3.2, CMR4, CMR+[4]
Data I/O Protocol	NMEA 0183, NMEA 2000, Hemisphere proprietary ASCII and Binary
Timing Output	PPS, CMOS, active high, rising edge sync by default, but can be programmed to active low, falling edge sync. Load and capacitance 10K Ω/10 pF
Event Marker Input	CMOS, programmable rising or falling edge sync

Vega 34 Power specifications

Table B-10: Vega 34 Power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5% typical
Power consumption	< 2.2 W all signals + L-band, typical
Current consumption	670 mA all signals + L-band, typical
Antenna voltage input	5 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 35 dB typical

Continued on next page

Vega 34 Technical Specifications, Continued

Vega 34 Environmental specifications

Table B-11: Vega 34 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 34 Mechanical specifications

Table B-12: Vega 34 Mechanical specifications

Item	Specification
Dimensions	71 L x 41 W x 10 H (mm) 2.8 L x 1.6 W x 0.4 H (in)
Weight	24 grams (0.85 oz)
Status indication (LED)	Power, Primary and Secondary GNSS lock, Differential lock, DGNSS position, Heading
Power/Data connector	2 x 17-pin male header, 0.05” pitch
Antenna connectors (2)	MCX, female, straight

Continued on next page

Vega 34 Technical Specifications, Continued

Vega 34 L-band receiver specifications

Table B-13: Vega 34 L-band receiver specifications

Item	Specification
Receiver Type	Dual Channel
Channels	1525 to 1560 MHz
Satellite Selection	Manual and Automatic
Reacquisition Time	15 seconds (typical)

Vega 34 Aiding devices

Table B-14: Vega 34 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 multipath 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.
4CMR and CMR+ do not cover proprietary messages outside of the typical standard.

Vega 60 Technical Specifications

Vega 60 specifications

Tables B-15 through B-21 provide the technical specifications for the Vega 60 board.

Vega 60 Receiver specifications

Table B-15: Vega 60 Receiver specifications

Item	Specification
Receiver type	Multi-Frequency GPS, GLONASS, BeiDou, Galileo, QZSS, NavIC (IRNSS) and Atlas
Signals Received	**GPS** L1CA/L1P/L1C/L2P/L2C/L5 **GLONASS** G1/G2/G3, P1/P2 **BeiDou** B1i/B2i/B3i/B1C/B2a/B2b/ACEBOC **GALILEO** E1BC/E5a/E5b/E5-AltBOC/E6BC **QZSS** L1CA/L1C/L2C/L5/LEX(L6D and L6E) **NavIC** (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 (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 km/h (999 kts)
Maximum Altitude	18,288 m (60,000 ft)

Continued on next page

Vega 60 Technical Specifications, Continued

Vega 60 Receiver specifications, continued

Table B-15: Vega 60 Receiver specifications (continued)

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Horizontal accuracy</td><td>
<table>
<tr><th></th><th>RMS (67%)</th><th>2DMRS (95%)</th></tr>
<tr><td>RTK[1]</td><td>8 mm + 1 ppm</td><td>15 mm + 2 ppm</td></tr>
<tr><td>SBAS[2]</td><td>0.3 m</td><td>0.6 m</td></tr>
<tr><td>Autonomous, no SA[1]</td><td>1.2 m</td><td>2.5 m</td></tr>
<tr><td>Atlas H10 [1, 3]</td><td>0.04 m</td><td>0.08 m</td></tr>
<tr><td>Atlas H30 [1, 3]</td><td>0.15 m</td><td>0.3 m</td></tr>
<tr><td>Atlas Basic [1, 3]</td><td>0.50 m</td><td>1.0 m</td></tr>
</table>
</td></tr>
<tr><td>Heading (RMS)</td><td>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</td></tr>
<tr><td>Pitch/roll (RMS)</td><td>0.5° RMS</td></tr>
<tr><td>Heave (RMS)[1]</td><td>30 cm RMS (DGNSS), 5 cm RMS (RTK)</td></tr>
</table>

Continued on next page

Vega 60 Technical Specifications, Continued

Vega 60 Communication specifications

Table B-16: Vega 60 Communication specifications

Item	Specification
Ports	5 x full-duplex 3.3V CMOS 2 x USB (1 Host, 1 Device) 1 x Ethernet 10/100Mbps 2 x CAN (NMEA2000, ISO 11783) 4 x PPS output 4 x Event input
Interface Level	3.3 V CMOS
UART Baud Rates	4800 – 460,800
Correction I/O Protocol	Hemisphere GNSS proprietary ROX format, RTCM v2.3, RTCM v3.2, CMR[4], CMR+[4]
Data I/O Protocol	NMEA 0183, NMEA 2000, Hemisphere proprietary ASCII and Binary
Timing Output	PPS, CMOS, active high, rising edge sync by default, but can be programmed to active low, falling edge sync. Load and capacitance 10K Ω/10 pF
Event Marker Input	CMOS, programmable rising or falling edge sync

Vega 60 Power specifications

Table B-17: Vega 60 Power specifications

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

Continued on next page

Vega 60 Technical Specifications, Continued

Vega 60 Environmental specifications

Table B-18: Vega 60 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 60 Mechanical specifications

Table B-19: Vega 60 Mechanical specifications

Item	Specification
Dimensions	71.1 L x 45.7 W x 10 H (mm) 2.80 L x 1.80 W x 0.40 (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, 2 mm pitch
Antenna connectors (2)	MMCX, female, straight

Continued on next page

Vega 60 Technical Specifications, Continued

Vega 60 L-band receiver specifications

Table B-20: Vega 60 L-band receiver specifications

Item	Specification
Receiver Type	Dual Channel
Channels	1525 to 1560 MHz
Satellite Selection	Manual and Automatic
Reacquisition Time	15 seconds (typical)

Vega 60 Aiding devices

Table B-21: Vega 60 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 multipath 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]CMR and CMR+ do not cover proprietary messages outside of the typical standard.

Appendix C: Frequently Asked Questions

Overview

Introduction

Appendix C contains the answers to questions pertaining to integrating the Vega board series.

Contents

Frequently Asked Questions (FAQ)

Integration

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

Question	Solution
Do I need to use the PPS and event marker?	No, these are not necessary for Vega board operation.
What should I do with the 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.
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 board?	Not necessarily, but you may need to if there are RF interference issues, such as if the Vega board 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 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

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, contact Hemisphere GNSS. 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

Power, communication, and configuration

Question	Solution
My Vega board system does not appear to be communicating.	This could be one of a few issues: • Examine the Vega board cables and connectors for signs of damage or offset. • Ensure the Vega board 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 board is connected to the receive line of the other device. Also, ensure the signal grounds are connected. • If the Vega board 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 board 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 board 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 board?	The **$JSHOW** command will request the configuration information from the Vega board. The response will be similar to: **$>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

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 board 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 board and configure it?	Hemisphere GNSS uses different software applications: • SLXMon - Available at HTTPS://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 multiple Windows platforms. • PocketMax - Available at HTTPS://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

Appendix C: Frequently Asked Questions (FAQ), Continued

GNSS reception and performance

Question	Solution
How do I know what the Vega board is doing?	The Vega boards support 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 boards have surface-mounted status LEDs that indicate receiver status.
Do I have to be careful when using the Vega board to ensure it tracks properly?	For best performance, the Vega board antenna must have a clear view of the sky for satellite tracking. The Vega board 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 board has acquired an SBAS signal?	The Vega board 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 board performs well up to 150 BER. The SLXMon and PocketMax utilities provide this information without needing to use NMEA commands.

Continued on next page

Frequently Asked Questions (FAQ), Continued

SBAS reception and performance

Question	Solution
How do I know if the Vega board is offering a differentially corrected or RTK- corrected position?	The Vega board 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 board 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). Refer to the HGNSS TRM Manual.
Do I need a dual frequency antenna for SBAS?	Hemisphere GNSS recommends using a dual frequency antenna with the Vega board. While some receiver function is possible with an L1-only antenna, full receiver performance will only be realized with a dual frequency antenna.

Continued on next page

Frequently Asked Questions (FAQ), Continued

External corrections

Question	Solution
My Vega board 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 board 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 board's serial port and the signal grounds are connected. • Make sure the Vega board has been set to receive external corrections by issuing the **$JDIFF** command. Refer to the HGNSS TRM.

Continued on next page

Frequently Asked Questions (FAQ), Continued

Installation

Question	Solution
How will the antenna selection and mounting affect Vega board 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 and in a location with the lowest possible multipath. Using a magnetic mount for the antenna will not affect performance. If you are using an antenna from another manufacturer, be mindful all specifications provided in this manual are based off of Hemisphere GNSS antennas, and the results may vary with if you are using an antenna from another manufacturer.

Continued on next page

Frequently Asked Questions (FAQ), Continued

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>**

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End User license agreement, continued

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Warranty Notice

Warranty notice

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Warranty Notice, Continued

Warranty notice, continued

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