Hemisphere®



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H328 Vector Eclipse OEM Board

Integrator Guide

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Device Compliance, License and Patents

Device Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

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

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

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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	

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Device Compliance, License and Patents, Continued

Notice to Customers

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

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H328 Terms & Definitions

Introduction

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

H328 terms & definitions

Term	Definition
1PPS	1 pulse-per-second is a pulse output by the receiver precisely once per second and is used for hardware synchronization.
Activation	Activation refers to a feature added through a one-time purchase. For features that require recurring fees, see Subscription.
Atlas	Atlas is a subscription-based service provided by Hemisphere GNSS.
Base Station	The Base Station is a receiver placed over a familiar point, provides real-time observations, and sends those observations to nearby RTK rovers via UHF radio or the internet.
BeiDou	BeiDou is a Chinese satellite-based navigation system.
Firmware	Firmware is the software loaded into the receiver that controls the functionality of the receiver and runs the GNSS engine.
GALILEO	Galileo is a global navigation satellite system implemented by the European Union and European Space Agency.
GLONASS	Global Orbiting Navigation Satellite System (GLONASS) is a Global Navigation Satellite System deployed and maintained by Russia.
GNSS	Global Navigation Satellite System (GNSS) is a system that provides autonomous 3D position (latitude, longitude, and altitude) and accurate timing globally by using satellites. Current GNSS providers are: GPS, GLONASS and Galileo.

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H328 Terms & Definitions, Continued

H328 terms & definitions, continued

Term	Definition
GPS	Global Positioning System (GPS) is a global navigation satellite system implemented by the United States.
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.
NMEA	National Marine Electronics Association (NMEA) is a marine electronics organization that sets standards for communication between marine electronics.
ROX	ROX is a Hemisphere GNSS propriety RTK message format that can be used as an alternative to RTCM3 when both the base and rover are Hemisphere branded.
RTCM	Radio Technical Commission for Maritime Services (RTCM) is a standard used to define RTK message formats so that receivers from any manufacturer can be used together.
RTK	Real-Time-Kinematic (RTK) is a real-time differential GPS method that provides better accuracy than differential corrections.
SBAS	Satellite Based Augmentation System (SBAS) is a system that provides differential corrections over satellite throughout a wide area or region.
Subscription	A subscription is a feature that is enabled for a limited time. Once the end-date of the subscription has been reached, the feature will turn off until the subscription is renewed.
WAAS	Wide Area Augmentation System (WAAS) is a satellite-based augmentation system (SBAS) that provides free differential corrections over satellite in parts of North America.

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Chapter 1: Introduction

Overview

Introduction

This Integrator Guide helps you integrate your H328 OEM board with your positioning product. You can download this manual from the Hemisphere GNSS website at WWW.HGNSS.COM.

This manual does not cover receiver operation, the PocketMax utility, or commands and messages (NMEA 0183, NMEA2000® or HGPS proprietary). For information on these subjects refer to the Hemisphere GNSS Technical Reference Manual.

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Product Overview

Product overview

The Vector Eclipse H328 is our most advanced GNSS heading and positioning board.

The Vector H328 uses dual antenna ports to create a series of additional capabilities to Eclipse™ Vector technology including fast, high-accuracy heading over short baselines, RTK positioning, onboard Atlas L-band, RTK-enabled heave, low-power consumption, and precise timing. It is well suited for sophisticated machine control and navigation solutions in complex dynamic environments.

The Eclipse™ H328 OEM board is available in the hardware configuration shown in Table 1-1.

Table 1-1: H328 board options

Model	GNSS Systems	L-band
H328™	• GPS L1CA/L1P/L2P/L2C/L5 • GLONASS G1/G2/Pcode (P1/P2) • BeiDou B1/B2/B3 • Galileo E1BC/E5a/E5b • QZSS L1CA	Yes

What's Included in Your Kit

Kit contents

The H328 is available in two configurations:

- H328 OEM board only - designed for integrators who are familiar with Eclipse board integration
- H328 OEM board and H328 adaptor board (by request only P/N 725-1521-0).

For more information on requesting the H328 adaptor board, go to the HGNSS OEM Products page or contact your local dealer.

To access a pdf version of the OEM adapter board schematics, go to the HGNSS Home page/Products/OEM Boards/Position & Heading/Vector™ Eclipse™ H328 OEM Board/H328 Adapter Board Schematics, and click **Open**.

Key Features

Overview

With small form factor, low power consumption, and simple on-board firmware, the H328 is an ideal solution for integrators, offering scalability and expandability from L1 GPS with SBAS to multi- frequency GPS, GLONASS, BeiDou, Galileo and QZSS (with RTK capability).



Key features of the H328 include:

• 744-channel GNSS engine	• Two CAN ports (NMEA2000, ISO-11783)
• Sub-meter horizontal accuracy 95%	• One Ethernet 10/100 TCP/IP
• Raw measurement output (via documented binary messages)	• Event marker input
• Tracer™ technology that provides consistent performance with correction data	• e-Dif®-ready - a base station-free differential positioning
• Position update rates up to 50 Hz	• Three full-duplex serial ports - two 3.3V CMOS UART (one with flow control) and one RS232 with flow control
• One USB device port	• One PPS timing output

Continued on next page

Key Features, Continued

Overview, continued

H328 is offered in the common industry form factor (100L x 60W mm) with integrated L-band. The reliable positioning performance of H328 is further enhanced by Athena RTK, Atlas corrections, aRTK, SureFix and TRACER™ technology.

The dual antenna H328 provides accurate heading with an on-board gyro and tilt sensor that provides heading during short GNSS outages.

With the H328, RTK performance is scalable. The H328 uses the same centimeter-level accuracy in L1- only mode or employs the full performance of fast RTK convergence over long distances with L1/L2/L5 GPS signals. H328 benefits from fewer RTK dropouts in congested environments, faster reacquisition, and more robust solutions due to better cycle slip detection.

Athena RTK

Athena RTK

Athena RTK (Real Time Kinematic) technology is available on Eclipse-based GNSS receivers. This is Hemisphere's most advanced RTK software and can be added to the H328 as an activation.

Athena RTK has the following benefits:

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

Atlas L-band

Atlas L-band is Hemisphere's industry leading correction service, which can be added to the H328 as a subscription. Atlas L-band has the following benefits:

- **Positioning accuracy -** Competitive positioning accuracies down to 4cm 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 4cm to 50cm range
- **Convergence time -** Industry-leading convergence times of 10-40 minutes

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

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

aRTK Position Aiding

aRTK position aiding

aRTK is an innovative feature available in Hemisphere's H328 that greatly mitigates the impact of land-based communication instability.

Powered by Hemisphere's Atlas L-band system service, aRTK augments the ability to maintain an RTK solution when the original RTK data link is lost or interrupted. The aRTK provides an additional layer of communication redundancy to RTK users, assuring that productivity is not impacted by intermittent data connectivity.

H328 receives aRTK augmentation correction data over satellite, while also receiving the land- based RTK correction data. The receiver internally operates with two sources of RTK correction, creating one additional layer of correction redundancy as compared to typical RTK systems.

After a few seconds of RTK correction loss aRTK is established. The receiver uses Atlas corrections in the absence of RTK. This allows for a slower degradation of accuracy until RTK corrections resume.

Firmware

Firmware

The software that runs the H328 is often referred to as firmware since it operates at a low level. You can upgrade the firmware in the field through Ports A, B, or C, as new versions become available.

The H328 currently ships with the Athena based firmware.

Using PocketMax to Communicate with the H328

PocketMax

Hemisphere's PocketMax is a free utility program that runs on your Windows PC or Windows mobile device. Simply connect your Windows device to the H328 via the COM port and open PocketMax.

Simply connect your Windows device to the H328 via a COM port and open PocketMax.

The screens within PocketMax allow you to easily interface with the H328 to:

- Select the internal SBAS, external beacon, or RTCM correction source and monitor reception (beacon optional)
- Configure GPS message output and port settings
- Record various types of data
- Monitor the H328's status and function

PocketMax is available for download from the Hemisphere GNSS website (https://hemispheregnss.com/).

Chapter 2: Integrating the H328

Overview

Introduction

This chapter provides instructions on how to integrate your H328 board to your positioning product.

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H328 Integration

Introduction

Successful integration of the H328 within a system requires electronics expertise that includes:

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

H328 integration requirements

The H328 GNSS engine is a low-level module intended for custom integration with the following general requirements:

- Regulated power supply input: 3.3 VDC ± 3% @ 1.9A maximum continuous
- 2x 3.3V CMOS UART and 1x RS232 serial ports" and "USB device port
- Radio frequency (RF) input to the engine from a GNSS antenna is required to be amplified (10 to 40 dB gain)
- Antenna input impedance is 50 Ω capable of supplying 5VDC @ 75ma for amplified antenna

Message interface

The H328 accepts proprietary ASCII commands over any serial port.

The H328 can output standard NMEA 0183 messages as well as Hemisphere proprietary ASCII messages. The H328 also supports a selection of binary messages, including Hemisphere proprietary.

For more information on NMEA 0183 and Hemisphere proprietary ASCII and binary commands and messages, refer to the Hemisphere GNSS Technical Reference Manual.

Mechanical Layout

H328 mechanical layout

Figure 2-1 shows the mechanical layout for the H328 OEM board. Dimensions are in millimeters (inches) for all layouts.

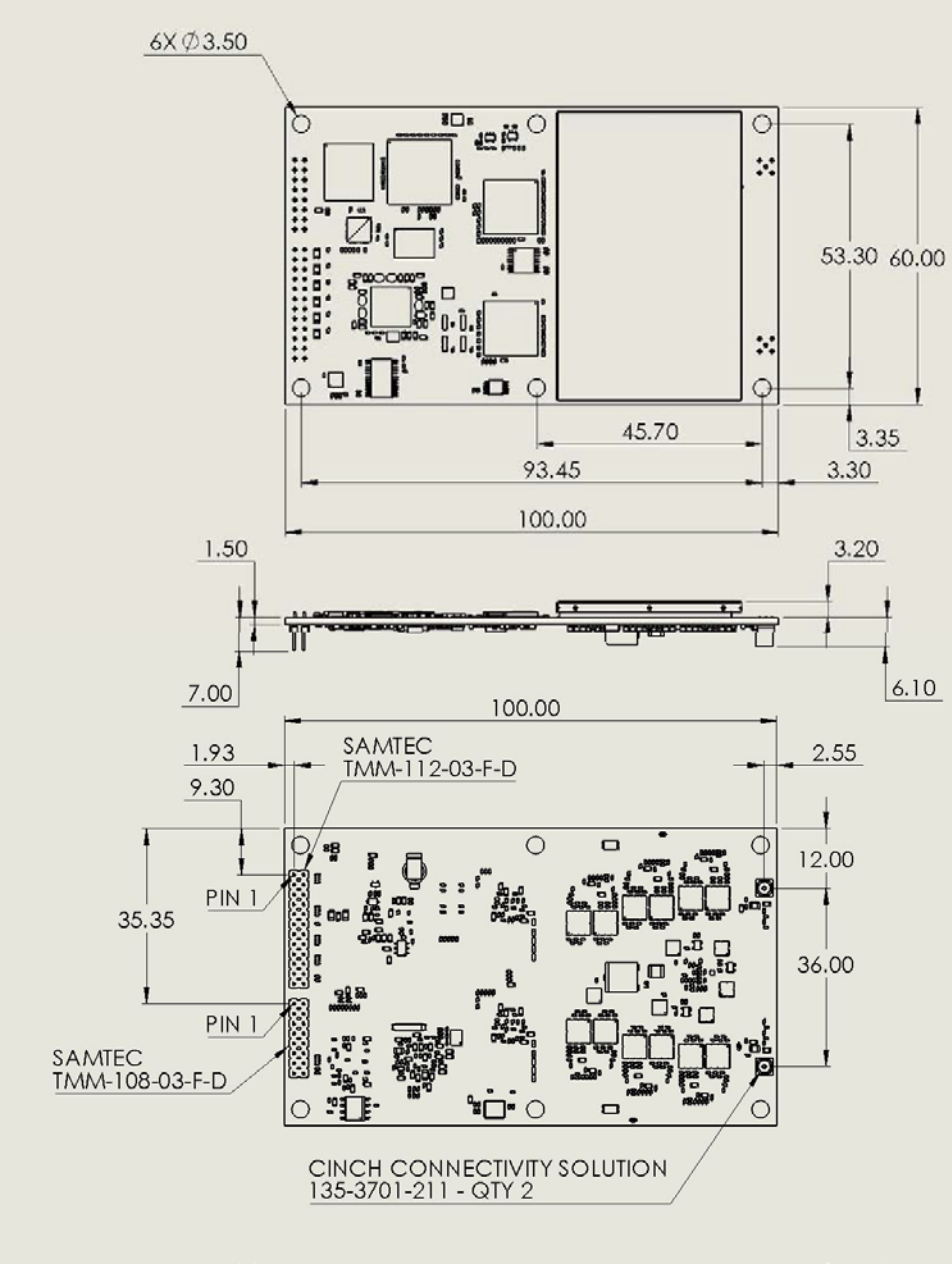


Figure 2-1: Vector Eclipse H328 mechanical layout

Connectors

H328 connectors

Table 2-1 describes H328 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: H328 connectors

Eclipse Board and Connector Type		Through-Hole Connector	Mating Connector
H328	RF	MMCX, female straight jack Emerson (Johnson) 135-3701-211	MMCX, male straight plug
	Power/ data	24-pin (12x2) male header, 0.0787 in (2 mm) pitch Samtec TMM-112-03-G-D	Board Mates: Samtec CLT, ESQT, MMS, SMM, SQT, SQW, TLE Eg: Samtec TLE-112-01-G-DV-K Cable Mates: TCSD
	Power/ data	16-pin (8x2) male header 0.0787 in (2 mm) pitch Samtec TMM-108-03-G-D	Board Mates: Samtec CLT, ESQT, MMS, SMM, SQT, SQW, TLE Eg: Samtec TLE-108-01-G-DV-K Cable Mates: TCSD

Mounting Options

Overview

There are two options for mounting the H328:

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

Direct electrical connection

Place an RF connector, header connector, and mounting holes on the carrier board and then mount the H328 on the standoffs and RF and header connectors. This method is very cost effective as it does not use cable assemblies to interface the H328.

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

The H328 uses a standoff height of 7.0 mm (0.2756 in). With this height, there should be no washers between either the standoff and the H328, or the standoff and the carrier board. You may need to change the standoff height if you select a different header connector.

If you want to use a right angle MMCX connector, use a taller header connector than the Samtec part number suggested in this guide. This will provide clearance to have a right-angle cable-mount connector and reduce the complexity, by not having the carrier board handle the RF signals. See Table 2-1 for H328 connector information.

The mounting holes of the H328 have a standard inner diameter of 3.50 mm (0.138 in).

Indirect electrical connection (cable) method

The second method is to mount the H328 mechanically, so you can connect a ribbon power/data cable to the H328. This requires cable assemblies and there is a reliability factor present with cable assemblies in addition to increased expense.

Header Layouts and Pin-outs

Overview

The H328 uses a dual-row header connector to interface with power, communications, and other signals.

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

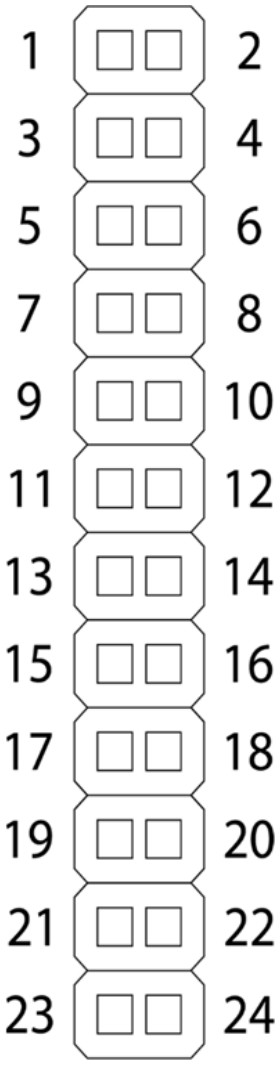


Figure 2-2 Identifying the first pin on the header connector

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Header Layouts and Pin-outs, Continued

H328 24- pin out

The H328 boards have a 24-pin header. Figure 2-3 shows the H328 24-pin header layout and Table 2-2 provides the 24-pin header pin-out.

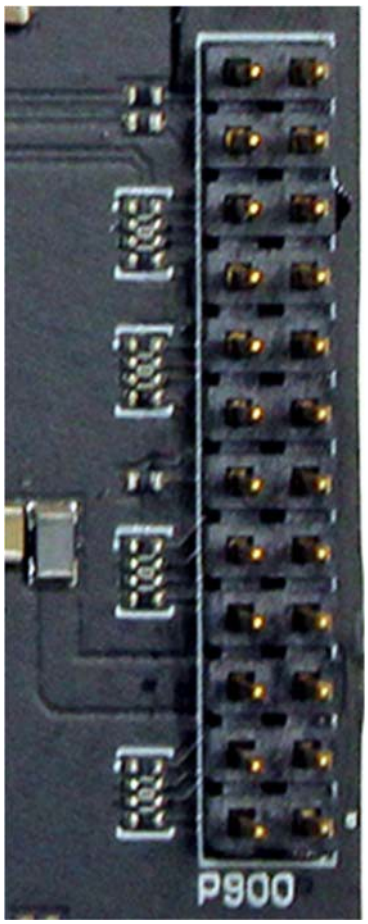


Figure 2-3: H328 24-pin header layout

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Header Layouts and Pin-outs, Continued

Table 2-2 provides the 24-pin header pin-out.

Table 2-2: H328 24-Pin header pin-out

Pin	Name	Signal	Description
1	Ground	Power	Ground
2	Alarm	3.3V CMOS	GPIO Active high
3	Speed	3.3V CMOS	VARF
4	1 PPS	3.3 V CMOS	PPS, Rising Edge
5	Power IN	3.3V	PWR
6	Power IN	3.3V	PWR
7	Port C RX	3.3V CMOS	COM 3_RX
8	Manual Mark	3.3V CMOS	Manual Mark, Falling Edge
9	ERROR	3.3V CMOS	Error Detected. (Not currently supported)
10	PValid	3.3V CMOS	Indicates a valid GNSS position solution is available (Not currently supported)
11	Port B CTS (RS-232/RS-422)	3.3V CMOS	COM2 CTS / SPI
12	RESET	3.3V CMOS	RESET, Active Low
13	Port B RTS (RS-232/RS-422)	3.3V CMOS	COM2 RTS / SPI / Gyro MISO
14	Port B RX (RS-232/RS-422)	3.3V CMOS	COM2 RX
15	Port A CTS (RS-232)	RS-232	COM1 CTS
16	Port B TX (RS-232/RS-422)	3.3V CMOS	COM2 TX
17	Port A RTS (RS-232)	RS-232	COM1 RTS
18	Port A RX (RS-232)	RS-232	COM1 232 RX
19	Port C TX	3.3V CMOS	COM3 TX
20	Port A TX (RS-232)	RS-232	COM1 232 TX
21*	USB D-	USB	USB-
22*	USB D+	USB	USB+
23	Ground	Power	Ground
24	Ground	Power	Ground
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.			

Continued on next page

Header Layouts and Pin-outs, Continued

H328 16-pin out

The H328 board has a 16-pin header. Figure 2-4 shows the Eclipse 16-pin header layout and Table 2-3 provides the Eclipse 16-pin header pin-out.

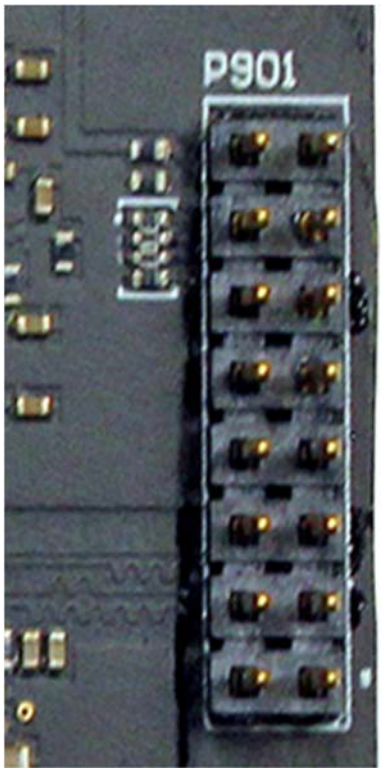


Figure 2-4: Eclipse 16-pin header layout

Continued on next page

Header Layouts and Pin-outs, Continued

Table 2-3 provides the Eclipse H328 16-pin header pin-out.

Table 2-3: H328 16-Pin header pin-out

Pin	Name	Type	Description
1	Ethernet RX-	Ethernet	ENET RX-
2	Ethernet RX+	Ethernet	ENET RX+
3	RDCT	3.3V CMOS	Center tap power for Ethernet magnetics. (Provides a voltage bias for Ethernet)
4	Ethernet TX+	Ethernet	ENET TX+
5	Ethernet TX-	Ethernet	ENET TX-
6	RDCT	3.3V CMOS	Center tap power for Ethernet magnetics. (Provides a voltage bias for Ethernet. Both RDCT pins are connected internally)
7	Ethernet LED	3.3V CMOS	LED A
8	n/c	n/c	n/c
9	Ground	Power	GND
10	CAN1 TX	3.3V CMOS	CAN Transmit Port A
11	CAN1 RX	3.3V CMOS	CAN Receive Port A
12	CAN2 TX / SPI	3.3V CMOS	CAN Transmit Port B / Gyro SCLK
13	CAN2 RX / SPI	3.3V CMOS	CAN Receive Port B / Gyro CS
14	USB ID	3.3V CMOS	USB ID
15	USB VBUS	5V	VBus / Power
16	Ground	Power	Ground
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 disconnected.			

Signals

Overview

This section provides information on the signals available via connectors.

RF Input

The H328 is designed to work with active GNSS antennas with an LNA gain range of 10 to 40 dB. The purpose of the range is to accommodate for losses in the cable system. Essentially, there is a maximum cable loss budget of 30 dB for a 40dB gain antenna. Depending on the chosen antenna, the loss budget will likely be lower (a 24dB gain antenna would have a 14 dB loss budget).

When designing the internal and external cable assemblies and choosing the RF connectors, do not exceed the loss budget; otherwise, you will compromise the tracking performance of the H328.

Ports

Serial ports

The H328 has three serial communication ports:

- **Port A- RS-232**
  - Pin 18 (RX), input, Pin 20 (TX), output Pin 15 (CTS), input Pin 17 (RTS), output
- **Port B- RS-232/RS-422**
  - Pin 14 (RX), input Pin 16 (TX), output Pin 11 (CTS), input Pin 13 (RTS), output
- **Port C- RS-232** Pin 7 (RX), input Pin 19 (TX), output

If serial ports B or C are used for external devices which use RS-232, an RS-232 transceiver is required.

Note: Hardware is capable of flow control with a firmware update.

Continued on next page

Ports, Continued

USB ports

The H328 USB device port: serves as a high-speed data communications port, such as for a PC.

Note: USB OTG ID must be connected to ground for the USB port to operate.

The H328 USB data line is bi-directional and is a differential pair. 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 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.

Note: The USB_ID pin needs to be grounded for the USB port to function.

Ethernet overview

The Hemisphere H328 receiver board has Ethernet support. It is disabled by default, but may be enabled.

The H328 is connected to a carrier board or enclosure which connects the H328's Ethernet pins to a standard RJ-45 jack (with integrated magnetics as appropriate).

Continued on next page

Ports, Continued

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
$> Current Ethernet IP Address: None

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 administrator of the network you wish to connect it to.

To enable Ethernet support with a DHCP-assigned IP address, simply use the command:
$JETHERNET,MODE,DHCP

The receiver will attempt to get an address from the DHCP server on the network. You should be able to see the current IP address reported by a “$JETHERNET” query change.

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 H328 (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

Continued on next page

Ports, Continued

Enabling ethernet services

With Ethernet enabled, you can test sending an ICMP ping to the H328 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 H328 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

Chapter 3: Understanding the H328 OEM Board

Overview

Introduction

This chapter provides information you need to better understand the H328 OEM board and functions.

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Timing Signal

1PPS timing signal

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

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

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

The H328 supports a programmable PPS. Users can select the frequency to 1,2,5 or 10Hz. The H328 can support widths up to 900ms.

The width command parameter is in µs (microseconds).

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

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

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

PPS Width can be controlled using

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

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

Event Marker Input

Event marker input

A GPS solution may need to be forced in an instance, (such as indicating to the GPS receiver when a photo is taken from a camera used for aerial photography), and not synchronized with GPS time, depending on the application.

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

The event marker input is 3.3 V CMOS, active low with falling edge synchronization. The input impedance and capacitance is higher than 10 kΩ and 10 pF respectively, with a threshold of lower than 0.7 V required to recognize the input.

Grounds

Grounds

You must connect all grounds together when connecting the ground pins of the H328. These are not separate analog and digital grounds which require separate attention. Refer to Table 2-1 through Table 2-2 for H328 pin-out ground information.

Speed Radar Output

Speed radar output

Pin 3 relates to the Speed Radar Pulse on the H328:

Speed Radar Pulse - Outputs a square wave with 50% duty cycle. The frequency of the square wave varies directly with speed. 97 Hz represents a speed of 1 m/s (3.28ft./s).

Note: Speed radar output is not essential to normal receiver operation. Do not connect these pins if you do not need this function.

Note: This pin has no form of isolation or surge protection if using the Speed Radar Pulse output. Hemisphere GNSS strongly recommends incorporating some form of isolation circuitry into the supporting hardware.

Contact Hemisphere GNSS Customer Support for an example of an optically isolated circuit.

Shielding

Shielding

The H328 is a sensitive instrument. When integrated into an enclosure, the H328 requires shielding from other electronics to ensure optimal operation.

The H328 shield design consists of a thin piece of metal with specific diameter holes, preventing harmful interference from penetrating, while still allowing air circulation for cooling.

Receiver Mounting

Receiver mounting

The H328 is a precision instrument. To ensure optimal operation, consider mounting the receiver to minimize vibration and shock.

When mounting the H328 immediately adjacent to the GPS antenna, Hemisphere GNSS highly recommends shielding the board from the LNA of the antenna.

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

Antenna Mounting

Antenna mounting

The H328 is compatible with the following Hemisphere GNSS single and dual frequency antennas:

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

When mounting the antennas, consider the following:

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

Mounting Orientation

Mounting orientation

The H328 outputs heading, pitch, and roll readings regardless of the orientation of the antennas.

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

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

Pitch orientation

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

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

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

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

Continued on next page

Mounting Orientation, Continued

Roll orientation

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

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

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

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

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

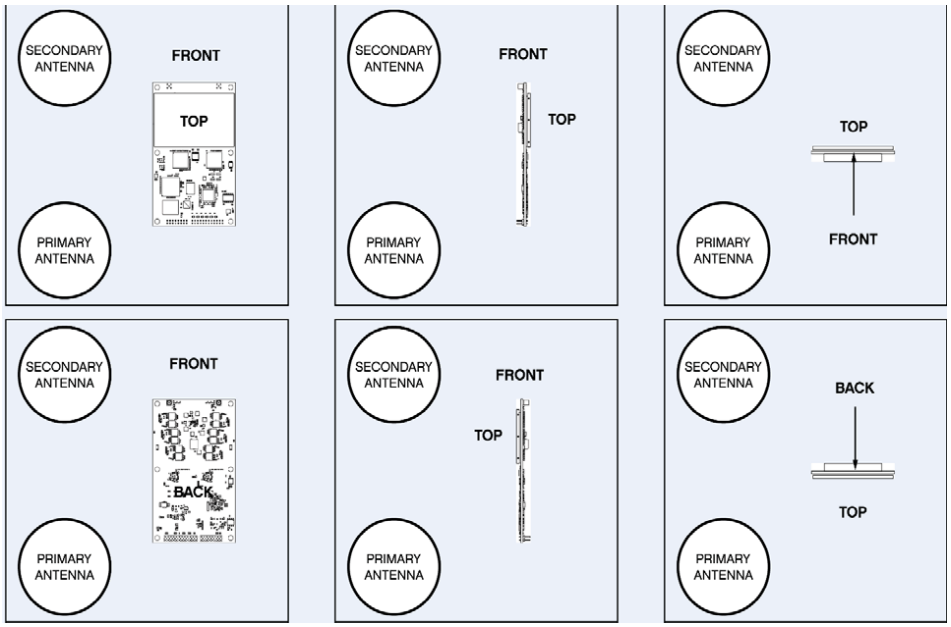
Note: Regardless of which mounting orientation you use, the H328 provides the ability to output the heave of the machine via the $GPHEV message. For more information on this message refer to the Hemisphere GNSS Technical Reference Manual.

H328 Orientation and Sensor Calibration

H328 orientation and sensor calibration

The H328 can determine mounting orientation in 90-degree steps using integrated inertial sensors. This allows the receiver to be installed in various orientations without affecting performance. A simple one-time calibration procedure is required to complete the orientation and sensor calibration:

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



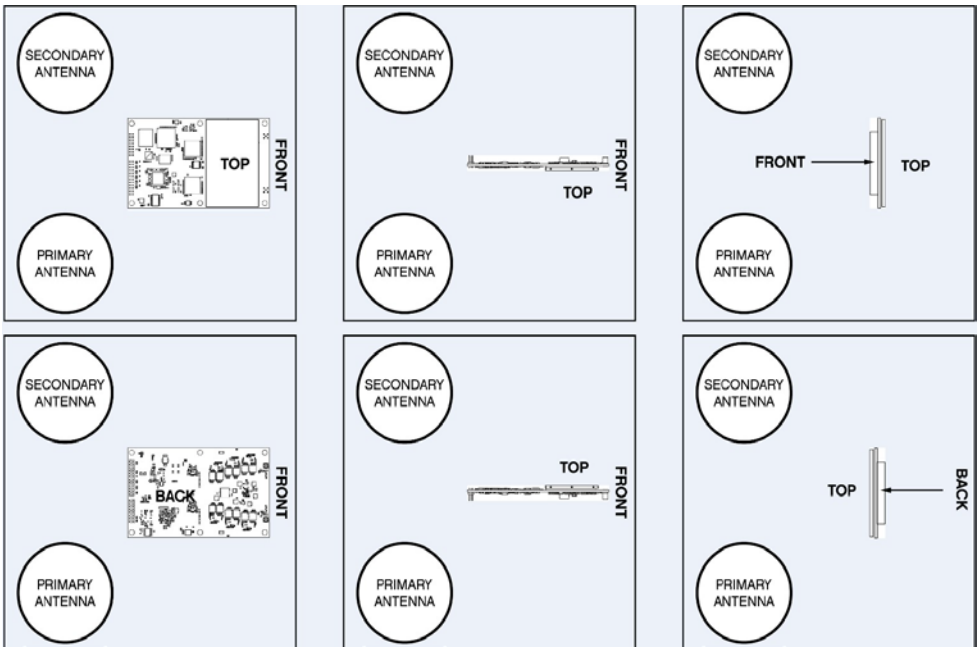
$JATT,ACC90,NO
$JATT,ACC180,NO

Figure 3-1: Group A

Continued on next page

H328 Orientation and Sensor Calibration, Continued

H328 orientation and sensor calibration, continued



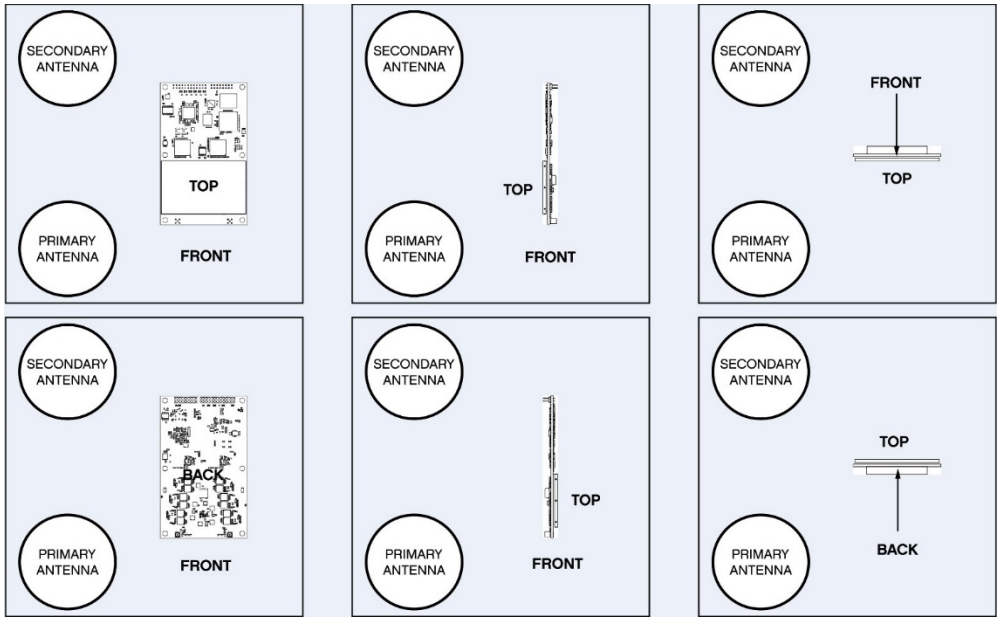
$JATT,ACC90,YES
$JATT,ACC180,NO

Figure 3-2: Group B

Continued on next page

H328 Orientation and Sensor Calibration, Continued

H328 orientation and sensor calibration, continued



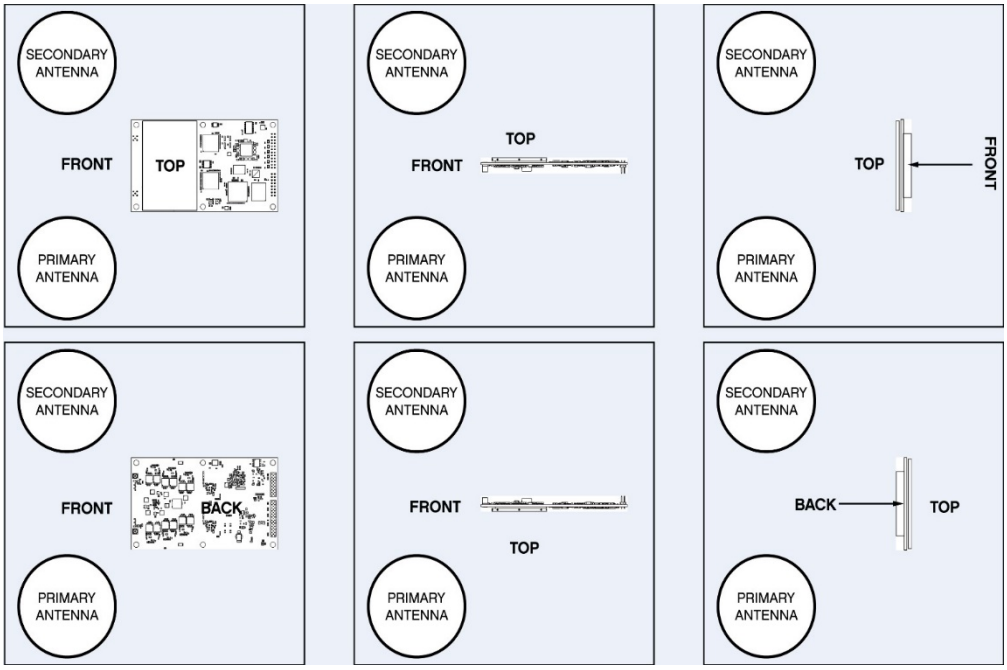
$JATT,ACC90,NO
$JATT,ACC180,YES

Figure 3-3: Group C

Continued on next page

H328 Orientation and Sensor Calibration, Continued

H328 orientation and sensor calibration, continued



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

Figure 3-4: Group D

Planning the Optimal Antenna Placement

Planning the optimal antenna placement

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

Place the antennas:

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

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

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

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

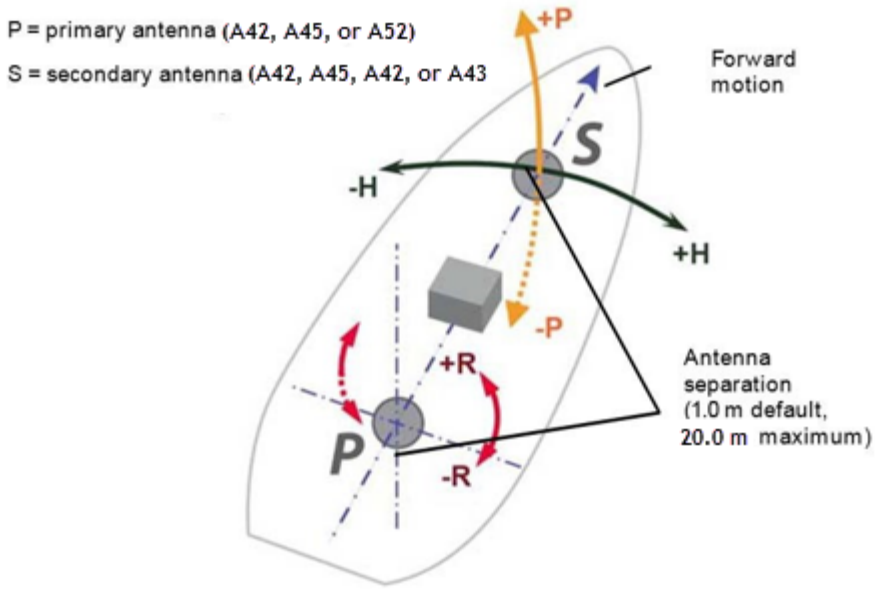


Figure 3-5: Recommended orientation and resulting signs of HPR values

Continued on next page

Planning the Optimal Antenna Placement, Continued

Planning the optimal antenna placement, continued

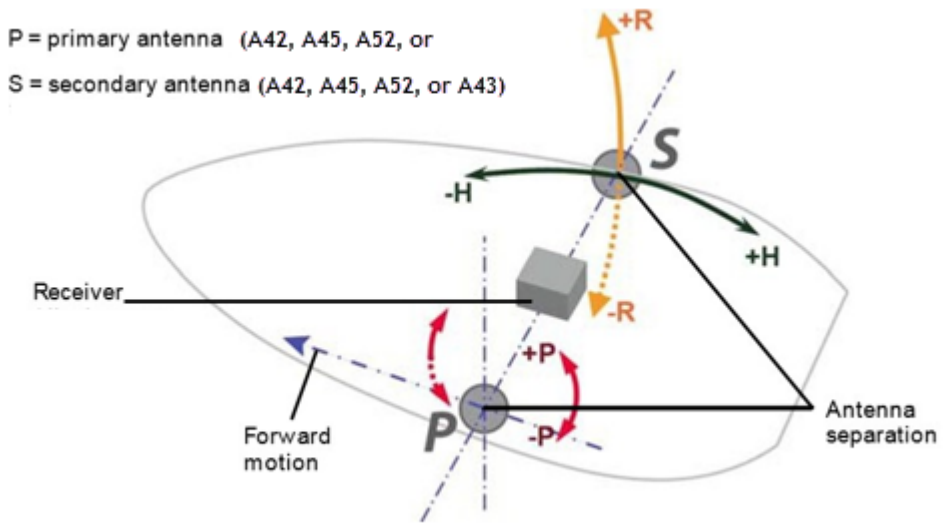


Figure 3-6: Alternate orientation and resulting signs of HPR values

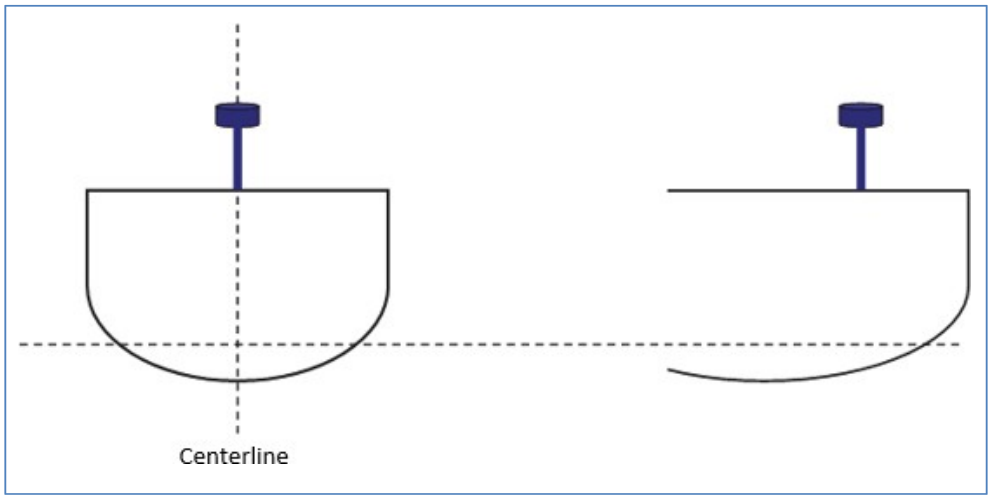


Figure 3-7: Antenna installation: cross-section of boat

Thermal Concerns

Thermal concerns

The H328 receiver will generate heat, and may raise the ambient temperature inside an enclosure. Ensure the internal enclosure temperature does not exceed the maximum operating temperature for the H328.

To achieve maximum dissipation, metal standoffs must be used on all six mounting points of the H328. Users should implement preferred industry standards for heat management.

Note: Thermal design may only be a concern if the integrated product's maximum design temperature is expected to be close to the temperature of the H328.

Chapter 4: Operating the H328

Overview

Introduction

This chapter provides H328 operation information, such as communicating with the H328, firmware, and configuration defaults.

Note: Install the antenna outdoors so it has a clear view of the entire sky. If you place the antenna indoors near a window, for example, you will likely not track a sufficient number of satellites. With a properly installed antenna, the H328 provides a position within approximately 60 seconds.

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TSP2019115123019293_MapTitles	49
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Powering the H328 On/Off

Powering the H328

The H328 is powered by a 3.3 VDC power source. Once you connect appropriate power, the H328 is active. Although the H328 proceeds through an internal startup sequence upon application of power, it is ready to communicate immediately.

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

Communicating with the H328

Communicating with the H328

The H328 features three primary serial ports (Port A, Port B, Port C), which can be configured independently. You can configure the ports for any combination of NMEA 0183, binary, and RTCM SC- 104 data. The default data output is limited to NMEA data messages as these are industry standard.

Configuring the H328

Configuring the H328

You can configure all aspects of H328 operation through any serial port using proprietary commands. For information on these commands refer to the Hemisphere GNSS Technical Reference Manual.

You can configure the following:

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

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

To issue commands to the H328 you will need to connect it to a terminal program or Hemisphere GNSS' software applications (SLXMon or PocketMax).

LED Indicators

Overview

The H328 features the following surface-mounted diagnostic LEDs to indicate board status (see Figure 4-1):

- PWR - Power
- PGNSS – Primary GNSS lock
- SGNSS-Secondary GNSS lock
- DIFF - Differential lock
- DGPS - DGPS position
- HDG-Heading

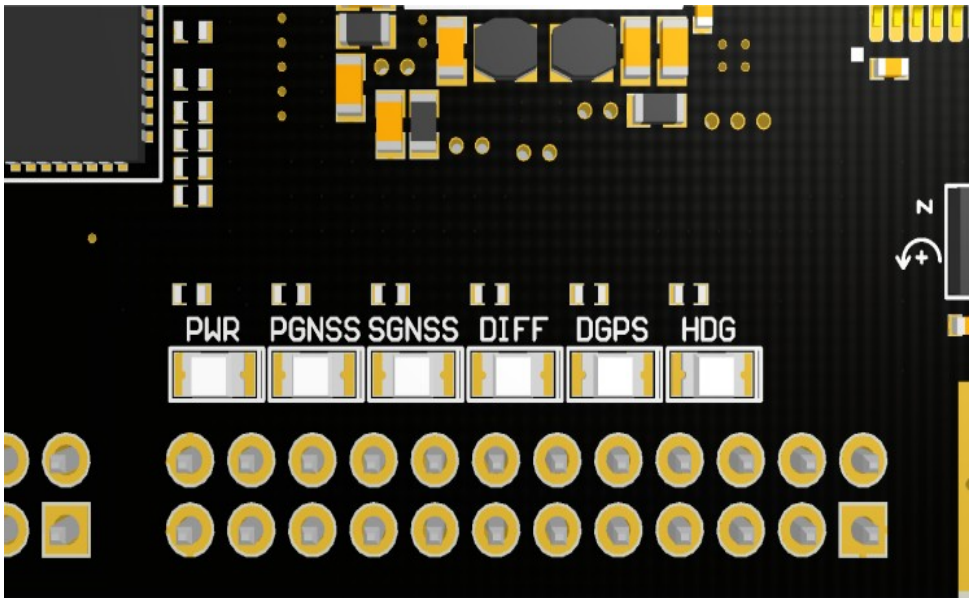


Figure 4-1: Onboard LEDs

Configuring the Data Message Output

Overview

The H328 features three primary bi-directional ports (Ports A, B and C. You can configure messages for all ports by sending proprietary commands to the H328 through any port. For a complete list of commands and messages refer to the Hemisphere GNSS Technical Reference Manual.

'THIS' Port and the 'OTHER' Port

Overview

Both Port A and Port B use the phrases "THIS" and "OTHER" when referring to themselves and each other in commands.

'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>

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>

Continued on next page

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

‘OTHER’ port

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

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

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

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

Saving the H328 Configuration

Saving the H328 configuration

Each time you change the H328’s configuration you may want to save the configuration, so you do not have to reconfigure the receiver each time you power it on.

To save the configuration, issue the $JSAVE command to the H328 using a terminal program or Hemisphere GNSS’ applications (SLXMon or PocketMax).

The H328 will save the configuration to non-volatile memory and indicates (after several seconds) when the configuration has been saved. Refer to the Hemisphere GNSS Technical Reference Manual.

Configuration Defaults

Configuration defaults

Below is the standard configuration for the H328. For more information on these commands refer to the Hemisphere GNSS Technical Reference Manual.

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

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

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

Continued on next page

Configuration Defaults, Continued

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

Appendix A: Troubleshooting

Overview

Introduction

Appendix A provides troubleshooting for H328 operation.

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Troubleshooting

H328 troubleshooting

Table A-1: H328 Troubleshooting

Issue	Possible Solution
What is the first thing to check if I have a problem with the operation of the H328?	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 H328 • No communication	• Check receiver power status (use a Multimeter) • Confirm communication with H328 via Hemisphere query command $JI, $JSHOW • Verify the H328 is locked to GPS satellites (this can often be done on the receiving device or by using SLXMon) • Check integrity and connectivity of power and data cable connections

Continued on next page

Troubleshooting, Continued

H328 troubleshooting, continued

Table A-1: H328 Troubleshooting (continued)

Issue	Possible Solution
Random binary data from the H328	• Verify the RTCM or Bin messages are not being accidentally output (send a $JSHOW command). • Verify the baud rate settings of H328 and remote device match. • Potentially, the volume of data requested to be output by the H328 could be higher than the current baud rate supports. Try using 19200 or higher for the baud rate for all devices.
No GPS Lock	• Check integrity of antenna cable • Verify antenna's view of the sky • Verify the lock status and signal to noise ratio of GPS satellites (this can often be done on the receiving device or by using SLXMon)
No SBAS	• Check antenna cable integrity • Verify antenna's view of the sky, especially towards the SBAS satellites, south in the northern hemisphere. • Verify the bit error rate and lock status of SBAS satellites (this can often be done on the receiving device or by using SLXMon - monitor BER value). • SBAS corrections are only applied to the position, not to the heading. If SBAS lock is lost, you will still have the same heading accuracy, but your position accuracy may be degraded.

Continued on next page

Troubleshooting, Continued

H328 troubleshooting, continued

Table A-1: H328 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 H328 SBAS and lock status (or external source is locked). • Confirm baud rates match an external source correctly • Issue a $JDIFF command and see if the expected differential mode is in fact the current mode. • Differential corrections are only applied to the position, not to the heading. If differential lock is lost, you will still have the same heading accuracy, but your position accuracy may be degraded.

Continued on next page

Troubleshooting, Continued

H328 troubleshooting, continued

Table A-1: H328 Troubleshooting (continued)

Issue	Possible Solution
No heading or incorrect heading values	• Ensure the antennas are connected to the proper ports: J1000 and J2000 are for the primary and secondary antennas. • Heading is from primary to secondary antenna, so the secondary antenna should be toward the bow and primary toward the stern. • Check the measurement of the antenna separation. • The Measured (MSEP) and Calculated (CSEP) values are in meters and should agree to within 1 cm. CSEP continuously changes, so average this reading over several minutes to obtain an approximate value. • Check CSEP value is fairly constant without varying more than 1 cm. Larger variations may indicate a high multipath environment and require moving the antenna locations. • Reduce antenna separation - Hemisphere GNSS recommends the separation between the antennas remain below 5 m for accurate and timely heading reading output • $JATT,SEARCH command forces the H328 to acquire a new heading solution. This should also be used after entering a new MSEP value • $JATT, GYROAID, YES Enable gyro aid as this will give heading for up to 3 minutes in times of GNSS signal loss • Enable tilt aid to reduce heading search times • Check the applications receiver using the $JAPP query; the receiver should answer $JAPP, MFAATT, 1,2 • Monitor the number of satellites and SNR values for both antennas within SLXMON; at least 3 satellites should have SNR values > 20 • Antenna connectors should both be facing the same direction

Appendix B: Technical Specifications

Technical Specifications

Introduction

Appendix B provides the H328 technical specifications.

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H328 Technical Specifications

H328 specifications

Tables B1-B6 provide the technical specifications for the H328.

H328 sensor specifications

Table B-1: H328 Sensor specifications

Item	Specification
Receiver type	GPS, GLONASS, BeiDou, Galileo and QZSS, RTK with carrier phase and L-band dual antenna
Channels	744
Satellites	12 L1CA GPS 12 L1P GPS 12 L2P GPS 12 L2C GPS 15 L5 GPS 12 G1 GLONASS 12 G2 GLONASS 12 G3 GLONASS 22 B1 BeiDou 22 B2 BeiDou 14 B3 BeiDou 12 Galileo E1 12 Galileo E5a 12 Galileo E5b 4 QZSS 3 SBAS or 3 additional L1CA GPS 2 L-band
Primary antenna	GPS L1,L1P,L2C,L2P,L5 GLONASS G1,G2,Pcode BeiDou B1,B2,B3 Galileo E1,E5a,E5b QZSS L1 L-band
Secondary antenna	GPS L1,L1P,L2C,L2P GLONASS G1,G2 BeiDou B1,B2 Galileo E1,E5b QZSS L1 L-band
GPS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	10 Hz standard, 20 Hz and 50 Hz available

Continued on next page

H328 Technical Specifications, Continued

H328 sensor specifications, continued

Table B-1: H328 Sensor specifications (continued)

Item	Specification		
Horizontal accuracy		**RMS (67%)**	**2DMRS (95%)**
	RTK[1,2]	8 mm + 1 ppm	15 mm + 2 ppm
	SBAS (WAAS)[1]	0.3 m	0.6 m
	Autonomous, no SA[1]	1.2 m	2.4 m
Heading accuracy	< 0.17º rms @ 0.5 m antenna separation < 0.09º rms @ 1.0 m antenna separation < 0.04º rms @ 2.0 m antenna separation < 0.02º rms @ 5.0 m antenna separation		
Pitch/roll accuracy	< 1° rms		
Heave accuracy	30 cm[4]		
Rate of turn	145°/s maximum		
Timing (1PPS) accuracy	20 ns		
Cold start time	< 60 s typical (no almanac or RTC)		
Warm start time	< 30 s typical (almanac and RTC)		
Hot start time	< 10 s (almanac, RTC, and position)		
Maximum speed	1,850 km/h (999 kts)		
Maximum altitude	18,288 m (60,000 ft)		
Differential options	SBAS, Autonomous, External RTCM v2.3, RTCM v3.x, L-band (Atlas), and DGPS		
Antenna LNA gain input	10 to 40 dB		

Continued on next page

H328 Technical Specifications, Continued

H328 communication specifications

Table B-2: H328 Communication specifications

Item	Specification
Serial ports	2 full duplex RS-232, 1 full duplex RS-232/RS-422
CAN	2 CAN ports NMEA2000, ISO-11783
Baud rates	4800 - 115200
Data I/O protocol	NMEA 0183, CAN, Hemisphere GPS binary
Correction I/O protocol	Hemisphere GNSS' ROX, RTCM v2.3 (DGPS), RTCM v3 (RTK), CMR, CMR+[3], and Atlas
Timing output	1 PPS CMOS, active high, rising edge sync, 10 kΩ, 10 pF load
Event marker input	CMOS, active low, falling edge sync, 10 kΩ 10 pF load
USB	1 USB Device, OTG with future firmware update
Ethernet	1x 10/100 base-T

H328 power specifications

Table B-3: H328 Power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5%
Power consumption	4.95W Maximum (All signals and L-band)
Current consumption	1.5A Maximum
Antenna voltage input	5 VDC Maximum
Antenna short circuit	Yes
Antenna input	50 Ω

Continued on next page

H328 Technical Specifications, Continued

H328 environmental specifications

Table B-4: H328 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 installed in an enclosure)
Shock and vibration[4]	Vibration: EP455 Section 5.15.1 Random Mechanical Shock: EP455 Section 5.14.1 Operational (when mounted in an enclosure with screw mounting holes used)
EMC[4]	CE (ISO 14982 Emissions and Immunity) FCC Part 15, Subpart B CISPR22

H328 mechanical specifications

Table B-5: H328 Mechanical specifications

Item	Specification
Dimensions	100 L x 60 W x 10 H mm (2.81 L x 1.60 W x 0.40 H in)
Weight	35-37 grams
Status indication (LED)	Power, GNSS lock, Differential lock, DGNSS position, Heading lock
Power/Data connector	24-pin (12x2) male header 0.078 in (2 mm) pitch 16-pin (8x2) male header 0.078 in (2 mm) pitch
Antenna connector	MMCX, female, straight

Continued on next page

H328 Technical Specifications, Continued

H328 L-band sensor specifications

Table B-6: H328 L-band sensor specifications

Item	Specification
Receiver Type	Single Channel
Channels	1525 to 1560 MHz
Sensitivity	140 dBm
Channel Spacing	5.0 kHz
Satellite	Manual and Automatic
Requisition Time	15 seconds (typical)

H328 aiding devices

Table B-7: H328 aiding devices

Device	Description
Gyro	Provides smooth heading, fast heading reacquisition, and reliable < 3° heading for periods up to 3 minutes when loss of GPS has occurred.[5]
Tilt Sensor	Provide pitch and roll data and assist in fast startup and reacquisition of heading solution.

[1] Depends on multi-path environment, number of satellites in view, satellite geometry, and ionospheric activity
[2] Depends also on baseline length
[3] Receive only, does not transmit this format
[4] When integrated in conjunction with the recommended shielding and protection as outlined in this guide
[5] Under static conditions

Appendix C: Frequently Asked Questions

FAQ

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Appendix C: Frequently Asked Questions (FAQ)

Integration

The following is a list of common questions and solutions when integrating the H328 OEM board.

Table C-1: Integration

Question	Solution
Do I need to use the 1 PPS and event marker?	No, these are not necessary for H328 operation.
What should I do with the 1 PPS signal if I do not want to use it?	We recommend you tie to ground through a 1k resistor.
What should I do with the manual mark input if I am not going to use it?	Do not connect the pin because this signal is active low.
Do I need to use the lock indicators?	No, these are present for applications where it is desirable to have an LED visible to the user. These signals need to be transistor-buffered, as these lines can only offer 1 mA. Depending on the product and the application, LEDs can be very useful to the end user. These signals are active low.
Do I need to use a shield-can for the H328?	Not necessarily, but you may need to if there are RF interference issues, such as if the H328 interferes with other devices. A shield-can is a good start in terms of investigating the benefit. If you are designing a smart antenna system, a shield-can is likely needed. Hemisphere GNSS recommends you always conduct an RF pre- scan when integrating OEM boards.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Integration, continued

Table C-1: Integration (continued)

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

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Support and repair

Table C-2: Support and repair

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

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Appendix C: Frequently Asked Questions (FAQ), Continued

Support and repair, continued

Table C-3: Support and repair (continued)

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

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Power, communication, and configuration

Table C-4: Power, communication, and configuration

Question	Solution
My H328 system does not appear to be communicating.	This could be one of a few issues: • Examine the H328 cables and connectors for signs of damage or offset. • Ensure the H328 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 H328 is connected to the receive line of the other device. Also, ensure the signal grounds are connected. • If the H328 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 H328 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

Table C-4: 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 H328 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 H328?	The $JSHOW command will request the configuration information from the H328. 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.

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Appendix C: Frequently Asked Questions (FAQ), Continued

Power, communication, and configuration, continued

Table C-4: 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 H328 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 H328 and configure it?	Hemisphere GNSS uses three different software applications: • SLXMon - Available at www.hgnss.com. This application is a very useful tool for graphically viewing tracking performance and position accuracy, and for recording data. It can also configure message output and port settings. SLXMon runs on Windows 95 or higher. • PocketMax - Available at www.hgnss.com. Similar to SLXMon, you can use this application to graphically view tracking performance and position accuracy, record data, and configure message output and port settings. PocketMax runs on multiple Windows platforms using the Windows .NET framework.

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Appendix C: Frequently Asked Questions (FAQ), Continued

GNSS reception and performance

Table C-5: GNSS reception and performance

Question	Solution
How do I know what the H328 is doing?	The H328 supports standard NMEA data messages. The $GPGSV and Bin99 data messages contain satellite tracking and SNR information. If available, the contained in the $GPGGA message. Additionally, the H328 has surface-mounted status LEDs indicating receiver status.
Do I have to be careful when using the H328 to ensure it tracks properly?	For best performance, the H328 antenna must have a clear view of the sky for satellite tracking. The H328 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 H328 has acquired an SBAS signal?	The H328 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 H328 performs well up to 150 BER. The SLXMon and PocketMax3 utilities provide this information without needing to use NMEA commands.

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Appendix C: Frequently Asked Questions (FAQ), Continued

SBAS reception and performance

Table C-5: GNSS reception and performance (continued)

Question	Solution
How do I know if the H328 is offering a differentially-corrected or RTK- corrected position?	The H328 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 H328 will automatically attempt to track the appropriate SBAS satellites. If multiple satellites are available, the one with the lowest BER value is selected to be used to decode the corrections. You can manually select which SBAS satellites to track (not recommended).
Do I need a dual frequency antenna for SBAS?	Hemisphere GNSS recommends using a dual frequency antenna with the H328. 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

Appendix C: Frequently Asked Questions (FAQ), Continued

External corrections

Table C-6: External corrections

Question	Solution
My H328 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 H328 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 H328's serial port and the signal grounds are connected. • Make sure the H328 has been set to receive external corrections by issuing the $JDIFF command. Refer to the Hemisphere GNSS Technical Reference Manual.

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Appendix C: Frequently Asked Questions (FAQ), Continued

Installation

Table C-7: Installation

Question	Solution
How will the antenna selection and mounting affect H328 performance?	For best results select a multipath-resistant antenna. Ensure the antenna tracks all the available signals for the receiver. Mount the antenna: • With the best possible view of the sky • In a location with the lowest possible multipath • Using a magnetic mount for the antenna will not affect performance.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Installation, continued

Table C-7: Installation (continued)

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

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HEMISPHERE IS NOT RESPONSIBLE FOR PURCHASER’S NEGLIGENCE OR UNAUTHORIZED USES OF THE PRODUCT. IN NO EVENT SHALL Hemisphere GNSS BE IN ANY WAY RESPONSIBLE FOR ANY DAMAGES RESULTING FROM PURCHASER’S OWN NEGLIGENCE, OR FROM OPERATION OF THE PRODUCT IN ANY WAY OTHER THAN AS SPECIFIED IN Hemisphere GNSS's RELEVANT USER’S MANUAL AND SPECIFICATIONS. Hemisphere GNSS is NOT RESPONSIBLE for defects or performance problems resulting from (1) misuse, abuse, improper installation, neglect of Product; (2) the utilization of the Product with hardware or software products, information, data, systems, interfaces or devices not made, supplied or specified by Hemisphere GNSS; (3) the operation of the Product under any specification other than, or in addition to, the specifications set forth in Hemisphere GNSS's relevant User’s Manual and Specifications; (4) damage caused by accident or natural events, such as lightning (or other electrical discharge) or fresh/ salt water immersion of Product; (5) damage occurring in transit; (6) normal wear and tear; or (7) the operation or failure of operation of any satellite-based positioning system or differential correction service; or the availability or performance of any satellite-based positioning signal or differential correction signal.
THE PURCHASER IS RESPONSIBLE FOR OPERATING THE VEHICLE SAFELY. The purchaser is solely responsible for the safe operation of the vehicle used in connection with the Product, and for maintaining proper system control settings. UNSAFE DRIVING OR SYSTEM CONTROL SETTINGS CAN RESULT IN PROPERTY DAMAGE, INJURY, OR DEATH.

Continued on next page

Warranty Notice, Continued

Warranty notice, continued

The purchaser is solely responsible for his/her safety and for the safety of others. The purchaser is solely responsible for maintaining control of the automated steering system at all times. THE PURCHASER IS SOLELY RESPONSIBLE FOR ENSURING THE PRODUCT IS PROPERLY AND CORRECTLY INSTALLED, CONFIGURED, INTERFACED, MAINTAINED, STORED, AND OPERATED IN ACCORDANCE WITH Hemisphere GNSS's RELEVANT USER'S MANUAL AND SPECIFICATIONS. Hemisphere GNSS does not warrant or guarantee the positioning and navigation precision or accuracy obtained when using Products. Products are not intended for primary navigation or for use in safety of life applications. The potential accuracy of Products as stated in Hemisphere GNSS literature and/or Product specifications serves to provide only an estimate of achievable accuracy based on performance specifications provided by the satellite service operator (i.e. US Department of Defense in the case of GPS and differential correction service provider. Hemisphere GNSS reserves the right to modify Products without any obligation to notify, supply or install any improvements or alterations to existing Products.

GOVERNING LAW. This agreement and any disputes relating to, concerning or based upon the Product shall be governed by and interpreted in accordance with the laws of the State of Arizona.

OBTAINING WARRANTY SERVICE. In order to obtain warranty service, the end purchaser must bring the Product to a Hemisphere GNSS approved service center along with the end purchaser's proof of purchase. Hemisphere GNSS does not warrant claims asserted after the end of the warranty period. For any questions regarding warranty service or to obtain information regarding the location of any of Hemisphere GNSS approved service center, contact Hemisphere GNSS at the following address:

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