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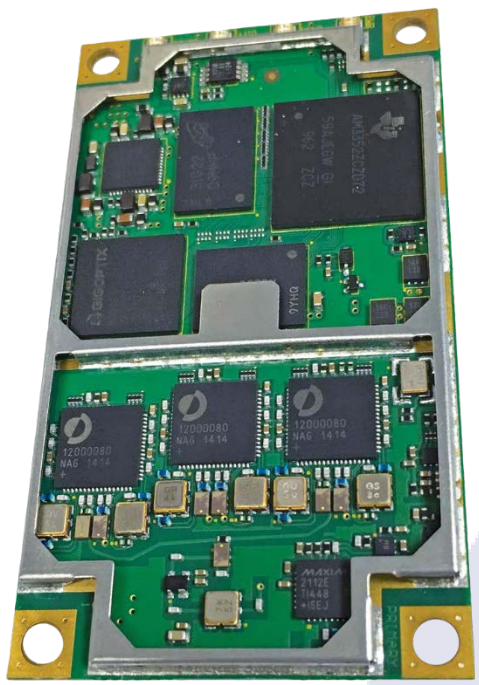

875-0362-0

P326/P327 Eclipse OEM Board

Integrator Guide
Revision: A2
August 2, 2018

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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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	

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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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P326/P327 Terms & Definitions

Introduction

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

P326/P327 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.
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.

Continued on next page

P326/P327 Terms & Definitions, Continued

P326/P327 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 provides information to help you integrate your P326/P327 OEM boards with your positioning product. You can download this manual from the Hemisphere GNSS website at WWW.HGNSS.COM.

Contents

Product Overview

Product overview

The Eclipse™ P326 and P327 OEM boards are available in two models as shown in Table 1-1.

Table 1-1: P326/P327 board options

Model	GNSS Systems	Compatibility	L-band support
P326™	L1CA/L1P/L1C/L2P/L2C/ L5 GPS G1/G2/P code (P1/P2) GLONASS	Hemisphere GNSS' standard pin-out configuration (34-pin)	Yes
	B1/B2 B3 (separate variant without L5) BEIDOU		
	E1BC/E5a/E5b Galileo		
	L1CA/L1C/L2C/L5 QZSS*		
P327	L1CA/L1P/L1C/L2P/L2C/ L5 GPS G1/G2/P code (P1/P2) GLONASS	Industry standard pin- out configuration (20- pin)	Yes
	B1/B2 B3 (separate variant without L5) BEIDOU		
	E1BC/E5a/E5b Galileo		
	L1CA/L1C/L2C/L5 QZSS*		
*Future FW update			

Note: This guide does not cover receiver operation, the PocketMax™ utility, or commands and messages (NMEA 0183, NMEA2000® or HGNSS proprietary).

For information on these subjects refer to the Hemisphere GNSS Technical Reference (go to ***WWW.HGNSS.COM*** and follow the links to Resources & Support, GNSS Reference Guide).

Continued on next page

Product overview, continued

Figure 1-1 P326/P327 OEM Board

Athena RTK

Athena RTK (Real Time Kinematic) technology is available on Eclipse-based GNSS receivers. This is Hemisphere's most advanced RTK processing software and can be added to the P326/P327 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

Continued on next page

Atlas L-band

Atlas L-band is Hemisphere's industry leading correction service, which can be added to the P326/P327 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 4cm to 50cm range
- **Convergence time -** Industry-leading convergence times of 10-40 minutes

For more information

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

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

Continued on next page

Product Overview, Continued

aRTK Position Aiding

aRTK is an innovative feature available in Hemisphere's P326 and P327, that greatly mitigates the impact of land-based communication instability. Powered by Hemisphere's Atlas L-band system service, aRTK provides an additional layer of communication redundancy to RTK users, assuring that productivity is not impacted by intermittent data connectivity.

P326 and P327 receive aRTK augmentation correction data over satellite, while also receiving the land- based RTK correction data. With this, the receiver internally operates with two sources of RTK correction, creating one additional layer of correction redundancy as compared to typical RTK systems.

Once that process is established (which takes only a few seconds), the receiver is able to operate in the absence of either correction source, and continue generating RTK positions in case the land-based RTK correction source becomes unavailable for a period of time.

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TRACER

Most accurate positioning tech-niches such as RTK and Atlas (Hemisphere's L-band global correction service) operate by using a correction data stream source.

One of the limitations in those positioning methods is the need for constant connectivity with the correction source. In most cases, the user receiver needs to receive correction data with very low data interruption to maintain a reasonable position accuracy.

For instance, certain systems in the GNSS market only allow as much as 10 to 20 seconds of signal interruption before RTK level accuracy solution completely stops being provided to the user.

Tracer is a core feature used in Hemisphere GNSS products to sustain positioning in the absence of corrections. With the use of specialized algorithms, Tracer greatly mitigates the impact of correction loss on the system positioning accuracy.

Tracer is of fundamental importance in an environment where connectivity over satellite, radio, or Internet is not stable, as it will for the most part allow users to operate with negligible loss of accuracy during outage periods. The length of the outage and associated performance loss will vary with the positioning technique used, as well as the satellite geometry and interference environment.

Key Features

Overview

With its small form factor, low power consumption, and simple on-board firmware P326 and P327 is an ideal solution for integrators, offering scalability and expandability from L1 GPS with SBAS to L1/L2 GPS, GLONASS, BEIDOU, and Galileo (with RTK capability).

P326 and P327 are offered in common industry form factors:

- P326 is a drop-in replacement for Hemisphere GNSS' Crescent® and mini Eclipse receivers (34-pin) with integrated L-band
- P327 has a mechanical design compatible with popular after-market products (20-pin) with integrated L-band

The reliable positioning performance of P326 and P327 is further enhanced by Athena RTK, Atlas corrections, aRTK, and TRACER™ technology.

With P326 and P327, RTK performance is scalable. Utilize the same centimeter-level accuracy in either L1-only mode, or employ the full performance of fast RTK performance over long distances with L1/L2/L5 GPS signals benefit from fewer RTK dropouts in congested environments, faster reacquisition, and more robust solutions due to better cycle slip detection.

Continued on next page

Key Features, Continued

P326/P327 key features

Key features of the P326/P327 include:

- 394-channel GNSS engine
- Sub-meter horizontal accuracy 95%
- Raw measurement output (via documented binary messages)
- Position update rates of 20 Hz max
- Tracer™ technology that provides consistent performance with correction data
- e-Dif®-ready - a base station-free way of differentially positioning
- Quick times to first fix
- Four full-duplex serial ports
- Two CAN ports (P326 only)
- USB ports
  - USB host (P326 only) and USB device ports
- 1 PPS timing output
- Event marker input

For complete specifications of P326 and P327 boards, see Appendix C Technical Specifications**.**

Continued on next page

What's Included in Your Kit

P326/P327 kit

The P326 and P327 are available in two configurations:

- P326 and P327 OEM boards only - designed for integrators who are familiar with Eclipse board integration
- P326 and P327 OEM boards and Universal Development Kit - designed for integrators who are new to Eclipse board integration

  The Universal Development Kit is designed to work with various Hemisphere GNSS OEM boards and includes an enclosure with carrier board, adapter boards, and various cables.

For more information on the Universal Development Kit visit WWW.HGNSS.COM and navigate to the OEM Products page or contact your local dealer.

Firmware

Firmware

The software that runs the P326 and P327 is often referred to as firmware since it operates at a low level. You can upgrade the firmware in the field through any serial port as new versions become available.

The P326 and P327 currently ships with the Athena based firmware 5.5.0 or higher. Refer to the Hemisphere GNSS Technical Reference (go to www.hgnss.com and follow the links to Resources & Support, GNSS Reference Guide) for information on the querying and talking to the P326 and P327 board.

Using PocketMax to Communicate with the P326/P327

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 P326 and P327 via the COM port and open PocketMax.

The screens within PocketMax allow you to easily interface with the P326 and P327 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 P326 or P327's status and function

PocketMax is available for download from the Hemisphere GNSS website (www.hgnss.com).

Chapter 2: Integrating the P326/P327

Overview

Introduction

This chapter provides instructions on how to integrate your P326/P327 boards to your positioning product.

Contents

P326 and P327 Integration

Introduction

Successful integration of the P326 and P327 within a system requires electronics expertise that includes:

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

P326/P327 integration requirements

The P326 and P327 GPS engine is a low-level module intended for custom integration with the following general integration requirements:

- Regulated power supply input (3.3 VDC ± 3%) and 700 mA continuous
- Low-level serial port (3.3 V CMOS) and/or USB port communications
- Radio frequency (RF) input to the engine from a GNSS antenna is required to be actively amplified (10 to 40 dB gain)
- GPS antenna is powered with a separate regulated voltage source up to 15 VDC maximum
- Antenna input impedance is 50Ω

Message interface

The P326 and P327 use a NMEA 0183 interface, allowing you to easily make configuration changes by sending text-type commands to the receiver.

The P326 and P327 also support a selection of binary messages. There is a wider array of information available through the binary messages, plus binary messages are inherently more efficient with data. If the application has a requirement for raw measurement data, this information is available only in a binary format.

For more information on NMEA 0183 commands and messages as well as binary messages, refer to the Hemisphere GNSS Technical Reference (go to WWW.HGNSS.COM and follow the links to Resources & Support, GNSS Reference Guide).

Mechanical Layout

P326/P327 mechanical layout

Figure 2-1 shows the mechanical layout for the P326 OEM board. Figure 2-2 shows the mechanical layout for the P327 OEM board.

Dimensions are in millimeters (inches) for all layouts.

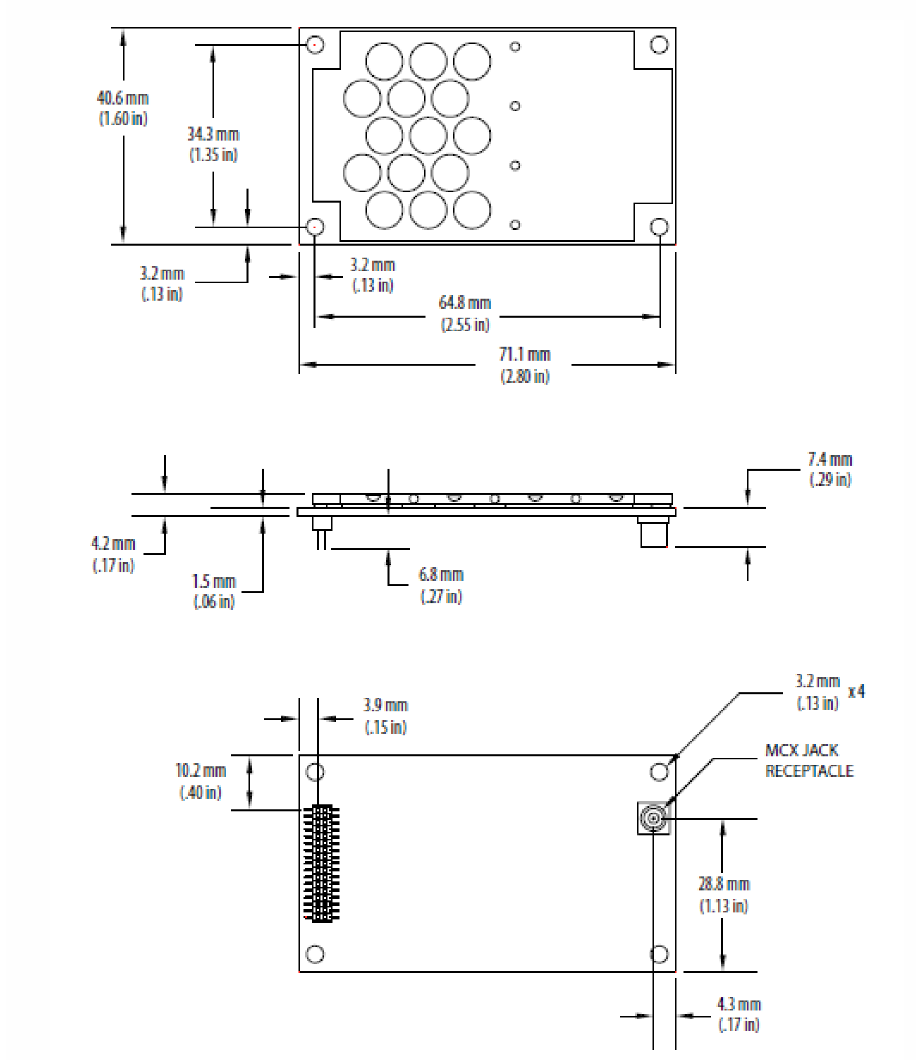

Figure 2-1: Eclipse P326 mechanical layout

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Mechanical Layout, Continued

P326/P327 mechanical layout, continued

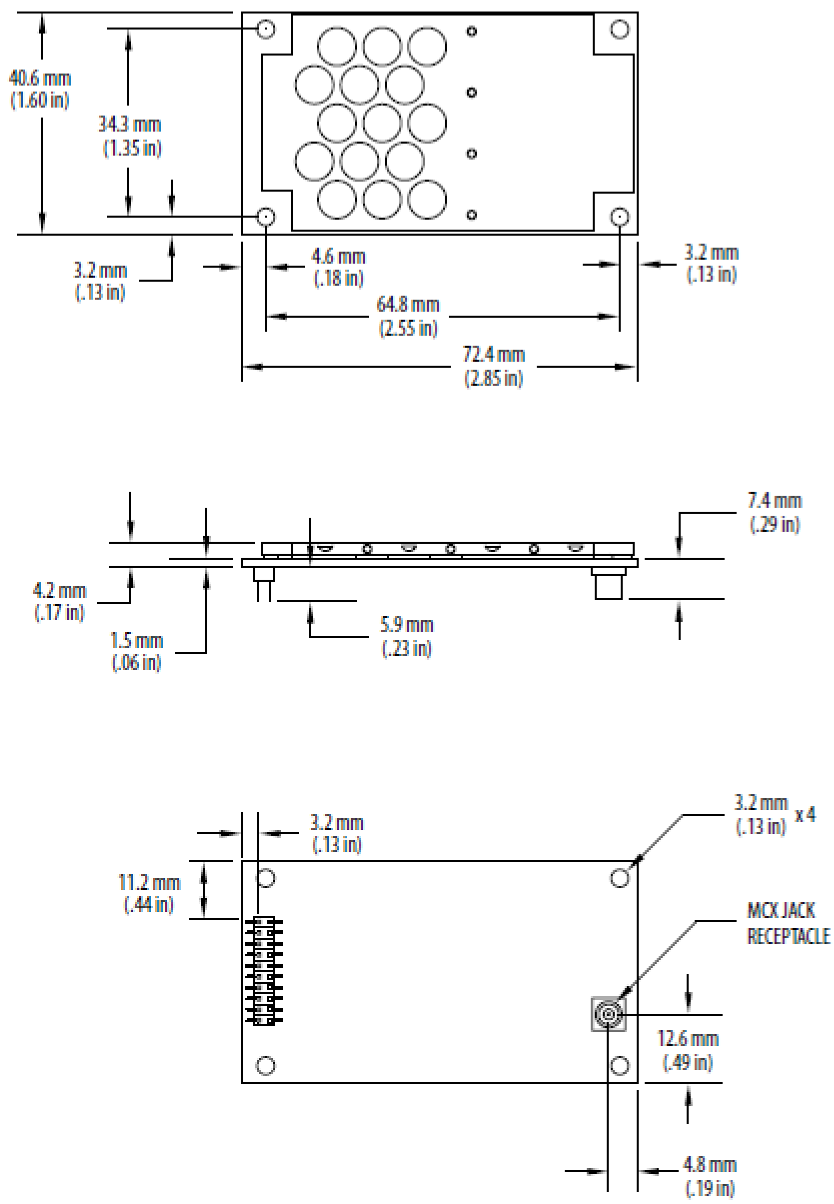

Figure 2-2: Eclipse P327 mechanical layout

Connectors

P326/P327 connectors

Table 2-1 describes P326 and P327 connectors and mating connectors. You can use different compatible connectors; however, the requirements may be different. The antenna input impedance is 50Ω.

Table 2-1: P326 and P327 connectors

Eclipse Board and Connector Type		SMT Connector	Mating Connector
P326	RF	MCX, female straight jack Emerson (Johnson) 133-3711-202	MCX, male straight plug Samtec RSP-127824-01
	Power/ data	34-pin (17x2) male header, 0.05 in (1.27 mm) pitch Samtec FTSH-117-04-L-DV	17x2 female SMT header socket, 0.05 in (1.27 mm)pitch Samtec FLE-117-01-G-DV
P327	RF	MCX, female straight jack Emerson (Johnson) 133-3711-202	MCX, male straight plug Samtec RSP-127824-01
	Power/ data	20-pin (10x2) male header, 0.08 in (2 mm) pitch Samtec TMM-110-01-T-D-SM	10x2 female SMT header socket, 0.08 in (2 mm)pitch Samtec TLE-110-01-G-DV
Note: For the Samtec FTSH headers, '-04' indicates 0.150" posts.			

Mounting Options

Overview

There are two options for mounting the P326 and P327:
- 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 P326 and P327 on the standoffs and RF and header connectors. This method is very cost effective as it does not use cable assemblies to interface the P326 and P327.

> **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.
>
> Use metal standoffs, bolts, nuts or screws. Plastic or nylon standoffs are not appropriate for vibration concerns. PCB snap-in place standoffs shall be avoided. The pressure and snapping action put undue stress on the board and compromise solder integrity. In addition, metal standoffs help heat dissipate off the GNSS board.

The P326 and P327 uses a standoff height of 7.9 mm (5/16 in or 0.3125 in). With this height, there should be no washers between either the standoff and the P326 or the standoff and the carrier board; otherwise, you must make accommodations. You may need to change the standoff height if you select a different header connector.

If you want to use a right angle MCX connector, use a taller header 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 P326 and P327 connector information.

Continued on next page

Mounting Options, Continued

Direct electrical connection, continued

The mounting holes of the P326 and P327 have a standard inner diameter of 3.2mm (0.125 in).

Indirect electrical connection (cable) method

The second method is to mount the P326 and P327 mechanically so you can connect a ribbon power/data cable to the P326 and P327. 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 P326 and P327 use 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 (see Figure 2-3).The pins are then sequentially numbered per row from top-to-bottom.

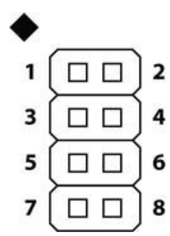

Figure 2-3: Identifying the first pin on the header connector

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Header Layouts and Pin-outs, Continued

P326 Header and pin-out

The P326 boards have a 34-pin header. Figure 2-4 shows the P326 34-pin header layout.

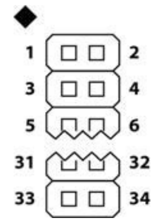

Figure 2-4: P326 34-pin header layout

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Header Layouts and Pin-outs, Continued

P326 Header and pin-out, continued

Table 2-2 provides the P326 34-pin header pin-out.

Table 2-2: P326 34-pin header pin-out

Pin	Name	Type	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	Batt Backup	Power	Power, 1.5 to 5.5 V, 500 nA typical
5	USB DEV+	I/O	USB device data +
6	USB DEV–	I/O	USB device data -
7	GND	Power	Receiver ground
8	GND	Power	Receiver ground
9	PATX	Output	Port A serial output, 3.3 V CMOS, idle high
10	PARX	Input	Port A serial input, 3.3 V CMOS, idle high
11	PBTX	Output	Port B serial output, 3.3 V CMOS, idle high
12	PBRX	Input	Port B serial input, 3.3 V CMOS, idle high
13	PDTX	Output	Port D serial output, 3.3 V CMOS, idle high
14	PDRX	Input	Port D serial input, 3.3 V CMOS, idle high
15	1 PPS	Output	Active high, rising edge, 3.3 V CMOS
16	Manual Mark	Input	Active low, falling edge, 3.3 V CMOS
17	GPS Lock	Output	Status indicator, 3.3 V CMOS, active low
18	Diff Lock	Output	Status indicator, 3.3 V CMOS, active low

Continued on next page

Header Layouts and Pin-outs, Continued

P326 Header and pin-out, continued

Table 2-2: P326 34-pin header pin-out (continued)

Pin	Name	Type	Description
19	DGPS Lock	Output	Status indicator, 3.3 V CMOS, active low
20	n/c	n/c	n/c
21*	TX CAN A (default) /GPIO0	Output*	Selectable between, CAN A transmit (default)/ General purpose (input/output)
22*	TX CAN B (default) /GPIO1	Output*	Selectable between, CAN B transmit (default)/ General purpose (input/output)
23*	RX CAN A/GPIO2	Input*	Selectable between, CAN A receive (default)/ General purpose (input/output)
24*	RX CAN B/GPIO3	Input*	Selectable between, CAN B receive (default)/ General purpose (input/output)
25	Speed Output	Output	0 - 3 V variable clock output
26	Speed Ready	Output	Active low, speed valid indicator, 3.3 V CMOS
27	GND	Power	Receiver ground
28	GND	Power	Receiver ground
29	USB HOST D+	I/O	USB HOST data +

Continued on next page

Header Layouts and Pin-outs, Continued

P326 Header and pin-out, continued

Table 2-2: P326 34-pin header pin-out (continued)

Pin	Name	Type	Description
30	USB HOST D-	I/O	USB HOST data -
31	PCTX	Output	Port C serial output, 3.3 V CMOS, idle high
32	PCRX	Input	Port C serial input, 3.3 V CMOS, idle high
33	n/c	n/c	n/c
34	Reset	Input	Reset, 3.3 V typical, not required

**Selectable pin with input/output option*

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.

Header Layouts and Pin-outs, Continued

P327 Header and pin-out

The P327 board has a 20-pin header. Figure 2-5 shows the Eclipse P327 20-pin header layout.

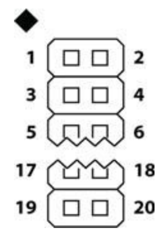

Figure 2-5: Eclipse P327 20-pin header layout

Table 2-3 provides the Eclipse P327 20-pin header pin-out.

Table 2-3: P327 20-pin header pin-out

Pin	Name	Type	Description
1	Antenna Pwr	Power	Antenna power, DC, 15 V max
2	3.3 V	Power	Receiver power supply, 3.3V
3	USB DEV–	I/O	USB device data -
4	USB DEV+	I/O	USB device data +
5	Reset	Open collector	Reset, open collector, 3.3 V typical, not required
6	PCRX	Input	Port C serial input, 3.3 V CMOS, idle high
7	PCTX	Output	Port C serial output, 3.3 V CMOS, idle high
8	PDRX	Input	Port D serial input, 3.3 V CMOS, idle high
9	PDTX	Output	Port D serial output, 3.3 V CMOS, idle high

Continued on next page

Header Layouts and Pin-outs, Continued

P327 Header and pin-out, continued

Table 2-3: P327 20-pin header pin-out (continued)

Pin	Name	Type	Description
10	GND	Power	Receiver ground
11	PATX	Output	Port A serial output, 3.3 V CMOS, idle high
12	PARX	Input	Port A serial input, 3.3 V CMOS, idle high
13	GND	Power	Receiver ground
14	PBTX	Output	Port B serial output, 3.3 V CMOS, idle high
15	PBRX	Input	Port B serial input, 3.3 V CMOS, idle high
16	GND	Power	Receiver ground
17	Manual Mark	Input	Active low, falling edge, 3.3 V CMOS
18	GND	Power	Receiver ground
19	1 PPS	Output	Active high, rising edge, 3.3 V CMOS
20	Position Valid Indicator	Output	Status indicator, 3.3 V CMOS, active low

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.

Signals

Overview

This section provides information on the signals available via connectors.

RF Input

The P326 and P327 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 40 dB gain antenna. Depending on the chosen antenna, the loss budget will likely be lower (a 24 dB 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 P326 and P327.

Ports

Serial ports

The P326 and P327 have four serial communication ports:

- Port A, Port B, Port C - main ports
- Port D - Exclusively used to interface with the SBX beacon board or an external corrections source or RTK communications. This port will not output normal GPS-related NMEA messages. When communicating into either Port A, B, or C, a virtual connection may be established to the device on Port D using the $JCONN command. See “Communication Port D” below for more information on Port D.

The P326 and P327 serial ports’ 3.3 V CMOS signal level can be translated to interface to other devices. For example, if serial Ports A, B, and/or C are used to communicate to external devices (such as PCs) you must translate the signal level from 3.3 V CMOS to RS-232.

Communication port D

Port D is exclusively for external DGPS correction input to the P326 and P327, such as from Hemisphere GNSS’ SBX beacon board and RTK communication.

Continued on next page

USB ports

The P326 has both a USB host port and a USB device port.

The P327 has only a USB device port:

- USB device port (data communication) shown in Figure 2-6 serves as a high-speed data communications port, such as for a PC
- USB host port (data storage) shown in Figure 2-7 serves as a data storage port, such as with a USB flash drive

The USB data lines are bidirectional 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.

Device can use USB Type-B or Mini-B connectors. If Mini-B is used, “ID” pin 4 is NOT CONNECTED.

Normally, a device uses 5 V; however, since Eclipse uses more than 900 mA (2.5 W) it cannot use the BUS-supplied 5 V and therefore it is not connected.

Host shall use USB Type-A connector. If Mini-A is used, “ID” pin 4 is tied to GROUND.

Mini-A connectors are not widely used and this defeats the purpose and usability of USB drives and typical accessories.
Host port should provide at least 500 mA (2.5W) of power at all times.

Continued on next page

CAN

CAN transceiver

A CAN Transceiver is required. The P326 CAN RX and CAN TX are 3.3V CMOS pins. The P326 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 P326 does not connect to this portion of the transceiver.

Example devices are the TI SN65HVD233 (see Figure 2-8). CAN TX shall be connected to the CAN transceiver "CAN Transmit Data Input". CAN RX shall be connected to the CAN transceiver "CAN Receive Data Output". Slope control is not a design parameter determined by the P326 and is dependent on Integrator's application.

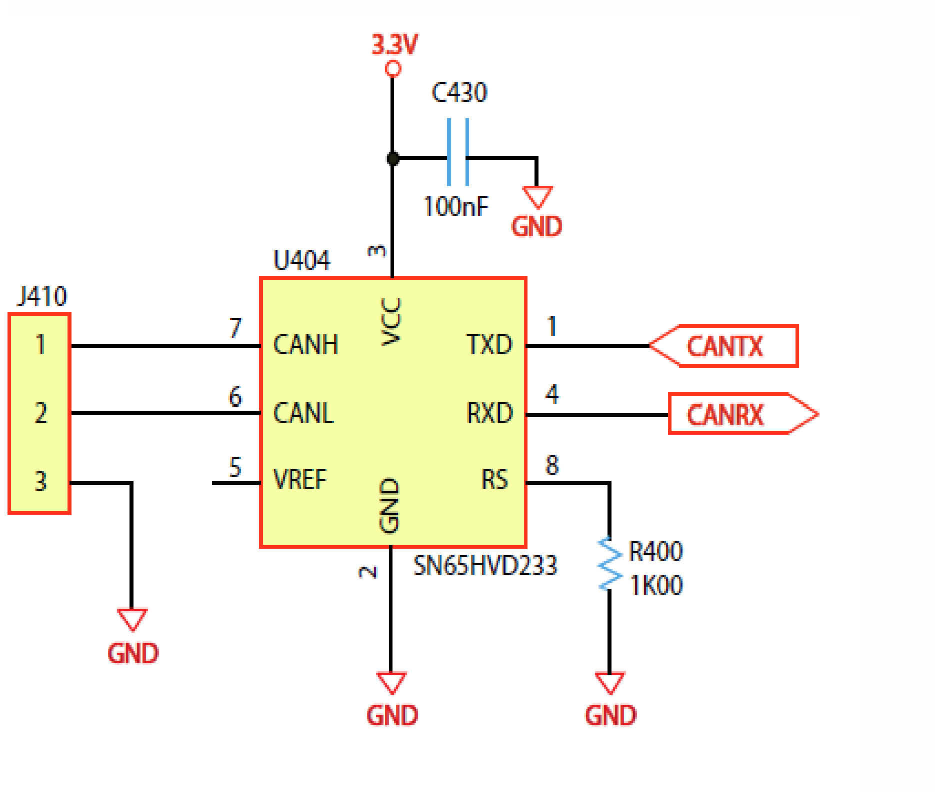

Figure 2-6: P326 CAN design example

Chapter 3: Understanding the P326/P327

Overview

Introduction

Chapter 3 provides the information you need to understand the P326/P327 OEM Boards.

Contents

Timing Signal

1PPS timing signal

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

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

The 1 PPS signal is 3.3 V CMOS, active high with rising edge synchronization. The pulse is approximately 1 ms. The pulse width can be adjusted by 100 ns.

Event Marker Input

Event marker input

An instantaneous GPS solution may be triggered with the Even Marker. This GPS solution will be time stamped and will not be synchronized with other data messages. The Event Marker is ideal for an application such as recording the time and position a photo is taken from a camera used in aerial photography.

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 k Ω 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 P326 and P327. These are not separate analog and digital grounds that require separate attention. Refer to Table 2-1 through Table 2-2 pin-out ground information for the P326 and P327.

Speed Radar Output

Speed radar output

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

The following two pins on the P326 relate to the Speed Radar.

- 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 (3.28 ft/s).
- Speed Radar Ready Signal - Indicates when the speed signal on the *Speed Radar Pulse* pin is valid. In static situations, such as when the vehicle has stopped, the GPS position may still have slight variations from one moment to the next. During these instances, the signal on the *Speed Radar Ready Signal* pin is ‘high’ or +Vcc, indicating the speed coming out of the *Speed Radar Pulse* pin is erroneous and not truly indicative of the GPS receiver’s actual speed. **Therefore, it should not be referred to or be used.** Once the vehicle starts moving again and meets a minimum threshold speed, the output on the *Speed Radar Ready Signal* pin will go ‘low,’ indicating valid speed information is present on the *Speed Radar Pulse* pin.

Table 2-4 provides the location of the Speed Radar Pulse and Speed Radar Ready Signal on the P326 and P327.

Continued on next page

Speed radar output, continued

Table 2-4: P326 and P327 speed radar output availability

Eclipse Board	Speed Radar Pulse	Speed Radar Ready Signal
P326	Pin 25	Pin 26
P327	N/A	N/A

Note: Neither pin has any form of isolation or surge protection. If utilizing 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 P326 and P327 are sensitive instruments. When integrated into an enclosure, the P326 requires shielding from other electronics to ensure optimal operation.

The P326 and P327 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 P326 and P327 are precision instruments. To ensure optimal operation, consider mounting the receiver in a way to minimize vibration and shock.

When mounting the P326 or P327, immediately adjacent to the GPS antenna, Hemisphere GNSS highly recommends shielding the board from the LNA of the antenna. This step can be more complex than some integrators initially estimate. Attempt to confirm the operation in your application as early in the project as possible.

Thermal Concerns

Thermal concerns

The P326 and P327 receiver consumes a few watts of power, which ultimately will generate heat. Since this may raise the ambient temperature inside an enclosure, consider managing the heat inside the enclosure to ensure the internal temperature does not exceed the maximum operating temperature for the P326/P327. Some suggestions for heat management are heat sinks or heat conductive foam.

Note: Thermal design may only be a concern if the integrated product's maximum design temperature is expected to be close to that of the P326 and P327.

Chapter 4: Operating the P326/P327

Overview

Introduction

This chapter provides P326 and P327 operation information, such as communicating with the P326 and P327, 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 P326 and P327 provides a position within approximately 60 seconds.

Contents

Powering the P326/P327 On/Off

Powering the P326/P327

The P326 and P327 is powered by a 3.3 VDC power source.

After you connect appropriate power the P326 and P327 is active. Although the P326 and P327 proceeds through an internal startup sequence upon application of power, it is ready to communicate immediately.

Communicating with the P326/P327

Communicating with the P326/P327

The P326 and P327 features three primary serial ports (Port A, Port B, Port C) that you can configure independently from each other.

You can configure the ports for any combination of NMEA 0183, binary, and RTCM SC-104 data. The usual data output is limited to NMEA data messages as these are industry standard.

Note: You may use the three serial ports to separate the different data types and output different rates. If the P326 and P327 is required to output different data types simultaneously, ensure data logging and the processing software used can correctly parse the different data from a single stream.

Configuring the P326/P327

Configuring the P326/P327

You can configure all aspects of P326 and P327 operation through any serial port using proprietary commands. For information on these commands refer to the Hemisphere GNSS Technical Reference (go to WWW.HGNSS.COM , follow the links to Resources & Support, GNSS Reference Guide.

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 rate of each message
- Set various receiver operating parameters

For a complete list of commands and messages refer to the Hemisphere GNSS Technical Reference (go to www.hemispheregnss.com and follow the links to Resources & Support, GNSS Reference Guide)

To issue commands to the P326 and P327 you will need to connect it to a terminal program such as HyperTerminal or either of Hemisphere GNSS' software applications (SLXMon or PocketMax). See "What is the best software tool to use to communicate with the P326 or P327 and configure it?" for descriptions of HyperTerminal, SLXMon, and PocketMax.

LED Indicators

Overview

The P326 and P327 features the following surface-mounted diagnostic LEDs that indicate board status (see Figure 2-9):

- PWR - Power
- GNSS - GNSS lock
- DIFF - Differential lock
- DGNSS - DGNSS position

Figure 2-9: Onboard LEDs

With the exception of the power LED the signals that drive the LEDs are available via the header connector. Refer to Table 2-1 through Table 2-2 for pin number descriptions for the P326 and P327.

Note: Each signal pin can offer only 1 mA of current and is active low. Since 1 mA of current may be inadequate for the application, you may want to transistor-buffer these signals to provide more current capacity for acceptable LED luminance.

Configuring the Data Message Output

Overview

The P326 and P327 feature three primary bidirectional ports (Ports A, B and C) and a differential-only port (Port D).

You can configure messages for all ports by sending proprietary commands to the P326 and P327 through any port. For a complete list of commands and messages refer to the Hemisphere GNSS Technical Reference (go to WWW.HGNSS.COM and follow the links to Resources & Support, GNSS Reference Guide).

'THIS' Port and the 'OTHER' Port

Overview

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

'THIS' port

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

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

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

Continued on next page

‘OTHER’ port

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

If you are using Port A to issue commands, then Port B is the ‘OTHER’ port, and vice versa. To specify the ‘OTHER’ port for the data output you need to include 'OTHER' in the command. For example, if you use Port A to request the GPGGA data message be output at 5 Hz on Port B, issue the following command:

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

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

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

Saving the P326/P327 Configuration

Saving the P326/P327 configuration

Each time you change the P326 and P327’s configuration, you should save the configuration to avoid reconfiguring the receiver each time you power it on.

To save the configuration, issue the $JSAVE command to the P326 and P327 using a terminal program such as HyperTerminal or either of Hemisphere GNSS’ applications (SLXMon or PocketMax). The P326 and P327 will take approximately five seconds to save the configuration to non-volatile memory and will indicate when the configuration has been saved. Refer to the Hemisphere GNSS Technical Reference (go to WWW.HGNSS.COM and follow the links to Resources & Support, GNSS Reference Guide).

Using Port D for RTCM Input

Using port D for RTCM input

Port D has been optimized to interface with 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 P326 and P327 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 P326 and P327:

$JDIFF,WAAS<CR><LF>

For a complete list of commands and messages, refer to the Hemisphere GNSS Technical Reference (go to WWW.HGNSS.COM and follow the links to Resources & Support, GNSS Reference Guide).

Atlas L-band Messages/Commands

Atlas L-band messages/ commands

To configure the P326 or P327 to automatically set the L-Band frequency parameters, use 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

Configuration Defaults

Configuration defaults

Below is the standard configuration for the P326 and P327.

For more information on these commands refer to the Hemisphere GNSS Technical Reference (go to WWW.HGNSS.COM and follow the links to Resources & Support, GNSS Reference Guide).

```
$JOFF,PORTA
$JOFF,PORTB
$JOFF,PORTC
$JBAUD,19200,PORTA
$JBAUD,19200,PORTB
$JBAUD,19200,PORTC
$JAGE,2700
$JLIMIT,10.0
$JMASK,5
$JDIFF,WAAS
$JPOS,33.0,-111.0
$JSMOOTH,LONG900
$JAIR,AUTO
$JALT,NEVER

$JNP,7
$JWAASPRN,AUTO
$JTAU,COG,0.00
$JTAU,SPEED,0.00
$JASC,GPGGA,1,PORTA
$JASC,GPGGA,1,PORTB
$JFREQ,AUTO

$JSAVE
```

Appendix A: Troubleshooting

Overview

Introduction

Appendix A provides troubleshooting for anomalous P326 and P327 operation.

Contents

Troubleshooting

P326/P327 troubleshooting

Table A-1: P326/P327 Troubleshooting

Symptom	Possible Solution
Receiver fails to power	• Verify polarity of power leads • Check 1.0 A in-line power cable fuse connection • Check integrity of power cable connections • Check power input voltage
No data from P326/P327	• (1) Check receiver power status (this may be done with an ammeter) • (2) Verify P326 and P327 is locked to a valid DGPS signal (this can often be done on the receiving device or by using SLXMon) • (2) Verify that P326 and P327 is locked to GPS satellites (this can often be done on the receiving device or by using SLXMon) • (2) Check integrity and connectivity of power and data cable connections
Random data from P326/P327	• Verify that the RCTM or Bin messages are not being accidentally output (send a $JSHOW command) • Verify that the baud rate settings of P326 and P327 and remote device match • Potentially, the volume of data requested to be output by the P326 and P327 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)

Continued on next page

P326/P327 troubleshooting, continued

Table A-1: P326/P327 Troubleshooting (continued)

Symptom	Possible Solution
No SBAS	• Check antenna cable integrity • Verify antenna's view of the sky, especially towards that 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)
No DGPS position in external RTCM mode	• Verify that 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 pinout must be connected, and from the "transmit" from the source must connect to the "receiver" of the RTCM input port).
Non-DGPS output	• Verify P326 and P327 SBAS and lock status (or external source is locked)

Continued on next page

Appendix B: Technical Specifications

Technical Specifications

Introduction

Appendix B provides the P326/P327 technical specifications.

Contents

P326 and P327 Technical Specifications

P326 specifications

Tables B1-B6 provide the technical specifications for the P326.

P326 sensor specifications

Table B-1: P326 Sensor specifications

Item	Specification
Receiver type	GPS, GLONASS, BeiDou, and Galileo RTK with carrier phase and L-band
Channels	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
GPS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	1 Hz standard, 10 Hz and 20 Hz available

Continued on next page

P326 and P327 Technical Specifications, Continued

P326 sensor specifications, continued

Table B-1: P326 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
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 kph (999 kts)		
Maximum altitude	18,288 m (60,000 ft)		
Differential options	SBAS, Autonomous, External RTCM v2.3, RTK v3, L-band (Atlas), and DGPS		

Continued on next page

P326 communication specifications

Table B-2: P326 Communication specifications

Item	Specification
Serial ports	4 full-duplex 3.3 V CMOS (3 main serial ports, 1 differential-only port) 2 CAN
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), RTCMv3 (RTK), CMR, CMR^{+4}, Atlas
Timing output	1 PPS CMOS, active high, rising edge sync, 10 k Ω, 10 pF load
Event marker input	CMOS, active low, falling edge sync, 10 k Ω, 10 pF load
USB	1 USB Host, 1 USB Device

P326 power specifications

Table B-3: P326 Power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5%
Power consumption	1.0 W (GPS L1) 1.6 W (GPS/GLONASS L1/L2G1/G2)
Current consumption	305 mA nominal (GPS L1) 485 mA nominal (GPS/GLONASS L1/L2 G1/G2) 696 mA nominal (All Signals + L-band)
Antenna voltage input	15 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 40 dB
Antenna input impedance	50Ω

Continued on next page

P326 and P327 Technical Specifications, Continued

P326 environmental specifications

Table B-4: P326 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[5]	Vibration: EP455 Section 5.15.1 Random Mechanical Shock: EP455 Section 5.14.1 Operational (when mounted in an enclosure with screw mounting holes utilized)
EMC[5]	CE (ISO 14982 Emissions and Immunity) FCC Part 15, Subpart B CISPR22

P326 mechanical specifications

Table B-5: P326 Mechanical specifications

Item	Specification
Dimensions	71.1 L x 40.6 W x 10.1 H mm (2.81 L x 1.60 W x 0.40 H in)
Weight	< 23 g (< 0.81 oz)
Status indication (LED)	Power, GNSS lock, Differential lock, DGNSS position
Power/Data connector	34-pin (17x2) male header 0.05” (1.27 mm) pitch
Antenna connector	MCX, female, straight

Continued on next page

P326 and P327 Technical Specifications, Continued

P326 L-band sensor specifications

Table B-6: P326 L-band sensor specifications

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

[1] Depends on multi-path environment, number of satellites in view, satellite geometry, and ionospheric activity
[2] Depends also on baseline length

[3] Requires an L-band subscription

[4] Receive only, does not transmit this format

[5] When integrated in conjunction with the recommended shielding and protection as outlined in this guide

P326 and P327 Technical Specifications, Continued

P327 specifications

Tables B7 – B12 provide the technical specifications for the P327.

P327 sensor specifications

Table B7 P327 Sensor specifications

Item	Specification
Receiver type	GPS, GLONASS, BeiDou, and Galileo RTK with carrier phase and L-band
Channels	*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
GPS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	1 Hz standard, 10 Hz and 20 Hz available

Continued on next page

P326 and P327 Technical Specifications, Continued

P327 sensor specifications, continued

Table B7 P327 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
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 kph (999 kts)		
Maximum altitude	18,288 m (60,000 ft)		
Differential options	SBAS, Autonomous, External RTCM v2.3, RTK v3, L-band (Atlas), and DGPS		

P327 communication specifications

Table B8 P327 Communication specifications

Item	Specification
Serial ports	4 full-duplex 3.3 V CMOS (3 main serial ports, 1 differential-only port)
Baud rates	4800 - 115200
Data I/O protocol	NMEA 0183, Hemisphere GPS binary
Correction I/O protocol	Hemisphere GNSS' ROX, RTCM v2.3 (DGPS), RTCMv3 (RTK), CMR, CMR[+4], Atlas
Timing output	1 PPS CMOS, active high, rising edge sync, 10 k Ω, 10 pF load
Event marker input	CMOS, active low, falling edge sync, 10 k Ω, 10 pF load
USB	1 USB Device

P326 and P327 Technical Specifications, Continued

P327 power specifications

Table B-9: P327 Power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5%
Power consumption	1.0 W (GPS L1) 1.6 W (GPS/GLONASS L1/L2G1/G2)
Current consumption	303 mA nominal (GPS L1) 484 mA nominal (GPS/GLONASS L1/L2 G1/G2) 696 mA nominal (All Signals + L-band)
Antenna voltage input	15 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 40 dB
Antenna input impedance	50Ω

Continued on next page

P327 environmental specifications

Table B-10: P327 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[5]	Vibration: EP455 Section 5.15.1 Random Mechanical Shock: EP455 Section 5.14.1 Operational (when mounted in an enclosure with screw mounting holes utilized)
EMC[5]	CE (ISO 14982 Emissions and Immunity) FCC Part15, Subpart B CISPR22

P327 mechanical specifications

Table B-11: P327 Mechanical specifications

Item	Specification
Dimensions	72.4 L x 40.6 W x 10.1 H mm (2.81 L x 1.60 W x 0.40 H in)
Weight	< 23 g (< 0.81 oz)
Status indication (LED)	Power, GNSS lock, Differential lock, DGNSS position
Power/Data connector	20-pin (10x2) male header 0.08” (2 mm) pitch
Antenna connector	MCX, female, straight

Continued on next page

P327 l-band sensor specifications

Table B-12: P327 L-band sensor specifications

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

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

Appendix C: Frequently Asked Questions (FAQ)

FAQ

Contents

Appendix C: Frequently Asked Questions (FAQ)

Integration

The following is a list of common questions and solutions when integrating the P326/P327 OEM boards.

Question	Solution
Do I need to use the 1 PPS and event marker?	No, these are not necessary for P326 and P327 operation.
What should I do with the 1 PPS signal if I do not want to use it?	This signal will be strobing at 1 Hz, so it should not be connected.
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 P326 and P327?	Not necessarily, but you may need to if there are RF interference issues, such as if the P326 and P327 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 that 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
What type of assistance can I expect from Hemisphere GNSS when integrating P326 or P327?	Integration of a GNSS board has such benefits as: • Lower system cost • Improved branding (rather than relabeling an existing product) • Better control of system design among others As an integrator, you are responsible for ensuring that the correct resources are in place to technically complete it. Hemisphere GNSS will provide reasonable assistance. However, Hemisphere GNSS does not have dedicated engineering resources for in- depth integration support. Hemisphere GNSS will do its best to provide support as necessary, but you should expect to have reasonable expertise to use this Integrator’s Guide.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Support and Repair

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

Continued on next page

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 our equipment.

Continued on next page

Power, Communication, and Configuration

Question	Solution
My P326 or P327 system does not appear to be communicating.	This could be one of a few issues: • Examine the P326 or P327 cables and connectors for signs of damage or offset. • Ensure the P326 or P327 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 P326 or P327 is connected to the receive line of the other device. Also, ensure the signal grounds are connected. • If the P326 or P327 is connected to a custom or special device, ensure the serial connection to it does not have any incompatible signal lines present that prevent proper communication. • Make sure the baud rate of the P326 or P327 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 that 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 P326 or P327 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 P326 orP327?	The $JSHOW command will request the configuration information from the P326 and P327. 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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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 P326 or P327 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 P326 or P327 and configure it?	Hemisphere GNSS uses three different software applications: • HyperTerminal™ - Available on all Windows® 95, 98, ME, and XP. This tool allows you to configure the P326 or P327 by directly typing commands into the terminal window. The output from the P326 or P327 is simultaneously shown. When using HyperTerminal, ensure it is configured to use the correct PC communication port and baud rate, and that the local echo feature is on. • 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.

Continued on next page

Power, Communication, and Configuration, continued

Question	Solution
What is the best software tool to use to communicate with the P326 or P327 and configure it?	• 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.

GNSS Reception and Performance

Question	**Solution**
How do I know what the P326 or P327 is doing?	The P326 and P327 supports standard NMEA data messages. The $GPGSV andBin99 data messages contain satellite tracking and SNR information. If available, the computed position is contained in the $GPGGA message. Additionally, the P326 and P327 has surface-mounted status LEDs that indicate receiver status.
Do I have to be careful when using the P326 or P327 to ensure it tracks properly?	For best performance, the P326 and P327's antenna must have a clear view of the sky for satellite tracking. The P326 and P327 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 that are used, the greater the positioning accuracy.

Continued on next page

SBAS Reception and Performance

Question	Solution
How do I know if the P326 or P327 has acquired an SBAS signal?	The P326 and P327 outputs the $RD1 message that 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 P326 and P327 performs well up to 150 BER. The SLXMon and PocketMax utilities provide this information without needing to use NMEA commands.
How do I know if the P326 or P327 is offering a differentially-corrected or RTK- corrected position?	The P326 and P327 outputs the $GPGGA message as the main positioning data message. This message contains a quality fix value that describes the GPS status. If this value is 2, the position is differentially corrected; if this value is 4, the position is RTK-corrected. The SLXMon and PocketMax utilities provide this information without needing to use NMEA commands.

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SBAS Reception and Performance, continued

Question	Solution
How do I select an SBAS satellite?	By default, the P326 and P327 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 Hemisphere GNSS Technical Reference (go to WWW.HGNSS.COM and follow the links to Resources & Support, GNSS Reference Guide) for more information.
Do I need a dual frequency antenna for SBAS?	Hemisphere GNSS recommends using a dual frequency antenna with the P326 and P327. 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

Question	Solution
My P326 or P327 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 P326 and P327 match that of 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 pinout information for the cables to ensure the transmit line of the external correction source is connected to the receive line of the P326 and P327's serial port and that the signal grounds are connected. • Make sure the P326 and P327 has been set to receive external corrections by issuing the $JDIFF command. Refer to the Hemisphere GNSS Technical Reference (go to WWW.HGNSS.COM and follow the links to Resources & Support, GNSS Reference Guide) for more information.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Installation

Question	Solution
Does it matter where I mount the P326 or P327's antenna?	Yes, the mounting location must provide a clear view of the sky for satellite tracking. Additionally, the position that it computes is based on the center of the antenna. It should be placed in the location for which the user would like a position. Often antennas are mounted on the centerline of a vehicle, or on a pole-mount for geo-reference
How will the antenna selection and mounting affect P326 orP327 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.

Index

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