Eclipse P306 / P307 OEM Modules

Integrator Guide

Part No. 875-0343-0 Rev. A1

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.

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Contents

Chapter 1: Introduction

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 (go to www.hemispheregnss.com and follow the links to Resources, GPS Reference Guide).

Eclipse OEM Board Options

The Eclipse™ OEM board is available in two form factors as shown in Table 1-1.

Table 1-1: Eclipse board options

Model	GNSS Systems	Compatibility	L-Band Support
P306™	L1/L2 GPS, GLONASS and BEIDOU	Hemisphere GNSS' standard pinout configuration (34-pin)	Yes - with optional Hemisphere GNSS LX-2 OEM board
P307™	L1/L2 GPS, GLONASS and BEIDOU	Compatible with popular aftermarket products (20-pin)	No

Note: This manual covers Eclipse P306 and P307 OEM boards. When referring to both boards this manual uses the term Eclipse. When referring to either Eclipse model this manual uses the model name (P306 or P307).

What’s Included

The Eclipse is available in two configurations:

- Eclipse OEM board only - designed for integrators who are familiar with Eclipse board integration
- Eclipse OEM board 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.hemispheregnss.com and navigate to the OEM Products page or contact your local dealer.

Eclipse Integration

Successful integration of the Eclipse 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

The Eclipse 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 50 Ω

Common Features of Eclipse Boards

Common features of Eclipse boards include:

- 372-channel GNSS engine
- Sub-meter horizontal accuracy 95%
- Raw measurement output (via documented binary messages)
- Position and heading update rates of 20 Hz max
- COAST™ technology that provides consistent performance with correction data
- e-Dif®-ready - a base station-free way of differentially positioning

- L-Dif™ -ready – Local differential is a proprietary Hemisphere GNSS method where a specialized set of messages are relayed between two Eclipse receivers
- Quick times to first fix
- Four full-duplex serial ports
- USB ports
  - USB device port only (P307)
  - USB host and USB device ports (P306)
- 1 PPS timing output
- Event marker input

Note: For complete specifications of Eclipse boards see Appendix C, "Technical Specifications."

Message Interface

The Eclipse uses a NMEA 0183 interface, allowing you to easily make configuration changes by sending text-type commands to the receiver.

The Eclipse also supports 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.hemispheregnss.com and follow the links to Resources, GPS Reference Guide).

Using PocketMax to Communicate with the Eclipse

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 Eclipse via the COM port and open PocketMax. The screens within PocketMax allow you to easily interface with the Eclipse 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 Eclipse's status and function

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

Chapter 2: Board Overview

Eclipse OEM Board Key Features

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

Eclipse is offered in two common industry form factors:

- P306 is a drop-in replacements for Hemisphere GNSS' Crescent® and mini Eclipse receivers (34-pin) and provide L-band support with the optional Hemisphere GNSS LX-2™ OEM board
- P307 has a mechanical design compatible with popular after market products (20-pin)

The reliable positioning performance of Eclipse is further enhanced through Eclipse RTK and COAST DGPS technology.

With Eclipse, 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 GPS signals. Hemisphere GNSS' SureTrack technology provides peace of mind knowing the RTK rover is making use of every satellite it is tracking, even satellites not tracked at the base. Benefit from fewer RTK dropouts in congested environments, faster reacquisition, and more robust solutions due to better cycle slip detection.

Patented COAST software enables select Hemisphere GNSS receivers to utilize aging DGPS correction data during times of interference, signal blockage, and weak signal. The receiver will coast and continue to maintain sub-meter positioning for 40 minutes or more without a DGPS signal.

Mechanical Layout

Figure 2-1 shows the mechanical layout for the Eclipse P306 OEM board.

Figure 2-2 shows the mechanical layout for the Eclipse P307 OEM board.

Dimensions are in millimeters (inches) for all three layouts.

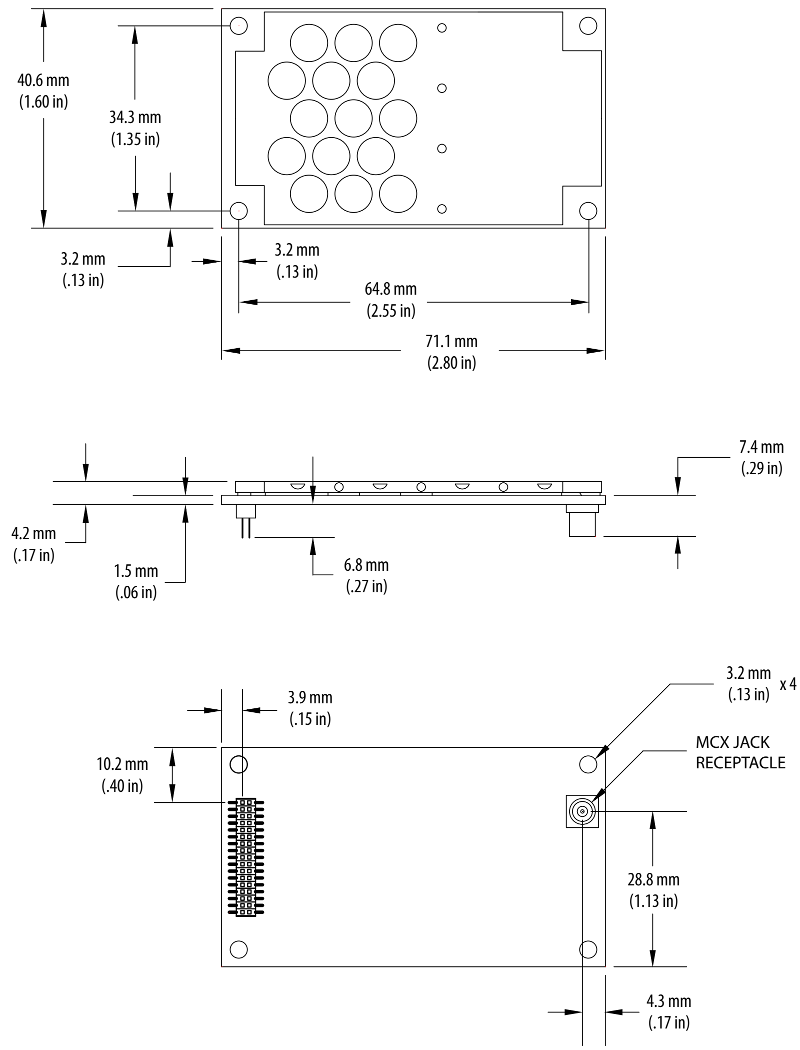


Figure 2-1: Eclipse P306 mechanical layout

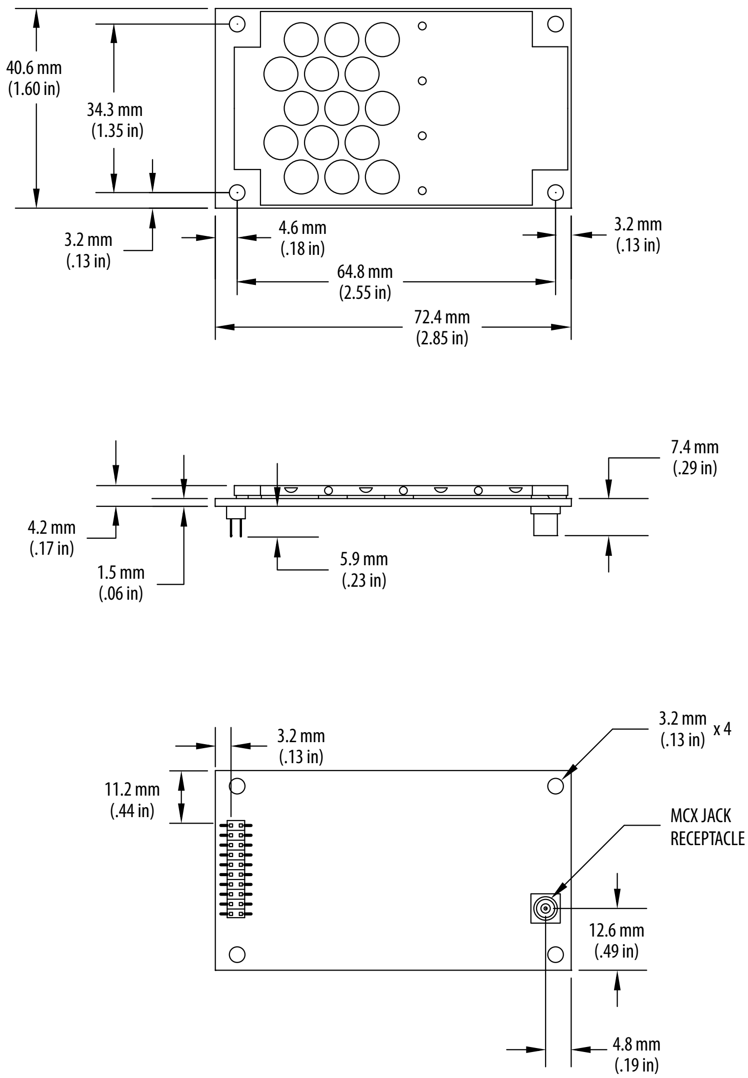


Figure 2-2: Eclipse P307 mechanical layout

Connectors

Table 2-1 describes Eclipse 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: Eclipse connectors

Eclipse Board and Connector Type		Eclipse SMT Connector	Mating Connector
Eclipse (P306	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-117-01-L-DV (older P200 boards) Samtec FTSH-117-04-L-DV	17x2 female SMT header socket, 0.05 in (1.27 mm) pitch Samtec FLE-117-01-G-DV
Eclipse (P307)	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

There are two options for mounting the Eclipse:

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

Direct Electrical Connection Method

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

Note: Be aware of the GPS RF signals present on the carrier board and ensure the correct standoff height to avoid any flexual stresses on the board when you fasten it down.

The Eclipse uses a standoff height of 7.9 mm (0.3125 in). With this height there should be no washers between either the standoff and the Eclipse 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 on page 9 for Eclipse connector information.

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

Indirect Electrical Connection (Cable) Method

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

Header Layouts and Pinouts

The Eclipse 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.

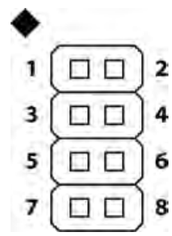


Figure 2-3: Identifying the first pin on the header connector

Eclipse 34-Pin Header Layout/Pinout

The P306 boards have a 34-pin header. Figure 2-4 shows the header layout and Table 2-2 provides the header pinout.

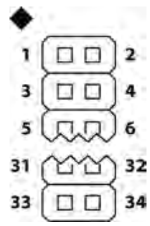


Figure 2-4: Eclipse 34-pin header layout

Table 2-2: Eclipse 34-pin header pinout

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
19	DGPS Lock	Output	Status indicator, 3.3 V CMOS, active low
20	n/c	n/c	n/c
21	GPIO0	I/O	General purpose input/output
22	GPIO1	I/O	General purpose input/output
23	GPIO2	I/O	General purpose input/output

Table 2-2: Eclipse 34-pin header pinout (*continued*)

Pin	Name	Type	Description
24	GPIO3	I/O	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	n/c	n/c	n/c
30	n/c	n/c	n/c
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	L-Band Enable	Output	Reserved
34	Reset	Open collector	Reset, open collector, 3.3 V typical, not required

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.*

Eclipse 20-Pin Header Layout/Pinout

The P307 boards have a 20-pin header. Figure 2-5 shows the header layout and Table 2-3 provides the header pinout.

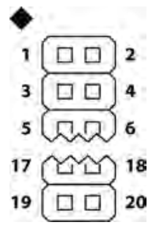


Figure 2-5: Eclipse 20-pin header layout

Table 2-3: Eclipse 20-pin header pinout

Pin	Name	Type	Description
1	Antenna Pwr	Power	Antenna power, DC, 15 V max
2	3.3 V	Power	Receiver power supply, 3.3 V
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
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

This section provides information on the signals available via connectors.

RF Input

The Eclipse 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 Eclipse.

Serial Ports

The Eclipse has 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. 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 Eclipse 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 Eclipse, such as from Hemisphere GNSS’ SBX beacon board.

USB Ports

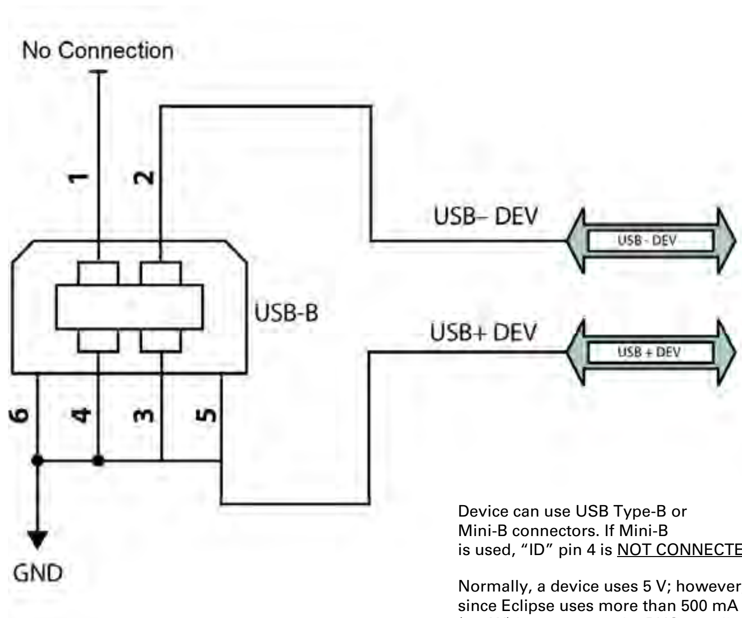
The Eclipse P306 has both a USB host port and a USB device port while P307 has only a USB device port, where:

- USB device port (data communication) shown in Figure 2-6 on page 16 serves as a high speed data communications port, such as for a PC
- USB host port (data storage) shown in Figure 2-7 on page 17 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.

Relevant Device Eclipse Pins

USB Device +	USB+ Host
USB Device –	USB– Host



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 500 mA (2.5 W) it cannot use the BUS-supplied 5 V and therefore it is not connected

Figure 2-6: Eclipse USB device design example

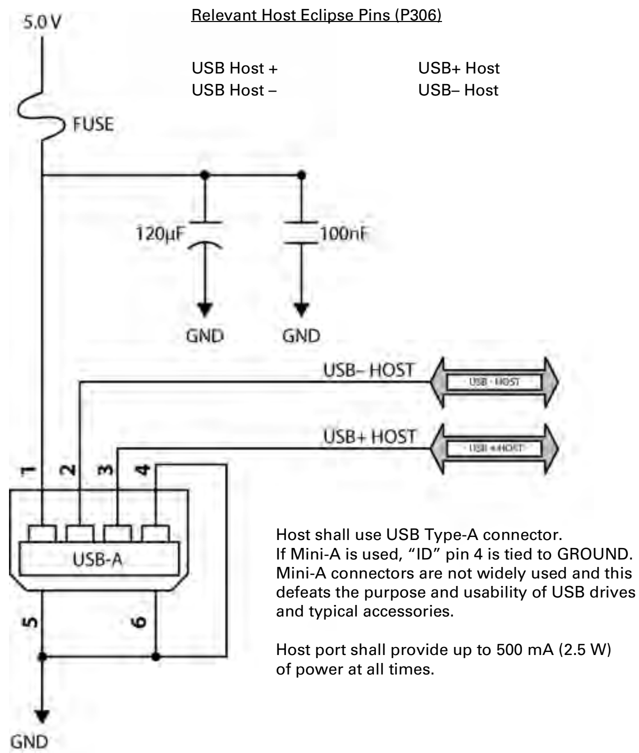


Figure 2-7: Eclipse USB host design example

LED Indicators

The Eclipse features the following surface-mounted diagnostic LEDs that indicate board status (see Figure 2-8):

- PWR - Power
- GPS - GPS lock
- DIFF - Differential lock
- DGPS - DGPS position

Figure 2-8: Onboard LEDs

With the exception of the power LED the signals that drive the LEDs are available via the header connector. Refer to Table 2-2 through Table 2-3 for pin number descriptions for the Eclipse.

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.

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 impendance greater than 10 kΩ in parallel with 10 pF. The pulse is approximately 1 ms.

Event Marker Input

A GPS solution may need to be forced at a particular instance, not synchronized with GPS time depending on the application, such as indicating to the GPS receiver when a photo is taken from a camera used for 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 kΩ and 10 pF respectively, with a threshold of lower than 0.7 V required to recognize the input.

Grounds

You must connect all grounds together when connecting the ground pins of the Eclipse. These are not separate analog and digital grounds that require separate attention. Refer to Table 2-2 through Table 2-3 for pinout ground information for the Eclipse.

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 Eclipse 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 Eclipse.

Table 2-4: Eclipse speed radar output availability

Eclipse Board	Speed Radar Pulse	Speed Radar Ready Signal
Eclipse (P306)	Pin 25	Pin 26
Eclipse (P307)	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

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

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

When mounting the Eclipse 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

The Eclipse 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 Eclipse. Some suggestions for heat management are heat sinks, heat conductive foam, or using a small cooling fan possibly using a thermal switch. Air moving over the Eclipse removes heat very effectively.

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 Eclipse.

Chapter 3: Operation

This chapter provides Eclipse operation information, such as communicating with the Eclipse, 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 Eclipse provides a position within approximately 60 sec.

Powering the Eclipse

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

Communicating with the Eclipse

The Eclipse 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 Eclipse 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 Eclipse

You can configure all aspects of Eclipse operation through any serial port using proprietary commands. For information on these commands refer to the Hemisphere GNSS Technical Reference (go to www.hemispheregnss.comand follow the links to Resources, GPS 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 lists of commands and messages refer to the Hemisphere GPS Technical Reference.

To issue commands to the Eclipse 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 Eclipse and configure it?" on page 29 for descriptions of HyperTerminal, SLXMon, and PocketMax.

Firmware

The software that runs the Eclipse 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.

You can have two firmware applications loaded on the receiver; however, you can only operate one at a time.

The Eclipse currently ships with the rover RTK application and the base RTK/SBAS application. Refer to the Hemisphere GNSS Technical Reference (go to www.hemispheregnss.com and follow the links to Resources, GPS Reference Guide) for information on the $JAPP command, which you use to change between the two Eclipse applications.

Configuring the Data Message Output

The Eclipse features 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 Eclipse through any port. For a complete lists of commands and messages refer to the Hemisphere GNSS Technical Reference (go to www.hemispheregnss.com and follow the links to Resources, GPS Reference Guide)

‘THIS’ Port and the ‘OTHER’ Port

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

‘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>
```

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 Eclipse Configuration

Each time you change the Eclipse'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 Eclipse using a terminal program such as HyperTerminal or either of Hemisphere GNSS' applications (SLXMon or PocketMax). The Eclipse 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.hemispheregnss.com and follow the links to Resources, GPS Reference Guide)

Using Port D for RTCM Input

Port D has been optimized to interface with Hemisphere GNSS' SBX-4 beacon board and operates at 9600 baud (8 data bits, no parity and 1 stop bit – 8-N-1).

To configure the Eclipse 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 Eclipse:

```
$JDIFF,WAAS<CR><LF>
```

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

Configuration Defaults

Below is the standard configuration for the Eclipse. For more information on these commands refer to the Hemisphere GNSS Technical Reference (go to www.hemispheregnss.com and follow the links to Resources, GPS 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,51.0,-114.0
$JSMOOTH,LONG900
$JAIR,AUTO
$JALT,NEVER

$JNP,7
$JWAASPRN,AUTO
$JTAU,COG,0.00
$JTAU,SPEED,0.00

$JSAVE
```

Appendix A: Frequently Asked Questions

Integration

Do I need to use the 1 PPS and event marker?

No, these are not necessary for Eclipse 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 Eclipse?

Not necessarily...but you may need to if there are RF interference issues, such as if the Eclipse interferes with other devices. A shield-can would be a good start in terms of investigating the benefit. If you are designing a smart antenna system, one is likely needed. Hemisphere GNSS recommends that you always conduct an RF prescan when integrating OEM boards.

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 the Eclipse?

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 Integrators Guide.

Support and Repair

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” on page i (just before the Contents page) for Technical Support contact information.

What do I do 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” on page i (just before the Contents page) for Technical Support contact information.

Can I contact Hemisphere GNSS Technical Support directly regarding technical problems?

Yes, however, Hemisphere GNSS recommends speaking to the dealer first as they would be the local support. They may be able to solve the problem quickly, due to their closer location and experience with our equipment.

Power, Communication, and Configuration

My Eclipse system does not appear to be communicating. What do I do?

This could be one of a few issues:

- Examine the Eclipse cables and connectors for signs of damage or offset.
- Ensure the Eclipse 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 Eclipse is connected to the receive line of the other device. Also, ensure the signal grounds are connected.
- If the Eclipse 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 Eclipse 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.

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 Eclipse 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 Eclipse?

The $JSHOW command will request the configuration information from the Eclipse. 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.

How do I change the baud rate of a port from that port?

Connect at the current baud rate of the Eclipse 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 Eclipse 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 Eclipse by directly typing commands into the terminal window. The output from the Eclipse 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 (to see what is being typed).
- SLXMon - Available at www.hemispheregnss.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.hemispheregnss.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

How do I know what the Eclipse is doing?

The Eclipse supports standard NMEA data messages. The $GPGSV and Bin99 data messages contain satellite tracking and SNR information. If available, the computed position is contained in the $GPGGA message. Additionally, the Eclipse has surface-mounted status LEDs that indicate receiver status.

Do I have to be careful when using the Eclipse to ensure it tracks properly?

For best performance, the Eclipse's antenna must have a clear view of the sky for satellite tracking. The Eclipse 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.

SBAS Reception and Performance

How do I know if the Eclipse has acquired an SBAS signal?

The Eclipse 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 Eclipse 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 Eclipse is offering a differentially-corrected or RTK-corrected position?

The Eclipse 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 5, the position is RTK-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 Eclipse 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—refer to the Hemisphere GNSS Technical Reference (go to www.hemispheregnss.com and follow the links to Resources, GPS Reference Guide) for more information; however, this is not recommended.

Should I be concerned if the Eclipse is frequently losing lock on SBAS due to obstructions or low satellite elevation angles at my geographic location?

No, provided the receiver is receiving a full set of corrections relatively often. Using COAST technology, the Eclipse is able to perform well for 40 minutes or more with aging correction data. Similar to DGPS corrections, accuracy degrades over time and distance. To obtain a full set of corrections the Eclipse antenna receives the ionospheric map over a period of a few minutes. This is the minimum amount of time required to get a full set of corrections for SBAS operation. After this, the receiver can coast until the next set of corrections have been received.

Accuracy is a function of correction age and current ionospheric activity, which will increase in the coming years.

Do I need a dual frequency antenna for SBAS?

Hemisphere GNSS recommends using a dual frequency antenna with the Eclipse. While some receiver function is possible with an L1-only antenna, full receiver performance will only be realized with a dual frequency antenna.

External Corrections

My Eclipse 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 a number of 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 Eclipse 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 Eclipse's serial port and that the signal grounds are connected.
- Make sure the Eclipse has been set to receive external corrections by issuing the $JDIFF command. Refer to the Hemisphere GNSS Technical Reference (go to www.hemispheregnss.com and follow the links to Resources, GPS Reference Guide) for more information.

Installation

Does it matter where I mount the Eclipse'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 georeference.

How will the antenna selection and mounting affect Eclipse 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.

Appendix B: Troubleshooting

Use the following checklist to troubleshoot anomalous Eclipse operation. Table B-1 provides a list of issues with possible solutions. Refer to Appendix C, "Technical Specifications" if necessary.

Table B-1: Troubleshooting

Issue	Possible Solution
What do I do initially if I have a problem with the operation of the Eclipse?	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 It is important to review each category in detail in order to eliminate it as a problem.
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 • Check current restrictions imposed by power source (minimum available should be > 1.0 A)
No data from the Eclipse 1. No communication 2. No valid data	• (1) Check receiver power status (this may be done with an ammeter) • (2) Verify Eclipse is locked to a valid DGPS signal (this can often be done on the receiving device or by using SLXMon) • (2) Verify that Eclipse 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 binary data from the Eclipse	• Verify that the RCTM or Bin messages are not being accidentally output (send a $JSHOW command) • Verify that the baud rate settings of Eclipse and remote device match • Potentially, the volume of data requested to be output by the Eclipse could be higher than the current baud rate supports. Try using 19200 or higher for the baud rate for all devices

Table B-1: Troubleshooting

Issue	Possible Solution
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 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 Eclipse SBAS and lock status (or external source is locked)

Appendix C: Technical Specifications

P306 Specifications

Table C-21 through Table C-25 provide specifications for the P306.

Table C-1: P306 sensor specifications

Item	Specification
Receiver type	GPS, GLONASS and BeiDou L1 and L2 RTK with carrier phase
Channels	12 L1CA GPS 12 L1P GPS 12 L2P GPS* 12 L2C GPS* 12 L1 GLONASS 12 L2 GLONASS* 22 B1 BeiDou 22 B2 BeiDou 3 SBAS or 3 additional L1CA GPS ** with subscription code* *Note: L-band support available with optional Hemisphere GNSS LX-2 OEM board.*
GPS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	1 Hz standard, 10 Hz and 20 Hz available
Horizontal accuracy	RMS (67%) / 2DRMS (95%) RTK[1,2]: 10 mm + 1 ppm / 20 mm + 2 ppm SBAS (WAAS)[1]: 0.3 m / 0.6 m Autonomous, no SA[1]: 1.2 m / 2.5 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

Table C-2: P306 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), RTCM v3 (RTK), CMR, CMR+[4]
Timing output	1 PPS CMOS, active high, rising edge sync, 10 kΩ, 10 pF load

Table C-2: P306 communication specifications (*continued)*

Item	Specification
Event marker input	CMOS, active low, falling edge sync, 10 kΩ, 10 pF load
USB	1 USB Host, 1 USB Device

Table C-3: P306 power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5%
Power consumption	< 2.32 W nominal
Current consumption	700 mA nominal GPS (L1/L2), GLONASS (L1/L2) and (B1/B2) BeiDou
Antenna voltage input	15 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 40 dB
Antenna input impedance	50 Ω

Table C-4: P306 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

Table C-5: P306 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, GPS lock, Differential lock, DGPS position
Power/Data connector	34-pin (17x2) male header 0.05” (1.27 mm) pitch
Antenna connector	MCX, female, straight

P307 Specifications

Table C-26 through Table C-30 provide specifications for the P307.

Table C-6: P307 sensor specifications

Item	Specification
Receiver type	GPS, GLONASS and BeiDou L1 and L2 RTK with carrier phase
Channels	12 L1CA GPS 12 L1P GPS 12 L2P GPS* 12 L2C GPS* 12 L1 GLONASS 12 L2 GLONASS* 22 B1 BeiDou 22 b2 BeiDou 3 SBAS or 3 additional L1CA GPS ** with subscription code* *Note: L-band support available with optional Hemisphere GNSS LX-2 OEM board.*
GPS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	1 Hz standard, 10 Hz and 20 Hz available
Horizontal accuracy	RMS (67%) / 2DRMS (95%) RTK[1,2]: 10 mm + 1 ppm / 20 mm + 2 ppm SBAS (WAAS)[1]: 0.3 m / 0.6 m Autonomous, no SA[1]: 1.2 m / 2.5 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

Table C-7: P307 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 GNSS binary
Correction I/O protocol	Hemisphere GPS' ROX, RTCM v2.3 (DGPS), RTCM v3 (RTK), CMR, CMR+[4]
Timing output	1 PPS CMOS, active high, rising edge sync, 10 kΩ, 10 pF load

Table C-7: P307 communication specifications (*continued)*

Item	Specification
Event marker input	CMOS, active low, falling edge sync, 10 kΩ, 10 pF load
USB	1 USB Host, 1 USB Device

Table C-8: P307 power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5%
Power consumption	< 2.32 W nominal
Current consumption	700 mA nominal GPS (L1/L2), GLONASS (L1/L2) and (B1/B2) BeiDou
Antenna voltage input	15 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 40 dB
Antenna input impedance	50 Ω

Table C-9: P307 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

Table C-10: P307 mechanical specifications

Item	Specification
Dimensions	72.4 L x 40.6 W x 10.1 H mm (2.85 L x 1.60 W x 0.40 H in)
Weight	< 23 g (< 0.81 oz)
Status indication (LED)	Power, GPS lock, Differential lock, DGPS position
Power/Data connector	20-pin (10x2) male header 0.08” (2 mm) pitch
Antenna connector	MCX, female, straight

[1] Depends on multipath 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 manual

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20. INDEMNIFICATION. Except in relation to an infringement action, Licensee shall indemnify and hold Hemisphere harmless from any and all claims, damages, losses, liabilities, costs and expenses (including reasonable fees of lawyers and other professionals) arising out of or in connection with Licensee's use of the Product, whether direct or indirect, including without limiting the foregoing, loss of data, loss of profit or business interruption.

21. TERMINATION. Licensee may terminate this Agreement at any time without cause. Hemisphere may terminate this Agreement on 30 days notice to Licensee if Licensee fails to materially comply with each provision of this Agreement unless such default is cured within the 30 days. Any such termination by a party shall be in addition to and without prejudice to such rights and remedies as may be available, including injunction and other equitable remedies. Upon receipt by Licensee of written notice of termination from Hemisphere or termination by Licensee, Licensee shall at the end of any notice period (a) cease using the Software; and (b) return to Hemisphere (or destroy and provide a certificate of a Senior Officer attesting to such destruction) the Software and all related material and any magnetic or optical media provided to Licensee. The provisions of Sections 6), 7), 8), 9), 10), 15), 21), 26) and 27) herein shall survive the expiration or termination of this Agreement for any reason.

22. **EXPORT RESTRICTIONS**. Licensee agrees that Licensee will comply with all export control legislation of Canada, the United States, Australia and any other applicable country's laws and regulations, whether under the Arms Export Control Act, the International Traffic in Arms Regulations, the Export Administration Regulations, the regulations of the United States Departments of Commerce, State, and Treasury, or otherwise as well as the export control legislation of all other countries.

23. **PRODUCT COMPONENTS.** The Product may contain third party components. Those third party components may be subject to additional terms and conditions. Licensee is required to agree to those terms and conditions in order to use the Product.

24. **FORCE MAJEURE EVENT.** Neither party will have the right to claim damages as a result of the other's inability to perform or any delay in performance due to unforeseeable circumstances beyond its reasonable control, such as labor disputes, strikes, lockouts, war, riot, insurrection, epidemic, Internet virus attack, Internet failure, supplier failure, act of God, or governmental action not the fault of the non-performing party.

25. **FORUM FOR DISPUTES**. The parties agree that the courts located in the State of Arizona and the courts of appeal there from will have exclusive jurisdiction to resolve any disputes between Licensee and Hemisphere concerning this Agreement or Licensee's use or inability to use the Software and the parties hereby irrevocably agree to attorn to the jurisdiction of those courts. Notwithstanding the foregoing, either party may apply to any court of competent jurisdiction for injunctive relief.

26. **APPLICABLE LAW**. This Agreement shall be governed by the laws of the State of Arizona, exclusive of any of its choice of law and conflicts of law jurisprudence.

27. **CISG.** The United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement or any transaction hereunder.

28. **GENERAL.** This is the entire agreement between Licensee and Hemisphere relating to the Product and Licensee's use of the same, and supersedes all prior, collateral or contemporaneous oral or written representations, warranties or agreements regarding the same. No amendment to or modification of this Agreement will be binding unless in writing and signed by duly authorized representatives of the parties. Any and all terms and conditions set out in any correspondence between the parties or set out in a purchase order which are different from or in addition to the terms and conditions set forth herein, shall have no application and no written notice of same shall be required. In the event that one or more of the provisions of this Agreement is found to be illegal or unenforceable, this Agreement shall not be rendered inoperative but the remaining provisions shall continue in full force and effect.

Warranty Notice

COVERED PRODUCTS: This warranty covers all products manufactured by Hemisphere GNSS and purchased by the end purchaser (the "Products"), unless otherwise specifically and expressly agreed in writing by Hemisphere GNSS.

LIMITED WARRANTY: Hemisphere GNSS warrants solely to the end purchaser of the Products, subject to the exclusions and procedures set forth below, that the Products sold to such end purchaser and its internal components shall be free, under normal use and maintenance, from defects in materials, and workmanship and will substantially conform to Hemisphere GNSS' applicable specifications for the Product, for a period of 12 months from delivery of such Product to such end purchaser (the "Warranty Period"). Repairs and replacement components for the Products are warranted, subject to the exclusions and procedures set forth below, to be free, under normal use and maintenance, from defects in material and workmanship, and will substantially conform to Hemisphere GNSS' applicable specifications for the Product, for 90 days from performance or delivery, or for the balance of the original Warranty Period, whichever is greater.

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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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