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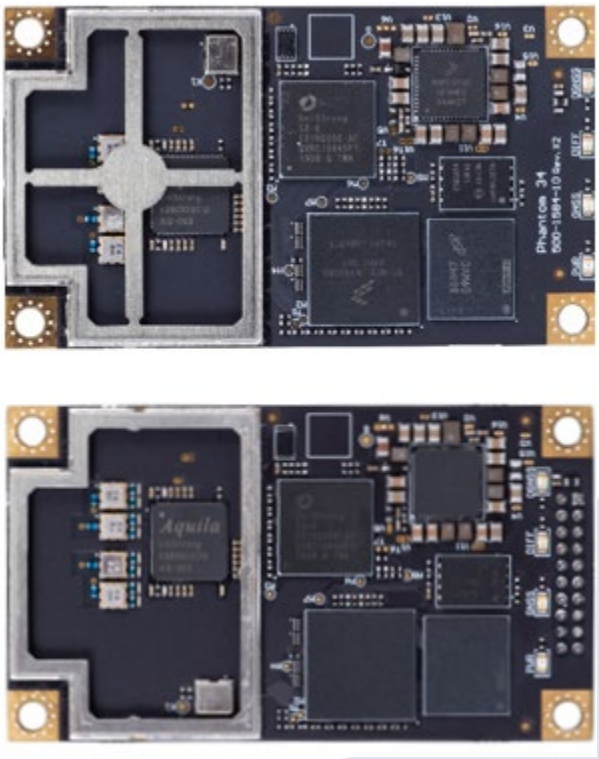

875-0433-10

Phantom™ 20/34 GNSS OEM Boards

Integrator Guide
Revision: A3
August 18, 2021

Table of Contents

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Device Compliance

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

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

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

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

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6539303	7292185	7689354	8138970
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6744404	7388539	7885745	8184050
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2002244539	2002325645
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Phantom 20/34 Terms & Definitions

Phantom 20/34 terms & definitions

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

Term	Definition
Activation	Activation refers to a feature added through a one-time purchase. For features that require recurring fees, see **Subscription**.
ASCII	American Standard Code for Information Interchange
Atlas	Atlas is a subscription-based service provided by Hemisphere GNSS.
BeiDou	BeiDou is a global navigation satellite system deployed and maintained by China.
BIN message	Binary message
dB	Decibel. The unit of measurement used to express signal-to-noise ratio (SNR).
Firmware	Firmware is the software loaded into the receiver that controls the functionality of the receiver and runs the GNSS engine.
Galileo	Galileo is a global navigation satellite system deployed and maintained by the European Union and European Space Agency.
GLONASS	Global Orbiting Navigation Satellite System (GLONASS) is a Global Navigation Satellite System deployed and maintained by Russia.
GNSS	Global Navigation Satellite System (GNSS) is a system that provides autonomous 3D position (latitude, longitude, and altitude) and accurate timing globally by using satellites. Current GNSS providers are GPS, GLONASS, Galileo, BeiDou, NavIC (IRNSS), and QZSS.
GPIO	General purpose input/output
GPS	Global Positioning System (GPS) is a global navigation satellite system deployed and maintained by the United States.

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Phantom 20/34 Terms & Definitions, Continued

Phantom 20/34 terms & definitions, continued

Term	Definition
I/O	Input/Output
LED	Light Emitting Diode
NavIC (IRNSS)	Navigation with Indian Constellation and Indian Regional Navigational Satellite System (IRNSS) is a regional navigation satellite system deployed and maintained by India.
NMEA	National Marine Electronics Association (NMEA) is a marine electronics organization that sets standards for communication between marine electronics.
PCB	Printed Circuit Board
PPS	Pulse-per-second is a pulse output by the receiver precisely aligned to the GNSS time. Default output is every one second.
QZSS	Quasi-Zenith Satellite System (QZSS) is a regional satellite navigation system deployed and maintained by Japan.
RF	Radio Frequency
RMS	Root Mean Square
ROX	ROX is a Hemisphere GNSS propriety RTK message format that can be used as an alternative to RTCM3 when both the base and rover are Hemisphere branded.
RTCM	Radio Technical Commission for Maritime Services (RTCM) is a standard used to define RTK message formats so that receivers from any manufacturer can be used together.
RTK	Real-Time-Kinematic (RTK) is a real-time GNSS differential method that provides better accuracy compared to other differential corrections.
SBAS	Satellite Based Augmentation System (SBAS) is a system that provides differential corrections over satellite throughout a wide area or region.
SNR	Signal-to-Noise ratio

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Phantom 20/34 Terms & Definitions, Continued

Phantom 20/34 terms & definitions, continued

Term	Definition
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.
UART	Universal Asynchronous Receiver/Transmitter (UART) is the electronic circuit that makes up the serial port.
WAAS	Wide Area Augmentation System (WAAS) is a satellite-based augmentation system (SBAS) that provides free differential corrections over satellite in parts of North America.

Chapter 1: Introduction

Overview

Introduction

This Integrator Guide provides information to help you integrate your Phantom 20/34 OEM boards with your positioning product. You can download this manual from the Hemisphere GNSS website at HTTPS://WWW.HEMISPHEREGNSS.COM/.

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

Contents

Product Overview

Product overview

The Phantom 20 and 34 GNSS OEM boards are the most accurate and reliable OEM modules with advanced technology features including the Athena™ RTK engine with availability of the Atlas® service corrections and aRTK™.

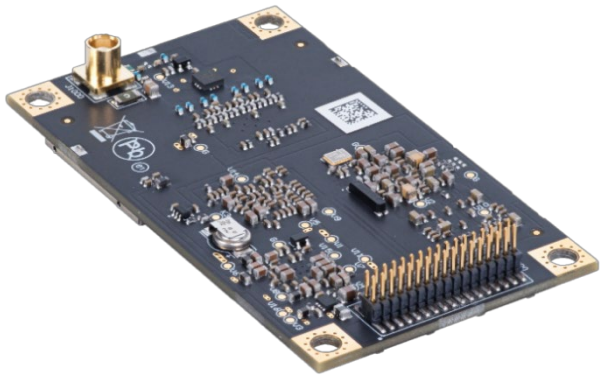

Figure 1-1: Phantom 34 GNSS OEM Board

The Phantom 20 and 34 GNSS OEM boards' positioning is scalable and field upgradeable with all Hemisphere software and service options. You can use the same centimeter-level accuracy in either single frequency mode or employ the full performance and fast RTK initialization times over long distances with multi-frequency, multi-constellation GNSS signals. The high-accuracy L-band positioning from meter to sub-decimeter levels is available via the Atlas GNSS correction service.

Note: Throughout the rest of this manual, the Phantom 20 GNSS OEM board, and the Phantom 34 GNSS OEM board is referred to simply as the Phantom 20 and the Phantom 34.

Key Features

Phantom 20/34 key features

The small form factor, low power consumption, and simple on-board firmware make Phantom 20/34 an ideal solution for integrators, offering scalability and expandability from L1 GPS with SBAS to L1/L2 GPS, GLONASS, BeiDou, NavIC (IRNSS)*, QZSS, and Galileo (with RTK capability). For information on commands and messages refer to the online HGNSS Technical Reference Manual (TRM) on the HGNSS website.

*NavIC (IRNSS) requires a future firmware update.

Phantom 20/34 boards are offered in common industry form factors:

- Phantom 20 has a mechanical design compatible with popular after-market products (20-pin) with integrated L-band.
- Phantom 34 is a drop-in replacement for Hemisphere GNSS' P306 or P326 OEM boards with integrated L-band.

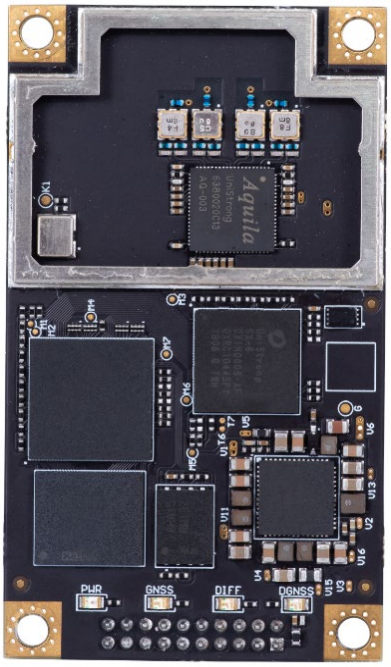

Figure 1-2: Phantom 20 GNSS OEM Board

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Key Features, Continued

Phantom 20/34 key features

Key features of the Phantom 20/34 boards include:

• Multi-frequency position, supporting GPS, GLONASS, BeiDou, Galileo, NavIC (IRNSS)* and QZSS	• Serial, USB host (Phantom 34 only), USB device and CAN connectivity (Phantom 34 only)
• Long-range RTK baselines up to 50 km with fast acquisition times	• Atlas L-band capable to 4 cm RMS
• Compatible with many RTK sources including Hemisphere GNSS' ROX format, RTCM, CMR, CMR+	• Athena GNSS engine providing best-in-class RTK performance
• Mechanically and electrically (pin-for-pin) compatible with many other manufacturers' modules	

*NavIC (IRNSS) requires a future firmware update.

For complete specifications of Phantom 20 and 34 boards, see Appendix B Technical Specifications.

What's Included

What's included

The Phantom 20/34 are available in two configurations:

- OEM boards only - designed for integrators who are familiar with Hemisphere board integration.
- OEM boards and Universal Development Kit ST (UDK ST)- designed for integrators who are new to OEM board integration.

The UDK ST 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 UDK ST visit HTTPS://WWW.HEMISPHEREGNSS.COM/ and navigate to the OEM Products page or contact your local dealer.

Firmware

Firmware

The software that runs the Phantom 20/34 is often referred to as firmware, since it operates at a low level.

The Phantom 20/34 currently ships with the Athena-based firmware 6.0.0 or higher. Refer to the online HGNSS Technical Reference Manual (TRM) for information on the querying and talking to the Phantom 20/34 boards.

You can upgrade the firmware when in the field through any serial port as new versions become available.

Using PocketMax to Communicate with the Phantom 20/34

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 Phantom 20/34 via the COM port and open PocketMax.

The screens in PocketMax easily interface with the Phantom 20/34:

- configure GNSS message output and port settings
- configure the receiver
- record various types of data
- monitor the Phantom 20/34's status and function

PocketMax is available for download from the Hemisphere GNSS website.

Athena RTK and Atlas L-band

Athena RTK

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

Athena RTK can be added to the Phantom 20/34 as an activation.

Athena RTK has the following benefits:

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

For more information about Athena RTK, see:
HTTPS://WWW.HEMISPHEREGNSS.COM/TECHNOLOGY/#ATHENA

Atlas L-band

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

- **Positioning accuracy -** Competitive positioning accuracies down to 4 cm RMS in certain applications.
- **Positioning sustainability -** Cutting edge position quality maintenance in the absence of correction signals, using Hemisphere's patented technology.
- **Scalable service levels -** Capable of providing virtually any accuracy, precision and repeatability level in the 4 cm to 50 cm range.
- **Convergence time -** Industry-leading convergence times of 10-40 minutes
- **Global Ionospheric Model** - Real-time ionospheric activity and data is sent to the receiver and allows Atlas-capable devices to adjust accordingly, providing excellent convergence performance.

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

aRTK Position Aiding

aRTK position aiding

aRTK is an innovative feature available that greatly mitigates the impact of land-based communication instability.

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

Phantom 20/34 receives aRTK augmentation correction data over satellite, while also receiving the land-based RTK correction data. The receiver internally operates with two sources of RTK correction, creating one additional layer of correction redundancy as compared to typical RTK systems.

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

Chapter 2: Integrating the Phantom 20/34 OEM Boards

Overview

Introduction

This chapter provides instructions on how to integrate your Phantom 20/34 boards with your positioning product.

Contents

Phantom 20/34 Integration

Introduction

Successful integration of the Phantom 20/34 within a system requires electronics expertise that includes:

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

Phantom 20/34 integration requirements

The Phantom 20/34 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 545 mA continuous typical, 600 mA maximum
- 3.3 V CMOS UART's and USB communications
- Radio frequency (RF) input to the engine from a GNSS antenna is required to be actively amplified (10 to 35 dB gain)
- The Phantom 20/34 supplies 5V for the antenna (no separate source is required)
- Antenna input impedance is 50 Ω

Message interface

The Phantom 20/34 can be configured (message output and receiver configuration) over serial (3.3V UART and USB ASCII commands published in the online HGNSS Technical Reference Manual (TRM)). Additionally, you can configure the Phantom 34 over CAN. Refer to the Hemisphere GNSS NMEA 2000 Standard Messages Reference Manual on the HGNSS website.

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

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

For more information on NMEA 0183 commands and messages and binary messages, refer to the online HGNSS Technical Reference Manual (TRM).

Mechanical Layout

Phantom 20/34 mechanical layout

Figure 2-1 shows the mechanical layout for the Phantom 20, and Figure 2-2 shows the mechanical layout for the Phantom 34. Dimensions are in millimeters (inches) for all layouts.

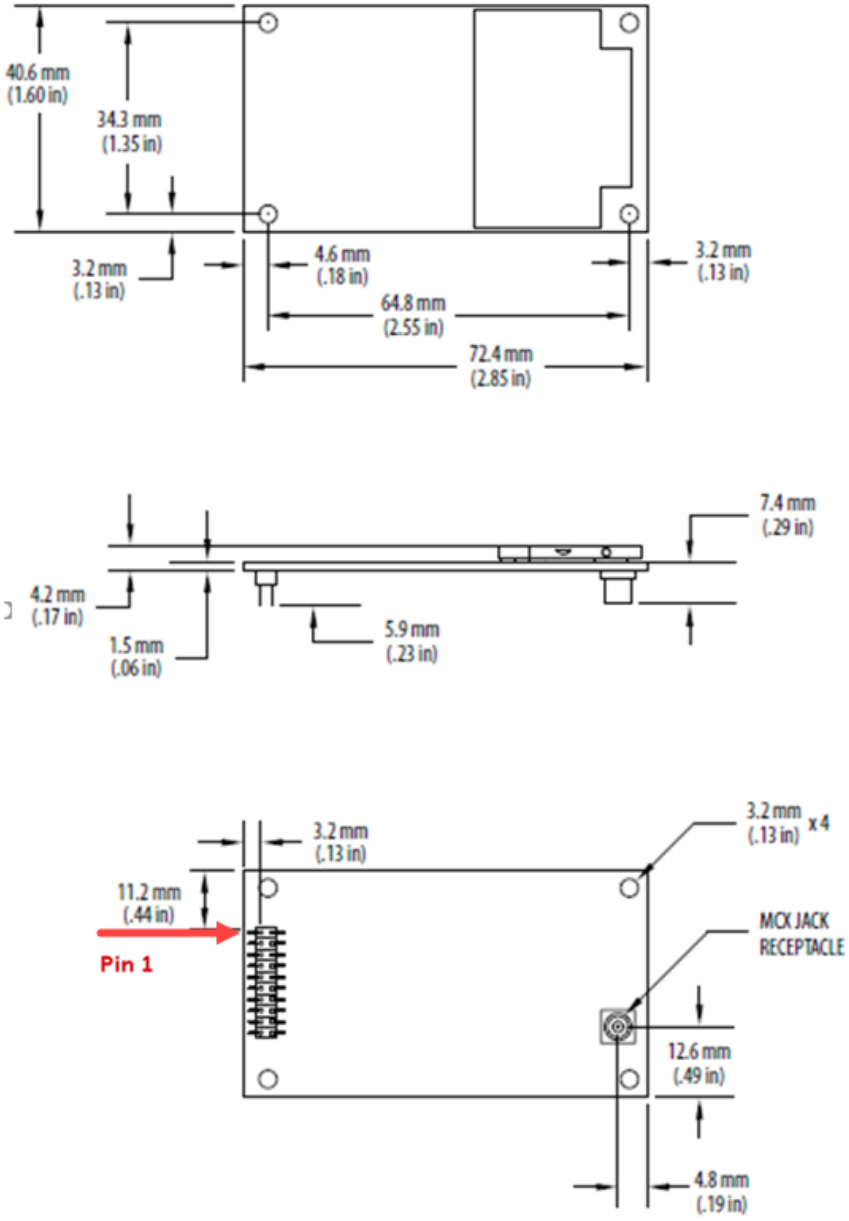

Figure 2-1: Phantom 20 mechanical layout

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Mechanical Layout, Continued

Phantom 20/34 mechanical layout, continued

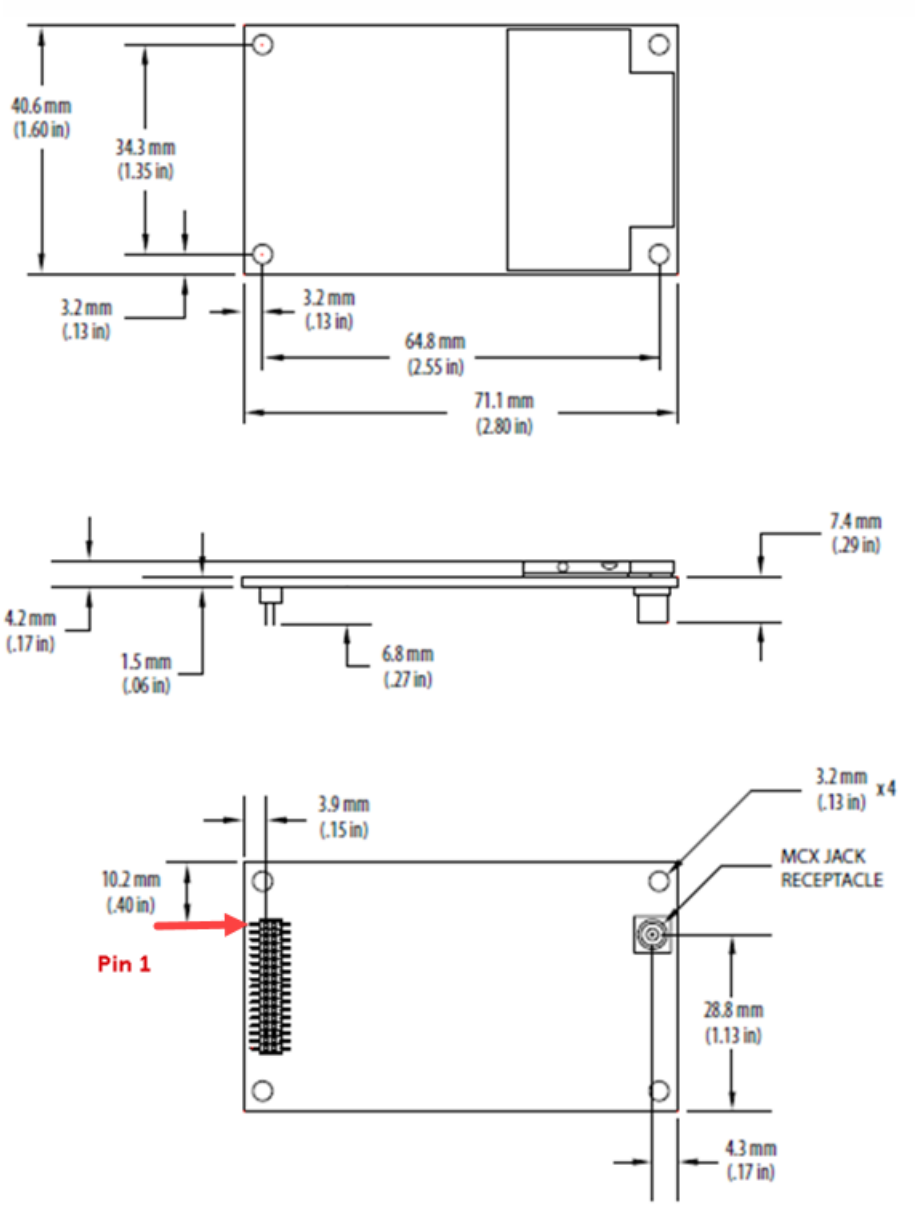

Figure 2-2: Phantom 34 mechanical layout

Connectors

Phantom 20/34 connectors

Table 2-1 lists the Phantom 20/34 connectors and mating connectors. You can use different compatible connectors; however, the requirements may be different. The antenna input impedance is 50 Ω.

Table 2-1: Phantom 20/34 connectors

GNSS Board and Connector Type		GNSS Connector	Mating Connector
Phantom 20	RF	MCX, female straight jack Emerson (Johnson) 133-3711-202	MCX, male straight plug There are two connector options: 1. Cinch 133-3801-201 requires 13/32 inch board gap 2. Würth Elektronik 60614003121504 requires 5/16 inch board gap
	Power/ data	20-pin (10x2) male header, 0.08 inch (2 mm) pitch Samtec TMM-110-01-T-D-SM	10x2 female SMT header socket, 0.08 inch (2 mm) pitch There are two connector options: 1. Samtec ESQT-110-03-F-D-345 requires 13/32 inch board gap 2. Samtec SQT-110-03-F-D requires 5/16 inch board gap

Continued on next page

Connectors, Continued

Phantom 20/34 connectors, continued

Table 2-1: Phantom 20/34 connectors (continued)

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

Mounting Options

Overview

When mounting the Phantom 20/34, use metal standoffs, bolts, nuts, or screws. Plastic or nylon standoffs are not appropriate for vibration concerns. PCB snap-in place standoffs should be avoided. The pressure and snapping action put undue stress on the board and compromises solder integrity. In addition, metal standoffs help heat dissipate off the GNSS board.

There are two options for mounting the Phantom 20/34:

1. Direct Electrical Connection method
2. 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 Phantom 20/34 on the standoffs and RF and header connectors. This method is very cost effective as it does not use cable assemblies to interface with the Phantom 20/34.

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

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

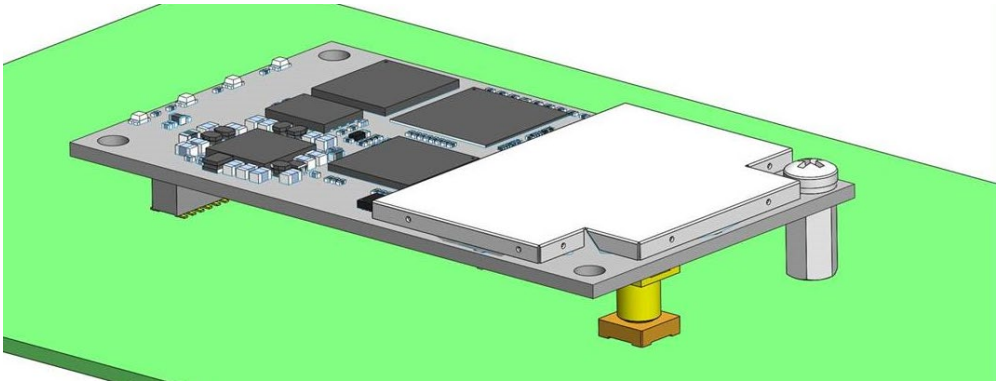

Figure 2-3: Connector selections

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Mounting Options, Continued

Direct electrical connection, continued

The figure above shows only one standoff for simplicity – always secure all four corners of the GNSS receiver.

When using standoffs with the Phantom 20 and 34, ensure the proper board gap is achieved. Note if washers are needed or not to achieve the correct board gap. There are two common methods to create a direct electrical connection:

1. Use a right-angle MCX connector. You must use a taller header than the Samtec part number suggested in this guide. This provides the clearance for a right-angle cable-mount connector and eliminates the need for the carrier board to handle the RF signals.
2. Use the standard headers and create a PCB cutout for the antenna connector.

Note: See Table 2-1 for Phantom 20/34 connector information. The mounting holes of the Phantom 20/34 have a standard inner diameter of 3.2mm (0.125 in).

Indirect electrical connection (cable) method

The second method is to mount the Phantom 20/34 mechanically, so you can connect a ribbon power/data cable to the Phantom 20/34. This requires cable assemblies and there is a reliability factor present with cable assemblies in addition to increased expense.

Header Layouts and Pinouts

Overview

The Phantom 20/34 uses a dual-row header connector to interface with power, communications, and other signals.

To identify the first header pin, orient the board so the bar is to the upper left of the pins; the first pin is on the left directly below the bar (see Figure 2-3). The pins are then sequentially numbered per row from top-to-bottom.

Phantom 20 Header and pin-out

Figure 2-4 shows the 20-pin header layout.

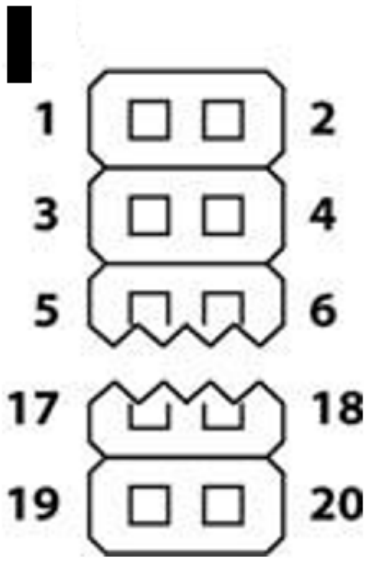

Figure 2-4: Phantom 20 20-pin header layout

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Header Layouts and Pinouts, Continued

Phantom 20 Header and pin-out, continued

The Phantom 20 board has a 20-pin header. Table 2-2 provides the Phantom 20 pin header pin-out signals and descriptions.

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

Table 2-2: Phantom 20 20-pin header pin-out

Pin	Signal Name	Signal Type	Signal Direction	Description
1	Antenna Pwr	Power	-	Antenna power, DC, 15 V max.
2	3.3 V	Power	-	3.3V±5% supply voltage
3	USB DEV–	Analog	Input/ Output	This is one half of a USB differential pair (pins 3 and 4), match lengths and route as 90 Ω differential pair if USB is used.
4	USB DEV+ (default)	Analog	Input/ Output	Dual use pin. USB_D+ is the default. USB_D+: This is one half of a USB differential pair (pins 3 and 4), match lengths and route as 90 Ω differential pair if USB is used.
5	Reset	3.3V CMOS	Input	Reset, 3.3 V typical, not required, Active Low. This pin must be held low for a minimum of 100 microseconds to guarantee operation. Internal 10 kΩ pullup.

Continued on next page

Phantom 20 Header and pin-out, continued

Table 2-2: Phantom 20 20-pin header pin-out (continued)

Pin	Signal Name	Signal Type	Signal Direction	Description
6	RXPC	3.3V CMOS	Input	Port C serial input, 3.3 V CMOS, idle high
7	TXPC	3.3V CMOS	Output	Port C serial output, 3.3 V CMOS, idle high
8	RXPD	3.3V CMOS	Input	Port D serial input, 3.3 V CMOS, idle high
9	TXPD	3.3V CMOS	Output	Port D serial output, 3.3 V CMOS, idle high
10	GND	Power	-	Supply Return (Ground)
11	TXPA	3.3V CMOS	Output	Port A serial output, 3.3 V CMOS, idle high
12	RXPA	3.3V CMOS	Input	Port A serial input, 3.3 V CMOS, idle high
13	GND	Power	-	Receiver ground
14	TXPB	3.3V CMOS	Output	Port B serial output, 3.3 V CMOS, idle high
15	RXPB	3.3V CMOS	Input	Port B serial input, 3.3 V CMOS, idle high
16	GND	Power	-	Receiver ground
17	Manual Mark	3.3V CMOS	Input	Rising or falling edge triggered. This input is used to provide a position or time data log based on an external trigger. Internal 10 kΩ pullup.
18	GND	Power	-	Supply Return (Ground)

Continued on next page

Header Layouts and Pinouts, Continued

Phantom 20 Header and pin-out, continued

Table 2-2: Phantom 20 20-pin header pin-out (continued)

Pin	Signal Name	Signal Type	Signal Direction	Description
19	PPS	3.3V CMOS	Output	Active high, rising edge, 3.3 V CMOS
20	Position Valid Indicator	3.3V CMOS	Output	Status indicator, 3.3 V CMOS, active low

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Header Layouts and Pinouts, Continued

Phantom 34 Header and pin-out

The Phantom 34 boards have a 34-pin header. Figure 2-5 shows the Phantom 34 pin header layout.

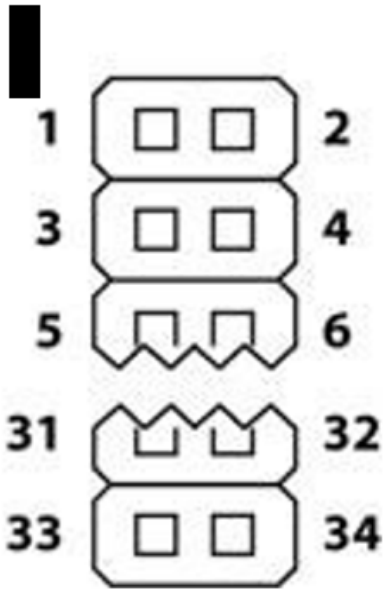

Figure 2-5: Phantom 34 - 34-pin header layout

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Header Layouts and Pinouts, Continued

Phantom 34 Header and pin-out, continued

Table 2-3 provides the Phantom 34 34-pin header pin-out.

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

Table 2-3: Phantom 34 34-pin header pin-out

Pin	Signal Name	Signal type	Signal Direction	Description
1	3.3 V	Power	-	Receiver power supply, 3.3 V
2	3.3 V	Power	-	Receiver power supply, 3.3 V
3	Antenna Pwr	Power	-	Antenna power, DC, 15 V max
4	N/C			
5	USB DEV+	Analog	Input/ Output	USB device data +
6	USB DEV–	Analog	Input/ Output	USB device data -
7	GND	Power	-	Receiver ground
8	GND	Power	-	Receiver ground
9	TXPA	3.3V CMOS	Output	Port A serial output, 3.3 V CMOS, idle high
10	RXPA	3.3V CMOS	Input	Port A serial input, 3.3 V CMOS, idle high
11	TXPB	3.3V CMOS	Output	Port B serial output, 3.3 V CMOS, idle high
12	RXPB	3.3V CMOS	Input	Port B serial input, 3.3 V CMOS, idle high
13	TXPD	3.3V CMOS	Output	Port D serial output, 3.3 V CMOS, idle high
14	RXPD	3.3V CMOS	Input	Port D serial input, 3.3 V CMOS, idle high

Continued on next page

Phantom 34 Header and pin-out, continued

Table 2-3: Phantom 34 34-pin header pin-out (continued)

Pin	Signal Name	Signal type	Signal Direction	Description
15	PPS	3.3V CMOS	Output	Pulse Per Second output. (1, 2, 5, or 10Hz, programmable width, rising or falling edge) This signal defaults to one pulse per second but may be altered across a wide range of frequencies using software commands. Edges can be synchronized to GNSS time reference.
16	Manual Mark	3.3V CMOS	Input	Rising or falling edge triggered. This input is used to provide a position or time data log based on an external trigger. Internal 10 kΩ pullup.
17	GPS Lock	3.3V CMOS	Output	Status indicator, 3.3 V CMOS, active low
18	Diff Lock	3.3V CMOS	Output	Status indicator, 3.3 V CMOS, active low
19	DGPS Lock	3.3V CMOS	Output	Status indicator, 3.3 V CMOS, active low
20	n/c	n/c	n/c	n/c
21*	TX CAN A (default) /GPIO0	3.3V CMOS	Output*	Dual use pin Selectable between, CAN A transmit (default)/ General purpose (input/output)

Continued on next page

Phantom 34 Header and pin-out, continued

Table 2-3: Phantom 34 34-pin header pin-out (continued)

Pin	Signal Name	Signal type	Signal Direction	Description
22*	TX CAN B (default) /GPIO1	3.3V CMOS	Input*	Dual use pin Selectable between CAN B transmit (default)/ General purpose (input/output)
23*	RX CAN A (default) /GPIO2	3.3V CMOS	Input*	Dual use pin Selectable between CAN A receive (default)/ General purpose (input/output)
24*	RX CAN B (default) /GPIO3	3.3V CMOS	Input*	Dual use pin Selectable between CAN B receive (default)/ General purpose (input/output)
25	Speed Output	3.3V CMOS	Output	0 - 3 V variable clock output
26	Speed Ready	3.3V CMOS	Output	Active low, speed valid indicator, 3.3 V CMOS
27	GND	Power	-	Receiver ground
28	GND	Power	-	Receiver ground
29	USB HOST D+	Analog	Input/ Output	USB HOST data +

Continued on next page

Phantom 34 Header and pin-out, continued

Table 2-3: Phantom 34 34-pin header pin-out (continued)

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

**Selectable pin with input/output option*

Signals

Overview

This section provides information on the signals available via connectors.

RF Input

The Phantom 20/34 is designed to work with active GNSS antennas with an LNA gain range of 10 to 35 dB. While the on-board Automatic Gain Control (AGC) circuitry will compensate for variations in signal level, system designers should try to have the antenna's gain offset the cable's loss with a 10-15 dB margin. For example, a cable with a signal loss of 10 dB @ 1575 MHz should be used with a 25 dB gain antenna. Cable losses of more than 20 dB should be avoided and may require special system design.

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

Ports

Serial ports

The Phantom 20/34 boards 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 Phantom 20/34 serial ports' 3.3 V CMOS signal level can be translated to interface to other devices.

Communication Port D

Communication Port D is exclusively for external DGPS correction input to the Phantom 20/34, such as from Hemisphere GNSS' SBX beacon board and RTK communication.

Continued on next page

Ports, Continued

USB ports

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

The Phantom 20 has only a USB device port.

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

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

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

CAN

CAN transceiver

A CAN transceiver is required. The Phantom 34 CAN RX and CAN TX are 3.3 V CMOS signals. The Phantom 34 connects to the transceiver on the single- ended CMOS port. CANH and CANL are CAN standard pins on the physical bus side of the transceiver The Phantom 34 does not connect to this portion of the transceiver.

Note: Resistor values can vary based on application.

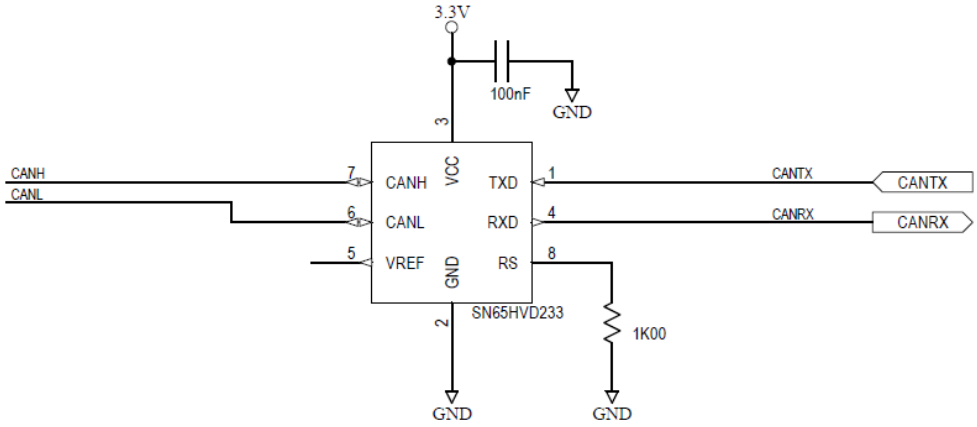

Figure 2-6: CAN design example

Chapter 3: Understanding the Phantom 20/34 OEM Board

Overview

Introduction

Chapter 3 provides the information you need to understand the Phantom 20/34 signals and mounting.

Contents

Timing Signal

PPS timing signal

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

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

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

The Phantom 20 and 34 support a programmable PPS. Users can select the frequency to be 1, 2, 5 or 10Hz. The pulse can be programmed as either active high (rising edge synchronized) or active low (falling edge synchronized). The Phantom 20 and 34 can support widths as wide as 900 ms.

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

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

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

PPS Width can be controlled using

$JPSS,WIDTH,<width in usec>,[SAVE]

The width command parameter is in µs (microseconds).

Note: $JSAVE does NOT save the JPPS configuration. The optional SAVE argument in the commands above must be included to save the settings to non-volatile memory, or the desired PPS configuration settings must be applied every time the receiver is powered on.

Each parameter must be individually saved as it is entered (by adding the optional SAVE at the end of the command).

Event Marker Input

Event marker input

Depending on the application, a GNSS solution may need to be forced and not synchronized with GPS time.

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

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

Grounds

Grounds	You must connect all grounds together when connecting the ground pins of the Phantom 20/34. These are not separate analog and digital grounds that require separate attention. Refer to Table 2-2 through Table 2-3 pin-out ground information for the Phantom 20/34.

Shielding

Shielding	The Phantom 20/34 are sensitive instruments. When integrated into an enclosure, the Phantom 34 requires shielding from other electronics to ensure optimal operation.

Speed Radar Output

Speed radar output

The following two pins 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. 93.99 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.

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

Table 3-1 provides the location of the Speed Radar Pulse and Speed Radar Ready Signal on the Phantom 20/34.

Table 3-1: Phantom 20/34 speed radar output availability

OEM Board	Speed Radar Pulse	Speed Radar Ready Signal
Phantom 20	N/A	N/A
Phantom 34	Pin 25	Pin 26

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.

Receiver Mounting

Receiver mounting

The Phantom 20/34 boards are precision instruments. To ensure optimal operation, mount the receiver in a way to minimize vibration and shock.

When mounting the Phantom 20/34, immediately adjacent to the GPS antenna, Hemisphere GNSS highly recommends shielding the board from the LNA of the antenna.

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

Chapter 4: Operating the Phantom 20/34 OEM Boards

Overview

Introduction

This chapter provides Phantom 20/34 operation information, such as communicating with the Phantom 20/34, firmware, and configuration defaults.

Contents

Powering the Phantom 20/34 On/Off

Powering the Phantom 20/34	The Phantom 20/34 boards are powered by a 3.3 VDC power source. After you connect appropriate power the Phantom 20/34 boards are active.

Communicating with the Phantom 20/34

Communicating with the Phantom 20/34

The Phantom 20/34 boards feature 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 Phantom 20/34 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 Phantom 20/34

Configuring the Phantom 20/34

You can configure all aspects of Phantom 20/34 operation through any serial port using proprietary commands. For information on these commands refer to the online HGNSS Technical Reference Manual (TRM).

You can configure one of the two firmware applications, set communication port baud rates, select which messages to output on the serial ports and the update message rate and set various receiver operating parameters.

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

To issue commands to the Phantom 20/34, connect to a terminal program or either of Hemisphere GNSS' software applications (SLXMon or PocketMax).

LED Indicators

LED Indicators

The Phantom 20/34 features the following surface-mounted diagnostic LEDs that indicate board status (see Figure 4-1- Figure 4-2):

LED Indicator	Light	Board Status
PWR-Power	Red	Power is on
GNSS-GNSS lock	Orange	The user has a position.
DIFF-Differential lock	Blinking	A blinking light indicates the user is receiving corrections, but the corrections aren't decoded and no frame synchronization.
	Solid	A solid light indicates the receiver has locked onto the differential source.
DGNSS-DGNSS position	Green	Indicates the user is receiving corrections.
	Blinking	The LED blinks when the estimated accuracy of the position does not meet the required threshold configured in the **$JLIMIT** command.

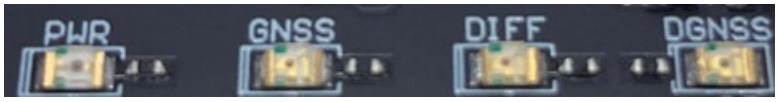

Figure 4-1: Phantom 20 Onboard LEDs

Figure 4-2: Phantom 34 Onboard LEDs

Configuring the Data Message Output

Configuring the Data Message Output

The Phantom 20/34 features three primary bi-directional 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 Phantom 20/34 through any port. For a complete list of commands and messages refer to the online HGNSS Technical Reference Manual (TRM).

‘THIS’ Port and the ‘OTHER’ Port

Overview

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

‘THIS’ port

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

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

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

Continued on next page

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

‘OTHER’ port

The ‘OTHER’ port is either Port A or Port B, or 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>

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

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

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

Using Port D for RTCM Input

Using Port D for RTCM input

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

To configure the Phantom 20/34 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 Phantom 20/34:

$JDIFF,WAAS<CR><LF>

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

Atlas L-band Messages/Commands

Atlas L-band messages/ commands

To configure the Phantom 20/34 to automatically set the L-band frequency parameters, by using the following command:

$JFREQ,AUTO<CR><LF>

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

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

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

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

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

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

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

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

$JASC,RD1,1

Saving the Phantom 20/34 Configuration

Saving the Phantom 20/34 configuration

Each time you change the Phantom 20/34'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 Phantom 20/34 using a terminal program such as HyperTerminal or either of Hemisphere GNSS' applications (SLXMon or PocketMax).

The Phantom 20/34 takes approximately five seconds to save the configuration to non-volatile memory and will indicate when the configuration has been saved. Refer to the online HGNSS Technical Reference Manual (TRM).

Configuration Defaults

Configuration defaults

Below is the standard configuration for the Phantom 20/34.

For more information on these commands refer to the online HGNSS Technical Reference Manual (TRM).

$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 common questions when operating the Phantom 20/34.

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

Contents

Troubleshooting

Phantom 20/34 troubleshooting

Table A-1: Phantom 20/34 Troubleshooting

Symptom	Possible Solution
What is the first thing I do if I have a problem with the operation of the Phantom 20/34?	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 • SBAS reception and performance • External corrections • Installation • Shielding and isolating interference
No data from Phantom 20/34	• Check receiver power status (this may be done with a multimeter). • Check the LED power indicator to see if it is illuminated. • Confirm communication with Phantom 20/34 via Hemisphere query command **$JI, $JSHOW.** • Verify that Phantom 20/34 is locked to GPS satellites (this can often be done on the receiving device). • Check integrity and connectivity of power and data cable connections.
Random data from Phantom 20/34	• Verify that the RCTM or Bin messages are not being accidentally output (send a **$JSHOW** command). • Verify that the baud rate settings of Phantom 20/34 and remote device match. • Check the serial grounding.
No GNSS lock	• Check integrity of antenna cable • Verify antenna's view of the sky • Verify the lock status and signal to noise ratio of GPS satellites (this can often be done on the receiving device or by using SLXMon).

Continued on next page

Phantom 20/34 troubleshooting, continued

Table A-1: Phantom 20/34 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 correction input port matches the baud rate of the external source. • Verify the pinout between the correction source and the correction input port (the "ground" pin and pinout must be connected, and from the "transmit" from the source must connect to the "receiver" of the correction input port). • Use the **$JDIFFX,INCLUDE** command to verify that RTCM2, RTCM3, CMR, or ROX (whichever one is applicable) is enabled.
Non-DGPS output	• Verify SBAS and lock status (or external source is locked). • Confirm baud rates match the external source correctly. • Issue a **$JDIFF** command and see if the expected differential mode is in fact the current mode.

Appendix B: Technical Specifications

Overview

Introduction

Appendix B provides the Phantom 20/34 technical specifications.

Contents

Phantom 20 Technical Specifications

Phantom 20 specifications

Tables B1 – B6 provide the technical specifications for the Phantom 20.

Phantom 20 sensor specifications

Table B-1: Phantom 20 Sensor specifications

Item	Specification
Receiver type	GPS, GLONASS, BeiDou, QZSS, NavIC (IRNSS)* and Galileo RTK with carrier phase and L-band
Signal Received	**GPS** L1CA/L1P/L1C/L2P/L2C/L5 **GLONASS** G1/G2/G3, P1/P2 **BeiDou** B1i/B2i/B3i/B10C/B2A/B2B/ACEBOC **GALILEO** E1BC/E5a/E5b/E5-AltBOC/E6BC **QZSS** L1CA/L1C/L2C/L5/LEX(L6D and L6E) **NavIC** (IRNSS)* L5 Atlas
Channels	800+
GPS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	1 Hz standard, 10 Hz and 20 Hz available

*NavIC (IRNSS) requires a future firmware update.

Continued on next page

Phantom 20 sensor specifications, continued

Table B1: Phantom 20 Sensor specifications (continued)

Item	Specification		
Horizontal accuracy		**RMS (67%)**	**2DMRS (95%)**
	RTK[1,2]	8 mm + 1 ppm	15 mm + 2 ppm
	Atlas H10[1]	0.04 m	0.08 m
	Atlas H30[1]	0.15 m	0.30 m
	Atlas Basic[1]	0.50 m	1.0 m
	SBAS (WAAS)[1]	0.3 m	0.6 m
	Autonomous, no SA[1]	1.2 m	2.4 m
Timing (PPS) 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

Phantom 20 Technical Specifications, Continued

Phantom 20 communication specifications

Table B-2: Phantom 20 Communication specifications

Item	Specification
Serial ports	4 full-duplex 3.3 V CMOS (3 main serial ports, 1 differential-only port)
Baud rates	4800 – 460,800
Data I/O protocol	NMEA 0183, Hemisphere proprietary ASCII and Binary
Correction I/O protocol	Hemisphere GNSS' ROX, RTCM v2.3 (DGPS), RTCMv3 (RTK), CMR, CMR^{+4}, Atlas
Timing output	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

Phantom 20 power specifications

Table B-3: Phantom 20 Power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5% typical
Power consumption	1.8 W (All Signals + L-band) typical
Current consumption	545 mA nominal (All Signals + L-band) typical
Antenna voltage input	15 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 35 dB typical
Antenna input impedance	50Ω

Continued on next page

Phantom 20 Technical Specifications, Continued

Phantom 20 environmental specifications

Table B-4: Phantom 20 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[3]	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[3]	CE (ISO 14982 Emissions and Immunity) FCC Part 15, Subpart B CISPR22

Phantom 20 mechanical specifications

Table B-5: Phantom 20 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

Phantom 20 Technical Specifications, Continued

Phantom 20 L-band sensor specifications

Table B-6: Phantom 20 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]When integrated in conjunction with the recommended shielding and protection as outlined in this guide

Phantom 34 Technical Specifications

Phantom 34 specifications

Tables B7- B12 provide the technical specifications for the Phantom 34.

Phantom 34 sensor specifications

Table B-7: Phantom 34 Sensor specifications

Item	Specification
Receiver type	GPS, GLONASS, BeiDou, NavIC (IRNSS)* and Galileo RTK with carrier phase and L-band
Signals Received	**GPS** L1CA/L1P/L1C/L2P/L2C/L5 **GLONASS** G1/G2/G3, P1/P2 **BeiDou** B1i/B2i/B3i/B10C/B2A/B2B/ACEBOC **GALILEO** E1BC/E5a/E5b/E5-AltBOC/E6BC **QZSS** L1CA/L1C/L2C/L5/LEX(L6D and L6E) **NavIC** (IRNSS)* L5 Atlas
Channels	800+
GPS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	1 Hz standard, 10 Hz and 20 Hz available

*NavIC (IRNSS) requires a future firmware update.

Continued on next page

Phantom 34 sensor specifications, continued

Table B-7: Phantom 34 Sensor specifications (continued)

Item	Specification		
Horizontal accuracy		**RMS (67%)**	**2DMRS (95%)**
	RTK[1,2]	8 mm + 1 ppm	15 mm + 2 ppm
	Atlas H10	0.04 m	0.08 m
	Atlas H30	0.15 m	0.30 m
	Atlas Basic	0.50 m	1.0 m
	SBAS (WAAS)[1]	0.3 m	0.6 m
	Autonomous, no SA[1]	1.2 m	2.4 m
Timing (PPS) 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

Phantom 34 Technical Specifications, Continued

Phantom 34 communication specifications

Table B-8: Phantom 34 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 – 460,800
Data I/O protocol	NMEA 0183, NMEA 2000, Hemisphere proprietary ASCII and Binary
Correction I/O protocol	Hemisphere GNSS' ROX, RTCM v2.3 (DGPS), RTCMv3 (RTK), CMR, CMR^{+4}, Atlas
Timing output	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

Phantom 34 power specifications

Table B-9: Phantom 34 Power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5% typical
Power consumption	1.8 W (All Signals + L-band) typical
Current consumption	545 mA nominal (All Signals + L-band) typical
Antenna voltage input	15 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 35 dB typical
Antenna input impedance	50Ω

Continued on next page

Phantom 34 Technical Specifications, Continued

Phantom 34 environmental specifications

Table B-10: Phantom 34 Environmental specifications

Item	Specification
Operating temperature	-40°C to +85°C (-40°F to+185°F)
Storage temperature	-40°C to +85°C (-40°F to+185°F)
Humidity	95% non-condensing (when installed in an enclosure)
Shock and vibration[3]	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[3]	CE (ISO 14982 Emissions and Immunity) FCC Part 15, Subpart B CISPR22

Phantom 34 mechanical specifications

Table B-11: Phantom 34 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

Phantom 34 Technical Specifications, Continued

Phantom 34 L-band sensor specifications

Table B-12: Phantom 34 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] When integrated in conjunction with the recommended shielding and protection as outlined in this guide

Appendix C: Frequently Asked Questions (FAQ)

FAQ

Contents

Frequently Asked Questions (FAQ)

Integration

The following is a list of common questions and solutions when integrating the Phantom 20/34 OEM boards.

Question	Solution
Do I need to use the PPS and event marker?	No, these are not necessary for Phantom 20/34 operation.
What should I do with the PPS signal if I do not want to use it?	Do not connect.
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 with an internal pull-up.
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 Phantom 20/34?	Not necessarily, but you may need to if there are RF interference issues, such as if the Phantom 20/34 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.

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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

Continued on next page

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.

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Frequently Asked Questions (FAQ), Continued

Power, Communication, and Configuration

Question	Solution
My Phantom 20 or Phantom 34 system does not appear to be communicating.	This could be one of a few issues: • Examine the Phantom 20/34 cables and connectors for signs of damage or offset. • Ensure the Phantom 20/34 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 Phantom 20/34 is connected to the receive line of the other device. Also, ensure the signal grounds are connected. • If the Phantom 20/34 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 Phantom 20/30 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.

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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 Phantom 20/34 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 baud rate high enough to transmit all the data is needed; otherwise, some data may not be transmitted.
How can I determine the current configuration of the Phantom 20/34?	The **$JSHOW** command will request the configuration information from the Phantom 20/34. The response will be similar to: **$>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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Frequently Asked Questions (FAQ), Continued

Power, Communication, and Configuration, continued

Question	Solution
How do I change the baud rate of a port from that port?	Connect at the current baud rate of the Phantom 20/34 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 Phantom 20/34 and configure it?	Hemisphere GNSS uses three different software applications: • SLXMon - Available at HTTPS://WWW.HGNSS.COM/. this application is a very useful tool for graphically viewing tracking performance and position accuracy, and for recording data. It can also configure message output and port settings. SLXMon runs on Windows 95 or higher.

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Frequently Asked Questions (FAQ), Continued

Power, Communication, and Configuration, continued

Question	Solution
What is the best software tool to use to communicate with the Phantom 20/34 and configure it?	• PocketMax - Available at HTTPS://WWW.HGNSS.COM/ Similar to SLXMon, you can use this application to graphically view tracking performance and position accuracy, record data, and configure message output and port settings. PocketMax runs on multiple Windows platforms using the Windows .NET framework.

GNSS Reception and Performance

Question	Solution
How do I know what the Phantom 20/34 is doing?	The Phantom 20/34 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. The Phantom 20/34 has surface-mounted status LEDs that indicate receiver status.
Do I have to be careful when using the Phantom 20/34 to ensure it tracks properly?	For best performance, the Phantom 20/34's antenna must have a clear view of the sky for satellite tracking. The Phantom 20/34 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.

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Frequently Asked Questions (FAQ), Continued

SBAS Reception and Performance

Question	Solution
How do I know if the Phantom 20/34 has acquired an SBAS signal?	The Phantom 20/34 can output the **$RD1** message that contains the Bit Error Rate (BER). The BER value describes the rate of errors received from SBAS. Ideally, this should be zero. However, the Phantom 20/34 performs well up to 150 BER for SBAS and up to 500 for Atlas. 150 for SBAS and 500 for Atlas implies that the receiver is not locked onto the relevant satellite. The SLXMon and PocketMax utilities provide this information without needing to use NMEA commands.
How do I know if the Phantom 20/34 is offering a differentially corrected or RTK- corrected position?	The Phantom 20/34 outputs the **$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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Frequently Asked Questions (FAQ), Continued

SBAS Reception and Performance, continued

Question	Solution
How do I select an SBAS satellite?	By default, the Phantom 20/34 will automatically attempt to track the appropriate SBAS satellites. If multiple satellites are available, the one with the lowest BER value is selected to decode the corrections. You can manually select which SBAS satellites to track (not recommended). Refer to the online HGNSS Technical Reference Manual (TRM).
Do I need a dual frequency antenna for SBAS?	Hemisphere GNSS recommends using a dual frequency antenna with the Phantom 20/34. While some receiver function is possible with an L1-only antenna, full receiver performance will only be realized with a dual frequency antenna.

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Frequently Asked Questions (FAQ), Continued

External Corrections

Question	Solution
My Phantom 20/34 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 Phantom 20/34 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 Phantom 20/34's serial port and that the signal grounds are connected. • Make sure the Phantom 20/34 has been set to receive external corrections by issuing the **$JDIFF** command. Refer to the online HGNSS Technical Reference Manual (TRM).

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End User license agreement

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