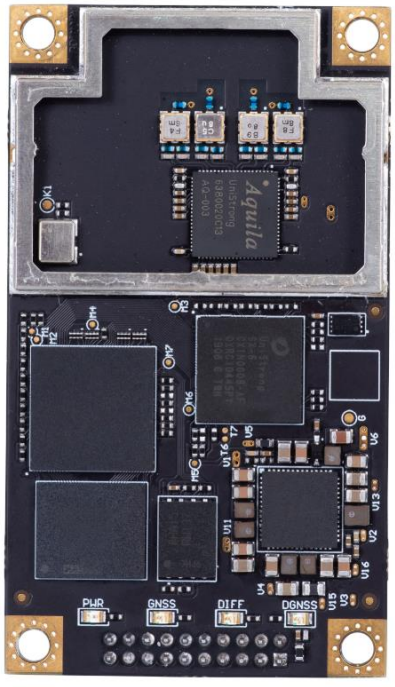
UniStrong



875-0433-10

Phantom™ 20/34 Eclipse OEM Boards

Integrator Guide
Revision: A1
December 15, 2019

www.geospb.ru

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Device Compliance, License and Patents

Device Compliance

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

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

This product complies with the essential requirements and other relevant provisions of Directive 2014/53/EU.

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

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Patents

UniStrong GNSS products may be covered by one or more of the following patents:

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

Australia Patents	
2002244539	2002325645
2004320401	

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Device Compliance, License and Patents, Continued

Notice to Customers

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

UniStrong GNSS, Inc 8515
East Anderson Drive
Scottsdale, AZ 85255 USA
Phone: (480) 348-6380
Fax: (480) 270-5070
PRECISION@HGNSS.COM
HTTPS://WWW.HEMISPHEREGNSS.COM/

Technical Support

If you need to contact UniStrong GNSS Technical Support:

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Fax: (480) 270-5070

Phantom 20/34 Terms & Definitions

Introduction

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

Phantom 20/ 34 terms & definitions

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

Continued on next page

Phantom 20/34 Terms & Definitions, Continued

Phantom 20/34 terms & definitions, continued

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

Chapter 1: Introduction

Overview

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Product Overview

Product overview

The Phantom 20 and 34 are the most accurate and reliable OEM modules with two advanced technology features; aRTK™ and Tracer™. UniStrong aRTK technology, powered by Atlas, allows the Phantom 20 and 34 to operate with RTK accuracies when RTK corrections fail. Tracer uses specialized algorithms to sustain positioning in the absence of correction data.

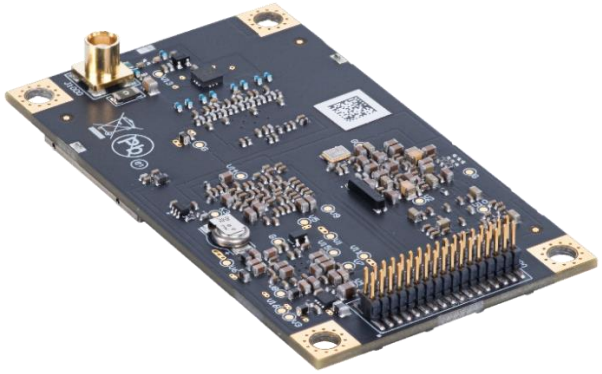


Figure 1-1: Phantom 34 OEM Board

The Phantom 20 and 34 positioning is scalable and field upgradeable with all UniStrong 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.

Continued on next page

Product Overview, Continued

Product overview, continued

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, and Galileo (with RTK capability).

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

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

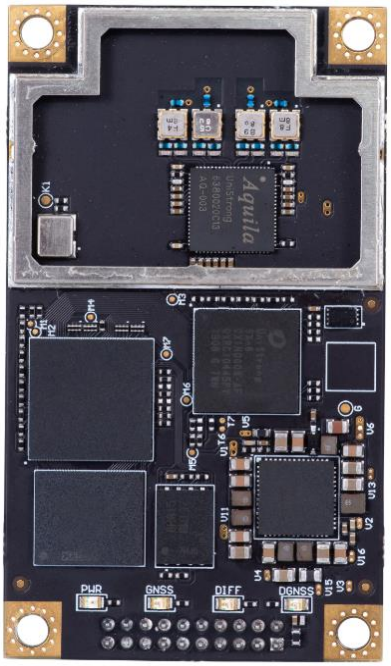


Figure 1-2: Phantom 20 OEM Board

Continued on next page

Product Overview, Continued

Product overview, continued

The Phantom 20/34 boards are available in two models as shown in Table 1-1.

Table 1-1: Phantom 20/34 board options

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

Key Features

Phantom 20/34 key features

Key features for ease of use and integration of the Phantom 20/34 boards include:

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

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

What's Included in Your Kit

Phantom 20/34 kit

The Phantom 20/34 are available in two configurations:

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

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

Firmware

Firmware

The software that runs the Phantom 20/34 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.

Using PocketMax to Communicate with the Phantom 20/34

PocketMax

UniStrong 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:

- 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 Phantom 20/34's status and function

Athena RTK and Atlas L-band

Athena RTK

Athena RTK (Real Time Kinematic) technology is available on Eclipse-based GNSS receivers. This is UniStrong most advanced RTK software and 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: HTTP://HGNSS.COM/TECHNOLOGY

Atlas L-band

Atlas L-band is UniStrong 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
- **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

aRTK Position Aiding

aRTK position aiding

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

Powered by UniStrong 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

Overview

Introduction

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

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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 700 mA continuous
- 3.3 V UART's, RS-232, RS-422, 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), USB with ASCII commands published in the HGNSS Technical Reference Manual (TRM). Additionally, you can configure the receiver over CAN. Refer to the Hemisphere GNSS NMEA2000 manual.

You can output standard NMEA0183 messages over serial and USB proprietary ASCII and binary messages.

You can output NMEA2000 and some Hemisphere proprietary messages over CAN.

For more information on NMEA 0183 commands and messages as well as binary messages, refer to the HGNSS Technical Reference Manual.

Mechanical Layout

Phantom 20/34 mechanical layout

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

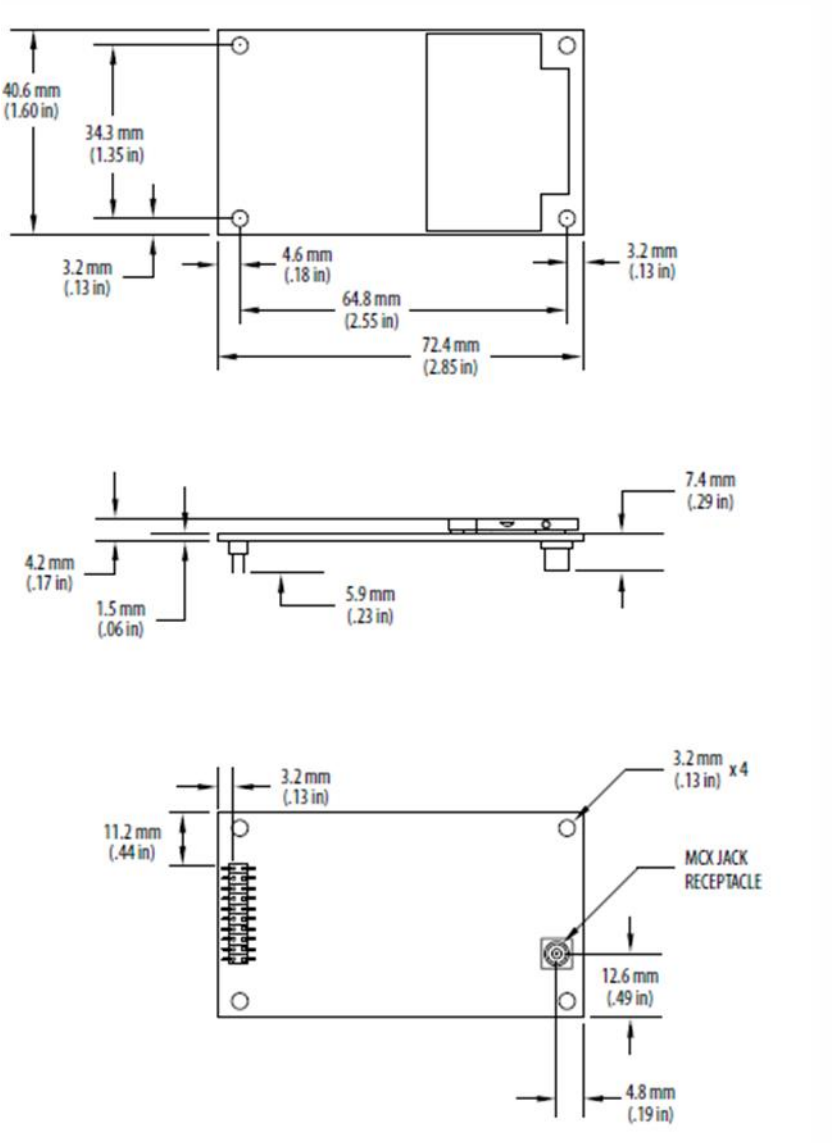


Figure 2-1: Phantom 20 mechanical layout

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Mechanical Layout, Continued

Phantom 20/34 mechanical layout, continued

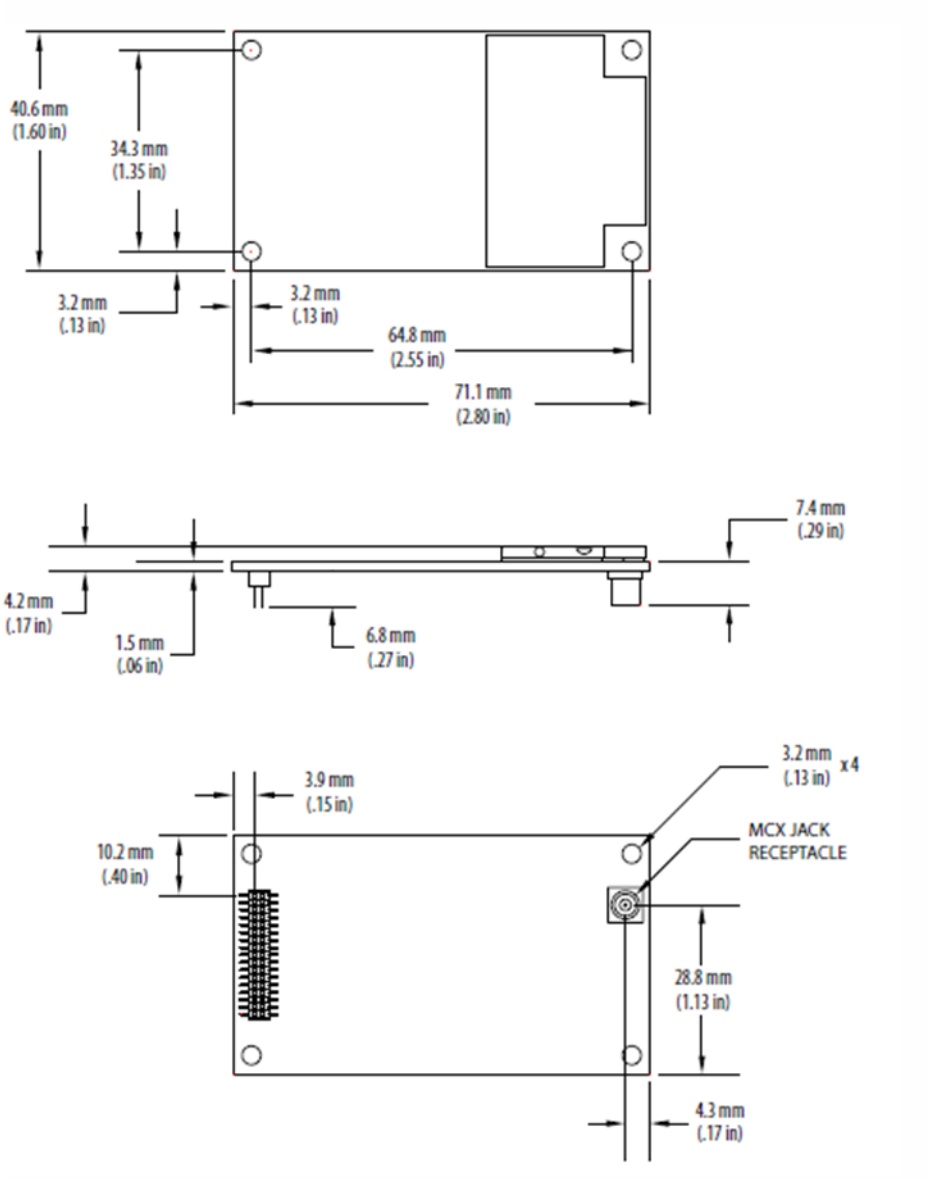


Figure 2-2: Phantom 34 mechanical layout

Connectors

Phantom 20/34 connectors

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

Table 2-1: Phantom 20/34 connectors

Eclipse Board and Connector Type		SMT Connector	Mating Connector
Phantom 20	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
Phantom 34	RF	MCX, female straight jack Emerson (Johnson) 133-3711-202	MCX, male straight plug Samtec RSP-127824-01
	Power/ data	34-pin (17x2) male header, 0.05 in (1.27 mm) pitch Samtec FTSH-117-04-L-DV	17x2 female SMT header socket, 0.05 in (1.27 mm) pitch Samtec FLE-117-01-G-DV
Note: For the Samtec FTSH headers, '-04' indicates 0.150" posts.			

Mounting Options

Overview

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

- Direct Electrical Connection method, and
- 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 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. 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 compromise solder integrity. In addition, metal standoffs help heat dissipate off the GNSS board.

The Phantom 20/34 use a standoff height of 7.9 mm (5/16 in or 0.3125 in). With this height, there should be no washers between either the standoff and the board or the standoff and the carrier board; otherwise, you may need to change the standoff height if you select a different header connector. There are two common methods to create a direct electrical connection:

1. If using a right angle MMCX connector, use a taller header than the Samtec part number suggested in this guide. This provides the clearance to 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).

Header Layouts and Pin-outs

Overview

The Phantom 20/34 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 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

The Phantom 20 board has a 20-pin header. Figure 2-4 shows the 20-pin header layout.

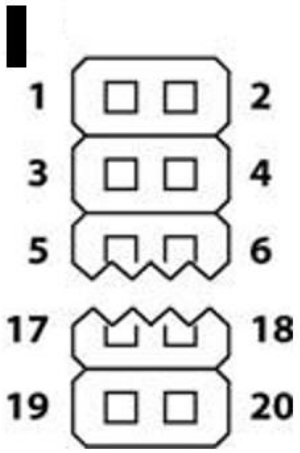


Figure 2-4: Phantom 20 - 20-pin header layout

Continued on next page

Header Layouts and Pin-outs, Continued

Phantom 20 Header and pin-out, continued

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

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

Continued on next page

Header Layouts and Pin-outs, Continued

Phantom 20 Header and pin-out, continued

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

Pin	Name	Type	Description
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

Phantom 34 Header and pin-out

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

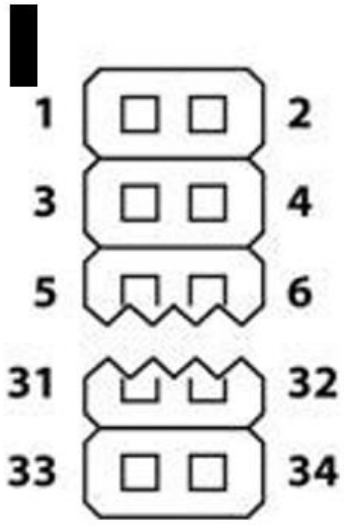


Figure 2-4: Phantom 34 - 34-pin header layout

Continued on next page

Header Layouts and Pin-outs, 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	Name	Type	Description
1	3.3 V	Power	Receiver power supply, 3.3 V
2	3.3 V	Power	Receiver power supply, 3.3 V
3	Antenna Pwr	Power	Antenna power, DC, 15 V max
4	Batt Backup	Power	Power, 1.5 to 5.5 V, 500 nA typical
5	USB DEV+	I/O	USB device data +
6	USB DEV–	I/O	USB device data -
7	GND	Power	Receiver ground
8	GND	Power	Receiver ground
9	PATX	Output	Port A serial output, 3.3 V CMOS, idle high
10	PARX	Input	Port A serial input, 3.3 V CMOS, idle high
11	PBTX	Output	Port B serial output, 3.3 V CMOS, idle high
12	PBRX	Input	Port B serial input, 3.3 V CMOS, idle high
13	PDTX	Output	Port D serial output, 3.3 V CMOS, idle high
14	PDRX	Input	Port D serial input, 3.3 V CMOS, idle high
15	1 PPS	Output	Active high, rising edge, 3.3 V CMOS
16	Manual Mark	Input	Active low, falling edge, 3.3 V CMOS
17	GPS Lock	Output	Status indicator, 3.3 V CMOS, active low
18	Diff Lock	Output	Status indicator, 3.3 V CMOS, active low

Continued on next page

Header Layouts and Pin-outs, Continued

Phantom 34 Header and pin-out, continued

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

Pin	Name	Type	Description
19	DGPS Lock	Output	Status indicator, 3.3 V CMOS, active low
20	n/c	n/c	n/c
21*	TX CAN A (default) /GPIO0	Output*	Selectable between, CAN A transmit (default)/ General purpose (input/output)
22*	TX CAN B (default) /GPIO1	Output*	Selectable between, CAN B transmit (default)/ General purpose (input/output)
23*	RX CAN A/GPIO2	Input*	Selectable between, CAN A receive (default)/ General purpose (input/output)
24*	RX CAN B/GPIO3	Input*	Selectable between, CAN B receive (default)/ General purpose (input/output)
25	Speed Output	Output	0 - 3 V variable clock output
26	Speed Ready	Output	Active low, speed valid indicator, 3.3 V CMOS
27	GND	Power	Receiver ground
28	GND	Power	Receiver ground
29	USB HOST D+	I/O	USB HOST data +
30	USB HOST D-	I/O	USB HOST data -
31	PCTX	Output	Port C serial output, 3.3 V CMOS, idle high
32	PCRX	Input	Port C serial input, 3.3 V CMOS, idle high
33	n/c	n/c	n/c
34	Reset	Input	Reset, 3.3 V typical, not required

**Selectable pin with input/output option*

Continued on next page

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.

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.

When designing the internal and external cable assemblies and choosing the RF connectors, do not exceed the loss budget.

Ports

Serial ports

The Phantom20/34 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 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:

- USB device port (data communication) serves as a high-speed data communications port, such as for a PC
- USB host port (data storage) serves as a data storage port, such as with a USB flash drive

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 3.3V CMOS pins. 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.

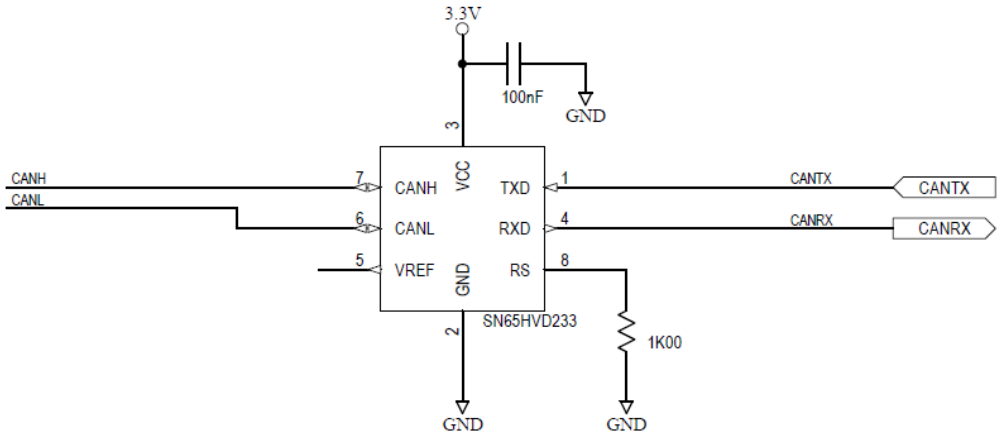


Figure 2-5: CAN design example

Chapter 3: Understanding the Phantom 20/34

Overview

Introduction

Chapter 3 provides the information you need to understand the signals, input/output, mounting and thermal concerns associated with the Phantom 20/34 OEM boards.

Contents

Topic	See Page
Timing Signal	31
Event Marker Input	32
Grounds	32
Shielding	32
Speed Radar Output	33
Receiver Mounting	34

Timing Signal

1PPS timing signal

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

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

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

The Phantom 40 supports a programmable PPS. Users can select the frequency to be 1,2,5 or 10Hz. The Phantom 40 can support widths as wide as 900ms.

The width command parameter is in µs (microseconds).

$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)

PPS Width can be controlled using

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

Note: $JSAVE does NOT save the JPPS configuration so the desired 1PPS configuration settings must be applied every time the receiver is powered on.

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

Event Marker Input

Event marker input

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

Note: Event marker input is typical of most GPS 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, active low with falling edge synchronization. The input impedance is higher than 10 k Ω 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 2-1 through Table 2-2 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.

The Phantom 20/34 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.

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 2-4 provides the location of the Speed Radar Pulse and Speed Radar Ready Signal on the Phantom 20/34.

Table 2-4: Phantom 20/34 speed radar output availability

Eclipse 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. Unistrong GNSS strongly recommends incorporating some form of isolation circuitry into the supporting hardware.

Receiver Mounting

Receiver mounting

The Phantom20/34 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, UniStrong GNSS highly recommends shielding the board from the LNA of the antenna.

Chapter 4: Operating the Phantom 20/34

Overview

Introduction

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

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Communicating with the Phantom 20/34	36
Configuring the Phantom 20/34	37
LED Indicators	38
Configuring the Data Message Output	39
'THIS' Port and the 'OTHER' Port	39
Saving the Phantom 20/34 Configuration	40
Using Port D for RTCM Input	41
Atlas L-band Messages/Commands	42
Configuration Defaults	43

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 Phantom20/34 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.

You can configure the following:

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

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

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

Overview

The Phantom 20/34 features the following surface-mounted diagnostic LEDs that indicate board status (see Figure 2-6):

LED Indicator	Light	Board Status
PWR-Power	Red	The board is powered 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 2-6: Onboard LEDs

Configuring the Data Message Output

Overview

The Phantom 20/34 feature 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 Hemisphere GNSS Technical Reference Manual.

'THIS' Port and the 'OTHER' Port

Overview

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

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 Hemisphere GNSS Technical Reference Manual.

Using Port D for RTCM Input

Using Port D for RTCM input

Port D has been optimized to interface with the 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 Hemisphere GNSS Technical Reference Manual.

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

Configuration Defaults

Configuration defaults

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

For more information on these commands refer to the Hemisphere GNSS Technical Reference Manual.

$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 unusual Phantom 20/34 operation.

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

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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 an multimeter). • Check the LED power indicator to see if it is illuminated. • Confirm communication with Phantom 20/34 via UniStrong 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).

Continued on next page

Troubleshooting, Continued

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

Technical Specifications

Introduction

Appendix B provides the Phantom 20/34 technical specifications.

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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, 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/E6BC/ALTBOC QZSS L1CA/L2C/L5/L1C/LEX *IRNSS L5 (*future firmware update) Atlas
Channels	800+
GPS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	1 Hz standard, 10 Hz and 20 Hz available

Continued on next page

Phantom 20 Technical Specifications, Continued

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	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 (1PPS) accuracy	20 ns		
Cold start time	< 60 s typical (no almanac or RTC)		
Warm start time	< 30 s typical (almanac and RTC)		
Hot start time	< 10 s (almanac, RTC, and position)		
Maximum speed	1,850 kph (999 kts)		
Maximum altitude	18,288 m (60,000 ft)		
Differential options	SBAS, Autonomous, External RTCM v2.3, RTK v3, L-band (Atlas), and DGPS		

Phantom 20 communication specifications

Table B-82 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 GPS binary
Correction I/O protocol	Hemisphere GNSS' ROX, RTCM v2.3 (DGPS), RTCMv3 (RTK), CMR, CMR[+4], Atlas
Timing output	1 PPS CMOS, active high, rising edge sync, 10 k Ω, 10 pF load
Event marker input	CMOS, active low, falling edge sync, 10 k Ω, 10 pF load
USB	1 USB Device

Phantom 20 power specifications

Table B-93 Phantom 20 Power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5%
Power consumption	1.0 W (GPS L1) 1.6 W (GPS/GLONASS L1/L2G1/G2)
Current consumption	303 mA nominal (GPS L1) 484 mA nominal (GPS/GLONASS L1/L2 G1/G2) 696 mA nominal (All Signals + L-band)
Antenna voltage input	15 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 35 dB
Antenna input impedance	50Ω

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[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

Continued on next page

Phantom 20 Technical Specifications, Continued

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

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] Requires an L-band subscription
[4] Receive only, does not transmit this format
[5] When integrated in conjunction with the recommended shielding and protection as outlined in this guide

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, 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/E6BC/ALTBOC QZSS L1CA/L2C/L5/L1C/LEX *IRNSS L5 (*future firmware update) Atlas
Channels	800+
GPS sensitivity	-142 dBm
SBAS tracking	3-channel, parallel tracking
Update rate	1 Hz standard, 10 Hz and 20 Hz available

Continued on next page

Phantom 34 Technical Specifications, Continued

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 (1PPS) accuracy	20 ns		
Cold start time	< 60 s typical (no almanac or RTC)		
Warm start time	< 30 s typical (almanac and RTC)		
Hot start time	< 10 s (almanac, RTC, and position)		
Maximum speed	1,850 kph (999 kts)		
Maximum altitude	18,288 m (60,000 ft)		
Differential options	SBAS, Autonomous, External RTCM v2.3, RTK v3, L-band (Atlas), and DGPS		

Continued on next page

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, CAN, Hemisphere GPS binary
Correction I/O protocol	Hemisphere GNSS' ROX, RTCM v2.3 (DGPS), RTCMv3 (RTK), CMR, CMR^{+4}, Atlas
Timing output	1 PPS CMOS, active high, rising edge sync, 10 k Ω, 10 pF load
Event marker input	CMOS, active low, falling edge sync, 10 k Ω, 10 pF load
USB	1 USB Host, 1 USB Device

Phantom 34 power specifications

Table B-9: Phantom 34 Power specifications

Item	Specification
Input voltage	3.3 VDC +/- 5%
Power consumption	TBD
Current consumption	TBD
Antenna voltage input	15 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 35 dB
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[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

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] Requires an L-band subscription
[4] Receive only, does not transmit this format
[5] When integrated in conjunction with the recommended shielding and protection as outlined in this guide

Appendix C: Frequently Asked Questions (FAQ)

FAQ

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Appendix C: 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 1 PPS and event marker?	No, these are not necessary for Phantom 20/34 operation.
What should I do with the 1 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.

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Integration, continued

Question	Solution
If my company wishes to integrate this product, what type of engineering resources will I need to do this successfully?	UniStrong 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 GNSS when integrating Phantom 20/34?	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

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Support and Repair

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

Continued on next page

Appendix C: Frequently Asked Questions (FAQ), Continued

Support and Repair, continued

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

Continued on next page

Appendix C: 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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Appendix C: Frequently Asked Questions (FAQ), Continued

Power, Communication, and Configuration, continued

Question	Solution
Am I able to configure two serial ports with different baud rates?	Yes, all the ports are independent. For example, you may set one port to 4800 and another port to 19200.
Am I able to have the 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 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 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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Appendix C: 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.

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Appendix C: 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.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

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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Appendix C: 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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Appendix C: 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 Hemisphere GNSS Technical Reference Manual.
Do I need a dual frequency antenna for SBAS?	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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Appendix C: 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 Hemisphere GNSS Technical Reference Manual.

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