

**Phoenix 200™ DGPS Receiver
Installation and Operation Manual**

P/N 016-0171-059 Rev. C 04/15

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Receiver Overview

Congratulations on your purchase of the Raven Phoenix 200 DGPS receiver. The Phoenix 200 receiver is designed to provide highly accurate and reliable DGPS navigation and positioning solutions for yield mapping and monitoring, swathing, custom applications and other precision farming functions while operating in the rugged agricultural environment.

Smart Antenna Design

The smart antenna design of the Phoenix 200 means that the DGPS receiver and antenna are enclosed within the same unit. All configuration and GPS data is stored on non-volatile memory inside the Phoenix 200 receiver. This design not only simplifies the initial system installation, but also allows the receiver to be moved between vehicles quickly to provide DGPS for multiple field operations throughout the season. A convenient magnet mount further streamlines installation on any equipment with a suitable metal mounting surface.

Invicta Front Panel Simulator Utility

The Phoenix 200 smart antenna design requires a PC or laptop computer to view or configure the receiver settings. The Invicta Front Panel utility is available as a free download from the Raven Applied Technology Division web site:

www.ravenhelp.com

Refer to the Chapter 3, *Invicta Front Panel (FP3) Utility*, for more information on using the Invicta Front Panel utility with the Phoenix 200 DGPS receiver.

Note: *Some Raven field computers may be capable of interfacing with a Phoenix 200 DGPS receiver connected directly to the DGPS port on the computer interface cable. The receiver must be connected directly to the field computer cable (not routed through tilt correction or autosteering hardware).*

Refer to Appendix A, Firmware Updates, for details on updating the DGPS receiver firmware.

Simulated Radar Output Feature

The Phoenix 200 receiver is capable of simulating a radar type speed signal commonly used with agricultural equipment. This signal may be routed to in-cabin equipment requiring this type of speed information during field operations.

Note: *The Phoenix 200 receiver is configured from the factory to output radar speed. To input this information to other in-cabin equipment, a speed adapter cable (P/N 115-0171-216) is required.*

The receiver outputs a radar speed signal at a default of 45 Hz per 1 mph [1.61 km/h].

While receiving adequate GPS messages, the Phoenix 200 will continuously calculate and output the radar speed signal during field operations. If the receiver is unable to collect GPS messages, or an adequate signal is not available, the radar speed output may become invalid. Settings which govern the radar speed source output may be configured via the FP3 Sim utility and a serial connection to a PC or laptop.

Updates

Updates for Raven manuals as well as software updates for Raven products are available at the Applied Technology Division web site:

www.ravenhelp.com

Sign up for e-mail alerts to receive notification when updates for Raven products are available on the Raven web site.

At Raven Industries, we strive to make your experience with our products as rewarding as possible. One way to improve this experience is to provide us with feedback on this manual.

Your feedback will help shape the future of our product documentation and the overall service we provide. We appreciate the opportunity to see ourselves as our customers see us and are eager to gather ideas on how we have been helping or how we can do better.

To serve you best, please send an email with the following information to

techwriting@ravenind.com

-Phoenix 200 Installation & Operation Manual

-Manual No. 016-0171-059 Rev. C

-Any comments or feedback (include chapter or page numbers if applicable).

-Let us know how long have you been using this or other Raven products.

We will not share your email or any information you provide with anyone else. Your feedback is valued and extremely important to us.

Thank you for your time.

Care and Use

Refer to the following guidelines for proper care and use of the Phoenix 200 DPGS receiver:

- Route cables to prevent tripping hazards and to keep wires from pinching or breaking.
- When temperatures are expected to be -40° F [-40° C] or lower, or if the system will not be used for an extended period, remove the receiver from the vehicle and store it in a climate controlled environment.
- Use caution when operating the vehicle around low hanging tree branches or driving in or out of buildings. Ensure the antenna has sufficient clearance and will not be struck or damaged while driving around these obstacles. If necessary, disconnect and remove the antenna from the mounting location to prevent damage to the receiver or connected cabling.

Technical Specifications

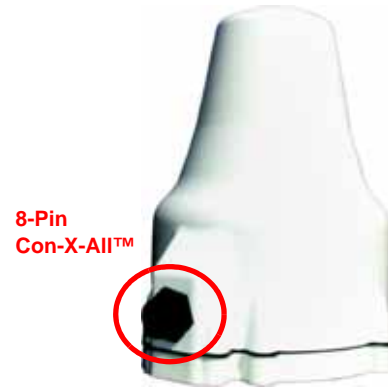
General			
Size	6.88 in. x 5.13 in. [17.475 cm x 13.03 cm]	Message Protocols	NMEA v 2.2 ^a
Weight	32 oz. [907.2 g]	Channels	1 WAAS, 12 GPS
Mounting	Magnetic		
Communication			
Update Rates	Port A - 10 Hz Port B - 10 Hz ^b	Available Baud Rates	1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200
Message Types	GGA, GLL, GSA, GST, GSV, RMC, VTG and ZDA		
Operating Conditions			
Temperature	-40° F to 158° F [-40° C to 70° C]	Voltage	9 V to 16 V (DC)
Humidity	5% to 95% R.H. Non-Condensing at 140° F [60° C]	Power Consumption	2 - 3 Watts (Typical)
Storage Conditions			
Temperature	-40° F to 185° F [-40° C to 85° C]	Humidity	100% Condensing

- NMEA format messages are a standard for most GPS receivers and therefore should be compatible with most any software or hardware application designed to work with GPS.
- Review the *Default Serial Setup* section on page 4 for information on Port B default settings.

Serial Interface

The Phoenix 200 features two bidirectional ports to interface with the internal receiver available via the 8-Pin Con-X-All™ connector on the receiver body.

Pin Number	Signal Name
1	Transmit - Port A
2	Receive - Port A
3	Ground (Serial Communications)
4	Radar
5	Transmit - Port B
6	+12 V (DC) Power
7	Ground
8	Receive - Port B



Default Serial Setup

The Phoenix 200 is configured from the factory with the following settings. These settings should be compatible with most applications.

Port	Default NMEA Messages and Rates	Baud Rate
A	GGA (10 Hz), VTG (10 Hz) and ZDA (0.2 Hz)	19200
B	GGA (5 Hz), VTG (5 Hz) and ZDA (0.2 Hz)	19200

Note: *The baud rate and desired output message types may be configured using the Phoenix 200 interface cable (P/N 115-0171-361) connected to a PC or laptop with an available serial port and with the free FP3 (Invicta Front Panel) software utility. See Chapter 3, Invicta Front Panel (FP3) Utility, or refer to the Chapter 5, Configuration Menus, for more information on configuring the Phoenix 200 with a computer.*

Refer to the device or equipment documentation for specific devices for information about which message types and serial communication settings the device will require to receive messages from the Phoenix 200 DGPS receiver.

Overview of DGPS Systems

While an in-depth study may be required to fully understand GPS, or Global Positioning Systems, a brief description may be useful to understand the operation and limitations of these systems.

GPS is a satellite-based, global navigation system operated and maintained by various organizations and government agencies around the world. Originally intended for military purposes, GPS capabilities have been extended to civilian applications and may be used to provide highly accurate position and navigation information.

A GPS system consists of a pattern, or constellation, of satellites above a given location on the earth's surface. Each satellite continually transmits a coded radio message containing the satellite position and time that the signal is transmitted. A GPS antenna and computer, or a GPS receiver, on the ground then receives signals from several satellites, decodes the messages and calculates a position in the longitude and longitude coordinate system.

To calculate the position, the receiver uses an equation based upon the following formula:

$$DISTANCE = RATE \times TIME$$

The equation calculates the time it took for each radio signal to travel from the satellite and reach the GPS antenna. The rate used in this formula is the known velocity of the radio signals transmitted from each GPS satellite. Time is determined using a code matching technique within the GPS receiver.

Sources of Error

Accuracy of a GPS receiver depends upon the ability of the receiver to correctly calculate the time signals from each satellite take to reach the GPS antenna. There are several natural conditions which can introduce error into this calculation and may cause problems when operating any GPS navigation system or receiver.

Four of the primary sources which can introduce errors are:

- Ionospheric and tropospheric delays on the radio signal
- Signal multi-path or reflection
- Receiver clock biases
- Orbital satellite (ephemeris) position errors

GPS is a line-of-sight system which means that a clear path must exist between the satellite and the GPS antenna. GPS signals can also be de-tuned if the antenna is in close proximity to other objects. Obstructions such as buildings, trees, parts of the vehicle like a fiberglass or metal roof, and human bodies may interfere or completely block signals from the GPS receiver. Moreover, items such as electrical motors, generators, alternators, strobe lights, radio transmitters, over-head power lines, microwave dishes, radar, other active antennas, etc., all generate electrical and magnetic fields which can interfere with GPS or L-Band signals.

NMEA Messages

The Phoenix 200 receiver may be used to communicate with other electronic devices including a Raven light bar for swath guidance during field operations. A set of rules, or communication protocol, known as the NMEA-0183 standard has been established by the National Marine Electronics Association. The NMEA-0183 standard contains numerous message formats such as the ones described below, which the Phoenix 200 receiver uses to communicate with other devices.

TABLE 1. NMEA Messages

Message Type	Description
ALM	Satellite Almanac Data
GGA	Global Positioning System Fix Data
GLL	Longitude and Latitude of Current Position
GRS	Range Residuals
GSA	GPS DOP and Active Satellites
GST	Pseudo Range Measurement Noise Stats
GSV	Satellites in View
RMC	Recommended Minimum Specific GPS/ Transit Data
VTG	Course Over Ground and Ground Speed
ZDA	Time and Date

Differential GPS (DGPS) Correction Sources

A correction signal or differential source from a known, stationary location on the surface of the earth may be used to correct for the common sources of error and may also be capable of enhancing the accuracy and precision of a GPS receiver. The following sections offer brief descriptions of the available differential correction sources which may be used with the Phoenix 200 receiver.

WAAS (Wide Angle Augmentation System)

WAAS uses a network of ground reference stations that cover a very large service area. Signals from GPS satellites are received by wide area ground reference stations and used to generate DGPS corrections.

Note: *WAAS is primarily used in the United States, but may also be used in some areas of Canada and Mexico.*

Hemisphere GPS[®] e-Dif[™]

The following Phoenix 200 receivers are compatible with the Hemisphere GPS e-Dif correction source:

- 063-0172-719 Rev A or earlier
- 063-0172-740 (all hardware revisions)

e-Dif was developed for customers in areas with limited access to SBAS services (e.g. WAAS, EGNOS, etc.) and who needed a reliable correction source without annual subscription fees. The e-Dif correction source is also a good backup for those using free differential sources such as WAAS or EGNOS.

The e-Dif correction source provides a 'localized correction' calibrated for a temporary reference location. During the calibration process, the receiver must be able to gather continuous GPS data for approximately 20 minutes to compute a differential reference location which corrects mostly for atmospheric conditions currently observed by the receiver. Calibration of the reference location may be done either while stationary or while driving to the field area.

The position accuracy of e-Dif corrections is initially very high, but will degrade slowly over time. Once the receiver is calibrated, e-Dif corrections will be available continuously for several hours without need to recalibrate unless the unit is switched off.

Contact a local Raven dealer for more information on unlocking the Phoenix 200 DGPS receiver to utilize the e-Dif correction source.

NovAtel[®] G11de[®]

The following Phoenix 200 receivers are compatible with the NovAtel G11de correction source:

- 063-0172-719 Rev B and higher
- 063-0173-288 (all hardware revisions)

The NovAtel G11de feature can be used either in conjunction with a SBAS correction signal as a position smoothing feature or as an independent correction source for areas with limited SBAS coverage. Both options are available as a standard feature of the compatible Phoenix 200 receiver.

CHAPTER

2

Installation and Initial Start Up

Kit Contents

FIGURE 1. Phoenix 200 DGPS Receiver Components

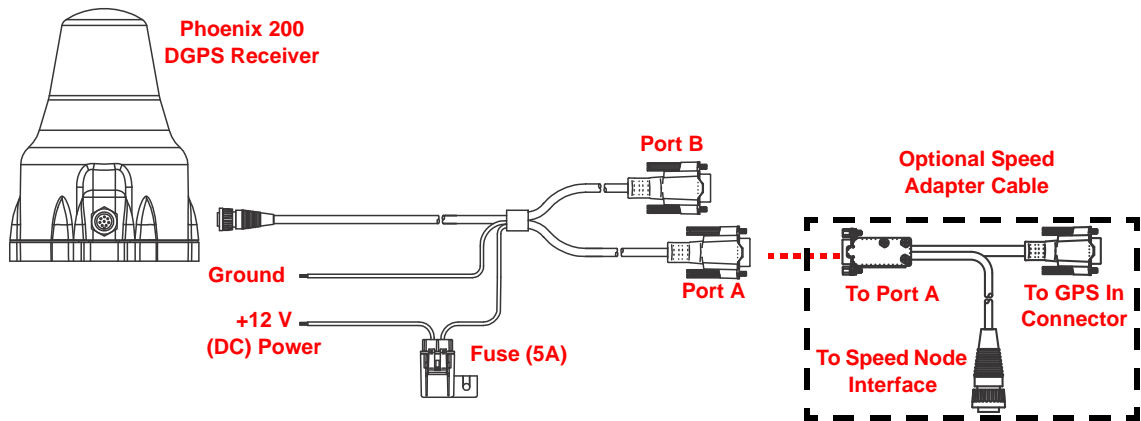


TABLE 1. Phoenix 200 Kit Contents

		Phoenix 200 Kits	
		Phoenix 200 Kit	Phoenix 200 with e-Dif Kit
Components	Part Number	117-0171-071	117-0171-072
Receiver, Phoenix 200	063-0172-719	1	-
Receiver, Phoenix 200 with e-Dif	063-0172-740	-	1
Cable, 15' [4.5 m] Invicta 115	115-0171-361	1	1
Plate, Aerial Antenna Mounting	063-0172-971	1	1
Manual, Phoenix 200 Installation and Operation	016-0171-059	1	1

TABLE 2. Optional Components

Description	Part Number
Speed Adapter Cable	115-0171-216

Installation

Refer to the following sections for mounting and installation recommendations for the Phoenix 200 DGPS receiver.

Mounting Recommendations

To ensure the best possible signal reception, the following recommendations should be considered when selecting the DGPS antenna mounting position.

- To reduce the amount of additional labor or delays, it is recommended to test the receiver in the selected mounting location before permanently routing cables or affixing any mounting hardware.
- The Phoenix 200 receiver should be mounted to the tallest part of the vehicle and away from other antennas or obstructions. The top of the vehicle cabin is generally a good mounting location.
- Make sure that the DGPS antenna has a clear 360° view of the sky.
- The simplest setup is achieved by mounting the antenna on the center line of the vehicle on a suitable metal surface.
- Mount the antenna as far as possible from sources of magnetic or electrical interference such as alternators, strobe lights, radio transmitters, microwave dishes, radar or cellular antennas.
- Route cables to prevent tripping hazards and to keep wires from pinching or breaking.
- The Phoenix 200 receiver must be connected to a clean, controlled power source such as vehicle bus bars or directly to the vehicle battery using a relay to toggle power to the receiver. Connecting the Phoenix 200 GPS receiver to clean power bus bars may allow vehicle shutdown without interrupting GPS reception.

Antenna Mounting

The Phoenix 200 provides a convenient magnet mount to secure the receiver to many vehicles and also allows the receiver to be moved between vehicles quickly and easily.

- If a suitable metallic surface is available, use the provided magnet mount to secure the antenna to the vehicle. No additional mounting procedures or hardware is necessary.
- If a suitable metal surface is not available, use the supplied aerial antenna mounting plate to mount the antenna.

Aerial Antenna Mounting Plate (Optional)

An optional aerial antenna mounting plate (P/N 063-0172-971) is included with kits featuring an MBA (helix) style antenna. If no suitable magnetic mounting location exists on the vehicle, this mounting plate may be affixed to the tallest point of the vehicle to provide a magnetic surface for mounting the GPS antenna.

To affix the aerial antenna mounting plate:

Note: *Test the receiver in the selected mounting location before placing the aerial mounting plate.*

1. Thoroughly clean and dry the selected mounting location on the vehicle.
2. Remove the backing from the adhesive tape on the bottom of the mounting plate.
3. Carefully place the plate on the prepared surface.
4. Set the Phoenix 200 on the top of the aerial mounting plate.

Cable Routing and Connection

A 15 foot [4.5 m] antenna cable (P/N 115-0171-361) is supplied with standard Phoenix 200 receiver kits. Other cable lengths or extension cables may also be available if necessary by contacting a local Raven dealer. Additional cable may be added as long as the voltage drop across the cable does not exceed 0.5 V (DC). This does not normally present a problem if the cable length is 50 feet [15 m] or less.

1. Connect the 8-pin, round connector to the Phoenix 200 receiver.
2. Route the 9-pin serial connectors into the vehicle cabin. Route the cable to avoid pinch points and to prevent tripping hazards.
3. Connect the port A or port B connectors to the GPS input connectors on the in-cabin GPS compatible device such as a Raven field computer or light bar.
4. Route the red and black power leads to a source of clean, controlled power and ground. Do not connect the power leads until all other equipment is properly installed and connected.

Refer to the *Powering the GPS Receiver* section on page 12 for details on powering the Phoenix 200 to avoid damage to the receiver or discharging the vehicle battery.

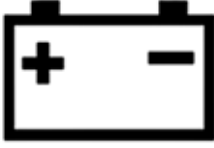
Optional Radar Speed Adapter Cable

The optional Raven radar speed adapter cable (P/N 115-0171-216) is required to output a simulated radar speed signal from the Phoenix 200 receiver. To connect the speed adapter cable:

1. Connect the female 9-pin serial connector to port A on the Phoenix 200 interface cable.
2. Route the male 9-pin serial connector to the GPS input port on the in-cabin device.
3. Route the 3-pin round connector to the speed node interface cable or radar input connector on the vehicle.

Powering the GPS Receiver

The Phoenix 200 DGPS receiver is designed to operate between 9 and 16 V (DC). The unit is reverse-voltage and over voltage power protected to reduce the possibility of damage during installation.

	⚠ CAUTION
Do not connect the smart antenna to the power cable before connecting the power leads to a source of clean power.	
The Phoenix 200 receiver is reverse-power protected. If power and ground leads are reversed, damage to the smart antenna or cabling could occur. A fuse has been installed in the power cable to protect the smart antenna.	

Apply power to the receiver by connecting the power leads as follows:

1. Route the lead wires on the supplied power cable (P/N 115-0171-361) to a clean source of power (e.g. vehicle battery).
2. Connect the red wire from the supplied power cable to a positive (+) power source.
3. Connect the black wire to a negative (-) power or ground.

Note: *If power and ground connections are reversed, the internal self-resetting fuse will open and power will be removed. If this occurs, disconnect the power connector from the back of the GPS receiver, connect the power lead wires as instructed above and reconnect power to the receiver. After verifying that power connections are installed properly, it is safe to reconnect the receiver and peripheral devices.*

If an automotive power adapter is used, verify that the vehicle has a negative ground system before connecting the Phoenix 200. If an AC adapter is used, be sure to connect the adapter to an AC power source.

Initial Start Up

During the initial start up of the Phoenix 200, the GPS receiver will search for satellites and download almanac data necessary for operation. The initial start up may take up to 15 minutes.

Note: *This initial start up time is only required when the receiver is powered up for the first time. Subsequent power up sequences should take significantly less time to refresh the almanac.*

1. Turn off all vehicle equipment and accessories and shutdown the engine.
All other equipment should be off as it may cause interference with the receiver. The receiver draws very little power and this test should only take a few minutes to complete.
2. Connect power to the Phoenix 200 receiver.
3. Connect the serial cable connectors between the Phoenix 200 receiver and any peripheral equipment.
4. Verify that any connected peripheral devices begin receiving NMEA messages. Review the documentation provided with the specific device or equipment to check communication or NMEA message reception.

Note: *Refer to Chapter 5, Configuration Menus, for information about configuring the Phoenix 200 DGPS receiver using a PC or laptop and the Raven Invicta Front Panel utility.*

5. Begin turning on other equipment and accessories on the machine. Wait at least 30 seconds after each device is powered on and watch NMEA messages to see if the receiver stops tracking satellites.
6. If a device causes interference with the Phoenix 200 receiver, check that the device is functioning properly and the power and ground connectors. Interference may be introduced into the GPS receiver due to improper power and ground connections for other devices on the same circuit or due to malfunctioning devices.
7. If the device is operating and connected correctly, try moving the Phoenix 200 further away from the specific device.
8. If the Phoenix 200 continues to receive NMEA messages once all other equipment and devices are powered up and running, the Phoenix 200 may be mounted and the cables routed as desired for permanent operation.

Normal Operation

After the initial start up, the receiver will operate in “Normal Mode.” The receiver acquires satellites, or converges, within a few minutes after subsequent power ups. Depending upon the source of differential corrections, the Phoenix 200 should be ready for operation within a few minutes.

Note: *Review the Differential GPS (DGPS) Correction Sources section on page 6 for more information on the Phoenix 200 receiver compatibility with the Hemisphere GPS[®] e-Dif[™] or NovAtel[®] G11de[®] correction sources.*

Be aware of possible satellite obstructions which may interfere with GPS operation. Refer to the Sources of Error section on page 5 for a review of possible sources of DGPS interference.

Note: *For high precision performance, the Horizontal Dilution of Precision (HDOP) value should be 2 or less during field operations. Connect a laptop to an available port connector and refer to Chapter 5, Configuration Menus, to monitor the HDOP value during field operations.*

If a connected peripheral device is capable of displaying GPS signal status and HDOP values during field operations, the HDOP value may be monitored using the peripheral display. Review the documentation provided with the connected peripheral device for information about accessing and displaying GPS signal information.

FP3 Utility Overview

The Phoenix 200 DGPS receiver is configured at the factory to operate in automatic mode which generally allows the receiver to begin operation quickly following initial installation without need to reconfigure or set up the receiver.

To modify factory settings, or to verify receiver operation and performance, the Phoenix 200 DGPS receiver must be connected to a PC or laptop with the Invicta Front Panel (FP3) utility installed. The FP3 utility allows the user to view the Phoenix 200 display and configuration menus and reconfigure the receiver if necessary to interface with specific equipment in the vehicle cabin.

Note: *When connecting to a PC or laptop computer, the Phoenix 200 receiver must still be powered via the interface cable. If the Phoenix 200 will be removed from the vehicle for this process, a 12 V power supply will be necessary to power the receiver.*

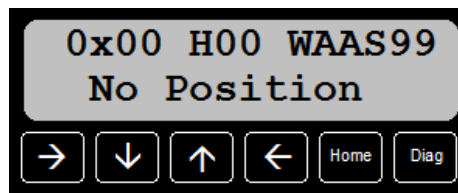
Using the FP3 Utility on a Home or Office PC

The FP3 utility is available free of charge from the Raven Applied Technology Division web site:

www.ravenhelp.com

The front panel simulator is self contained within the "FP3Simulator.exe" file. Extract or unzip the downloaded file to a location on the PC or laptop that will be easy to find later (e.g. desktop).

FIGURE 1. FP3 Interface on a Home or Office PC



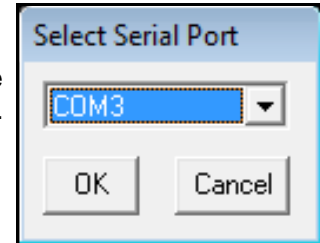
Connecting the Receiver to the PC

To connect the Phoenix 200 DGPS receiver to the PC or laptop:

1. Power up the receiver and wait for the receiver to start up.

Note: For Phoenix 200 receivers (P/N 063-0172-719) with Rev. C or newer hardware, the start up process may take up to 2 minutes. If the Front Panel Utility attempts to communicate with the receiver during the start up process, the receiver may not respond and will need to be restarted before reattempting communication.

2. Connect the Port A serial connector to an available serial port.
3. Open the “FP3Simulator.exe” file extracted to the PC or laptop. The ‘Select Serial Port’ prompt will be displayed.
4. Select the COM port to which the Phoenix 200 is connected and click ‘OK.’ Use the Windows Device Manager to identify the serial port connection if necessary.



Note: Refer to the Windows help for details on using the Device Manager.

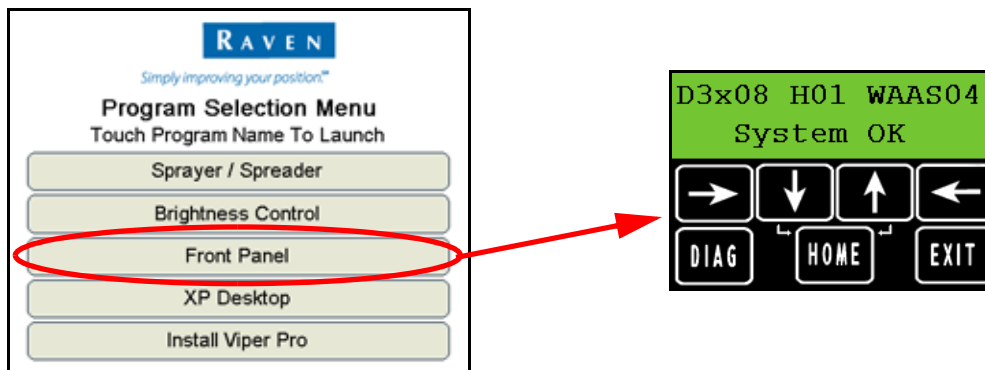
5. Wait for the FP3 utility to establish communication with the connected receiver. This may take a few seconds. When communication is established, the Home screen will be displayed as shown in Figure 1 on page 15.

Note: If communication is not established within 30 seconds, check serial connections and serial port selections and restart the FP3 utility.

Using the Front Panel Utility on a Viper Pro

When connected to a Raven Viper Pro field computer, the Viper Pro is capable of interfacing with the Phoenix 200 by selecting the Front Panel option from the Program Selection Menu.

FIGURE 2. FP3 Interface on a Raven Viper Pro



Note: For Phoenix 200 receivers (P/N 063-0172-719) with Rev. C or newer hardware, the start up process may take up to 2 minutes. If the Front Panel Utility attempts to communicate with the receiver during the start up process, the receiver may not respond and will need to be restarted before reattempting communication.

To allow the field computer to communicate with the DGPS receiver, the Phoenix 200 interface cable must be connected directly to the ‘COM1/DGPS’ port on the Viper Pro interface cable. In addition, the field computer

baud rate may need to be adjusted to 19,200. Refer to the Viper Pro Installation and Operation Manual for details on setting the field computer baud rates.

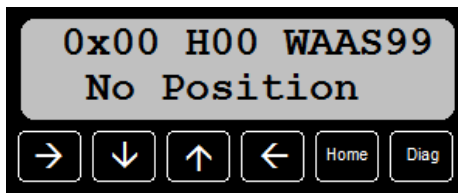
Note: *If a separate guidance or steering component is connected between the Phoenix 200 and the Viper Pro, the field computer will not be able to configure the receiver. Disconnect the cable connections and connect the Viper Pro and Phoenix 200 interface cables directly.*

When connecting to a Phoenix 200 (P/N 063-0172-719) with Rev. C or higher hardware, ensure that firmware version 3.9 or higher is installed on the Viper Pro to ensure that the Front Panel Utility functions correctly.

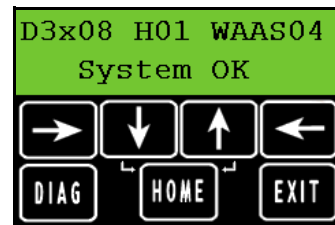
Navigation Overview

The soft key arrows are used to navigate through the receiver display and configuration menus.

PC or Laptop Interface



Viper Pro Front Panel Interface



Home Key. Select the Home key while navigating the Display or Configuration menus to return to the receiver home screen at any time. Refer to *Home Display Screen* section on page 19 for details on the Phoenix 200 receiver Home screen viewed through the Invicta Front Panel utility.

Diagnostic Key. Select the “Diag” key while navigating the Display or Configuration menus to advance to the diagnostic menu at any time.

Exit Key (Viper Pro Only). When interfacing with the Phoenix 200 receiver using a Raven Viper Pro, touch the exit button to close the Front Panel viewer and return to the Program Selection Menu screen.

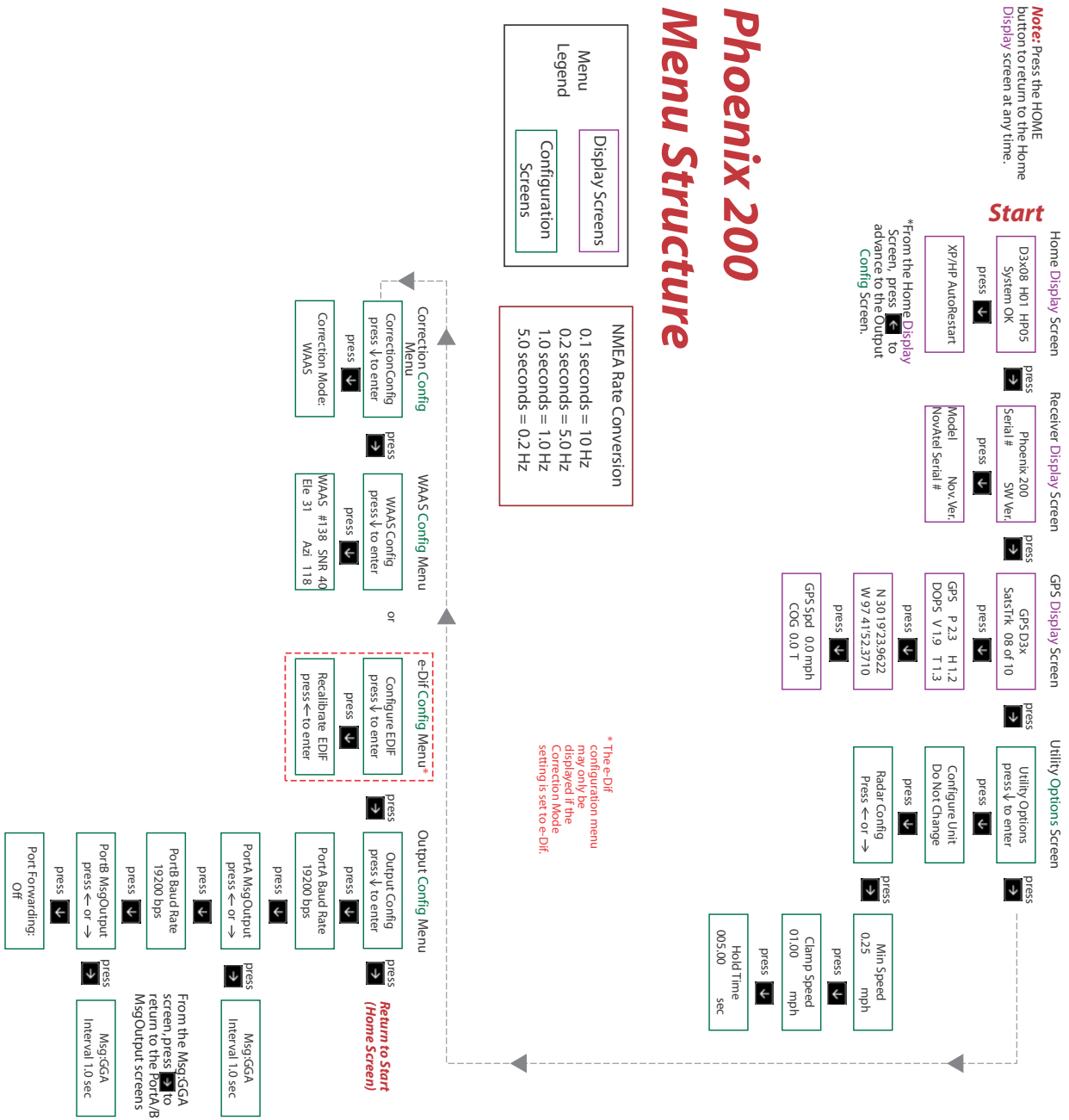
Edit Mode

Use the edit mode to program numerical values or change settings on the Phoenix 200 DGPS receiver. To enter edit mode:

1. Select (Left/Enter) button. The default or existing value will begin flashing.
2. Use the up, down and right buttons to edit the selected setting or value.
3. Select (Left/Enter) button to accept the displayed setting or value and return to normal operation.

Menu Structure

FIGURE 3. Phoenix 200 Menu Structure



The following sections offer descriptions of the Phoenix 200 Display menus. These menus may be used to review signal strength or receiver performance information. Review the *Menu Structure* section on page 18 for an overview of the Phoenix 200 menu structure and general navigation.

Home Display Screen

The Home screen displays the current status of GPS signal reception and source of differential corrections, if available. Select the Home key while navigating the Display or Configuration menus to return to the receiver home screen at any time.

The receiver Home screen displays the following information when the receiver is powered on:

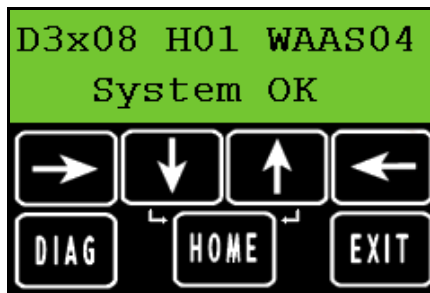


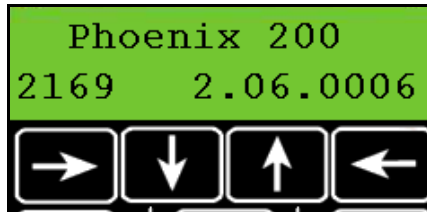
TABLE 1. Phoenix 200 Display Information


Character(s)	Description
D	Differential mode. D = Differential, C = Converging, Blank = GPS only
3	Type of position solution (None, 2 Dimensional, 3 Dimensional)
08	Number of satellites used in position solution
H01	Horizontal Dilution of Precision (HDOP)
WAAS	Selected source of differential corrections with its associated age of data. WAAS = WAAS, EDIF = e-Dif
System OK	The second line is reserved for warning messages (OK, Poor SV Tracking, High AOD, High GDOP, High HDOP, No Diff Corrs, Hgt Constrained, No Pos Solution, Antenna Fault)

Receiver Display Screen

Access the Receiver display screen to view the receiver model, Raven serial number, and firmware version.

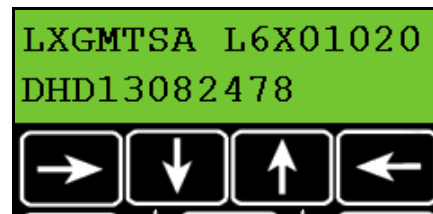
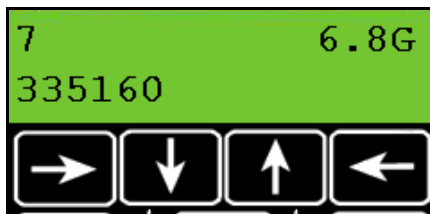
From the Home screen, select the  key to view the receiver information.



Select the  key to view the NovAtel[®] model, software version, and NovAtel serial number.

Hemisphere GPS

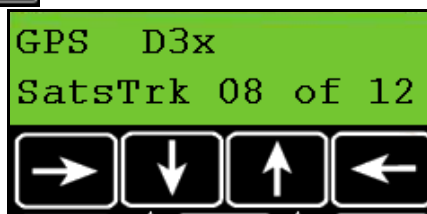
NovAtel



GPS Display Screen

Access the GPS display screens to view detailed GPS information. This information may be helpful for reviewing performance of the Phoenix 200 DGPS receiver during operation. For GPS configuration settings and features, refer to the *Correction Configuration Menu* section on page 27 or the *WAAS Configuration Menu* section on page 29.


From the Home screen, select the  key until the GPS Display screen is displayed.

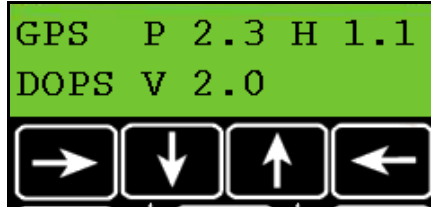


This screen displays a more detailed view of the information displayed on the home screen:

TABLE 2. GPS Status Display Screen Definitions

D	Differential mode. D = Differential, C = Converging, Blank = GPS only
3	Type of position solution (None, 2 Dimensional, 3 Dimensional)
SatsTrk	The number of satellites used in the differential correction and the number of satellites being tracked


Select the  key to display the PDOP, HDOP and VDOP values currently observed by the receiver.

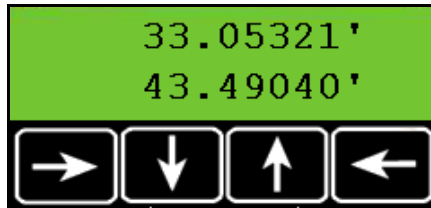


The term “DOP” (Dilution of Precision) is an estimation of error caused by spacing between the satellites being tracked and used in the GPS solution. Smaller values denote better accuracy. A value of 9.9 is displayed when there are not enough satellites being tracked to provide a usable GPS solution.

TABLE 3. Dilution of Precision Abbreviations

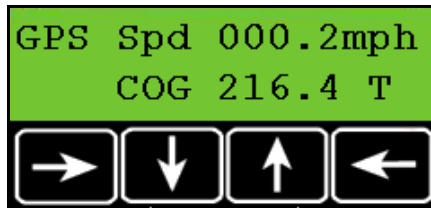
DOP	Definition
H (HDOP)	Horizontal
V (VDOP)	Vertical
P (PDOP)	Position

Select the  key to display the Latitude and Longitude Coordinate screen.




This displays the current location of the vehicle.

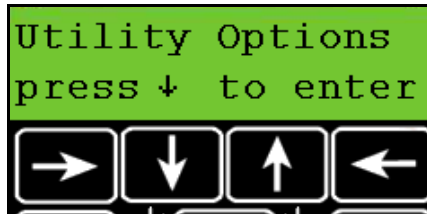
Select the  key to view the GPS Speed and Course Over Ground.




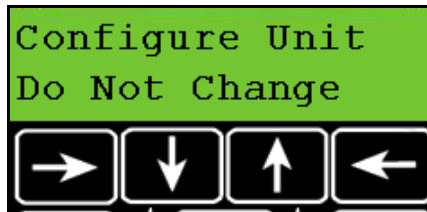
Utility Options Screen




Access the Utility Options to configure the Phoenix 200 to operate with other devices such as a Raven Radar speed sensor or the Raven SmarTrax automated steering system.




From the Home screen, select the  key until the GPS Display screen is displayed.

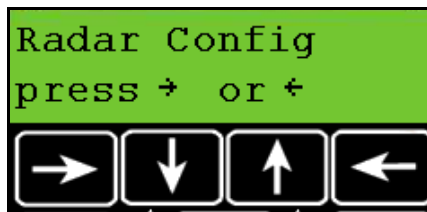


Select the  key to access the Configure Unit screen.




Select the  key and use the  or  keys to cycle through the available presets. Select one of the available presets to set up the Phoenix 200 communication settings as shown in the *Pre-Defined Setting Configurations* section on page 24.

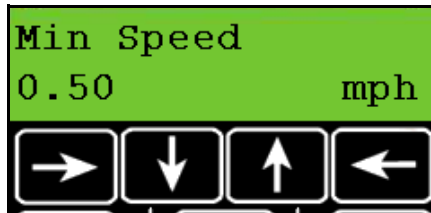
From the Configure Unit screen, select the  key again and select either the  or  key to access the Radar Config menu.





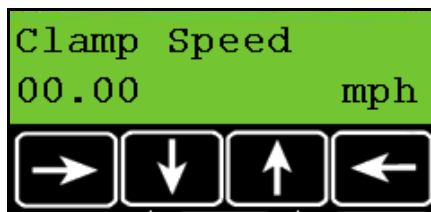
The Radar configuration menu may be used to configure the simulated radar speed signal output from the Phoenix 200 receiver.



Radar Config Menu

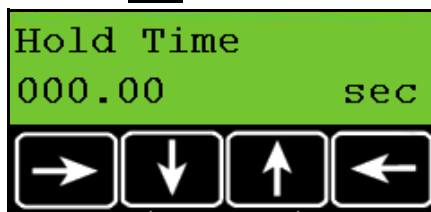
The Min. Speed screen displays the minimum speed at which radar will be output. Select the  arrow key to edit the minimum speed.



Select the  key to view the Clamp Speed screen. The radar output will be held constant when the actual speed drops below the clamp speed and is greater than the Min. Speed setting. Select the  arrow key to edit the clamp speed.



Selecting the  key will display the Hold Time screen. This screen displays and allows you to adjust the radar hold time. When a loss of navigation occurs, the radar output is held constant for a length of time specified with the Hold Time setting. Press the  arrow key to edit this value.




Pre-Defined Setting Configurations

The following presets are available and may be helpful to quickly configure the Phoenix 200 GPS receiver. The settings may be adjusted after the preset is applied to customize the GPS receiver for the equipment or application needs. See the following chart for each of the specific configuration setting values.

TABLE 4. Phoenix 200 Receiver Preset Configurations

Configuration Setting	Presets			
	Do Not Change	Zero All	Raven SmarTrax	Raven Classic
Port A Baud Rate	Current Setting	38400	19200	19200
Port A Messages	Current Settings	None	GGA (10 Hz) VTG (10 Hz) ZDA (1 Hz)	GGA (10 Hz) VTG (10 Hz)
Port B Baud Rate	Current Setting	38400	19200	4800
Port B Messages	Current Settings	None	GGA (5 Hz) VTG (5 Hz) ZDA (1 Hz)	GGA (1 Hz) RMC (1 Hz) VTG (1 Hz)
Optimization	Current Setting	None	Pass-to-Pass	Pass-to-Pass
HP Seed Mode	Current Setting	Manual	No Change	No Change
Radar Min Speed	Current Setting	0	0	0
Radar Clamp Speed	Current Setting	0	0	0
Radar Hold Time	Current Setting	0	0	0
Differential	Current Setting	None	WAAS	WAAS

Select the  key again to select the currently displayed preset. The Phoenix 200 will automatically configure the port baud rates and message output settings. Once the preset is applied, the display will return to **Do Not Change**.


Note: Select **Do Not Change** to cancel any changes to the baud or messages rate settings.

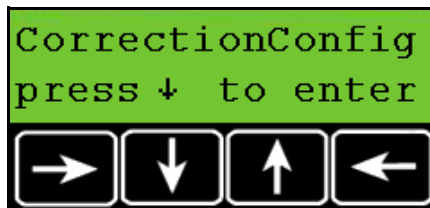
The following sections offer descriptions of the Phoenix 200 Configuration menus. These menus are used to configure the source of differential corrections or change the output settings for NMEA messages from the Phoenix 200 DGPS receiver. Review the *Menu Structure* section on page 18 for an overview of the Phoenix 200 menu structure and general navigation.


Correction Configuration Menu

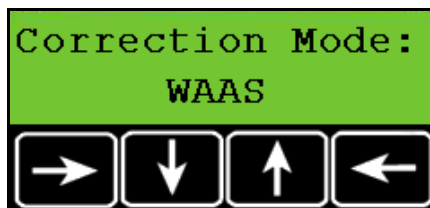
Access the Correction Configuration menu to set the differential correction source used with the Phoenix 200 receiver.





Note: *If 'None' is selected, the Phoenix 200 will not receive a differential correction signal. In this mode, the position reported by the receiver is only accurate within 30 feet [9 m] of the actual vehicle position.*

Select the  key until the Correction Configuration screen is displayed.



Select the  key to access the Correction Mode screen.



Select the  key and use the  or  arrow keys until the desired correction source setting is flashing on the screen. Select the  key to save the displayed setting.

The Phoenix 200 may be used with the following differential correction sources:

TABLE 1. Correction Types

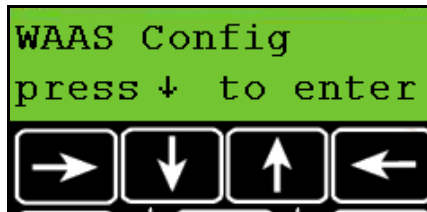
Type	Description
WAAS	Wide Area Augmentation System
NovAtel G11de ^{®a}	GPS smoothing and autonomous GPS features
Hemisphere GPS [®] e-Dif ^{™a}	GPS smoothing and autonomous GPS features
None	No differential correction


a. The G11de or e-Dif options may only be available on specific Phoenix 200 DPGS receivers. Refer to the *Differential GPS (DGPS) Correction Sources* section on page 6 for more information.

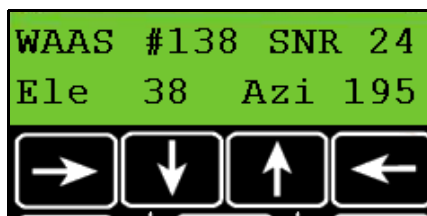
WAAS Configuration Menu




Access the WAAS Configuration menu to manually select the differential satellite PRN (pseudo-random number) or allow the receiver to automatically select the best differential satellite for corrections when using WAAS.


Select the  key until the WAAS Configuration screen is displayed.



Select the  key and the selected WAAS differential satellite is displayed.



Select the  key and use the  or  arrow keys to manually select the PRN of the desired differential satellite.

Select the  key to save the displayed PRN number.

Note: The WAAS number is the satellite PRN currently used for differential corrections. If this screen displays “WAAS AUTO” the Phoenix 200 will automatically select the satellite with the best signal to noise ratio for differential corrections.

Setting the Phoenix 200 to Auto may cause the receiver to switch differential satellites during operations which can cause the vehicle position to shift slightly. If this becomes a problem, manually select a satellite PRN providing adequate signal and coverage for the area of operation.

e-Dif™ Configuration Menu

Note: The e-Dif option may only be available on specific Phoenix 200 DPGS receivers. Refer to the Differential GPS (DGPS) Correction Sources section on page 6 for more information.

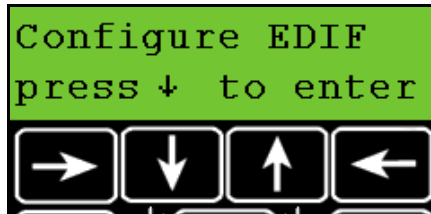
For information on obtaining e-Dif authorization codes, or for more information about the optional e-Dif correction service, please contact a local Raven dealer.


The position accuracy of e-Dif corrections is initially very high, but will degrade slowly over time. Once the receiver is calibrated, e-Dif corrections will be available continuously for several hours without need to recalibrate unless the unit is switched off.

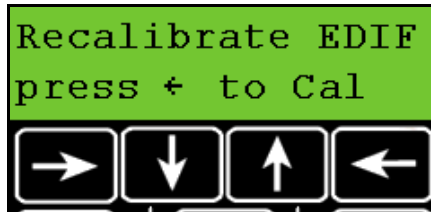
To recalibrate e-Dif differential corrections on the Phoenix 200, the operator may either reboot the receiver or access the e-Dif Configuration menu using the Invicta Front Panel utility.


To recalibrate e-Dif using the Front Panel utility:

Select the  key until the e-Dif Configuration screen is displayed.



Select the  key and the current configuration is displayed.




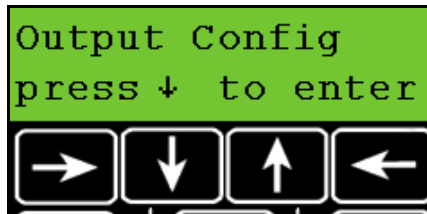
Select the  key. The receiver will attempt to recalibrate the e-Dif corrections for the current GPS conditions.


- If the receiver is able to recalibrate position corrections, the display will flash 'Cal Complete' and normal operation may be resumed. The Hemisphere GPS e-Dif differential corrections may need to be recalibrated every few hours during field operations to maintain position accuracy.
- If the receiver is unable to recalibrate, the Front Panel utility will display a 'Failed' prompt. Retry the calibration in a few minutes. If the system is still unable to recalibrate, contact a local Raven dealer for further assistance.

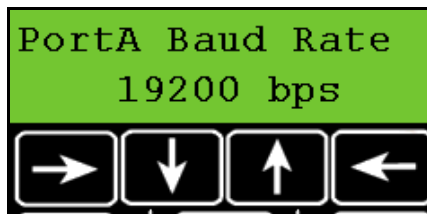
Output Configuration Menu




Access the Output Configuration menu to set the Port A or B baud rate settings or to manually configure the NMEA (National Marine Electronics Association) output messages. See the Appendix B, *NMEA Protocols and Message Structure* for more information on NMEA messages.


Select the  key until the Output Configuration screen is displayed.



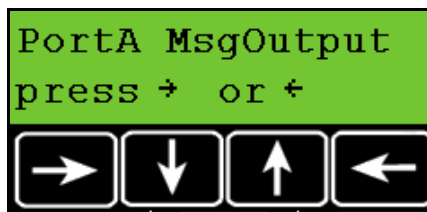
Select the  key and the baud rate for Port A is displayed.







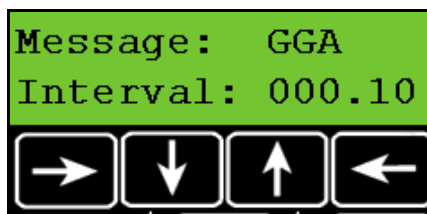
Select the  key and use the  or  keys to change the message rate for Port A on the Phoenix 200 interface cable.

Select the  key to save the new setting.






Press the  key to access the Port A Message Output screen.



To view the output rate for each NMEA message, press either the  or  key and use the  or  keys to scroll through the available message types.




Note: The current output rate for each message is displayed in seconds. An interval of 0.0 sec disables output of the selected messages on Port A.


To change an output rate for a message, select the  key and use the  or  keys to set the first digit. Select the  key to advance to the next digit or select the  key to save the displayed output setting.

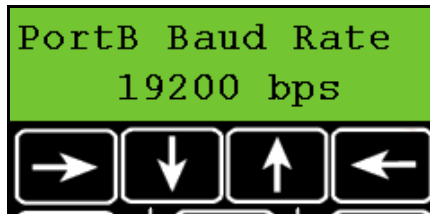
The table below lists the optional interval rates:





TABLE 2. Standard Output Message Rates


Programmed Interval of NMEA message	Output frequency (number of updates per second)
0.0	OFF
0.1 sec	10 Hz
0.2 sec	5 Hz
0.5 sec	2 Hz
1.0 sec	1 Hz

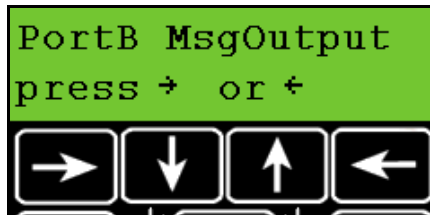
Select the  key to return to the Port A Message Output screen.





Select the  key to access the Port B Message Output screen.







Select the  key and use the  or  keys to change the message rate for Port B on the Phoenix 200 interface cable. Select the  key to save the new setting.


Select the  key to access the Port B Message Output screen.

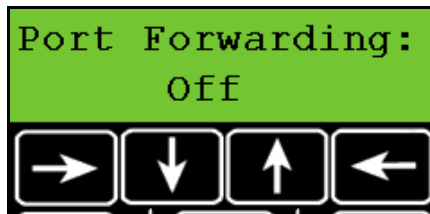


To view the output rate for each NMEA message, select either the  or  key and use the  or  keys to scroll through the available message types.

Note: The current output rate for each message is displayed in seconds. An interval of 0.0 sec disables output of the selected messages on Port A.

To change a output rate for a message, select the  key and use the  or  keys to set the first digit. Select the  key to advance to the next digit or select the  key to save the displayed output setting.

Select the  key to access the Port Forwarding screen.







The port forwarding feature allows messages to be transmitted through the Phoenix 200 to ports A and B on the receiver interface cable. In certain configurations, this feature allows other devices in the cabin (e.g. light bar and field computer) to communicate without extra cable connections.

The operator may select the following port forwarding settings:

A to B. Forward messages through the interface cable from Port A input to Port B output.

B to A. Forward messages through the interface cable from Port B input to Port A output.

A to B_B to A. Forward messages from both port inputs to the opposite port output.

Select the  key and use the  or  keys to toggle the Port Forwarding setting on or off. Select the  key to save the new setting.

Overview

Before troubleshooting, attempt to isolate problems into one of the following categories:

- Receiver
- Antenna (including cables)
- Power
- Transmitting Site
- Serial Communications (receiver or peripheral device)

Check the Installation

Monitor the effects of the GPS receiver performance as each device on the vehicle is powered on. If the receiver stops operating properly when a particular device is powered on, that device may be causing magnetic or electrical interference. For example, if running the engine causes interference, ignition noise or alternator noise could be interfering with GPS signal reception. Try moving the GPS antenna further away from the engine. Test the battery and alternator for faulty connections or bad equipment.

Receiver

Normally only 5 GPS satellites are required for good accuracy. Connect the receiver to a PC or laptop and use the Invicta Front Panel utility to view the receiver configuration and check the number of satellites being tracked. Also look for the “D”, “C”, or “R” indicating a differential correction signals are being used for the vehicle position. Refer to *Home Display Screen* section on page 19 for display descriptions.

Note: *Make sure the DGPS antenna is mounted on the tallest point of the vehicle (usually the vehicle cab) and has a clear 360° view of the sky and is as far away from sources of magnetic or electrical interference as possible.*

DGPS Antenna

Check the connections between the antenna and peripheral devices. Verify the connectors and cables are in good condition.

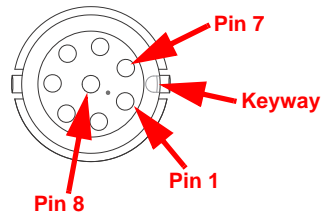
Power

The Phoenix 200 is designed to operate between 9 and 16 VDC. The unit is reverse-voltage and overvoltage power protected to reduce the possibility of damage during installation. The table below identifies each pin and gives the wire colors for the supplied cable.

TABLE 1. Interface Cable Connector Pins

Pin Number	Signal Name
1	Transmit - Port A
2	Receive - Port A
3	Ground
4	Radar
5	Transmit - Port B
6	+12 V (DC) Power
7	+12 V (DC) Power Output
8	Receive - Port B

Receiver Interface Cable Connector



Signal Reception

If the receiver is operating in WAAS mode, make sure the proper PRN is selected (e.g., WAAS #135 or 138). WAAS status information is available on the FAA web site:

www.nstb.tc.faa.gov

A

Receiver Connection

1. Connect Port A on the receiver interface cable to an available COM port on a PC or laptop.

Note: A USB to serial port adaptor may be used if a serial port is not available on the PC or laptop.

2. Connect the 8-pin Con-X-All™ connector on the receiver interface cable to the receptacle on the smart antenna.
3. If the receiver is removed from the vehicle to update firmware, connect the power and ground lead wires on the interface cable to a power supply to power up the receiver.

Receiver Engine Identification

Phoenix 200 receivers may utilize either a Hemisphere GPS® or NovAtel® engine. Before updating the receiver, verify which engine is used.

1. The autonomous GPS correction source may be used to help identify the GPS engine.
 - E-Dif corrections are exclusive to the Hemisphere GPS engine.
 - GL1DE corrections are exclusive to the NovAtel engine.
2. Receivers with the NovAtel engine also have a serial number tag on the smart antenna with the NovAtel engine serial number similar to the figure below.

FIGURE 1. NovAtel Serial Number Example



Note: NovAtel serial numbers may vary from the figure above. For more assistance with identification of the GPS engine, contact a local Raven dealer.

Phoenix 200 Update Procedure

Note: Review the release notes for the specific firmware to be loaded onto the Phoenix 200 DGPS receiver for compatibility notes and specifications.

Updates for Raven manuals as well as software updates for Raven products are available at the Applied Technology Division web site:

www.ravenhelp.com

Sign up for e-mail alerts to receive notification when updates for Raven products are available on the Raven web site.

To update the Phoenix 200 smart antenna:

1. Download the firmware update file from the Raven web site to your PC or laptop.
2. Extract the firmware '.zip' file.

Note: If the computer does not already have the ability to unzip a file, a trial version of WinZip™ software tool is available at:

www.winzip.com

A free version of an unzip program is also available from the following web site:

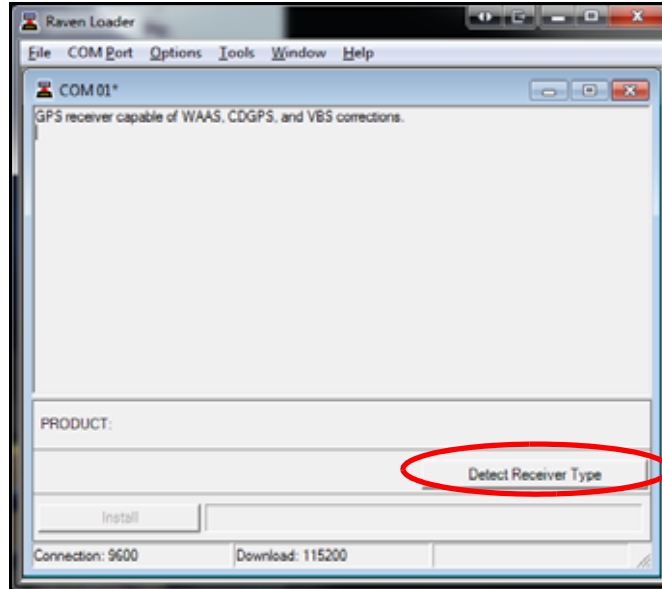
www.freebyte.com/fbzip/

3. Run the "Ravenloader.exe" program located in the folder extracted in the previous step.
4. Click on "File" and select "New."
5. Click on "COM Port" in the top toolbar and select "Settings."
6. Set the COM Port number to match the port number connected to the Phoenix 200 receiver. If a USB to Serial adaptor, verify which COM port is assigned to the adaptor.

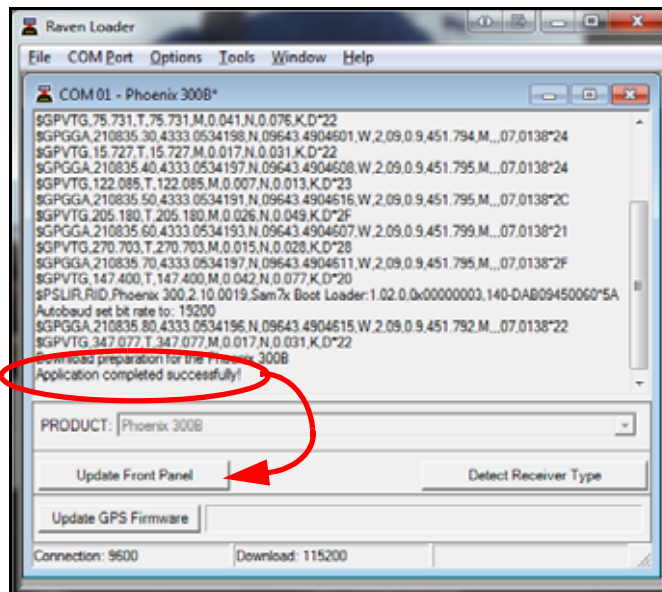
To verify the COM port:

- a. Right click on the "My Computer" icon on the desktop or in the "Start" menu.
 - b. Left click on "Properties."
 - c. Choose the "Hardware" tab.
 - d. Select "Device Manager."
 - e. Click on the plus (+) sign next to "Ports (COM & LPT)."
7. Click the "OK" button.

- Click the “Detect Receiver Type” button.



- When the Raven Loader displays “Application completed successfully,” click the “Update Front Panel” button to run the Raven firmware update.



Once the Raven firmware update is complete, cycle power to the receiver by either removing the cable from the smart antenna body or removing the power source.

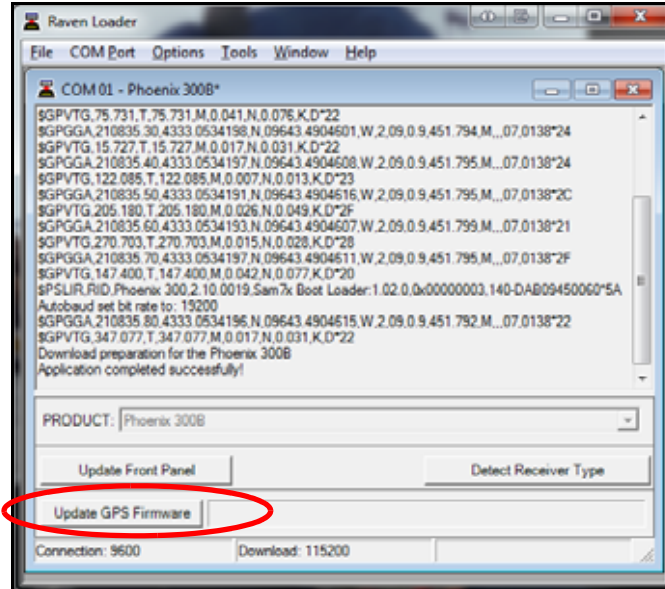
- Allow the receiver to reboot before proceeding. This process will take a minimum of 2 minutes to complete.

Note: The update process for a Phoenix 200 with a Hemisphere GPS® engine (e.g. E-Dif capable) is complete. The following steps will only be required if updating a Phoenix 200 with a NovAtel GPS® engine (e.g. GL1DE capable).

- Click the “Detect Receiver Type” again after the receiver has restarted to redetect the connected hardware.

Note: Detecting the receiver type a second time may not be required if the Front Panel firmware was previously updated to version 2.11 or newer firmware.

12. Click the “Update GPS Firmware” button to start the NovAtel® GPS firmware update.



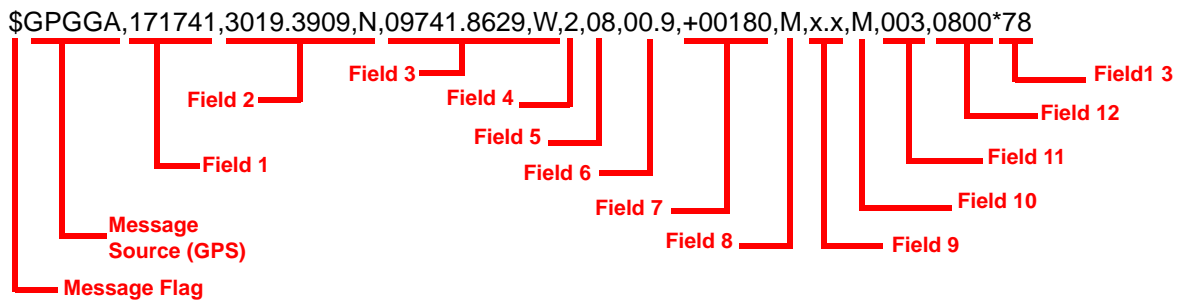
The updater program will display the update progress in the window. The update is complete when the progress bar stops scrolling and the “Application completed successfully!” message is displayed.

- 13. Disconnect the power cable from the DGPS receiver for approximately 5 seconds and then reconnect to reboot the receiver.
- 14. Update is complete.

NMEA Protocols and Message Structure

Sample GGA NMEA Message Structure

The following example of the GGA message structure shows the format typical of NMEA messages.



Field	Description	Field	Description
\$	Message Flag	6	Horizontal Dilution of Precision
GP	Message Source (GPS)	7	Antenna Altitude Reference: Mean Sea Level (Geoid)
GGA	NMEA Message Type	8	Units of Antenna Altitude (meters in example)
1	Universal Time Coordinate (UTC) of Position	9	Geoidal Separation
2	Latitude (North or South)	10	Units of Geoidal Separation (meters in example)
3	Longitude (East or West)	11	Age of Differential Data (Seconds)
4	GPS Quality Indicator (mode)	12	Reference Station ID
5	Number of Satellites in Use	13	Checksum

NMEA Message Types

The Phoenix 200 receiver may be used to communicate with other electronic devices including a Raven light bar for swath guidance during field operations. A set of rules, or communication protocol, known as the NMEA-0183 standard has been established by the National Marine Electronics Association. The NMEA-0183 standard contains numerous message formats such as the ones described below, which the Phoenix 200 receiver uses to communicate with other devices.

TABLE 1. NMEA Messages

Message Type	Description
ALM	Satellite Almanac Data
GGA	Global Positioning System Fix Data
GLL	Longitude and Latitude of Current Position
GRS	Range Residuals
GSA	GPS DOP and Active Satellites
GST	Pseudo Range Measurement Noise Stats
GSV	Satellites in View
RMC	Recommended Minimum Specific GPS/Transit Data
VTG	Course Over Ground and Ground Speed
ZDA	Time and Date

Starlink Protocol

Raven receivers may be controlled using a proprietary set of commands called the “Starlink Protocol.” These commands are compliant with the NMEA 0183 standard. A complete list and description of commands may be obtained from the Raven Applied Technology web site:

www.ravenhelp.com

Receiver Command	Receiver Query
DIF	DIF
NME	GPSID
PBM	NME
PTA	PAR
PTB	PBM
RKC	PTA
RST	PTB
SAV	RID
SLI	RKC
SPD	SLI
W1M	W1S

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RAVEN

Limited Warranty

What Does this Warranty Cover?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service when used for intended purpose.

How Long is the Coverage Period?

Raven Applied Technology products are covered by this warranty for 12 months from the date of retail sale. In no case will the Limited Warranty period exceed 24 months from the date the product was issued by Raven Industries Applied Technology Division. This warranty coverage applies only to the original owner and is non-transferable.

How Can I Get Service?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including proof of purchase) must be included inside the box to be sent to Raven Industries.

What Will Raven Industries Do?

Upon confirmation of the warranty claim, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

What is not Covered by this Warranty?

Raven Industries will not assume any expense or liability for repairs made outside our facilities without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit, labor, or other damages. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.



Extended Warranty

What Does this Warranty Cover?

This warranty covers all defects in workmanship or materials in your Raven Applied Technology Division product under normal use, maintenance, and service when used for intended purpose.

Do I Need to Register My Product to Qualify for the Extended Warranty?

Yes. Products/systems must be registered within 30 days of retail sale to receive coverage under the Extended Warranty. If the component does not have a serial tag, the kit it came in must be registered instead.

Where Can I Register My Product for the Extended Warranty?

To register, go online to www.ravenhelp.com and select Product Registration.

How Long is the Extended Warranty Coverage Period?

Raven Applied Technology products that have been registered online are covered for an additional 12 months beyond the Limited Warranty for a total coverage period of 24 months from the date of retail sale. In no case will the Extended Warranty period exceed 36 months from the date the product was issued by Raven Industries Applied Technology Division. This Extended Warranty coverage applies only to the original owner and is non-transferable.

How Can I Get Service?

Bring the defective part and proof of purchase to your Raven dealer. If the dealer approves the warranty claim, the dealer will process the claim and send it to Raven Industries for final approval. The freight cost to Raven Industries will be the customer's responsibility. The Return Materials Authorization (RMA) number must appear on the box and all documentation (including proof of purchase) must be included inside the box to be sent to Raven Industries. In addition, the words "Extended Warranty" must appear on the box and all documentation if the failure is between 12 and 24 months from the retail sale.

What Will Raven Industries Do?

Upon confirmation of the product's registration for the Extended Warranty and the claim itself, Raven Industries will (at our discretion) repair or replace the defective product and pay for the standard return freight, regardless of the inbound shipping method. Expedited freight is available at the customer's expense.

What is Not Covered by the Extended Warranty?

Raven Industries will not assume any expense or liability for repairs made outside our facilities without written consent. Raven Industries is not responsible for damage to any associated equipment or products and will not be liable for loss of profit, labor, or other damages. Cables, hoses, software enhancements, and remanufactured items are not covered by this Extended Warranty. The obligation of this warranty is in lieu of all other warranties, expressed or implied, and no person or organization is authorized to assume any liability for Raven Industries.

Damages caused by normal wear and tear, misuse, abuse, neglect, accident, or improper installation and maintenance are not covered by this warranty.