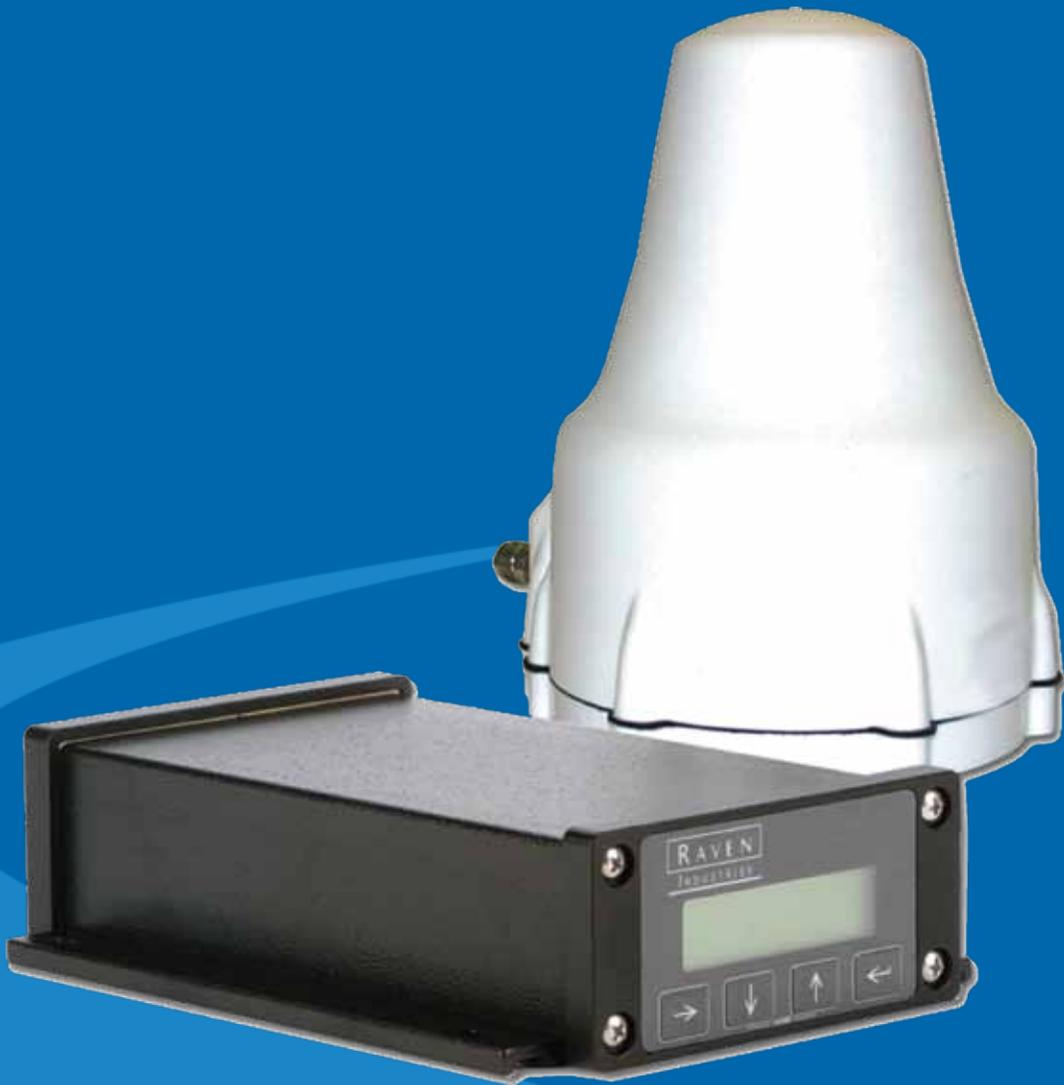


RAVEN

# Installation & Operation Manual



**Phoenix 300™ DGPS Receiver**

## ***Disclaimer***

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## *Receiver Overview*

Congratulations on your purchase of the Raven Phoenix 300 GPS receiver. The Phoenix 300 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. The Phoenix 300 receiver features a front panel display for simple configuration and operation.

The Phoenix 300 receiver is a sophisticated, dual frequency receiver with superior impulse noise performance while the 20-channel GPS system provides quick and stable satellite acquisition. The Phoenix 300 provides reliable tracking of GNSS signals automatically using WAAS or CDGPS open source services, or the OmniSTAR<sup>®</sup> or Slingshot RTK subscription-based services. The Phoenix 300 also features two bidirectional RS-232 serial interface ports to provide GPS data to peripheral devices.

## Updates

With the receiver front panel display, extra software or a computer connection is not required to set up or operate this receiver. However, a free software utility is available via the Raven Applied Technology web site for standard upgrades and authorizing additional features.

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

[www.ravenhelp.com](http://www.ravenhelp.com)

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

## Overview of DGPS Systems

While an in-depth study may be required to fully understand Global Positioning Systems, or GPS, a brief description can 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.

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## 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 300 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.*

### CDGPS (Canadian WAAS)

**Important:** *As of 1 April 2011, the CDGPS correction source has been de-commissioned. While the Phoenix 300 DGPS receiver still provides access to menus and settings for this correction source, no differential corrections will be received when this source is selected. Please review and select one of the other available correction sources when using the Phoenix 300 DGPS receiver for actual field operations.*

Similar to the WAAS system established in the United States, CDGPS, or the Canada-Wide DGPS Correction Service), was established for use in Canada.

### OmniSTAR® VBS, XP or HP

The OmniSTAR system is a full-time differential GPS broadcast system, delivering corrections to the world's major land masses from a worldwide array of reference sites. Data from these reference sites flows to Network Control Centers (NCC's) where the corrections are decoded, checked, and repackaged in a highly efficient format for broadcast. The data is then up converted for transmission to communication satellites which broadcast over geographical areas. Communication links with each reference site include a dial-up line to serve as backup to leased lines to allow control of the receivers.

The satellite broadcast is received at the user's location, demodulated, and passed to a processor that reformats the data into corrections for use by the Phoenix 300 receiver. When using an OmniSTAR correction service, atmospheric corrections are applied to the data from multiple sites which are then combined to provide an optimal correction for the user's location. These corrections, recast in RTCM SC-104 format, are used by the Phoenix 300 receiver for maximum accuracy.

**Note:** *Contact OmniSTAR for details and subscription information.*

### NovAtel® G11de®

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 Phoenix 300 receiver.

## RTK (Real-Time Kinematic)

RTK systems utilize a fixed, local GPS receiver or 'base station' to provide a highly accurate correction signal to a GPS receiver within the base station coverage area.

The Phoenix 300 is capable of interfacing with a Slingshot<sup>®</sup> Field Hub<sup>™</sup> to receive RTK level corrections via a cellular network.

**Note:** *Contact a local Raven dealer for more information or to obtain an RTK authorization code for the Phoenix 300 receiver.*

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## *Mounting GPS Receiver Equipment*

The following sections contain procedures and guidelines for installing the Phoenix 300 DGPS receiver. Please read the following sections carefully before beginning the installation procedure to avoid potential issues or damage to the receiver.

### DGPS Receiver

Mount the receiver using the elongated holes in the flange assembly. Tighten the support screws securely to prevent jarring or bouncing of the receiver.

### DGPS Antenna Mounting

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

- Mount the DGPS antenna to the tallest point of the vehicle (usually the vehicle's cab) using the standard magnet mount.
- Make sure that the DGPS antenna has a clear 360° view of the sky.
- 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.
- The simplest setup is achieved by mounting the antenna on the center-line of the vehicle.

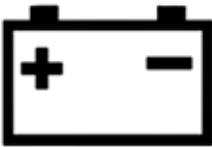
### **Aerial Antenna Mounting Plate (Optional)**

An optional aerial antenna mounting plate (P/N 063-0172-971) is included with kits featuring an MBA-6 (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.

### **Antenna Cable**

A 15 foot [4.6 m] antenna cable (P/N 115-0171-117) is supplied with standard Phoenix 300 receiver kits. Other cable lengths or extension cables are also 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 VDC. This does not normally present a problem if the cable length is 50 feet or less.

## Powering the GPS Receiver

	<b>⚠ CAUTION</b>
<p>Before powering this receiver, make sure the antenna is connected. The Phoenix 300 receiver is reverse-power protected. A direct path exists between the ground pin of the power connector and the chassis. If power is reversed with the chassis grounded, a short exists between power and ground and the power wire could be damaged or even catch fire. This is not a problem unique to the Phoenix 300 receiver, as any grounded equipment will have the same issue.</p>	

The Phoenix 300 is designed to operate between 9 and 16 VDC. The unit is reverse-voltage and over voltage power protected to reduce the possibility of damage during installation.

1. Route the supplied power cable (P/N 115-0171-118) 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 300. If an AC adapter is used, be sure to connect the adapter to an AC power source.*

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## Initial Startup

During the initial start up of the Phoenix 300, the GPS receiver will search for satellites and download almanac data necessary for operation. The initial start up may take up to 15 minutes.

- Make sure the antenna is connected to the receiver before powering up the receiver.
- Connect power to the Phoenix 300 receiver and verify that the front panel display is illuminated.
- Connect the serial cable provided between the Phoenix 300 receiver and any peripheral equipment.

## OmniSTAR<sup>®</sup> Service

When using the OmniSTAR DGPS correction service in North America, call OmniSTAR at 888-883-8476 to activate the OmniSTAR subscription.

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## Normal Operation

After the initial start up, the receiver will operate in “Normal Mode.” The receiver acquires satellites, or converge, within a few minutes after subsequent power ups. Depending upon the source of differential corrections, the Phoenix 300 should be ready for operation within a few minutes with WAAS, CDGPS or OmniSTAR VBS.

**Note:** *OmniSTAR HP or XP may take up to 45 minutes to lock onto a differential correction source.*

*The Slingshot RTK service is constantly streaming RTK level corrections over the cellular network. Once the Slingshot<sup>®</sup> Field Hub<sup>™</sup> is powered up, it will automatically connect to the Slingshot RTK service (if activated) and begin transmitting RTK level corrections to the Phoenix 300 receiver within a few seconds.*

All configuration and frequency data is stored in non-volatile memory within the Phoenix 300 receiver. Configuration or settings changes are made using the receiver front panel display. See Chapter 3, *Display Menus* for detailed setting and configuration information.

Be aware of possible satellite obstructions which may interfere with GPS operation. Refer to the *Sources of Error* section on page 2 for a review of possible sources of DGPS interference.

**Note:** *For high precision performance, watch the Horizontal Dilution of Precision (HDOP) value should be 2 or less. See the GPS Display Screen section on page 13 for more information.*



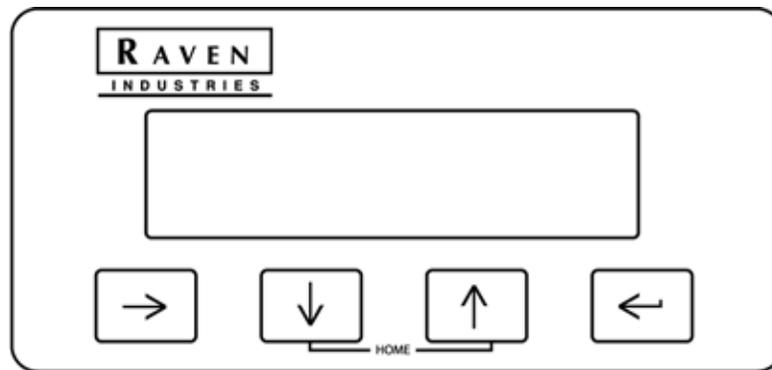
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## Overview

**Note:** Prior to using the Phoenix 300, gently peel away the protective film covering the front panel display.

The Phoenix 300 receiver is configured at the factory to operate in automatic mode. This allows the receiver to begin operation quickly following initial installation. The front panel display allows the vehicle operator to reconfigure the receiver, switch to an alternate differential source, and review performance statistics during operation.

The keypad arrows are used to navigate through the display and configuration menus.



The following sections offer descriptions of the information displayed on the Phoenix 300 receiver front panel.

The following sections contain information about the menus and screen displays used to view GPS and differential information during operation of the Phoenix 300 receiver. For information on configuring the Phoenix 300 receiver, refer to Chapter 4, *Configuration Menus*.

## Home Display Screen

The Home screen is displayed when the receiver is powered up.

**Note:** Press the  and  arrow keys at the same time to return to the Home screen at any time.

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

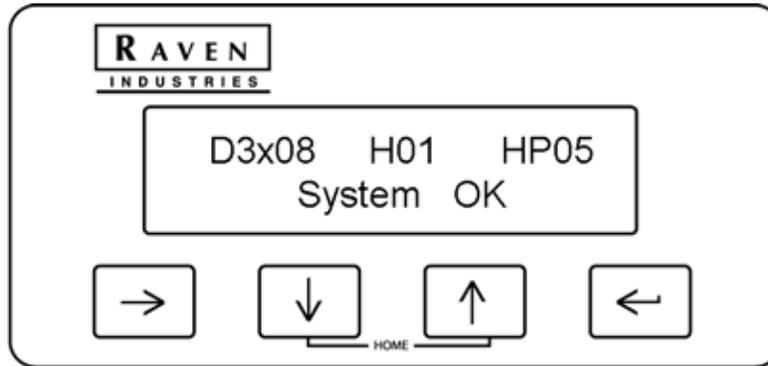


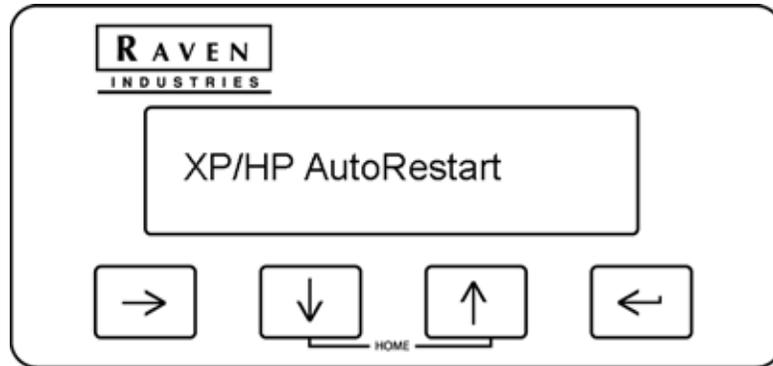
TABLE 1. Phoenix 300 Display Information

Character(s)	Description
D	Differential mode. <b>D</b> = Differential, <b>C</b> = Converging, <b>R</b> = RTK/Decimetric, <b>Blank</b> = 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)
HP	Selected source of differential corrections with its associated age of data. WAAS = WAAS, CDGPS = Canadian GPS, HP = OmniSTAR, XP = OmniSTAR, RTK = RTK
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)

**Note:** If the RTK correction signal is lost for several minutes, the receiver may revert to a WAAS correction source (if available) until the RTK correction signal is restored. The Home screen will still display 'RTK' as the selected correction source, however the differential mode will display 'D,' along with the age of WAAS correction updates (between 3 to 9 seconds). The RTK Display screen will display the WAAS differential satellite PRN instead of the base station ID number.

## OmniSTAR® XP/HP Restart

If the OmniSTAR XP or HP service is set as the differential source, press the  key from the Home screen to access the XP/HP Auto-Restart screen.



This screen displays the XP/HP restart status. When using the OmniSTAR XP or HP correction source, restart status is the last position where the receiver received an OmniSTAR correction and may be stored for subsequent receiver start ups to reduce the time required for the receiver to converge or lock onto OmniSTAR correction.

If a “seed” is available for storage, “**NOT STORED**” will be displayed on this screen. Press the  arrow key to change the state to “**DO RESTORE.**” The receiver will store the last seed position for use on the next startup.

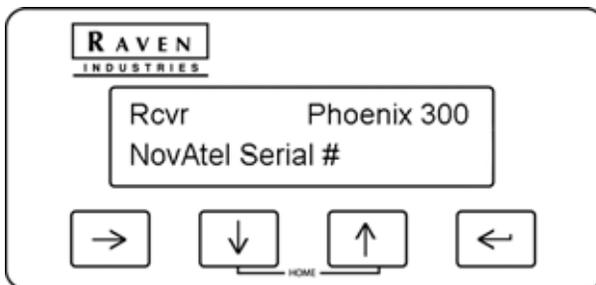
If a “seed” is available upon startup, this screen will display “**RESTORING.**” No seed is available if the screen displays “**NOT AVAILABLE.**”

## Receiver Display Screen

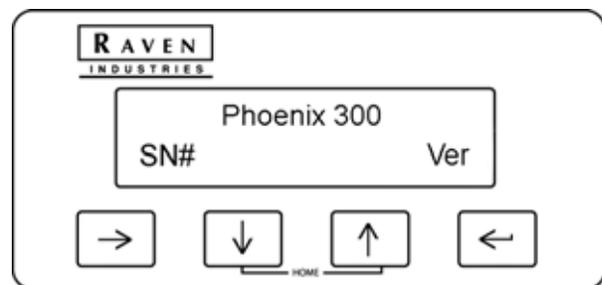
Access the Receiver display screen to view the receiver model, Raven serial number, and firmware version.

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

Phoenix 300-A

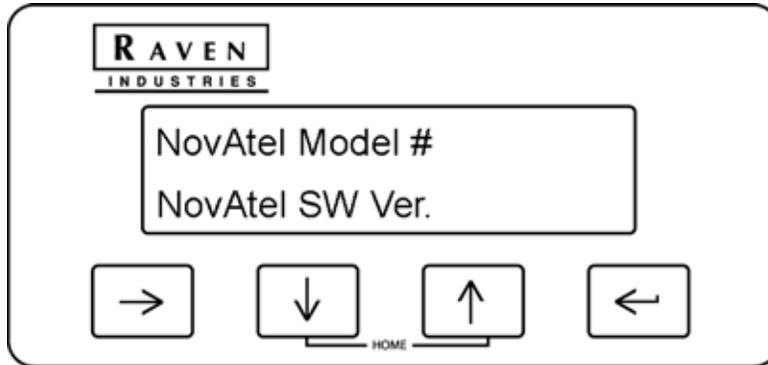


Phoenix 300-B

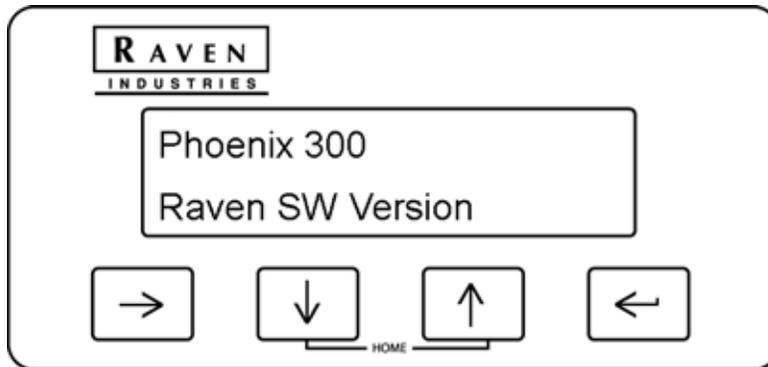


## Phoenix 300-A

Press the  key to display the NovAtel® model and software version.

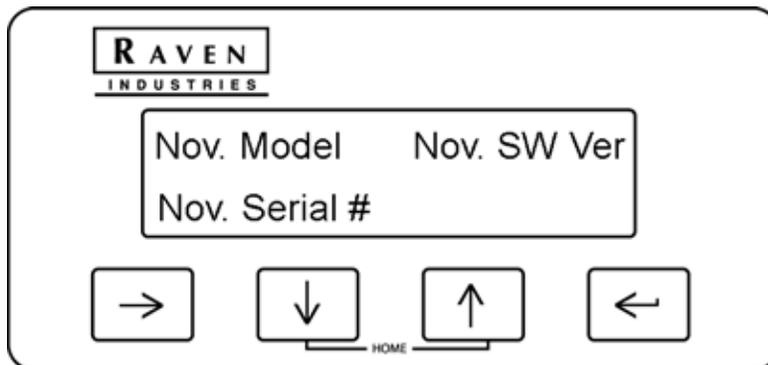


Press the  key to display the Raven software version currently installed on the receiver.



## Phoenix 300-B

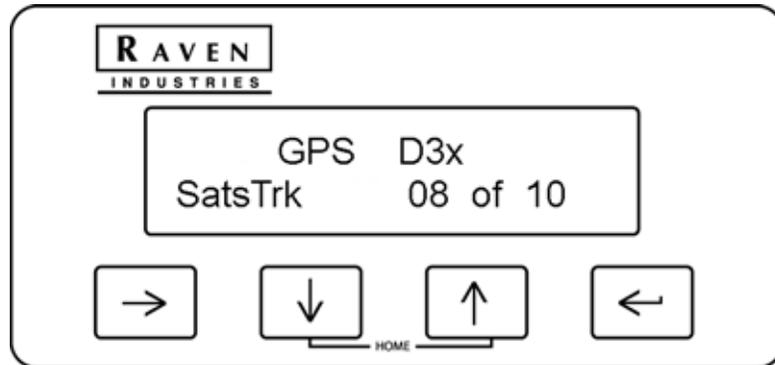
Press the  key to view the NovAtel® model, software version, and NovAtel serial number.



## GPS Display Screen

Access the GPS display screens to view detailed GPS information 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.

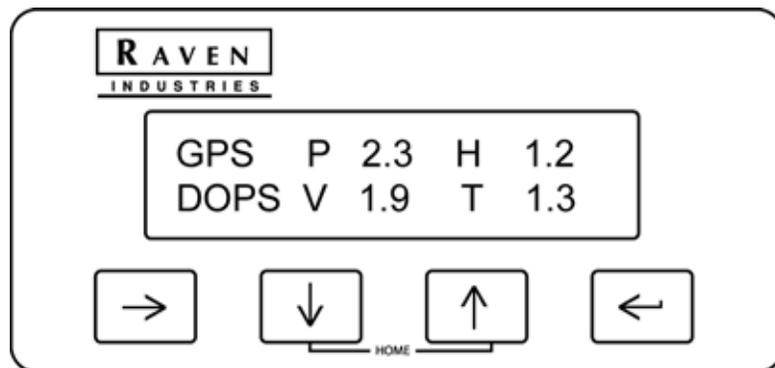
From the Home screen, press the  key until you get to the GPS Display screen.



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

D	Differential mode. <b>D</b> = Differential, <b>C</b> = Converging, <b>R</b> = RTK/Decimetric, <b>Blank</b> = 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

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

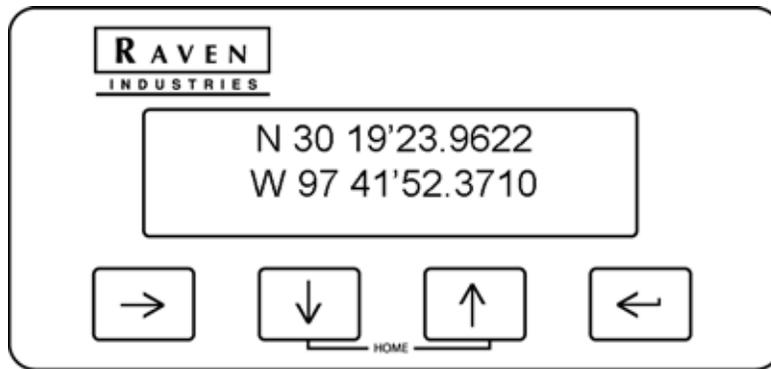


The term “DOP” (Dilution of Precision) is an estimation of error caused by spacing between the satellites being tracked and used in the GPS solution. Smaller values denote better accuracy. A value of 9.9 is displayed when there are not enough satellites being tracked to provide a usable GPS solution.

TABLE 2. Dilution of Precision Abbreviations

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

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

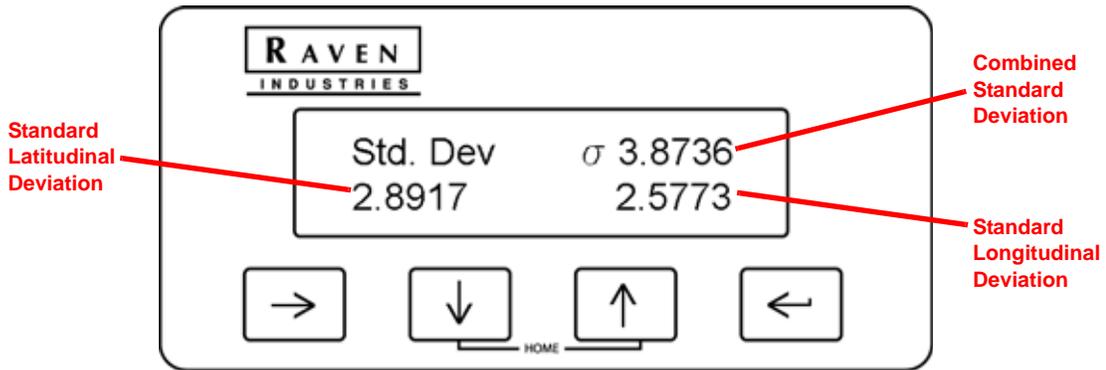


This displays the current location of the vehicle.

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



Press the  key to view the deviation screen.



Standard Deviation is a representation of the accuracy of the receiver.

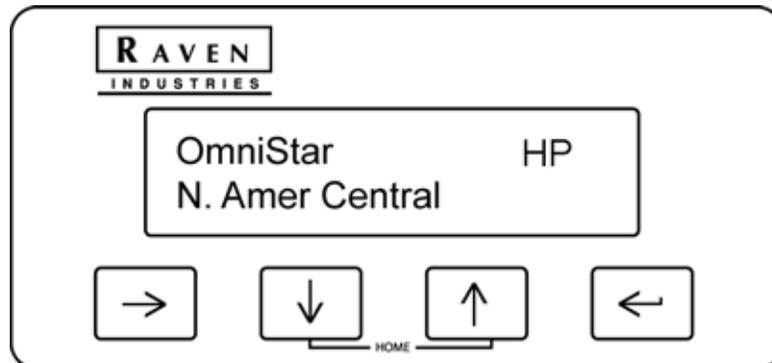
The lower, left value is the standard latitudinal deviation. The lower, right value is the standard longitudinal deviation. The value displayed in the top, right corner of the screen is the combined standard deviation.

## OmniSTAR<sup>®</sup> Display Screen

**Note:** The OmniSTAR display screen may only be available if “OmniSTAR HP/XP” is selected on the Correction Mode screen. Refer to the Correction Configuration Menu section on page 27 for more information on selecting the correction source.

Access the OmniSTAR display screens to view subscription status and expiration information or service communication information right on the Phoenix 300 display. For OmniSTAR configuration options and features, refer to the *OmniSTAR<sup>®</sup> Configuration Menu* section on page 30.

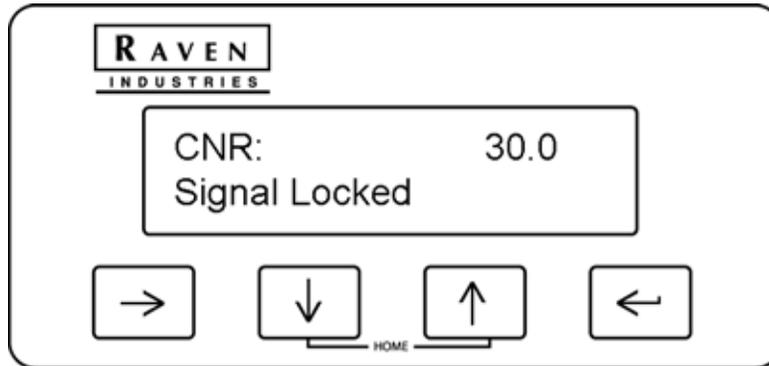
**Note:** Press the  key until the OmniSTAR screen is displayed.



This screen displays the region for currently selected on the receiver. To provide the best possible correction signal to the receiver, make sure that this setting is properly configured via the *OmniSTAR<sup>®</sup> Configuration Menu* section on page 30.



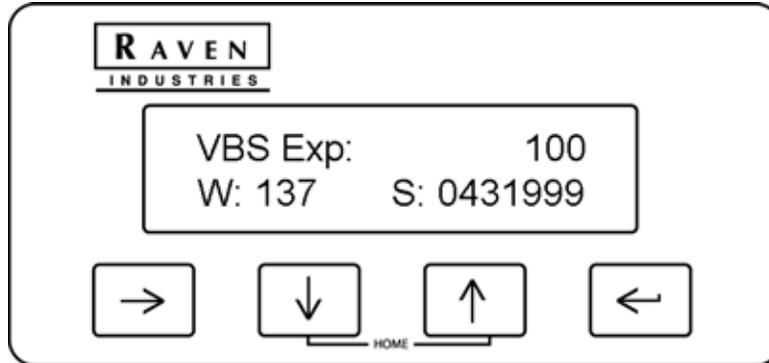
Press the  key to view the CNR and signal status screen.



CNR (Carrier to Noise Ratio) is the signal strength of the correction signal to noise. As this value increases, noise level may cause interference, position accuracy or precision issues, or cause the system to lose differential all together.

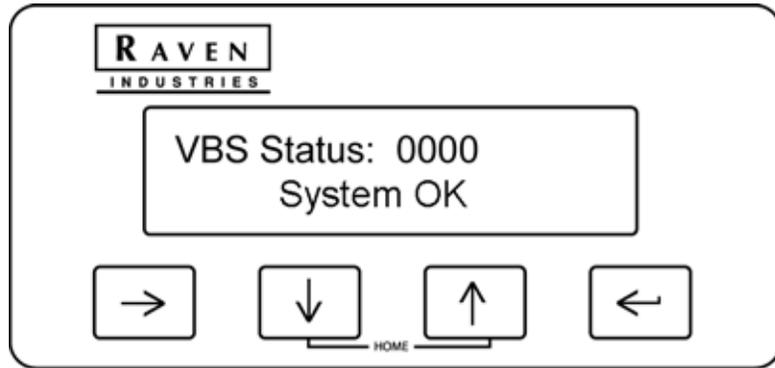
This screen also displays the status of OmniSTAR correction signal reception. This screen may display **Signal Locked** or **No Signal Lock** when operating with OmniSTAR correction enabled.

Press the  key to display the VBS (Virtual Base Station) time remaining until expiration in days, weeks, and seconds.



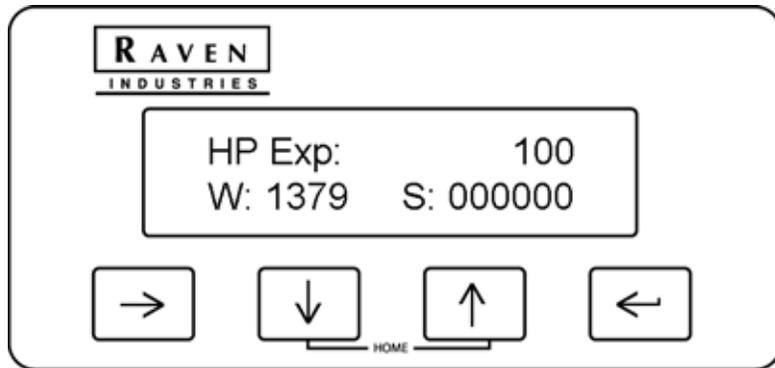
**Note:** Contact OmniSTAR for more information or to extend services.

Press the  key to display the OmniSTAR VBS subscription status.



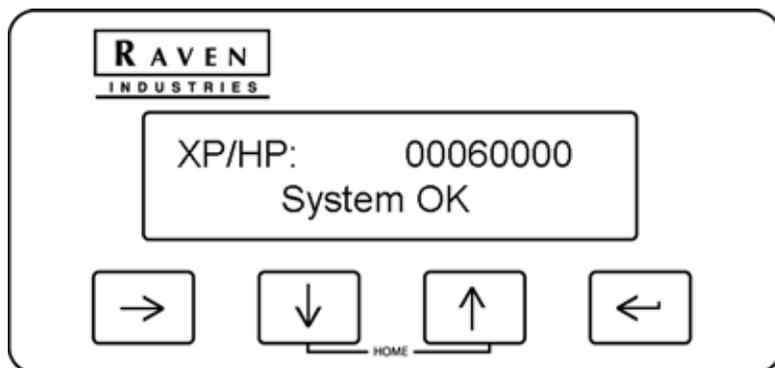
**Note:** Contact OmniSTAR for more information or to extend services.

Press the  key to display the HP subscription status. The remaining time until expiration in days, weeks, and seconds is displayed on this screen.



**Note:** Contact OmniSTAR for more information or to extend services.

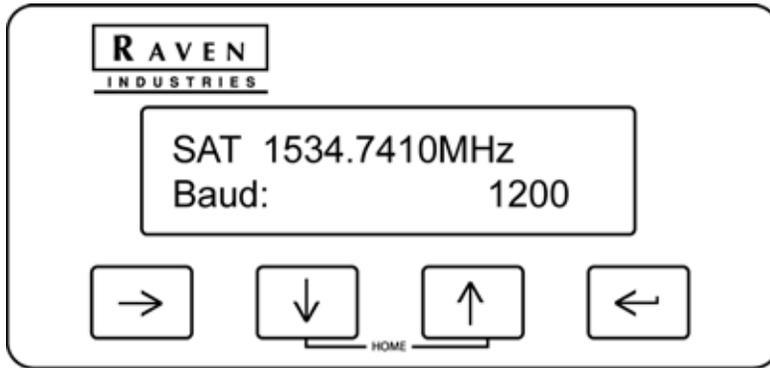
Press the  key to display the OmniSTAR HP subscription status.



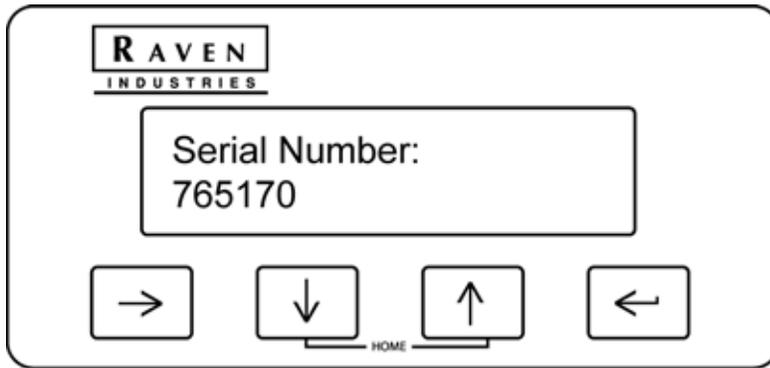
**Note:** Contact OmniSTAR for more information or to extend services.



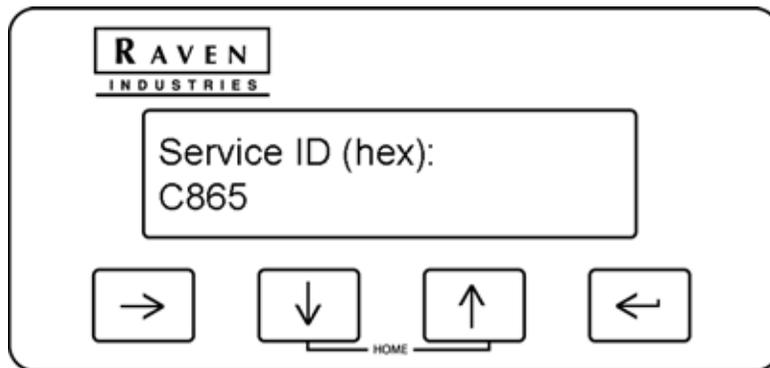
Press  key again to display the satellite frequency and baud rate.



Press the  key again to display the OmniSTAR serial number.



Press the  key to display the OmniSTAR Service ID number.



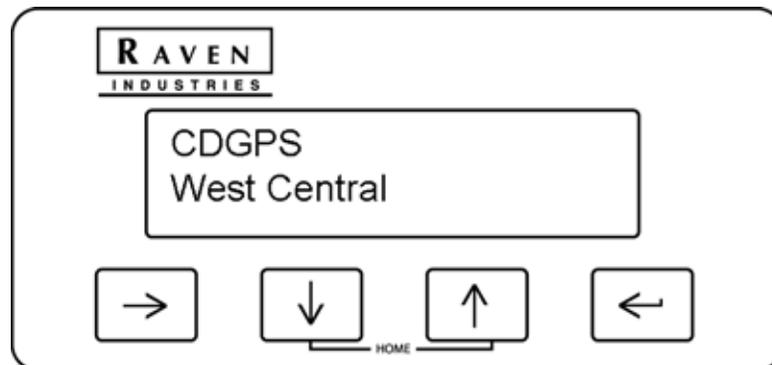
## CDGPS Display Screen

**Important:** As of 1 April 2011, the CDGPS correction source has been de-commissioned. While the Phoenix 300 DGPS receiver still provides access to menus and settings for this correction source, no differential corrections will be received when this source is selected. Please review and select one of the other available correction sources when using the Phoenix 300 DGPS receiver for actual field operations.

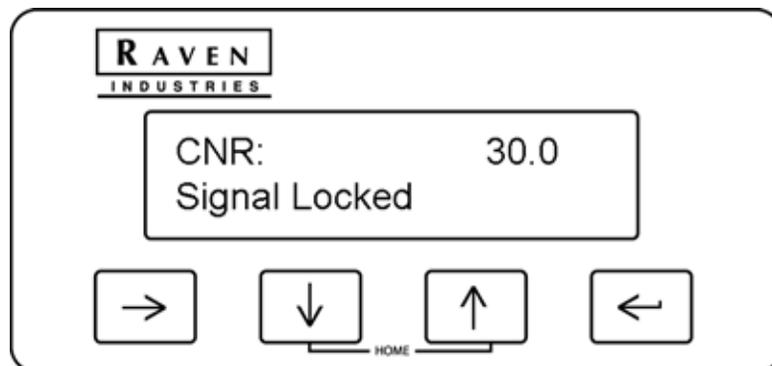
**Note:** The CDGPS display screen may only be available if “Canadian DGPS” is selected on the Correction Mode screen. Refer to the Correction Configuration Menu section on page 27 for more information on selecting the correction source.

Access the Canadian DGPS display screens to view region and communication information right on the Phoenix 300 display. For Canadian DGPS configuration options and features, refer to the CDGPS Configuration Menu section on page 35.

**Note:** Press the  key until the CDGPS screen is displayed.



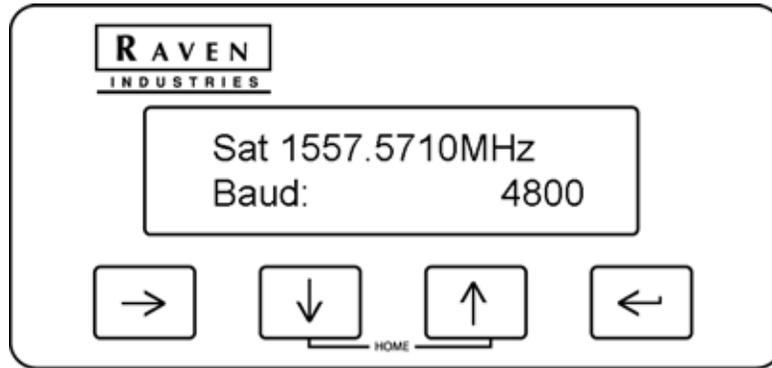
Press the  key will display the CNR and signal screen. CNR refers to the carrier to noise ratio.



CNR (Carrier to Noise Ratio) is the signal strength of the correction signal to noise. As this value increases, noise level may cause interference, position accuracy or precision issues, or cause the system to lose differential all together.

This screen also displays the status of the correction signal reception. This screen may display **Signal Locked** or **No Signal Lock** when operating with the CDGPS correction source.

Press the  key to view the satellite frequency and baud rate setting.



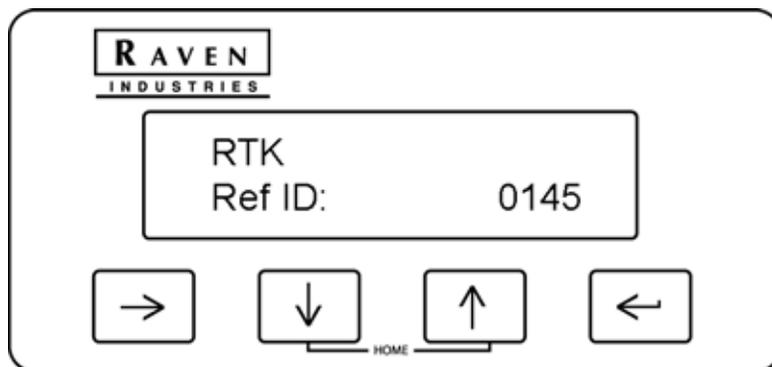
---

## RTK Display Screen

**Note:** The RTK display screen may only be available if “RTK” is selected on the Correction Mode screen. Refer to the Correction Configuration Menu section on page 27 for more information on selecting the correction source.

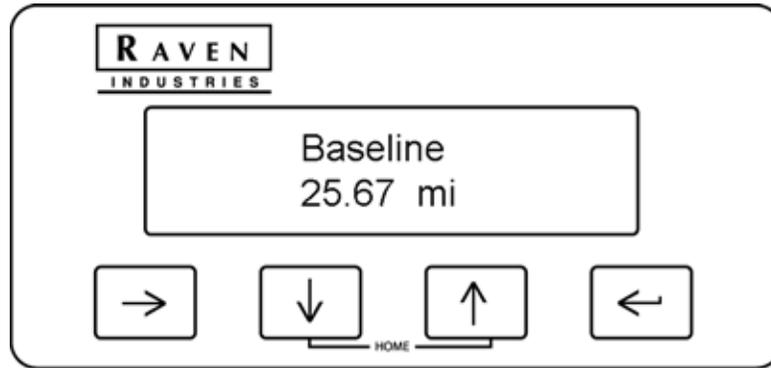
Access the RTK display screens to view reference or base station information. For RTK configuration options and features, refer to the RTK Configuration Menu section on page 33.

Press the  key until the RTK Reference ID screen is displayed.



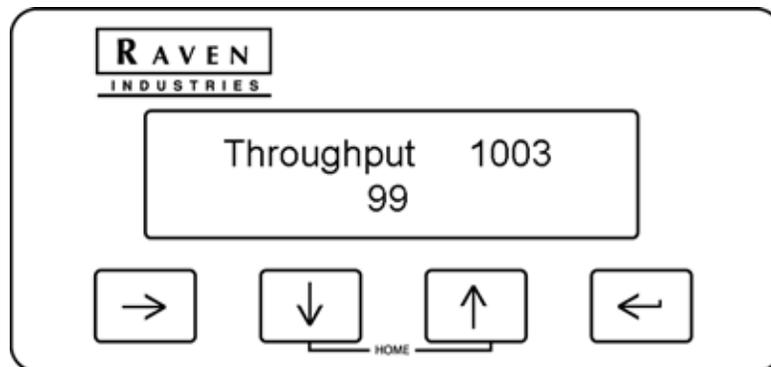
The reference ID displayed is the identification number assigned to the base station which the Phoenix 300 receiver is currently using for RTK corrections.

Press  to display the RTK baseline, or distance from the base station location.



Use this screen to help determine whether or not the vehicle is within range of RTK level corrections from the base station.

Press  to display the RTK throughput screens.

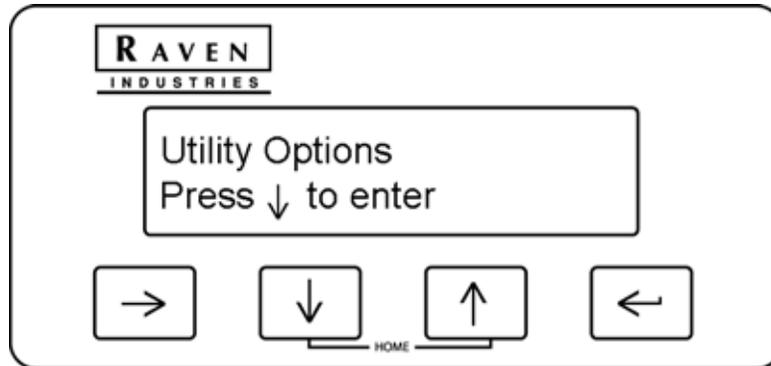


**Note:** Depending upon the RTK network selected for delivering RTK corrections, the Phoenix 300 will display up to three throughput screens.

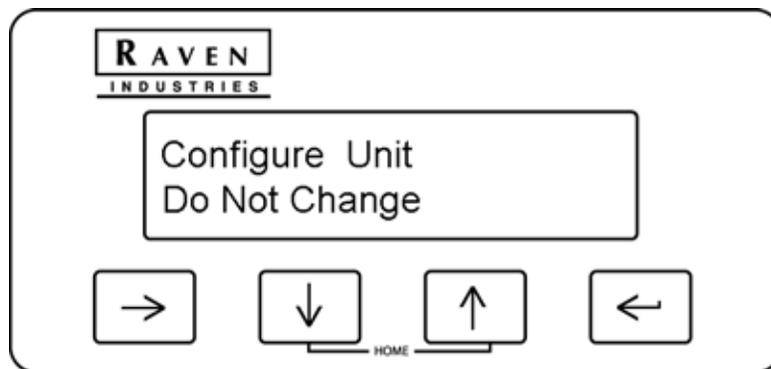
The RTK throughput displays the validity of message strings received for each message type. The validity displays as a value between 0 and 100. A value of 0 means no messages are being received for the displayed string while a value of 100 means all messages are being received on time. Low throughput values may indicate a connection issue.

## Utility Options Screen

Access the Utility Options to configure the Phoenix 300 to operate with other devices such as a Raven Radar speed sensor or the Raven SmarTrax automated steering system.



Press the  key to access the Configure Unit screen.



Press the  key and use the  or  keys to cycle through the available presets. Select one of the available presets to set up the Phoenix 300 communication settings as shown in the *Pre-Defined Setting Configurations* section on page 23.

## Pre-Defined Setting Configurations

The following presets are available and may be helpful to quickly configure the Phoenix 300 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.

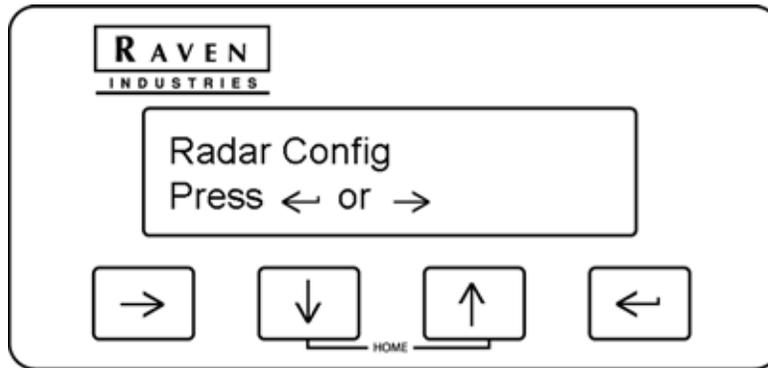
**TABLE 3. Phoenix 300 Receiver Preset Configurations**

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

Press the  key again to select the currently displayed preset. The Phoenix 300 will automatically configure the port baud rates and message output settings. Once the preset is applied, the display will return to **Do Not Change**.

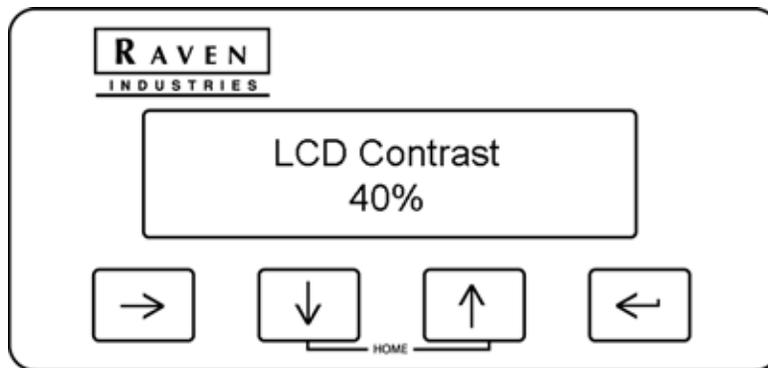
**Note:** Select **Do Not Change** to cancel any changes to the baud or messages rate settings.

Press the  key again and press either the  or  key to access the Radar Config menu.



**Note:** Refer to the Radar Configuration Screen section on page 25 for additional information regarding the Radar Configuration Screen.

Press the  key to display the LCD Contrast screen (if available).



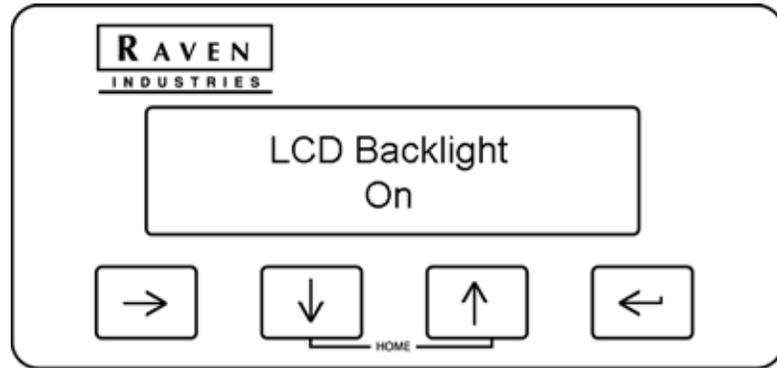
Press the  key and use the  or  keys to adjust the screen contrast as necessary.

**Note:** The LCD Contrast screen is only available on Phoenix 300-B GPS receivers. Review the Receiver Display Screen section on page 11 to assist with identifying the receiver hardware configuration.

The latest versions of Phoenix 300 firmware limit the contrast between 22% and 85%. Setting the contrast too low (below 30%) or too high (above 80%) may result in difficulty reading the display.

Press the  key again to lock in the desired setting.

Press the  key to display the LCD Backlight screen.

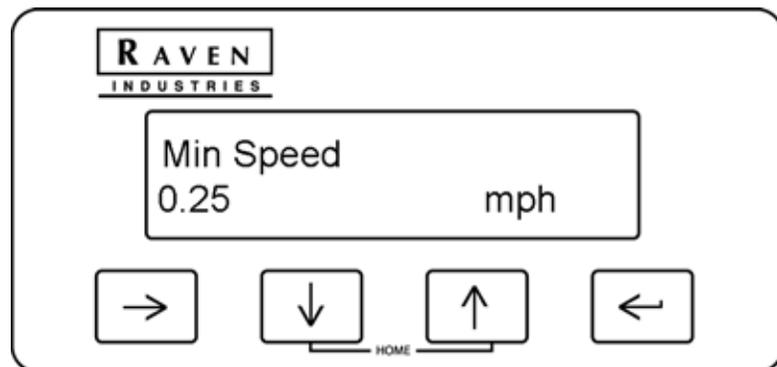


Press the  key and use the  or  keys to toggle the backlight setting on or off. Press the  key again to lock in the desired setting.

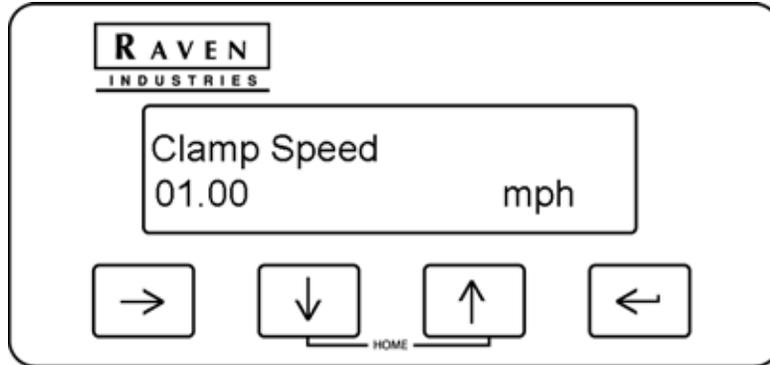
## Radar Configuration Screen

The Radar configuration screens may be used to configure the simulated radar speed signal output from the Phoenix 300 receiver.

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



Press 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. Press the  arrow key to edit the clamp speed.



Pressing 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.



## *Correction Configuration Menu*

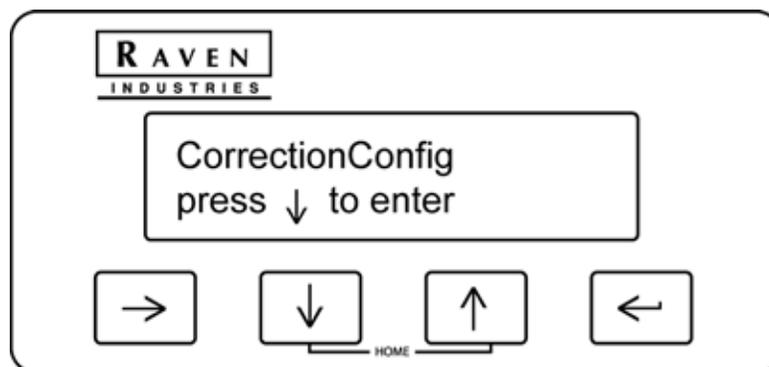
Access the Correction Configuration menu to set the differential correction source used with the Phoenix 300 receiver.

**Note:** *The OmniSTAR® VBS, HP, and XP correction sources require a subscription to OmniSTAR services. Contact OmniSTAR for subscription information.*

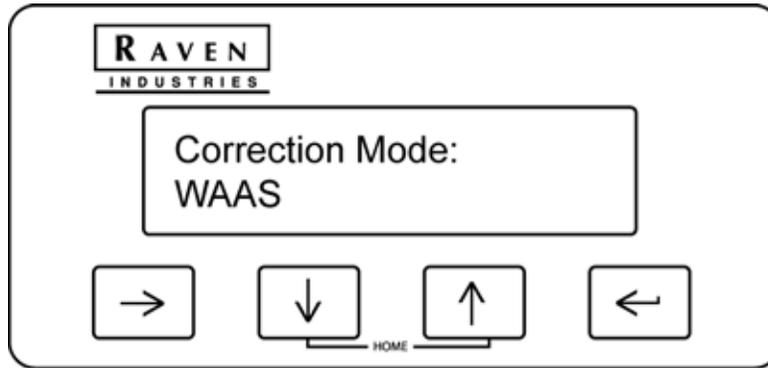
*To receive RTK corrections, a Slingshot® Field Hub™ is required and must be authorized to receive corrections from a local Slingshot base station or CORS network. Contact a local Slingshot dealer for more information.*

*If 'None' is selected, the Phoenix 300 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.*

Press the  key until the Correction Configuration screen is displayed.



Press the  key to access the Correction Mode screen.



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

The Phoenix 300 may be used with the following differential correction sources:

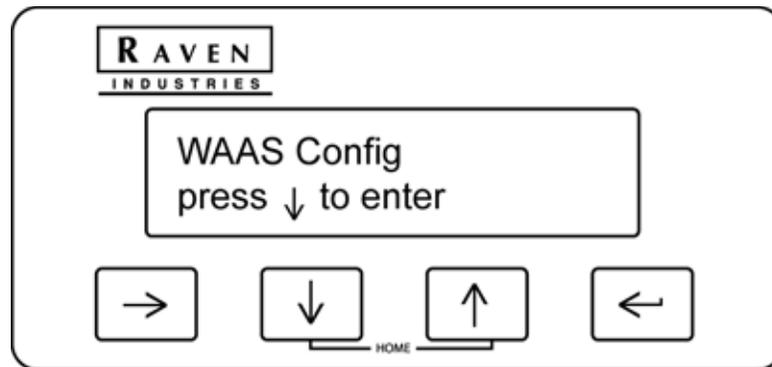
**TABLE 1. Correction Types**

Type	Description
WAAS	Wide Area Augmentation System
OmniSTAR <sup>®</sup> XP/HP	OmniSTAR DGPS
OmniSTAR <sup>®</sup> VBS	OmniSTAR DGPS
CDGPS	Canadian DGPS
RTK	Real Time Kinematic
NovAtel G11de <sup>®</sup>	GPS smoothing and autonomous GPS features
None	No differential correction

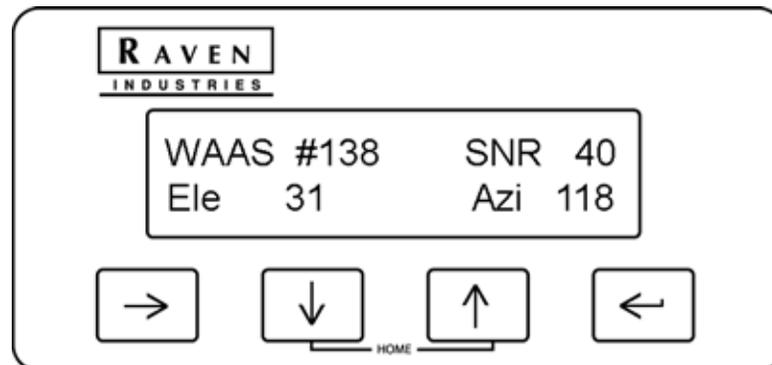
## WAAS Configuration Menu

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.

Press the  key until you get to the WAAS Configuration screen.



Press the  key and the current configuration is displayed.



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

- For Phoenix 300-A receivers, select a value between 120 and 138.
- For Phoenix 300-B receivers, select a value between 120 and 151.

Press the  key to select 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 300 will automatically select the satellite with the best signal to noise ratio for differential corrections.*

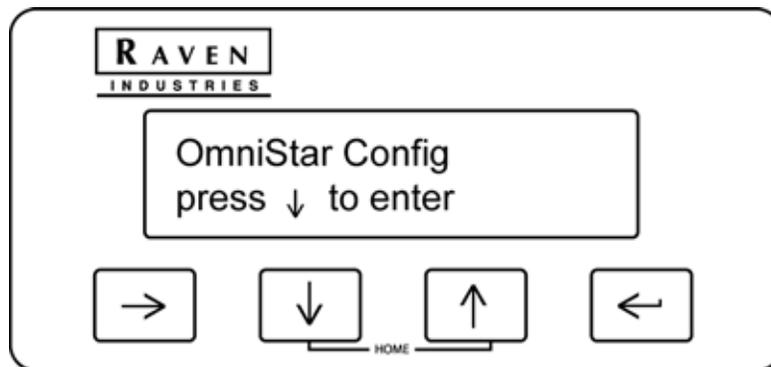
*Setting the Phoenix 300 to Auto may cause the receiver to switch differential satellites during operations which can cause the vehicle position to shift slightly. If this becomes a problem, manually select a satellite PRN providing adequate signal and coverage for the area of operation.*

## OmniSTAR<sup>®</sup> Configuration Menu

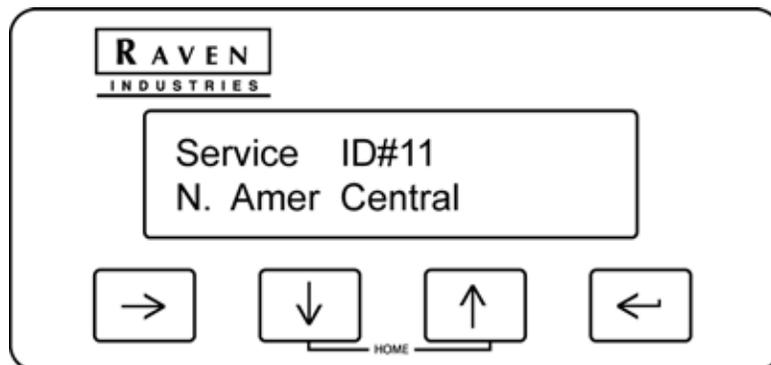
Access the OmniSTAR Configuration menu to configure the Phoenix 300 for OmniSTAR DGPS services. Contact OmniSTAR to activate an OmniSTAR subscription.

**Note:** *The OmniSTAR configuration menu may only be available if “OmniSTAR HP/XP” is selected on the Correction Mode screen. Refer to the Correction Configuration Menu section on page 27 for more information on selecting the correction source.*

Press the  key until the OmniSTAR Configuration screen is displayed.



Press the  key to view the current Service ID number and region setting.



The Service ID screen is used to select the correct OmniSTAR satellite for the region of operation.

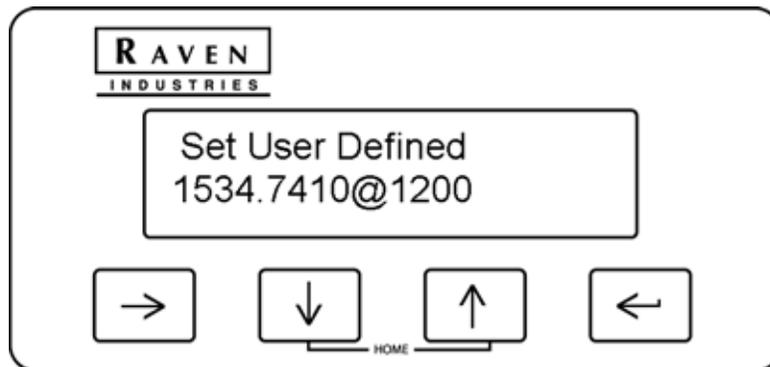
Press the  key and use the  or  arrow keys until the desired region is flashing on the screen.

Press the  key to select the displayed setting. The following service region ID numbers are available on the Phoenix 300 receiver.

**TABLE 2. Region ID Numbers**

ID #	Description	ID #	Description
00	User Defined	07	East Africa
01	N. America East	08	Australia
02	N. America Central	09	Atlantic O. East
03	N. America West	10	Indian Ocean
04	South America	11	Pacific Ocean
05	Asia-Pacific	12	Atlantic O. West
06	Africa		

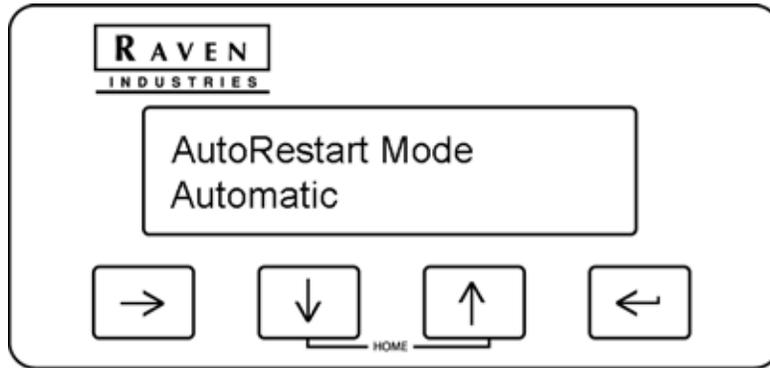
To input a user defined frequency, set the User Defined option on the Service ID screen and press the  key. The Set User Defined screen will be displayed.



Use this screen to enter a satellite frequency (e.g., 1554.4970 MHz) and baud rate (e.g., 1200) supplied by OmniSTAR for a User Defined configuration:

1. Press the  key and use the  or  arrow keys to change the first digit in the frequency value.
2. Press the  key to proceed to the second digit and repeat step 1 to set the second digit.
3. Repeat the above steps to enter each digit for the satellite frequency.
4. Press the  key when the frequency is displayed correctly and use the  or  arrow keys to select the baud rate.
5. Press the  key to set the baud rate and set the User Defined frequency.

Press the  key to display the Auto-Restart screen.



This screen displays the current mode for the OmniSTAR “seed” state. Review the *OmniSTAR® XP/HP Restart* section on page 11 for more information on the seed state and using seed positions.

Press the  key and use the  or  arrow keys to toggle the AutoRestart Mode between “Automatic” and “Manual” on the screen. Press the  key to select the displayed setting.

Select one of the following modes for the OmniSTAR autorestart feature:

- **Automatic** - Automatically stores the last position at which a differential position signal was received before powering down the receiver. This option works well if the receiver will be powered back on at or near the location where it was powered down.
- **Manual** - The operator must manually store the restart location. Use the manual mode if the vehicle will be stored in a garage or shop where GPS signal may be weak or blocked.

**Note:** *If the receiver is restarted further from the stored location, the receiver may need to re-converge. Depending upon the time since the last power up and distance from the stored location, re-convergence may take several minutes.*

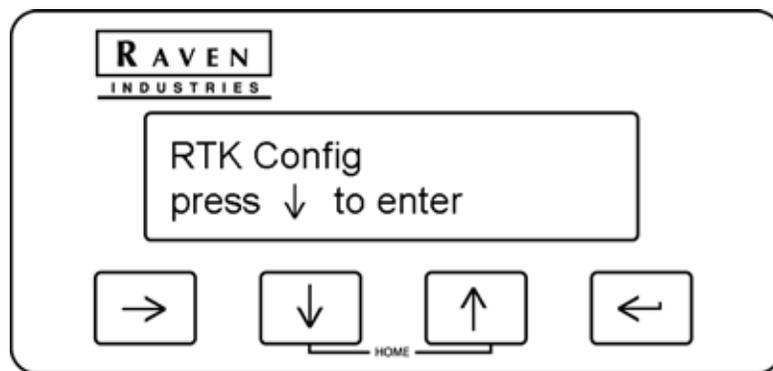
## RTK Configuration Menu

**Note:** The RTK configuration menu may only be available if “RTK” is selected on the Correction Mode screen. Refer to the Correction Configuration Menu section on page 27 for more information on selecting the correction source.

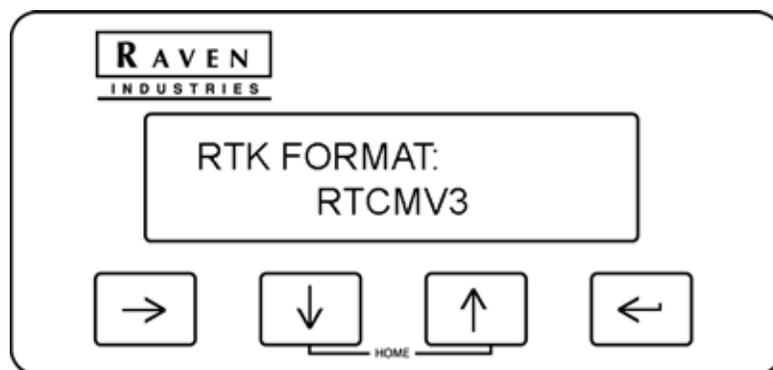
Review the Phoenix 300 Quick Start and RTK Update Guide for more information about requirements and unlocking RTK for the receiver. For purchasing information and assistance, contact a local Raven dealer.

If RTK is selected as the differential correction mode, the RTK configuration screen will be available.

Press the  key until the RTK Config screen is displayed.



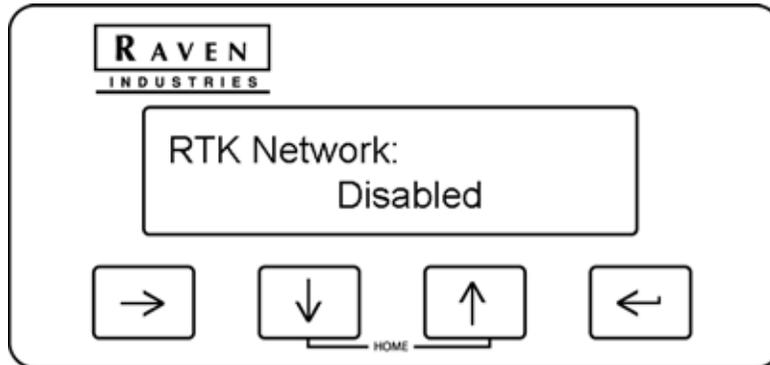
Press  to display the currently selected RTK signal format.



This format must be output from the base station to receive corrections on the Phoenix 300 receiver. Press the  key and use the  or  arrow keys to modify the RTK signal format accepted by the Phoenix 300 receiver.



Press  to display the currently selected RTK network.

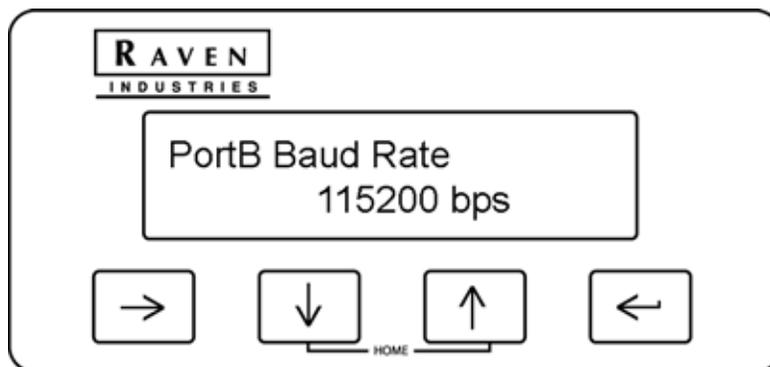


**Note:** The RTK Network screen is only displayed in software versions 1.22 (for 300-A receivers) or 2.05 (for 300-B receivers) and newer.

Press the  key and use the  or  arrow keys to select one of the following settings:

- Disabled - select disabled if the Phoenix 300 receiver will be operating with a Slingshot<sup>®</sup> base station via a Field Hub<sup>™</sup>.
- VRS (Virtual Reference Station) or iMax - select the VRS or iMax option when working with a CORS network. Select the network setting which matches the CORS network technology.

Press  to display the Port B Baud Rate setting.



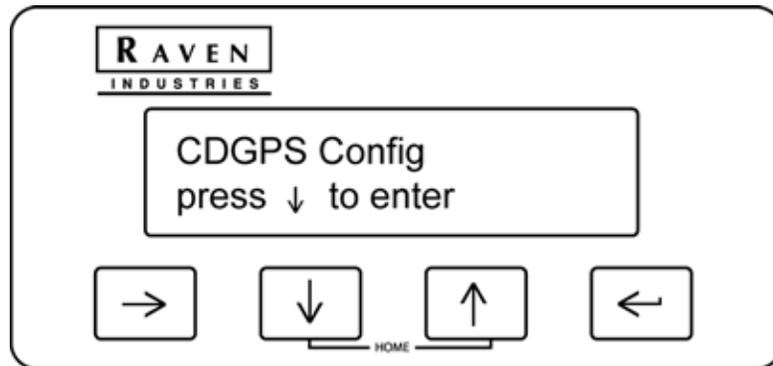
Press the  key and use the the  or  arrow keys to select a different baud rate for the correction messages sent from the Phoenix 300 receiver.

## CDGPS Configuration Menu

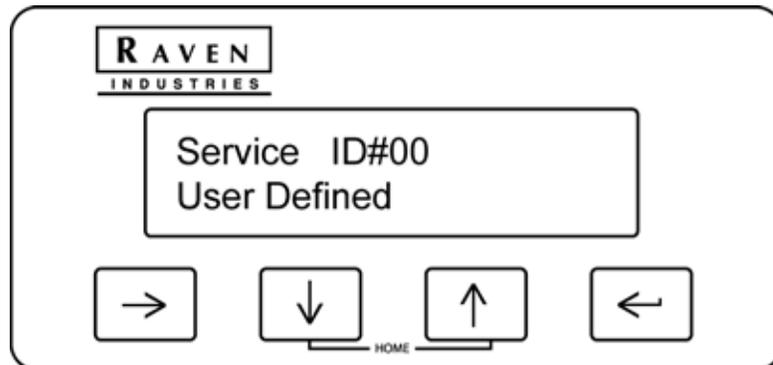
**Important:** As of 1 April 2011, the CDGPS correction source has been de-commissioned. While the Phoenix 300 DGPS receiver still provides access to menus and settings for this correction source, no differential corrections will be received when this source is selected. Please review and select one of the other available correction sources when using the Phoenix 300 DGPS receiver for actual field operations.

**Note:** The CDGPS configuration menu may only be available if “Canadian DGPS” is selected on the Correction Mode screen. Refer to the Correction Configuration Menu section on page 27 for more information on selecting the correction source.

Press the  key until the CDGPS Configuration screen is displayed.



Press the  key to view the current Service ID number and region setting.



The Service ID screen is used to select the correct OmniSTAR<sup>®</sup> satellite for the region of operation.

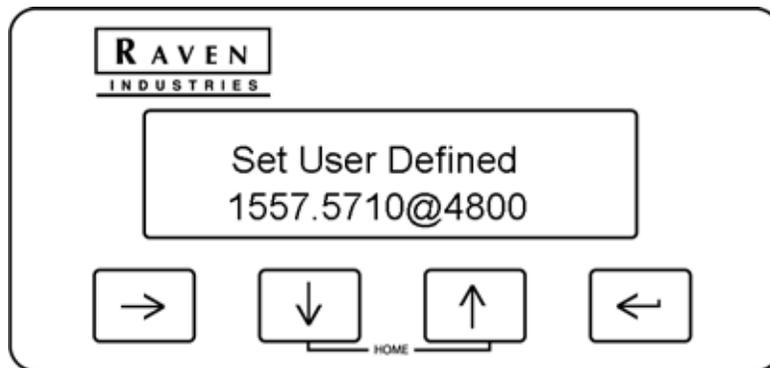


Press the  key and use the  or  arrow keys until the desired region is flashing on the screen.

Press the  key to select the displayed setting. The following service region ID numbers are available on the Phoenix 300 receiver.

ID #	Description
0	User Defined
1	East
2	East Central
3	West Central
4	West

Press the  key to view the current Service ID number and region setting.



Use this screen to enter a satellite frequency (e.g., 1554.4970 MHz) and baud rate (e.g., 1200) supplied by OmniSTAR for a User Defined configuration:

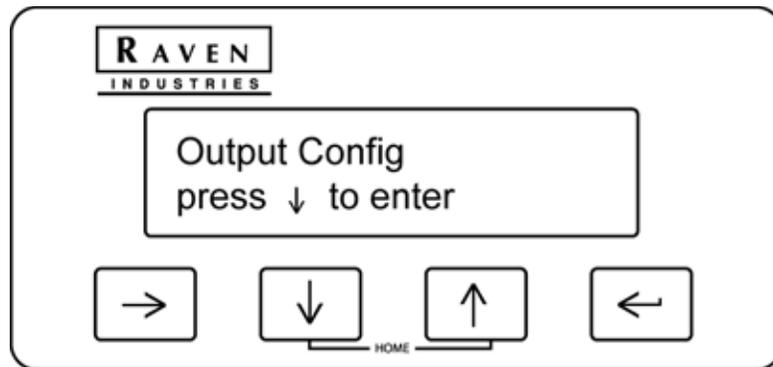
1. Press the  key and use the  or  arrow keys to change the first digit in the frequency value.
2. Press the  key to proceed to the second digit and repeat step 1 to set the second digit.
3. Repeat the above steps to enter each digit for the satellite frequency.
4. Press the  key when the frequency is displayed correctly and use the  or  arrow keys to select the baud rate.

**Note:** Press the  key to set the baud rate and set the User Defined frequency.

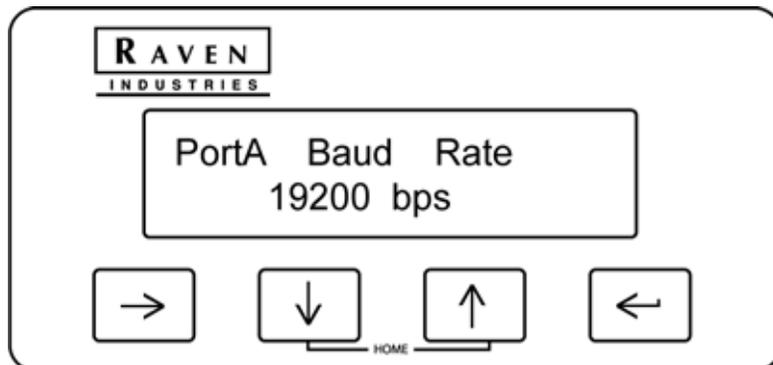
## Output Configuration Menu

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 *NMEA Messages* section on page 40 for more information on NMEA messages.

Press the  key until the Output Configuration screen is displayed.

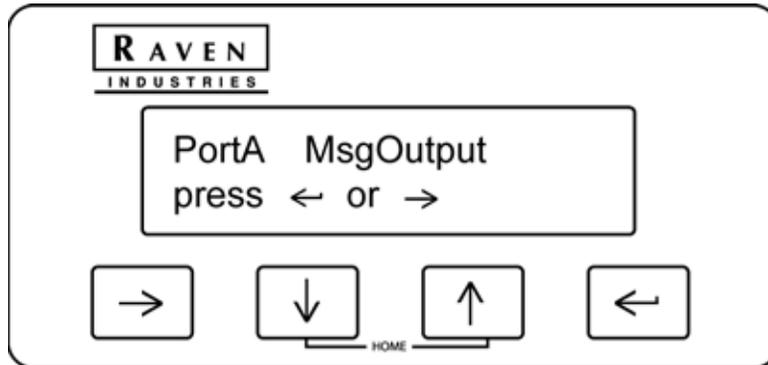


Press the  key and the baud rate for Port A is displayed.



Press the  key and use the  or  keys to change the message rate for Port A on the back of the Phoenix 300 receiver. Press 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. Refer to

**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, press the  key and use the  or  keys to set the first digit.

Press the  key to advance to the next digit or press the  key to save the displayed output setting.

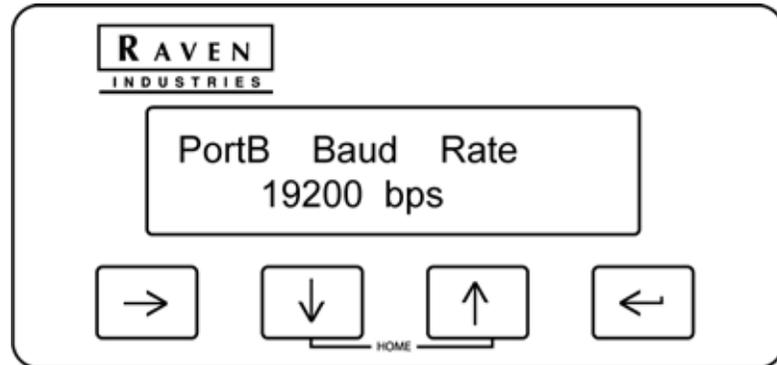
The table below lists the optional interval rates:

**TABLE 3. 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

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

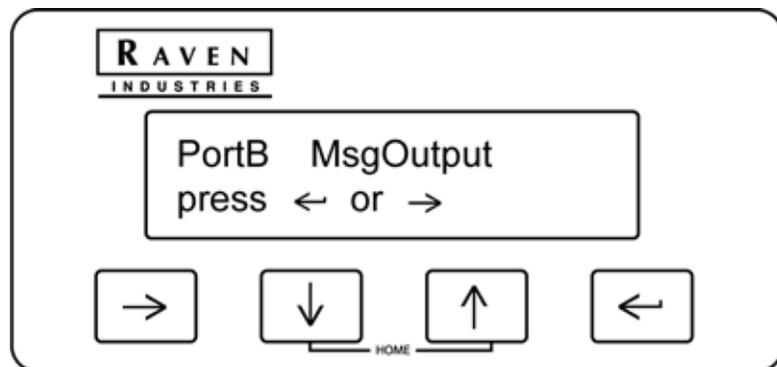
Press the  key to access the Port B Message Output screen.



**Note:** If the Correction Mode is set to RTK, the Port B baud rate and message output screens will not be displayed in the Output Configuration menu.

Press the  key and use the  or  keys to change the message rate for Port B on the back of the Phoenix 300 receiver. Press the  key to save the new setting.

Press the  key to access the Port B 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 a output rate for a message, press the  key and use the  or  keys to set the first digit. Press the  key to advance to the next digit or press the  key to save the displayed output setting.

## NMEA Messages

The Phoenix 300 receiver can be used to communicate with other electronic devices including Raven's Guidance Lightbar. A communication protocol (set of rules) 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 300 receiver uses to communicate with other devices.

**TABLE 4. NMEA Messages**

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

CHAPTER

5

*Sample NMEA  
Message Structure*

The following example of the GGA message string is an example the typical format of NMEA messages:

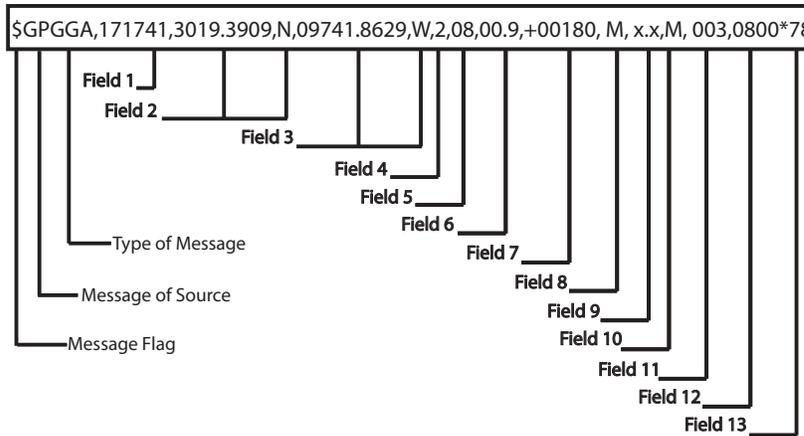


TABLE 1. Message Structure Disambiguation

Field	Description	Field	Description
\$	Message Flag	6	Horizontal Dilution of Precision
GP	Message Source (GPS)	7	Antenna Altitude Ref: Sea Level (geoid)
GGA	Type of Message	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



**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.*

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. View the Front Panel Display Home Screen 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 Table 1 on page 10 for display descriptions.

## DGPS Antenna

Check the connections between the antenna and receiver. Verify the connectors and cable are in good condition.

An ohmmeter may be used to determine if the antenna cable is open or shorted. Normal resistance will be measured between 66 and 70 Ohms.

## Power

The front panel display should remain lit while power is applied.

### Power Connection

The Phoenix 300 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.

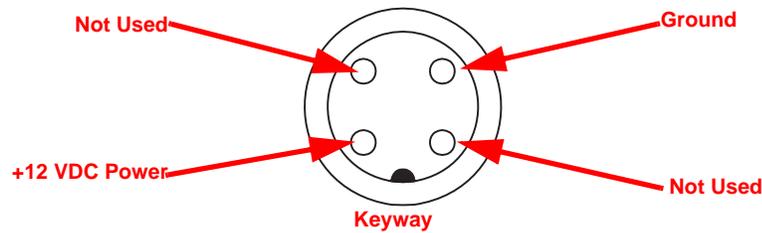


TABLE 1. Power Connector Pins

Pin	Description	Wire Color
1	+12 VDC Power Input	Red
2	Not Used	N/A
3	Power Return (GND)	Black
4	Not Used	N/A

## Signal Reception

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

[www.nstb.tc.faa.gov](http://www.nstb.tc.faa.gov)

If the receiver is in OmniSTAR<sup>®</sup> mode, verify the frequency of the satellites.

## Receiver Specifications

TABLE 2. Receiver Specifications

Position Accuracy	See chart below	Update Rate	10 Hz
Timing Accuracy	N/A	Max. Velocity	1000 Knots
Num. of Channels	24	Rel. Humidity	95% non-condens.
Min. Signal Strength	5 $\mu$ V @ 1000 bps	Altitude	60,000 feet
Dynamic Range	> 100 dB	Dimensions	8.3" L x 5.7" W x 2.1" H
Adj. Channel Rej.	50 dB at 1 KHz	Weight	20 ounces
Cold Start	6 min. typical, 15 min. max.	Antenna Weight	< 1.3 pounds
Warm Start	40 seconds	Antenna Diam.	7.5 inches
Reacquisition	1 second	Input Voltage	9-16 VDC
Acceleration	2G	Power Consump.	< 34 W @ 12 VDC
Connectors/Ports	2 RS-232 I/O	Current	400 mA @ 12 VDC
Operating Temp.	-40 to +65° C		

## Position Accuracy Chart

TABLE 3. Phoenix 300 Accuracy Chart

Differential Source	Direction	Accuracy
WAAS	Horizontal RMS	<1 m (40 in)
OmniSTAR <sup>®</sup> VBS	Horizontal RMS	<1.2 m (50 in)
OmniSTAR <sup>®</sup> XP	Horizontal RMS	<0.24 m (10 in)
OmniSTAR <sup>®</sup> HP	Horizontal RMS	<0.12 m (5 in)
RTK	Horizontal RMS	1 cm (0.4 in) + 1 ppm

## Configuration

### Rear Panel Serial Interfaces

The Phoenix 300 has two bidirectional RS-232 serial interfaces. Each port is assigned a single letter in uppercase, “A” or “B”, and each one provides communication between the Phoenix 300 receiver and external guidance or navigation devices.

**TABLE 4. Serial Port Pins**

PORT A		PORT B	
Pin	Signal Name	Pin	Signal Name
1	Port “A” TX	1	Port “B” TX
2	Port “A” RX	2	Port “B” RX
3	GND	3	GND
4		4	RADAR
5		5	
6	Ext. PWR	6	Ext. PWR
7	GND	7	GND

**A**

The following procedure contains detailed instructions for updating software on the Phoenix 300.

**Note:** *Software updates for the Phoenix 300 receiver are available on the Raven web site:*

[www.ravenhelp.com](http://www.ravenhelp.com)

---

## *Preparation*

Refer to the *Receiver Display Screen* section on page 11 to determine which version of the Phoenix 300 receiver is being updated. When connecting to:

- Phoenix 300-A, connect the PC Interface Cable to “Port B” on the back of the receiver.
- Phoenix 300-B, connect the PC Interface Cable to “Port A” on the back of the receiver.

**Note:** *If a 9-pin serial COM port is not available on the PC, a USB to Serial adaptor (P/N 524-0002-063) will be required to perform the update.*

Check whether the NovAtel® serial number starts with an ‘S’ or ‘D’ and download the appropriate update from the Raven web site.

## Software Update Procedure

**Note:** Be sure to update the Raven firmware before beginning the NovAtel® firmware update.

*When updating a Phoenix 300-A, set the Port B baud rate to 19200 from the Output Configuration screen. Refer to the Output Configuration Menu section on page 37 for more information.*

1. Extract, or unzip, the “RavenLoader” zip file.
2. Run the “Ravenloader.exe” program located in the folder extracted in the previous step.
3. Click on “File” and select “New.”
4. Click on “COM Port” in the top toolbar and select “Settings.”
5. Set the COM Port number to match the port number connected to the Phoenix 300 receiver. If a USB to Serial adaptor, verify which COM port is assigned to the adaptor.

**Note:** *When updating a Phoenix 300-A, verify that the Connection Baud is set to 19200 and the Download Baud is set to 115200.*

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).”
6. Click the “OK” button.
  7. Click the “Detect Receiver Type” button.
  8. 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, the receiver will automatically reboot. Allow the receiver to reboot and the Home screen to display before proceeding.
  9. 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.
  10. Disconnect the power cable from the DGPS receiver for approximately 5 seconds and then reconnect to reboot the receiver.
  11. Update is complete.

---

## APPENDIX

# B

# *OmniSTAR<sup>®</sup>* *Activation*

This section contains information for upgrading the Phoenix 300 to receive OmniSTAR XP/HP corrections. Contact a local Raven dealer for more information and to begin the upgrade process.

The following information will be required to generate an OmniSTAR XP/HP authorization code:

- NovAtel<sup>®</sup> serial number
- NovAtel software version

**Note:** Refer to the *Receiver Display Screen* section on page 11 for assistance locating this information on the Phoenix 300 receiver.

*The NovAtel serial number must begin with a 'D' to utilize OmniSTAR corrections.*

---

## *Preparation*

Refer to the *Receiver Display Screen* section on page 11 to determine which version of the Phoenix 300 receiver is being updated. When connecting to:

- Phoenix 300-A, connect the PC Interface Cable to “Port B” on the back of the receiver.
- Phoenix 300-B, connect the PC Interface Cable to “Port A” on the back of the receiver.

**Note:** *If a 9-pin serial COM port is not available on the PC, a USB to Serial adaptor (P/N 524-0002-063) will be required to perform the update.*

*To complete the authorization process, the Raven Loader program for the Phoenix 300 version is also required. The Raven Loader is available free of charge from the Raven web site:*

[www.ravenhelp.com](http://www.ravenhelp.com)

*The Raven Loader program is included with the firmware download for the latest Phoenix 300 software update.*

## Authorization Procedure

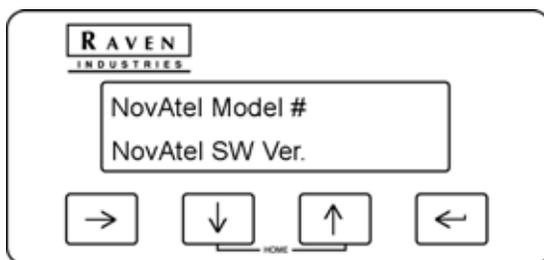
1. With the Phoenix 300 connected to a PC or laptop computer, power up the receiver.
2. Extract, or unzip, the “RavenLoader” zip file.
3. Run the “Ravenloader.exe” program located in the folder extracted in the previous step.
4. Click on “File” and select “New.”
5. Click on “COM Port” in the top toolbar and select “Settings.”
6. Set the COM Port number to match the port number connected to the Phoenix 300 receiver. If a USB to Serial adaptor, verify which COM port is assigned to the adaptor.

To verify the COM port:

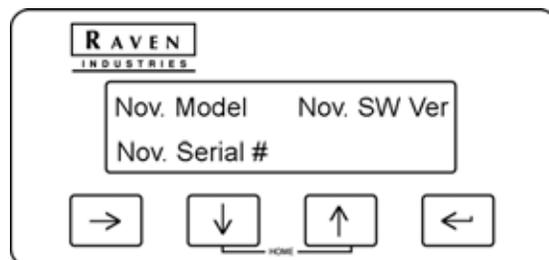
- a. Right click on the “My Computer” icon on the desktop or in the “Start” menu.
- b. Left click on “Properties.”
- c. Choose the “Hardware” tab.
- d. Select “Device Manager.”
- e. Click on the plus (+) sign next to “Ports (COM & LPT).”
7. Click on “Tools” and select “Authorization.”
8. In the Authorization window, enter the authorization code received from your Raven dealer.
9. Click the “Send” button to begin authorization.  
Allow the receiver to process the update.
10. When the update is completed:
  - Phoenix 300-A receivers, close the Raven Loader program. Disconnect the power cable from the DGPS receiver for approximately 5 seconds and then reconnect to reboot the receiver.
  - Phoenix 300-B receivers will automatically reboot after a few seconds if the code is accepted.
11. To verify that OmniSTAR XP/HP feature is authorized:

- a. From the Phoenix 300 Home screen, press the  key on the receiver.
- b. Press the  key on the receiver.
- c. The NovAtel® software version should now match the last field of the authorization code.

Phoenix 300-A



Phoenix 300-B



**C**

This section contains information for activating RTK level corrections on the Phoenix 300 receiver. An RTK activation code will be necessary to complete the activation. Contact a local Raven dealer for more information or to obtain an RTK Unlock Code for one of the following:

- from WAAS to RTK (P/N 077-0180-021)
- from OmniSTAR<sup>®</sup> XP/HP to RTK (P/N 077-0180-014)

The following information will be required to generate an RTK authorization code:

- NovAtel<sup>®</sup> PSN (example DAB09020187)
- Receiver Model (example N12BVA)
- NovAtel Software Revision

---

## *Preparation*

Refer to the *Receiver Display Screen* section on page 11 to determine which version of the Phoenix 300 receiver is being updated. When connecting to:

- Phoenix 300-A, connect the PC Interface Cable to “Port B” on the back of the receiver.
- Phoenix 300-B, connect the PC Interface Cable to “Port A” on the back of the receiver.

**Note:** *If a 9-pin serial COM port is not available on the PC, a USB to Serial adaptor (P/N 524-0002-063) will be required to perform the update.*

*To complete the authorization process, the Raven Loader program for the Phoenix 300 version is also required. The Raven Loader is available free of charge from the Raven web site:*

[www.ravenhelp.com](http://www.ravenhelp.com)

*The Raven Loader program is included with the firmware download for the latest Phoenix 300 software update.*

## RTK Upgrade Procedure

**Note:** Before activating the RTK unlock code, verify that the Phoenix 300 receiver has the latest Raven software version available. Refer to Appendix A, *Software Updates*, for a detailed software update procedure.

Be sure to update the Raven firmware before beginning the NovAtel® firmware update.

1. With the Phoenix 300 connected to a PC or laptop computer, power up the receiver.
2. Extract, or unzip, the “RavenLoader” zip file.
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 300 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 “Detect Receiver Type” button. Allow the Raven Loader program will communicate with the receiver.
  8. When the Raven Loader displays “Application completed successfully,” click on “Tools” and select “Authorization.”
  9. In the Authorization window, enter the authorization code received from your Raven dealer.
  10. Click the “Send” button to begin authorization.
  11. Disconnect the power cable from the DGPS receiver for approximately 5 seconds and then reconnect to reboot the receiver.

Refer to the *Correction Configuration Menu* section on page 27 and verify that the RTK Correction Mode is available.

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**RAVEN**

# **RAVEN INDUSTRIES**

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### ***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.

### ***How Long is the Coverage Period?***

Raven Applied Technology Division products are covered by this warranty for 12 months after the date of purchase. This warranty coverage applies only to the original owner and is nontransferable.

### ***How Can I Get Service?***

Bring the defective part and proof of purchase to your Raven dealer. If your dealer agrees with the warranty claim, the dealer will send the part and proof of purchase to their distributor or to Raven Industries for final approval.

### ***What Will Raven Industries Do?***

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### ***What is not Covered by this Warranty?***

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

# RAVEN

Phoenix 300™ DGPS Receiver  
Installation & Operation Manual  
(P/N 016-0171-060 Rev E 3/12 E19345)



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