R100 Series Receiver

User Guide

Part No. 875-0173-000 Rev H1

Hemisphere GPS®

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

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

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6469663	7162348	7437230	8085196	8265826	2004320401
6501346	7277792	7460942	8102325	8271194	
6539303	7292185	7689354	8138970	8307535	
6549091	7292186	7808428	8140223	8311696	
6711501	7373231	7835832	8174437	8334804	
6744404	7388539	7885745	8184050	RE41358	
6865465	7400294	7948769	8190337		

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Notice to Customers

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

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Technical Support

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Contents

Chapter 1: Introduction

What's In This Guide?

This user guide provides the following information to get you up and running quickly with your R100™ Series receiver.

- This chapter briefly describes the R100 Series and the parts in your R100 Series kit.
- Chapter 2, "Installing the R100 Series" describes how to mount the receiver and antenna, connect the cables, connect the receiver to external devices, and configure the receiver.
- Chapter 3, "Operating the R100 Series" provides instructions on powering the receiver and using the LED indicators and menu system.
- Chapter 4, "RTK/L-Dif" discusses base station/rover setup.
- Appendix A, "Troubleshooting" provides possible solutions for issues.
- Appendix B, "Menu Maps" provides a full map of all system menus.
- Appendix C, "Technical Specifications" lists R100 Series specifications.

Product Overview

The R100™ Series consists of multiple GPS receiver models that track GPS and SBAS, with some models tracking differential radio beacon signals and/or L-band DGPS service. All R100 Series receivers:

- Utilize Hemisphere GPS' exclusive COAST™ technology that maintains accuracy during temporary loss of differential signal
- Are capable of using Hemisphere GPS' e-Dif® technology

Table 1-1 lists all the available R100 Series receiver models.

Table 1-1: R100 Series receiver models

Model	Application	Beacon	L-Band	1 PPS Output	Rack Mount
R100	Marine/GIS/survey	No	No	DB9	No
R110	Marine/GIS/survey	Yes	No	DB9	No
R120	Marine/GIS/survey	No	Yes	DB9	No
R130	Marine/GIS/survey	Yes	Yes	DB9	No
R101	Air	No	No	PWR/data	No
R121	Air	No	Yes	PWR/data	No
R131	Marine/GIS/survey	Yes	Yes	SMA	Yes

Note:

- *Any reference to the R100 Series refers to all the receivers listed in Table 1-1.*
- *Any reference to "Beacon only" applies to the R110, R130, or R131.*
- *Any reference to "L-band DGPS service only" applies to the R120, R121, R130, or R131.*

Features Specific to the R131

The following features relate only to the R131:

- Rack-mountable enclosure
- Soft power switch located on the front display - all other R100 Series models have a push-button power switch located on the top of the unit
- 1 PPS output support via an SMA connector on the back of the unit

What's Included in Your Kit

You can purchase any R100 Series receiver as a standalone receiver or as part of a kit. Although they vary by receiver model R100 Series kits contain the following parts:

- Receiver and related mounting hardware
- Antenna
- Antenna mounting hardware (Marine/GIS/survey models only)
- Cables
- R100 Series User Guide (Air models only - R101 and R121)

Review the parts shipped with your kit: if any parts are damaged, contact your freight carrier. If any parts are missing, contact your dealer.

Table 1-2 lists available accessories for the R100 Series. The information contained in this table is accurate at time of printing. Contact your Hemisphere GPS dealer to obtain replacement parts or to order accessories.

Table 1-2: R100 Series parts list

Part	Models	Qty	Part No.
Receiver (one of models listed at right)	R100 R101 R110 R120 R121 R130 R131	1 1 1 1 1 1 1	803-0055-000# 803-0048-000# 803-0056-000# 803-0057-000# 803-0043-000# 803-0044-000# 803-0053-000#
Receiver mounting hardware kit	R100, R101, R110, R120, R121, R130, R131	1	710-0056-000#
Power cable (circular)	R100, R110, R120, R131	1	054-0118-000#
Power cable (circular)	R130	1	054-0009-000#
Data cable, DB-9 female to DB-9 male, 3 m	R100, R110, R120, R130	1	050-0011-022#
A21 antenna	R100, R101, R120, R121	1	804-3036-000#
A21 antenna mounting hardware kit	R100, R101, R120, R121	1	710-0110-000#
A31 antenna	R110, R130, R131	1	804-3043-000#
A31 antenna mounting hardware kit	R110, R130, R131	1	710-0111-000#
Antenna cable, TNC-TNC, 5 m	R100, R101, R110, R120, R121, R130, R131	1	052-0005-000#

Chapter 2: Installing the R100 Series

Mounting the Receiver
Mounting the Antenna
Routing and Connecting the Cables
Connecting the Receiver to External Devices
Default Settings
Configuring the Receiver

This chapter describes how to mount the receiver and antenna, connect the cables and external devices, and provides default settings and configuration information.

Mounting the Receiver

Note: Although you are not required to mount the receiver, you may want to do so to prevent damage to the receiver and any cables connected to the receiver.

When mounting the receiver, adhere to the following guidelines:

- Install the receiver inside and away from the elements and in a location that minimizes vibration, shock, extreme temperatures, and moisture
- Ensure the front panel (menu screen, LEDs, and buttons) is visible and accessible
- Ensure the top panel (R100 Series, except R131) or back panel (R131) is easily accessible to connect/switch out cables and turn power on and off
- Although the R100 Series is splash-proof in case of accidental exposure, it is designed for indoor use (see Table C-5 on page 39 for R100 Series environmental specifications)
- **R131 only:** Ensure soft power switch on front panel is accessible

Note: There is an option within the menu to switch (flip 180°) the direction of the display. If it is easier to mount the unit upside down, you can mount it this way and still operate the display.

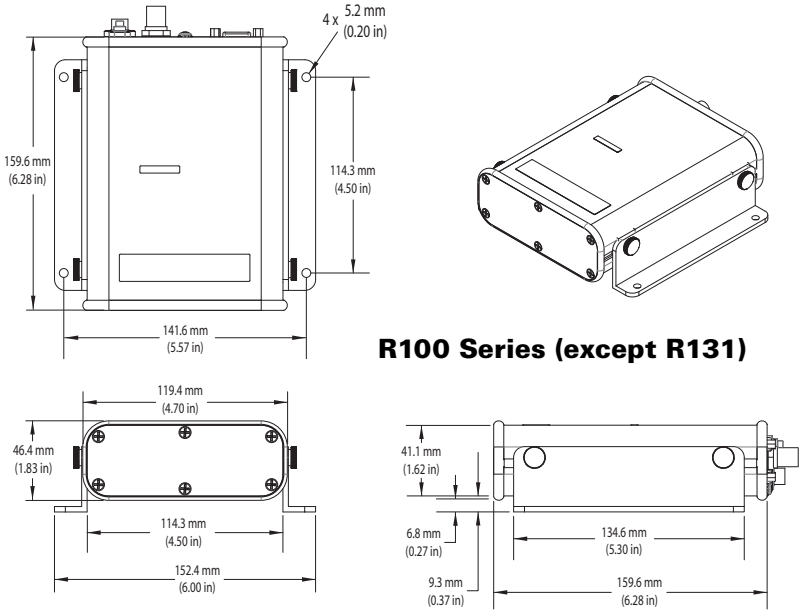
Figure 2-1 illustrates the typical mounting orientation of the R100 Series receivers, indicating that the R131 receiver is rack-mountable.

All R100 Series receivers (except R131)

R131 receiver (rack mountable)

Figure 2-1: Receiver mounting orientation

Figure 2-2 shows the dimensions (including attached mounting brackets) of the R100 Series (except R131) and the R131, respectively. Use Figure 2-2 when using the receiver mounting procedure that follows. The connectors differ between different R100 Series models—keep this in mind when installing your receiver. See Figure 2-3 on page 11 for more information.



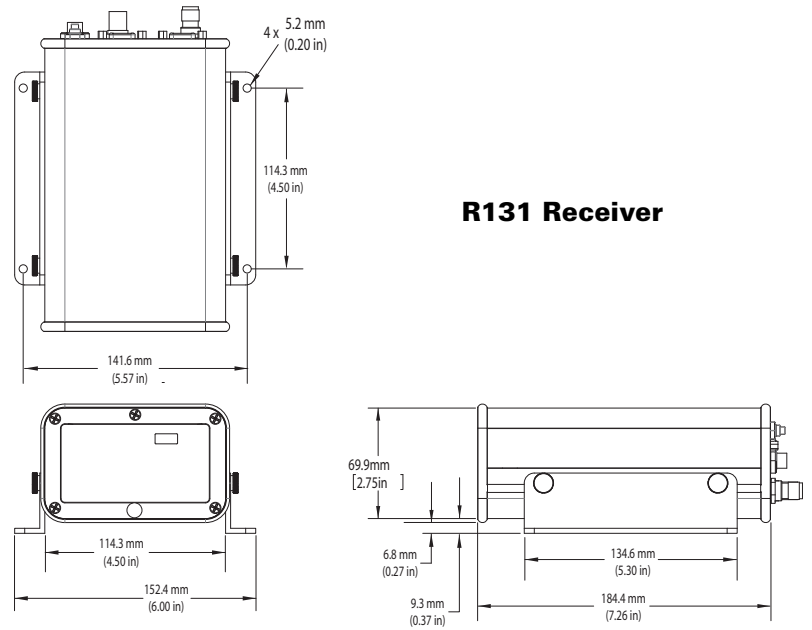
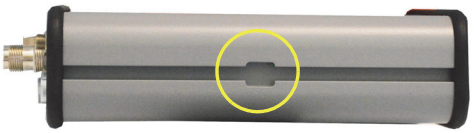


Figure 2-2: R100 Series (except R131) and R131 dimensions with mounting brackets

Note: The following procedure shows how to mount the R100 Series receiver (except R131). Instructions are similar for mounting the R131.

To mount the receiver:

1. Locate the thumbscrews, nuts, and brackets included in your R100 Series kit.
2. Slide the nuts through the opening (at right) along both sides of the receiver (see also Figure 2-1 on page 6 for opening on R131).



3. Place the bracket alongside the receiver and insert the thumbscrews (two thumbscrews per bracket) so they screw into the nuts.
4. Using the remaining holes in the brackets (two holes per bracket) screw down the brackets in your preferred location.

Note: Hemisphere GPS does not provide the screws in this step.

Mounting the Antenna

Proper antenna placement is critical to positioning accuracy. When mounting the antenna, adhere to the following:

- Make sure the antenna has a clear view of the sky (an obstructed view of the sky may impair system performance)
- Mount the antenna on, or as close to, the measurement center point (the GPS engine inside the receiver computes a position based on measurements from each satellite to the phase center of the antenna)
- Position the antenna as high as possible
- Antenna is designed for outdoor use (see Table C-5 on page 39 for R100 Series environmental specifications)

You can mount the antenna as follows:

- Magnetic mount
- Pole mount
- Surface mount

Magnetic Mount

The magnetic mount can be screwed into the bottom of the antenna and mounted to metal surfaces. The magnetic mount includes a metal disc and foam adhesive that allow you to bond the metal disc to the desired mounting location if there are no metal surfaces. You then place the magnetic mount on the metal disc.

To attach the antenna using the magnetic mount:

1. Clean and dry the surface where you will attach the metal disc.
2. Remove the backing from one side of the foam adhesive and press the adhesive onto the mounting surface.
3. Remove the backing from the other side of the foam adhesive and press the metal disc onto the mounting surface, applying firm pressure to ensure good adhesion.
4. Place the magnetic mount (with antenna attached) on top of the metal disc.

Pole Mount

The center thread of the antenna is 5/8" for compatibility with a survey pole (not included). Simply thread the pole into the antenna.

Surface Mount

As an alternative to the magnetic mount, you can attach the antenna directly to the mounting surface with four machine screws (no. 8-32).

To attach the antenna directly to the mounting surface:

1. Photocopy the bottom of the antenna and use it as a template to plan the mounting hole locations.

   ⚠WARNING: Make sure the photocopy is scaled one to one with the mounting holes on the bottom of the antenna.

2. Mark the mounting hole centers, as necessary, on the mounting surface.
3. Place the antenna over the marks to ensure the planned hole centers align with the true hole centers (adjusting as necessary).
4. Use a center punch to mark the hole centers.
5. Drill the mounting holes with a 3/16" bit appropriate for the surface.
6. Place the antenna over the mounting holes and insert the mounting screws through the bottom of the mounting surface and into the antenna.

   ⚠WARNING: When installing the antenna, hand tighten only. Damage resulting from overtightening the antenna is not covered by the warranty.

Routing and Connecting the Cables

Adhere to the following when routing and connecting cables:

- Power cable must reach an appropriate power source
- Antenna cable must reach from the antenna to the receiver
- Data cable may connect to a data storage device, computer, or other device that accepts GPS data
- Do not run cables in areas of excessive heat
- Do not expose cables to corrosive chemicals
- Do not crimp or excessively bend cables
- Do not place tension on cables
- Coil up excess cable near unit
- Secure along the cable route using plastic tie wraps as necessary
- Do not run cables near high Voltage or strong RF noise and transmitter sources

⚠WARNING: Improperly installed cables near machinery can be dangerous.

Connecting the Receiver to External Devices

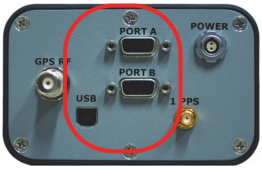
Communication between the R100 Series and external devices occurs through serial ports and USB ports.Table 2-1 lists these connections for each R100 Series model.

Table 2-1: R100 Series serial and USB communication

Model	Serial Communication Through Port A and Port B	USB Communication
R100	External ports connected via DB9 cable	(1) USB-B port
R101	Internal ports connected via power/data connector	None
R110	External ports connected via DB9 cable	(1) USB-B port
R120	External ports connected via DB9 cable	(1) USB-B port
R121	Internal ports connected via power/data connector	None
R130	External ports connected via DB9 cable	(1) USB-B port
R131	External ports connected via DB9 cable	(1) USB-B port

Figure 2-3 shows how the serial and USB ports may appear on your particular R100 Series model.

R100, R110, R120, R130 receivers



R131 receiver (rack mountable)

R101 and R121 receivers (serial, no USB)

Figure 2-3: Serial and USB ports

If you connect a device to Port A, Port B, or the USB port you can transmit and receive data between the R100 Series and the device. Similarly, if you connect one device to Port A and another device to the USB port you can transmit and receive data between the R100 Series and each device.

Note: For those models that include a USB port (R100, R110, R120, R130, and R131) Port B is shared with the USB port. If you connect a device to Port B and another device to the USB port the receive functionality on Port B is disabled. Therefore, Hemisphere GPS recommends using Port A and the USB port if want to connect two devices to these R100 Series models.

The USB port is designed to be connected to a host device such as a PC. When you connect a PC to the R100 Series the PC should recognize it as a serial device and a new COM will appear as a valid connection on the PC. Set the communication software to use this new port to access the R100 Series.

The serial ports operate at the RS-232 interface level to communicate with external data loggers, navigation systems, and other devices. Either serial port can also be used for firmware updates. Figure 2-4 shows the pinout assignment for the DB9 connector (female), Figure 2-5 shows the pinout assignment for the power/data connector, and Table 2-2 and Table 2-3 provide the related pinout descriptions.

Note: For successful communication you must set the baud rate of the R100 Series serial ports to match that of the connected devices.

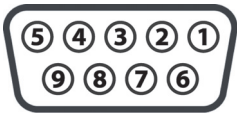


Figure 2-4: Serial port pinout assignment

Table 2-2: Port A / Port B serial port pinouts (R100/R110/R120/R130/R131)

Pin	Port A Description	Port B Description
1	Not connected	Not connected
2	Transmit data Port A	Transmit data Port B
3	Receive data Port A	Receive data Port B
4	Not connected	Not connected
5	Signal ground	Signal ground
6	Not connected	Event marker
7	Not connected	Not connected
8	Not connected	Not connected
9	5V output, 350 mA max	1 PPS

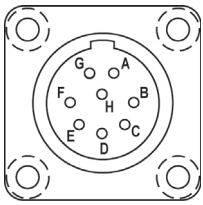


Figure 2-5: Power/data port pinout assignment

Table 2-3: Power/data connector pinout for R101 and R121

Pin	Description
A	Power
B	1 PPS
C	Port A Tx
D	Port A Rx
E	Port B Tx
F	Port B Rx
G	Manual mark
H	Ground

Default Settings

Table 2-4 through Table 2-6 provide default options/settings for the R100 Series.

Table 2-4: DGPS options

DGPS Option
SBAS (WAAS, EGNOS, MSAS, etc)
e-Dif
Beacon (R110, R130, R131 only)
External RTCM
L-Band (R120, R121, R130, R131 only)
L-Dif

Table 2-5: Serial port settings

Serial Ports	Baud Rates	Data Bits	Parity	Stop Bits	Interface Level
A and B	4800, 9600, 19200, 38400, 57600, 115200	8	None	1	RS-232

Table 2-6: GPS message output options

GPS Message	Update rate	Max DGPS age	Elevation mask
Hemisphere GPS Binary	1 Hz to 20 Hz	259,200 seconds	5°
NMEA 0183 GGA	1 Hz to 20 Hz	259,200 seconds	5°
NMEA 0183 GLL	1 Hz to 20 Hz	259,200 seconds	5°
NMEA 0183 GSA	1 Hz	259,200 seconds	5°
NMEA 0183 GST	1 Hz	259,200 seconds	5°
NMEA 0183 GSV	1 Hz	259,200 seconds	5°
NMEA 0183 RMC	1 Hz	259,200 seconds	5°
NMEA 0183 RRE	1 Hz	259,200 seconds	5°
NMEA 0183 VTG	1 Hz to 20 Hz	259,200 seconds	5°
NMEA 0183 ZDA	1 Hz	259,200 seconds	5°

Configuring the Receiver

You can configure many aspects of the R100 Series through the serial port using Hemisphere GPS commands. For more information regarding the use of Hemisphere GPS commands refer to the Hemisphere GPS Technical Reference (go to www.hemispheregps.com and click the GPS Reference icon).

Note: Changes you make to the R100 Series via the serial port are not automatically saved to memory for subsequent powerup; therefore, you must issue the $JSAVE command to save the changes. However, if you make changes via the menu system, they are automatically saved.

Chapter 3: Operating the R100 Series

Powering the Receiver On/Off

LED Indicators

Using the Menus

The R100 Series is designed for easy operation with LED indicators and a straightforward menu system. This chapter discusses how to:

- Power the receiver on/off
- View/interpret LED indicators
- Use the built-in menu system

Powering the Receiver On/Off

All R100 Series models, except the R131, have a hard power switch located on the top panel, while the R131 has a soft power switch on the front panel (see Figure 3-1).

Hard power switch
For all R100 Series receivers (except R131)

Soft power switch
R131 Receiver (rack mountable)

Figure 3-1: R100 Series power switch

The R100 Series accepts an input voltage of 8 to 36 VDC via the power cable. The supplied power should be continuous and clean for best performance. Table C-6 on page 39 provides the power specifications of the R100 Series.

⚠WARNING: Do not apply a voltage higher than 36 VDC. This will damage the receiver and void the warranty. Also, do not attempt to operate the R100 Series with the fuse bypassed as this will void the warranty.

The R100 Series features reverse polarity protection to prevent damage if the power leads are accidentally reversed. Although the R100 Series proceeds through an internal startup sequence when you apply power, it will be ready to communicate immediately.

Initial startup may take 5 to 15 minutes depending on the location. Subsequent startups will output a valid position within 1 to 5 minutes depending on the location and time since the last startup.

The R100 Series may take up to 5 minutes to receive a full ionospheric map from SBAS. Optimum accuracy is obtained once the R100 Series is processing corrected positions using complete ionospheric information.

To power on the R100 Series:

1. Connect the ends of the R100 Series power cable to a clean power source providing 8 to 36 VDC.

   Note: Hemisphere GPS recommends you use a weather-tight connection and connector if the connection is located outside.

2. R100 Series (except R131): Press the Power button on the top panel.

   R131: Press and hold the soft power switch on the front panel until the splash screen appears.

To power off the R100 Series:

- R100 Series (except R131): Press the Power button on the top panel.
- R131: Press and hold the soft power switch on the front panel until the screen goes blank (the screen will display "Power Down in 4...3...2...1" before powering off).

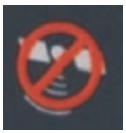
LED Indicators

The R100 Series uses LEDs to indicate power, GPS lock, and DGPS position.

- On all models except the R131 there is a corresponding icon below each LED
- On the R131 the text to the left of each LED indicates the purpose of the LED

Table 3-1 describes each LED indicator.

Table 3-1: LED indicators

LED Indicator	LED Color	Description/Function
 or POWER	Red	Power indicator Illuminates solid red when the receiver is powered on.
 or GPS LOCK	Yellow	GPS lock indicator Illuminates solid yellow when the receiver achieves a solid GPS lock.
 or DIFF	Green	DGPS position indicator Illuminates solid green when the receiver achieves a differential position and a pseudorange residual of better than 10.0 m. If the residual value is worse than the current threshold, the LED blinks green indicating differential mode has been attained but the residual has not met the threshold.

Using the Menus

The R100 Series menu system is designed for easy setup and configuration of the unit in or out of the field and supports multiple languages. You can perform most configuration tasks entirely through the menu without having to connect to a computer or PDA.

Refer to Appendix B, “Menu Maps” for a complete menu map for the following options on the Main menu.

- GPS
- Differential corrections (menu item will be the selected differential source, such as SBAS or Autonomous)
- Configuration Wizard
- System Setup

The R100 Series front panel contains the three soft buttons shown at right: Up Arrow, Enter, and Down Arrow (see Figure).

Note: On the R131 the Enter button also functions as the Power switch. See “Powering the Receiver On/Off” on page 16 for more information.

Up Arrow button - moves to the previous menu item or to the previous selection within a menu item

Enter button - displays a submenu or selects an option within a menu item

Down Arrow button - moves to the next menu item or to the next selection within a menu item

Table 3-2 describes the indicators to the right of specific menu items.

Table 3-2: Menu item indicators

Indicator	Purpose	Example
 Display indicator	Go to the indicated submenu This indicator also appears to the right of the "Back" and "Top Menu" menu items. • Press Enter when "Back" is selected to return to the previous menu. • Press Enter when "Top Menu" is selected to return to the Main menu.	1. On the Main menu press the **Down Arrow** button to highlight System Setup. The Display indicator appears to the right of System Setup. 2. Press **Enter** to display the System Setup menu. 3. Press the **Down Arrow** button again to highlight the Display Format option and then press **Enter**. The items on the Display Format menu appear and the Select indicator appears to the right of Disp Update (the first item on the Display Format menu). 4. Press **Enter** on the Disp Update item. The Display indicator changes to the Select indicator. 5. Press the **Up Arrow** or **Down Arrow** button to scroll through the available options (such as 1Hz and 5Hz). 6. Press **Enter** on the highlighted option to select it. That option is now the setting for the menu item and the Select indicator changes back to the Display indicator.
 Select indicator	Scrolls within a menu to highlight an option to select.	

To return the menu system to the factory default configuration:

- R100 Series (except R131): Press and hold the Enter and Up Arrow buttons and then power up the receiver until the splash screen disappears.
- R131: Press and hold the Enter and Up Arrow buttons until the splash screen disappears (Enter and Power share the same soft switch).

Chapter 4: RTK/L-Dif

Installing the Base Station
Installing the Rover Radio
Using the Receiver as a Base Station or Rover
RTK Operation

RTK and Local Differential (L-Dif) are R100 Series differential options that provide the highest accuracy (see Table C-1 on page 38 for accuracy specifications). A local base station is required for both options. Most commonly, the base station and rover are each comprised of the following:

- GPS receiver
- GPS antenna
- Radio: transmitter for base station, receiver for rover
- Power source

Installing the Base Station

The base station tracks GPS signals and broadcasts differential corrections to a radio and rover GPS receiver. You typically set up the base station near the working area and at a location with no obstructions between the base station and rover radio.

When installing the base station adhere to the following:

- Do not place the base station near metal objects
- Make sure the base station is at least 50 m from obstructions
- Make sure the base station and rover radio have a clear line of sight up to 5 km or less depending on the radio type when operating L-Dif/RTK

Installing the Rover Radio

The rover GPS system processes the corrections and outputs highly accurate position information.

When installing the rover radio adhere to the following:

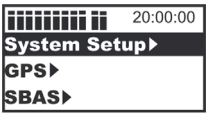
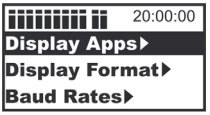
- Ensure the rover radio and GPS antenna are at least 1 m apart
- Rover radio must not block the GPS antenna
- Rover radio must receive regular corrections from the base station every one to two seconds (differential age) for up to 15 minutes to achieve RTK lock (maximum accuracy) - typically, a lock is achieved within five minutes

Using the Receiver as a Base Station or Rover

Using the R100 Series as a base station or rover receiver requires a link between the base and rover to transfer differential correction data from the base to the rover. The link can be wired or wireless (such as a radio modem).

Setting Up the Receiver as a Base Station or Rover

Make sure the current R100 Series application is set to RTKBAS for a base station or LOCRTK for a rover.

Step	Button (where applicable)
1. On the Main menu press the **Up Arrow** or **Down Arrow** button until System Setup is highlighted.	
	
2. Press **Enter**. The System Setup menu appears with Display Apps highlighted.	
	
3. With Display Apps highlighted press **Enter**. Make sure In Use: displays as either: • RTKBAS for an RTK or L-Dif base station • LOCRTK for an RTK or L-Dif rover receiver If the RTK application only appears next to Other:, scroll down and select Swap Applications. The desired application will then be shown as In Use.	
 	

Connecting the Receiver to a PC

You can also select the appropriate application using a terminal program such as Hyper Terminal®, SLXMon™, or PocketMax™.

When using direct commands from a PC, send the $JAPP command to view the current application. A response such as $>JAPP,RTKBASE,WAAS,1,2 will appear, indicating the RTKBASE application is active and WAAS is the secondary application. If the application was different and WAAS was first, such as $>JAPP,WAAS,RTKBASE,2,1, then send $JAPP,other to swap applications so that correct application is used.

Step	Button (where applicable)
1. Connect either Port A or Port B of the R100 Series receiver to the serial port of the PC using the 9-pin serial cable.	
2. Configure the port communication parameters on the receiver. a. On the Main menu press the **Up Arrow** or **Down Arrow** button to highlight System Setup and then press **Enter**. b. Press the **Up Arrow** or **Down Arrow** button to highlight 'Baud Rates' and then press **Enter**. c. Press the **Up Arrow** or **Down Arrow** button to highlight the desired baud rate and then press **Enter**.	Up/Down arrows  Enter 
See "System Setup Menu" on page 35 for more information.	
3. Ensure the connected serial port on the PC has matching communication parameters.	

Connecting the Receiver to an External Device or Base/Rover Radio

You can connect the R100 Series to an external device or a base/rover radio. Before selecting an external device or base or radio system, ensure it meets the following requirements:

- Does not interfere with GPS
- Serial connection, with a minimum of 9600 baud, set to N,8,1
- Over the air throughput of at least 300 bps

Step	Button (where applicable)
1. Connect either Port A or Port B of the R100 Series receiver to the serial port of the device using the 9-pin serial cable.	
2. Configure the port communication parameters on the receiver. a. On the Main menu press the **Up Arrow** or **Down Arrow** button to highlight System Setup and then press **Enter**. b. Press the **Up Arrow** or **Down Arrow** button to highlight 'Baud Rates' and then press **Enter**. c. Press the **Up Arrow** or **Down Arrow** button to highlight the desired baud rate and then press **Enter**.	Up/Down arrows  Enter 
See "System Setup Menu" on page 35 for more information.	
3. Ensure the device has matching communication parameters for the connecting port.	

Note: Hemisphere GPS recommends testing with a wired condition prior to using a radio connection to ensure communication parameters are properly defined.

Make sure both the rover radio and base station are on the same channel or frequency in order for the rover radio to receive corrections from the base station.

RTK Operation

After you connect the receiver to the desired devices and are operating using RTK, the status LEDs indicate the following (see “LED Indicators” on page 17 for more information on R100 Series LED indicators):

- Yellow (GPS LOCK LED): tracking GPS
- Flashing green (DIFF LED): differential has been attained, but the residual has not met the threshold
- Solid green (DIFF LED): RTK lock

The R100 Series will output standard NMEA messages through Port A as desired. Set the message and port output as required by the user-supplied interface.

Appendix A: Troubleshooting

Table A-1 provides troubleshooting information for the R100 Series.

Table A-1: Troubleshooting

Problem	Possible Solution
Receiver fails to power	• Verify polarity of power leads • Check integrity of power cable connections • Check power input voltage (8 - 36 VDC) • Check current restrictions imposed by power source (maximum is 250 mA @ 12 VDC) • Press the Power button
No data from R100 Series	• Check receiver power status (red LED) • Check integrity and connectivity of power and data cable connections • The volume of data requested to be output by the R100 Series could be higher than what the current baud rate supports. Try using 19200 or higher as the baud rate for all devices.
No GPS lock	• Check integrity of cable connections • Verify antenna's clear view of the sky
No SBAS lock	• Check integrity of cable connections • Verify antenna's clear view of the sky • Check SBAS visibility map
No beacon lock	• Check beacon listings to ensure proximity to a beacon station • Ensure there are no sources of interference nearby • Check antenna connections • Verify MSK rate is set correctly • Verify frequency of transmitting beacon • Select alternate antenna position
No L-band DGPS service lock	• Subscription activated and not expired • Check antenna connections • Verify antenna's clear view of the sky

Appendix B: Menu Maps

GPS Menu

Differential Corrections (Diff) Menu

Configuration Wizard Menu

System Setup Menu

This appendix shows the complete menu map for each menu (listed below) on the R100 Series Top menu.

- GPS
- Differential corrections (menu item will be the selected differential source, such as SBAS or Autonomous)
- Configuration Wizard
- System Setup

GPS Menu

Use the GPS menu to view/edit such settings as data output, positioning parameters, UTC time offset, and satellite visibility/positioning information.

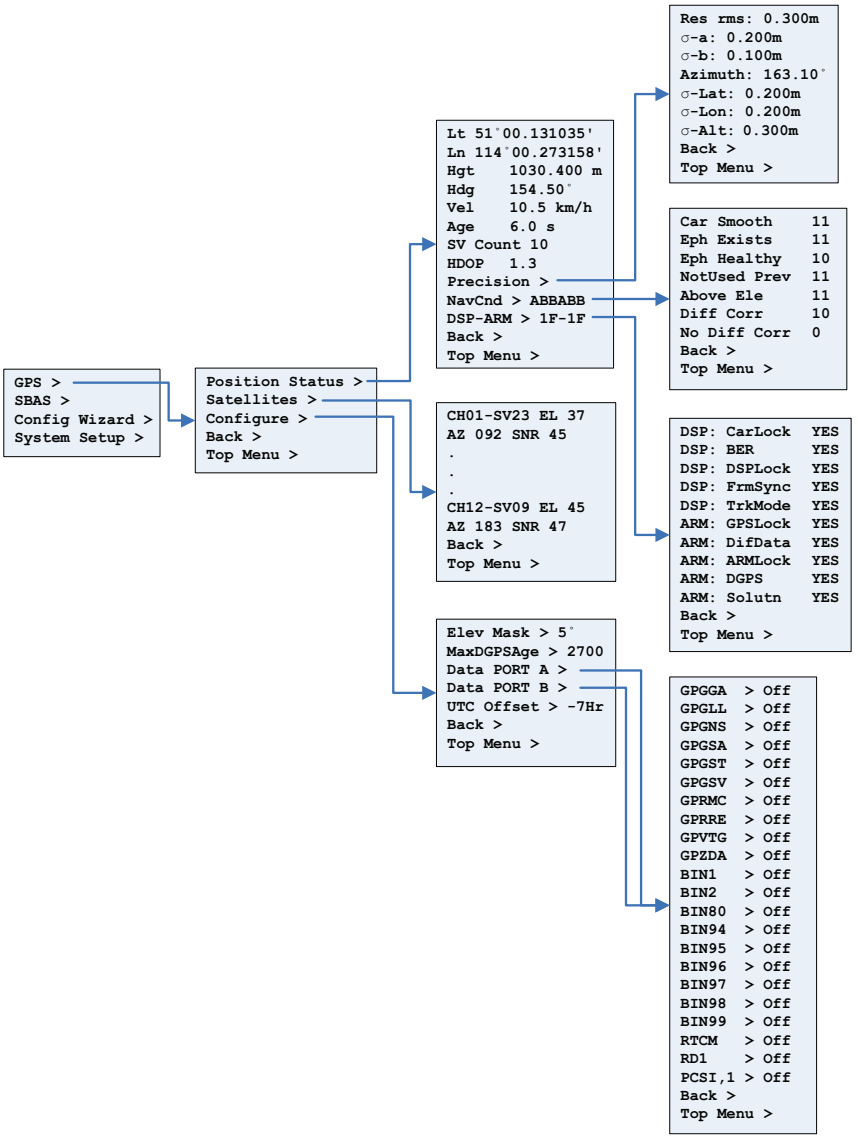


Figure B-1: GPS menu

Differential Corrections (Diff) Menu

Use the Diff (differential) menu to view your differential settings. The name of the differential menu reflects your current differential source. For example, if using SBAS, then SBAS appears as the third menu item on the Top menu and the associated SBAS submenus are available, as shown in Figure B-2.

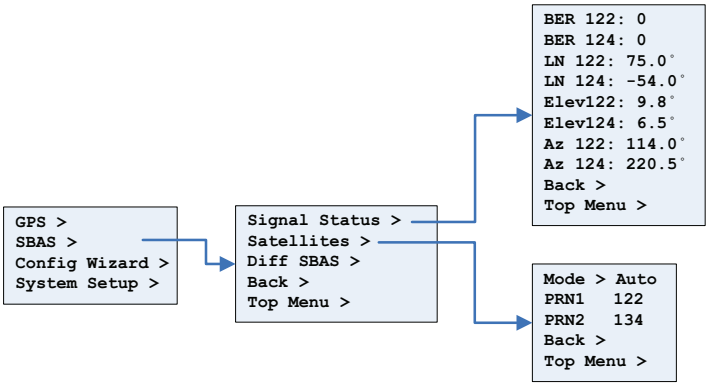


Figure B-2: SBAS menu

The following available differential sources depend on the R100 Series model and the configuration you purchased.

- SBAS
- L-Band
- Beacon
- External RTCM
- Autonomous

Figure B-3 through Figure B-6 show the complete menu maps for the L-Band, Beacon, External RTCM, and Autonomous differential sources, respectively.

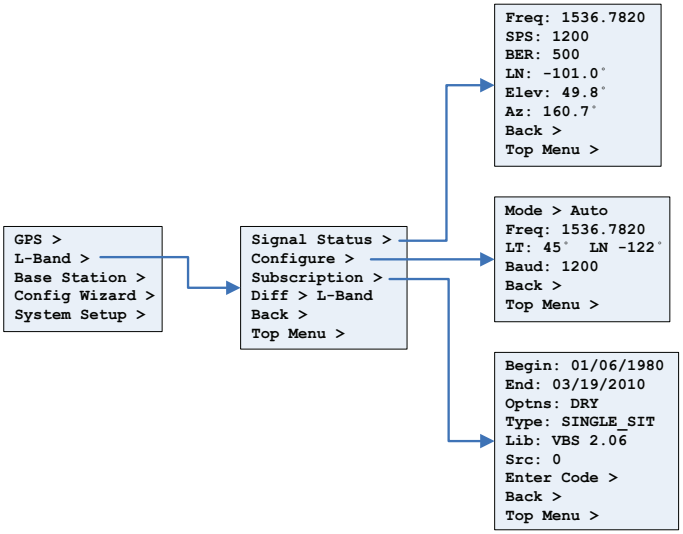


Figure B-3: L-Band menu

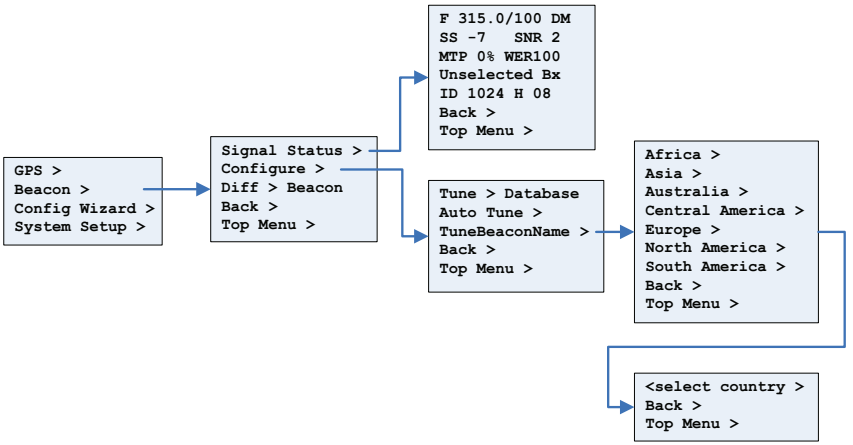


Figure B-4: Beacon menu

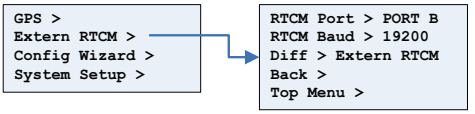


Figure B-5: External RTCM menu

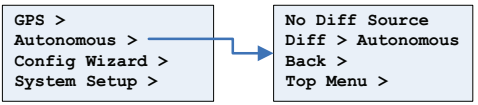


Figure B-6: Autonomous menu

Configuration Wizard Menu

The Configuration Wizard walks you through basic settings to get up and running.

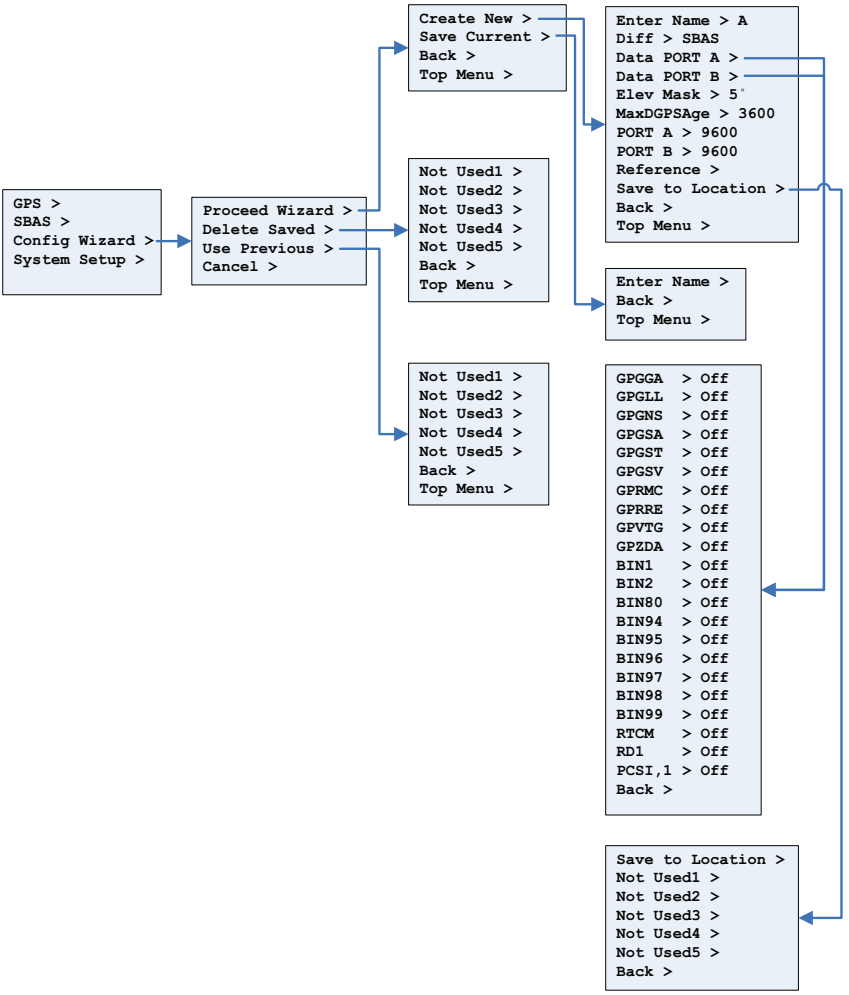


Figure B-7: Config Wizard menu

System Setup Menu

The System Setup menu allows you to view and edit such current system settings as current applications, units, baud rates, logs, screen contrast, subscription code, display orientation (you can flip the display 180° by selecting “YES” under FLIP DISPLAY), and language.

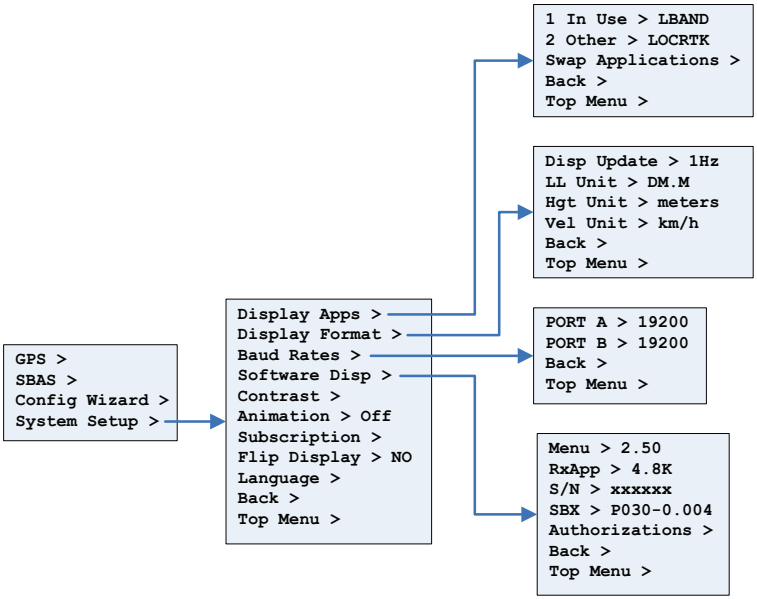


Figure B-8: System Setup menu

Appendix C: Technical Specifications

Table C-1 through Table C-7 provide the sensor, communication, environmental, power, and mechanical specifications for the R100 Series.

Table C-1: R100 Series GPS sensor specifications

Item	Specification
Receiver type	L1, C/A code, with carrier phase smoothing
Channels	12-channel, parallel tracking (10-channel when tracking SBAS)
SBAS Tracking	2-channel, parallel tracking
Update rate	Standard 10 Hz; optional 20 Hz
Horizontal accuracy	< 0.02 m 95% confidence (RTK[1,2]) < 0.28 m 95% confidence (L-Dif[1,2]) < 0.6 m 95% confidence (DGPS[1,3]) < 2.5 m 95% confidence (autonomous, no SA[1])
Cold start	60 s (no almanac or RTC)

Table C-2: L-Band sensor specifications

Item	Description
Channels	Single channel
Frequency range	1530 to 1560 MHz
Satellite selection	Manual or automatic (based on location)
Startup and satellite reacquisition time	15 seconds, typical

Table C-3: Beacon sensor specifications

Item	Description
Channels	2-channel, parallel tracking
Frequency range	283.5 to 325 kHz
MSK bit rates	50, 100, and 200 bps

Table C-4: Communication specifications

Item	Description
Serial ports	2 full-duplex RS-232
USB ports	1 USB-B
Baud rates	4800 - 115200
Correction input/output protocol	All R100 Series except R131: RTCM SC-104 R131: Hemisphere GPS RTK, RTCM v2.3 (DGPS)
Data input/output protocol	All R100 Series except R131: NMEA 0183 R131: NMEA 0183, Hemisphere GPS binary
Raw data	All R100 Series except R131: Proprietary binary (RINEX utility available)
Timing output	1 PPS CMOS, active high, rising edge sync, 10 kΩ, 10 pF load)
Event marker	CMOS, active low, falling edge sync, 10 kΩ

Table C-5: Environmental specifications

Item	Specification
Operating temperature	-30°C to +70°C (-22°F to +158°F)
Storage temperature	-40°C to +85°C (-40°F to +185°F)
Humidity	95%, non condensing
Shock and vibration	Mechanical Shock: EP455 Section 5.14.1 Vibration: EP455 Section 5.15.1 Random
EMC	R100 Series (except R131): FCC Part 15, Subpart B, Class B, CISPR 22, CE (IEC 60945) R131: FCC Part 15, Subpart B, CISPR 22, CE

Table C-6: Power specifications

Item	Specification
Input voltage	8 - 36 VDC
Reverse polarity protection	Yes
Power consumption	3 W
Current consumption	<250 mA @ 12 VDC
Antenna voltage output	5.0 VDC
Antenna short circuit protection	Yes

Table C-7: Mechanical specifications

Item	R100 Series (except R131)	R131
Enclosure	Powder coated aluminum	Powder coated aluminum
Dimensions	16.0 L x 11.4 W x 4.5 H (cm) 6.3 L x 4.5 W x 1.8 H (in)	18.8 L x 11.4 W x 7.1 H (cm) 7.4 L x 4.5 W x 2.8 H (in)
Weight	0.54 kg (1.2 lb)	0.86 kg (1.9 lb)
LED indicators	Power, GPS lock, DGPS position	Power, GPS lock, DGPS position
Power connector	R100,R110,R120: 2-pin metal ODU R101,R121: 8-pin MIL circular R130: 2-pin micro-Conxall	2-pin metal ODU
Data connectors	DB9-female x 2	DB9-female x 2
Antenna connector	TNC-female	TNC-female
1 PPS connector	N/A	SMA

[1]Depends on multipath environment, antenna selection, number of satellites in view, satellite geometry, and ionospheric activity

[2]Up to 5 km baseline length

[3]Depends also on baseline length

Index

P

R

S

U

W

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HEMISPHERE IS NOT RESPONSIBLE FOR PURCHASER'S NEGLIGENCE OR UNAUTHORIZED USES OF THE PRODUCT. IN NO EVENT SHALL HEMISPHERE GPS BE IN ANY WAY RESPONSIBLE FOR ANY DAMAGES RESULTING FROM PURCHASER'S OWN NEGLIGENCE, OR FROM OPERATION OF THE PRODUCT IN ANY WAY OTHER THAN AS SPECIFIED IN HEMISPHERE GPS'S RELEVANT USER'S MANUAL AND SPECIFICATIONS. Hemisphere GPS is NOT RESPONSIBLE for defects or performance problems resulting from (1) misuse, abuse, improper installation, neglect of Product; (2) the utilization of the Product with hardware or software products, information, data, systems, interfaces or devices not made, supplied or specified by Hemisphere GPS; (3) the operation of the Product under any specification other than, or in addition to, the specifications set forth in Hemisphere GPS's relevant User's Manual and Specifications; (4) damage caused by accident or natural events, such as lightning (or other electrical discharge) or fresh/salt water immersion of Product; (5) damage occurring in transit; (6) normal wear and tear; or (7) the operation or failure of operation of any satellite-based positioning system or differential correction service; or the availability or performance of any satellite-based positioning signal or differential correction signal.

THE PURCHASER IS RESPONSIBLE FOR OPERATING THE VEHICLE SAFELY. The purchaser is solely responsible for the safe operation of the vehicle used in connection with the Product, and for maintaining proper system control settings. UNSAFE DRIVING OR SYSTEM CONTROL SETTINGS CAN RESULT IN PROPERTY DAMAGE, INJURY, OR DEATH. The purchaser is solely responsible for his/her safety and for the safety of others. The purchaser is solely responsible for maintaining control of the automated steering system at all times. THE PURCHASER IS SOLELY RESPONSIBLE FOR ENSURING THE PRODUCT IS PROPERLY AND CORRECTLY INSTALLED, CONFIGURED, INTERFACED, MAINTAINED, STORED, AND OPERATED IN ACCORDANCE WITH HEMISPHERE GPS'S RELEVANT USER'S MANUAL AND SPECIFICATIONS. Hemisphere GPS does not warrant or guarantee the positioning and navigation precision or accuracy obtained when using Products. Products are not intended for primary navigation or for use in safety of life applications. The potential accuracy of Products as stated in Hemisphere GPS literature and/or Product specifications serves to provide only an estimate of achievable accuracy based on performance specifications provided by the satellite service operator (i.e. US Department of Defense in the case of GPS) and differential correction service provider. Hemisphere GPS reserves the right to modify Products without any obligation to notify, supply or install any improvements or alterations to existing Products.

GOVERNING LAW. This agreement and any disputes relating to, concerning or based upon the Product shall be governed by and interpreted in accordance with the laws of the State of Arizona.

OBTAINING WARRANTY SERVICE. In order to obtain warranty service, the end purchaser must bring the Product to a Hemisphere GPS approved service center along with the end purchaser's proof of purchase. Hemisphere GPS does not warrant claims asserted after the end of the warranty period. For any questions regarding warranty service or to obtain information regarding the location of any of Hemisphere GPS approved service center, contact Hemisphere GPS at the following address:

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