Hemisphere®

875-0339-0

R330 Receiver Web

User Guide

Revision: A3

August 25, 2017

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

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

This product complies with the essential requirements and other relevant provisions of Directive 2014/53/EU. The declaration of conformity may be consulted at https://hemispheregnss.com/About-Us/Quality-Commitment.

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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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Introduction

This user guide provides the following information to get you up and running quickly with your R330™™ GNSS receiver.

Note: Throughout the rest of this user guide the R330™ GNSS receiver is referred to simply as the R330™.

Product Overview

The R330™ is a multi-GNSS RTK, high accuracy GNSS receiver that allows you to complete your work quickly and accurately. Built on Hemisphere GNSS' Eclipse™ platform, R330™ boasts the latest GNSS patented technology and offers extremely quick startup and reacquisition times.

The standard model R330™ tracks L1 GPS and L1 GLONASS and via subscriptions can track L1/L2 GPS, SBAS, beacon, and L-band DGNSS/HP/XP DGPS and high precision signals. R330™ supports raw data logging to a removable USB flash drive for post processing.

You can upgrade your R330™ by adding RTK6 base station functionality or RTK rover performance, as well as GLONASS tracking for a cost effective, multi-GNSS solution compatible with other GNSS products.

RTK performance is scalable on the R330™. Utilize the same centimeter-level accuracy with L1/L2 GPS, or improve performance and reliability with L1/L2 GNSS signals. Hemisphere's exclusive SureTrack® technology gives peace of mind knowing the RTK rover is making use of every satellite it is tracking, even satellites not tracked at the base. Benefit from fewer RTK dropouts in congested environments, faster reacquisitions and more robust solutions due to better cycle slip detection. SureTrack also removes concerns with using various manufacturers GNSS base. Even if the GNSS base delivers L1/L2 GPS, SureTrack with GLONASS at the rover will deliver RTK performance where

The R330™ receiver, with its display and user interface, can be conveniently installed near the operator, while the included antenna can be installed elsewhere.

R330™ also features Hemisphere GNSS' exclusive COAST™ technology that enables Hemisphere GNSS receivers to utilize aging differential GNSS correction data for 40 minutes or more without significantly affecting positioning quality. R330™ is less likely to be affected by differential signal outages due to signal blockages, weak signals, or interference when using COAST™.

Key Features

Key features of the R330™ include:

- High-precision positioning in RTK, L1/L2, SBAS, beacon, and L-band
- SureTrack technology improves RTK performance, especially with optional GLONASS tracking
- Long-range RTK baselines of up to 50 km
- COAST™ technology maintains accurate solutions for 40 minutes or more after loss of DGPS or SBAS signal
- Uses standard USB flash drive for data logging
- Status LEDs and menu system make R330™ easy to monitor and configure
- Integrated L-band DGNSS/HP/XP tracking powers down when not in use
- SBAS satellite ranging technology increases the number of satellites in view for greater RTK reliability
- Fast update rate of up to 20 Hz providing the best guidance and machine control

What's Included in Your Kit

Table 1-1 lists the parts included in your R330™ kit. Review the parts shipped with your kit: if any parts are damaged, contact your freight carrier. If any parts are missing, contact your dealer.

Note: The R330™ requires an antenna; the antenna, antenna cable, and any related antenna mounting hardware are purchased separately.

Table 1-1: Parts List

Item	Description	Qty	Part Number
A	R330™ GNSS receiver	1	803-0070-0
B	Receiver mounting kit (two brackets and related hardware)	1	710-0056-000#
C	Power cable, circular, 3 m	1	054-0146-000#
D	Data cable, DB-9 female to DB-9 male, 3 m	1	050-0011-022#
E	Data cable, USB (A) to USB (A), 3 m	1	051-0192-000#

Using PocketMax™ to Communicate with the R330™

Hemisphere's PocketMax™ is a free utility program that runs on your Windows PC or Windows mobile device. Simply connect your Windows device to the R330™ via the COM port and open PocketMax™. The screens within PocketMax™ allow you to easily interface with the R330™ to:

- Select the internal SBAS, beacon, L-band, or RTCM correction source and monitor reception
- Configure GNSS message output and port settings
- Record various types of data
- Monitor the R330™'s status and function

PocketMax™ is available for download from the Hemisphere GNSS website.

Chapter 2: Installation

Mounting the Receiver

Mounting the Antenna

Routing and Connecting the Cables

Connecting the Receiver to External Devices

Default Parameters

Installation

This chapter describes how to mount the receiver and antenna, connect the cables and external devices, configure the receiver, and provides default settings and environmental considerations.

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 (ports/connectors) is easily accessible to connect/ switch out cables and turn power on and off
- Although the R330™ is splash-proof in case of accidental exposure, it is designed for indoor use (see Table C-7 for R330™ environmental specifications)

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 R330™.

Figure 2-1: Receiver mounting orientation

Figure 2-2 shows the dimensions (including attached mounting brackets) of the R330™. Use Figure 2-2 when using the receiver mounting procedure that follows and see Figure 2-3 for ports/connections.

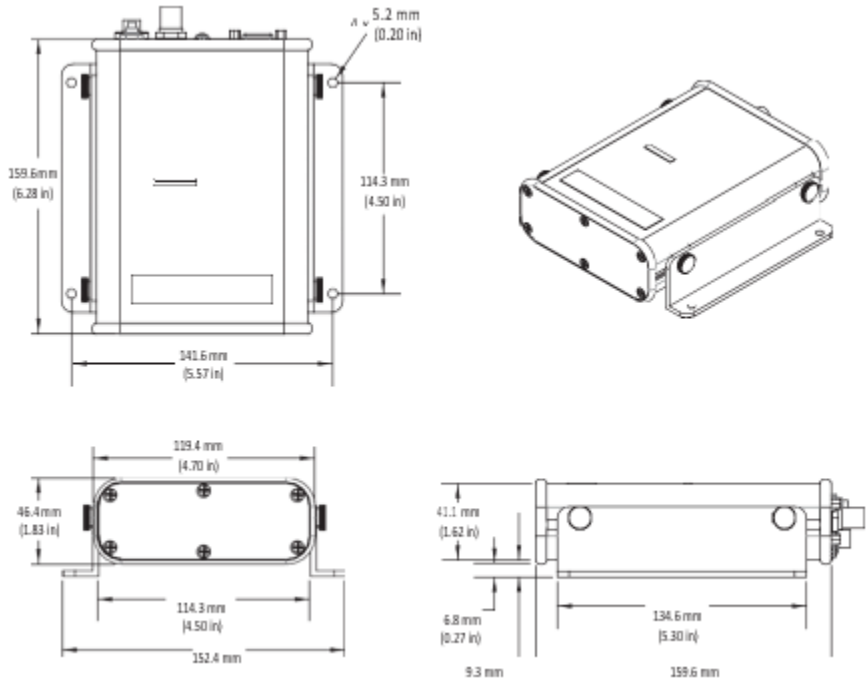


Figure 2-2: R330™ Dimensions (with Mounting Brackets)

To mount the receiver:

1. Locate the thumbscrews, nuts, and brackets included in your kit.
2. Slide the nuts through the opening (circled at right) along both sides of the receiver.

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 GNSS does not provide the screws in this step.

Use the remaining holes in the brackets to secure the receiver in your preferred location

Mounting the Antenna

Note: The antenna, antenna cable, and any related antenna mounting hardware are purchased separately.

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-7 for R330™ 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 R330™ and external devices occurs through two serial ports and two USB ports, as shown in Figure 2-3. You can configure the ports for a combination of NMEA 0183, binary, and/or RTCM SC-104 data.

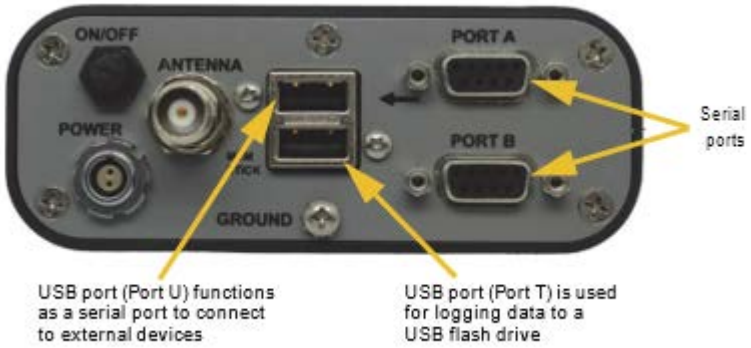


Figure 2-3: R330™ Serial and USB Ports

The serial ports and USB ports function independently. If you connect external devices to Port A, Port B, and/or the top USB port (Port T), you can transmit and receive data between the R330™ and the devices.

- The top USB port (Port U) is designed to be connected to a host device such as a PC. When you connect a PC to the R330™ 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 R330™.
- The bottom USB port (Port T) is used for data logging to a USB flash drive (see "Data Logging Menu").

Note: If you connect the supplied USB cable to Port T or connect a USB flash drive to Port U, the USB functionality will not work as the USB ports are not interchangeable.

- 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 illustrates the numbering for the female DB9 port (the numbering for each male connector is a mirror reflection of Figure 2-4) and Table 2-1 provides the pin configuration for the serial ports.

Note: For successful communication, you must set the baud rate of the R330's serial ports to match that of the connected devices.

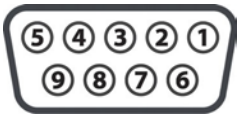


Figure 2-4: Port A/Port B Pinout

Default Parameters

The following represents the standard configuration for the R330™. For more information on these commands refer to the Hemisphere GNSS Technical Reference.

Note: Use the $JSAVE command to save changes you make to the R330™ configuration for the changes to be present in subsequent power cycles.

To save PPS power cycle settings, add ,SAVE to the end of the commands.

To reset the R330™ to its default parameters you can re-install the configuration file (shown below)—contact your dealer or Hemisphere GNSS Technical Support for information on obtaining and re-installing the

JOFF
$JOFF,PORTA
$JOFF,OTHER
$JBAUD,19200,OTHER
$JBAUD,19200
$JSAVE

Chapter 3: Operating the R330™

The R330™ 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
- Set the differential source
- Log data

Powering the Receiver On/Off

The R330™ is automatically powered-on after receiving 8DCV-36DVC. Press and hold the “enter” button for four seconds to power-down the R330™.

The R330™ 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 provides the power specifications of the R330™.

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 R330™ with the fuse bypassed as this will void the warranty.

The R330™ features reverse polarity protection to prevent damage if the power leads are accidentally reversed. Although the R330™ 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 R330™ may take up to 5 minutes to receive a full ionospheric map from SBAS. Optimum accuracy is obtained once the R330™ is processing corrected positions using complete ionospheric information.

Status LED Indicators

The R330™ uses LEDs to indicate power, GPS lock, and DGPS position. Table 3-1 describes each LED indicator.

Table 3-1: LED Indicators

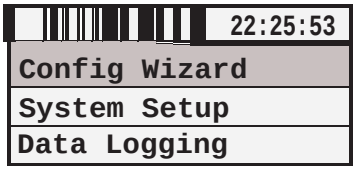
LED	Function	LED Color	Description
	Power	Red	Illuminates solid red when the receiver is powered on.
	GPS	Yellow	Illuminates solid yellow when the receiver achieves a solid GPS lock.
	DGPS	Green	Illuminates solid green when the receiver achieves a differential position and a pseudorange residual of better 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.

Startup

When you power on the R330™ the Hemisphere GNSS splash screen appears followed by the main screen, or Top menu (see at top right). Press the Down Arrow button to display the remaining items on the Top menu (see at bottom right).

You use the menus to view and configure system data and settings for the following Top menu items:

- GNSS
- Differential (menu item will be the selected differential source, such as SBAS or Autonomous)
- Config Wizard
- System Setup
- Data Logging



For a complete menu path of each Top menu item, see Appendix B, “Menu Map.”

Menu System Overview

The R330™ 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 PC or PDA.

Menu Display

Figure 3-2: R330™ Menu

The bars along the top left of the display offer a visual representation of each channel's tracking status (one bar section for each channel). Depending on what signals you're tracking, the bars represent something different, where:

- If you're tracking L1 GPS only, each bar represents L1 GPS.
- If you're tracking L1/L2 GPS, each bar is two separate bars (starting from the left, first bar for L1 GPS, second bar for L2 GPS)
- If you're tracking L1/L2 GPS and GLONASS, each bar is four separate bars (starting from the left, first bar for L1 GPS, second bar for L2 GPS, third bar for L1 GLONASS, fourth bar for L2 GLONASS

Navigating the Menus

The R330™ front panel contains the three soft buttons shown at right: Up Arrow, Enter, and Down Arrow.

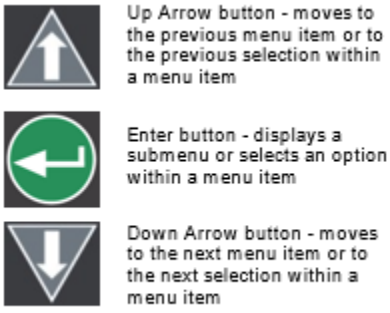


Table 3-2 describes the indicators to the right of specific menu items.

Table 3-2: Menu Item Indicators

Indicator	Purpose	Example
 Display indicator	Goes 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 Top menu.	1. On the Top 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:

- Press and hold the Enter and Up Arrow buttons and then power up the receiver until the splash screen disappears.

Menu and Menu Item Selection in This User Guide

For many instructions in this User Guide the following example illustrates the nomenclature used for making navigating the menus:

"On the Main menu select **Data Logging > Config**" is the equivalent to saying "On the Main menu select **Data Logging** and press **Enter**. Then select **Config** and press **Enter**."

When making selections for a menu item, such as selecting Yes or No for Auto-Name (Data Logging > Config menu), the instructions will indicate to select the menu item and press Enter to allow you to then select an option for that menu item and then press Enter again to select that option.

Configuring the R330™

The Config Wizard menu guides you through various configuration options, enabling you to save up to five different configurations that are useful when using the R330™ on different vessels or for different applications.

If you use a Windows PC or Windows mobile device, you can use Hemisphere GPS' VectorPC software to configure the R330™. See "Using PocketMax™ to Communicate with the R330™" for more information.

Config Wizard Menu

This section describes the basic Config Wizard options you need to set to get up and running. Figure 3-3 outlines the menu structure of the Config Wizard menu.

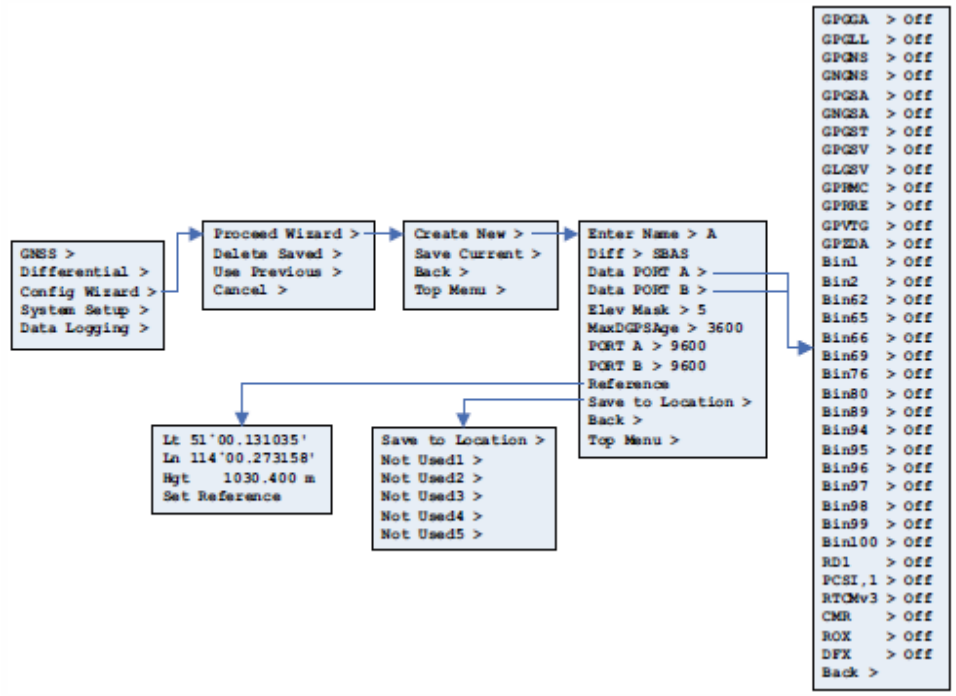


Figure 3-3: Config Wizard Menu

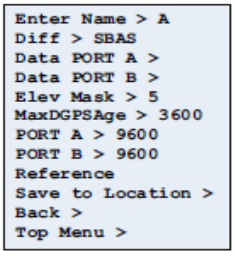
Using the Config Wizard

The basic setup instructions outlined in this section assume the antennas are:

- Installed parallel to, and along the centerline of, the vessel's axis
- Separated by 1.0 m

If this is not the case, you will need to enter the actual antenna separation and bias in the Config Wizard.

1. Select **Config Wizard > Proceed Wizard**. The Proceed Wizard menu appears.



2. Select **Create New** to create a new configuration. You are prompted to enter a name for your configuration. In addition to the Name you can set the options shown at right (also shown in Figure 3-3 on the previous page).

Note: For help on using the menus to view and setting values see "Startup"

3. Enter a name:
   a. Use the arrow buttons to select a character and then press the **Enter** button to save the character. The cursor moves to the right.
   b. Repeat step a for each additional character in the name.
   c. Scroll through the list of characters until you reach "◀" and press the **Enter** button to accept the name. You are returned to the previous menu and the name you entered appears next to "Enter Name."

   If you are editing an existing name, for characters you want to replace simply select a different character. If the new name is shorter and you need to delete unneeded characters to the right:

   a. After you change the final character in the new name press the **Enter** button repeatedly until the last character is highlighted.
   b. Scroll through the list of characters until you reach "◀" and press the **Enter** button to delete the character. The cursor moves to the left.
   c. Repeat step b for each additional rightmost character you want to delete.
   d. Scroll through the list of characters until you reach "□" and press the **Enter** button to accept the name. You are returned to the previous menu and the name you entered appears next to "Enter Name."
4. Set a DGPS source: From the same menu, select **DIFF**. The options are:
   - SBAS (default)
   - Beacon
   - Autonomous
   - e-Dif
   - L-band
   - RTK
   - Extern RTCM (External RTCM)

5. Change the type of GPS data message sent to the data ports: Select either **Data Port A** or **Data Port B** from the menu list.
6. Set the elevation cutoff angle: Select **Elev Mask** and set the angle between 0° and 45°. The default value is 5°.
7. Set the maximum DGPS age: The maximum DGPS age is 2700 seconds (45 minutes) by default.
8. Configure baud rates: If the default baud rate on the selected port does not match that of the external device you are connecting to, you will need to configure the Baud Rate, using the Port A or Port B entries. 4800, 9600, 19200, 38400, 57600, and 115200 are the available baud rates.
9. Save your configuration: To save your new configuration, select the Save to Location field. You will be prompted for a location to save your configuration.

Select one of the empty slots, noted by the name Not Used or select a slot with an existing configuration to overwrite it.

After your configuration is saved, you must select it from the Config Wizard in order to activate it. You may then continue to enter different receiver configurations without upsetting the current operation of the receiver. Re- enter the Config Wizard and select the configuration to use.

USB Data Logging

When you insert a USB flash drive into the R330™, the Data Logging menu indicates you can start recording (logging data) and displays the free space on the flash drive (see Figure 3-4). When you start logging data the “Start Recording” indicator changes to “End <filename>.”

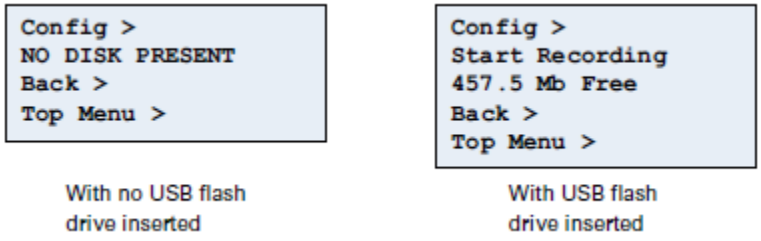


Figure 3-4: USB Flash Drive Indicators on Data Logging Menu

WARNING: Stop data logging before removing the USB flash drive from the R330™. Failure to do so may result in a loss of data.

Selecting the Data File Type and Log Options

You can log the following data types to a USB flash drive:

- RAW - binary, NMEA, and other data options (see Table 3-3)
- KML - Google Earth KML format with latitude, longitude and height
- CSV - comma-separated value (CSV) format with time, latitude, longitude, and height
- PostPro - R330™ automatically turns on the appropriate messages for post processing
- debug - R330™ logs high speed data for troubleshooting purposes (contact Hemisphere GNSS Technical Support for more information)

Table 3-3: RAW Data Log Options

Format	Description
Raw (binary)	For raw (binary) data logging, you may also want the receiver configuration to be inserted into the file. If you select this option the file will start with the receiver configuration comprised of the replies to the $JI, $JK, $JT, and $JSHOW queries.
NMEA	National Marine Electronics Association (NMEA 0183) - industry standard data transmission format
CMR	Proprietary data correction format
DFX	Hemisphere -proprietary data correction format
ROX	Hemisphere GNSS-proprietary data correction format
RTCM	Radio Technical Commission for Maritime Services - industry standard data correction format

To select a data logging type:

1. Select **Data Logging > Config > FileType**.
2. Press the **Up/Down Arrow** buttons until your preferred data type appears then press **Enter**.

When logging using the RAW data type (File Type > RAW as shown in Figure 3-5) you can select which data to log and at what rate by selecting Data Logs and then making the desired selections on the Data Logs menu.

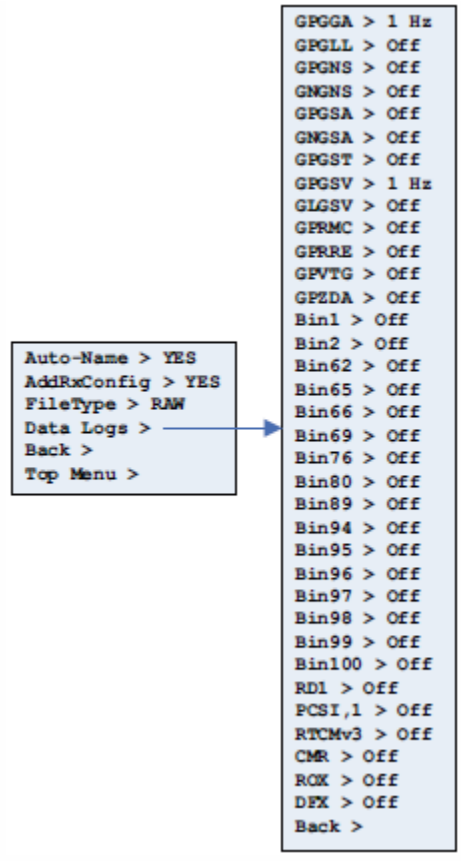


Figure 3-5: Data Logging> Config> Data Logs Menu

Note: Logged data options are limited by your receiver subscriptions (certain options may not appear on the Data Logs menu without a specific subscription). For example, GNGNS, GNGSA, GLGSV, Bin62, Bin65, Bin66, and Bin69 only appear on the Data Logs menu if you are authorized to receive GLONASS. To view your subscriptions press **System Setup > Software Disp > Authorizations**.

Logging Data to a File

You can log data to a file that the R330™ auto-generates or you can manually enter a filename to which to log data. You can append data to or overwrite data on a manually-named file; however, you cannot append data to or overwrite data on an R330™-generated file.

To log data to an R330™ auto-generate filename:

1. Select Data Logging > Config.
2. If Auto-Name displays No select Auto-Name and then press Enter.
3. Select Yes and then press Enter.
4. Select Back to return to the Data Logging menu.
5. Select Start Recording to begin logging data. The Start Recording option changes to End <filename>.
6. Select End <filename>.

To log data to a manually-created filename:

1. Select Data Logging > Config.
2. If Auto-Name displays Yes select Auto-Name and then press Enter.
3. Select No and press Enter. The Enter Name and Mode menu items appear below Auto-Name.
4. Enter a filename:
    a. Select Enter Name and press Enter.
    b. Enter the desired characters for the filename and then scroll to the return character and press Enter.
5. Select the mode:
    a. Select Mode and press Enter.
    b. Select Append to log data to new file or to append data to an existing file (based on the filename in step 4) and press Enter.

    or

    Select Overwrite to overwrite an existing file (based on the filename in step 4) and press Enter.

WARNING: No warnings are given to confirm overwriting a previous file.

6. Select Back to return to the Data Logging menu.
7. Select Start Recording to begin logging data. The Start Recording option changes to End <filename>.
8. Select End <filename>.

Data Post-Processing

After you log data you can then process the data with a Receiver Independent Exchange (RINEX) format software utility. Hemisphere GNSS Rinex conversion software is available from the Hemisphere GNSS website.

Make sure you select PostPro as the file type before logging the data you will use for post processing (see “Selecting the Data File Type and Log Options”).

To post-process raw data:

1. Log the raw data to the USB flash drive inserted in the R330™. Make sure you properly end your data logging before removing the flash drive in step 2 below.
2. Remove the flash drive from the R330™ then insert the drive in a PC with Hemisphere GNSS’ Rinex conversion software installed.
3. Run the Rinex conversion software.

Chapter 4: RTK

Installing the Base Station

Installing the Rover Radio

Using the R330™ as a Base Station or Rover

Setting up the R330™ as a Rover

RTK Operation

RTK

RTK provides the highest accuracy (see Table C-1 for accuracy specifications). You can set up a base/rover RTK system using one R330™ as a base station and one R330™ for each rover. Most commonly, each base station and rover include 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 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

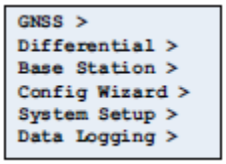
Using the R330™ as a Base Station or Rover

Using the R330™ 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 R330™ as a Base Station

When you set up the R330™ as a base station, the Base Station menu option appears just below Differential on the Top menu.

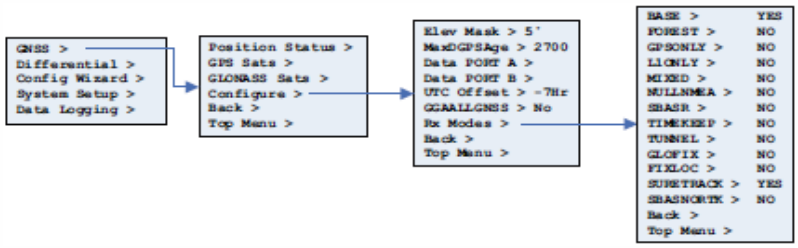
The baud rates of the base, rover, and radio (if part of the setup) must be the same.



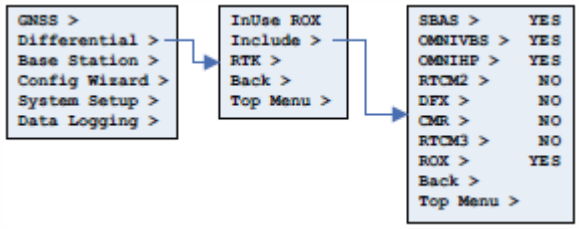
Note: Before you can set up your R330™ as a base station, you unit must be subscribed for base station functionality. Contact your Hemisphere GNSS sales representative for more information.

To set up the R330™ as a base station:

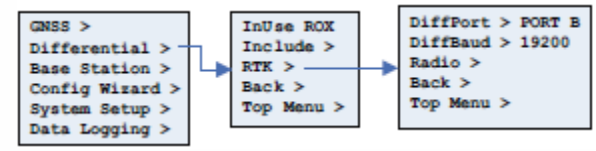
1. Put the R330™ in base station mode: From the Top menu press **GNSS > Configure > Rx Modes** then set **BASE** to **YES**.



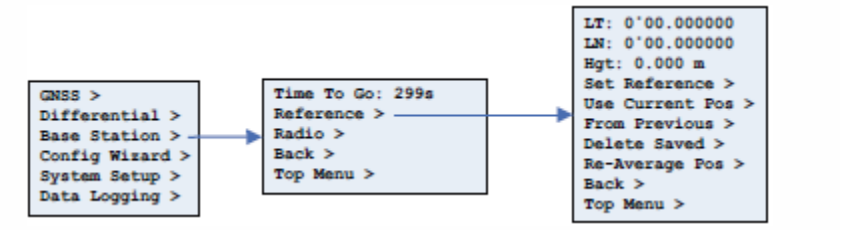
2. Set the differential port and baud rate of the base station: From the Top menu press **Differential > RTK** then set **DiffPort** to your preferred differential port and set **DiffBaud** to your preferred baud rate (PORT B and 19200, respectively, in example below).



3. Set the position of the base station: From the Top menu press **Base Station> Reference > Use Current Pos** to use your current position.



4. Set the position of the base station: from the Top menu press Base Station>Referene>Use Correct Pos to use your current position.



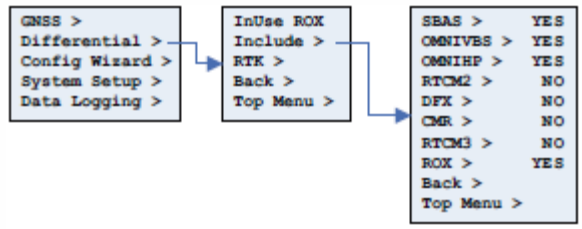
Setting Up the R330™ as a Rover

The baud rates of the base, rover, and radio (if part of the setup) must be the same.

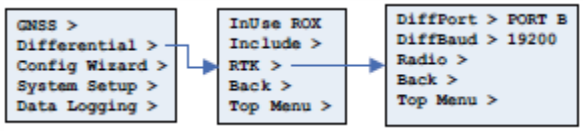
Note: Before you can set up your R330 as a rover, you unit must be subscribed for rover functionality. Contact your Hemisphere GNSS sales representative for more information.

To set up the R330™ as a rover:

1. Select your differential corrector: From the Top menu press **Differential > Include** then set your preferred RTK corrector to **YES** (ROX set to YES in example below). When the base station sends correctors to the rover the Differential menu shows the corrector type next to InUse and RTK below Include.



2. Set the differential port and baud rate of the base station: From the Top menu press **Differential > RTK** then set **DiffPort** to your preferred differential port and set **DiffBaud** to your preferred baud rate (PORT B and 19200, respectively, in example below).



Connecting the R330™ to a Base/Rover Radio

When connecting the R330™ to a base/rover radio, verify/set the following:

1. Radio does not interfere with GPS
2. Radio supports a serial connection, with a minimum of 9600 baud, set to N,8,1
3. Radio supports over-the-air throughput of at least 300 bps
4. Base station, rover, and radio all are set to the same baud rate

Note: Hemisphere GNSS 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 set up your RTK system, the status LEDs indicate the following (see "Status LED Indicators" for more information on R330™ 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 R330™ will output standard NMEA messages through Port A or Port B. Set the message and port output as preferred (see "Config Wizard Menu" for more information on message output).

Appendix A: Troubleshooting

Appendix B: Troubleshooting

Table A-1 provides troubleshooting information for the R330™.

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 R330™	• 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 R330™ 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 Map

Appendix B: Menu Map

This appendix shows the complete menu map for each menu (listed below) on the R330™ Top menu:

- GNSS
- Differential (menu item will be the selected differential source, such as SBAS or Autonomous)
- Base Station (appears only if you set BASE to YES—see "Setting Up the R330™ as a Base Station")
- Config Wizard
- System Setup
- Data Logging

GNSS Menu

Use the GNSS menu to view and edit your GNSS settings. Settings include the data port outputs, specific positioning parameters, UTC time offset, and satellite visibility and positioning information.

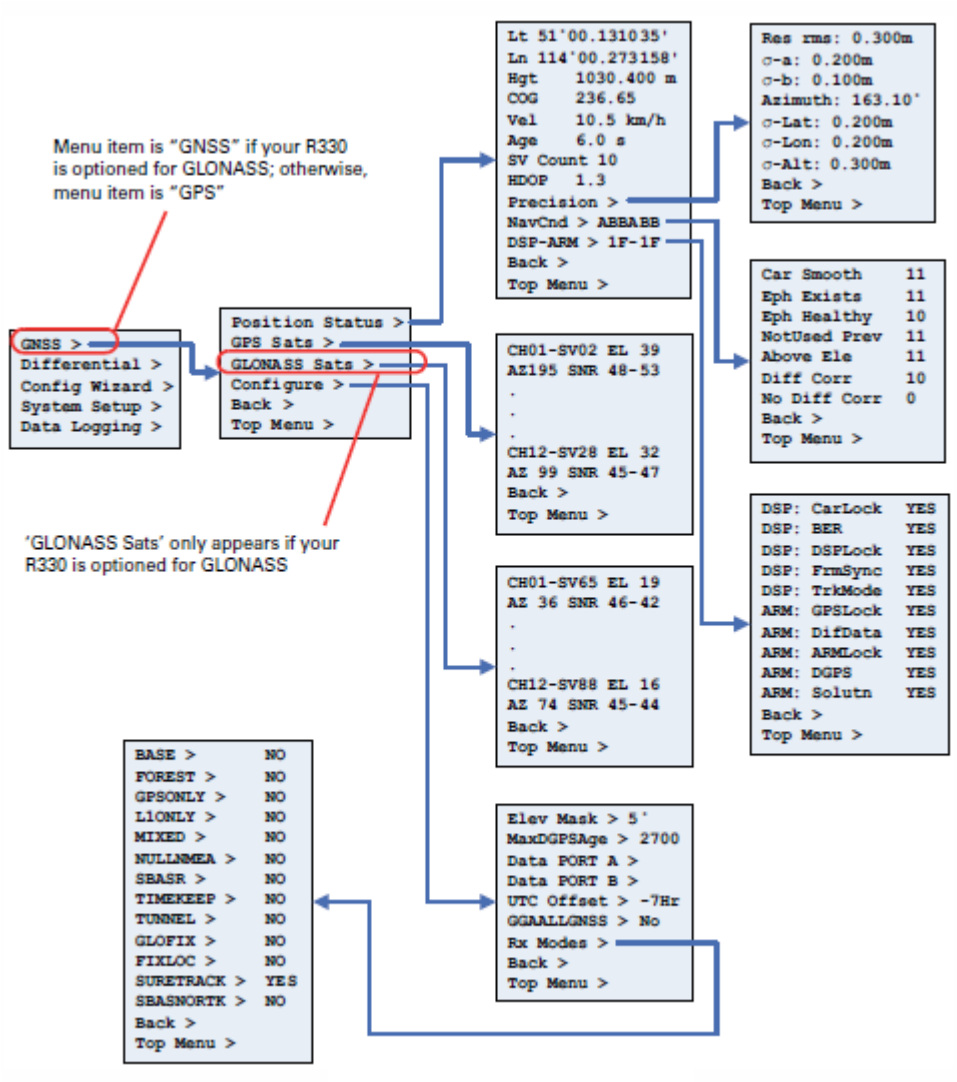


Figure B-1: GNSS Menu

Differential Menu

Use the Differential menu to view or change your differential settings. The following available differential sources depend on the configuration you purchased.

- SBAS
- Beacon (RTCM2) - available with purchased unlock code
- RTK (CMR, ROX, RTCM3)
- L-band (OMNIVBS, OMNIHP) - available with purchased unlock code
- None (Autonomous)

To select the differential source:

1. Press Differential > Include then set each format you may use to Yes. For example, if you will be using Beacon, set RTCM2 to Yes.
2. Press Back to return to the previous menu level, press InUse, then select your preferred differential source. For example, if you will be using Beacon, select Beacon (RTCM2 will be displayed when finished).

Figure B-2 through Figure B-5 show the complete menu maps for the SBAS, Beacon, RTK, L-band, and Autonomous, respectively. The Include menu (at right) in each of these figures shows all available formats. If you have not purchased unlock codes for L-band and Beacon, the OMNIVBS/OMNIHP (L-band) and RTCM2 (Beacon) menu items will not appear on your menu.

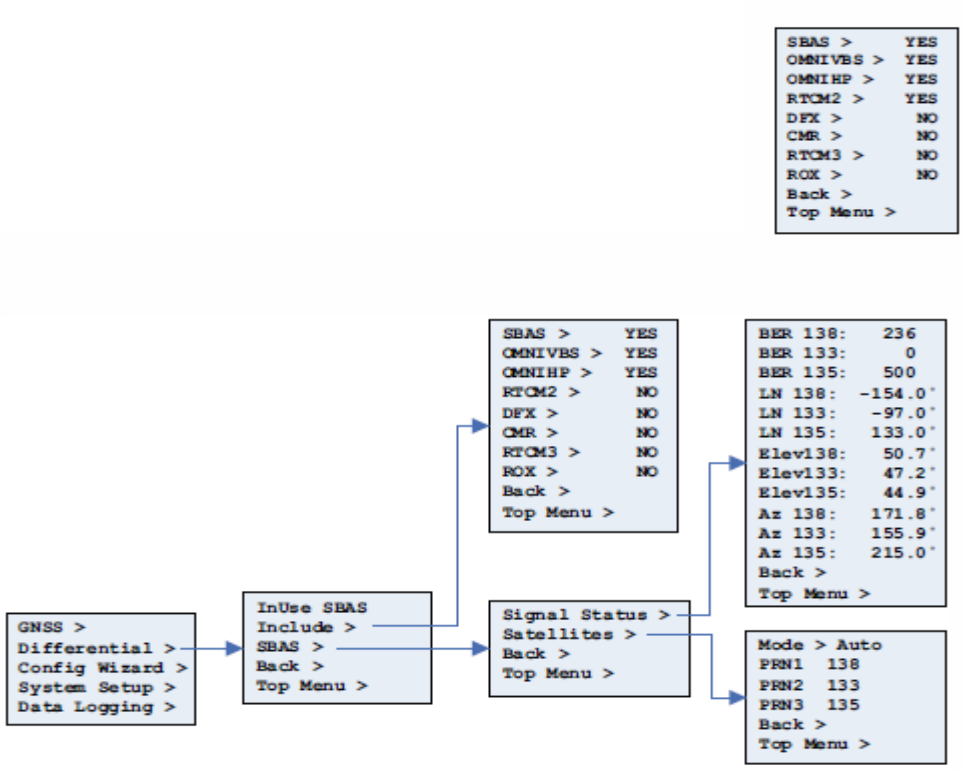


Figure B-2: SBAS Menu

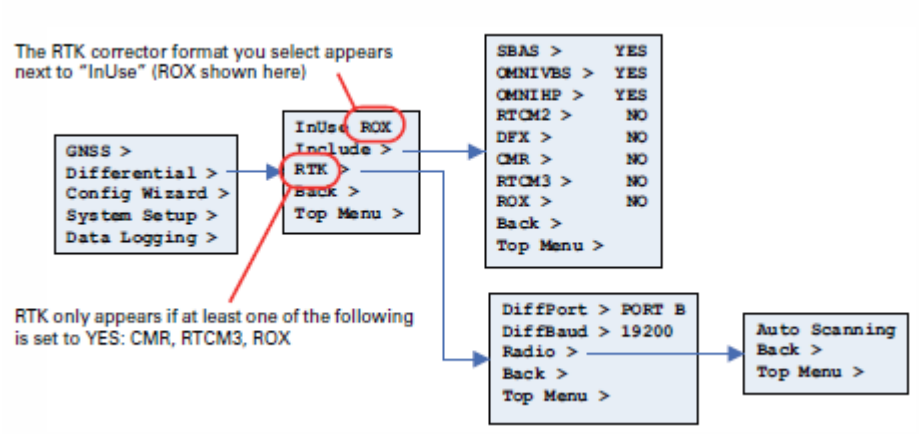


Figure B-3: RTK Menu

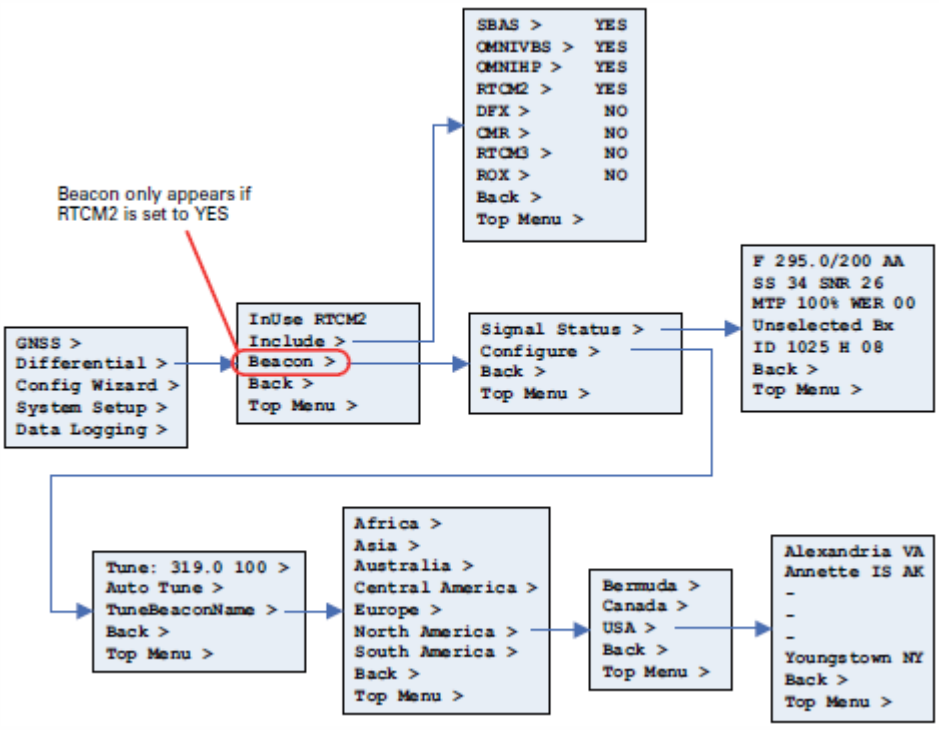


Figure B-4: Beacon Menu

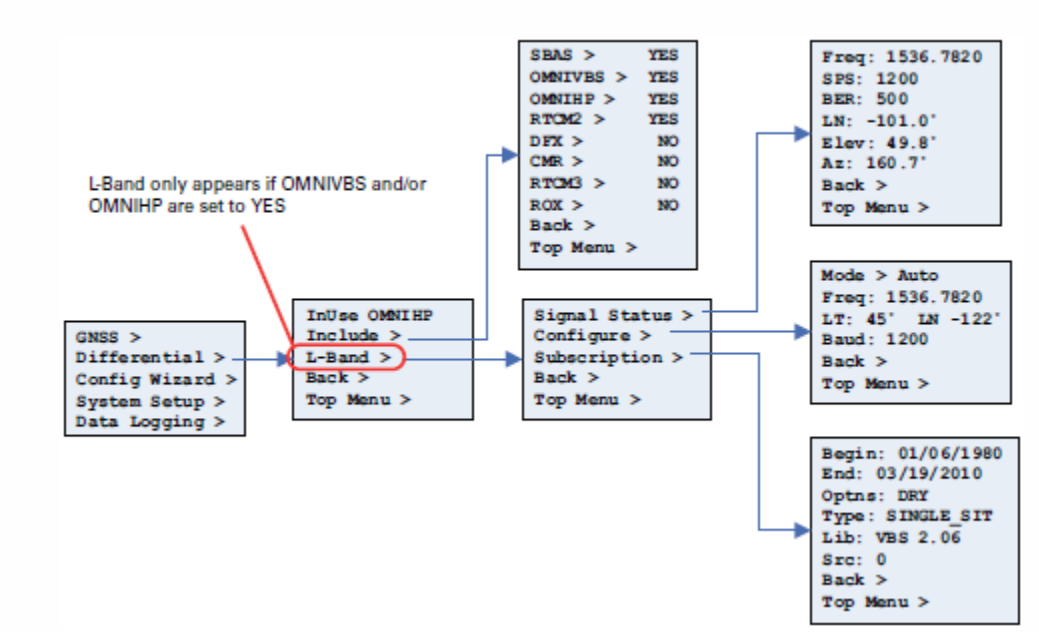


Figure B-5: L-band Menu

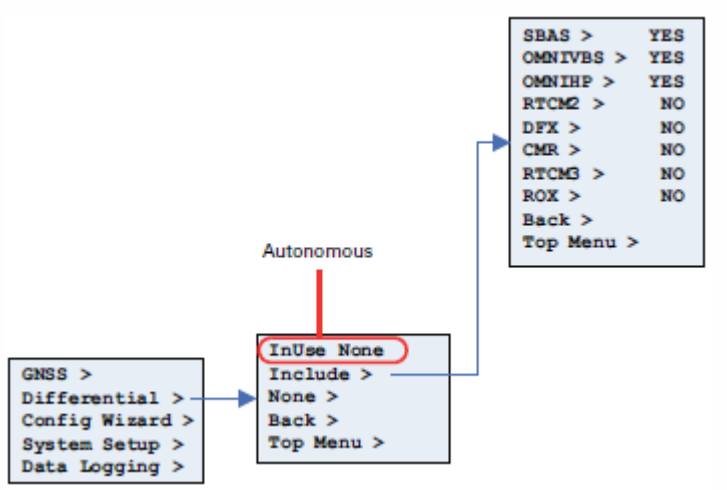


Figure B-6: Autonomous Menu

Base Station Menu

The Base Station menu enables you to configure an R330™ as a base station. This menu only appears if you set BASE to YES—see "Setting Up the R330™ as a Base Station".

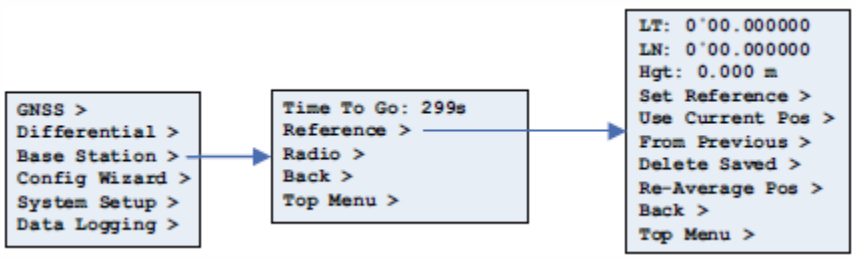


Figure B-7: Base Station Menu

Config Wizard Menu

The Config Wizard walks you through basic settings to get up and running. See "Configuring the R330™" to view the Config Wizard menu map.

System Setup Menu

The System Setup menu allows you quickly view and edit current system settings. General settings include such items as current applications, units, baud rates, logs, LED contrast, subscription code, display orientation (you can flip the display 180° by selecting YES under Flip Display), and language.

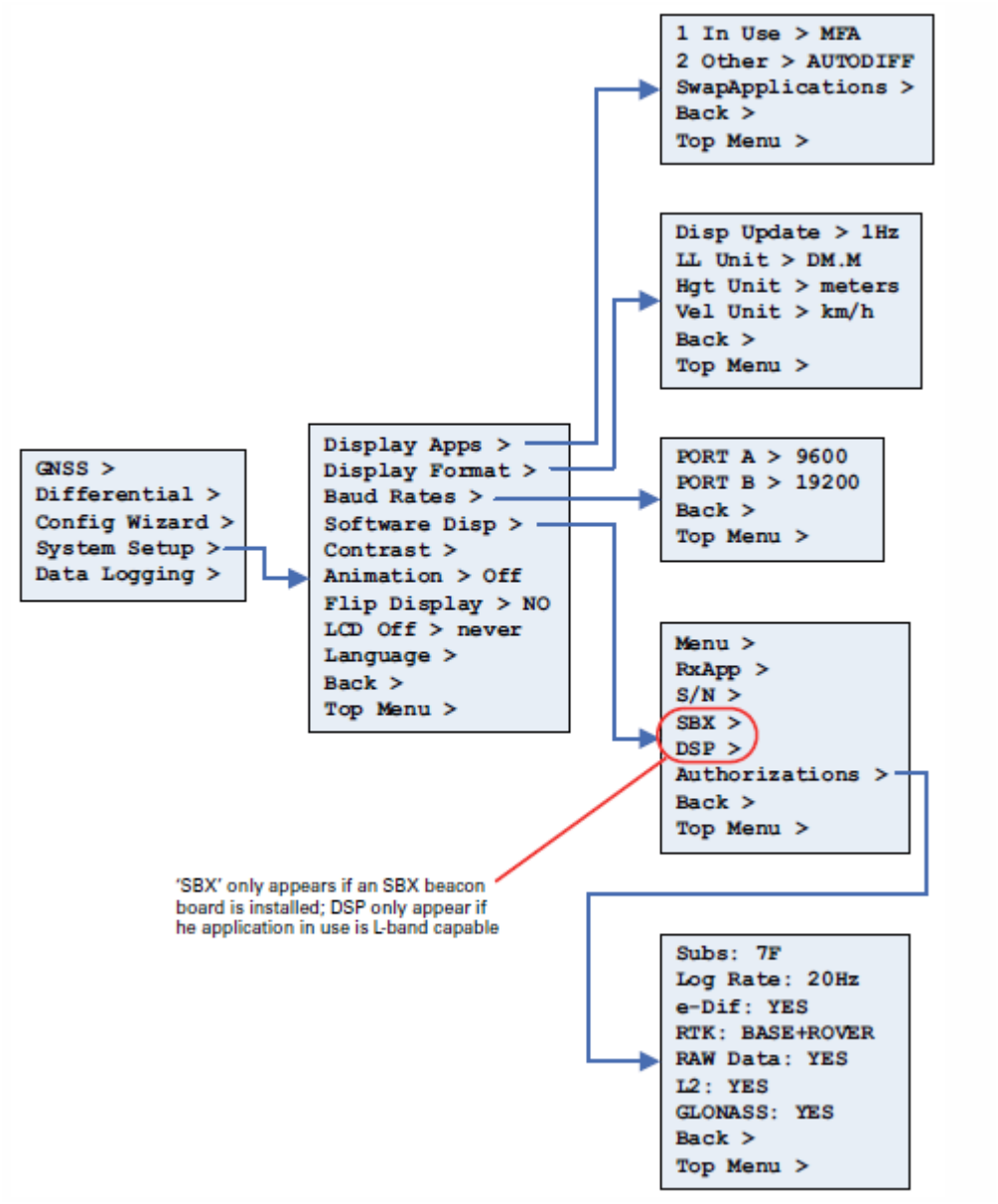


Figure B-8: System Setup Menu

Data Logging Menu

The Data Logging menu allows you to log or output job data, view USB flash drive free storage space, set up file auto-naming, and view what type of data you are logging.

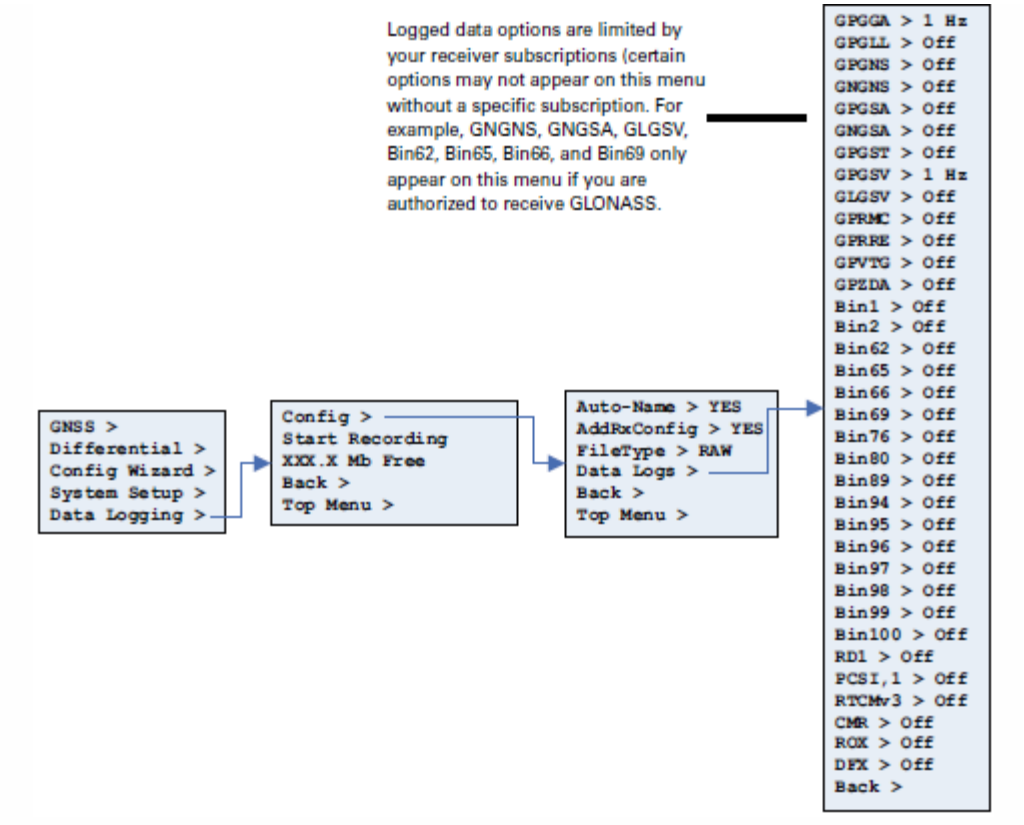


Figure B-9: Data Logging Menu

Appendix C: Technical Specifications

Appendix C: Technical Specifications

Table C-1 through Table C-8 provide the technical specifications for the R330™.

Table C-1: GNSS Sensor Specifications

Item	Specification
Receiver type	GNSS L1 and L2, RTK with carrier phase
Signals received	GPS, GLONASS, and BeiDou[1]
Channels	270
SBAS tracking	3-channel, parallel tracking
Update rate	10 Hz standard, 20 Hz optional
Timing (1 PPS) accuracy	20 ns
Cold start time	< 60 s typical (no almanac or RTC)
Warm start time	< 30 s typical (almanac and RTC)
Hot start time	< 10 s typical (almanac, RTC, and position)
Maximum speed	1,850 kph (999 kts)
Maximum altitude	18,288 m (60,000 ft)
Differential options	SBAS, autonomous, external RTCM, RTK, and L-band DGNSS/HP/XP/G2[2]

Table C-2: Positioning Accuracy Specifications

RMS (67%)	Horizontal	Vertical
Single Point, no SA	1.2 m	2.5 m
SBAS (WAAS)[3]	0.3 m	0.6 m
L-band DGPS	0.3 m	0.6 m
Code differential GPS	0.3m	0.6 m
L-band L1/L2	0.15 m	0.3 m
RTK	10 mm + 1 ppm	20 mm + 2 ppm

Table C-3: Beacon Sensor Specifications

Item	Specification
Channels	2-channel, parallel tracking
Frequency range	283.5 to 325.0 kHz
Operating modes	Manual, automatic, and database
Compliance	EN50081-4-2 ESD

Table C-4: L-band Sensor Specifications

Item	Specification
Sensitivity	-130 dBm
Channel spacing	7.5 KHz
Satellite selection	Manual and automatic
Reacquisition time	15 s (typical)
Rejection	15 kHz spacing > 30 dB 300 kHz spacing > 60 dB

Table C-5: Communication Specifications

Item	Specification
Serial ports	2 full-duplex RS-232
USB ports	1 USB host, 1 USB device
Baud rates	4800 - 115200
Data I/O protocol	NMEA 0183, Hemisphere GNSS binary
Correction I/O protocol	Hemisphere GNSS proprietary, RTCM v2.3 (DGPS), RTK v3, CMR, CMR+[1]
Timing output	1 PPS CMOS, active high, rising edge sync, 10 kΩ, 10 pF load
Event marker input	CMOS, active low, falling edge sync, 10 kΩ

Table C-6: Power Specifications

Item	Specification
Input voltage	8 to 36 VDC
Power consumption	3.8 W nominal (WAAS and Beacon) 4.6 W nominal (L-band)
Current consumption	315 mA nominal (WAAS and Beacon) 383 mA nominal (L-band)
Antenna voltage output	15 VDC maximum
Antenna short circuit protection	Yes
Antenna gain input range	10 to 40 dB
Antenna input impedance	50 Ω

Table C-7: Environmental Specifications

Item	Specification
Operating temperature	-40°C to +70°C (-40°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 Operational Vibration: EP455 Section 5.15.1 Random
EMC	CE (IEC 60945 Emissions and Immunity), FCC Part 15, Subpart B, CISPR22

Table C-8: Mechanical Specifications

Item	Specification
Dimensions	17.8 L x 12.0 W x 4.6 H (cm) 7.0 L x 4.7 W x 1.8 H (in)
Weight	645 g (1.42 lbs)
Status LED indicators	Power, GPS lock, Differential lock, DGPS position, L-band lock
Power/data connector	2-pin metal ODU
Antenna connector	TNC-male, straight

[1]Upgrade required
[2]Requires a subscription from L-band service provider
[3]Depends on multipath environment, number of satellites in view, satellite geometry, and ionospheric activity

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21. **EXPORT RESTRICTIONS**. Licensee agrees that Licensee will comply with all export control legislation of Canada, the United States, Australia and any other applicable country's laws and regulations, whether under the Arms Export Control Act, the International Traffic in Arms Regulations, the Export Administration Regulations, the regulations of the United States Departments of Commerce, State, and Treasury, or otherwise as well as the export control legislation of all other countries.

22. **PRODUCT COMPONENTS.** The Product may contain third party components. Those third party components may be subject to additional terms and conditions. Licensee is required to agree to those terms and conditions in order to use the Product.

23. **FORCE MAJEURE EVENT.** Neither party will have the right to claim damages as a result of the other's inability to perform or any delay in performance due to unforeseeable circumstances beyond its reasonable control, such as labor disputes, strikes, lockouts, war, riot, insurrection, epidemic, Internet virus attack, Internet failure, supplier failure, act of God, or governmental action not the fault of the non-performing party.

24. **FORUM FOR DISPUTES**. The parties agree that the courts located in Calgary, Alberta, Canada and the courts of appeal there from will have exclusive jurisdiction to resolve any disputes between Licensee and Hemisphere concerning this Agreement or Licensee's use or inability to use the Software and the parties hereby irrevocably agree to attorn to the jurisdiction of those courts. Notwithstanding the foregoing, either party may apply to any court of competent jurisdiction for injunctive relief.

25. **APPLICABLE LAW**. This Agreement shall be governed by the laws of the Province of Alberta, Canada, exclusive of any of its choice of law and conflicts of law jurisprudence.

26. **CISG.** The United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement or any transaction hereunder.

27. **GENERAL.** This is the entire agreement between Licensee and Hemisphere relating to the Product and Licensee's use of the same, and supersedes all prior, collateral or contemporaneous oral or written representations, warranties or agreements regarding the same. No amendment to or modification of this Agreement will be binding unless in writing and signed by duly authorized representatives of the parties. Any and all terms and conditions set out in any correspondence between the parties or set out in a purchase order which are different from or in addition to the terms and conditions set forth herein, shall have no application and no written notice of same shall be required. In the event that one or more of the provisions of this Agreement is found to be illegal or unenforceable, this Agreement shall not be rendered inoperative but the remaining provisions shall continue in full force and effect.

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COVERED PRODUCTS: This warranty covers all products manufactured by Hemisphere GNSS and purchased by the end purchaser (the "Products"), unless otherwise specifically and expressly agreed in writing by Hemisphere GNSS.

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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 GNSS approved service center along with the end purchaser's proof of purchase. Hemisphere GNSS 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 GNSS approved service center, contact Hemisphere GNSS at the following address:

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