Crescent VS100 Series

User Guide

Part No. 875-0179-000 Rev. B1

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

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

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Contact your local dealer for technical assistance. To find the authorized dealer near you, call or write us at:

Hemisphere GPS
4110 9th Street S.E.
Calgary, Alberta, Canada
T2G 3C4
Phone: (403) 259-3311
Fax: (403) 259-8866

Warranty Notice

Covered Products

This warranty covers all products manufactured by Hemisphere GPS LLC (the "Products").

Hemisphere GPS LLC Limited Warranty

Hemisphere GPS LLC hereby warrants solely to the end purchaser of the Products, subject to the exclusions and procedures set forth herein below, that the Products sold to such end purchaser shall be free, under normal use and maintenance, from defects in material and workmanship for a period of 12 months from delivery to such end purchaser. Repairs and replacement components are warranted, subject to the exclusions and procedures set forth below, to be free, under normal use and maintenance, from defects in material and workmanship for 90 days from performance or delivery, or for the balance of the original warranty period, whichever is greater.

Purchaser's Exclusive Remedy

The end purchaser's exclusive remedy under this warranty shall be limited to the repair or replacement, at the option of Hemisphere GPS, of any defective Products or components thereof. The end user shall notify Hemisphere GPS or a Hemisphere GPS approved service center immediately of any claimed defect. Repairs shall be made through a Hemisphere GPS approved service center only.

Exclusions

Hemisphere GPS does not warrant damage occurring in transit or due to misuse, abuse, improper installation, neglect, lightning (or other electrical discharge) or fresh/salt water immersion of Products. Repair, modification or service of Hemisphere GPS products by any party other than a Hemisphere GPS approved service center shall render this warranty null and void. Hemisphere GPS does not warrant claims asserted after the end of the warranty period. Hemisphere GPS does not warrant or guarantee the precision or accuracy of positions 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:

- Specifications provided by the US Department of Defense for GPS Positioning,
- GPS OEM Receiver specifications of the appropriate manufacturer (if applicable), and
- DGPS service provider performance specifications.

Hemisphere GPS reserves the right to modify Products without any obligation to notify, supply or install any improvements or alterations to existing Products.

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THE FOREGOING WARRANTY IS EXCLUSIVE OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, IMPLIED OR ARISING BY STATUTE, COURSE OF DEALING OR TRADE USAGE, IN CONNECTION WITH THE DESIGN, SALE, INSTALLATION, SERVICE OR USE OF ANY PRODUCTS OR ANY COMPONENTS THEREOF, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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THE EXTENT OF HEMISPHERE GPS' LIABILITY FOR DAMAGES OF ANY NATURE TO THE END PURCHASER OR ANY OTHER PERSON OR ENTITY WHETHER IN CONTRACT OR TORT AND WHETHER TO PERSONS OR PROPERTY SHALL IN NO CASE EXCEED, IN THE AGGREGATE, THE COST OF CORRECTING THE DEFECT IN THE PRODUCT OR, AT HEMISPHERE GPS' OPTION, THE COST OF REPLACING THE DEFECTIVE ITEM. IN NO EVENT WILL HEMISPHERE GPS BE LIABLE FOR ANY LOSS OF PRODUCTION, LOSS OF PROFITS, LOSS OF USE OR FOR ANY SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES, EVEN IF HEMISPHERE GPS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. WITHOUT LIMITING THE FOREGOING, HEMISPHERE GPS SHALL NOT BE LIABLE FOR ANY DAMAGES OF ANY KIND RESULTING FROM INSTALLATION, USE, QUALITY, PERFORMANCE OR ACCURACY OF ANY PRODUCTS.

Governing Legislation

To the greatest extent possible, this warranty shall be governed by the laws of the province of Alberta. In the event that any provision hereof is held to be invalid by a court of competent jurisdiction, such provision shall be severed from this warranty and the remaining provisions shall remain in full force and effect.

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. For any questions regarding warranty service or to obtain information regarding the location of any of Hemisphere GPS' approved service centers, contact Hemisphere GPS at the following address:

Hemisphere GPS, LLC
4110 9th Street S.E.
Calgary, AB CANADA
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TABLE OF CONTENTS

1: Introduction

About the Crescent VS100 Series

GPS Overview

How the Crescent VS100 Works

About the Crescent VS100 Series

Introduction

The Crescent VS100 series offers a high-precision GPS heading solution to meet the unique needs of the marine and machine control market. The series uses our Crescent-based receiver and two separate antennas to achieve heading accuracy ranging from 0.1 to 0.25 degrees (rms), depending on the antenna separation. In addition, it offers a sub-meter GPS positioning performance of less than 60 centimeters, 95 percent of the time using WAAS or other suitable differential GPS signals.

While the series is designed to provide a highly-accurate GPS heading taking into account the pitch, roll and speed of various marine vessels, the use of the Crescent VS100 is not limited to the marine market. Other excellent applications include machine control and agricultural guidance, or any application that requires a high precision heading solution.

The Crescent VS100 series includes two versions.

Table 1-1: Crescent VS100 Series Available Versions

Crescent VS100 Series Version	GPS/SBAS	Beacon
VS100	x	
VS110	x	x

Note: Throughout this manual, any reference to the Crescent VS100 refers to either of the following receivers: Crescent VS100 and Crescent VS110. See Table 1-1 for the DGPS signal types each version supports.

Figure 1-1. Crescent VS100 GPS Compass.

The module features the exclusive Hemisphere GPS, Crescent-branded, application-specific integrated circuit (ASIC) computer chipset technology that enables it to achieve:

- higher update rates
- noise-reduced raw measurements
- more memory
- more processor capacity
- lower power consumption

- more advanced applications and sophisticated configurations
- tighter coupling of measurements from separate antennae

The Crescent VS100 offers excellent accuracy and stability due to more accurate code phase measurements, improved multipath mitigation and fewer components than competing products.

GPS Overview

For your convenience, the Crescent VS100 automatically tracks and calculates position information with complex algorithms, whether using GPS or differential GPS (DGPS).

When turned on for the first time, the Crescent system acquires the available GPS satellites in view and the satellite-based augmentation system (SBAS) differential service.

If SBAS is not available in your area, you can use Beacon and/or OmniSTAR corrections, depending on your model. Alternatively, you may use an external source of RTCM SC-104 differential corrections.

GPS Operation

The GPS engine is always operating, regardless of the DGPS mode of operation. The following sections describe the general operation of the Crescent VS100's internal GPS engine.

Automatic Tracking - The Crescent VS100's internal GPS engine automatically searches for GPS satellites, acquires the signals and manages the navigation information required for positioning and tracking. This is a hands-free mode of operation.

Receiver Performance - The Crescent VS100 works by finding 4 or more GPS satellites in the visible sky and uses the information those satellites provide to compute an appropriate position (within 2.5 meters). Since there is some error in the GPS data calculations, the Crescent VS100 also tracks a differential correction. The Crescent VS100 uses the differential corrections to improve its position to less than 1 meter.

There are two main aspects of GPS receiver performance:

- positioning

- satellite acquisition quality

When the Crescent VS100 is properly positioned, the satellites transmit coded information to the antenna on a specific frequency that allows the receiver to calculate a range to each satellite.

GPS is essentially a timing system. The ranges are calculated by timing how long it takes for the GPS signal to reach the GPS antenna. To calculate the geographic location, the GPS receiver uses a complex algorithm incorporating satellite locations and ranges to each satellite. Reception of any 4 or more of these signals allows a GPS receiver to compute 3-dimensional coordinates.

Differential Operation

The purpose of differential GPS (DGPS) is to remove the effects of atmospheric errors, timing errors and satellite orbit errors, while enhancing system integrity.

Autonomous positioning capabilities of the Crescent VS100 will result in positioning accuracies of 2.5 m (95%). In order to improve positioning quality to sub-meter levels, the Crescent VS100 uses differential corrections received through one of the following:

- the internal SBAS demodulator
- a subscription code for one of Hemisphere GPS' patented e-Dif® or L-Dif® applications
- radiobeacon corrections

For more information on available differential services and the associated commands, please refer to the GPS Technical Reference manual.

Automatic SBAS (WAAS, EGNOS, MSAS, etc.) tracking - The Crescent VS100 will automatically scan and track SBAS signals without the need to tune the receiver. The Crescent VS100 features two-channel tracking that provides an enhanced ability to maintain a lock on a SBAS satellite when more than one satellite is in view. This redundant tracking approach results in more consistent tracking of a SBAS signal when in an area where signal blockage of a satellite is possible.

e-Dif® - Extended differential (e-Dif) is an optional mode in which the receiver can perform with differential-like accuracy for extended periods without the expense or uncertainty of an external differential service. It models the effects of ionosphere, troposphere and timing errors for extended periods by computing its own set of pseudo-corrections. e-Dif may be used anywhere geographically and is especially useful where SBAS networks have not yet been installed, such as South America, Africa, Australia and Asia.

The positioning performance of the receiver unit is dependent upon the rate at which the environmental modeling of e-Dif and the environmental errors diverge. The more that e-Dif is able to model the errors correctly, the longer that e-Dif will provide reliable, accurate positioning. The accuracy of positioning will have a slow drift that limits use of e-Dif to approximately 30 to 40 minutes. However, this depends on how tolerable your application is to drift, as e-Dif can be used for longer periods. Our testing has shown that accuracy will often be better than 1.0 m virtually 95% of the time after 30 minutes of e-Dif operation.

L-Dif® / RTK - Local differential (L-Dif) and RTK are Hemisphere GPS methods where a specialized set of messages is relayed between two Crescent receivers. Because the messages transmitted are in a proprietary format, two Crescent receivers are necessary for L-Dif operation. A base receiver is established on a site of known coordinates, which then broadcasts corrections to a

rover unit. Performance testing has shown positioning accuracy at the centimeter level.

Beacon Operation - Many marine authorities, such as coast guards, have installed networks of radiobeacons that broadcast DGPS corrections. Increasingly, this radiobeacon network is used for terrestrial applications as well, resulting in a densification of networks inland. The dual-channel beacon receiver in the VS110 is able to operate in manual or automatic tuning mode. Alternately, a database mode will select the closest station in compliance with IEC 61108-4 standards.

Satellite Signal Loss? No Problem.

The exclusive Hemisphere GPS COAST™ software enables the Crescent VS100 receivers to use old DGPS correction data for 40 minutes or more without significantly affecting the quality of positioning.

How the Crescent VS100 Works

The Crescent VS100 series provides accurate, reliable heading and position information at high update rates. It consists of a high performance GPS engine and two multipath-resistant antennas for GPS signal processing.

The Crescent VS100 uses moving base station Real-Time Kinematic (RTK) technology to achieve very precise heading and position accuracies.

Moving Base Station RTK

RTK technology uses two antennas. One antenna is designated as the primary GPS, while the other is designated as the secondary GPS.

Knowing the fixed distance between the primary and secondary antennas (by default, 0.5 m) allows the Crescent VS100 to constrain its search volume when computing GPS satellite positioning data.

The Crescent VS100 is able to constrain its search volume because the location of the secondary antenna can theoretically only fall on the surface of a sphere with the radius centered on the location of the primary antenna.

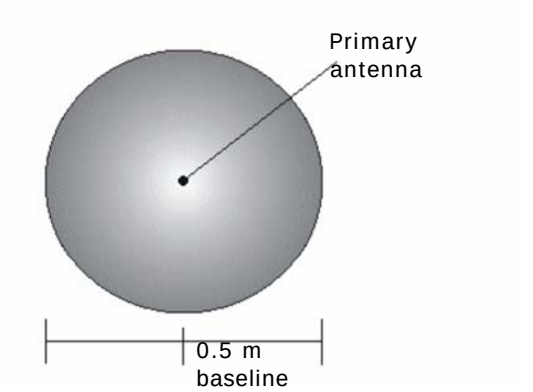


Figure 1-2. Secondary antenna's search volume.

Therefore, positions computed by the Crescent VS100 are referenced to the phase center of the primary GPS antenna. The Crescent VS100's internal GPS engine uses both the L1 GPS C/A code and carrier phase data to compute the location of the secondary GPS antenna in relation to the primary GPS antenna with a very high, sub-centimeter level of precision.

Using RTK technology, the Crescent VS100 analyzes a significant number of possible solutions to determine where various combinations of integer numbers of L1 wavelengths to each satellite intersect within the search volume.

Heading data references the vector formed from the primary GPS antenna phase center to the secondary GPS antenna phase center.

Note: The Crescent VS100 RTK algorithm only uses GPS to calculate heading. Differential corrections are not used in this calculation and will not affect heading accuracy.

Supplemental Sensors

The Crescent VS100 contains an integrated tilt sensor and gyro, which are enabled by default. Each supplemental sensor may be turned on or off individually; however, the full functionality of the Crescent VS100 system is realized only when both are used. Each supplemental sensor is inside the Crescent VS100 enclosure, mounted on the internal printed circuit board.

Both sensors act to reduce the RTK search volume, which improves heading startup and reacquisition times. This also improves heading reliability and accuracy by eliminating other possible erroneous solutions.

The GPS Technical Reference manual describes the commands and methodology required to recalibrate, query or change the status of these sensors.

Tilt aiding - The Crescent VS100's internal tilt sensor (accelerometer) is enabled by default and is factory calibrated. The tilt sensor constrains the RTK heading solution beyond the volume associated with just a fixed antenna separation. It is able to do so since the Crescent VS100 knows the approximate inclination of the secondary antenna with respect to the primary antenna.

The search space defined by the tilt sensor is reduced to a horizontal ring on the surface of the sphere. By reducing the search

volume, startup and reacquisition times are considerably decreased. (See Figure 1-3.)

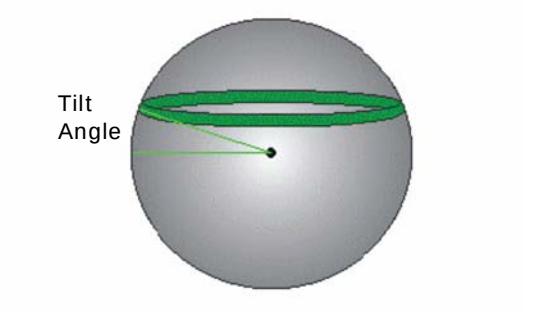


Figure 1-3. Crescent VS100's tilt aiding.

Gyro aiding - The gyro initializes and calibrates itself when power is turned on. Alternately, you can manually calibrate it as outlined in the GPS Technical Reference manual. When the gyro is first initializing, the dynamics the gyro experiences **MUST BE SIMILAR** to the regular operating dynamics.

For example, if you will be using the Crescent VS100 on a high-speed, maneuverable craft, you must use the receiver under highly dynamic conditions for the first 5 to 10 minutes after turning on power, rather than sitting stationary.

The Crescent VS100's internal gyro offers two benefits.

1. It shortens reacquisition times when a GPS heading is lost due to obstruction of satellite signals. The gyro reduces the search volume required for solution of the RTK by providing a relative change in angle since the last computed heading. When used

in conjunction with the tilt sensor, the search space is reduced to a wedge-shaped range. (See Figure 1-4.)

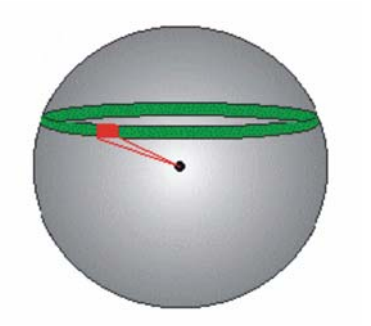


Figure 1-4. Crescent VS100's gyro aiding.

2. It also provides an accurate substitute heading for a short period (depending on the roll and pitch of the vessel), ideally seeing the system through to reacquisition. The gyro will provide an alternate heading source accurate to within 1° for up to 3 minutes if either antenna loses GPS.

   If the outage lasts longer than 3 minutes, the Crescent VS100 will assume the gyro readings have drifted too far and it will begin outputting null fields in the heading output messages. This 3-minute time-out period is fixed and cannot be changed.

Time Constants

The Crescent VS100 incorporates customizable time constants that can provide a degree of smoothing to the heading, course-over-ground and speed measurements.

Depending on the expected dynamics of the vessel, you may wish to adjust these parameters. For instance, if the vessel is very large and is not able to turn or pitch quickly, increasing this time is reasonable. The resulting values would have reduced "noise,"

resulting in consistent values with time. However, artificially increasing this value such that it does not agree with a more dynamic vessel could create a lag in measurements. Formulas for determining the level of smoothing are located in “6: Customizing Settings” on page 31. If you are unsure on how to set this value, it is best to be conservative and leave it at the default setting.

Heading - The heading time constant allows you to adjust the level of responsiveness of the true heading measurement provided in the $HEHDT and $GPHDT messages. The default value of this constant is 2.0 seconds of smoothing when the gyro is enabled. The gyro is enabled by default, but can be turned off. If you turn off the gyro, the equivalent default value of the heading time constant is 0.5 seconds of smoothing. However, if you turn off the gyro, you will need to enter this heading constant manually. Increasing the time constant will increase the level of heading smoothing.

Pitch - The pitch time constant allows you to adjust the level of responsiveness of the pitch measurement provided in the $PSAT,HPR message. The default value of this constant is 0.5 seconds of smoothing. Increasing the time constant will increase the level of pitch smoothing.

Heading rate - The heading rate time constant allows you to adjust the responsiveness level of the rate of heading change measurement provided in the $HEROT message. The default value of this constant is 2.0 seconds of smoothing. Increasing the time constant will increase the level of heading smoothing.

Course-over-ground (COG) - The course-over-ground (COG) time constant allows you to adjust the level of responsiveness of the COG measurement provided in the $GPVTG message. The default value of this constant is
0.0 seconds of smoothing. Increasing the time constant will increase the level of COG smoothing. COG is computed using the

primary GPS engine only, and its accuracy is dependant upon the speed of the vessel (noise is proportional to 1/speed). When stationary, this value is invalid.

Speed - The speed time constant allows you to adjust the level of responsiveness of the speed measurement provided in the $GPVTG message. The default value of this parameter is 0.0 seconds of smoothing. Increasing the time constant will increase the level of speed measurement smoothing.

2: Unpacking the Crescent VS100

Overview

Crescent VS100 Series Parts List

Overview

Please look over the parts shipped with your system. If anything is damaged due to shipping, please contact your freight carrier. If any parts are missing, please contact your dealer.

Figure 2-1. Crescent VS100 series system parts diagram.

CRESCENT VS100 SERIES PARTS LIST

Table 2-1: Crescent VS100 Series Parts List

Diagram Letter	Part Name	Qty	Part Number
Not pictured	Marketing CD (Includes user guide)	1	0132-0127
A	Crescent receiver model (1 of the following): VS100 VS110	1	 803-3014 803-3015
B	Receiver mounting bracket (2 brackets)	1	710-0056
C	*A10 antenna	2	804-0045
D	Antenna magnetic mount	2	725-0007
E	Antenna cable (TNC-TNC), 3 m	2	052-0004
F	Data serial cable (DB9-DB9), 3 m	2	050-0011
G	Power cable, 3 m	1	054-0009

***Note:** Depending on the version of the Crescent VS100 series you purchased, you may have a different antenna model. However, the mounting instructions apply to all antenna installations.

3: Installing the Crescent VS100

Mounting the Antennas
Mounting the Receiver
Connecting the Cables

MOUNTING THE ANTENNAS

Selecting the Antenna Orientation

The Crescent VS100 series GPS compass can be installed:

- to read heading and *pitch,* or
- heading and *roll.*

The relation of the antennas to the boat's axis determine whether the Crescent VS100 will output pitch or roll readings in addition to heading.

Pitch - Installing for heading and pitch is the most common installation. Orienting the antennas parallel to, and along the centerline of, the axis of the boat will provide a true heading.

You can enter a heading bias in the Crescent VS100 to calibrate the physical heading to the true heading of the boat if using a gyrocompass.

Roll - Installing for heading and roll is an alternate installation. Orienting the antennas perpendicular to, and along the centerline of, the axis of the boat will provide roll readings.

Note: If you choose this installation, you will need to enter a heading bias in the Crescent VS100. The heading bias will be either $+90^{\circ}$ if the antennas face port, or -90° if the antennas face starboard.

Planning the Optimal Antenna Placement

Optimal antenna placement is important to obtain a high-precision GPS reading. Antennas must be placed:

- with a clear view of the horizon
- away from other electronics and antennas
- along the centerline of the vessel

Warning!

The Crescent VS100 will not translate its position to the vessel's centerline if not installed along the centerline.

- on a level plane
- at a maximum separation of 2.0 m (default is 0.5 m)
- away from radio frequencies and as high as possible

See Figure 3-1 through Figure 3-3 for examples.

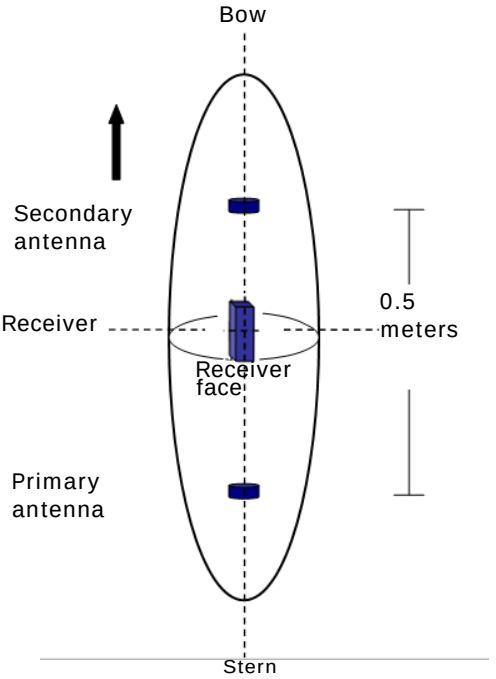


Figure 3-1. Heading and pitch installation: top-down view of boat.

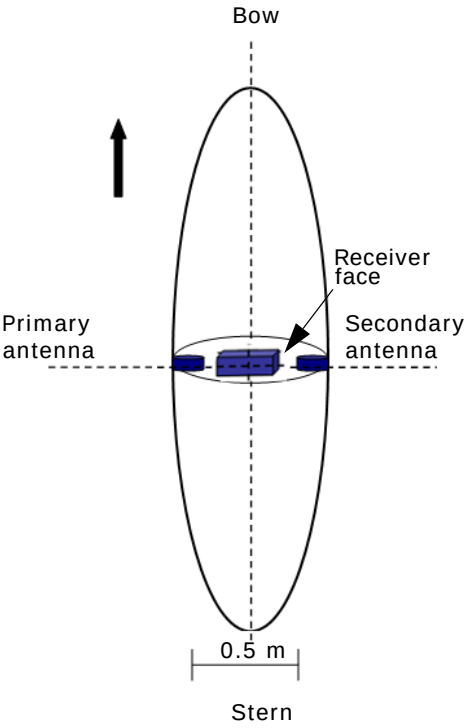


Figure 3-2. Heading and roll installation: top-down view of boat.

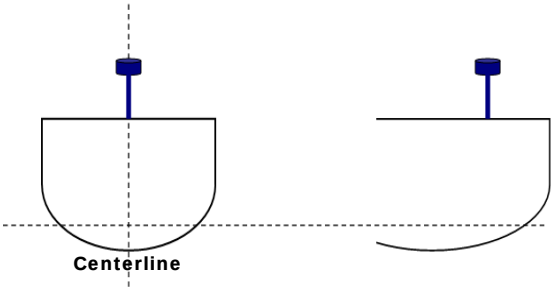


Figure 3-3. Antenna installation: Cross-section of boat.

Mounting the Antennas

The antennas may be mounted with a magnetic mount, pole mount or rail mount configuration.

The antennas are secured to the mounting bracket using 1-14-UNS-2B threaded mounts. These brackets are located beneath the mass center of the antennas in order to resist vibration modes.

Warning!

The maximum allowable antenna separation is 2.0 m. Any increase beyond this limit may result in an incorrect heading.

Magnetic Mounting - Magnetic mounts are optional. They may simplify antenna mounting for certain installations, such as portable systems for harbor and waterway pilots.

To install the antennas using the magnetic mounts:

1. Select a location and orientation that meets the requirements listed in “Selecting the Antenna Orientation” and “Planning the Optimal Antenna Placement” on page 22 and page 23.

2. Thread the magnetic mount into the mounting bracket on the bottom of the antenna. **Hand tighten only.**

Warning!

When threading the magnetic mounts, **hand-tighten only**. Damage resulting from over-tightening is not covered by warranty.

3. Ensure that the antenna is secure in its mounting position.

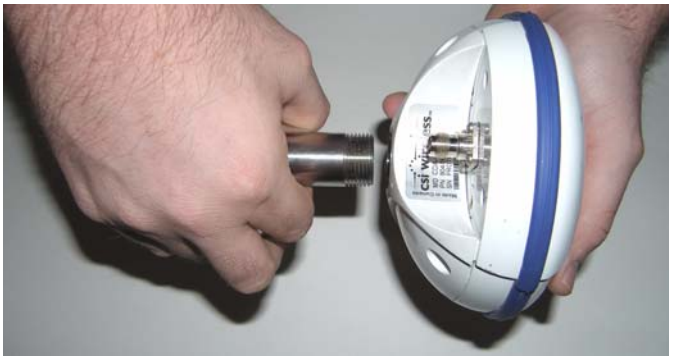
Note: The metal disk and adhesive foam pad (included with the magnetic mount) can be used on non-magnetic surfaces. Follow steps 1 and 2, above. Then, attach the foam pad to the magnetic disk and place in your desired location. Finally, place the assembled antenna and magnetic mount on the magnetic disk.

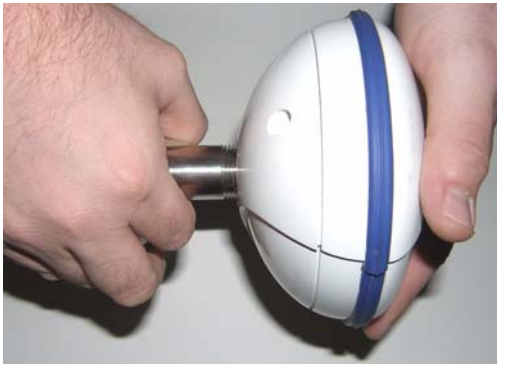
Pole Mounting - Alternately, you may pole-mount the antennas using existing hardware on your vessel.

To mount the antenna on a pole mount bracket:

1. Select a location and orientation that meets the requirements listed in “Selecting the Antenna Orientation” and “Planning the Optimal Antenna Placement” on page 22 and page 23.

2. Thread the pole mount into the mounting bracket on the bottom of the antenna**. Hand tighten only.**





Warning!

When threading the pole mounts, **hand-tighten only**. Damage resulting from over-tightening is not covered by warranty.

Note: The pole shown in the photos is not included.

3. Mark and drill any mounting holes necessary for the pole mounts.

Rail Mounting - Alternately, you may rail mount the antennas using existing hardware on your vessel.

To rail mount the antennas:

1. Select a location and orientation that meets the requirements listed in “Selecting the Antenna Orientation” and “Planning the Optimal Antenna Placement” on page 22 and page 23.
2. Use appropriate hardware to securely attach the antenna to the railing.

Routing and Securing the Antenna Cable

To route and secure the antenna cables, please review the following guidelines.

- The two enclosed antennas each require a 50 Ω impedance antenna extension cable such as RG-58U (up to a maximum of 15 m (49 ft.) in length) for proper operation.
- The GPS engine inside the Crescent VS100 requires a minimum input gain of 10 dB (and maximum of 40 dB before saturation will occur). The antennas offer 28 dB of gain, so the loss budget to accommodate for cable losses is 18 dB.
- Regardless of the cable material and length that you choose, you must ensure that cable losses are less than 18 dB of attenuation. Due to variances in the antenna gain and practical attenuation of cable materials and connectors, we recommend reducing this budget to 15 dB. This budget of 15 dB is present to overcome the resulting attenuation of an RF cable.

- When deciding on an antenna location, consider the amount of cable required. Keep in mind that a longer cable of the same material will result in a higher loss than a shorter one. If the overall loss of the longer cable exceeds 15 dB, the cable material will need to be changed. This normally means a more expensive material that has a larger diameter and less flexibility. The standard cables that come with the Crescent VS100 are of an RG58 material family. Their attenuation is approximately 0.8 dB/m. Including connector losses, the nominal loss of these RF cables is approximately 10 dB, which is within the tolerable loss budget. If a 15 m or 20 m cable run is required, an RG8 variety is available. If lengths longer than 20 m are required, more sophisticated materials will be required.

For more information on cable length or low-loss cable, please contact your Hemisphere GPS dealer or Hemisphere GPS Technical Support. The following is a short summary of other readily available cable materials that have 50 Ω impedance. Cable loss cited below does not include any connector losses.

Table 3-1: Cable Loss

Material	**Loss at GPS L1 (1.575 GHz)**
RG58	0.78 dB / m
RG8	0.36 dB / m
Times Microwave LMR400	0.15 dB / m

Warning!

When choosing a route for the antenna extension cable:

- Avoid running cables in areas of excessive heat.
- Keep antenna cables away from corrosive chemicals.
- Do not run the extension cable through door or window jams.
- Keep the antenna cable away from rotating machinery.
- Do not bend excessively or crimp the antenna extension cable.
- Avoid placing tension on the cable.
- Remove unwanted slack from the antenna extension cable at the receiver end.
- Secure along the cable route using plastic tie wraps.

Warning!

The Crescent VS100 receiver provides 5 VDC across the antenna ports. Connection to incompatible devices may result in damage to equipment.

Warning!

Improperly installed cables near machinery can be dangerous.

Mounting the Receiver

Selecting the Receiver Orientation

The Crescent VS100 must be installed:

- inside and away from the elements, and in a location that minimizes vibration, shock, extreme temperatures and moisture
- horizontally
- with the face of the receiver facing the secondary antenna
- so the front panel (menu screen, LEDs and buttons) is visible and accessible
- so the back panel is visible and accessible to switch out cables and turn power on and off

Mounting the Crescent VS100

Use the enclosed mounting kit to mount the receiver. To install the brackets for mounting:

1. Slide the nuts through the opening along both sides of the receiver.

2. Place the bracket alongside the receiver and insert the screws so they screw into the nuts.

3. Screw down the brackets in your desired location.

CONNECTING THE CABLES

This section contains instructions for connecting the cables for:

- power
- serial ports

Please review the following warnings before connecting the cables.

Warning!

- Do not run cables in areas of excessive heat.
- Keep cables away from corrosive chemicals.
- Do not run the extension cable through door or window jams.
- Keep cables away from rotating machinery.
- Do not bend excessively or crimp cables.
- Avoid placing tension on cables.
- Remove unwanted slack from the extension cable at the receiver end.
- Secure along the cable route using plastic wraps.

Connecting the Power Source

The power source for the Crescent VS100 must be between 9 - 36 Volts.

Use the Power cable (Part no. 054-0009) to connect the connector labeled “Ground” to your power source.

Selecting a Port for GPS Data Message Output

The serial ports of the Crescent VS100 operate at the RS-232C interface level to communicate with external data loggers, navigation systems and other devices.

There are two ports available on the back panel of the Crescent VS100 using a standard DB9 socket connection.

Figure 3-4. Port connections on the Crescent VS100.

The available ports and associated default baud rates, NMEA message types and update rates are shown in Table 3-2 .

Table 3-2: Default Data Messages by Port

Port	Baud Rate	NMEA Messages	Update Rate
A, B	19,200	GGA, GSV	1 Hz

Ports A and B have the connections detailed below on the DB9 socket.

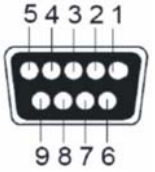


Table 3-3: Pin Connections for Ports A and B

Pin	Signal	Description
2	TXD	NMEA 0183, binary, and RTCM input
3	RXD	NMEA 0183, binary, and RTCM output
5	Signal Ground	Signal return
6	Mark Input	Event marker input
9	1 PPS	Timing output

After selecting the physical connection, you will need to select the desired NMEA data messages if different from the defaults shown above.

Select the desired NMEA message types and update rates by port using the Configuration Wizard (see “4: Setting Up the Crescent VS100”).

4: Setting Up the Crescent VS100

INTRODUCTION

These instructions are for configuring the Crescent VS100 settings using the interface on the Crescent VS100 receiver. A Configuration Wizard on the receiver itself walks you through setup options.

The Configuration Wizard allows you to save up to five different configuration settings if using this product on different vessels or for different applications.

If using a personal computer, you may also use Hemisphere GPS' PocketMax software, which was included on your CD. Please refer to the PocketMax guide for help using PocketMax.

Turning the Crescent VS100 On/Off

Turn the Crescent VS100 “ON” using the ON/OFF Power toggle switch on the rear panel.

Figure 4-1. Turn the Crescent VS100 on at the Power toggle switch.

SETTING BASIC OPTIONS

Introduction

The Configuration Wizard option appears in the display on the front panel of the Crescent VS100.

This section covers the basic items you need to set in the Configuration Wizard to get up and running.

Figure 4-2 shows the Configuration Wizard.

Note: Basic setup assumes that you are using the following defaults:

- antennas are installed parallel to, and along the centerline of, the boat's axis
- antennas are separated by 0.5 meters

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

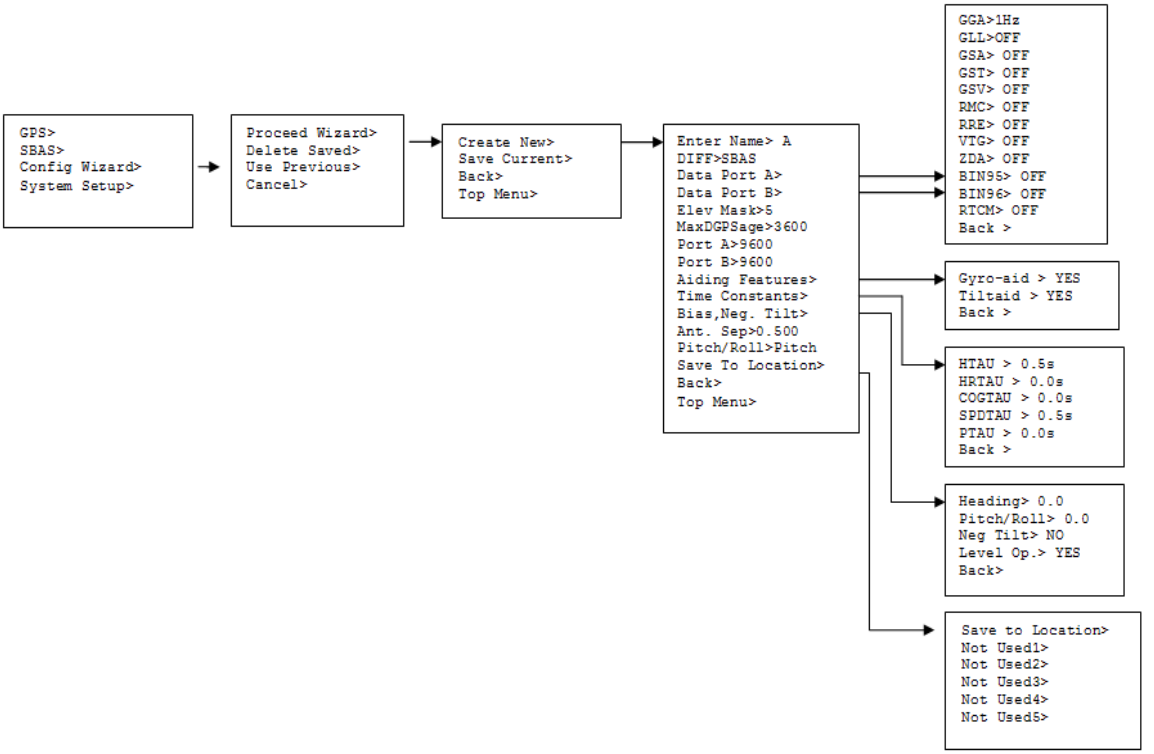


Figure 4-2. Configuration Wizard.

Perform the following steps using the Configuration Wizard.

1. Select the Configuration Wizard
2. Select “Proceed with Wizard”
3. Select “Create New” to create a New Configuration
4. Enter the Name of the Configuration
5. Select a DGPS Source

6. Select the GPS Data Message Output
7. Configure the Elevation Cutoff Angle
8. Set the Maximum DGPS Age (Optional)
9. Configure the Baud Rate
10. Configure Aiding Features (Optional)
11. Configure Time Constants (Optional)
12. Input the Heading Bias (Optional)
13. Input the Bias for Pitch or Roll (Optional)
14. Select the Antenna Separation (Optional)
15. Configure the Crescent VS100 for Pitch or Roll
16. Save Your Settings

1. Select the Configuration Wizard

Select the “Config Wizard” option from the main menu.

2. Select “Proceed Wizard”

In this submenu, you can select from the following options:

- proceed with the wizard
- use a previous configuration
- delete a saved configuration

3. Select “Create New” to Create a New Configuration

You may alternately save the current receiver configuration if you have modified the receiver setup through other menu items or via the COM port.

4. Enter the Name of the Configuration

To enter a name to save your current setting under:

a. First, use the arrow keys to select a letter and then press the enter key to save the letter. The cursor will move to the right.

b. Enter a blank character at the end of your name until the “Enter” character appears at the end of the name.

c. When you are finished, press the enter key again.

After entering the configuration name, the first few letters of the name will be displayed on the previous menu.

5. Select a DGPS Source

The default DGPS source is SBAS. If using a differential source other than SBAS, please select it here.

Options are: SBAS, *Beacon, Autonomous, External RTCM, **e-Dif, and **L-Dif

**Beacon is only available on the VS110.*

***Only available if purchased with this configuration.*

6. Select the GPS Data Message Output

Select the desired message type for the desired port.

7. Configure the Elevation Cutoff Angle

You may set the elevation cutoff angle between 0° and 45°. The default value is 5°.

8. Set the Maximum DGPS Age (Optional)

The maximum DGPS age is 2700 seconds (45 minutes) by default. If you need a shorter or longer DGPS age, set it here.

9. Configure the Baud Rate

If the default baud rate on the desired port does not match that of the external device you are connecting to, you will need to set it here.

Available values: 4,800; 9,600; 19,200; 38,400; 57,600; *115,200

***Note**: 115,200 baud has no PocketMax support.

10. Configure Aiding Features (Optional)

While the default settings will work for most users, you can configure the aiding features to reduce heading startup and reaquisition times.

Customers who may want to configure aiding features include those with a large, slow-to-turn vessel, or those with a small, dynamic vessel.

To configure the aiding features, see “6: Customizing Settings”.

11. Configure Time Constants (Optional)

While the default settings will work for most users, you can configure the time constants to reduce heading start up and reaquisition times.

Customers who may want to configure aiding features include those with a large, slow-to-turn vessel, or those with a small, dynamic vessel.

To configure the time constants, see “6: Customizing Settings”.

12. Input the Heading Bias (Optional)

If you did not install the antenna’s parallel to and along the boat’s centerline, enter a heading bias (-180° — +180°) to compensate for any offset.

Note: If you installed the antennas for roll (perpendicular to the boat’s axis), rather than pitch, you must enter the heading bias (+/- 90°).

You must also enter the bias for roll (see below).

13. Input the Bias for Pitch or Roll (Optional)

Enter the bias for pitch or roll (-15° - +15°) to compensate for any offset from the boat’s centerline.

14. Select the Antenna Separation (Optional)

If you did not install the antennas 0.5 meters apart, enter the actual antenna separation here.

Available range: 0 - 2.0 meters

15. Configure the Crescent VS100 for Pitch or Roll (Optional)

Pitch is the default installation for most users. If you installed the Crescent VS100 to read roll, select “Roll” here.

16. Save Your Settings

a. After selecting the “Save to Location” option at the end of the Configuration menu, you will be prompted for a location to save your configuration.

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

c. After saving your configuration, you must re-enter the Configuration Wizard and select the configuration to use. (This way, you may continue to enter different receiver configurations without upsetting the current operation of the receiver.)

5: Operating the Crescent VS100

INTRODUCTION

Operating the Crescent VS100 is simple. Turn it on and you're ready to go!

Most users connect the Crescent VS100 to their existing navigation system during installation. These users will receive the Crescent VS100's position and heading updates through the interface of their existing system.

The interface on the front panel of the Crescent VS100 is helpful for configuring or changing system settings. In addition, the LEDs on the panel will notify you in the event of a GPS or DGPS signal loss.

INITIALIZING THE SYSTEM

Turn the Crescent VS100 “ON” using the ON/OFF Power toggle switch on the rear panel.

Figure 5-1. Turn the Crescent VS100 on at the Power toggle switch.

The main menu screen will appear in the display on the front panel the first time you boot up (Figure 5-2). See “4: Setting Up the Crescent VS100” for help configuring your system.

Warning!

When the gyro is first initializing, the dynamics the gyro experiences MUST BE SIMILAR to the regular operating dynamics.

For example, if you will be using the Crescent VS100 on a high speed, maneuverable craft, you must use the receiver under highly dynamic conditions for the first 5 to 10 minutes after turning on power, rather than sitting stationary.

When the following LEDs are illuminated, you have signal lock for:

Figure 5-2. Crescent VS100 front panel.

For additional menu options, please see “B: Menu Map” in the Appendix.

VIEWING GPS/DGPS STATUS

Most users will receive position and heading information through their on-board navigation system. If you have not connected the Crescent VS100 to an existing navigation system, or are troubleshooting your unit, you may need to view GPS, DGPS or Beacon status on the Crescent VS100's display screen.

Do I Have a Signal?

Figure 5-2 shows which LEDs on the Crescent VS100 will indicate GPS, DGPS or Beacon signal lock when illuminated.

If you do lose the differential signal lock, the Hemisphere GPS COAST technology allows the Crescent VS100 to perform well for up to 45 minutes with old correction data. The amount of time you can "coast" depends on the degree of tolerable drift.

Note: In order to obtain a full set of SBAS corrections, the Crescent VS100 must receive the ionospheric map over a period of a few minutes. After this, the receiver can "coast" until the next set of corrections has been received.

How Good is the Quality of My Signal?

In addition to the LED indicators for signal lock, the Crescent VS100's display screen indicates the *quality* of your signal.

The bar chart shows an indication of the quality of the GPS and DGPS (or if applicable, Beacon) signal. The first group of bars

shows the GPS signal; the second group of bars shows the DGPS or Beacon signal.

Each bar represents a distinct channel and its associated signal quality. The higher the bar, the better the signal.

Note: If using autonomous or external correction mode, the DGPS signal indicator will not appear in the display.

DGPS (SBAS) - The differential correction (or SBAS) signal indicator reflects the quality of each satellite signal, or the Bit Error Rate (BER).

A full bar height reflects a signal lock and a BER of 0. A bar height only 2 pixels tall reflects a signal loss, or a BER of 500 or greater. Bar heights in between reflect intermediate degrees of signal quality.

For example, if using WAAS, there are two satellites available, so two BERs are provided.

Beacon - The Beacon indicator reflects the quality of the Beacon signal, or the signal strength (SS) and the signal-to-noise ratio (SNR).

A full bar height reflects a signal lock and an SS of 35 or greater, and an SNR of 24 or greater. A bar height only 2 pixels tall reflects a signal loss, or SS and SNR values of 0. Bar heights in between reflect intermediate degrees of signal quality.

If using Beacon, the first bar indicates SS signal quality; the second bar indicates SNR signal quality.

Troubleshooting a Signal Loss

With the Hemisphere GPS COAST and e-Dif technologies, you should be able to continue working in the event of a GPS or DGPS signal loss.

General Troubleshooting Checklist (GPS, DGPS, and Beacon)

- Check antenna connections.
- Verify antennas have an unobstructed view of the sky.
- Verify the lock status of the satellites.
- Confirm baud rates match external source.
- Verify the differential source.

Beacon

In addition to checking the above general items, check the following:

- Verify that the receiver is tuned to the correct frequency and bit rate.
- Verify antennas are away from potential sources of interference.
- Ensure Beacon signal coverage is available in your area.

External RTCM

In addition to checking the above general items, check the following:

- Verify the pin-out between the RTCM source and the RTCM input port (transmit from the source must go to receive of the RTCM input port and grounds must be connected).
- Verify that the baud rate of the RTCM input port matches the baud rate of the external source.
- Ensure corrections are being transmitted to the correct port.

Troubleshooting Heading

In the event of no heading or incorrect heading values, use the following checklist:

- Verify that the primary antenna faces the bow, and the secondary antenna faces the stern (Heading is from Primary to Secondary antenna).
- Check the measurement of the antenna separation. The Measured (MSEP) and Calculated (CSEP) values are in meters, and should agree to within 1 centimeter. CSEP will continuously change, so you should average this reading over a few minutes to obtain an approximate value.

Note: The standard antenna mounting configuration provides 0.5° heading accuracy of 95%. If you require more performance, you will need to increase the antenna separation (maximum recommended separation is 2.0 meters).

- Reduce antenna separation – the separation between the antennas must remain below 2 meters for accurate and timely heading reading output.
- Verify that GYROAID is enabled (default setting) this will give heading for up to 3 minutes in times of GPS signal loss.
- Verify that TILTAID is enabled (default setting) to reduce heading search times.
- Monitor the number of satellites and SNR values for both antennas. At least 3 satellites should have SNR values above 20.
- Verify antenna connectors are facing in the same direction.

6: Customizing Settings

INTRODUCTION

While the default settings will work for most users, you can configure the aiding features to further reduce heading start up and reaquisition times.

Customers who may want to configure aiding features include those with a large, slow-to-turn vessel, or those with a small, dynamic vessel.

DISABLING THE TILT AID

The Vector Sensor's tilt aid (accelerometer) is enabled by default and constrains the RTK heading solution to reduce startup and reaquisition times.

The tilt aid is pre-calibrated at the factory. However, if you experience any tilt measurement offset, you can recalibrate the tilt sensor from the main "Vector" menu. Be sure that the receiver is perfectly level before recalibrating the tilt aid.

The only times you might need to disable the tilt aid feature are:

- if you were unable to install the Crescent VS100 in a level plane with the antennas. The tilt aid (or tilt sensor) is located inside of the Crescent VS100, so it is important that the Crescent VS100 be installed in a horizontal plane.

Warning!

If you were unable to install the Crescent VS100 in a horizontal plane with the antennas, you MUST DISABLE tilt aid.

- if troubleshooting, to ensure the receiver is working properly.

You can turn the tilt aiding feature off either through the Configuration Wizard or through the main Vector menu.

DISABLING THE GYRO AID

The Crescent VS100's internal gyro aid is enabled by default. The gyro:

- shortens reaquisition times when a GPS heading is lost, due to obstruction of satellite signals, by reducing the search volume required for the RTK solution
- provides accurate substitute headings for a short period (depending on the roll and pitch of the vessel) ideally seeing you through to reacquisition

The only time you might need to disable the gyro aid is if troubleshooting, to ensure the receiver is working properly.

Warning!

Do not exceed turn rates of 90 degrees-per-second! The Crescent VS100 uses gyro measurements to obtain a heading rate measurement, and the gyro cannot measure rates beyond this rate.

You can turn the gyro aiding feature off either through the Configuration Wizard or through the main Vector menu.

CONFIGURING THE TIME CONSTANTS

The Crescent VS100 default settings are fine for most users. If desired, you can set the following time constants to further smooth heading, course-over-ground and speed measurements.

Table 5-1 below provides an overview of the time constant values that you can set in the Configuration Wizard, including the formulas for figuring out the optimal value of each time constant for your particular vessel.

For further details, please consult the Hemisphere GPS manual: GPS Technical Reference.

Table 5-1: Time Constants

Time Constant	Purpose	Range	Formula
HTAU (Heading)	Adjusts the responsiveness to true heading. If vessel is large and unable to turn quickly, you may want to increase this value.	2.0 s with gyro enabled (default) 0.0 to 60 s	htau (s) = 40/max rate of turn ($^{\circ}$/s) (with gyro ON) htau (s) = 20/max rate of turn ($^{\circ}$/s) (with gyro OFF)
HRTAU (Heading Rate)	Adjusts the responsiveness to the rate of heading change. If vessel is large and unable to turn quickly, you may want to increase this value.	2.0 s with gyro enabled (default) 0.0 to 60 s	hrtau (s) = max rate of turn ($^{\circ}$/s^2)/10

Table 5-1: Time Constants

Time Constant	Purpose	Range	Formula
COGTAU (Course-Over-Ground)	Adjusts the responsiveness to the course-over-ground measurement. If vessel is small and dynamic, leave this value at 0.0 s to be conservative. If the vessel is large and resistant to motion, you may want to increase this value.	0.0 s (default) 0.0 to 60 s	cogtau (s) = max rate of change of course (^{o}/sec)/10
SPDTAU (Speed)	Adjusts the responsiveness to speed. If vessel is small and dynamic, leave this value at 0.0 s to be conservative. If the vessel is large and resistant to motion, you may want to increase this value.	0.0 s (default) 0.0 to 60 s	spdtau (s) = max acceleration (m/s^2)/10
PTAU (Pitch)	Adjusts the responsiveness to pitch. If vessel is large and unable to pitch quickly, may want to increase this value.	0.5 s (default) 0.0 to 60 s	ptau (s) = 10/max rate of pitch (^{o}/s)

APPENDIXES

A: FAQs

B: Menu Map

C: Specifications

A: FAQs

This section covers power, communication and external RTCM questions. For GPS and Heading troubleshooting, please see “5: Operating the Crescent VS100”.

Q: Can the COAST technology work with corrections from an external source?

A: Yes, the Crescent VS100 will operate in a similar fashion with the COAST technology as when using SBAS or Beacon corrections. However, SBAS corrections have the advantage that they are separated into separate error components, allowing the Crescent VS100 to anticipate how errors will change over the coasting period with more consistent accuracy and for a longer period than regular RTCM range corrections.

Q: My Crescent VS100 doesn’t appear to be communicating, what do I do?

A: This could be one of a few issues:

- Examine the power cable and its connector for signs of damage.
- Ensure that you are properly powering the system with the correct voltage (9 to 36 Volts) by measuring the voltage at the receiver end of the power cable when the cable is connected to the power source.
- Check current restrictions imposed by power source (minimum available should be > 1.0 A).
- Verify that the LCD has turned on, that time is incrementing in the upper right-hand corner of the display and configure the COM port baud rates appropriately through the menu system.
- Verify polarity of power leads.

- Check 1.0 A in-line power cable fuse.
- Since you're required to terminate the power input with your choice of connector, ensure that you have made a good connection to the power supply.
- Consult the troubleshooting section of the other device's reference manual to determine if there may be a problem with that equipment.

Q: Am I able to configure the two serial ports with different baud rates?

A: Yes, the ports are independent. For instance, you may have one port set to 4,800 and the other to 19,200, or vice versa.

Q: Am I able to have the Crescent VS100 output different NMEA messages through the two ports?

A: Yes, you may have different NMEA messages turned on for the two serial ports. Further, these NMEA messages may also be at different update rates.

Q: How can I determine what the current configuration of the Crescent VS100 is?

A: You can view the current configuration from various screens of the menu which show all configurable items of the receiver. Alternately, you may return the receiver to a previously saved configuration by selecting **Config Wizard -> Use Previous** to return to a known configuration.

Q: My Crescent VS100 doesn't appear to be using corrections from an external correction source, what could be the problem?

A: This could be due to a number of issues:

- Make sure that the corrections are of an RTCM SC-104 protocol.
- Check to see that the baud rates of the port used by the Crescent VS100 matches that of the external correction source.

- The external correction source should be using an 8 data bit, no parity, and 1 stop bit serial port configuration.
- Inspect the cable connection to ensure there's no sign of damage.
- Check the pin-out information for the cables to ensure that the transmit line of the external correction source is connected to the receive line of the Crescent VS100's serial port and that the signal grounds are connected.

Save the configuration as the profile named "RTCM" in the Configuration Wizard, cycle the power and load the RTCM profile.

Q: Why am I not getting data from the Crescent VS100?

A: This could be due to the following:

- Check receiver power status LED to ensure that the receiver is powered
- Verify that Crescent VS100 is locked to a valid DGPS signal (this can often be done on the receiving device or with PocketMAX)
- Verify that Crescent VS100 is locked to GPS satellites (this can often be done on the receiving device or with PocketMAX)
- Check integrity and connectivity of power and data cable connections

Q: Why am I getting random data from Crescent VS100?

A: This could be due to the following:

- Verify that the RTCM or the Bin95 and Bin96 messages are not being output accidentally (send a $JSHOW command)
- Verify baud rate settings of Crescent VS100 and remote device match correctly

- Potentially, the volume of data requested to be output by the Crescent VS100 could be higher than the current baud rate supports. Try increasing the baud rate to 38,400 for all devices or reduce the amount of data being output.

B: Menu Map

There are five main menus available from the start-up screen of the Crescent VS100:

- Vector
- GPS
- SBAS
- Configuration Wizard
- System Setup

Vector

The Vector menu allows you to view and adjust Vector settings. Options vary depending on whether Pitch or Roll is selected, and include items such as aiding features, time constants, heading bias and antenna separation.

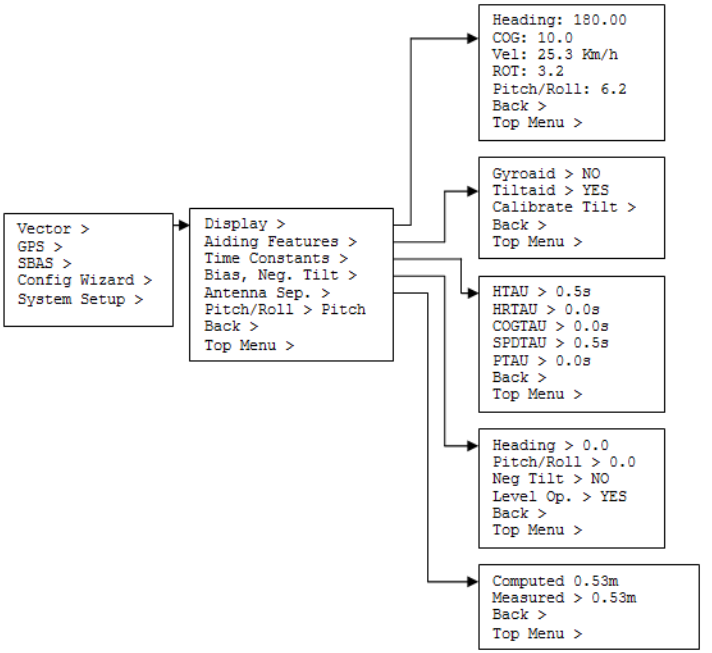


Figure B-1. Vector menu.

GPS

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

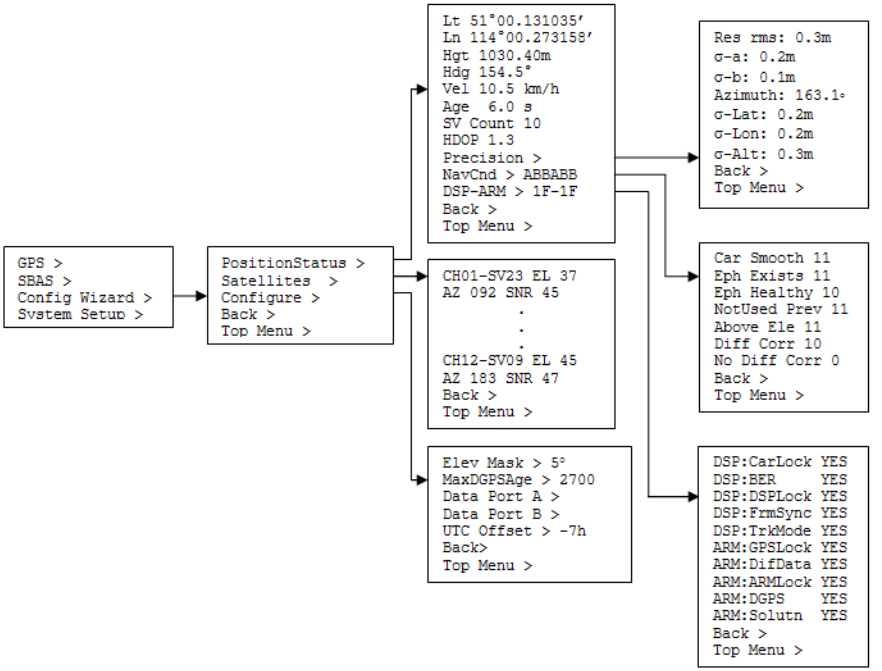


Figure B-2. GPS menu.

SBAS

The SBAS menu allows you to view your differential settings. The name of the differential menu shown in the display reflects your current differential source. So, for example, if you are using SBAS, you will see “SBAS” and the associated menu.

Please find your differential source, below, for available menu options. Differential sources available vary by model and the purchased configuration. Potential options include:

- SBAS
- Beacon
- External RTCM
- Autonomous

From this menu, you can view your current status or adjust satellites tracked.

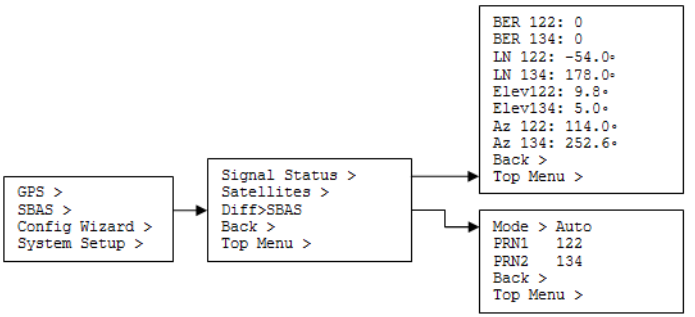


Figure B-3. SBAS menu.

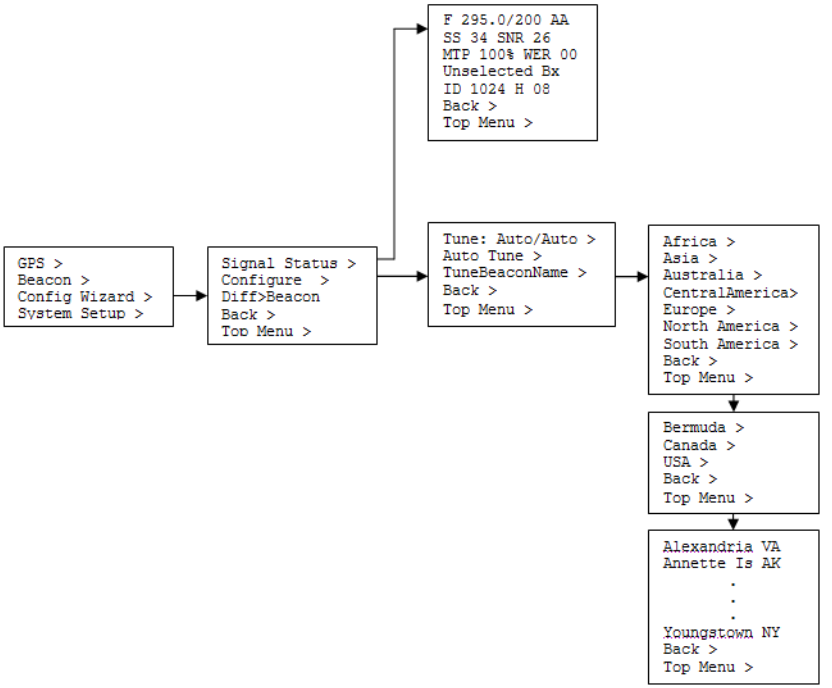


Figure B-4. Beacon menu.

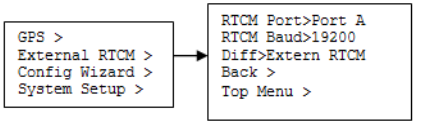


Figure B-5. External RTCM menu.

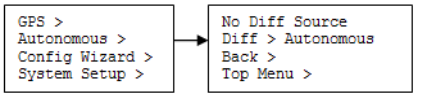


Figure B-6. Autonomous menu.

Configuration Wizard

The Configuration Wizard walks you through basic settings to get up and running. Please see “4: Setting Up the Crescent VS100” to view the Configuration Wizard menu map.

System Setup

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.

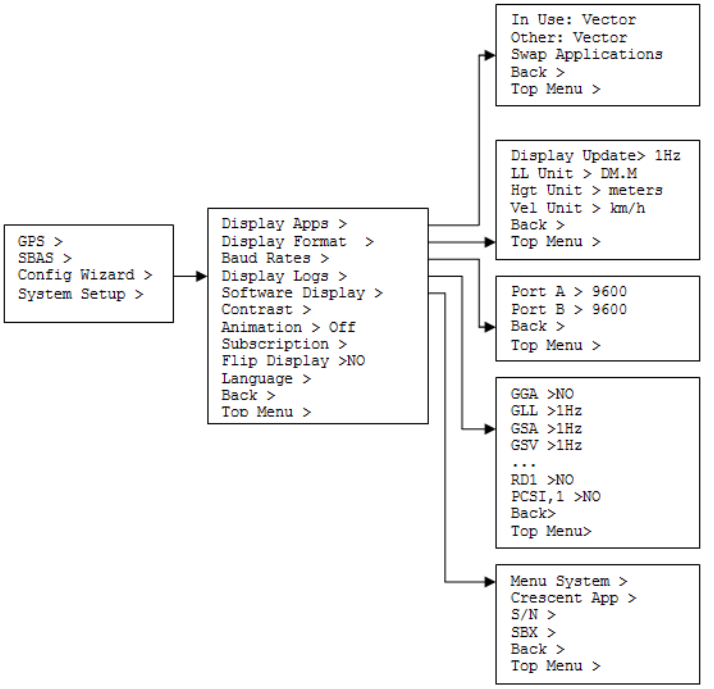


Figure B-7. System Setup menu.

C: SPECIFICATIONS

Crescent VS100 Series Receiver Specifications

Table C-1: GPS Sensor Specifications

Receiver type	L1, C/A code, with carrier phase smoothing
Channels	Two 12-channel, parallel tracking (Two 10-channel when tracking SBAS)
Horizontal accuracy	< 0.6 m 95% confidence (DGPS)* < 2.5 m 95% confidence (autonomous, no SA)**
Heading accuracy	<0.25º rms @ 0.5 m antenna separation <0.15º rms @ 1.0 m antenna separation <0.10º rms @ 2.0 m antenna separation
Update rate (position and heading)	Up to 20 Hz
Pitch/roll accuracy	< 1º rms @ 0.5 m antenna separation
Rate of turn	90º / s max
Start up time	< 60 s typical
Heading fix	< 20 s
Satellite reacquisition	< 1 s

Notes:

*Depends on multipath environment, number of satellites in view, satellite geometry, baseline length (for local services), and ionospheric activity

**Depends on multipath environment, number of satellites in view, and satellite geometry

Table C-2: Beacon Sensor Specifications (VS110)

Channels	2-channel, parallel tracking
Frequency range	283.5 to 325 kHz
Operating modes	Automatic (signal strength or range), manual and database
Compliance	IEC 61108-4 beacon standard

Table C-3: Communication Specifications

Serial ports	2 full duplex
Interface level	RS-232C
Baud rates	4,800 - 115,200
Correction I/O protocol	RTCM SC-104, L-Dif (Hemisphere GPS proprietary)
Data I/O protocol	NMEA 0183, Crescent binary, L-Dif (Hemisphere GPS proprietary)

Table C-3: Communication Specifications

Timing output	1 PPS (HCMOS, active high, rising edge sync, 10 k, 10 pF load)
1 PPS accuracy	50 ns

Table C-4: Environmental Specifications

Operating Temperature	-30°C to +70°C
Storage Temperature	-40°C to +85°C
Humidity	95%, non-condensing

Table C-5: Power Specifications

Power Input Voltage	9 to 36 VDC
Power Consumption	< 5 W
Current Consumption	< 360 mA @ 12 VDC
Antenna Voltage Output	5 VDC
Antenna Short Circuit Protection	Yes

Table C-6: Mechanical Specifications

Dimensions	189 mm L x 114 mm W x 71 mm H (7.4” L x 4.5” W x 2.8” H)
Weight	0.86 kg (1.9 lb.)
Status indication	Power, primary GPS lock, secondary GPS lock, differential lock, and heading lock
Power switch	Miniature push-button
Power connector	2-pin, micro-Conxall
Data connectors	DB9-female
Antenna connectors	TNC-male

A10 Antenna Specifications

Table C-7: GPS Sensor Specifications

GPS Frequency Range	1.575 GHz (L1)
GPS Bandwidth	20 MHz
GPS LNA Gain	30 dB
GPS LNA Noise	1.4 dB typical

Table C-8: Power Specifications

Input Voltage	5-12 VDC
Input Current	20 mA

Table C-9: Mechanical Specifications

Enclosure Polycarbonate Dimensions	146 mm dia. X 80 mm high (5.76” dia. X 3.15” high)
Weight	535 g (1.2 lb.
Mounting Thread	1-14-UNS-2B
Connector	TNC-S
Storage Temperature	-40° C to +85°C
Operating Temperature	-40° C to +85°C
Humidity	100% condensing

INDEX

W

WAAS 2

www.hemispheregps.com
e-mail: info@hemispheregps.com