

Hemisphere
GPS



Crescent A100

User Guide

Part No. 875-0163-000 Rev. C1

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 9 Street S.E.
Calgary, AB, Canada
T2G 3C4

Telephone number: (403) 259-3311
Fax number: (403) 259-8866
E-mail address: sales@hemispheregps.com

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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

7560 East Redfield Road, Suite B
Scottsdale, Arizona 85260
Phone 480.348.9919 Fax 480.348.6370
techsupport@hemispheregps.com
<http://www.hemispheregps.com>

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1: Installation

Features

Installation

Mounting the Crescent A100

Powering the Crescent A100

Connecting Crescent A100 to External Devices

Introduction

Congratulations on buying Hemisphere GPS' new Crescent A100. The Crescent A100 is a smart antenna that tracks GPS and SBAS (WAAS and EGNOS) signals. The Crescent A100 provides sub-meter performance with 50 centimeter accuracy 95% of the time. This chapter provides information on the following:

- Features
- Installation
- Mounting the Crescent A100
- Powering the Crescent A100
- Connecting the Crescent A100 to external devices



Features

The Crescent A100 has several new features that will enhance your product's performance. The main features are:

- 2 RS232 serial ports
- LED
- Radar-simulated pulse output
- CAN communication

RS232 Serial Port

The RS232 serial is used for NMEA 0183, Hemisphere GPS interface protocol, RTCM SC-104 and upgrading firmware. See the general GPS technical reference at www.hemispheregps.com for more detailed information.

LED

The Crescent A100 uses one tri-colored LED:

- Red indicates the power is on
- Amber indicates a GPS lock
- Flashing green indicates DGPS is being acquired
- Green indicates a DGPS solution

Radar-Simulated Pulse Output

The radar-simulated pulse output provides accurate ground speed.



1: Installation

The Crescent A100 uses pin 12 for the speed out pin. Pin 12 will output a square wave with a 50% duty cycle. The frequency of the square wave varies directly with speed. 94 Hz represents a speed of 1 meter per second, or a 28.65 pulse per foot traveled.



Note: Pin 12 does not have any form of isolation or surge protection. You are **STRONGLY** encouraged to incorporate some form of isolation circuitry into your supporting hardware if you wish to utilize the Speed Radar Pulse output.

CAN

The Crescent A100 features Controller Area Network (CAN) to handle communication between CAN-based devices.

The Crescent A100 supports a selection of NMEA 2000 messages that can be broadcast on a CAN bus. Table 1-1 provides a listing of the NMEA 2000 commands that are used.

Table 3-1: NMEA 2000 commands

PGN 129029	GNSSPositionData
PGN 129025	GNSSPositionRapidupdate
PGN 129026	NMEACogSogData



Installation

The Crescent A100 is a smart antenna that tracks GPS and SBAS (WAAS and EGNOS). It utilizes Hemisphere GPS' exclusive COAST™ technology during differential outages. The Crescent A100 is also capable of using Hemisphere GPS' e-Dif® and L-Dif® technology. Figure 1-1 provides a front view of the deutsche connector receptacle's numbering.

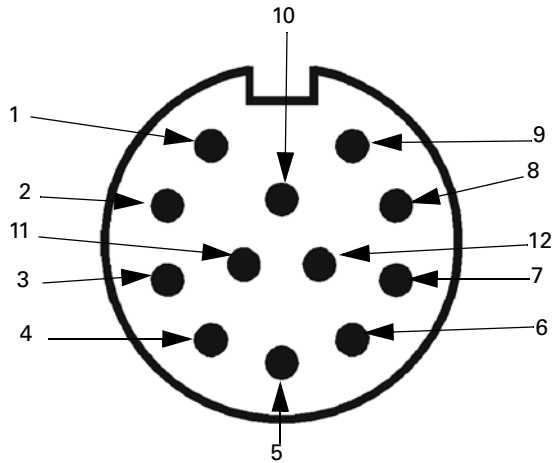


Figure 3-1. Deutsche connector receptacle numbering

Table 1-2 provides the Deutsche connector's pin-outs.

Table 3-2: Deutsche connector's pin-outs

Pin-Out	Function
1	Manual mark in
2	TxB
3	RxB
4	CAN high



Table 3-2: Deutsche connector's pin-outs

Pin-Out	Function
5	Signal Ground
6	TxA
7	One PPS
8	RxA
9	CAN low
10	Power in (12 V)
11	Power ground
12	Speed out

Cable Interface

The cable options include:

- DB9 serial
- Speed
- CAN
- Power

Additional extension cables may be purchased, as necessary, for other installations. This allows the Crescent A100 to be quickly and easily moved from one installation to another. If an extension cable is damaged in the field, it can be replaced without returning the complete Crescent A100 system.

Other power cables are available as accessories to fit a wide variety of applications. See Appendix E for a list of Crescent A100 accessories.



Extension Power/Data Cable

The Crescent A100 system is quickly installed with one of the various extension cables. The location of the extension cable should be made with the following requirements in mind:

- Power leads at the “Y” end must reach a power source.
- The data connector communication port must reach to connect to a data storage device or guidance system.

When choosing a route for the Crescent A100 extension cable:

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



Warning:

Improperly installed cables near machinery can be dangerous.

Crescent A100 Placement

Placement of the Crescent A100 is crucial to the system’s operation. The GPS engine inside the Crescent A100 computes a position based upon measurements from each satellite to the internal GPS antenna unit. Mount the Crescent A100 on your point of interest. When choosing a



1: Installation

location to mount the antenna, please make certain that there is an unobstructed view of the sky available to the Crescent A100 smart antenna. This will ensure that GPS satellites are not masked by obstructions, which can potentially reduce system performance. To place the Crescent A100:

1. Mount the Crescent A100 on, or as close to, the center of your point of measurement.
2. Position the Crescent A100 as high as possible.

Figure 1-2 on page 9 shows the ideal location to place the Crescent A100 on a vehicle.





Figure 1-2. Crescent A100 placement on a vehicle



Mounting the Crescent A100

The Crescent A100 can be mounted in several ways:

- Magnetic mount
- Surface mount
- Pole mount

Magnetic Mount

The magnetic mount can be screwed into the bottom of the Crescent A100 and mounts to metal surfaces. A metal disc and foam adhesive are included with each magnetic mount. Use the foam adhesive to bond the metal disc to the desired mounting location if there are no metal surfaces. To use the metal disc and foam adhesive:

1. Clean and dry the mounting surface on the vehicle.
2. Remove the backing from one side of the foam adhesive and press the metal plate onto the mounting surface on the vehicle.
3. Remove the backing from the other side of the foam adhesive
4. Press the metal plate onto the mounting surface on the vehicle.
5. Apply firm pressure to ensure good adhesion.



6. Place the Crescent A100 on top of the metal disc. (See Figure 1-3 for the magnetic mounted Crescent A100.)



Figure 1-3. Magnetic mounted Crescent A100

Surface Mount

As an alternative to the magnetic mount, the Crescent A100 is easily attached to the surface with four machine screws (no. 8-32). To surface mount the Crescent A100:

1. Photocopy, or remove, Appendix E and use its line drawing as a template to plan the mounting hole locations.
2. Mark the mounting hole centers, as necessary, on the mounting surface.
3. Place the Crescent A100 antenna over the marks to ensure that the planned hole centers agree with the true hole centers, then adjust.
4. Use a center punch on the hole centers in order to guide the drill bit.
5. Drill the mounting holes with a 3/16 inch bit appropriate for the surface mount.



1: Installation

6. Place the Crescent A100 over the mounting holes and insert the mounting screws through the bottom of the mounting surface and into the antenna.



Warning:

Install the Crescent A100 only hand-tight. Damage resulting from overtightening the Crescent A100 is not covered by warranty.

Pole Mount

The center thread of the Crescent A100 is 5/8 inches for compatibility with a survey pole (not included).



Powering the Crescent A100

To power the Crescent A100:

Connect the Crescent to a 12 volt DC source with a power connector. Choosing the right power connector will depend on your specific installation requirements.



Note: We suggest that a weather-tight connection and connector be used if the connection will be located outside.

The power cable with the cigarette lighter adapter is ideal for use in a vehicle. Other power cables are available as accessories to fit a wide variety of applications. See Appendix D for a list of Crescent A100 accessories.

Warning:



Be careful not to provide a voltage higher than the input range. This will damage the antenna.

The Crescent A100 accepts an input voltage between 7 and 36 VDC via the cable. For best performance, the supplied power should be continuous and clean. Refer to Table B-1: Power specifications in the Appendix for power requirements.

Warning:



Do not apply a voltage higher than 36 VDC. This will damage the receiver and void the warranty.

The Crescent A100 features reverse polarity protection to prevent excessive damage if the power leads are accidentally reversed.

With the application of power, the Crescent A100 will automatically proceed through an internal start-up sequence, however it will be ready to communicate immediately.



1: Installation



Note: The first start-up can take from 5 to 15 minutes depending on your location. This may vary depending where you are in the world.



Note: The Crescent A100 can take up to five minutes for a full ionospheric map to be received from SBAS. Optimum accuracy will be obtained once the Crescent A100 is processing corrected positions using complete ionospheric information.



Connecting the Crescent A100 to External Devices

The serial ports of the Crescent A100 operates at the RS-232C interface level to communicate with external data loggers, navigation systems and other devices. The serial ports are accessible via the extension cable that features a DB9 female data connector. The serial ports are also used for firmware updates.



Note: For successful communication, the baud rate of the Crescent A100 serial ports must be set to match that of the devices to which they are connected.

Figure 1-4 displays the numbering for the extension cable's DB-9 socket connector (female). The associated numbering for the plug connector (male) is a mirror reflection of the scheme shown in figure 1-4.

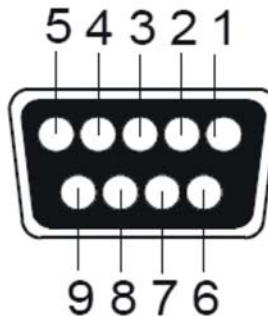


Figure 1-4. DB-9 socket numbering

Table 1-3, on page 16, provides the pin configuration for communication through the serial ports.



Note: Other pins on the serial ports may be active, depending on the optional cable selected.



Table 3-3: Extension cable pin-out, DB-9

Pin number	Description
2	Transmit Crescent A100 NMEA 0183, binary and RTCM
3	Receive Crescent A100 NMEA 0183, binary and RTCM input
5	Signal ground

Factory parameters

Tables 1-4 to 1-6 identify the default Crescent A100 configuration.

Table 3-4: DGPS

Application 1	SBAS (WAAS, EGNOS, etc.)
Application 2	e-Dif (unsubscribed)

Table 3-5: Serial port settings

Serial port	Baud Rate	Data bits	Parity	Stop bit	Interface level
Serial port A and B	4800 9600 19200 57600	8	None	1	RS-232C

Table 3-6: GPS message output options

GPS message	Update rate	Max DGPS age	Elevation mask
Hemisphere GPS Binary NMEA 0183 NMEA 2000 (CAN)	From 1 Hz to 20 Hz	259,200 seconds	5°



The CAN port will automatically output the NMEA 2000 messages according to Table 1-7.

Table 3-7: NMEA 2000 commands

NMEA 2000 message	Updates rates
GNNSPositionData	1 Hz
GNNSPositionRapidUpdate	20 Hz with updates based on the subscribed rate (i.e. every other message will be a copy of the previous on a 10 Hz receiver)
NMEACogSogData	20 Hz with updates based on the subscribed rates (i.e. every other messages will be a copy of the previous on a 10 Hz receiver)

Custom Configuring the Crescent A100

All aspects of the Crescent A100 may be configured through the serial port with the use of Hemisphere GPS commands. The user can configure the following items:

- Selecting one of the two on-board applications
- Selecting the baud rate
- Choosing which NMEA 0183 data message to output on the dual serial ports and the update rate of each message



Note: The changes you make to the Crescent A100 will not be saved to the memory for subsequent power-up unless a save command is issued.



Note: Contact your local Hemisphere GPS dealer for more information regarding the use of Hemisphere GPS commands and customized configuration.



Environmental Considerations

The Crescent A100 is designed to withstand various outdoor environments. However, there are specific environmental limits that you should meet when storing and using the Crescent A100. See Table B-4: Environmental specifications in Appendix B.





2: GPS Overview

GPS Operation
Differential Operation

GPS Overview

This chapter describes the various modes of operation and features of your Crescent A100 receiver and internal sensors.

For your convenience, both the GPS and differential correction of the Crescent A100 are pre-configured. The receiver will work out of the box, and for most applications, little user set up is necessary. When powered for the first time, the Crescent A100 will perform a “cold start,” which involves acquiring the available GPS satellites in view and the SBAS differential service.

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 A100's internal GPS engine.

Automatic Tracking -

The GPS engine within the Crescent A100 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 A100 works by finding four or more GPS satellites in the visible sky and uses the information those satellites provide to compute an appropriate position (typically within 2-3 meters). Since there is some error in the GPS data calculations, the Crescent A100 also tracks a differential correction. The Crescent A100 uses these corrections to improve its position to less than 1 meter (3 feet) (see Table B-5: GPS sensor specifications in the appendix).



There are two main aspects of GPS receiver performance:

- Positioning
- Satellite acquisition quality

When the Crescent A100 is properly positioned on your vehicle, the satellites transmit coded information to the antenna in 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.

The GPS receiver uses a complex algorithm incorporating satellite locations and ranges to each satellite to calculate the geographic location. Reception of any four or more of these signals allows a GPS receiver to compute 3-dimensional coordinates.

Differential Operation

The Radio Technical Commission of Marine services (RTCM) has a differential service intended for correction services. This includes the Space Based Augmentation Systems (SBAS), such as the Wide Area Augmentation System (WAAS) and the European Geostationary Navigation Overlay System (EGNOS). The Crescent A100 is compatible with each of these differential services in addition to Hemisphere GPS' patented e-Dif.

SBAS -

A SBAS enabled Crescent A100 operates automatically anywhere within the coverage areas of the WAAS, EGNOS or other SBAS programs.



The basics -

WAAS is a free service of the FAA that allows regular GPS positions to be improved to a DGPS level of accuracy. Tests using a Crescent A100 have shown better than one-meter accuracy. WAAS is available everywhere in the U.S., including Alaska, Hawaii and Puerto Rico. It can also be picked up in some of the border areas of Mexico and Canada. There are no subscription charges incurred when using WAAS.

EGNOS is a similar service that is available in Europe and Western Russia.

Automatic SBAS tracking -

The Crescent A100 will automatically scan and track the satellite signals. This automatic tracking allows you to focus on other aspects of differential operation without the need to tune the receiver. The Crescent A100 features two-channel SBAS 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 -

A Crescent A100 that is equipped with Hemisphere GPS' e-Dif capabilities can operate anywhere in the world where normal GPS signals can be viewed. e-Dif can be used anywhere on the globe where a GPS lock can be achieved.

Hemisphere GPS developed e-Dif for our customers who are not able to receive other types of differential signals due to location or budget.



e-Dif requires a subscription. Once the Hemisphere GPS e-Dif capable Crescent A100 computes a differential correction. The user can operate for unlimited time and provide good relative accuracy. Alternatively, the operator can regularly update e-Dif to maintain absolute accuracy (typically less than 1 meter over 40 minutes.)



2: GPS Overview





Appendix

Troubleshooting
Crescent A100 Specifications
Network
Crescent A100 accessories
Surface mount template

A: Troubleshooting

Table A-1 provides a checklist to troubleshoot common problems and their solutions for the Crescent A100.

Table A-1: Troubleshooting

Problem	Possible solution
Receiver fails to power	<ul style="list-style-type: none"> • Verify polarity of power leads • Check integrity of power cable connections • Check power input voltage (7 - 36 VDC) • Check current restrictions imposed by power source (maximum is 250 mA)
No data from Crescent A100	<ul style="list-style-type: none"> • Check receiver power status (LED) • Check integrity and connectivity of power and data cable connections • The volume of data requested to be output by the Crescent A100 could be higher than what the current baud rate supports. Try using 19,200, or higher, as the baud rate for all devices.
No GPS lock	<ul style="list-style-type: none"> • Check integrity of cable connections • Verify Crescent A100's unobstructed view of the sky



Table A-1: Troubleshooting

Problem	Possible solution
No SBAS lock	<ul style="list-style-type: none">• Check integrity of cable connections• Verify Crescent A100's unobstructed view of the sky• Check SBAS visibility map



B: Specifications

Table B-1 to B-5 provides the power, mechanical, communication, environmental and DGPS specifications for the Crescent A100.

Table B-1: Power specifications

Item	Specification
Input voltage	7 - 36 VDC
Power consumption	< 2 W @ 12 VDC (typical)
Current Consumption	150 mA @ 12 VDC (typical)
Power connector	Cable mount environmentally sealed

Table B-2: Mechanical specifications

Item	Specification
Height	54.7 mm (2.2in)
Width	129.5 mm (5.1 in)
Weight	0.66 kg (1.45 lbs)
Mounting Options	Magnetic mount Fixed mount - low or high pole



Table B-3: Communication specifications

Item	Description
Serial ports	2 full duplex RS232
CAN	NMEA 2000 broadcast
Pulse output	1 PPS (HCMOS, active high, rising edge sync)
Baud rates	4800 - 57600
Differential correction I/O protocol	RTCM SC-104
Data I/O protocol	NMEA 0183, SLX binary and NMEA 2000
Ground speed output	Range: 0.8 - >322 Km/h (0.5 - >200 mph) Signal: Opto-isolated pulse out Frequency Conversion: 94 Hz/m/s (28.65 pulse per foot traveled)
Event mark output	HCMOS, active low, falling edge sync, 10 k-ohm, 10 pF load

Table B-4: Environmental specifications

Item	Specification
Operating temperature	-30° C to +70° C (-22° F to + 158° F)
Storage temperature	-40° C to +85° C (-40° F to + 185° F)



Table B-4: Environmental specifications

Item	Specification
Humidity	100%
Enclosure	Waterproof and dust proof
Compliance	FCC, CE
Shock	IEC 68-2-27
Vibration	ISO 16750-1
EMI certification	FCC part 15, E-Mark

Table B-5: GPS sensor specifications

Item	Specification
Receiver type	L1, C/A code with carrier phase smoothing (Patented COAST technology during differential signal outage)
Channels	12-channel, parallel tracking (10-channel when tracking SBAS)
Update rate	1 - 20 Hz positions
Horizontal accuracy	<ul style="list-style-type: none"> • < 0.6 m 95% confidence (DGPS) * • < 2.5 m 95% confidence (autonomous) **
Differential Options	SBAS, e-Dif, L-Dif
SBAS Tracking	2-channel, parallel tracking
Start up time	60 s (no almanac and RTC)
Satellite Reacquisition	< 1 s



* 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, satellite geometry and ionospheric activity.



D: Crescent A100 Accessories

Tables D-1 to D-4 provides the available accessories for the Crescent A100.

Table D-1: Crescent A100

Part Number	Item
804-0032	Crescent A100 receiver

Table D-2: Crescent A100 documentation accessories

Part Number	Documentation
875-0163	Crescent A100 owner's manual
875-0066	Warranty

Table D-3: Crescent A100 cable accessories

Part Number	Cables
051-0129	Cable, Crescent A100 power, single port DB9, 3 m (10 ft)
051-0130	Cable: Crescent A100 power, dual port DB-9, 3 m (10 ft)
051-0132	Cable: Guidance console port, single port DB9, 5 m (15 ft)
051-0133	Cable adaptor converts 051-0132 guidance console port to a speed port



Table D-3: Crescent A100 cable accessories

Part Number	Cables
051-0134	Cable adaptor converts 051-0132 guidance console port to a console port and speed port
051-0136	Cable adaptor converts 051-0132 guidance console port to DB9 and speed port
054-0035	Cable: power to battery clips, 1 m (3 ft)
054-0034	Cable: power cigarette lighter adapter extension .91 m (3 ft)
054-0037	Cable: power to AC adapter, 1.83 m (6 ft)
054-0038	Cable: power cable, .91 m (3 ft) extension

Table D-4: 710-0052 A-Series antenna magnetic mounting kit

Part number	Mounting accessories
478-0006-000	Black magnet mount
601-0003-005	Zinc disc
675-1022-000	Screw, 5/8 Hex
683-0001-007#	Tape
683-0001-008	Foam pad

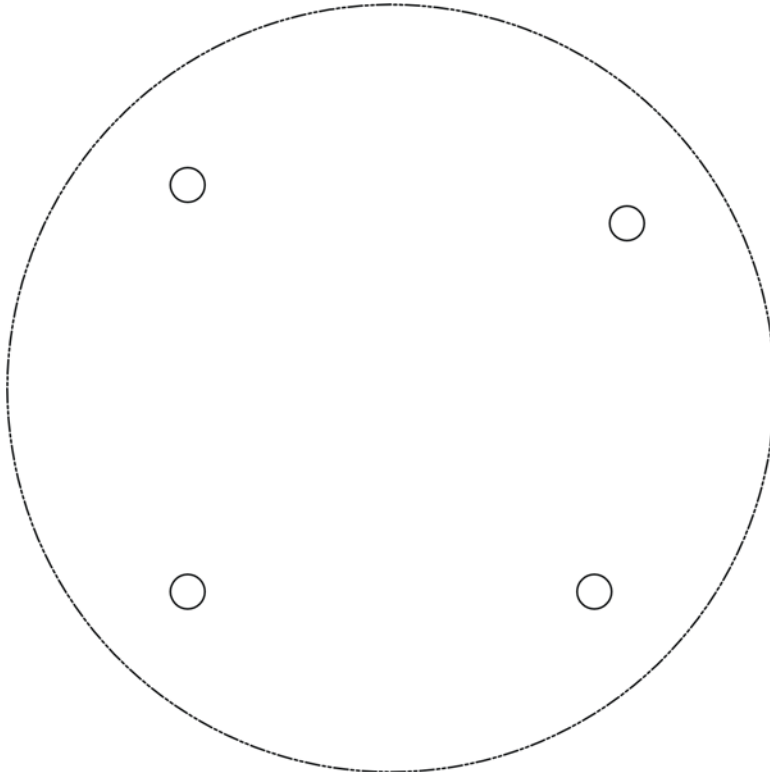


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E: Surface Mount Template

The following template should be used to plan for the location of the mounting holes used when surface mounting the Crescent A100.



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