



# **S320 GNSS Survey Receiver™**

## **User Guide**

Part No. 875-0281-000 Rev. C2

## Environmental

Temperature – operating -30C to +65C

Temperature – storage -40C to +85C Humidity

MIL-STD-810F Method 5-7.4 Vibration MIL-

STD-810F FIG. 514.5C-1 Loose cargo MIL-STD-

810F FIG. 514.5C-5

## Regulatory Compliance

### CE Compliance

- EN 301 489-1 v1.8.1
- EN 301 489-3 v1.4.1
- EN 301 489-7 v1.3.1

### FCC Compliance

- FCC Part 15 Subpart B
- FCC Part 22
- FCC Part 24

### IC Compliance

- RSS210
- RSS132 Issue 2
- RSS133 Issue 5

### Certifications

- FCC ID: ZC8S320
- IC: 9586A-S320

### Contains Bluetooth Module:

- FCC ID: ED9LMX9838
- IC: 1520A-LMX9838

### Contains UHF Radio Module:

- If 900MHz  
FCC ID: NS908P24IC: 3143A-08P24
- If 400MHz  
FCC ID: NS909P30IC: 3143A-09P30

**⚠ WARNING:** If your S320 is equipped with a 400 MHz radio you may be required to obtain a valid radio license for your jurisdiction.

Only set the radio to the frequency and power you are licensed to use at your location.

## USA- Federal Communication Commission (FCC)

### Radio frequency radiation exposure Information:

*This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.*

#### GSM Mode

- *When using the GSM to receive correction data, this equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.*

#### UHF Radio Mode

- *When using the 900 MHz radio, n920 from Microhard, this equipment should be installed and operated with a minimum distance of 23 cm.*
- *When using the 400 MHz radio, nL400 from Microhard, this equipment should be installed and operated with a minimum distance of 24 cm.*

*This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.*

Modifications not expressly approved by Hemisphere GNSS could void the user's authority to operate the equipment.

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 equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instructions, it may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by tuning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**Caution:** Exposure to Radio Frequency Radiation.

This device must not be co-located or operating in conjunction with any other antenna or transmitter.

### **Canada - Industry Canada (IC)**

This device complies with RSS 210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

L' utilisation de ce dispositif est autorisée seulement aux conditions suivantes: (1) il ne doit pas produire d'interférence et (2) l' utilisateur du dispositif doit être prêt à accepter toute interférence radioélectrique reçue, même si celle-ci est susceptible de compromettre le fonctionnement du dispositif.

**Caution:** Exposure to Radio Frequency Radiation.

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website <http://www.hc-sc.gc.ca/rpb>.

### **Europe – Declaration of Conformity**

This device is in compliance with the essential requirements of the R&TTE Directive 1999/5/EC.

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Hemisphere GNSS Precision GPS Applications

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The Outback S™ and S-Lite™ automated navigation and steering guide systems are covered by U.S. Patents No. 6,539,303 and No. 6,711,501. The Outback Hitch™ automated hitch control system is covered by U.S. Patent No. 6,631,916. The Outback eDriveTC™ GPS assisted steering system is covered by U.S. Patent No. 7,142,956. Hemisphere GNSS products may be covered by one or more of the following U.S. Patents:

|           |           |           |           |           |
|-----------|-----------|-----------|-----------|-----------|
| 6,111,549 | 6,397,147 | 6,469,663 | 6,501,346 | 6,539,303 |
| 6,549,091 | 6,631,916 | 6,711,501 | 6,744,404 | 6,865,465 |
| 6,876,920 | 7,142,956 | 7,162,348 | 7,277,792 | 7,292,185 |
| 7,292,186 | 7,373,231 | 7,400,956 | 7,400,294 | 7,388,539 |
| 7,429,952 | 7,437,230 | 7,460,942 |           |           |

Other U.S. and foreign patents pending.

## Notice to Customers

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

Hemisphere GNSS  
8515 E. Anderson Drive  
Scottsdale, AZ 85255, USA  
Phone: +1-480-348-6380  
Fax: +1-480-270-5070  
[precision@hemispheregnss.com](mailto:precision@hemispheregnss.com)  
[www.hemispheregnss.com](http://www.hemispheregnss.com)

## Technical Support

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# Contents

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|   |           |
|---|-----------|
| <b>Chapter 1: Introduction .....</b>              | <b>1</b>  |
| Product Overview and Features .....               | 2         |
| What's Included.....                              | 3         |
| <b>Chapter 2: Installation .....</b>              | <b>5</b>  |
| Ports and Connections.....                        | 6         |
| Installing/Connecting the S320.....               | 7         |
| Attaching the Antenna.....                        | 7         |
| Connecting to a Power Source.....                 | 8         |
| Connecting to External Devices .....              | 9         |
| Setting Up the Unit .....                         | 10        |
| <b>Chapter 3: Setup and Configuration.....</b>    | <b>11</b> |
| Control Panel Overview .....                      | 12        |
| Powering the S320 On and Off .....                | 14        |
| Modes of Operation .....                          | 14        |
| Displaying Current Module Status .....            | 15        |
| Changing Module Status.....                       | 16        |
| Tilt Function Control .....                       | 17        |
| Alarm/Buzzer .....                                | 18        |
| Power and Battery Status/Charge .....             | 18        |
| Replacing/Swapping the Batteries.....             | 19        |
| Removing/Inserting the SD Card / SIM Card .....   | 20        |
| Bluetooth Communication.....                      | 21        |
| Upgrading S320 Firmware .....                     | 22        |
| Upgrading S320 Firmware via Serial Port.....      | 22        |
| Upgrading S320 Firmware via SD Card.....          | 23        |
| GSM Functionality .....                           | 24        |
| AT&T 2G Network.....                              | 24        |
| Configuring SMS Messaging.....                    | 25        |
| Restoring Factory Defaults.....                   | 26        |
| <b>Appendix A: Troubleshooting .....</b>          | <b>27</b> |
| <b>Appendix B: Technical Specifications .....</b> | <b>29</b> |
| <b>Index .....</b>                                | <b>33</b> |
| Warranty Notice .....                             | 38        |



## **Chapter 1: Introduction**

Product Overview and  
Features  
What's Included

## Product Overview and Features

The S320 is an integrated GNSS survey and mapping device for mobile data collection providing differential GPS (DGPS) accuracy in a rugged, all-in-one enclosure.



Powered by Hemisphere GNSS' powerful dual constellation and dual frequency Eclipse™ II OEM board, the S320 is suitable for GIS, mapping, land surveying, and construction with the following features:

- Can be mounted on a range pole or tripod and carried by a single worker
- Small and lightweight with good pole balance
- Rugged construction
- Hot-swappable batteries
- Data storage
- Fully functional without the need for external cables
- Radio communications

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**⚠ WARNING:** If your S320 is equipped with a 400 MHz radio you may be required to obtain a valid radio license for your jurisdiction.

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## What's Included

The S320 is available as a single unit or two units (base/rover setup). Figure 1-1 shows the parts included in the single unit kit and Table 1-1 lists the parts included in both kits.

Figure 1-1: S320 single unit kit



Table 1-1: S320 parts list

| Item      | Item   | Qty (1 Unit) | Qty (2 Units) | Part Number                                      |
|-----------|--|--------------|---------------|--|
| A         | S320   | 1            | 2             | 804-0079-000 (400 MHz)<br>804-0090-000 (900 MHz) |
| B         | Antenna bracket (for upward vertical antenna mounting)               | 1            | 2             | 602-1096-000                                     |
| C         | Antenna (model/type depends on region of use)                        | 1            | 2             | 150-0021-000 (400 MHz)<br>150-0022-000 (900 MHz) |
| D         | SD card  | 1            | 2             | 750-1099-000                                     |
| E         | Batteries (rechargeable lithium-ion)                                 | 2            | 4             | 427-0043-000                                     |
| F         | Power cable, external, 2-pin circular, 3 m (for base station unit)   | N/A          | 1             | 054-0119-000                                     |
| G         | Battery charger  | 1            | 2             | 427-0044-000                                     |
| H         | Data cable, 9-pin to 9-pin serial, USB connector, and USB receptacle | 1            | 2             | 051-0258-000                                     |
| Not shown | Pelican case   | 1            | 1             | 002-0083-000                                     |
| Not shown | S320 User Guide (this document)                                      | 1            | 1             | 875-0281-000                                     |





## **Chapter 2: Installation**

Ports and Connections

Installing/Connecting the S320

Attaching the Antenna

Connecting to a Power Source

Connecting to External Device

Setting Up the Unit

## Ports and Connections

All connections and ports are located on the bottom of the unit, as shown in Figure 2-1. Table 2-1 provides additional information about each port/connection.



**Figure 2-1: S320 ports and connectors**

**Table 2-1: S320 ports and connections**

| Port                     | What to connect                                      |
|--------------------------|--|
| Data port (ODU 9-pin)    | Data cable (Item H in Table 1-1 on page 3)           |
| Power port               | External power cable (Item F in Table 1-1 on page 3) |
| Mounting hole            | Pole or tripod mount                                 |
| Antenna port             | External antenna (Item C in Table 1-1 on page 3)     |
| Serial port (DB9 female) | External serial devices                              |

## Installing/Connecting the S320

This section describes how to perform the following:

- Attaching the antenna
- Connecting to a power source)
- Setting up the unit)

### Attaching the Antenna

You can attach the antenna in one of two ways:

- Attach the antenna directly to the antenna port on the bottom of the unit with the antenna vertical and pointing downward (left photo in Figure 2-2)
- Attach the antenna bracket to the unit and then attach the antenna to the port at the end of the bracket with the antenna vertical and pointing upward (right photo in Figure 2-2)

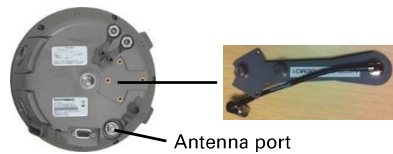


**Figure 2-2: Antenna installation options**

**Tip:** The antenna bracket offers an alternative solution in situations where installing the antenna on the bottom of the unit may not provide suitable reception, such as where a small increase in antenna height has a noticeable effect on reception.

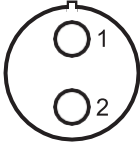
To install the antenna directly into the unit:

1. On the bottom of the unit remove the rubber cap covering the antenna port.
2. Screw the antenna into the antenna port until snug. Do not overtighten. To install the antenna using the antenna bracket:
  1. Align the bracket to fit into the recessed area on the bottom of the unit (as shown at right).
  2. Using the two thumbscrews on the bracket secure the bracket to the unit. Do not overtighten.
  3. Attach the bracket's antenna cable to the unit's antenna port.
  4. Screw the antenna into the bracket's antenna port until snug. Do not overtighten.



## Connecting to a Power Source

The S320 power cable has a circular connector (2-pin ODU) at one end and two clamps at the other end (red clamp positive and black clamp negative). Figure 2-3 shows the power port pinout on the S320 and Table 2-2 shows the pin descriptions.



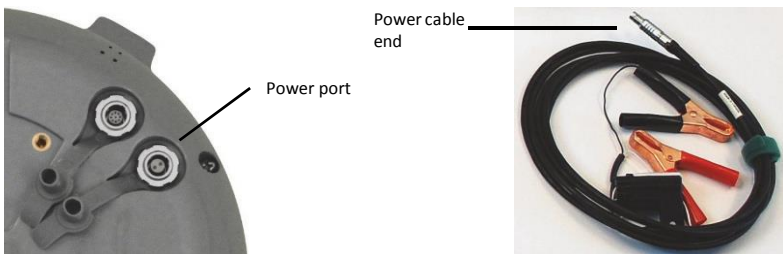
**Figure 2-3: Power port pinout assignment**

**Table 2-2: Power port pinouts**

| Pin | Description |
|-----|-------------|
| 1   | GND         |
| 2   | VCC         |

The power supply is a nominal 12 VDC power supply and maximum current consumption is < 1 A at 12 VDC.

**Note:** The power cable is included with the two-unit base/rover kit; it is not included in the single-unit kit. See Table 1-1 on page 3 for information on the parts in each kit.



**Figure 2-4: Connecting the power cable**

**Note:** Applying external power does not charge the Li-ion batteries in the battery trays. You must use a suitable battery charger to charge the batteries.

To connect the power cable:

- Line up the red dot on the power cable end with the red dot on the power port and press into place.

To disconnect the power cable:

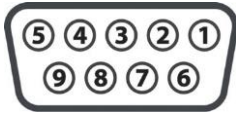
- Slide the cable collar (at the connector end) away from the unit and gently remove the cable.

## Connecting to External Devices

You can connect the S320 to external devices via the serial and data ports on the bottom of the unit.

### Serial Port Pinout Specifications

Figure 2-5 shows the DB9 serial port (female) pinout, while Table 2-3 shows the serial port pinout specifications.



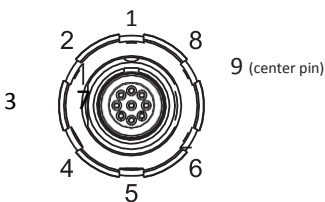
**Figure 2-5: Serial port pinout assignment**

**Table 2-3: Serial port pinouts**

| Pin | Description               |
|-----|---------------------------|
| 1   | Not connected             |
| 2   | Transmit data port (TXD)  |
| 3   | Receive data port (RXD)   |
| 4   | Data terminal ready (DTR) |
| 5   | Signal ground (GND)       |
| 6   | Not connected             |
| 7   | Request to send (RTS)     |
| 8   | Not connected             |
| 9   | Timing output (1 PPS)     |

### Data Port Pinout Specifications

Figure 2-6 shows the data port (ODU 9-pin) pinout, while Table 2-4 shows the data port pinout specifications.



**Figure 2-6: Data port pinout assignment**

**Table 2-4: Data port pinouts**

| Pin | Description         |
|-----|---------------------|
| 1   | USB host positive   |
| 2   | USB host VBS        |
| 3   | Ground              |
| 4   | Port B receive      |
| 5   | Port B transmit     |
| 6   | USB device source   |
| 7   | USB device negative |
| 8   | USB host negative   |
| 9   | USB device positive |

**Note:** When using the USB device end of the included data cable (Item H in Table 1-1) to connect to a USB port on an external device make sure the S320 is already powered on.

To connect the data cable:

- Line up the red dot on the data cable end with the red dot on the data port and press into place.

To disconnect the data cable:

- Slide the cable collar (at the connector end) away from the unit and gently remove the cable.

## Setting Up the Unit

Figure 2-7 shows a typical setup for both a base station unit and a rover unit (tripod and pole mount not included, data collector optional).

The antenna in Figure 2-7 is connected to the bottom of the unit; you have the option of attaching the antenna to the antenna bracket so the antenna faces upward. See “Attaching the Antenna” for more information on attaching the antenna.



**Figure 2-7: Typical base and rover setup**



## **Chapter 3: Setup and Configuration**

Control Panel Overview

Powering the S320 On and Off

Modes of Operation

Displaying Current Module Status

Changing Module Status

Tilt Function Control

Alarm/Buzzer

Power and Battery Status/Charge

Replacing/Swapping the Batteries

Removing/Inserting the SD Card / SIM Card

Bluetooth Communication

Upgrading S320 Firmware

GSM Functionality

AT&T 2G Network

Configuring SMS Messaging

Restoring Factory Defaults

## Control Panel Overview

You operate the S320 using the control panel shown in Figure 3-1.

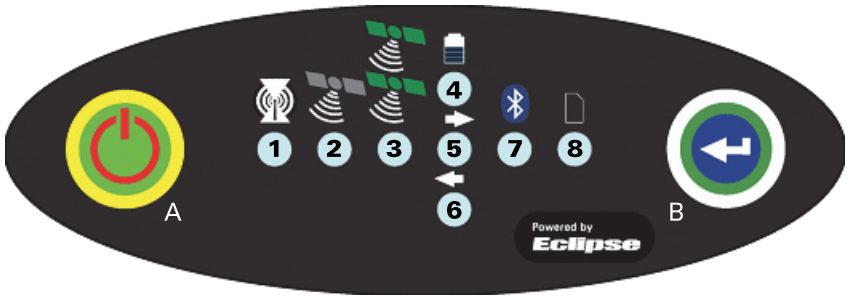


Figure 3-1: S320 control panel

The S320 beeps on any keypress. Table 3-1 describes each button and LED on the control panel.

Table 3-1: S320 control panel items

| Diagram Item | Name         | Description  |
|--------------|--------------|--|
| A            | Power button | <ul style="list-style-type: none"> <li>If unit is Off, press and hold until unit powers up (until you hear one beep)</li> <li>If unit is On, press and hold for approximately 3 seconds (until you hear three beeps) to turn unit off</li> </ul> |



Table 3-1: S320 control panel items (continued)

| Diagram Item | Name   | Description  |
|--------------|--|--|
| B            | Select button (for Bluetooth/UHF/GSM/SD modules) | Allows you to review module status or change the status (power on/off) of a module<br>See “Displaying Current Module Status” and “Changing Module Status” for more information on the Select button.   |
| 1            | UHF/GSM radio status LED                         | <ul style="list-style-type: none"> <li>Off – UHF radio or GSM module is OFF; or no RTK position computed</li> <li>On (yellow) – floating point RTK position achieved</li> <li>On (green) – fixed ambiguity RTK position achieved</li> <li>Blink (green) – UHF radio or GSM module transmitting/receiving data</li> <li>Pulse (red) – error condition with UHF radio or GSM module</li> </ul> |
| 2            | GPS position status LED                          | <ul style="list-style-type: none"> <li>Off – no position</li> <li>On (yellow) – valid position</li> <li>Blink (yellow) – operating as a base station and converging on reference coordinates</li> </ul>  |
| 3            | DGPS position status LED                         | <ul style="list-style-type: none"> <li>Off – no differential corrections available</li> <li>On (green) – differentially corrected position computed</li> </ul>   |
| 4            | External power status LED                        | <ul style="list-style-type: none"> <li>Off – external power not present</li> <li>On (red) – external power present and in use</li> </ul>   |
| 5 and 6      | Battery status LED                               | <ul style="list-style-type: none"> <li>Off – battery not present</li> <li>On (green) – battery charge full</li> <li>On (yellow) – battery charge &lt;50%</li> <li>On (red) – battery charged depleted</li> <li>Blink – battery in use</li> </ul>   |
| 7            | Bluetooth status LED                             | <ul style="list-style-type: none"> <li>Off – Bluetooth inactive</li> <li>On (blue) – active Bluetooth connection</li> <li>Blink (blue) - Bluetooth active and transmitting/receiving data</li> </ul>   |
| 8            | SD logging status LED                            | <ul style="list-style-type: none"> <li>Off – SD card not inserted</li> <li>On (yellow) – SD card inserted, not logging data</li> <li>Blink (yellow) - SD card inserted and reading/writing data to SD card</li> <li>Pulse (yellow) at 5 Hz - SD card inserted and low free space</li> </ul>  |

## Powering the S320 On and Off

Use the Power button to power the S320 on and off.



To power on the S320:

- Press and hold the **Power** button until the S320 powers up (until you hear one beep).

To power off the S320:

- Press and hold the **Power** button for 3 seconds (until you hear three beeps).

---

**Note:** When you power on the S320 the LEDs go through a ‘heartbeat’ sequence (each LED lights up in succession); during this time the modules power up and the devices initialize.

---

## Modes of Operation

Table 3-2 lists the modes of operation for the S320.

**Table 3-2: S320 modes of operation**

| Mode Description                                 | Eclipse Software | GSM Mode | UHF Mode | Bluetooth Mode                                |
|--|------------------|----------|----------|---|
| L-band rover                                     | SBASRTKB         | OFF      | OFF      | ON or OFF                                     |
| Single point data collection for post processing | SBASRTKB         | OFF      | OFF      | ON or OFF                                     |
| RTK Base Station                                 | SBASRTKB         | OFF      | ON       | ON or OFF                                     |
| RTK Rover - UHF                                  | RTK              | OFF      | ON       | ON or OFF                                     |
| RTK Rover - GSM                                  | RTK              | ON       | OFF      | ON or OFF                                     |
| RTK Rover - External corrections via Bluetooth   | RTK              | OFF      | OFF      | ON (both ports - one monitor, one diff input) |
| RTK Rover - External serial corrections          | RTK              | OFF      | OFF      | ON or OFF                                     |

You can quickly review and/or change the GSM, UHF, and Bluetooth states using the Power and Select buttons.

## Displaying Current Module Status

The S320 allows you to quickly review the status of each module (UHF/GSM, mode of operation, Bluetooth, and SD card logging).
















To display current module status:

- Press the **Select** button.

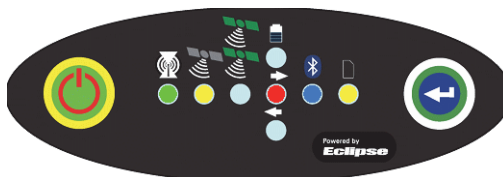
The external power status LED is red (the unit is displaying its current status) and the LED of each module will be either OFF (LED not illuminated, module powered off) or ON (LED illuminated, module powered on).

Table 3-3 illustrates the colors of the LEDs for each module.

**Table 3-3: Module status LED color descriptions**

| LED  | LED Color  | S320 Operation                    |
|--|--|-----------------------------------|
|  UHF/GSM                          |  Off                      | UHF radio and GSM module both off |
|  |  Green                    | UHF radio on                      |
|  |  Yellow                   | GSM module on                     |
|  GPS and DGPS position indicators |  Off (both)               | L-band                            |
|  |  GPS Yellow<br>DGPS None  | RTK rover                         |
|  |  GPS None<br>DGPS Green   | RTK base                          |
|  |  GPS Yellow<br>DGPS Green | e-Dif                             |
|  Bluetooth                       |  Off                     | Bluetooth off                     |
|  |  Blue                   | Bluetooth on                      |
|  SD card logging                |  Off                    | SD card logging off               |
|  |  Yellow                 | SD card logging on                |

For example, in the figure below the UHF radio is on, the unit is in RTK Rover mode, Bluetooth is active, and SD card logging is on.



## Changing Module Status

You change module status by using the Select button to select the module and the Power button to change the module status.

To change module status:

1. Press the **Select** button to display the status of all modules (if the LED is on, the module is on; if the LED is off, the module is off).
2. Press the **Select** button again to select the first module (UHF/GSM).

---

**Note:** When you press the Select button the LED (for the module status you are changing) remains illuminated for 5 seconds, during which time you can use the Power button to change the module status in step 3.

---

3. If you want to change the current module's status, press the **Power** button.

---

**Note:** When you press the Power button the LED (for the module status you are changing) blinks 5 times to indicate a status change.

---

Repeat steps 2 and 3 for each remaining module (if desired). After a status change, the function of the LEDs return to normal mode.

## Tilt Function Control

The S320 includes tilt control functionality that allows you to level your unit using five of the LED indicators. When you activate tilt control you see the changes to the angle of the antenna in real time (similar to a level).

To activate tilt control functionality:

- Press the **Power** button and the **Select** button at the same time. The tilt of the unit is displayed for a period of 1 minute or until you deactivate tilt control functionality.

To deactivate tilt control functionality (return to normal operation):

- Press the **Power** button and the **Select** button at the same time. When tilt control functionality is activated:
- X-axis tilt is displayed along three horizontal LEDs
- Y-axis tilt is displayed along three vertical LEDs
- Each LED shows a 0.5° tilt (user-configurable)

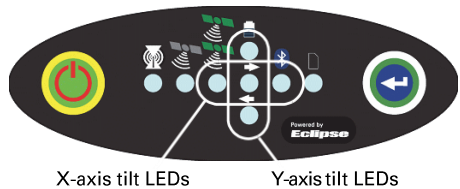


Table 3-4 illustrates the colors of the LEDs depending on the tilt direction of the unit. These LED colors only apply if you have activated tilt control.

**Table 3-4: Tilt control LED colors**

| LED Colors | Meaning   |
|------------|---|
|            | Unit is level   |
|            | Unit is off level to the left<br>Unit is off level to the right   |
|            | Unit is off level to the left by more than twice the configurable amount<br>Unit is off level to the right by more than twice the configurable amount |
|            | Unit is tilted backward<br>Unit is tilted forward   |

## Alarm/Buzzer

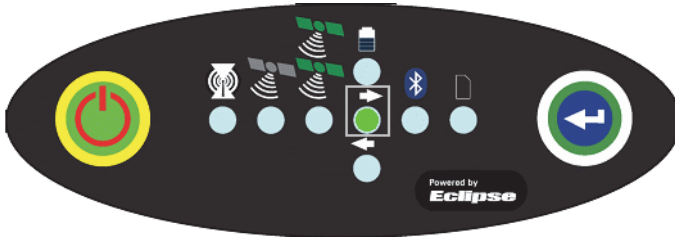
The S320 beeps under the following conditions:

- Whenever you press a button
- Position is lost
- Differential position is achieved
- Bluetooth device is connected/disconnected
- Low memory for data storage (SD card almost full)
- Both batteries are very low

If an alarm is sounding, you can silence the alarm by pressing the Power button.

## Power and Battery Status/Charge










LEDs on the console provide power and battery status/charge information based on the color of the LEDs. For example, Figure 3-2 indicates there is no external power, the right battery is fully charged, and the left battery is not present (not in the unit).



**Figure 3-2: No external power, right battery full, left battery not present**

Table 3-5 describes what the power/battery LED colors indicate. The S320 prioritizes power usage to use external power when available, regardless of the status of the internal batteries.

**Table 3-5: Power/battery LED color descriptions**

| LED   | LED Color  | Meaning  |
|---|--|--|
|  Power   |  Off    | No external power  |
|   |  Red    | External power present and in use  |
|  Left battery Right<br> battery |  Off    | Battery not present  |
|   |  Red    | Battery very low or fully discharged (unit will beep when both batteries are very low) |
|   |  Yellow | Battery less than 1/2 charged  |
|   |  Green  | Battery fully charged  |
| <b>Note:</b> A blinking battery light indicates that battery is in use.   |  |  |

## Replacing/Swapping the Batteries

If the S320 is off you can replace both batteries at one time. If you want to keep the unit running while replacing the batteries you must replace them one at a time to ensure the unit is receiving power from at least one battery.

To replace/swap a battery:

1. For the battery you want to replace remove the battery tray by squeezing the thumb lever and pulling.



2. Remove the battery from the tray.

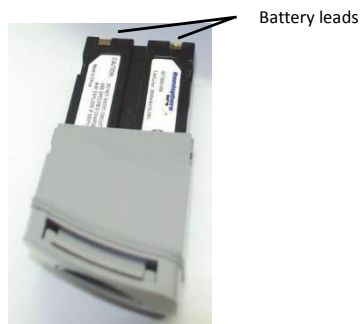


3. Insert the new battery.

---

**Note:** When inserting the battery make sure the end with the leads (on top) points away from the tray.

---



4. Replace the tray, making sure the tray snaps into place.

## Removing/Inserting the SD Card / SIM Card



**Caution:** Use electrostatic discharge (ESD) protection by wearing an ESD strap that is attached to an earth ground, before inserting or removing the SIM card on the S320. If an ESD strap is not available then touch a metal object prior to accessing the SIM card holder.

The SD card and the SIM card are only accessible by first removing the appropriate battery tray, where the:

- Left tray is labeled “SD”
- Right tray is labeled “SIM”



To remove the SD card or SIM card:

1. Remove the appropriate battery tray.
2. Place the S320 upside down (on its top) to get a better view of the card.



Gently push the card in; it will then snap back and slightly out.

---

**Note:** When you insert either card make sure the contacts on the card are facing the top of the unit and the side of the card with the notch goes in first (see figure in step 2 above).

---

3. Remove the card.

To insert the SD card or SIM card:

1. Place the card in its appropriate card slot.
2. Gently push the card in until it clicks.
3. Replace the battery tray.



## Bluetooth Communication

If you have a Bluetooth-enabled device, such as a data collector, you can wirelessly communicate with the S320.




When you attempt to connect the S320 to a Bluetooth-enabled device, such as a handheld data collector, the following S320 Bluetooth information appears on the device:

HGPS S320 XXXXXX

where “XXXXXX” is the Eclipse board serial number

To complete the connection you must use the correct PIN/Passkey, which is 0000. Table 3-6 describes the Bluetooth status LED options.

**Table 3-6: Bluetooth LED status**

| LED Colors  | Meaning   |
|---|---|
|  Off                   | Bluetooth inactive  |
|  Blue                  | Active Bluetooth connection                                 |
|  Blue blinking/pulsing | Active Bluetooth connection and transmitting/receiving data |

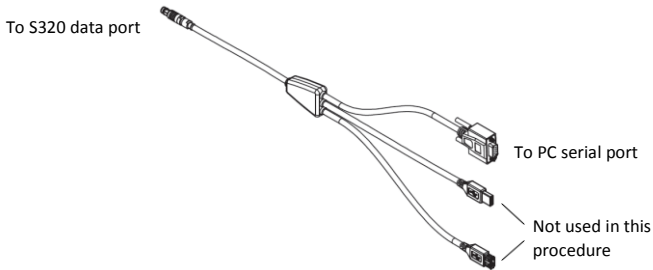
## Upgrading S320 Firmware

You can upgrade S320 firmware via serial port or SD card.

### Upgrading S320 Firmware via Serial Port

Before you upgrade verify the S320 is powered off and, if you will not be using external power, both Li-ion batteries are fully charged and inserted into the S320.

1. Download the Autoloader\_S320 executable (.exe file) for the most recent version from the Hemisphere GNSS website at [www.hemispheregnss.com](http://www.hemispheregnss.com) and save it to your PC.
2. Using the data cable included in your S320 kit, connect the DB9 serial port end of the cable to your PC and connect the other end of the cable to the data port on the S320 (see below):



3. Power on the S320.
4. Double-click the Autoloader\_S320 file you download in step 1 to start the Autoloader program.
5. In the Com Port drop-down box select the appropriate COM port on your PC and then click **Load**.

**Hemisphere**

**Setup**

Com Port  
ATEN USB to Serial Bridge (COM4)

Load Exit

**Status**

Status: Updating Firmware  
Firmware on Device: 2.2.3  
Firmware to be Loaded: 2.2.4

Progress: 445731/1248944  
35%

**Instructions**

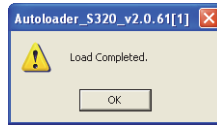
**WARNING:** If the device is disconnected from the PC, powered off, or this program is shutdown it could damage the device!

1. Connect the S320 receiver to the PC with a serial cable. Do not use Bluetooth for the connection.
2. Select the PC Comport.
3. Click Load
4. Wait for the load to Complete.

\*\* If the red power LEDs are blinking after completion, the load has failed. Please try the upgrade again.

\*Status area shows the load progress

The Status area shows the load progress. When loading is complete the following message appears.



6. Click **OK**.

In the Autoloader window click **Exit**.

## Upgrading S320 Firmware via SD Card

Before you upgrade verify the S320 is powered off and, if you will not be using external power, both Li-ion batteries are fully charged and inserted into the S320.

1. Download the S320\_Upgrade.zip file from the Hemisphere GNSS website at [www.hemispheregnss.com](http://www.hemispheregnss.com) and save it to your PC.
2. Unzip the file and extract the contents to the root folder of the SD card, ensuring the same folder structure of the contents on the SD card.
3. Remove the SD card from the PC.
4. If necessary remove the left battery tray from the S320 (the left tray labeled SD).



5. Insert the SD card into the S320 (see "Removing/Inserting the SD Card / SIM Card").
6. Replace the battery tray.
7. Power on the S320.
  - a. The LEDs cycle from left to right while the receiver is reading the upgrade file.
  - b. After the file has passed all internal verifications, the bottom battery LED illuminates green.
  - c. The LEDs cycle from left to right while the file is copied.
  - d. All the LEDs flash quickly to indicate the new firmware file is being committed to the receiver.
  - e. After committing the new file to internal memory, the LEDs cycle from left to right one more time before resetting the receiver and returning to the heartbeat sequence.

The upgrade is complete.

## GSM Functionality

This section provides advanced GSM information that requires connection to a PC running either Hemisphere GNSS' PocketMax utility or a terminal program such as HyperTerminal.

This section covers the following topics:

- GSM overview
- GSM modes
- Configuring GSM for NTRIP
- SMS messaging

## AT&T 2G Network

Due to a recent change to the AT&T 2G data network, the S320 internal GSM modem will no longer operate on the AT&T data network in the United States. This change, known as the "AT&T 2G Sunset", was implemented on January 1st, 2017. S320 users who require the use of the S320 with a data network connection will need to use one of the following three options to establish a connection.

1. Replace your current AT&T SIM card with a SIM Card from T-Mobile. This will allow the use of the S320 internal GSM modem.
2. Use the "Data Collector Internet" option in Carlson SurvCE software to establish a network connection using the internal modem inside of the data collector. In that case the AT&T network can still be used.
3. Tether the data collector in use with the S320 to a Wi-Fi hotspot to gain access to a data network using the "Data Collector Internet" option in the Carlson SurvCE software. In that case the user must have an external internet hotspot available, created with a mobile phone.

## GSM Overview

Global System for Mobile Communications (GSM) is a network technology for mobile phone communications. The GSM modem in the S320 is what allows you to connect to a GSM carrier.

The Access Point Name (APN) is a protocol that allows the S320 to access the internet using the mobile phone network. It is a configurable network identifier used when connecting to a GSM carrier. The default APNCFG value is "internet.com". The specific APN required by the S320 depends on your mobile carrier. Check with your mobile provider for details.

## GSM Modes

The GSM module operates in four modes:

- IDLE - Default mode for the module. In this state, the GSM module only attempts to register on the network.
- DIRECT IP - For users who have direct access to a server providing differential corrections.
- LINK - For users to establish a link between two S320 modules directly, where the BASE has a dynamic IP address. You should only use this mode on the rover in a base station / rover setup (use IDLE mode for the base station).
- NTRIP - Used to provide differential correction information to the GPS receiver.

## Configuring GSM for NTRIP

NTRIP (Networked Transport of RTCM via Internet Protocol) is the protocol for transmitting GNSS data over the internet.

---

**Note:** To configure NTRIP you must connect the S320 to a PC running either Hemisphere GNSS' PocketMax utility or a terminal program such as HyperTerminal.

---

To configure NTRIP send the following command:

```
$GSMCFG,NTRIP,[remote host name or IP address],[portnumber],[mount point name],[[username],[password]]
```

where,

- Remote host name - server name (such as [www.igs-ip.net](http://www.igs-ip.net)) or an IP address
- Mount point name - caster stream name from NTRIP Caster Source Table (you can download a sample source table from <http://www.igs-ip.net:2101/>). If you leave this field blank, the S320 will fetch the caster source table and select the mount point closest to its current position.
- User name and password - authentication with a user name and password is required for most NTRIP casters. You can leave both blank to specify that no authentication is required. The user name and password are case sensitive.

For example, to connect to the CALGO stream on [igs-ip.net](http://igs-ip.net) send the following command:

```
$GSMCFG,NRTIP,www.igs-ip.net,2101,CALGO,Usrnam,passwd
```

## Configuring SMS Messaging

The S320 supports Short Message Service (SMS) configuration and event updates for both base and rover operations.

When using SMS messaging keep the following in mind:

- The GSM module must be powered on for SMS commands to work correctly.
- You can send SMS messages to the S320 from up to three numbers and these numbers must be added to the S320 approved numbers list.
- By default the approved numbers list is comprised of the first three entries in the SIM card address book. However, for a typical data-only SIM card, the address book of the SIM card will be empty.
- Use the appropriate country code (the following procedures use the "+1" country code for USA/Canada).

### Adding or Overwriting a Number on the Approved Numbers List

You can add a number to an empty slot or overwrite an existing number using the following command:

```
$JSMS,CONFIG,[slot number 1/2/3],[number],[name],[status messages ON | OFF]
```

For example, to add "Service" (USA phone number 999-555-1212) to slot 1 with status messages OFF (or to replace the current number in slot 1) send the following command:

```
$JSMS,CONFIG,1,+19995551212,Service,OFF
```

The status message state (ON or OFF) allows the S320 to send an SMS message back to the number to report information and events on the operation of the unit.

### Displaying the Current List of Approved Numbers

To display the current list of approved numbers send the following command:

```
$JSMS,CONFIG
```

The reply below contains all the information on the configured numbers and may include SIM card address book defaults that you can overwrite with your own information.

```
$>JSMS,CONFIG,1,1,+19995551212,Service,OFF
```

The format of the reply is:

```
$>JSMS,CONFIG,[number of approved numbers],[slot number 1/2/ 3],[number],[name],[status messages ON | OFF]
```

---

**Note:** The reply contains one line for each number. For example, if there are two approved numbers then the reply will contain a “\$>JSMS,CONFIG” line for each number.

---

### Deleting a Number from the Approved Numbers List

To delete a number from the approved numbers list, send the following command:

```
$JSMS,CONFIG,[1/2/3 or keyword ALL],DELETE
```

For example, to delete the number in slot 2 send the following command:

```
$JSMS,CONFIG,2,DELETE
```

And to delete all numbers from the list, send the following command:

```
$JSMS,CONFIG,ALL,DELETE
```

### Sending an SMS Message to an Approved Number

To send an SMS message to an approved number, send the following command:

```
$JSMS,SEND,[name or phone number or slot number],[message]
```

For example, to send a “This is a test” message to Customer Support (USA phone number 480-348-9919, slot number 2) you can send any of the following commands:

```
$JSMS,SEND,SERVICE,This is a test
```

```
$JSMS,SEND,+14803489919,This is a test
```

```
$JSMS,SEND,2,This is a test
```

## Restoring Factory Defaults

If you need to restore your factory defaults for any reason you can do this via the Control panel.

To restore factory defaults:

- Press and hold the **Power** button for 10 to 20 seconds and release it while the GPS status and DGPS status LEDs are blinking.



## **Appendix A: Troubleshooting**

Table A-1 provides troubleshooting tips for the S320.

**Table A-1: S320 troubleshooting**

| Issue   | Possible Resolution  |
|---|--|
| Receiver fails to power                                   | <ul style="list-style-type: none"> <li>• External power is low</li> <li>• Check charge on external battery and the fuse on the power cable, if applicable</li> <li>• Internal power: Check charge on internal batteries</li> <li>• Check all power cables and pins</li> <li>• Try other batteries or cables</li> <li>• Make sure to hold the power button down for a minimum of one full second to turn on</li> <li>• Ensure batteries are installed with contacts pointed in the correct direction</li> </ul>   |
| No data logged<br>1. No communication<br>2. No valid data | <ul style="list-style-type: none"> <li>• (1) Check receiver power status</li> <li>• (2) Verify it is locked to a valid DGPS signal</li> <li>• (2) Verify that it is locked to 4 or more GPS satellites</li> <li>• (2) Check integrity and connectivity of power and data cable connections</li> <li>• Verify that the baud rate settings match</li> <li>• If trying to connect over Bluetooth, ensure Bluetooth module is powered ON and device is paired prior to opening the port</li> </ul>   |
| Random binary data from Eclipse OEM board                 | <ul style="list-style-type: none"> <li>• Verify the RCTM or the Bin messages are not being accidentally output (send a \$JSHOW command)</li> <li>• Verify the baud rate settings match</li> <li>• Potentially, the volume of data requested to be output could be higher than the current baud rate supports. Try using a higher baud rate for communications.</li> </ul>  |
| No GNSS position  | <ul style="list-style-type: none"> <li>• Verify the antenna’s view of the sky, especially toward SBAS satellites, south in the northern hemisphere</li> <li>• Verify the bit error rate (BER) and lock status of SBAS satellites (this can often be done on the receiving device or by using SLXMon - monitor BER value)</li> <li>• Verify the proper application is running on the Eclipse (SBASRTKB)</li> <li>• Set the satellite selection to automatic mode \$JFREQ,AUTO</li> <li>• Set the differential mode to \$JDIFF,WAAS</li> <li>• Ensure there is SBAS coverage in your area</li> </ul> |
| No DGPS position in external RTCM mode                    | <ul style="list-style-type: none"> <li>• Verify the baud rate of the RTCM input port matches the baud rate of the external source</li> <li>• Verify the pinout between the RTCM source and the RTCM input port (the “ground” pin and pinout must be connected, and the “transmit” from the source must connect to the “receiver” of the RTCM input port)</li> </ul>  |
| Non-DGPS output   | <ul style="list-style-type: none"> <li>• If using RTK, ensure receiver is properly authorized for RTK by sending a \$JI command or a \$JK command</li> </ul>   |





## **Appendix B: Technical Specifications**

The following tables provide information on the technical specifications of the S320.

**Table B-1: GNSS receiver specifications**

| Item                             | Specification   |
|----------------------------------|---|
| Receiver type                    | Dual frequency GNSS   |
| Channels                         | All in view<br>GPS L1CA,<br>L1P L2P,<br>L2C<br>GLONASS<br>L1CA, L1P<br>L2CA, L2P<br>3 SBAS or 3 additional L1CA GPS 1 L-band<br><b>Note:</b> Some options may require a subscription. |
| Positioning modes                | RTK, ROX, SBAS, External RTCM, Autonomous, L-band DGPS service, L-band high precision services, L-band high precision service with GLONASS  |
| RTK formats                      | CMR, CMR+ <sup>1</sup> , RTCM3  |
| Update rate / recording interval | Selectable from 1, 2, 4, 5, 10 Hz (20 Hz available)   |
| Static performance               | Horizontal 5 mm + 0.5 ppm   |
| Cold start time                  | < 60 s typical (no almanac or RTC)  |

**Table B-2: Performance specifications**

| Item               | Specification             |
|--------------------|---------------------------|
| Static performance | Horizontal 5 mm + 0.5 ppm |
| DGPS performance   | < 0.3 m                   |

**Table B-3: Horizontal accuracy specifications**

| Item  | Description   |               |
|---|---------------|---------------|
|   | RMS (67%)     | 2DRMS (95%)   |
| RTK <sup>2,3</sup>                            | 10 mm + 1 ppm | 20 mm + 2 ppm |
| L-band high precision services <sup>2,4</sup> | 0.1 m         | 0.2 m         |
| SBAS (WAAS) <sup>2</sup>                      | 0.3 m         | 0.6 m         |
| Autonomous, no SA <sup>2</sup>                | 1.2 m         | 2.5 m         |

**Table B-4: Communication and port specifications**

| Item      | Description |
|-----------|-------------|
| Bluetooth | Dual port   |

**Table B-4: Communication and port specifications**

| Item              | Description   |
|-------------------|---|
| Radio GSM options | Integrated<br>1 x GSM/GPRS<br>1 x SS (900 MHz or UHF range: 400 MHz) CDMA capable |
| Baud rates        | 4800 - 115200   |
| Serial ports      | 1 x RS-232 (9-pin circular, multi use) 1 x RS-232 (9-pin DSUB)                    |
| Power port        | 1 x Power input (2-pin circular)  |
| USB               | 1 USB Host<br>1 USB Device (9-pin circular)                                       |

**Table B-5: Environmental specifications**

| Item                  | Specification                    |
|-----------------------|----------------------------------|
| Operating temperature | -30°C to +65°C (-22°F to +149°F) |
| Storage temperature   | -40°C to +85°C (-40°F to +185°F) |
| Humidity              | Up to 100% condensing            |
| Enclosure             | IP67                             |
| Shock                 | EP455, 2 m (6.56 ft) pole drop   |

**Table B-6: Power specifications**

| Item                 | Specification                                     |
|----------------------|---|
| Battery              | 2 x lithium ion, 2.6 Ah each, 5.2 Ah total, 7.2 V |
| External voltage     | 9 to 20 VDC                                       |
| Internal radio power | 1 Watt  |

**Table B-7: Mechanical specifications**

| Item       | Description                              |
|------------|--|
| Dimensions | 114 H x 197 D mm<br>(4.49 H x 7.76 D in) |
| Weight     | 1.51 kg (3.33 lb)                        |
| Material   | Plastic                                  |

<sup>1</sup> Receive only, does not transmit this format.

<sup>2</sup> Depends on multipath environment, number of satellites in view, satellite geometry, and ionospheric activity.

<sup>3</sup> Depends also on baseline length.

<sup>4</sup> Requires an L-band subscription.

---

# Index

---

## A

- alarm 18
- antenna 3
  - attaching 7
  - bracket 3
  - port 6
- attaching the antenna 7
- Autoloader 22

## B

- batteries 3
  - replacing 19
  - swapping 19
- battery charger 3
- battery status 18
- Battery status LED 13
- Bluetooth 21
  - device name 21
  - passkey 21
  - status LED 13
- bracket (antenna) 3
- buzzer 18

## C

- cables
  - power 28
- case 3
- changing
  - module status 16
- communication
  - Bluetooth 21
  - specifications 30
- configuring
  - GSM for NTRIP 24
  - SMS messaging 25
  - connecting to a power source 8
- connections 6
  - mounting hole 6
- control panel
  - overview 12
  - power button 12
  - Select button 13

## D

- data cable 3, 22
- data port 6

- device name for Bluetooth 21
- DGPS position status LED 13
- displaying
  - current module status 15
  - SMS approved numbers 25

## E

- Eclipse II 2
- environmental specifications 31
- External power status LED 13

## F

- features 2
- firmware
  - upgrading 22

## G

- GNSS receiver specifications 30
- GPS position status LED 13
- GSM
  - configuring for NTRIP 24
  - functionality 24
  - modes 24
  - overview 24

## H

- horizontal accuracy specifications 30

## I

- inserting SD/SIM card 20
- installation overview 7

## L

- L-band rover mode 14
- LED
  - Battery 13
  - Bluetooth 13
  - DGPS position 13
  - External power 13
  - GPS position 13
  - SD logging 13
  - UHF/GSM 13

## M

- mechanical specifications 31
- modes

- GSM 24
  - operation 14
- module status
  - changing 16
  - displaying 15
- mounting hole 6

## N

- NTRIP 24

## O

- operation modes 14
- overview 2
- overwriting SMS number on approved list 25

## P

- parts list 3
- passkey 21
- pelican case 3
- performance specifications 30
- port specifications 30
- ports 6
  - antenna 6
  - data 6
  - power 6
  - serial 6

- Power button 12
- power cable 3, 8
- power port 6
- power source connection 8
- power specifications 31
- power status 18
- power supply 8
- powering the unit on and off 14
- product overview 2

## R

- removing SD/SIM card 20
- replacing batteries 19
- rover setup 10
- RTK base station mode 14
- RTK rover (external corrections via Blue- tooth) mode 14
- RTK rover (external corrections via serial) mode 14
- RTK rover (GSM) mode 14
- RTK rover (UHF) mode 14

## S

- SD card 3
  - inserting 20
  - removing 20
  - upgrading firmware 23
- logging status LED 13

- Select button 13
- sending SMS message to approved number 26
- serial port 6
  - upgrading firmware 22
- setting up the S320 10
- SIM card
  - inserting 20
  - removing 20
- Single point mode 14
- SMS messaging 25
  - adding a number to approved list 25
  - deleting number from approved list 26
  - displaying approved numbers 25
  - overwriting a number on approved list 25
  - sending message to approved number 26
- status LED
  - Battery 13
  - Bluetooth 13
  - DGPS position 13
  - External power 13
  - GPS position 13
  - SD logging 13
  - UHF/GSM 13
- swapping batteries 19

## T

- technical specifications
  - communication 30
  - environmental 31
  - GNSS receiver 30
  - horizontal accuracy 30
  - mechanical 31
  - performance 30
  - port 30
  - power 31
- tilt control 17
- troubleshooting 28

## U

- UHF/GSM status LED 13
- upgrading firmware
  - overview 22
  - via SD card 23
  - via serial port 22

## W

- what's included 3

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# S320 GNSS Survey Receiver User Guide

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| C2       | 04/21/17         | R. Stankovic | User Guide updated to add references and warnings for 2G modem integration. |

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