

GEOMATICS USA, LLC

---

GLOG™ – RS232 Serial Data Logger



---

# USER GUIDE

GEOMATICS USA, LLC

# GLOG™ – RS232 Serial Data Logger

---

© Geomatics USA, LLC  
2019 NW 21<sup>st</sup> Ln  
Gainesville, FL 32605  
Phone 352.226.9564 • Email [info@geomatics.us](mailto:info@geomatics.us)

## Document History

Revision	Date	Author	Status and Description
1.0	20.10.2014	Bill Quinlivan	First Draft

---

© 2014 Geomatics USA, LLC. All rights reserved

Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent or other industrial or intellectual property rights. GUSA assumes no responsibility or liability whatsoever for any failure or unexpected operation resulting from misuse, neglect, improper installation, repair or improper handling or unusual physical or electrical stress including, but not limited to, exposure to parameters beyond the specified maximum ratings or operation outside the specified range.

All brands and product names in this publication are registered trademarks or trademarks of their respective holders.

GLOG™ is a trademark of Geomatics USA, LLC.

#### **WARRANTY**

The GLOG RS232 Serial Data Logger is warranted against defects in materials and manufacturing for a period of one year from the date of purchase. In the event of a product failure due to materials or workmanship, GUSA will, at its discretion, repair or replace the product. For warranty service, return the defective produce to GUSA, shipping prepaid, for prompt repair or replacement. GUSA, its suppliers, and its licensors shall in no event be liable for any damages arising from the use of or inability to use this product. This includes business interruption, loss of business information, or other loss which may arise from the use of this product.

#### **DISCLAIMER**

GUSA PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF GUSA PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE UNDERTAKEN SOLELY AT THE CUSTOMER'S OWN RISK. SHOULD A CUSTOMER PURCHASE OR USE GUSA PRODUCTS FOR ANY SUCH UNAUTHORIZED APPLICATION, THE CUSTOMER SHALL INDEMNIFY AND HOLD GUSA AND ITS OFFICERS, EMPLOYEES, SUBSIDIARIES, AFFILIATES, AND DISTRIBUTORS HARMLESS AGAINST ALL CLAIMS, COSTS DAMAGES AND ATTORNEY FEES WHICH COULD ARISE.

# Table of Contents

Definition .....	1
<u>    </u> Tested Garmin units.....	1
<u>    </u> Acknowledgment.....	1
<u>    </u> Message to Owner .....	1
GLOG™ Features .....	2
<u>    </u> Power Requirement .....	3
<u>    </u> Parts Description.....	3
GLOG™ Operation.....	6
<u>    </u> Operational Precautions.....	7
<u>    </u> RINEX File Generation.....	9
GLOG™ Troubleshooting .....	11
<u>    </u> Error Codes.....	13
GLOG™ Specifications .....	14
<u>    </u> Electrical .....	14
<u>    </u> Mechanical.....	14

---

## Definition

**G**LOG™ is a battery-powered device manufactured by Geomatics USA, LLC, to log binary data from select Garmin handheld GPS units, and store the data to a microSD memory card for later use in post-processing, e.g. to improve accuracy of position estimates.

## Tested Garmin units

GLOG™ should work with most Garmin GPS units. However, at the time of writing this text, it has only been tested on the following Garmin models:

- GPS12
- eTrex

## Acknowledgment

GLOG was created through adaptation of the firmware and hardware of the Open Source OpenLog™ product developed and marketed by SparkFun. This work is gratefully acknowledged.

### Note

Additional information about GLOG™ will be posted on the Geomatics USA, LLC website as it becomes available.

## Message to Owner

Congratulations on your purchase of the GLOG™ product from Geomatics USA, LLC. This guide is provided to help you understand and make best use of your GLOG™ to get years of trouble-free service. Good navigating!

# GLOG™ Features



Figure 1: The GLOG™ Unit

Figure 1 above shows the GLOG™ unit in its enclosure. The two halves of the enclosure are held in place with four Phillip’s-head screws accessible from the battery-compartment side.



Other than the battery compartment, there are no operator-accessible parts or function selections available within the enclosure, so there is usually no reason to open up the device.

As with most devices containing logic circuits, it is possible to damage the device by contacting exposed metal parts with stray voltage sources such as static electricity.

The device should also be kept dry and clean. The microSD card holder in particular is vulnerable to sand and debris.

## Power Requirement

The GLOG™ unit runs on **3.7-Volt Lithium Ion batteries** such as the model 10440 600mAh 3.7-volt rechargeable AAA battery, available e.g. from Amazon, eBay, etc. The unit will run on a single battery but allows for two batteries in parallel for extended battery life. The batteries can be inspected, recharged, or changed by removing them from the unit. To access the compartment, press firmly on the knurled recess and slide the cover sideways away from the power switch.

### Note

Exercise caution to get the batteries inserted correctly, because if either is reversed, it may damage the device and/or short the batteries together and create a fire hazard or cause burns to your hands or other bodily injury.



DO NOT TRY TO OPERATE THE GLOG™ UNIT ON 1.5 VOLT DRY CELLS, NiCad, etc.

### Note

$$2 \times 3.7\text{V} \times 600 \text{ mAh} = 4440 \text{ mWh}$$

GLOG™ consumes about 45 mW at full recording speed

$$4440 / 45 \sim 100 \text{ hours of continuous operation}$$

## Parts Description

Place the device in front of you battery-down on a flat surface with the prominent DB9 male nine-pin serial connector facing away from you and the microSD card slot facing you.

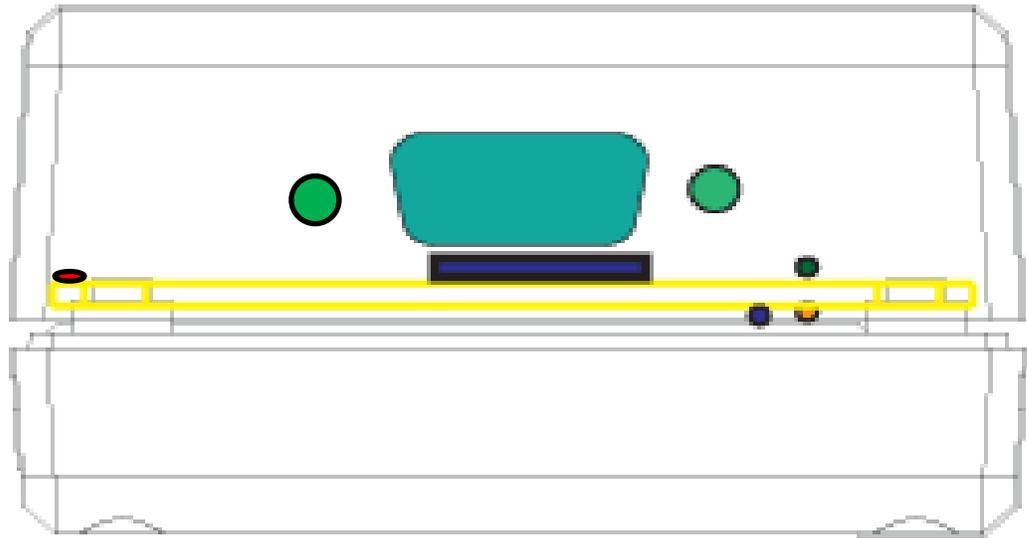


Figure 2: GLOG™ Parts and LEDs

Features now can be located by analogy with positions on a clock-face. The notable features are arranged around the periphery of the device, close to the now-horizontal slot where the two halves meet along the GLOG™ printed circuit board.



With this orientation, and assuming the device has batteries, it is recommended for initial familiarization that you switch the device on at the slider **switch** to the left, or **nine** o'clock position, to observe the function of the various LEDs. A **red LED** illuminates at **eight** o'clock position to indicate **power on**.

**Note:** No need to connect the GPS unit just yet.



First stop at the high **noon** twelve o'clock position is the **DB9** connector. This connects to the serial cable (available from Garmin) to receive serial data from the GPS receiver.



Continuing clockwise from the DB9 connector, at the **one** o'clock position, two LED "**traffic lights**" are present to indicate data moving between GLOG™ and the GPS receiver to verify functioning, and help diagnose problems. If the device is switched on but without a connected GPS receiver, you should see the GLOG™ "send" LED dimly flickering in a repeating pattern to indicate the GLOG™ attempt to initiate a handshake with the GPS receiver.

**Note:** With no GPS receiver connected, you will see no "received" traffic in response.



Next, all the way around to the **five** o'clock position, a **blue LED** provides **status** information about the GLOG™ session and the microSD **recording** device. It lights when data is physically being saved to the device, and also uses patterns of fast and slow flashes to indicate status and error conditions; this will be discussed later.

**Note:** Status LED should always start with ten rapid flashes to tell you "I am GLOG™!" If there is no GPS receiver connected, or if it is in the wrong mode (more below), or unable to acquire enough satellites to navigate, the unit will repeat the ten flashes at regular intervals to indicate that no GPS signal is available.



At the **six** o'clock position, you find the microSD recording device itself, visible only as a small metal-enclosed slot. It employs a "push-push" insertion style, meaning that you (gently!) push the recording media in until it clicks, and again push it until it clicks and releases to remove.

**Note:** If you feel any snags or sharp resistance when pushing - anything - other than the smooth increasing pushback of the ejection spring, stop, reorient the microSD card and try again. With the GLOG™ device in this orientation, the microSD card/chip itself should be oriented before insertion with the logo and any writing up and the contact strips down, and the small bulge on its periphery protruding to the right.



Continuing to the **eight** o'clock position, a red LED indicates power present, and the power switch is right beside it at the nine o'clock position.

**Note**

Care should be taken in the storage and handling of the unit that the switch not be damaged, or inadvertently turned on and left on to drain the batteries.

# GLOG™ Operation

When ready to initiate a logging session,

1. Connect the GPS receiver to the GLOG™ via Garmin serial cable, and turn on the GPS unit

## Note

Ensure the GPS receiver Menu->Setup->Interface is set to "Garmin"

2. Snap a fresh microSD card into the GLOG™ microSD card slot as described above

## Note

There is no reason to turn on the GLOG™ unit until the GPS receiver enters navigation mode with a message on the satellite tracking screen like "READY TO NAVIGATE ACCURACY: 27 ft."

3. When the GLOG™ is switched on, you should see the GLOG™ annunciator flash pattern: 10 rapid flashes on the microSD blue status LED

## Note

Assuming the GPS is in navigation mode, you should immediately see return traffic from the GPS receiver on the serial interface receive data traffic light, and a steady, mostly-on blue microSD status LED (see above). If GLOG is turned on before the GPS, or before the GPS enters navigation mode, repeats of the GLOG annunciator flash pattern tell you it has not acquired all the information it needs to proceed to the bulk acquisition phase. Ordinarily, GLOG should eventually get this handshake data but it may take a couple of minutes.

Once you see the irregular flickering of the microSD status light – congratulations - you are now recording GPS binary data! Use the GPS as you normally would, monitoring reception and clearing problems like lack of sky view due to being inside a building, or confined in a metal vehicle, occlusion by mountains, or tree cover, etc.

## Operational Precautions

- If the serial connection is lost, the data recording will be suspended, but should resume when the GPS signal comes back online. When this occurs, the microSD status light toggles off and on at one-second intervals to indicate no data is being received.
- If the GPS receiver power is lost, whether because it is turned off, the batteries go dead, or simply shift in their cradle so that power is momentarily interrupted, recording will not resume even if the GPS receiver recovers, until GLOG™ power is cycled off and back on. As with lost serial connection, the “no data” flashing will be observed at the microSD status light.

### Note

For this reason, long logging sessions should be monitored to ensure the microSD status light is still indicating data is being recorded, and if not, a new session established by cycling the power. If the microSD status LED is not lit or flickering most of the time, the GLOG™ is not recording

- Logging will continue until GLOG™ power is removed or lost (low battery etc.), GPS receiver power is lost (as above), or until the microSD card is removed or its space exhausted
- Once the logging session is complete, the microSD card can be manually removed from the GLOG™ and read, e.g. on a PC using a dedicated reader slot, or microSD-USB carriers, etc.

### Note

Host computer services allow capabilities including browsing, copying, editing, and deleting files off the microSD card

- GLOG™ creates chronologically numbered data files with the ".GAR" extension

### Note

Although the logged data is binary, the first few bytes of a GLOG™ “.GAR” file can be examined, e.g. in a text editor, and confirmed as a legitimate GLOG™ file by confirming the leading text: "Recorded by GLOG A.B" where the "A.B" gives the major and minor software

version numbers and may be important when reporting a malfunctioning device e.g. the first GLOG™ software version is "1.9"

- There is usually no reason to try to decipher the contents of the file other than determining that you are in fact using a GLOG™ output file
- The binary format of the ‘.GAR’ file generally is described in the Garmin document titled "Garmin Device Interface Specification" which is available online
- The raw data packets recorded by GLOG™ are not publicly documented by Garmin but include satellite range and related necessary to produce RINEX files
- GLOG™ maintains some configuration information in a file named "CONFIG.TXT"

**Note**

There is no reason to modify the configuration file, and changes on a given microSD card may prevent GLOG from operating correctly with that card. For example, the baud rate, normally 9600, can be altered, but doing so will prevent the GLOG from communicating with the GPS

- The amount of data that can be logged depends on the available space on the microSD media card used

**Note**

As a rough rule of thumb, GLOG™ records between 2 MB and 3 MB of data per hour

So for example, an empty 8 GB card could hold approximately  $8 \text{ GB} / (3 \text{ MB} / \text{h}) = 2667 \text{ hours}$  - roughly 111 days

- Obviously, file size considerations may dictate that such long sessions be broken up into shorter recording sessions

**Note**

This is easily done by cycling the GLOG™ power - turn it off and back on; you are now recording to a new file

- Don't let too many files accumulate on the microSD card

#### Note

It is recommended that logged files be stored and managed on a PC or a data storage archive. microSD cards should occasionally be reformatted using host computer services like the Windows file manager, or by using an online freeware program such as “SDFormatter”

## RINEX File Generation

A binary “.GAR” file can be used to generate receiver-to-satellites range ASCII files in RINEX (Receiver INdependent EXchange) format using the “gar2rnrx.exe” PC utility. The PC utility is a console application that runs on a DOS prompt as follows:

```
> gar2rnrx <GAR File path> and hit enter
```

Where: *<GAR File path>* is the full path to the acquired binary data file

e.g. > **gar2rnrx** AAG00234.GAR

#### Note

Make sure to change the directory to where the “GAR” and “EXE” files reside; otherwise, give the full path to either or both files

e.g.

```
> C:\Garmin\gar2rnrx D:\data\LOG00123.GAR and then hit enter
```

Where: *gar2exe* resides in the *C:\Gaermin* folder, and the *LOG00123.GAR* is in *D:\data* folder

**Note:** Windows OS is case insensitive

The result of the gar2rnrx conversion operation is .obs (and possibly .nav) file(s) of the same base name as the input “.GAR” file containing necessary receiver-to-satellites

range values (and possibly satellite navigation information) to precisely determine the receiver position!

**Note:** satellite navigation information is receiver independent and can be independently downloaded from several online services such as <http://geodesy.noaa.gov/CORS/standard1.shtml>

## Receiver Position Computation

Use your favorite GPS post-processing software, like Horus, to compare the acquired RINEX file(s) against a correction source, like a CORS, and produce precise position of the GPS receiver. Accuracy reported for static sessions is sub meter.

# GLOG™ Troubleshooting

Issue	Possible Cause	Remedy
GLOG™ does not power on when I slide the power switch to the right	<ul style="list-style-type: none"> <li>• No batteries</li> <li>• Batteries not charged</li> <li>• Batteries incorrectly inserted in compartment</li> <li>• Wrong batteries<sup>1</sup></li> </ul>	check, recharge, or replace the batteries
Even though the power LED comes on, the unit is not working	there may still be insufficient battery charge to power the GLOG™ unit	try a new, freshly-charged battery, or pair of batteries
Power issue persists	There may be switch or battery issues	try cycling the power; turn off the device and then turn it back on or shift the batteries in their compartment
GLOG™ received data traffic LED never shows any activity, repeats either the GLOG™ annunciator (never got past the handshake), or the repeating one second “no data” flash patterns (indicating data was lost after acquisition began)	<p>GLOG™ is not getting serial data from the GPS receiver; causes could be:</p> <ul style="list-style-type: none"> <li>• GPS receiver not turned on</li> <li>• GPS receiver not in correct Setup-&gt;Interface-&gt;Garmin mode, or</li> <li>• serial cable not making proper contact</li> </ul>	Try removing and remaking the connections at the GLOG™ DSUB DB9 connector and at the GPS receiver end as well

<sup>1</sup> Note the required battery type described above; if you are trying to operate your GLOG on 1.5 volt batteries, your GLOG™ is not working; you need one or preferably two lithium ion 3.7-volt rechargeable AAA batteries as described above

<p>I made up my own serial cable and now GLOG doesn't work!</p>	<p>If both devices are powered on but cannot seem to communicate, you may have the TX (transmit) of the GPS receiver wired to the TX of the GLOG™ or gotten TX and RX (receive) swapped e.g. through use of a "gender change" adapter<sup>2</sup></p>	<p>Try using a DB9 "Null Modem" between the GPS cable and the GLOG™ DB9 connector<sup>3</sup>; If a null modem solves your problem you can just use it like that, or rewire the connections in your cable</p>
<p>GLOG™ saves corrupt files</p>	<p>You may have:</p> <ul style="list-style-type: none"> <li>• a card with format errors,</li> <li>• corrupted directory structure, or</li> <li>• no space available</li> </ul>	<ul style="list-style-type: none"> <li>• delete files from your card, or</li> <li>• reformat the card</li> <li>• Sometimes the cards themselves can be bad, so try a fresh card</li> </ul>
<p>GLOG™ powers on but does not save files</p>	<p>there is a possibility that the CONFIG.TXT file has been corrupted on a given microSD card</p>	<p>simply delete the CONFIG.TXT file and retry<sup>4</sup></p>

<sup>2</sup> A gender change adapter is a small double-sided DB9 fixture, either M-M or F-F to allow proper mating of connections

<sup>3</sup> A null modem looks like a gender-change adapter, but swaps the transmit and the receive lines internally for just this purpose. In use, a null modem sits between the GLOG unit and the serial cable connecting the GPS receiver

<sup>4</sup> GLOG will save a new CONFIG.TXT file with proper settings the next time it is turned on using that same microSD card

## Error Codes

Several error conditions in the GLOG recording subsystem are shown via internal "error messages" – a series of N slower (so you can count them) flashes of the blue microSD status light with the following meanings:

# LED Blinks	Name	Description
3	ERROR_SD_INIT	microSD card not found or cannot be initialized
5	ERROR_NEW_BAUD	Baud rate error
6	ERROR_CARD_INIT	microSD card faulty
7	ERROR_VOLUME_INIT	Error creating a directory on disk
8	ERROR_ROOT_INIT	Root directory on disk is not accessible (maybe open by another application)
9	ERROR_FILE_OPEN	File open error (file may not exist on specified path)
10	GLOG_ANNONCIATION	“Hello World” message from GLOG

### Note

By far the most frequent error observed will be **three** flashes indicating an error initiating the SD device - usually because there is no microSD card in it; a fresh card can be snapped in, and the device should come back up

### Note

If in doubt, power cycle

# GLOG™ Specifications

## Electrical

### Power

- Consumption: 45 mW (at full recording speed, less otherwise)
- Input Voltage: **3.7 Volt Lithium Ion batteries**
- Battery Life (1x 3.7V LIPO model 10440 rechargeable AAA battery): 50 hours

### Data

- 1x micro SD card drive (up to 16 GB)
- Baud Rate: 9600 for Garmin receivers

### Status LEDs

- Power ON/OFF
- Recording
- Receiving
- Transmitting

### Communication

- 1x 9-pin mini-DIN D-SUB
- D-SUB DB9 to Garmin receiver cable required (not included)

## Mechanical

- ABS plastic enclosure with 2x AAA battery compartment
- Dimensions: 2.5"×1.5"×1.5" (65×40×40 mm)
- Weight: 75g (including battery weight)