



Figure 1

## SD GPS Data Logger V3.1.4 15 September 2008

### Overview

The E-TEK EB85A GPS engine uses the latest technology to make sure you get a signal in areas of dense foliage, canyons, and even inside buildings.

Data from the GPS engine can be stored on an SD or SDHC memory card (64 Mb to 32 GB). A file system has been implemented to allow you to have up to 255 folders, with each folder holding 255 files. The size of these files is not limited and can hold tens of thousands of positions. The time and date of each file is also recorded when the file is created and updated. The memory card can be formatted in either FAT16 or FAT32 format.

Data can be stored in two formats:

1. NMEA Mode – where the data is simply received from the GPS engine in NMEA 0183 format and recorded.
2. EXCEL Mode – where the NMEA sentences are parsed and data requested by the user is recorded.

Power is supplied from a rechargeable 1800 mAh 3.6V lithium ion battery that contains a protection circuit module. Testing has shown that the logger can operate continuously for ~36 hours on a full charge. Increased run times can be achieved using sampling intervals from 1-29 seconds. During these intervals the main microprocessor of the logger is placed into a low power sleep mode for the sampling interval. Sampling intervals from 30-65535 seconds will achieve the longest run times by shutting off power to the GPS engine and having the microprocessor being sleep mode. When power is reapplied to the GPS Engine it is forced to perform a cold restart. Depending on the time the GPS engine remained off it could take from 8 to 48 seconds to reacquire a GPS fix. The microprocessor will wait for the GPS engine to regain a fix before recording a sample.

### Setup and Operation

#### 1. Turn It On

The SD GPS Data is shipped with a 70% charged battery from the factory. Without inserting an SD Memory card turn on the data logger via the sliding switch located in the upper left corner of the printed circuit board. LEDs D5 & D6 just below the on/off switch should be oscillating on and off (Figure 2). This indicates the unit is receiving 3.3V and is awaiting insertion of an SD card.

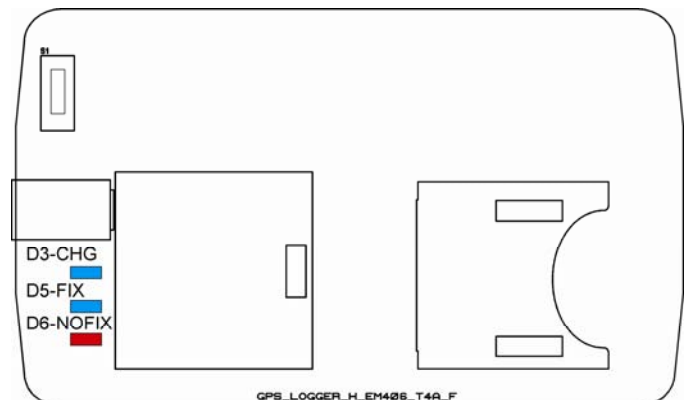


Figure 2

Onboard the GPS engine resides an almanac of data for the positions of the GPS satellite constellation. After a long period of non-use this almanac data

requires updating. Set the GPS Logger in a position with as clear a view of the sky as possible, with the power on, for approximately 15 minutes so that the GPS engine can update the almanac and acquire a satellite fix.

## **2. Insert SD Memory Card**

At this time go ahead and insert the memory card into the GPS data logger. The memory card socket is a push-pull socket so be sure to push the memory card into the socket, until an audible click is heard, then release. Upon immediate insertion of the memory card the onboard microprocessor will begin to flash its LEDs indicating that the card has been detected. The microprocessor will then enter into the file initialization mode. This initialization is 5 steps long and the LEDs will quickly flash 1, 2, 3, 4, or 5 times indicating which step has just been completed.

With initialization complete, either the Fix LED (blue) or the No Fix Led (red) will begin to flash during the writing of information to the SD card at the set sampling interval. After a minute or two of operation turn off the data logger via the sliding switch. Put the card into your card reader and you will find 2 files on the card, one called CONFIGUR.CSV and one called GPSXX000.CSV.

Care should be taken to remove the data memory card only after the power has been turned off. It is advised that power should only be turned off when the LED is not lit. Corruption of not only the file but the entire card could occur if the card is removed during a write cycle. If a file appears corrupted, backup your data and reformat the card.

## **FILES**

### **1. Configuration**

CONFIGUR.CSV is the configuration file for the data logger and contains a single configuration line and numerous documentation lines.

\*It is recommended that the CONFIGUR.CSV file only be edited in a simple text editor such

as Notepad. Editing the file in Excel can cause the logger to not operate properly.

The default configuration line should appear as such:  
**“0,00001101,0,0”**

The first number represents the delay in seconds between samples of the NMEA data. Therefore if you wanted a delay of 5 seconds between each line of data you would enter 5. Values of 0-65535 can be entered.

The second number is an 8-bit binary number that allows the user to turn on-off the features they desire. The first number in the sequence (Bit 8 – far left) indicates which data mode the logger will record data in. 0 indicates NMEA Mode and 1 indicates EXCEL mode. The next 7 numbers in the sequence turn on-off the different values that are to be recorded in each data mode. 0 – indicates that this value will not be recorded and 1 indicates that the value will be recorded.

The third number in the configuration file indicates whether data is recorded or not recorded when the EM406A/EB85A has a satellite fix. This is used in both NMEA and EXCEL mode and eliminates lines of erroneous data when there is no satellite fix. 0 – indicates that information will always be recorded and 1 indicates that the values will only be recorded if the unit has a valid 2D or 3D satellite fix.

Finally, the fourth number in the configuration file indicates whether the CHARGED mode has been implemented. This feature was added for users in vehicles with a charge source readily available. Information is meant to be recorded while the ignition is on. If after the designated time has elapsed, with the ignition being off, the unit pauses recording and waits for the ignition to be turned back on. This way when a user is on safari in their vehicle if they stop for a break, event, or to camp extraneous data is not recorded.

When using CHARGED mode the DC charge input should be tied to the ignition switch of the vehicle and will allow the unit to record data whenever an external dc power source is available. Whenever, this external source is removed the unit will start a

variable countdown timer (data is still recorded). If the designated time has elapsed without the external power source being returned the unit will pause recording and enter a low power sleep mode. When in this mode the unit will alternately flash LEDs D5-FIX and D6-NOFIX to indicate this mode in 20 second intervals. Once dc power has returned the unit will reset the timer and resume recording data to the same file prior to the removal of power. 0 – indicates that the CHARGED mode is disabled and (1-65535 seconds) indicates that the CHARGED mode is enabled at the selected time interval.

From the factory the default configuration is “0,00001101,0,0”. The last used configuration data is stored in the EPROM (non-volatile) memory of the microprocessor after each successful read of the CONFIGUR.CSV file. Therefore, if you ever inserted a blank memory card the microprocessor would create a new file with the last known settings.

## 2. NMEA Mode

NMEA mode simply allows the recording of NMEA 0183 sentences as they are received from the EM406A/EB85A. In NMEA mode only bits 8 and 3-0 are functional (Table 1). By changing the last 4 bits of the second configuration number you can decide which NMEA sentences to record. Detailed descriptions of the NMEA sentences can be found at <http://aprs.gids.nl/nmea/>.

Bit 7	Mode
Bit 6	NC
Bit 5	NC
Bit 4	NC
Bit 3	GPGGA
Bit 2	GPGSA
Bit 1	GPGSV
Bit 0	GPRMC

Table 1

To record all of the NMEA data you would set the configuration line to “0,00001111,0”. To only record GPGSV sentences the configuration line would be “0,00000010,0”.

Recommended settings for road trips in automobiles are “0,00001001,1,500”. This setting records maximum amount of data possible using the GPGGA and GPRMC sentences. Records data only when valid 2D or 3D fix data is available. Finally, it records up to 30 minutes after external 12VDC power supply is removed (i.e. Ignition switched off).

## 3. EXCEL Mode

In this format, the configuration file will allow you to record longitude, latitude, altitude, heading, speed, number of satellites currently being tracked, position dilution of precision, horizontal dilution of precision, vertical dilution of precision, fix, Universal Time Code (UTC) Time, UTC Date in a comma separated file (CSV). This allows for easy importation into Excel, Matlab, and GPSTabel.

Bit 7	Mode
Bit 6	Lat/Long
Bit 5	Altitude
Bit 4	Heading
Bit 3	Speed
Bit 2	Satellites,PDOP,VDOP,HDOP
Bit 1	Fix
Bit 0	Time/Date

Table 2

To record all EXCEL data you would set the first line of the configuration file to “0,11111111,0,0”. If you only wanted to record the speed at which you were traveling then “0,10001000,0,0” would be used.

## 4. Data Conversion

NMEA Mode data can be converted to many other useable forms using [www.GPSBabel.org](http://www.GPSBabel.org). GPSBabel is a software program that resides on your local machine and does not require an internet connection to convert your data. It has both a command line and GUI interface for easy translation of files. GPSBabel is recommended for conversions into Garmin Mapsource databases (.gdb). The command line to use is:

```
gpsbabel.exe -p "" -w -i nmea -f "<Source>.csv" -o gdb -F "<output>.gdb"
```

Replace <source> with the path and filename of the csv file from the SD Card. Replace <output> with the path and filename where you wish to store the converted data.

the memory card. During continuous logging mode this will indicate that approximately 30 minutes of operating time remains.

Both NMEA Mode and EXCEL Mode data can be converted using [www.gpsvisualizer.com](http://www.gpsvisualizer.com). This online conversion source is recommended for translation of files into Google Earth and Google Maps.

## HARDWARE

### 1. Charging

The data logger battery contains a protection circuit module that prevents overcharging and discharging. There is also an onboard charging circuit that requires 7-22V and will sink up to 250 mA of current through a wall wart adapter via a 2.1 mm center positive DC jack. Typically, DC sources include wall wart adaptors, automobile cigarette lighter ports, and solar panels. The LED D3-CHG indicates that the battery is charging.

## SAFETY

The lithium ion batteries in these devices contain a very high energy density due to their chemical makeup. The energy in these batteries can be released very quickly due to the highly reactive nature of Lithium.

**DO NOT PUNCTURE OR PIERCE THE BATTERY AT ANY TIME!**

**DO NOT EXPOSE THE BATTERY TO TEMPERATURES GREATER THAN 140F!**

**THE BATTERY SHOULD ONLY BE CHARGED VIA A DC POWER SOURCE BETWEEN 7-22V!**

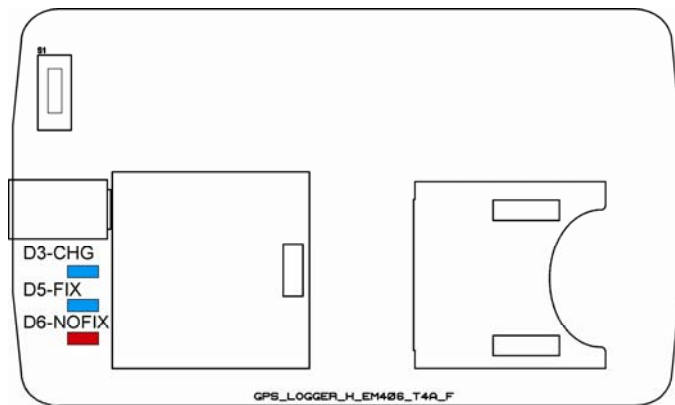


Figure 4

The dc current source can simultaneously charge and power the data logger allowing for uninterrupted usage of the device. Charging is complete when the charge LED no longer remains lit when external power is still applied.

A low battery indicator will signal when the voltage of the battery reaches ~3.3V. This signal is a series of 4 short blinks of LED D5-FIX or D6-NOFIX, depending on whether the GPS has a satellite fix at the time of sampling, following a successful write to

