



Figure 1

## SD GPS Data Logger V2.0 06 March 2007

### Overview

The EM406 GPS engine uses the latest SIRFSTAR III chipset to make sure you get a signal in areas of dense foliage, canyons, and even inside buildings.

Data from the EM406 is stored on an SD memory card (64 Mb to 2 GB). Up to 255 files can exist on each memory card at one time. The size of these files is not limited and can hold literally thousands of positions. The time and date of each file is also recorded when the file is created and updated. This memory card must be formatted in FAT16 format to operate properly.

Data can be stored in two formats:

1. NMEA Mode – where the data is simply received from the EM406 in NMEA 0183 format and recorded.
2. KML Mode – where the NMEA sentences are parsed and data requested by the user is recorded.

Power is supplied from rechargeable 3.6V lithium ion battery that contains a protection circuit module. Testing has shown that the logger can operate continuously for ~48 hours on a full charge. Increased run times can be achieved using sampling intervals from 1-59 seconds. During these intervals the main microprocessor of the logger is placed into a low power sleep mode for the set sampling interval. Sampling intervals greater than 59 seconds will achieve the longest run times by shutting off

power to the EM406 and SD card in addition to the processor being in sleep mode. When power is reapplied to the EM406 it is forced to restart. Depending on the time the EM406 remained off it could take from 8 to 48 seconds to reacquire a GPS fix. The processor will wait for the EM406 to regain a fix before recording a sample.

### Setup and Operation

#### 1. Turn It On

The SD GPS Data is shipped with a fully charged battery from the factory. Without inserting an SD Memory card turn on the data logger via the sliding switch located by the USB Mini B port. A small LED near the ceramic patch antenna of the EM406 should be solid red (Figure 2). This indicates the EM406 is receiving 3.3V and does not have a fix on any satellites.



Figure 2

A single LED near the power switch should be oscillating on-off (Figure 3). This indicates that the micro processor is waiting to detect the insertion of an SD Memory card.

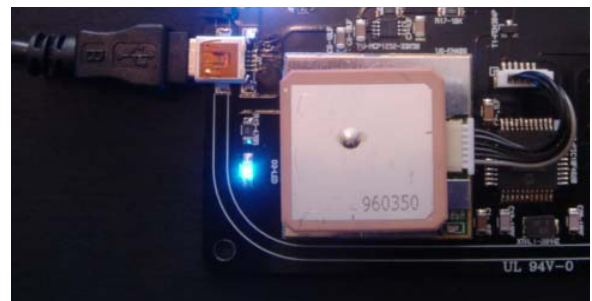


Figure 3

Onboard the EM406 GPS Engine is a small super capacitor that allows the EM406 to store almanac data of the GPS satellite constellation. Upon startup after a long period of non-use this almanac data requires updating. Set the GPS Logger in a place/position with as clear a view of the sky as possible, with the power on, for approximately 15 minutes so that the EM406 can update the almanac and acquire a satellite fix. The EM406 will indicate that it has a satellite fix when its LED blinks on and off in one second intervals.

## 2. FAT16 File Format

Place your SD Card into a card reader so that your computer recognizes the card as a removable disk. Using "MY COMPUTER" right click on the removable drive and select format. The menu in Figure 3 menu should popup. Select File System -> FAT and click start. This will automatically erase all data on the SD Memory Card and will format it in FAT16 format.

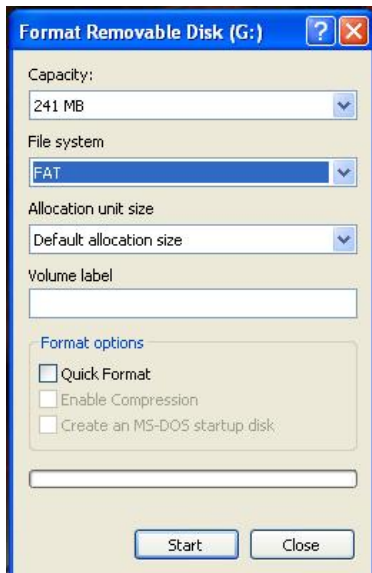


Figure 4

## 3. Insert SD Memory Card

By this time the small LED on the EM406 should be blinking in 1 second intervals indicating that it has a satellite fix. If not, move the GPS logger into another position such that there are as few obstructions between the ceramic antenna and the sky.

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 LED 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 LED will flash 1, 2, 3, 4, or 5 times indicating which step has just been completed.

With initialization complete, the LED 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 CONFIG.CSV and one called GPSXX001.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 in FAT16 file format.

## FILES

### 1. Configuration

CONFIG.TXT is the configuration file for the data logger and contains a single configuration line and numerous documentation lines. The configuration line should appear as such: "0 , 11111111 , 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 KML 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 and last number in the configuration file indicates whether data is recorded or not recorded when the EM406 has a satellite fix. This is only used in KML Data mode and eliminates lines of erroneous when there is no satellite fix.

From the factory the default configuration is “0,1111111,0”. The last used configuration data is stored in the EPROM (non-volatile) memory of the microprocessor after each successful read of the CONFIG.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 EM406. 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.

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”.

## 3. KML 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 KML data you would set the first line of the configuration file to “0,1111111,0”. If you only wanted to record the speed at which you were traveling then “0,10001000,0” would be used.

## 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 5V and will sink up 500 mA of current through a computer’s hardware USB port. The battery can be charged in mobile applications using an adapter that provides the required voltage and current. The lighted LED (Figure 4) indicates that the battery is charging. The USB can

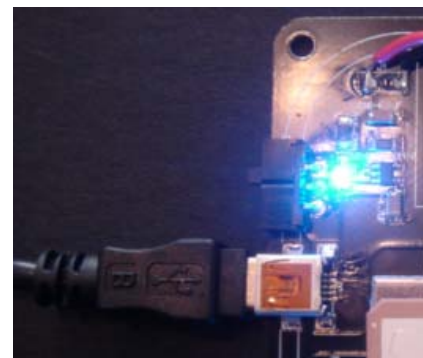


Figure 5

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 by the processor's LED following a successful write to the memory card. During continuous logging mode this will indicate that approximately 30 minutes of operating time remains.

## **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 THE PROVIDED USB PORT.**

## SD GPS LOGGER F - 25 FEB 07 OHARARP LLC

