

# ***User's Manual / GR-312***

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***Google Earth Enabled***

***SiRFstarIII***

***Cute***

***Bluetooth GPS Receiver &***

***Data Logger Dongle***



***Version 0.2***

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## Revision History

Ver.	Date	Description
0.2	Dec. 20 <sup>th</sup> , 2007	Initial draft

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# 1 Introduction

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## 1.1 Applications

This cute USB dongle provides navigation and data logging functions in either wired or wireless way. It could be used with computer devices such as Smart phone, PDA, UMPC, MID, Notebook PC etc.



The power could be from a computer, a cigarette lighter car adaptor, or the matched accessory - BB-100 battery bank directly.



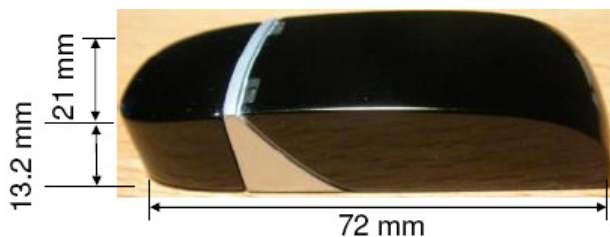
The power could also be from above devices via an extension cable.

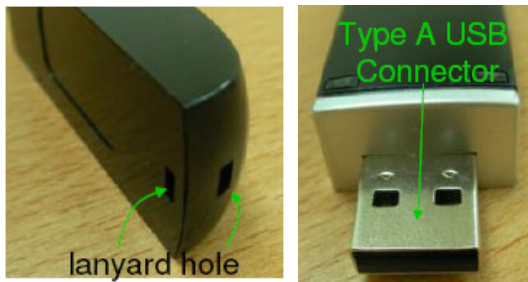


## 1.2 Outlook

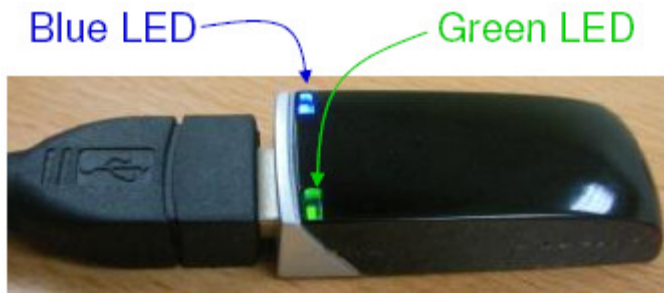
### GR-312

Dimension of GR-312: 21 mm (W) x 72 mm (L) x 13.2 mm (H)





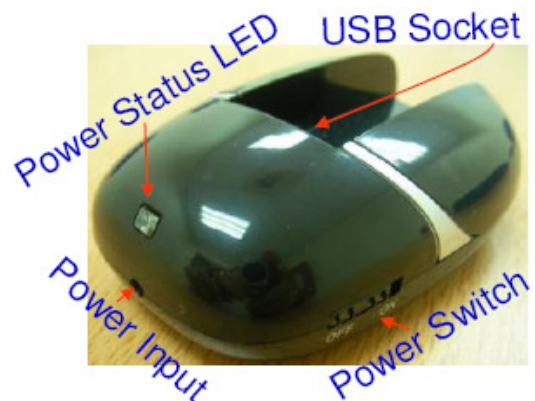
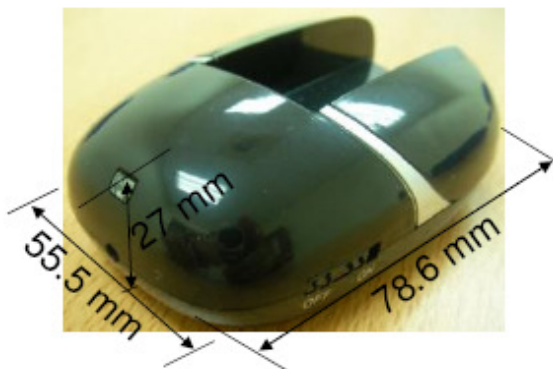
When GR-312 is powered,



- Blue LED indicates the Bluetooth communication status and logging or not
- Green LED indicates GPS fixing status and the remaining logging capacity.

### BB-100

Dimension of BB-100: 55.5 mm (W) x 78.6 mm (L) x 27 mm (H)



## 1.3 Main Features

GR-312 merits not only cute design and excellent performance but also the popular USB and Bluetooth communications in one device. In addition, the Google Earth enabled features make every trip more tangible.

### Stylish

- ◆ Cute and sleek
- ◆ Lanyard hole for neck wearing
- ◆ Convertible and easy to bring

### Wired & wireless communication support

- ◆ Navigation support by wired (USB) and wireless (Bluetooth) communications

- ◆ Convenient PC side data management via either USB or Bluetooth communications

#### **Convenient logging choices**

- ◆ Logging by distance
- ◆ Logging by time
- ◆ Logging by speed

#### **Logging status indication**

- ◆ Logging is enabled or not
- ◆ Capacity is low, near full, or full

#### **No worry of logging data loss**

- ◆ Logging stopped when capacity is full

#### **Logging capacity**

- ◆ 131 thousands way points, or 364 hours for 10 seconds logging interval
- ◆ Capacity of double/quadruple versions have double/quadruple logging time.

#### **Google Earth enabled with trip summary**

- ◆ Support both concise path view or detailed point view
- ◆ Support both metric unit and imperial unit
- ◆ Convenient time zone translation for global use
- ◆ Start/stop/excessive speed/maximum speed points information
- ◆ Stop points mileage summary for paths between each start/stop points
- ◆ Full trip mileage summary

#### **Concise trip report**

- ◆ Trip filtering allows choosing specified logging interval
- ◆ Useful trip reports generated accordingly

#### **Compatible to various map applications**

- ◆ NMEA enabled: in turn can marry with abundant features based on NMEA format
- ◆ Photo tagging compatible: For example, photo tagging with locr\*

#### **Long working time**

- ◆ 15 hours non-stop continuous working time when powered by BB-100 after first full charging. (BB-100 is equipped with battery of Japan-made 1100mAh Lithium-ion cell.)

#### **Ultra-high performance**

- ◆ Full implementation of ultra-high performance SiRFstarIII single chip architecture

Note. \* locr is a trademark of locr GmbH.

## **1.4 Specifications**

### **GPS Receiver**

Features	Specifications
GPS receiver type	20 channels, L1 frequency, C/A code

Horizontal Position Accuracy	< 2.5m (Autonomous) < 2.0m (WAAS) (50% 24hr static, -130dBm)
Velocity Accuracy	<0.01 m/s (speed) <0.01° (heading) (50%@30m/s)
Time accuracy	1µs or less
TTFF (Time to First Fix) (50%, -130dBm, autonomous)	Hot Start: 1s Warm Start: 35s Cold Start: 42s
Sensitivity (Autonomous)	Tracking: -159dBm Acquisition: -142dBm (-142dBm 28dB-Hz with 4dB noise figure)
Measurement data output	Update time: 1 second NMEA output protocol: V.3.00 Baud rate: 4800 bps (8-N-1) Datum: WGS-84 Default: GGA, GSA, RMC, VTG at 1Hz and GSV at 1/5Hz
Max. Altitude	<18,000 m
Max. Velocity	<1,852 km/hr
SBAS Support	Optional WAAS, EGNOS
Dynamics	<4g

### Bluetooth

Version	Version 2.0
Class	2
Communication range	10m
Communication profile	SPP (Serial Port Profile)

### Data Logging

Capacity	131,071 way points
Logging information	Date, time, latitude, longitude, altitude, speed
User ID	Length of 32 alpha-numeric characters
Data formats	NMEA, KML, CSV

## 1.5 Electrical and Environmental Data

GR-312 is built-in with a small backup battery for GPS performance enhancement reason only. The optional power source accessory, BB-100, could be used to power GR-312.

### Power

Power consumption	73mA, continuous tracking mode
Power supply	3.3V ~ 5.5V



BB-100 Battery	1100mAh, Lithium-ion Charging voltage: 4.2V~5.5V
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### Environmental

Item	GR-312	BB-100
Operating temperature	-20 °C ~ +65 °C	-20 °C ~ +60 °C
Storage temperature	-20 °C ~ +80 °C	-20 °C ~ +60 °C

## 1.6 LED Display

### GR-312

Green LED	<p>Always on (bright) as <b>no position fix</b>  Blinks in following way as <b>position is fixed</b>:</p> <ul style="list-style-type: none"> <li>1s on 1s off as <b>capacity &lt; 80%</b></li> <li>2s on 1s off as <b>capacity ≥ 80% and not full</b></li> <li>1s on 2s off as <b>capacity full</b></li> </ul>
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Blue LED	<ul style="list-style-type: none"> <li>Always off as there is <b>no Bluetooth connection</b> and <b>recording is off</b>.</li> <li>Blinks 0.25s on 10s off as there is <b>no Bluetooth connection</b> and <b>recording is on</b>.</li> <li>Blinks 2s on 0.5s off as there is <b>Bluetooth connection</b> and <b>recording is on</b>.</li> <li>Blinks 2s on 2s off as there is <b>Bluetooth connection</b> and <b>recording is off</b>.</li> <li>Blinks 0.5s on 0.5s off during <b>data upload</b></li> </ul>
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### BB-100

Orange LED	<ul style="list-style-type: none"> <li><b>Battery low</b>: LED on until it is recharged or power is used up.</li> <li><b>Charging</b>: LED on as it is under charging; off as charging is done.</li> </ul>
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## 1.7 Communication Connections

### Wired

GR-312 could connect to the USB socket of a computer directly. The computing device can use the position data provided by GR-312 for navigation or data logger management.

### Wireless

GR-312 could connect to a computing device by Bluetooth wireless interface. The PIN code for Bluetooth connection is **0000**. After the connection is established, it can be used for navigation and data logger management.

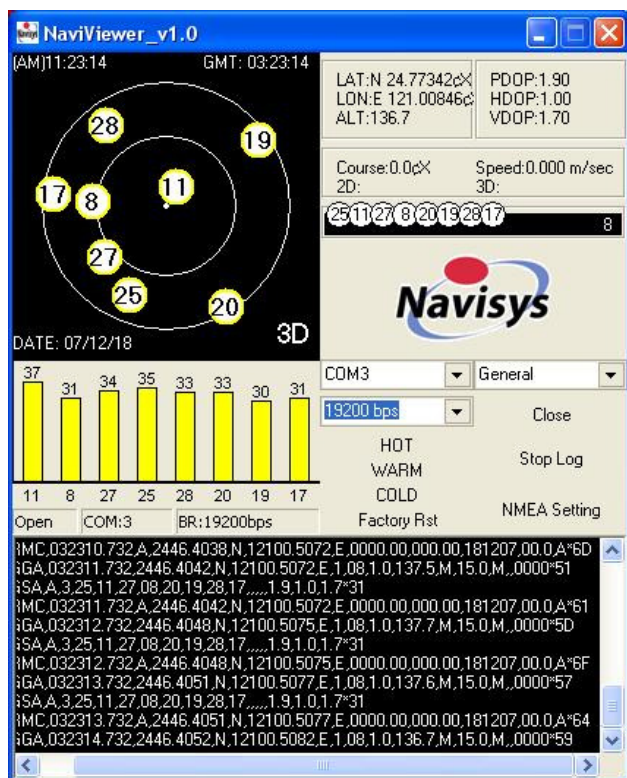
## 1.8 Bundled Tools

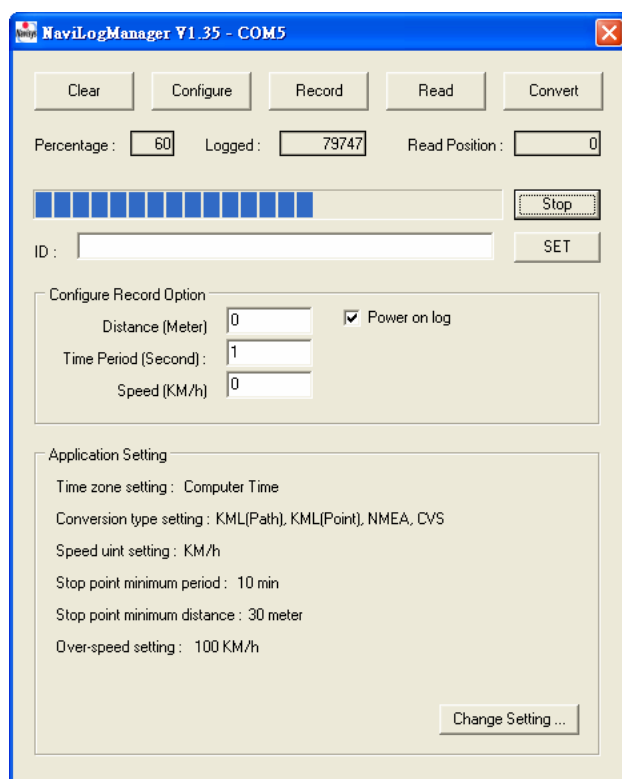
The following tools are designed for running on PC Windows's environment. They are for your

reference purpose only. We do our best to improve the compatibility with mostly used PC windows environment. However, we do not guarantee the compatibility.

NaviViewer: This bonus tool is for checking GPS signal receiving status. One can also use other GPS viewer tool to check GPS receiving status.

NaviLogManager: for logging data management





## 1.9 Certifications

CE, FCC, BQB, RoHS

## 1.10 Related Documents

- USB Driver Quick Installation Guide
- Quick Guide of NaviViewer
- Quick Guide to GR-312 Bluetooth GPS Logger Receiver
- User's Guide to NaviLogManager

## 2 Getting Started

GR-312 can provide the position data for navigation or logging management via either wired (USB) or wireless (Bluetooth) interface.

Both USB and Bluetooth interfaces are connected via serial COM port.

### 2.1 Bluetooth Connection Establishment

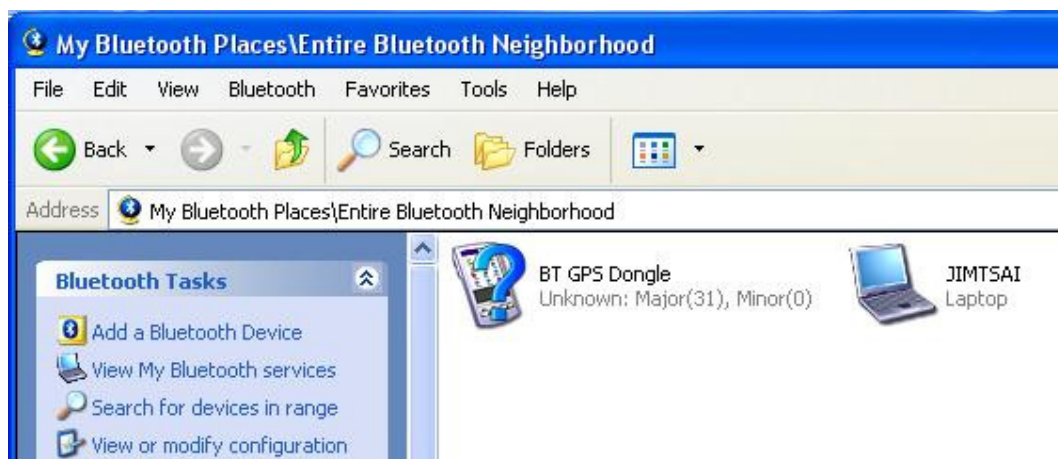
To establish a Bluetooth connection with a computing device, please make sure that the computing device itself supports Bluetooth and the device is turned on first.

Following is an example of establishing a Bluetooth connection on a PC Window's environment.

1. Find the Bluetooth application program and double click on it to start the program. Following is an example.



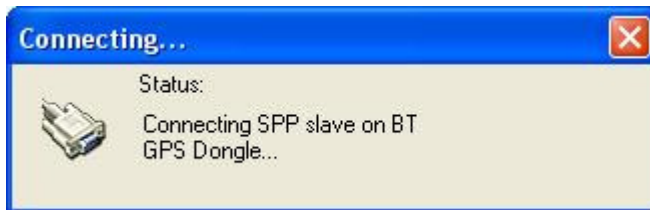
2. Double click on the item of View devices in range. It shows the devices found.



- Click on item of BT GPS Dongle for connecting to GR-312.



- It shows the SPP service is available. Double click on the item SPP slave on BT GPS Dongle.



- It shows it is connecting the GPS Dongle and may request entering the Bluetooth security (PIN) code.



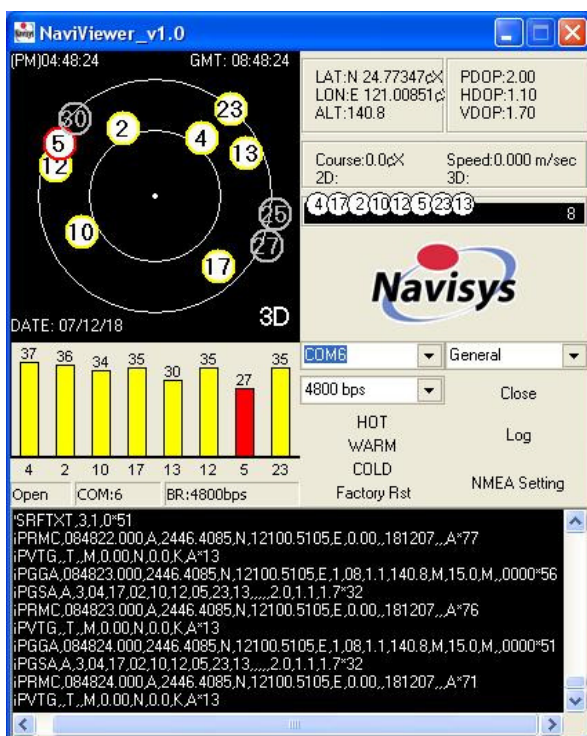
- The PIN code for GR-312 is **0000**. Click on **OK**.



- It shows the device as connected. Move cursor to the icon and it shows the service as connected and COM port number 6 is used for this function.



8. Until now, the Bluetooth connection has been connected between GR-312 and the PC. One can use GPS viewer tool or Navigation software using COM6.



9. One can also use NaviLogManager to manage the data logger using COM6. For the detailed operation of NaviLogManager, please see the [User's Guide to NaviLogManager](#).



**NaviLogManager V1.33 - COM6**

Clear Configure Record Read Convert

Percentage:  Logged:  Read Position:

Stop

ID:  SET

Configure Record Option

Distance (Meter)  ☒ Power on log

Time Period (Second):

Speed (KM/h)

Application Setting

Time zone setting : Computer Time

Conversion type setting :

Speed unit setting : KM/h

Stop point minimum period : 10 min

Stop point minimum distance : 30 meter

Over-speed setting : 0 KM/h

Change Setting ...

**NaviLogManager V1.33 - COM6**

Clear Configure Record Read Convert

Percentage:  Logged:  Read Position:

Stop

ID:  SET

Configure Record Option

Distance (Meter)  ☒ Power on log

Time Period (Second):

Speed (KM/h)

Application Setting

Time zone setting : Computer Time

Conversion type setting :

Speed unit setting : KM/h

Stop point minimum period : 10 min

Stop point minimum distance : 30 meter

Over-speed setting : 0 KM/h

Change Setting ...

## 2.2 USB Connection Establishment

To establish a USB connection, the Prolific PL-2303 USB driver should be installed. For the detailed information, please see the [USB Driver Quick Installation Guide](#). After the connection has been successfully established, a corresponding COM port will be

available for future use.

Wired and wireless interfaces could be connected simultaneously or separately by same or different devices.

## 2.3 Viewing Visited Path from Google Earth

Before one can view the path that one has been visited, one needs to

### 1. **Log the visiting data** in GR-312

GR-312 is by default in data logging mode and it will log data automatically according to setting of record options as its power is on.

The logging could also be turned off by tool of NaviLogManager.

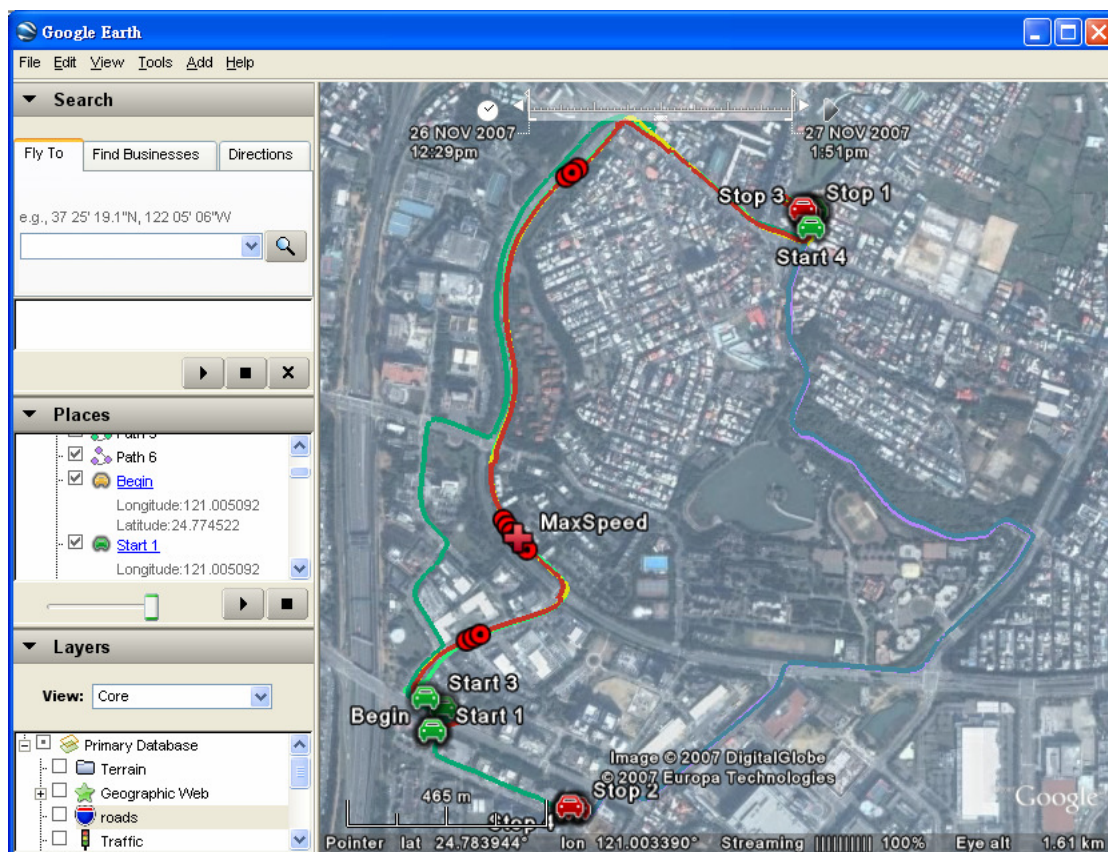
2. **Run NaviLogManager**; click the stop button to stop logging, set parameters such time zone, unit system, over speed definition etc.
3. **Retrieve logging data** (Read) from GR-312 to computer using NaviLogManager.
4. **Choose the formats for conversion**. For viewing from Google Earth, one should choose one or two of KML (path) and KML (point) via Application Setting of NaviLogManager.
5. **Convert the data to KML format** and the converted files are saved at your specified location. (Convert function of NaviLogManager)
6. Make sure **Google Earth ready**. Download and install Google Earth if one has not installed it before.
7. Double click on the **converted KML file** or **open** it from Google Earth "File | Open" menu and one will see the visited path, start/stop information, over speed information, max speed information, mileage information etc.

## 2.4 Track Browsing in Google Earth

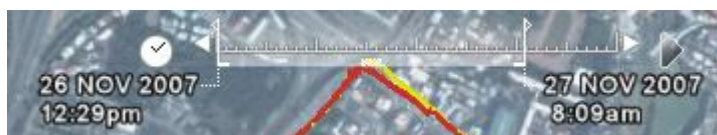
There are many functions in Google Earth. However, it's not our focus to introduce those functions. Instead, some hints are given to start the track viewing.

In following picture, one can see the track of logged data displayed in Google Earth.

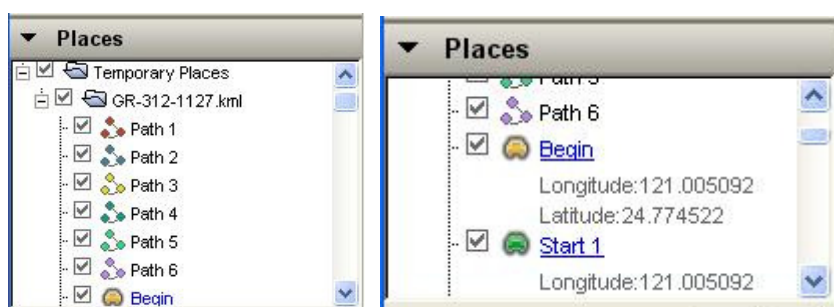




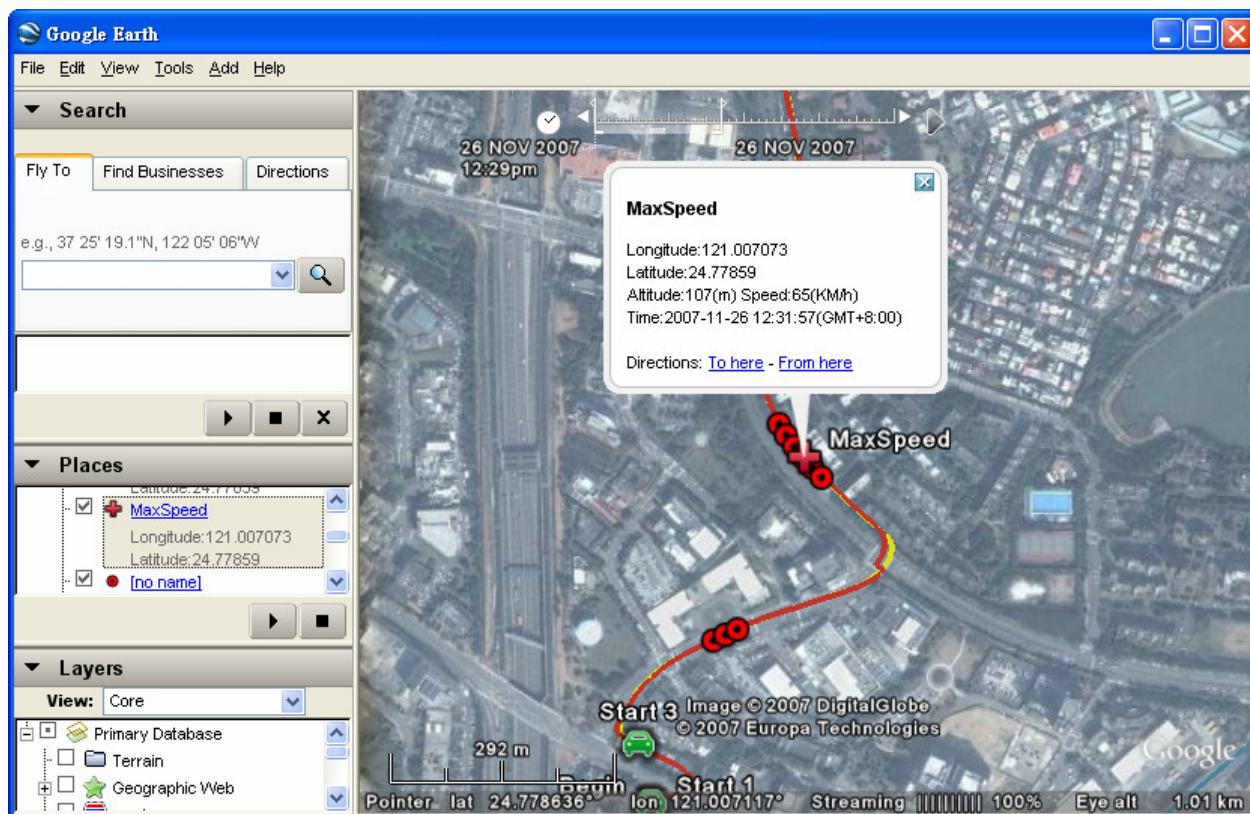
The display content could be selected by adjusting the **time scale**.



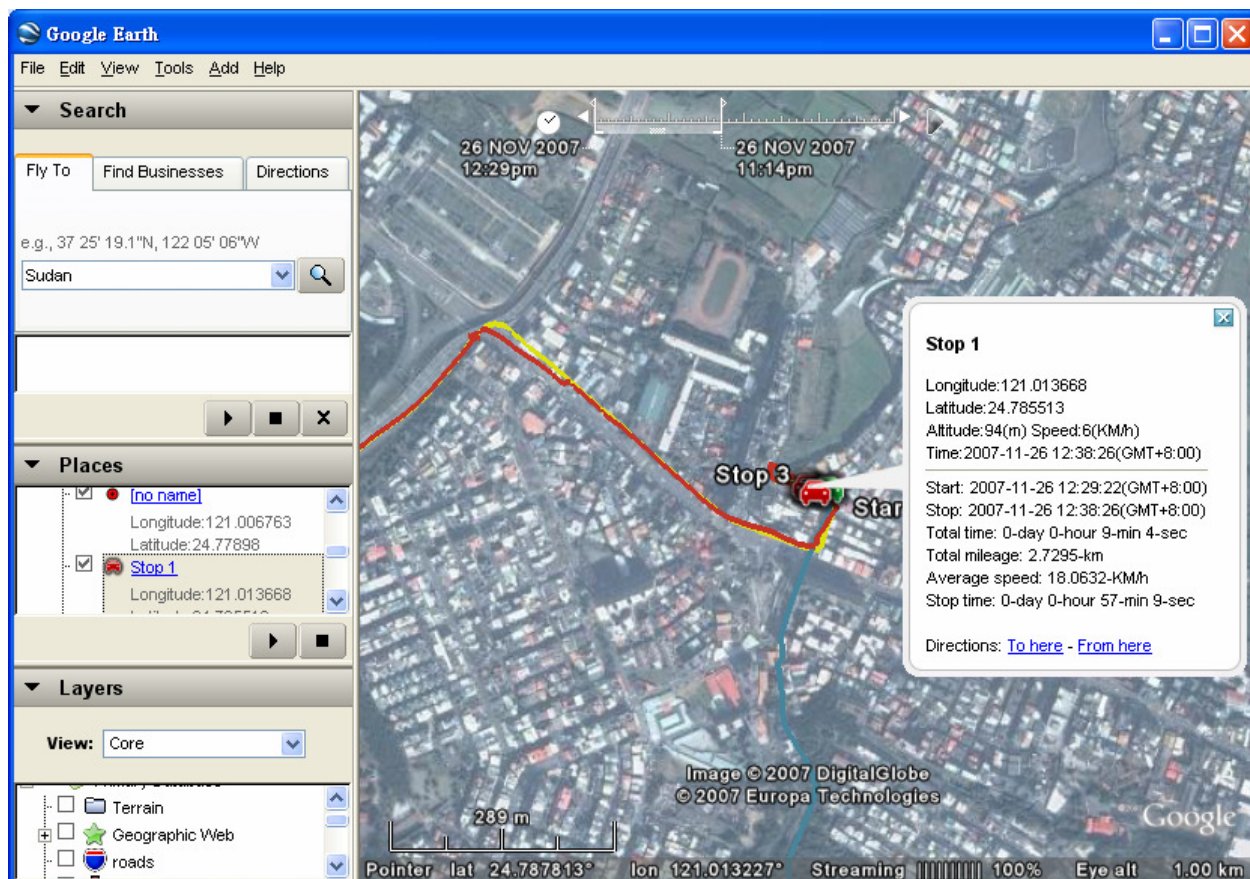
Under the **Places** menu, one can see the logged data summary – path and points. Click on those items, the display would focus on corresponding data.



For example, click on item of MaxSpeed.

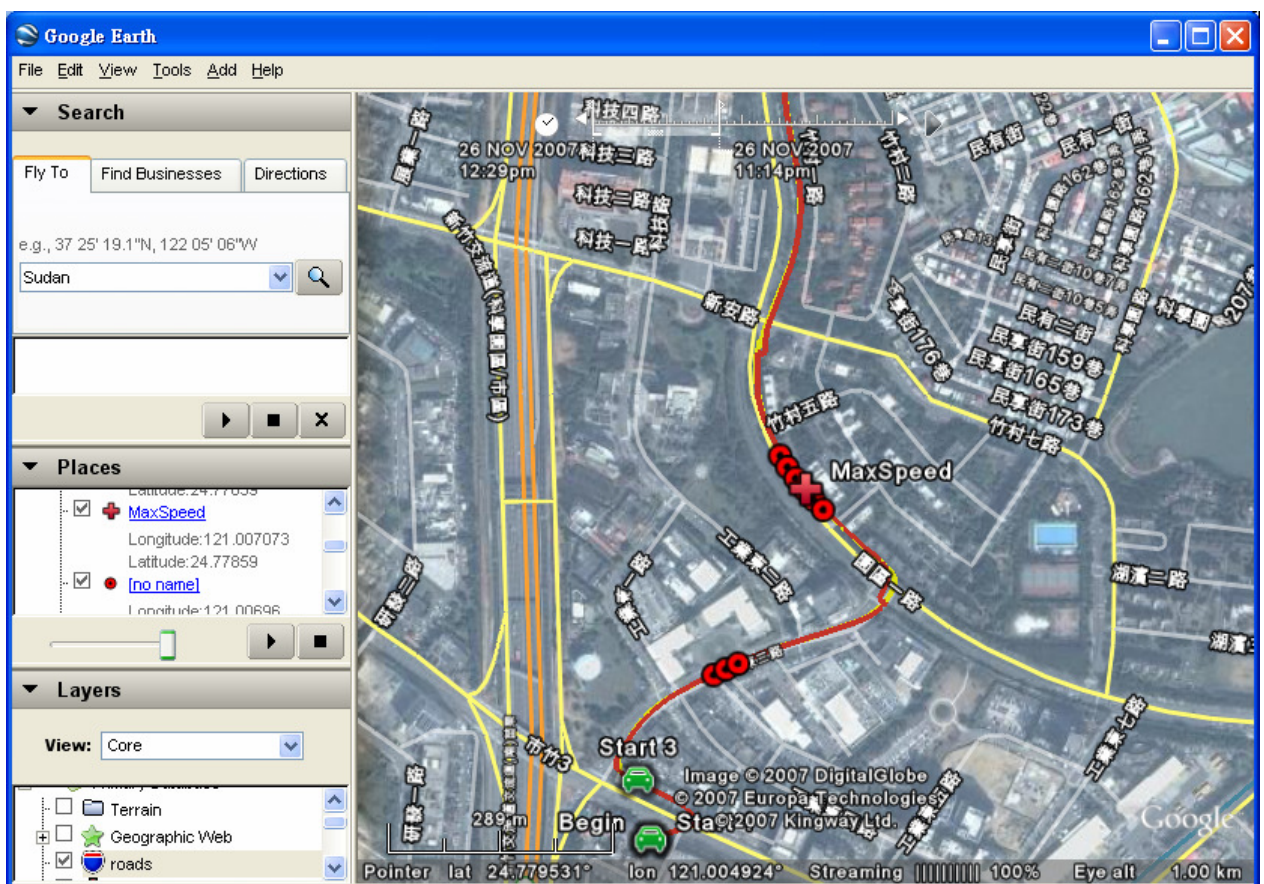
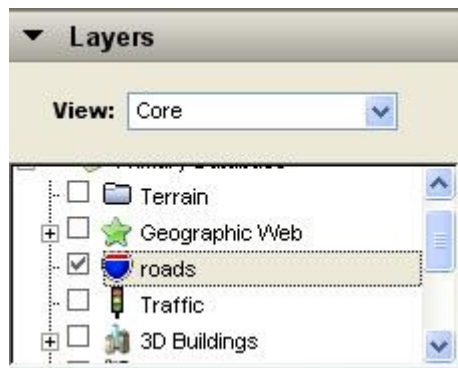


Click on item of Stop 1. (One can also click on icon Stop 1 from the display directly.)





If one prefers to see the map information, remember to enable the roads selection under **Layers** menu.



The map in local language would be displayed. Please note that not every area has their corresponding map.

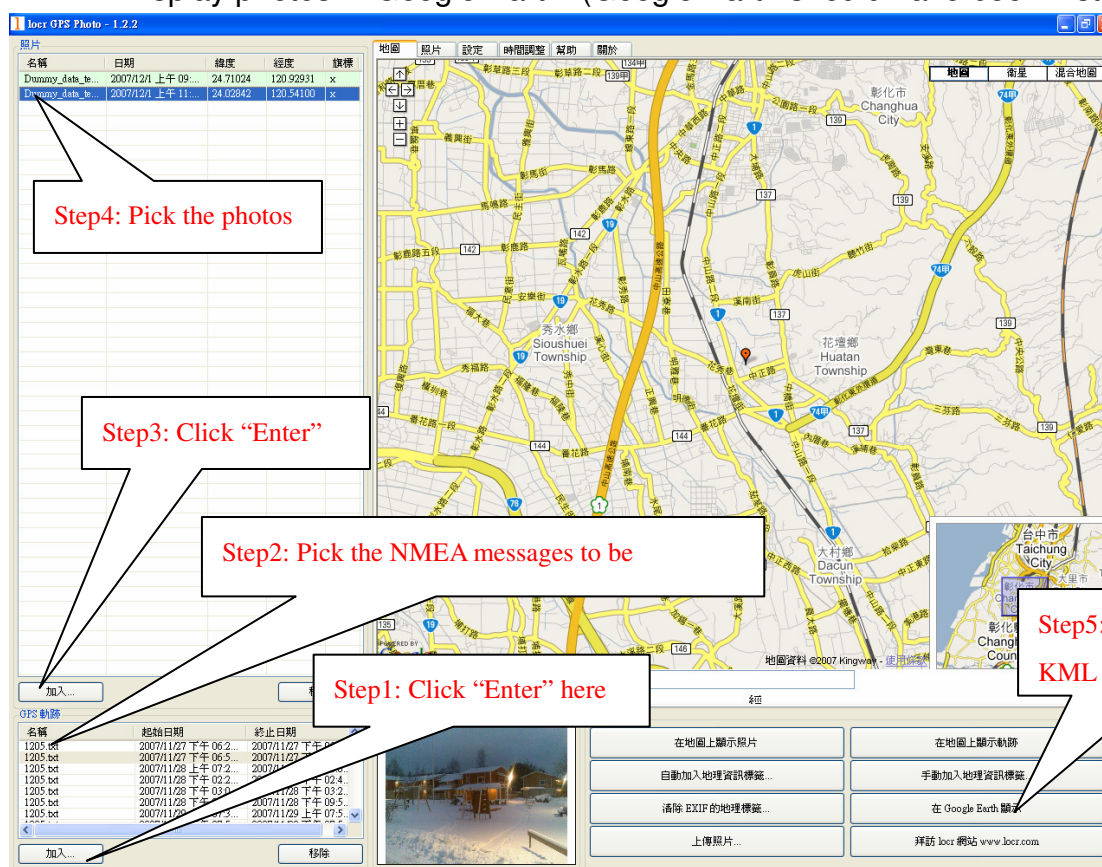
## 2.5 Photo Tagging


NaviLogManager does not support photo tagging directly. However, it's easy to use it with public domain free photo tagging tool. Most photo tagging tools support NMEA format which could also be generated by NaviLogManager.

Following is an example of photo tagging with **locr**.

The rule of thumb is

1. Specify where the NMEA file of logging data is.
2. Specify where the pictures are.
3. Choose the Google Earth KML format for photo display.
4. Display photos in Google Earth. (Google Earth should have been installed.)



- Step 1: Click "Enter"
- Step 2: Pick the NMEA messages to be converted
- Step 3: Click "Enter"
- Step 4: Pick the Photos 
- Step 5: Click for KML format conversion
- Step 6: Click "Yes" to see photos on Google Earth

Locr's web address: <http://www.locr.com/>

## 3 Software Interface

### 3.1 NMEA Output Messages

The NMEA-0183 Output Messages are shown as below:

NMEA Record	Descriptions
GPGLL	Global positioning system fixed data: time, position, fixed type
GPGLL	Geographic position: latitude, longitude, UTC time of position fix and status
GPGLL	GPS receiver operating mode, active satellites, and DOP values
GPGLL	GNSS satellites in view: ID number, elevation, azimuth, and SNR values
GPGLL	Recommended minimum specific GNSS data: time, date, position, course, speed
GPGLL	Course over ground and ground speed
GPGLL	PPS timing message (synchronized to PPS)

GR-312 adopts interface protocol of National Marine Electronics Association's NMEA-0183 Version 3.00 interface specification. GR-312 supports 7 types of sentences - 7 standard NMEA sentences (GPGLL, GPGLL, GPGLL, GPGLL, GPGLL, GPGLL, and GPGLL).

The default output sentences are GPGLL, GPGLL, GPGLL, GPGLL, and GPGLL. The UART communication parameters are 4800 bps, 8 data bits, 1 stop bit, and no parity. Other output sentences, baud rate, and related configurations could be requested based on MOQ.

Single message example

```
$GPGLL,101229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M,,0000*3E
$GPGLL,2446.8619,N,12100.2579,E,060725.000,A,A*7E
$GPGLL,A,3,05,02,26,27,09,04,15,,1.8,1.0,1.5*11
$GPGLL,3,1,12,07,62,081,37,16,61,333,37,01,60,166,37,25,56,053,36*74
$GPGLL,3,2,12,03,43,123,33,23,32,316,34,14,17,152,30,20,16,263,33*78
$GPGLL,3,3,12,19,17,210,29,06,08,040,,15,06,117,27,21,05,092,27*7E
$GPGLL,101229.487,A,3723.2475,N,12148.3416,W,0.13,309.62,120598,,A*7A
$GPGLL,,T,,M,0.00,N,0.0,K,A*13
$GPGLL,060526.000,20,06,2006,,*51
```

## 3.2 GPGGA - Global Positioning System Fix Data

### ■ Example

\$GPGGA,101229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M,, , ,0000\*3E

### ■ Explanation

Contents	Example	Unit	Explanation
Message ID	\$GPGGA		GGA protocol header
UTC Time	101229.487		hhmmss.sss hh: hour, mm: minute, ss: second
Latitude	3723.2475		ddmm.mmmm dd: degree, mm.mmmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12158.3416		dddmm.mmmm dd: degree, mm.mmmm: minute
East/West	W		E: East Longitude, W: West Longitude
Position Fix Indicator	1		0: Fix not available or invalid, 1: GPS SPS Mode, fix valid, 2: Differential GPS, SPS Mode, fix valid, 3~5: Not supported, 6: Dead Reckoning Mode, fix valid
Satellites Used	07		Number of satellites used in positioning calculation (0 to 12)
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Unit	M		Meters
Geoidal separation		meters	
Units	M		Meters
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
checksum	*3E		
<CR><LF>			End of sentence

## 3.3 GPGLL - Geographic Position - Latitude / Longitude

### ■ Example

\$ GPGLL,2446.8619,N,12100.2579,E,060725.000,A,A\*7E

### ■ Explanation

Contents	Example	Unit	Explanation
Message ID	\$GPGLL		GLL protocol header
Latitude	2446.8619		ddmm.mmmm dd: degree, mm.mmmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12100.2579		dddmm.mmmm dd: degree, mm.mmmm: minute
East/West	E		E: East Longitude, W: West Longitude
UTC Time	060725.000		hhmmss.sss hh: hour, mm: minute, ss: second
Status	A		A: Data valid, V: Data invalid
Mode Indicator	A		A: Autonomous, D: DGPS, E: DR
checksum	*7E		
<CR><LF>			End of sentence



### 3.4 GPGSA - GNSS DOP and Active Satellites

■ Example

\$GPGSA,A,3,05,02,26,27,09,04,15,, , , , ,1.8,1.0,1.5\*11

■ Explanation

Contents	Example	Explanation
Message ID	\$GPGSA	GSA protocol header
Mode 1	A	M: Manual—forced to operate in 2D or 3D mode A: 2D Automatic—allowed to automatically switch 2D/3D
Mode 2	3	1: Fix not available 2: 2D (< 4 Satellites used) 3: 3D (> 3 Satellite s used)
Satellite used in solution	05	Satellite on Channel 1
Satellite used in solution	02	Satellite on Channel 2
...		Display of quantity used (12 max)
PDOP	1.8	Position Dilution of Precision
HDOP	1.0	Horizontal Dilution of Precision
VDOP	1.5	Vertical Dilution of Precision
checksum	*11	
<CR><LF>		End of sentence

### 3.5 GPGSV - GNSS Satellites in View

■ Example

\$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42\*71

\$GPGSV,2,2,07,09,23,313,42,04,19,159,41,15,12,041,42\*41

■ Explanation

Contents	Example	Unit	Explanation
Message ID	\$GPGSV		GSV protocol header
Number of messages	2		Range 1 to 3
Message number	1		Range 1 to 3
Satellites in view	07		Number of satellites visible from receiver
Satellite ID number	07		Channel 1 (Range 1 to 32)
Elevation	79	degrees	Elevation angle of satellite as seen from receiver channel 1 (00 to 90)
Azimuth	048	degrees	Satellite azimuth as seen from receiver channel 1 (000 to 359)
SNR (C/No)	42	dBHz	Received signal level C/No from receiver channel 1 (00 to 99, null when not tracking)
...			
Satellite ID number	27		Channel 4 (Range 1 to 32)
Elevation	27	degrees	Elevation angle of satellite as seen from receiver channel 4 (00 to 90)
Azimuth	138	degrees	Satellite azimuth as seen from receiver channel 4 (000 to 359)
SNR (C/No)	42	dBHz	Received signal level C/No from receiver channel 4 (00 to 99, null when not tracking)
checksum	*71		
<CR><LF>			End of sentence

### 3.6 GPRMC - Recommended Minimum Specific GNSS Data

■ Example

\$GPRMC,151229.487,A,3723.2475,N,12148.3416,W,0.13,309.62,120598,,,A\*5F

■ Explanation

Contents	Example	Unit	Explanation
Message ID	\$GPRMC		RMC protocol header
UTC Time	151229.487		hhmmss.sss hh: hour, mm: minute, ss: second
Status	A		A: Data valid, V: Data invalid
Latitude	3723.2475		ddmm.mmmm dd: degree, mm.mmmm: minute
North/South	N		N: North Latitude, S: South Latitude
Longitude	12148.3416		dddmm.mmmm dd: degree, mm.mmmm: minute
East/West	W		E: East Longitude, W: West Longitude
Speed over ground	0.13	knots	Receiver's speed
Course over ground	309.62	degrees	Receiver's direction of travel Moving clockwise starting at due north
Date	120598		ddmmyy dd: Day, mm: Month, yy: Year
Magnetic variation		degrees	This receiver does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.
East/West indicator			
Mode Indicator	A		A: Autonomous M: Manual D: DGPS S: Simulation E: Dead Reckoning N: Data Invalid
checksum	*5F		
<CR><LF>			End of sentence

### 3.7 GPVTG - Course Over Ground and Ground Speed

■ Example

\$GPVTG,309.62,T,,M,0.18,N,0.5,K,A\*0F

■ Explanation

Contents	Example	Unit	Explanation
Message ID	\$GPVTG		VTG protocol header
Course over ground	309.62	degrees	Receiver's direction of travel Moving clockwise starting at due north (geodetic WGS84 directions)
Reference	T		True
Course over ground		degrees	Receiver's direction of travel
Reference	M		Magnetic
Speed over ground	0.18	knots	Measured horizontal speed
Unit	N		Knots
Speed over ground	0.5	km/hr	Measured horizontal speed
Unit	K		km/hr
Mode Indicator	A		A: Autonomous, D: DGPS, E: DR
checksum	*0F		
<CR><LF>			End of sentence



### 3.8 GPZDA - SiRF Timing Message

■ Example

\$GPZDA,181813,14,10,2006,00,00\*4A

■ Explanation

Contents	Example	Unit	Explanation
Message ID	\$GPZDA		ZDA protocol header
UTC time	181813		Either using valid IONO/UTC or estimated from default leap seconds
Day	14		Day according to UTC time (01 to 31)
Month	10		Month according to UTC time (01 to 12)
Year	2006		Year according to UTC time (1980 to 2079)
Local zone hour	00	hour	Offset from UTC (set to 00)
Local zone minutes	00	minute	Offset from UTC (set to 00)
checksum	*4F		
<CR><LF>			End of sentence

## 4 Trouble Shooting

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Q. The data logger does not log data even the power is on.

A. Possible reasons:

1. Power on log (see NaviLogManager) is turned off.
2. It's in management mode. It logs data only in recording mode. If a user runs NaviLogManager, stops recording, terminates NaviLogManager then the data logger is still in management mode.
3. The GPS signal is not well-received (e.g. in basement) and thus not able to get the position fix. There is no new logging data while it can not fix its position.
4. Value of record options (by distance, by time period, by speed) is big and still needs to wait for it to meet the criteria.

Q. Turn on power of BB-100 battery bank, no LED light on the mounted GR-312.

A. The power of battery is used up. Please charge it immediately.

Q. When using NaviLogManager, it shows communication error.

A. NaviLogManager supports both wired and wireless communications to manage GR-312.

However, if two NaviLogManager are running to manage the same GR-312 the result is unpredictable. The simplest way to solve this problem is to cycling GR-312 and NaviLogManager. That is to say, to power off and then power on GR-312, to terminate and run again one NaviLogManager only.

## 5 FCC Safety Statement

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### **Federal Communication Commission Interference Statement**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the 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 and, if not installed and used in accordance with the instructions, 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 turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this 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 complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. To maintain compliance with FCC RF exposure compliance requirements, please avoid direct contact to the transmitting antenna during transmitting.

## 6 Warranty

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### Warranty conditions

Navisys GPS products are warranted to be free from defects in material and function for one year dated from the shipping date. Navisys GPS products are free from material defects and function defects under normal operation. Any fault within warranty period under normal conditions will be taken care of by DOA/RMA policy.

- Navisys will be responsible for DOA/ RMA which results from material faults or processing errors by means of repair or replacement of the faulty units.
- Within warranty period, in case of defect or malfunction, Navisys will provide RMA form for customers to fill in failure description and product serial number. The original invoice is also necessary in order to smooth RMA process.
- Within warranty period, if RMA return shipment is necessary and agreed between two parties, Navisys will share one way transportation costs with customers. The RMA service is valid for customers with original invoice.

Navisys warranty will not be valid in cases of disassembly, physical damage, misuse, carelessness, modification or repair by unauthorized persons, and application for other purposes rather than normal usage.

#### Exclusions of warranty:

- Damage which is caused by accidents or disasters such as fire, flood, earthquake, war, vandalism or theft.
- Defect which results from improper shipping, improper usage, modification or repair without Navisys written permission
- Serial number tag is illegible, removed, altered, or damaged
- In no event shall the manufacturer be liable for any special, consequential or incidental damages, including any loss of business profits or any other commercial damages, arising out of the abnormal use of product.

## 7 Ordering Information

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### Accessory

USB Cable	
Car charger	
Battery bank (BB-100)	
Charging cable of BB-100	