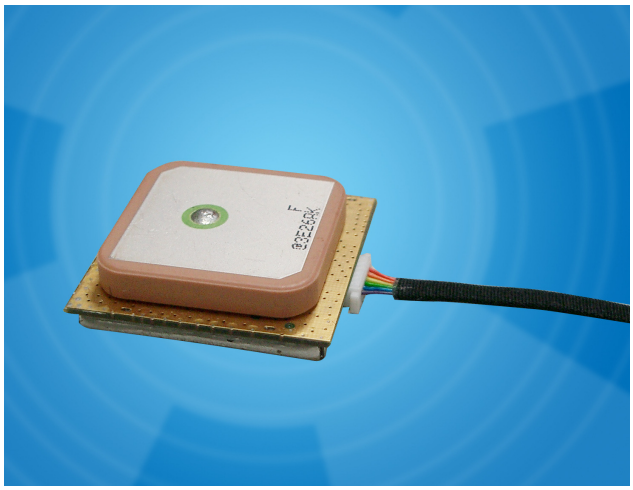
SANAV™

MTK-3301 GPS Receiver Series

Model: FV–M8 GPS Receiver

USER'S GUIDE



The objective of The FV-M8 User's Guide is to help users to understand the properties of FV-M8 thoroughly and, therefore, obtain the maximum performance from the module easily. This document describes and provides the useful information the FV-M8 module, which includes the functions of pins on the module, configuration setting and utility. It will help users to understand the capability of the module and, therefore, successfully integrate the FV-M8 into users' GPS systems. Each chapter is one of the pieces for the module and carries its own purpose.

Title FV-M8
Subtitle GPS Receiver Module
Doc Type User Manual
Doc Id GPS.FV-M8-070516

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Contents

Chapter 1 Introduction

The main goal of FV-M8 is to be used as a part of integrated system, which can be a simple PVT (Position-Velocity-Time) system, for instance, G-mouse, PND (Personal Navigation Device), or complex wireless systems, such as a system with GSM function, a system with Bluetooth function, and a system with GPRS function. The module (FV-M8) can be the best candidate for users' systems as the users' systems need the careful consideration on the performance, sensitivity, power consumption, and/or size of the module. In the specification of FV-M8 at the next page, it is noticeable that in addition to excellent start-up times and position accuracy, the updated rate can be up to 5 Hz and the sensitivity of -158dbm.

The active antenna on board helps the system integrators to do the design-in easily. FV-M8 is feature with high sensitive GPS receiver and GPS antenna. The perfect match is most suitable for any GPS mobile devices, such as PND, GPS PDA, personal tracker and any portable devices, which need GPS features.

If you have any technical questions, please contact us by either e-mail (prefer), telephone or fax.

e-mail: san.jose@sanav.com

Tel: 886-2-26879500

Fax: 886-2-26878893

When you send a request to us, please prepare the following information that may help us to resolve your problem as soon as possible:

1. Serial No. of Product;
2. Type of antenna that is connected to the module;
3. Operating System (OS) of your host PC;
4. Simple description of your integrated system (may also included peripheral connections and devices);
5. Describing the way you operate your system;
6. Description of failure by text, figure, or both;
7. Contact information, such as name, address, phone number, and e-mail address.

1.1 Specifications

PHYSICAL CONSTRUCTION			
Dimension	L30mm*W30mm*H8.6mm		
Weight	10 grams		
Antenna	Active antenna on board		
Receiving frequency	1575.42MHZ; C/A code		
Connector	8pin connector with 1.0mm pitch		
Mounting	Soldering		
Construction	Full EMI Shielding		
ENVIRONMENTAL CONDITIONS			
Temperature	Operating: -30 ~ +80 ℃		
	Storage: -40 ~ +85 ℃		
COMMUNICATION			
Protocol	NMEA V3.01		
Signal level	UART @ 2.8V * 2		
INTERFACE CAPABILITY			
Standard Output Sentences	Default	RMC, GGA, GSV*5, VTG, GSA*5	
	Optional	GLL, ZDA	

PERFORMANCE		
Built-in Antenna	Highly-reliable ceramic patch	
Sensitivity	GPS	-158dbm
	Antenna	21db
SBAS	1 channel (Support WAAS, EGNOS, MSAS)	
DGPS	RTCM Protocol	
Receiver architecture	32 parallel channels	
Start-up time	Hot start	1 sec. typical
	Warm start	35 sec. typical
	Cold start	41sec. typical
Position accuracy	Without aid	3.3 m CEP
	DGPS (RTCM)	2.6 m
Velocity accuracy	0.1 Knot RMS steady state	
Update Rate	1 ~ 5Hz	
Power Supply	3.3~5V +- 5%	
Power Consumption	Acquisition	58mA
	Tracking	50mA (first 5 minutes)
		33mA (after 5 minutes)
		32mA (after 20 minutes)
Baud Rate	4800 bps (default) & 4800/9600/38400/57600/115200 bps are adjustable	

Chapter 2 Pin Assignment

2.1 Pin Assignment

Figure 2.1 shows the pin definitions of FV-M8. Table 2.1 describes the corresponding definitions for pins.

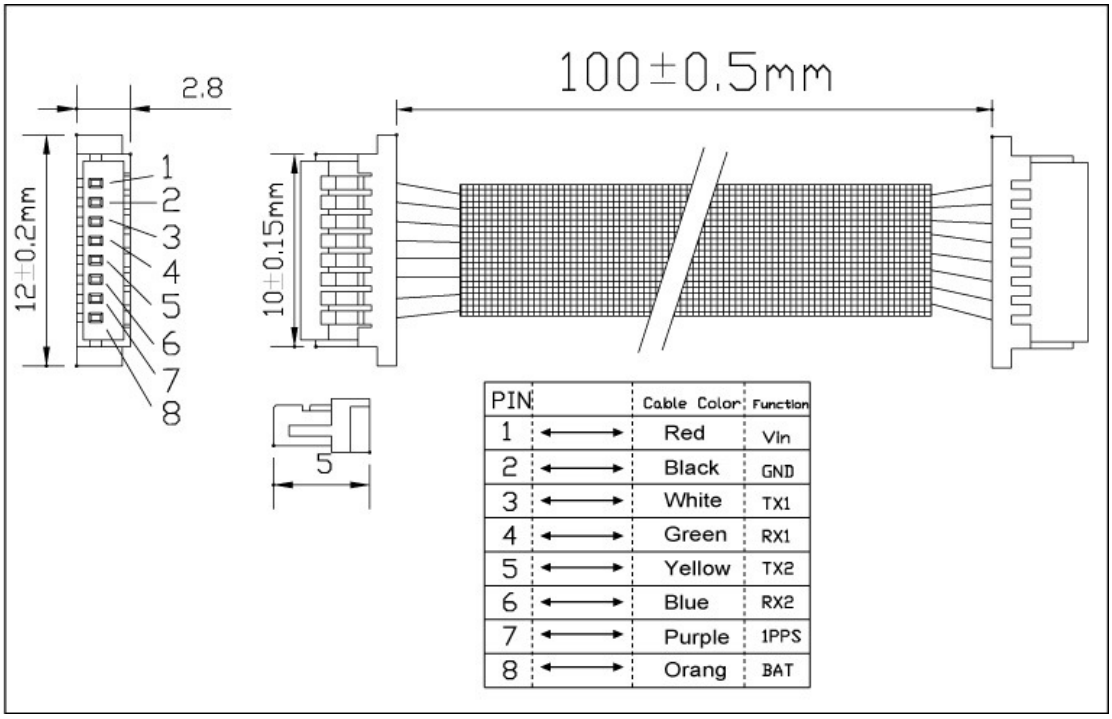


Figure 2.1 FV-M8 Pin definitions

2.2 Pin Definitions

Pin No.	Title	I/O	Note
1	Vin	P	Voltage input 3.3~5V DC ± 10%
2	GND	G	Ground
3	TX1	O	Serial port 1 (leave open if not used)
4	RX1	I	Serial port 1 (leave open if not used)
5	TX2	O	Reserve
6	RX2	I	Serial port 2 (leave open if not used)
7	1PPS	O	Time pulse (leave open if not used)
8	BAT	I	Backup input voltage 2 ~ 5V DC ± 10%

Table 2.1 Description of pin definition for FV-M8

2.3 Pin description

VIN (DC power input):

This is the main DC supply for a 3.3V ~ 5V +- 5% DC input power module board.

BAT (Backup battery):

This is the battery backup input that powers the SRAM and RTC when main power is removed. Typical current draw is <10uA. Without an external backup battery, the module/engine board will execute a cold star after every turn on. To achieve the faster start-up offered by a hot or warm start, a battery backup must be connected. The battery voltage should be between 2.0v and 5.0v.

1PPS:

User can use this pin for special function.

For example, on/off LED

Output TTL level, 0V ~ 2.8V, 1PPS timemark output

TX1:

This is the main transmits channel for outputting navigation and measurement data to user's navigation software or user written software.

Output TTL level, 0V ~ 2.8V

RX1:

This is the main receive channel for receiving software commands to the engine board from MiniGPS or GPS Locator Utility (SV-3301) software or from user written software.

Input TTL level, 0V ~ 2.8V

GND:

GND provides the ground for the engine board. Connect all grounds.

TX2:

Please do not utilize this pin and leave it open.

RX2:

This is mainly used to receive RTCM signals for differential purpose. Please note that a MTK

Input TTL level, 0V ~ 2.8V

Chapter 3 Operating GPS Utility and Mini GPS

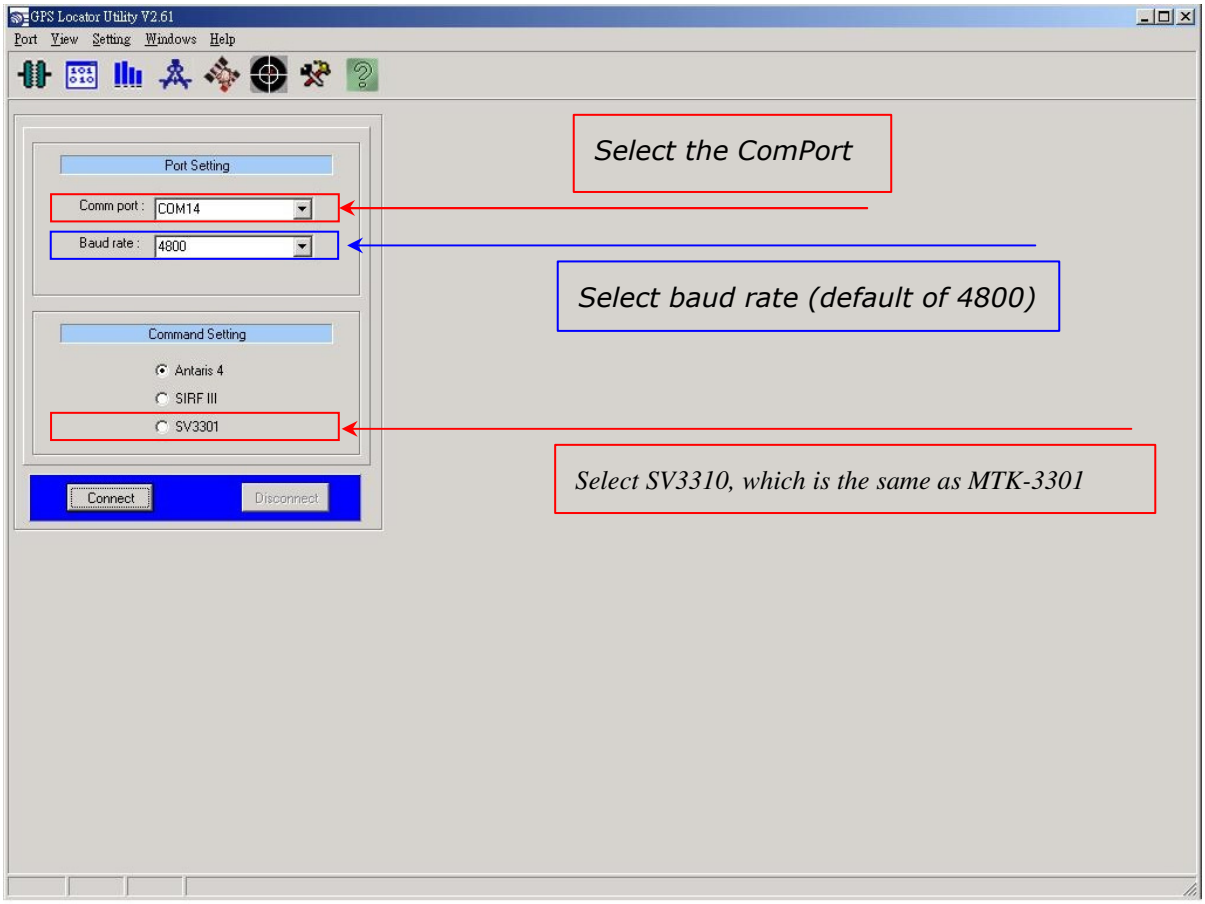
GPS Locator Utility V2.61 is the latest utility for configuring the GPS settings of Sanav GPS receivers. You can find the utility in the CD (FV-M8\Utility\Setup) and the password is in License.txt. Double click on the Setup.exe and follow the installation procedures.

GPS Locator Utility (Version 2.61), an application program for **FV-M8**, enables you to do the configurations on the unit. Below are instructions of how to work with this software, with assumption that you have successfully installed **GPS Locator Utility**.

Mini GPS is an utility from MTK. If the users would like to read *32-channel, change update rate (1 ~5Hz) and baud rate*, please use **Mini GPS**.

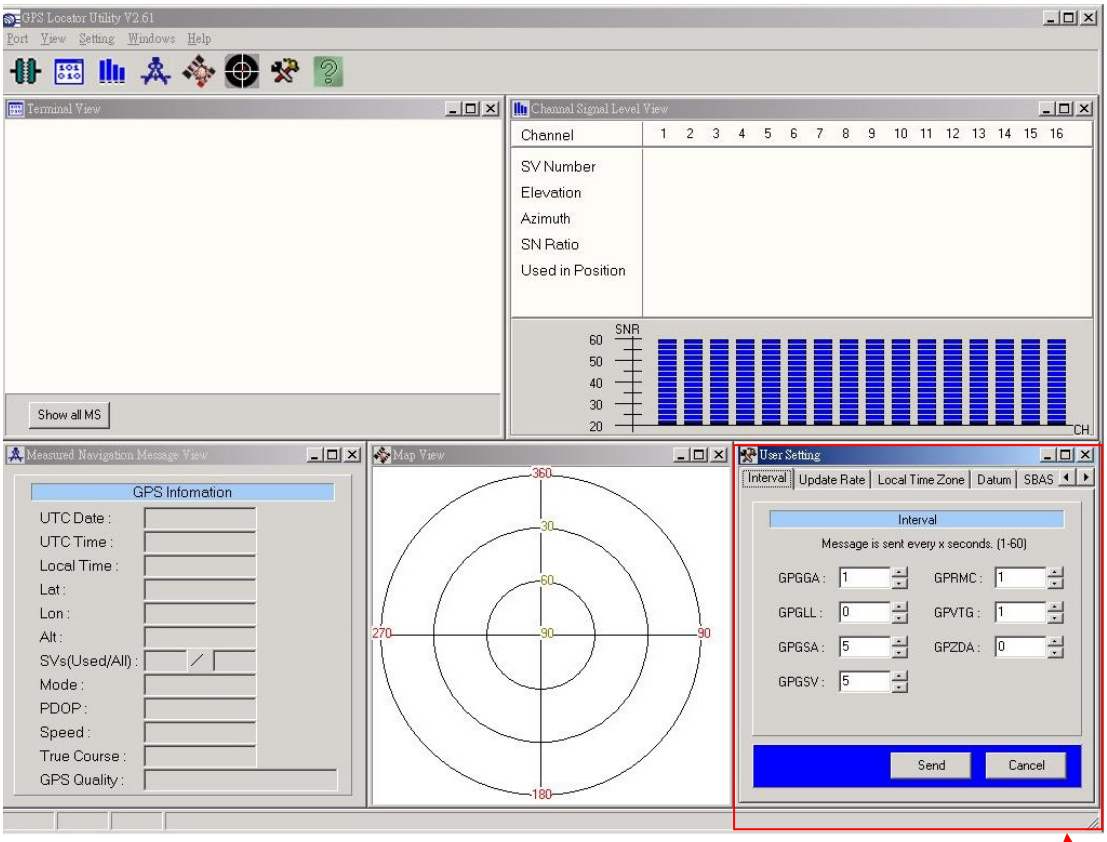
3.1 Connecting Com Port

After selecting the Com Port, bard rate and Command Setting, click on "**Connect**" and you will be able to do the configurations.



3.2 Functional Windows (Interval Setting)

After connecting with success, you can view the NMEA data from different functional windows. The configurations can be done in the "**User Setting**" window. On top of the "User Setting" window, there are several taps. Please select the taps for different settings.



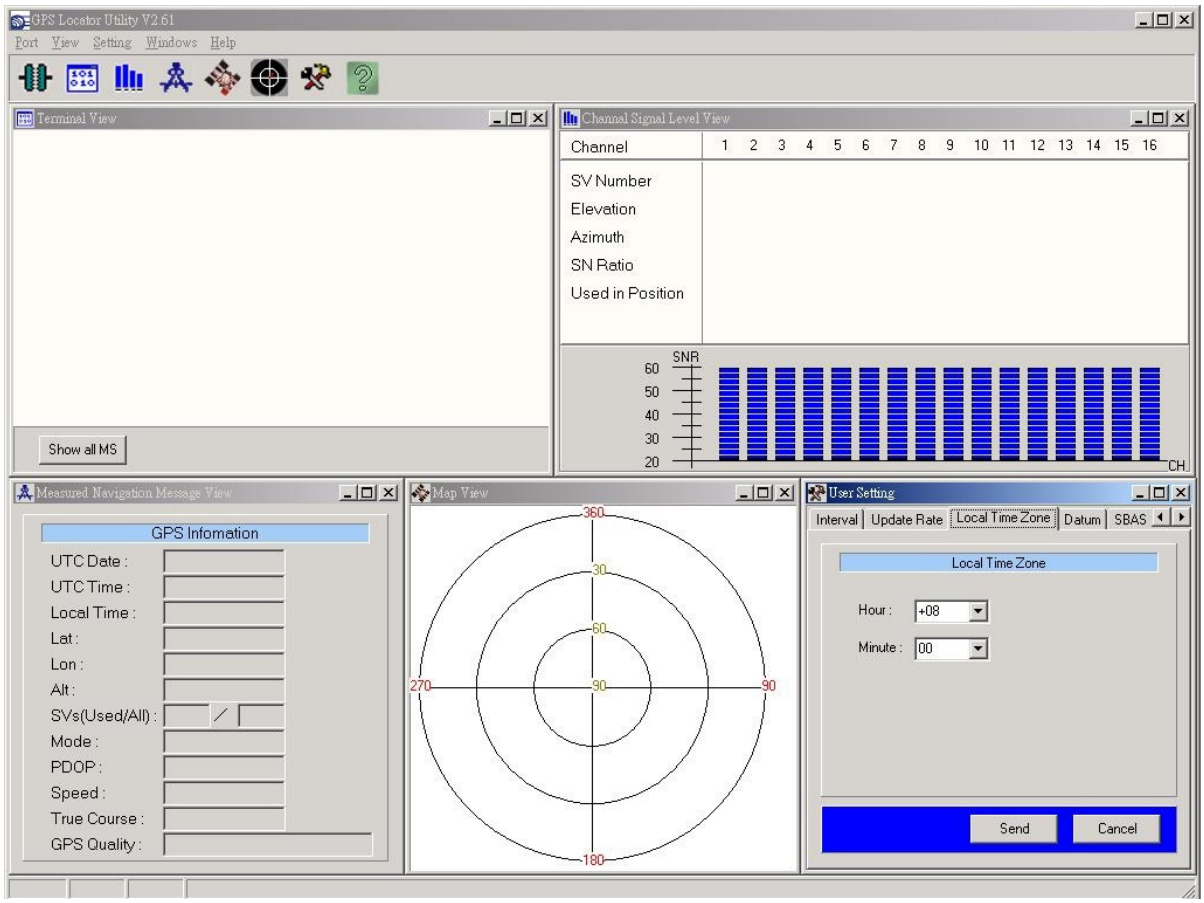
User Setting Window, change GPS sentence output interval

Note: After finishing interval setting, click "Send" to confirm the setting before proceeding next tap window for the other setting.

Note: If there is no backup power connected, all the settings will go back to default after a power cycle.

3.3 Functional Windows (Local Time Zone Setting)

Different local time zones are available.

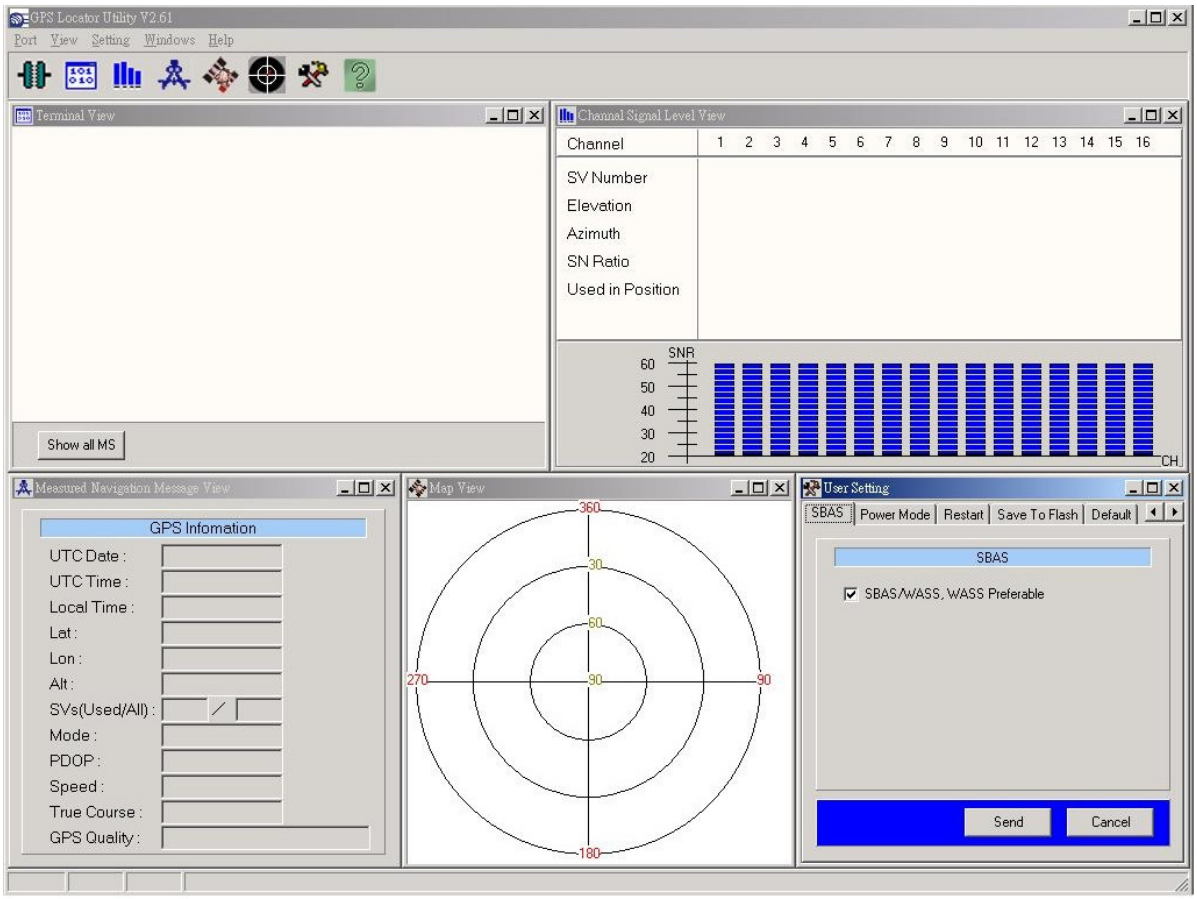


Note: After finishing local time zone setting, click "Send" to confirm the setting before proceeding next tap window for the other setting.

Note: If there is no backup power connected, all the settings will go back to default after a power cycle.

3.4 Functional Windows (SBAS Setting)

Enable/Disable the SBAS (WAAS).

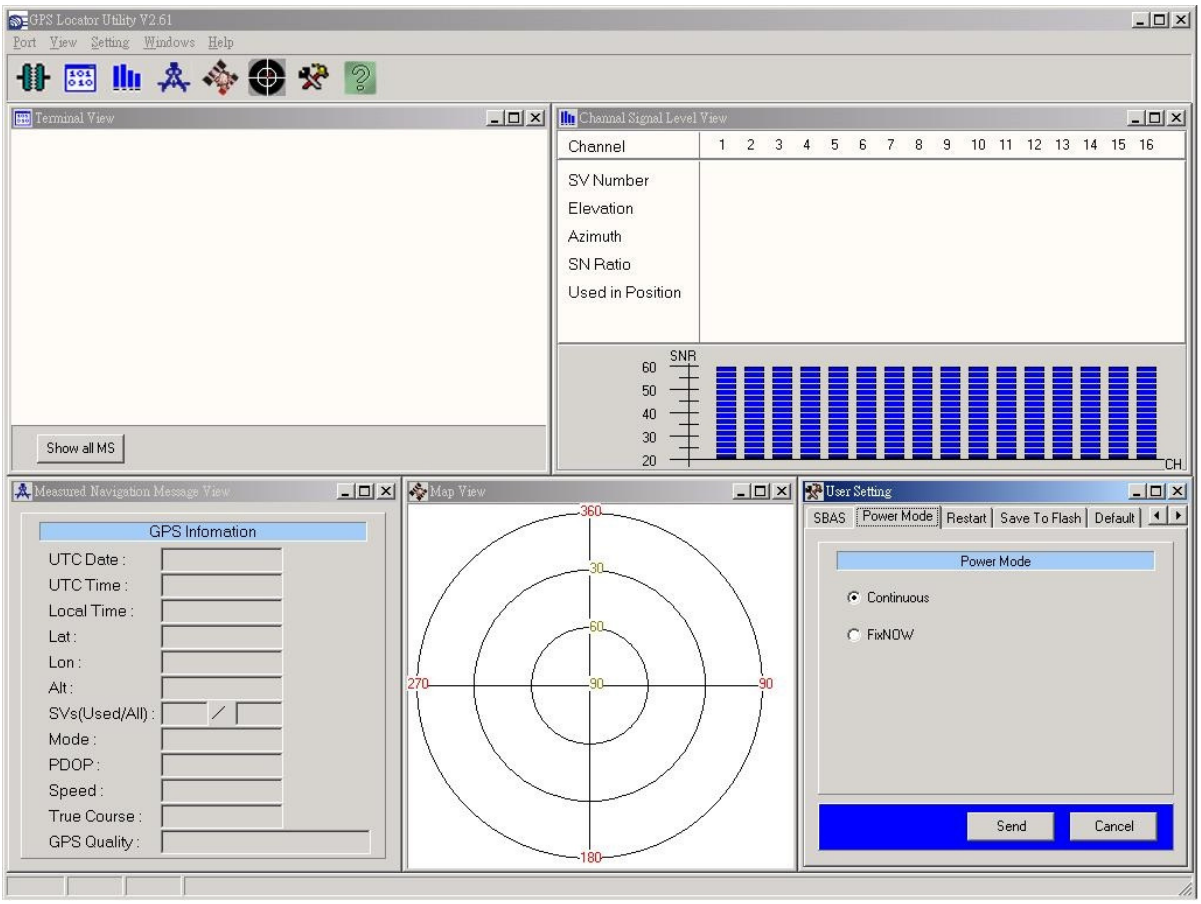


Note: After selecting the wanted SBAS setting, click "Send" to confirm the setting before proceeding next tap window for the other setting.

Note: If there is no backup power connected, all the settings will go back to default after a power cycle.

3.5 Functional Windows (Power Mode Setting)

Select the power mode and "**Continuous**" is preferred. Please contact Sanav for more information about the power mode.

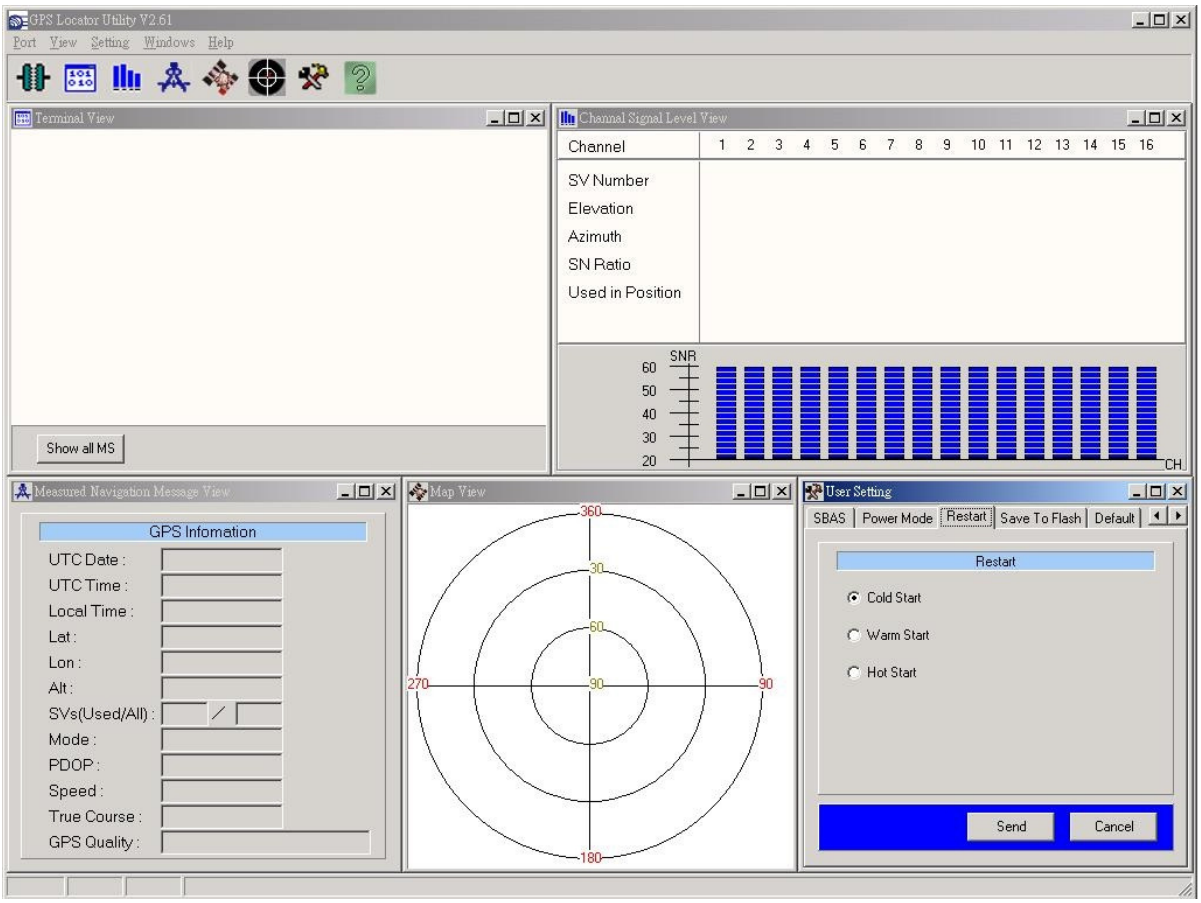


Note: After selecting the wanted power mode setting, click "Send" to confirm the setting before proceeding next tap window for the other setting.

Note: If there is no backup power connected, all the settings will go back to default after a power cycle.

3.6 Functional Windows (Restart Setting)

User can restart the unit by using this utility.

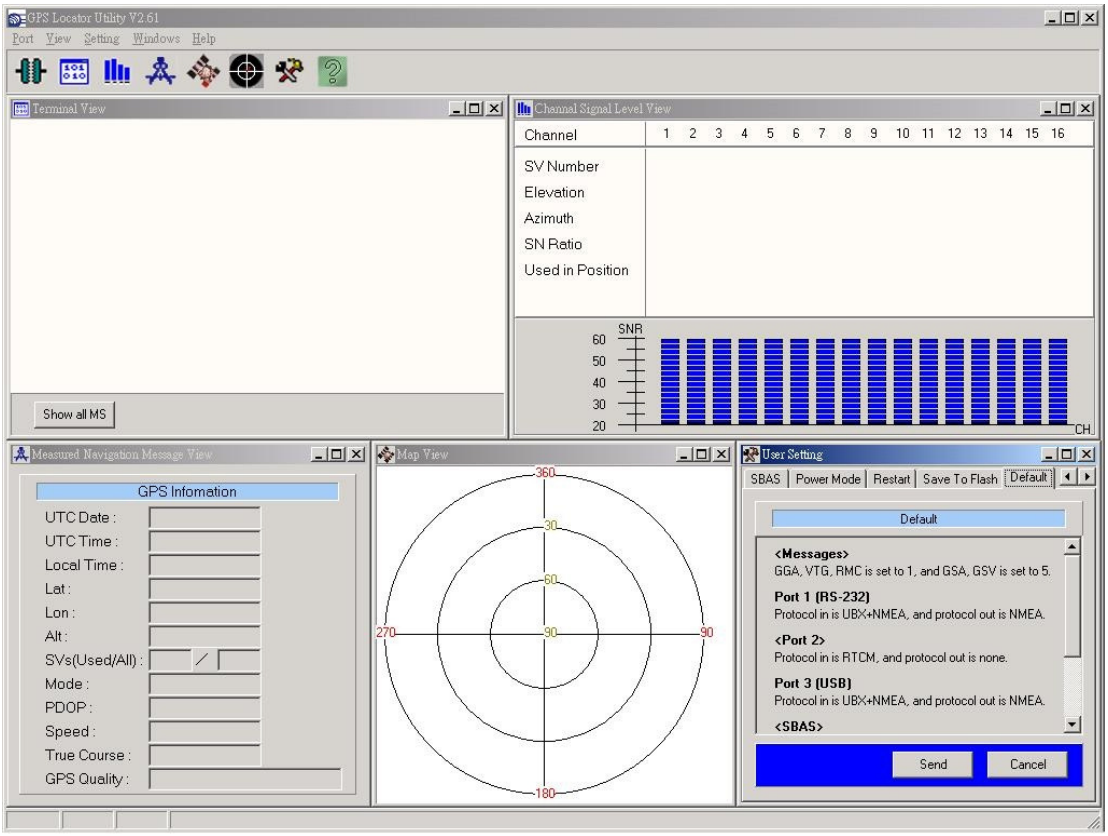


Note: After selecting the wanted restart setting, click "Send" to confirm the setting before proceeding next tap window for the other setting.

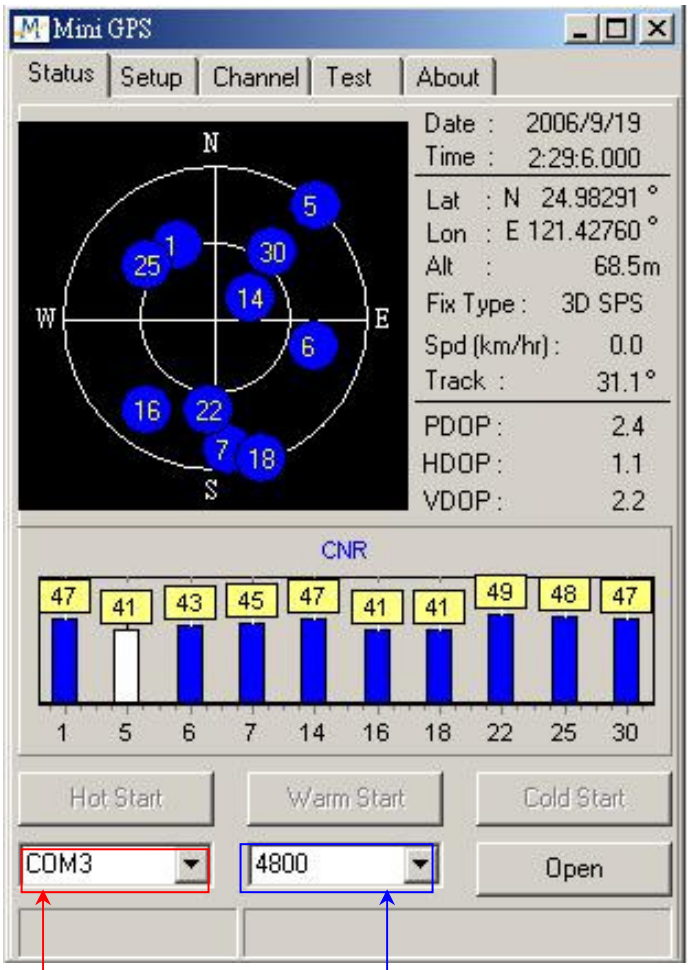
Note: If there is no backup power connected, all the settings will go back to default after a power cycle.

3.7 Functional Windows (View Default)

The default of receiver can be seen in this window.



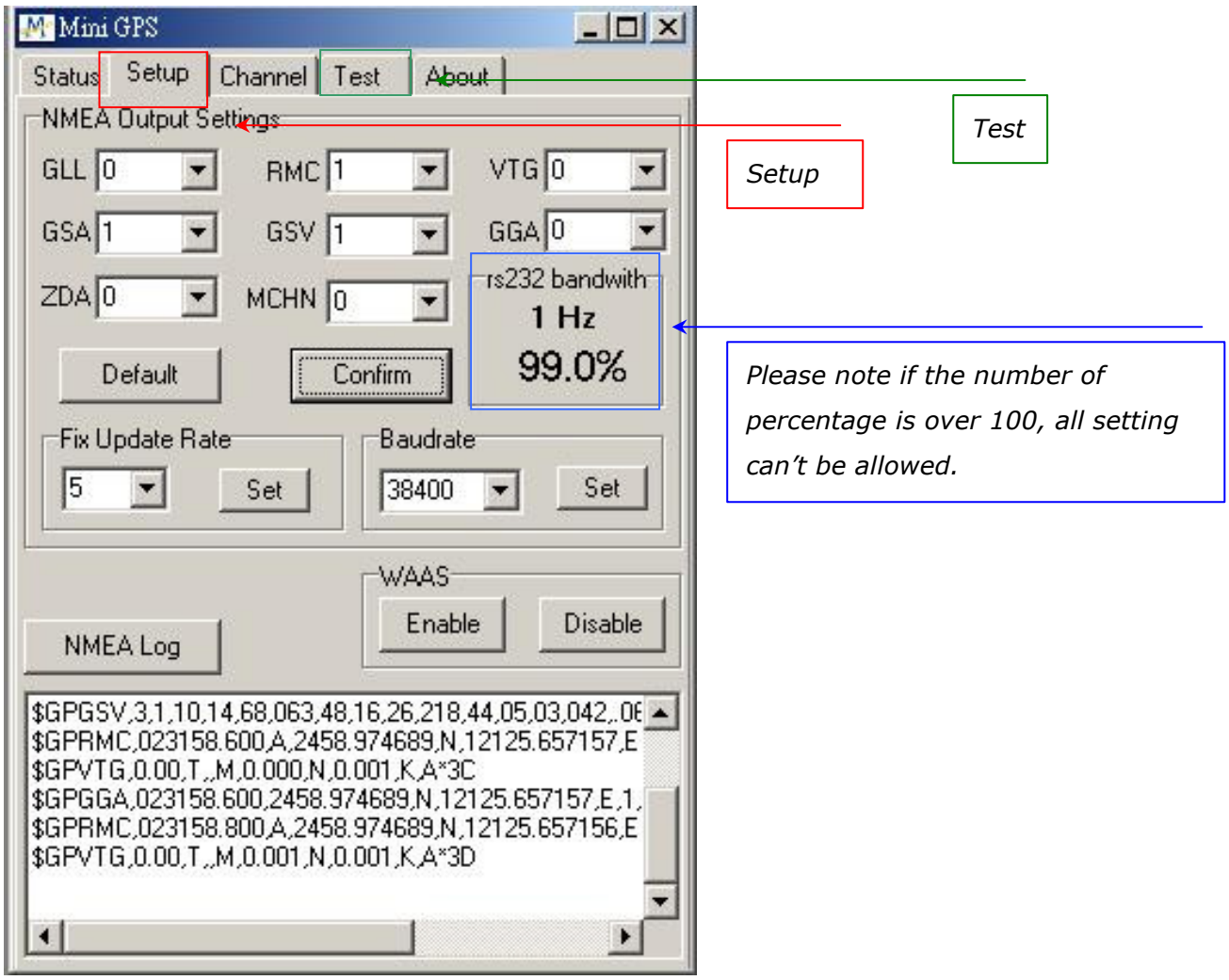
3.8 Using Mini GPS to Open Com Port



Select the ComPort

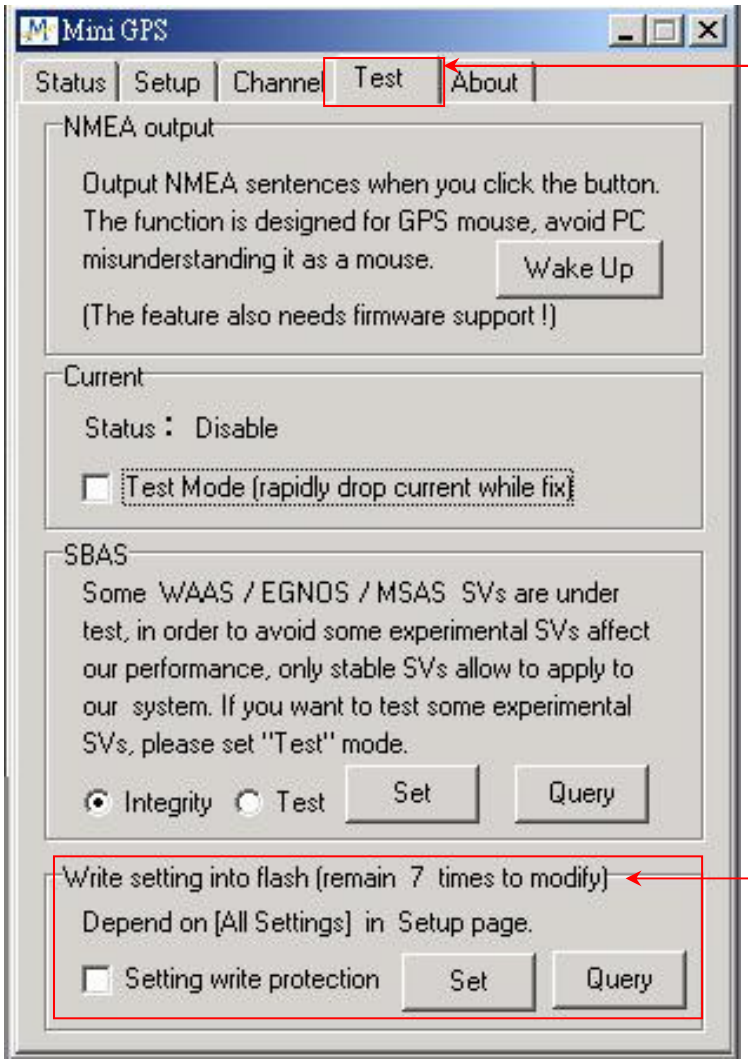
Select baud rate (default of 4800)

3.9 Using Mini GPS to Setup



1. Fix update rate can be changed from 1 ~ 5Hz
2. Baud rate can be changed from 4800 ~ 115200 bps.
3. When the settings are done, click on "Test" and follow the instruction in the next page. You will be able to save the settings into the flash.

3.10 Using Mini GPS to Save Settings into Flash



Test

Set the setting and check the how many times that can refresh the module left.

FV series engine board module currently offers a function to refresh the firmware to your desired setting like baud rate, updated rate or sentences output. Please complete the setting at **Chapter 3.9** then save the setting at this page by clicking on the **Set**. The module is only allowed the user to refresh the module **7-8 times**. How many times remain, please see this information at the top of red box above. Please note when the **Setting write protection** is marked, no matter how many times left, the module won't allow any setting of refreshing.

Chapter 4 Available NMEA Messages

4.1 NMEA Protocol

The NMEA protocol expresses the data in the format of ASCII. This is a standard format for GPS applications.

4.1.1 Standard NMEA Messages

The module can output 7 standard NMEA messages, which are

NMEA Output Messages

NMEA Record	Description
GGA	Global Positioning System Fix Data.
GSA	GNSS DOP and Active Satellites
GSV	GNSS Satellites in View
RMC	Recommended Minimum Navigation Information
VTG	Course Over Ground and Ground Speed
GLL	Geographic Position – Latitude / Longitude
ZDA	Time & Date

Those messages are output at TX1 at the rate of 4800 bps (default setting). When more than 4 messaged are chosen, a higher baud rate than 4800 bps is required.

The following will summarize the available NMEA messages. More information about the NMEA messages refers to "NMEA 0183, Standard For Interfacing Marine Electronic Devices, Version 3.01.

GGA – GPS Fix Data

Position fix related data, such as position, time, number of satellites in use, etc..

$GPGGA,gga1,gga2,gga3,gga4,gga5,gga6,gga7,gga8,gga9,gga10,gga11,gga12,gga13,gga14*hh<CR><LF>

Parameters	Descriptions	Notes
gga1	UTC time as position is fixed	hhmmss.sss: hh – hour; mm – minute; ss.sss – second
gga2	Latitude	ddmm.mmmmmm: dd – degree; mm.mmmmmm – minute (0^o ~ 90^o)
gga3	Latitude sector	N – North; S - South
gga4	Longitude	dddmm.mmmmmm: dd – degree; mm.mmmmmm – minute (0^o ~ 180^o)
gga5	Longitude sector	E – East; W - West
gga6	GPS quality indicator	0 – No fixed or invalid position 1 – SPS Position available 2 – Differential GPS (SPS)
gga7	Number of SVs used in position estimation	xx: 00 ~ 12
gga8	HDOP	xx.xx: 00.00 ~ 99.99
gga9	Altitude above mean sea level (geoid)	xx.xxx: 00.000 ~ 99.999
gga10	Unit for Altitude	M: meter
gga11	Geoidal separation	
gga12	Unit for geoidal separation	M: meter
gga13	Age of differential corrections	unit : second; null when DGPS is not used
gga14	Reference station ID (DGPS)	xxxx: 0000 ~ 1023
hh	Checksum	hex number (2 – character)
<CR><LF>	End of message	

GLL – Geographic Position – Latitude/Longitude

Navigation data and status.

$GPGLL,gll1,gll2,gll3,gll4,gll5,gll6,gll7*hh<CR><LF>

Parameters	Descriptions	Notes
gll1	Latitude	ddmm.mmmmmm: dd – degree; mm.mmmmmm – minute (0^o ~ 90^o)
gll2	Latitude sector	N – North; S – South
gll3	Longitude	dddmm.mmmmmm: dd – degree; mm.mmmmmm – minute (0^o ~ 180^o)
gll4	Longitude sector	E – East; W – West
gll5	UTC time as position is fixed	hhmmss.ss: hh – hour; mm – minute; ss.ss – second
gll6	Status for position fix	A – Valid; V – Invalid
gll7	Navigation mode indicator	A – Autonomous mode (fix); D – Differential mode (fix); E – DR (fix); N – not valid
hh	Checksum	hex number (2 – character)
<CR><LF>	End of message	

GSA – GNSS DOP and Active Satellites

Receiver operating mode, the values of DOPs, and PRN numbers for satellites used in the GGA position solution.

$GPGSA,gsa1,gsa2,(gsa3*12),gsa4,gsa5,gsa6*hh<CR><LF>

Parameters	Descriptions	Notes
gsa1	Selection Mode	
gsa2	Mode for position fix	1 – fix not available; 2 – 2D; 3 – 3D;
gsa3*12	PRN numbers for satellites used in the position solution. There will be 12 available fields for PRN numbers. If number of satellites is less than 12, the remaining fields will be left as empty fields. If number of satellites is greater than 12, only the values of the first 12 satellites will be output.	xx
gsa4	PDOP	0 ~ 99.99 in meters
gsa5	HDOP	0 ~ 99.99 in meters
gsa6	VDOP	0 ~ 99.99 in meters
hh	Checksum	hex number (2 – character)
<CR><LF>	End of message	

GSV – GNSS Satellites in View

This message indicates the observable satellites' information, such as PRN numbers, elevation, azimuth, SNR, and number of satellites in view.

$GPGSV,gsv1,gsv2,gsv3,((gsv4,gsv5,gsv6,gsv7)*n)*hh<CR><LF>

Parameters	Descriptions	Notes
gsv1	Total number of messages	1 ~ 9
gsv2	Message number	1 ~ 9
gsv3	Total number of satellites in view	xx
gsv4	PRN number	xx
gsv5	Elevation (degrees)	90° maximum
gsv6	Azimuth (degrees)	0° ~ 360°
gsv7	SNR (C/N_0)	0 ~ 99 dB-Hz, null when not tracking
hh	Checksum	hex number (2 – character)
<CR><LF>	End of message	

The message can carry at most four (gsv4,gsv5,gsv6,gsv7) sets of observable satellites. For a less than four-set case, the message only transmits available sets and the rest of them will not be output, i.e., the message doesn't transmit empty fields.

RMC – Recommended Minimum Specific GNSS Data

This message transmits the necessary navigation data, such as time, position, speed, course, and so on.

$GPRMC,rmc1,rmc2,rmc3,rmc4,rmc5,rmc6,rmc7,rmc8,rmc9,rmc10,rmc11,rmc12*hh<CR><LF>

Parameters	Descriptions	Notes
rmc1	UTC time as position is fixed	hhmmss.sss: hh – hour; mm – minute; ss.sss – second
rmc2	Status of position fix	A – data valid, which includes the scenarios of 2D, 3D, and DR. V – navigation receiver warning
rmc3	Latitude	ddmm.mmmmmm: dd – degree; mm.mmmmmm – minute (0^o ~ 90^o)
rmc4	Latitude sector	N – North; S – South
rmc5	Longitude	dddmm.mmmmmm: ddd – degree; mm.mmmmmm – minute (0^o ~ 180^o)
rmc6	Longitude sector	E- East; W- West
rmc7	Speed over ground (SOG)	x.xxx knots
rmc8	Course over ground (COG)	Referenced to true north (xx.xx degrees)
rmc9	UTC Date	ddmmyy: dd – day; mm – month; yy – year
rmc10	Magnetic variation	Not supported
rmc11	Direction of magnetic variation	Not supported
rmc12	Navigation mode indicator	A – Autonomous mode (fix); D – Differential mode (fix); E – DR (fix); N – not valid
hh	Checksum	hex number (2 – character)
<CR><LF>	End of message	

VTG – Course Over Ground and Ground Speed

This message transmits the speed and course relative to ground.

$GPVTG,vtg1,vtg2,vtg3,vtg4,vtg5,vtg6,vtg7,vtg8,vtg9*hh<CR><LF>

Parameters	Descriptions	Notes
vtg1	Course over ground (degrees)	Referenced to true north (xx.xx°)
vtg2	Indicator of course reference	T – true north
vtg3	Course over ground (degrees)	Not Support
vtg4	Indicator of course reference	M – magnetic north
vtg5	Speed over ground	x.xxx knots
vtg6	Unit of speed	N – nautical miles per hour
vtg7	Speed over ground	x.xxx km/hr
vtg8	Unit of speed	K – kilometers per hour
vtg9	Navigation mode indicator	A – Autonomous mode (fix); D – Differential mode (fix); E – DR (fix); N – not valid
hh	Checksum	hex number (2 – character)
<CR><LF>	End of message	

ZDA – Time & Date

This message transmits UTC time and date, and local time zone.

$GPZDA,zda1,zda2,zda3,zda4,zda5,zda6*hh<CR><LF>

Parameters	Descriptions	Notes
zda1	UTC time	hhmmss.sss: hh – hour; mm – minute; ss.sss – second
zda2	UTC day	01 ~ 31
zda3	UTC month	01 ~ 12
zda4	UTC year	xxxx (4 digits)
zda5	Local zone hours	00 to ± 13 hours
zda6	Local zone minutes	00 to ± 60 minutes
hh	Checksum	hex number (2 – character)
<CR><LF>	End of message	

Chapter 5 Limited Warranty

This unit can be used as part of navigational aids, and is not intended to replace other means of navigation or aids. San Jose Navigation, Inc. warrants this GPS receiver and accessories to be free of defect for a period of 12 months from the date of original purchase.

THIS WARRANTY APPLIES ONLY TO ORIGINAL PURCHASE.

In any event of a product defect while in normal usage, San Jose Navigation, Inc. will replace or repair the defective product at no charge to the original the original purchaser for parts and labor. However, San Jose Navigation, Inc. reserves the right of determination to replace or repair the defective product. The replacement or repaired product will be warranted for a total of 90 days from the date of return shipment, or for the remaining balance of the original warranty, whichever is longer.

PURCHASER DUTIES

The purchaser must return defective unit postpaid, with the proof of original purchase and a return address to:

San Jose Navigation, Inc.

9F, No.105, Shi-Cheng Rd., Pan-Chiao City

Taipei Hsien, Taiwan, R.O.C. (220)

Tel: 886-2-26879500

Fax: 886-2-26878893

Website: http://www.sanav.com

Technical Support: san.jose@sanav.com