

Marine GPS Locator

GM-88K

User's Manual

Version A

Please read this manual before operating the unit

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© SAN JOSE NAVIGATION, INC.

SAN JOSE NAVIGATION, INC.

9F, No.105, Xicheng Rd., Banqiao City,

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

TEL: 886-2-26879500 FAX: 886-2-26878839

E-Mail: sanav@sanav.com

<http://www.sanav.com>

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Package Content

1. **One GM-88K w/15 meter cable**
2. **User's Manual**
3. **CD-ROM** (Software-GPS Utility Analyzer)

Please check if all of the contents listed are included and it not damage from shipping if any of the items are missing or damage, please notify **SAN JOSE NAVIGATION, INC.**

<http://www.sanav.com>

E-mail: sanav@sanav.com

Chapter 1 Overview



GM-88K is an outstanding high sensitivity Marine GPS receiver. Its excellent performance easily conquers the most difficult tasks. In addition, it provides various functions to meet customers' needs. You will find the device an **accurate, reliable** and **useful** aid to your positioning pursuits.

GM-88K is the latest GPS product innovation in combining GPS receiver technology and mini-antenna in a Plug-Navigate-Location concept from SAN JOSE NAVIGATION, INC.

GM-88K receives FREE broadcast signals from the Low Orbit Global Positioning System (GPS), a satellite-based transmitter which emits ranging/satellite information/high precision time signals that the **GM-88K** receiver can use to determine positions and time. It also has high sensitivity for weak signal operation without compromising accuracy. Undoubtedly, **GM-88K** is the best choice for you.

Before introducing you our new receiver, we would like to give you some basic background knowledge about GPS, which should be helpful for you to better understand your **GM-88K**.

1.1 What is GPS?

GPS (Global Positioning System) is a satellite-based global navigation system created and operated by the United States Department of Defense (DOD). Originally intended solely to enhance military defense capabilities, GPS capabilities have expanded to provide

highly accurate position and timing information for many civilian applications.

An in-depth study of GPS is required to fully understand how it works, but simply stated: Twenty four satellites in six orbital paths circle the earth twice each day at an inclination angle of approximately 55 degrees to the equator. This constellation of satellites continuously transmits coded positional and timing information at high frequencies in the 1500 Megahertz range. GPS receivers with antennas located in a position to clearly view the satellites pick up these signals and use the coded information to calculate a position in an earth coordinate system. GPS is the navigation system of choice for today and many years to come. While GPS is clearly the most accurate worldwide all-weather navigation system yet developed, it still can exhibit significant errors. GPS receivers determine position by calculating the time it takes for the radio signals transmitted from each satellite to reach earth. It's that old "Distance = Rate x Time" equation. Radio waves travel at the speed of light (Rate). Time is determined using an ingenious code matching technique within the GPS receiver. With time determined, and the fact that the satellite's position is reported in each coded navigation message, by using a little trigonometry the receiver can determine its location on earth.

Position accuracy depends on the receiver's ability to accurately calculate the time it takes for each satellite signal to travel to earth. This is where the problem lies. There are primarily five sources of errors which can affect the receiver's calculation. These errors consist of (1) ionosphere and troposphere delays on the radio signal, (2) signal multi-path, (3) receiver clock biases, (4) orbital errors, also known as ephemeris errors of the satellite's exact location, and (5) the intentional degradation of the satellite signal by the DOD. This intentional degradation of the signal is known as "Selective Availability (SA)" and is intended to prevent adversaries from exploiting highly accurate GPS signals and using them against the United States or its allies. However, on May 1, 2000, U.S. President Bill Clinton ordered Selective Availability (SA) turned off at midnight (Coordinated Universal Time). Now, civilian GPS users around the world will no longer experience the up to 100 meter (approximate 300 feet) random errors that SA added to keep GPS a more powerful tool for the military. Today, GPS units are accurate to within 20 meters (approximately 60 feet); although in good conditions, units should display an error of less than 10 meters. The combination of these errors in conjunction with poor satellite geometry can limit GPS accuracy to 100 meters 95% of the time and up to 300 meters 5% of the time. Fortunately, many of these errors can be reduced or eliminated through a technique known as "Differential."

1.2 System Requirements

System requirements for operating your new **GM-88K** GPS Locator are as follows:

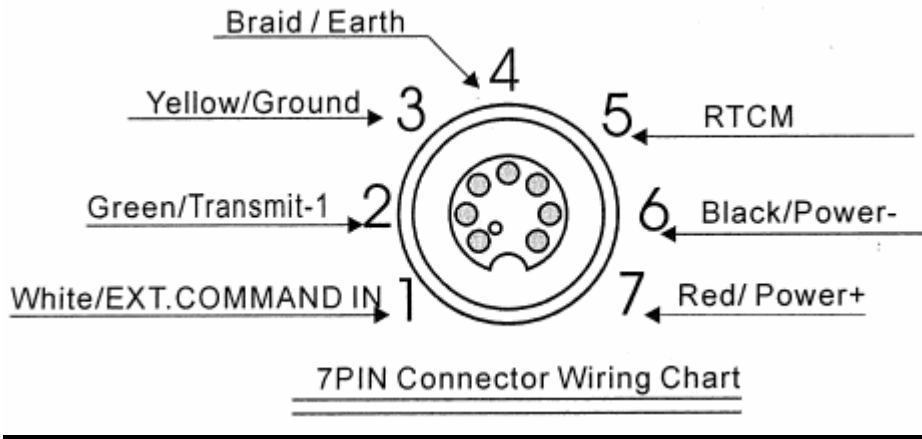
- PC running Windows OS or any OS that is compatible with GPS NMEA data format. PDA,

Palm-PC, Chart Plotter, Notebook or Micro-controller using UART as serial bus.

- Power source using DC 12V from car or boat.
- Un-obstructed view of the SKY for the satellites over the sky can be seen by the device.

Chapter 2 Installing GM-88K

2.1 Interfacing



I/O PIN ASSUGNMENT

I/O PIN & CABLE			
Connector	Wire	Function	Description
PIN1	White	receive	To receive external command from PC(Rx)
PIN2	Green	transmit	Outputs NMEA0183 sentences(Tx)
PIN3	Yellow	Ground	Signal ground common to receiver and transmit
PIN4	Braid	Earth	To be connected to vehicleleasis for EMI suppression if necessary
PIN5	Blue	RTCM	DGPS or WAAS correction data in
PIN6	Black	Power-	Power ground (Negative)
PIN7	Red	Power+	Power input 8 to 35 V DC (Positive)
-	Purple	-	Reserved

Chapter 3 Installation & Operating

Procedures

With a complete familiarity of your new GPS Locator after referring to Figure 1 & Figure 2, you are now supposed to be ready to connect the unit to your computing device.

PLEASE MAKE SURE THAT THE POWER IS OFF BEFORE PROCEEDING.

3.1 Installing GPS Utility Analyzer

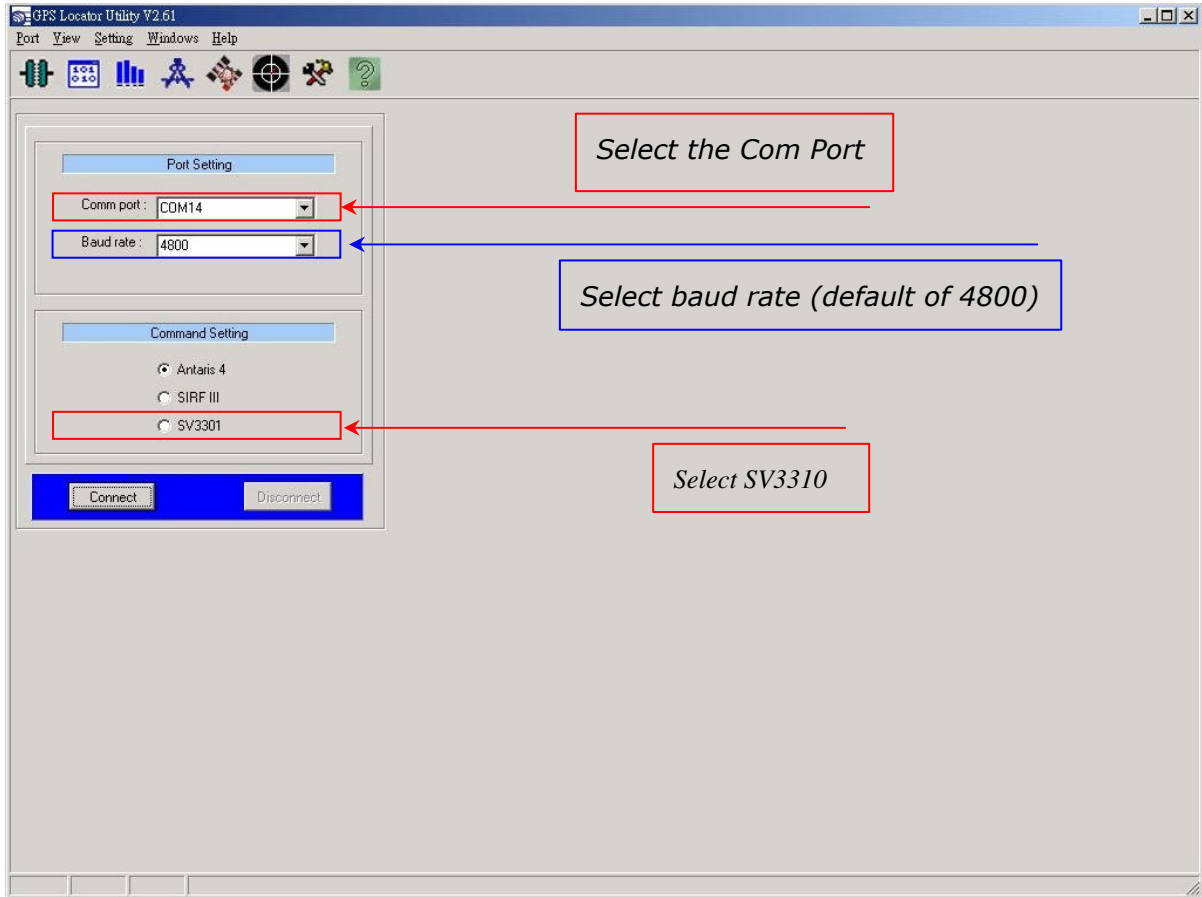
GM-88K is shipped with a CD that stores an application program **GPS Utility Analyzer**. To install this program, please follow the steps stated in next pages.

GPS Utility V2.61 is the latest utility for configuring the GPS settings of SAN JOSE GPS receivers. You can find the utility in the CD and the password is in License.txt. Double click on the Setup.exe and follow the installation procedures.

GPS Utility (Version 2.61), an application program for **GM-88K**, enables you to do the configurations on the receiver. Below are instructions of how to work with this software, with assumption that you have successfully installed **GPS Utility**

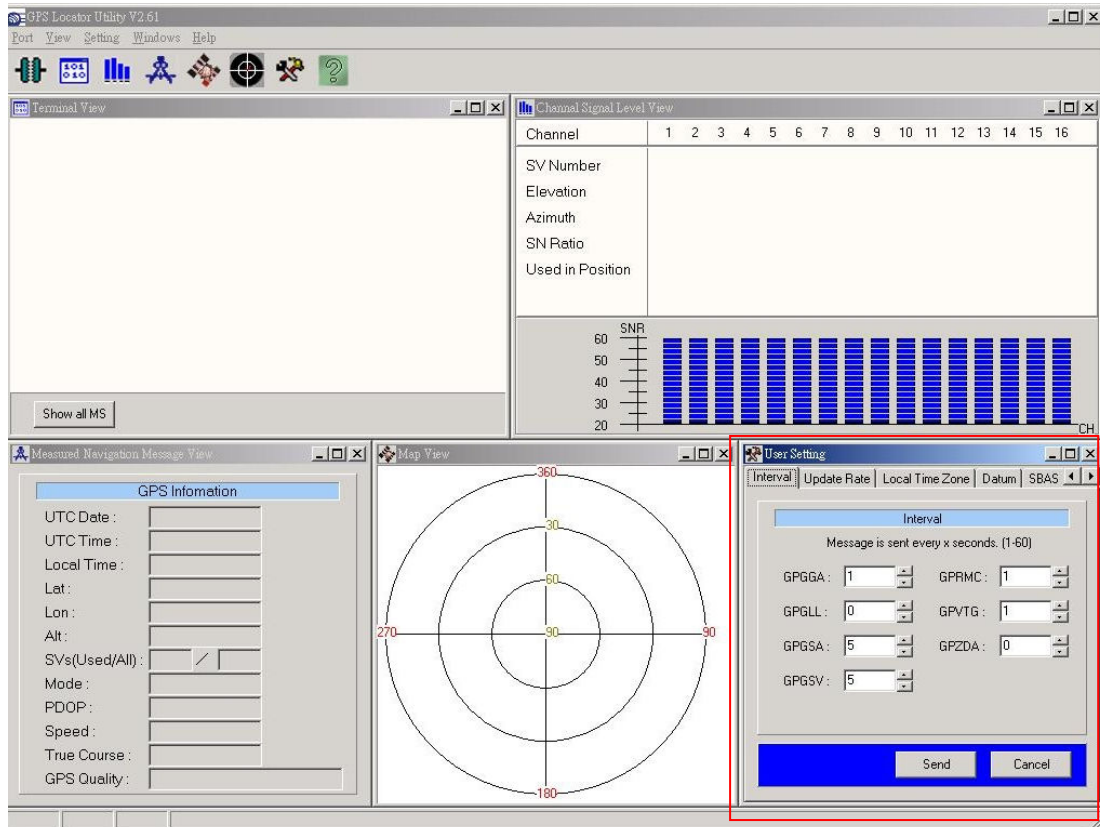
3.2 Connecting Com Port

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



3.3 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.



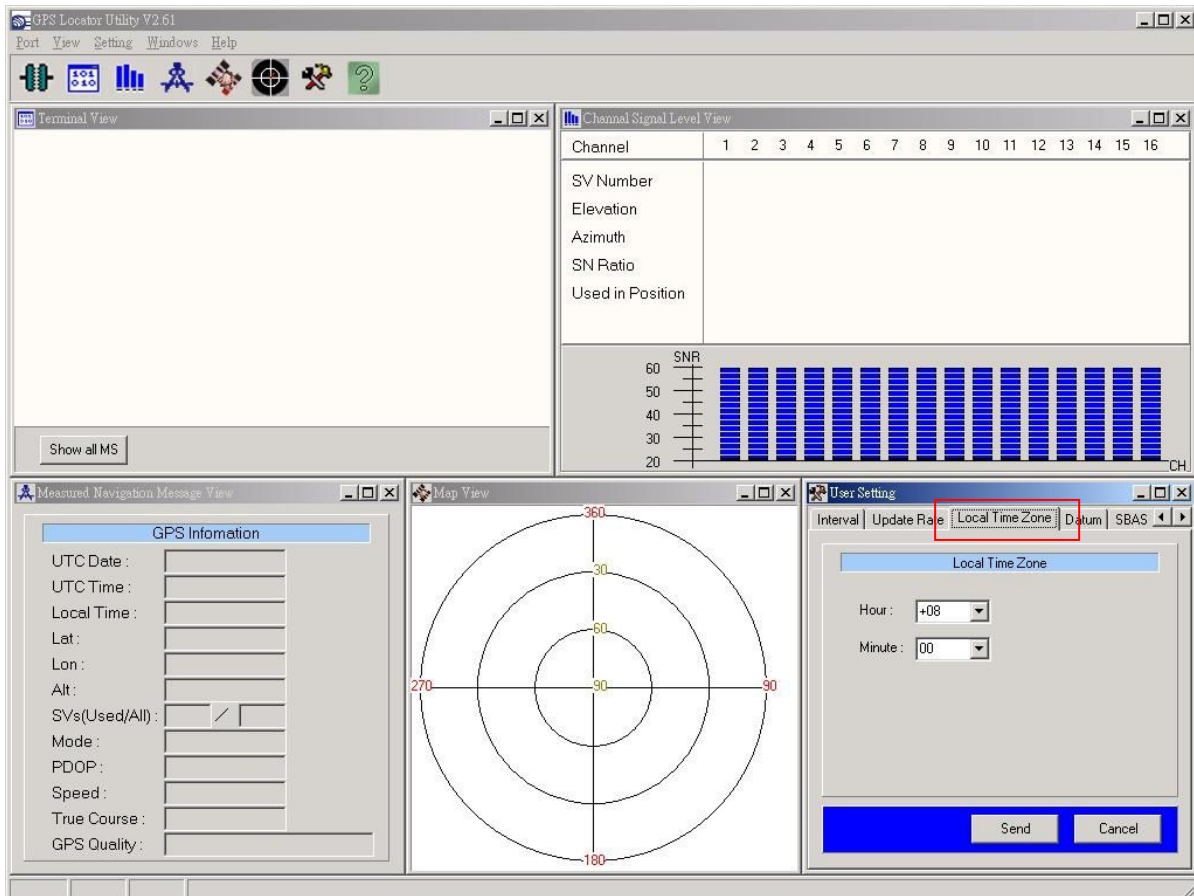
User Setting Window, change GPS sentence output interval

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

Note: After finishing all the setting(s), please tap to “Save to Flash” window. Tick “Save to Flash” and click on “Send” if the user would like to save the customized setting(s) into flash.

3.4 Functional Windows (Local Time Zone Setting)

Different local time zones are available.

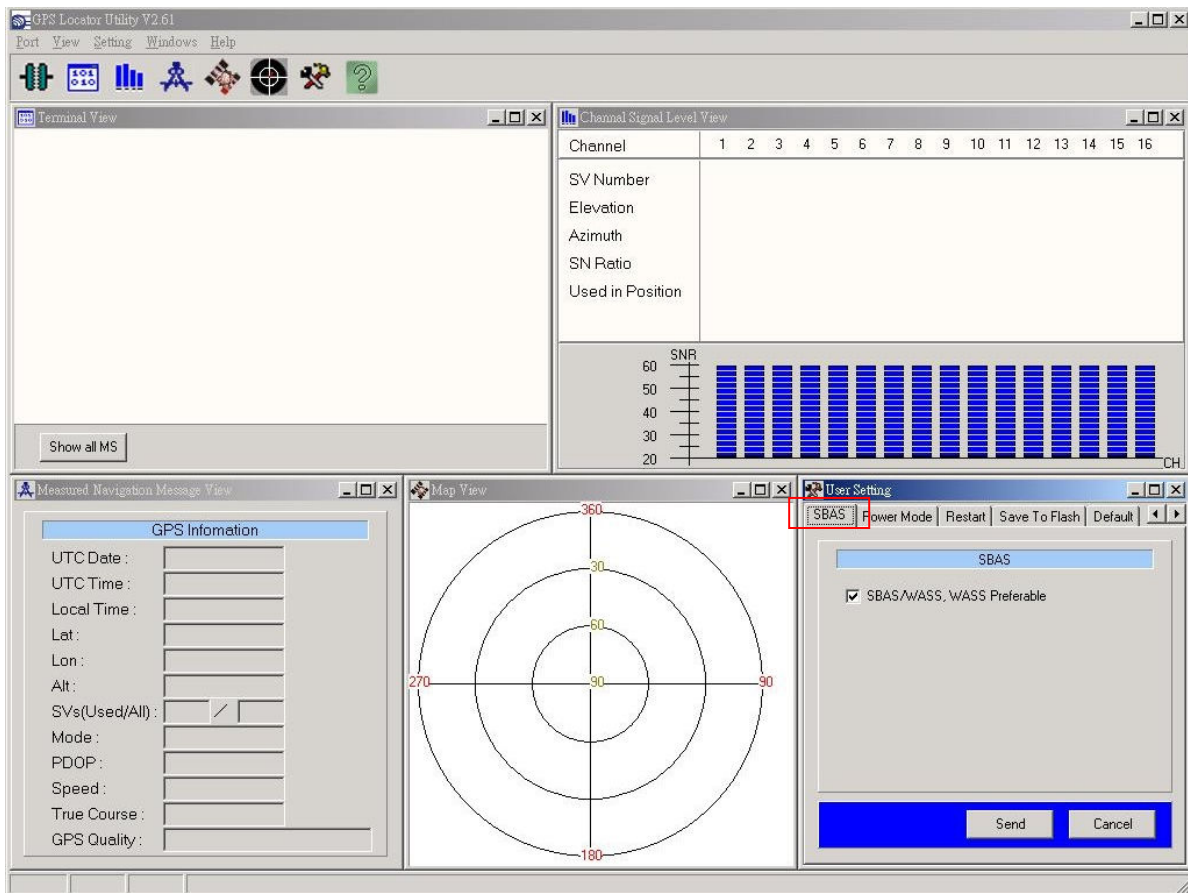


Note: After finishing local time zone setting, click "Send" to confirm the setting before proceeding next tap window for the other setting.

Note: After finishing all the setting(s), please tap to "Save to Flash" window. Tick "Save to Flash" and click on "Send" if the user would like to save the customized setting(s) into flash.

3.5 Functional Windows (SBAS Setting)

Enable/Disable the SBAS (WAAS).

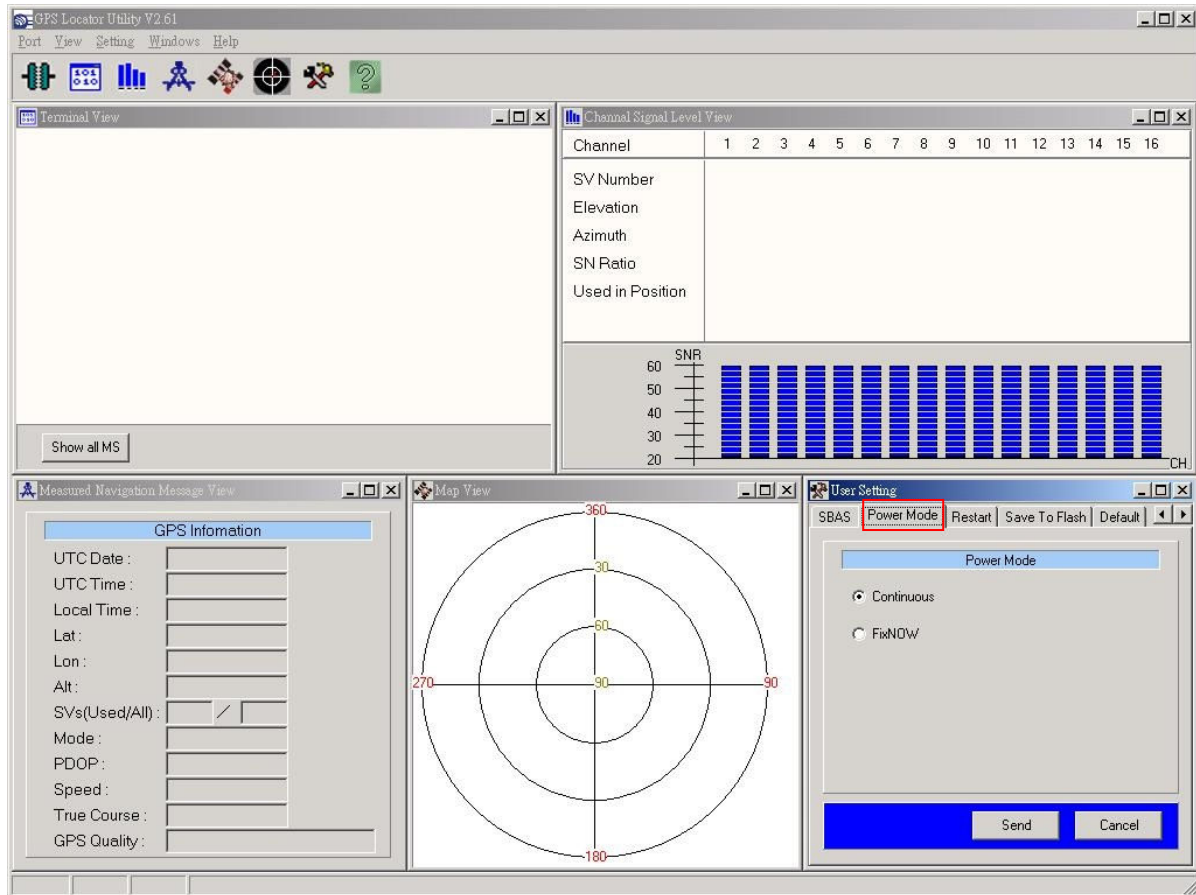


Note: After selecting the wanted SBAS setting, click "Send" to confirm the setting before proceeding next tap window for the other setting.

Note: After finishing all the setting(s), please tap to "Save to Flash" window. Tick "Save to Flash" and click on "Send" if the user would like to save the customized setting(s) into flash.

3.6 Functional Windows (Power Mode Setting)

Select the power mode and “**Continuous**” is preferred. Please contact SAN JOSE for more information about the power mode.

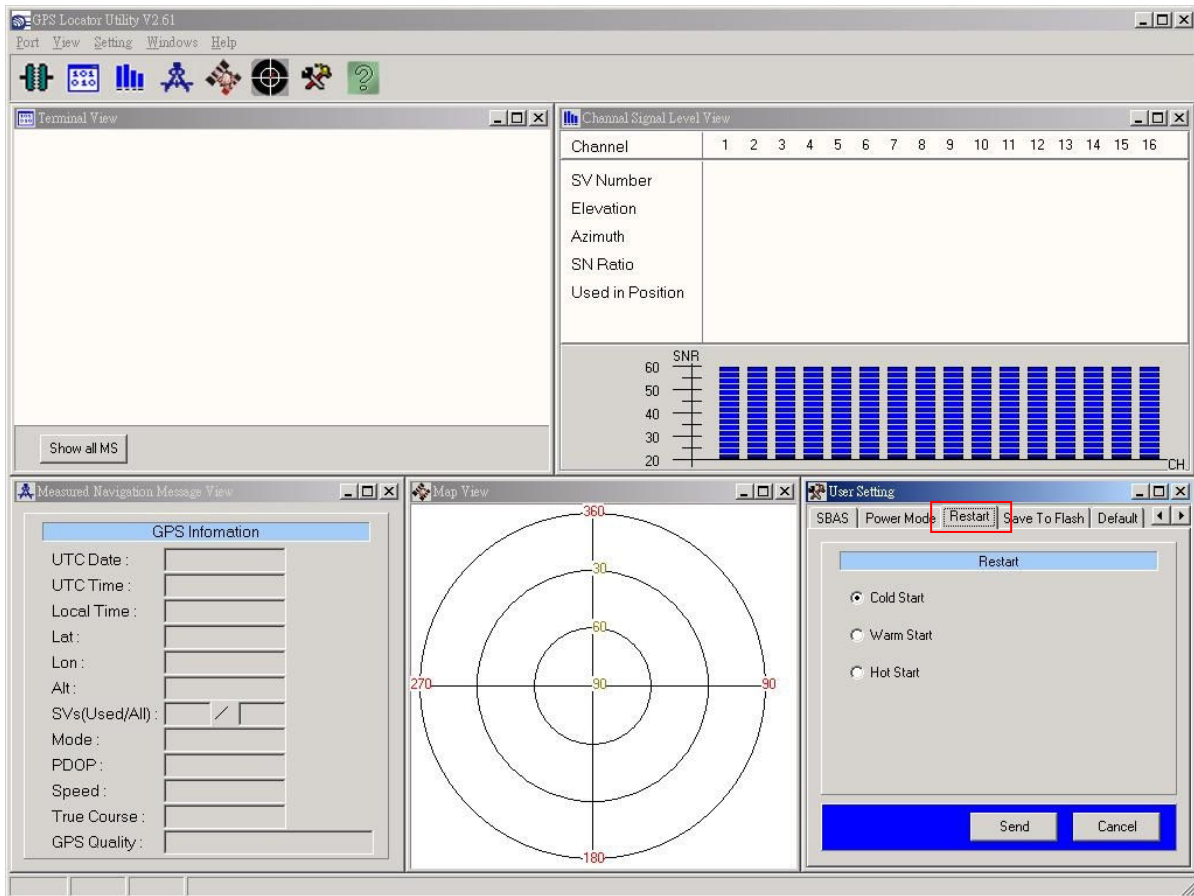


Note: After selecting the wanted power mode setting, click “Send” to confirm the setting before proceeding next tap window for the other setting.

Note: After finishing all the setting(s), please tap to “Save to Flash” window. Tick “Save to Flash” and click on “Send” if the user would like to save the customized setting(s) into flash.

3.7 Functional Windows (Restart Setting)

User can restart the unit by using this utility.

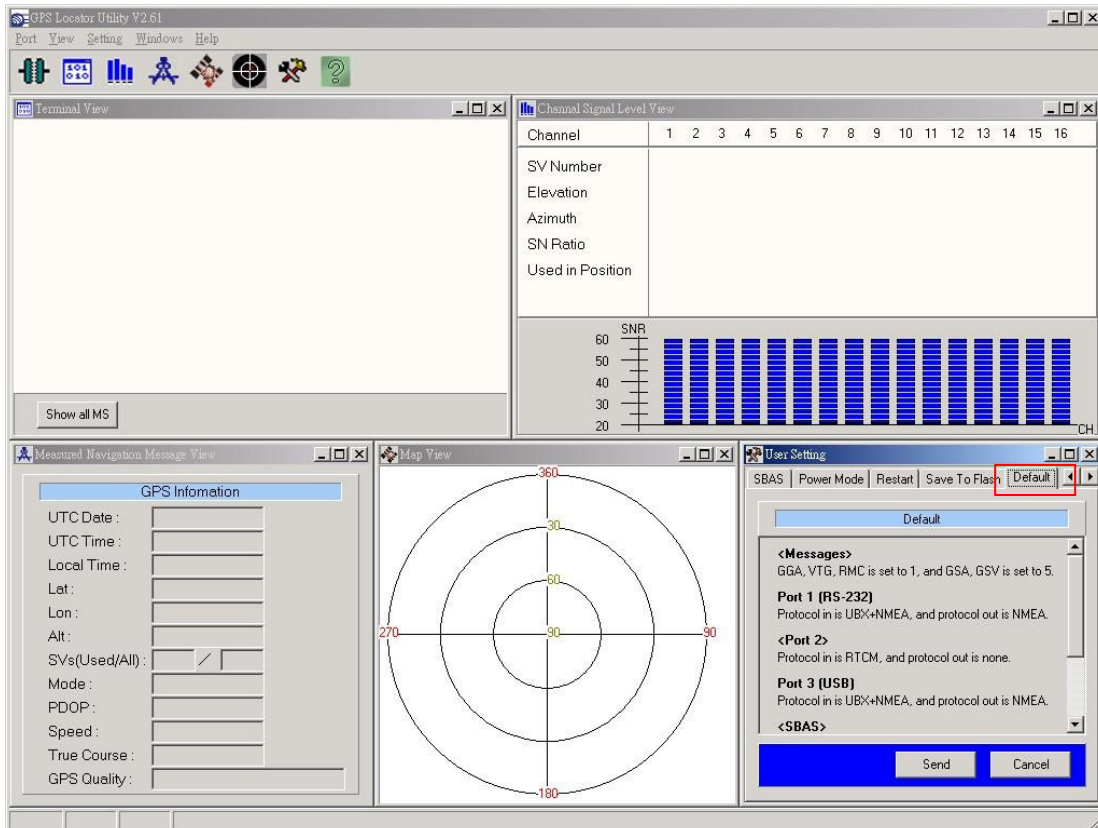


Note: After selecting the wanted restart setting, click "Send" to confirm the setting before proceeding next tap window for the other setting.

Note: After finishing all the setting(s), please tap to "Save to Flash" window. Tick "Save to Flash" and click on "Send" if the user would like to save the customized setting(s) into flash.

3.8 Functional Windows (View Default)

The default of receiver can be seen in this window.



Chapter 4 Applications

GM-88K can be used in meeting GPS navigational needs or Precise Time source, with a range of applicable fields as follows:

- Car Navigation.
- Fleet Management.
- Mileage Management.
- Tracking devices/system.
- Data logging for marine Navigation.
- Mapping devices for PC & Pocket PC.
- Marine Navigation or touring devices.
- AVL and Location-Based service system.

Chapter 5 Specification

Specifications	Parameter	Description
General		L1 frequency, C/A code(SPS), 32 Independent tracking channel
Sensitivity		-158dBm
Accuracy	Position	Without aid: 3.3m CEP DGPS(RTCM): 2.6m
	Velocity	0.1 Knot RMS steady state
Acquisition	Cold start	41 sec. (typical)
	Warm start	35 sec. (typical)
	Hot start	1 sec. (typical)
Reacquisition		100 ms typical (signal reacquisition)
Dynamics	Altitude	18000m max.
	Velocity	500 m/sec.
	Vibration	4G max.
Operation Temperature		-30° C to +80° C
Storage Temperature		-40° C to +85° C
Operating Humidity		0% to 95% RH, non condensing
Water Resistance		100% waterproof
Primary Power		8V ~ 35V DC
Power Consumption		34mA~44mA @ 12V DC
Protocol		NMEA-0183 v3.01 baud rate(adjustable) 4800/9600/19200/38400/115200, default 4800
Signal level		RS-232(standard)
NMEA Message	Default	RMC, GGA, GSV*5, VTG, GSA*5
	Optional	GLL, ZDA
	Update rate	1~5Hz (Default, 1Hz)
DGPS Capability		RTCM protocol
EMI filter		Rejects power line interference
SBAS		1 channel (support WAAS, EGNOS, MSAS)
Power cable		UL 2464/ 24AWG,15M
Enclosure		High impact, corrosion-proof polycarbonate resin
Connector		7 pin circular, hermetically sealed. Gold plated for anti-corrosion
Dimensions	GPS Locator	80mm(D) × 71.3 mm(H)
	Mounting Base	110mm(W) × 70mm(L) × 75.2mm(H)
Weight		150 grams (without cable)

Chapter 6 Troubleshooting

Case 1

No output

Suggested Solution:

Check whether the Com Port is enabled and whether you are using correct power supply.

Case 2

No activity or the Map Software is not receiving any GPS data.

Suggested Solution:

In our FREE GPS program the software automatically searches for Com 1 or Com 2 data as soon as the program is executed. Make sure that the **VP-88** is connected to Com 1 or Com 2.

Chapter 7 Limited Warranty

Thank you for your purchase of GPS product from San Jose Navigation, Inc.

San Jose Navigation, Inc. warrants this product to be free from defects in materials and workmanship for one year from the date of purchase. The warranty for accessories is six months. The stamp of distributor or a copy of the original sales receipt is required as the proof of purchase for warranty repairs. San Jose Navigation, Inc. will, at its sole option, repair or replace any components, which fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor. The customer is, however, responsible for any transportation costs.

This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration of repairs. San Jose Navigation, Inc. assumes no responsibility for special, incidental, punitive or consequential damages, or loss of use.

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, Xicheng Rd., Banqiao City,
Taipei County 220, Taiwan (R.O.C.).

Tel: 886-2-26879500

Fax: 886-2-26878893

<http://www.sanav.com>

Technical Support: sanav104@sanav.com

Chapter 8 Available NMEA Messages

8.1 NMEA Protocol

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

8.1.1 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 messages 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.

8.2 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° ~ 90°)
gga3	Latitude sector	N – North; S – South
gga4	Longitude	dddmm.mmmmmm: dd – degree; mm.mmmmmm – minute (0° ~ 180°)
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	

8.3 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° ~ 90°)
gll2	Latitude sector	N – North; S – South
gll3	Longitude	dddmm.mmmmmm: dd – degree; mm.mmmmmm – minute (0° ~ 180°)
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	

8.4 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	

8.5 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.

8.6 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° ~ 90°)
rmc4	Latitude sector	N – North; S – South
rmc5	Longitude	dddmm.mmmmmm: ddd – degree; mm.mmmmmm – minute (0° ~ 180°)
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	

8.7 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	

8.8 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	