

# SL869 V2 SW User Guide

1VV0301125 Rev.1 – 2014-02-04



## APPLICABILITY TABLE

PRODUCT

SL869 V2

SW Version

0433.004





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## 1. Introduction

### 1.1. Scope

This document describes the serial communications interface between the SL869 V2 GPS/GLONASS, GPS/Beidou receiver module firmware and Host Processor software.

### 1.2. Audience

This document is intended for public distribution to potential customers who are evaluating the SL869 V2 GPS/GLONASS, GPS/Beidou module. It can also be used by customers who are developing application software for the Host Processor in a device that incorporates the SL869 V2.

### 1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

[TS-EMEA@telit.com](mailto:TS-EMEA@telit.com)  
[TS-NORTHAMERICA@telit.com](mailto:TS-NORTHAMERICA@telit.com)  
[TS-LATINAMERICA@telit.com](mailto:TS-LATINAMERICA@telit.com)  
[TS-APAC@telit.com](mailto:TS-APAC@telit.com)

Alternatively, use:

<http://www.telit.com/en/products/technical-support-center/contact.php>

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

<http://www.telit.com>

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.







## 2. Communication Interface

The serial communication interface between the SL869 V2 receiver module and the Host processor is based on the NMEA-0183 protocol standard specified by the National Marine Electronics Association (NMEA). This is an ASCII-based standard that is widely used in the GPS industry for serial communication with GPS receivers.

### 2.1. UART

Serial communication with the SL869 V2 is primarily conducted over the UART port, which is assigned to Pins 20 (Tx) and 21 (Rx). There is no hardware flow control. The default port settings are:

- 9600 Baud
- Eight data bits
- No parity bits
- One stop bit

Note that manual user interaction with the SL869 V2 can be achieved using a PC terminal emulator.

### 2.2. NMEA Characteristics

This subsection highlights characteristics of the NMEA-0183 protocol as they pertain to the SL869 V2 interface.

#### **Start And Termination**

An NMEA data packet is transmitted as an ASCII string beginning with a “\$” character, but it is terminated with <carriage return> <line feed> character sequence.

#### **Proprietary Packets**

Proprietary data packets are allowed by the NMEA protocol standard. They begin with “\$” followed by a Manufacturer’s Mnemonic Code that is assigned by the NMEA. The SL869 V2 module is based on the MT3333 device from Mediatek Inc, who has been assigned the code “PMTK.” Therefore, proprietary packets used by the SL869 V2 begin with the character sequence “\$PMTK.”

#### **Checksums**

The NMEA standard specifies a two-character checksum field that follows a “\*” delimiting character placed at the end of the ASCII data string. The checksum is calculated as the 8-bit exclusive-OR (XOR) of all characters in the string, excluding the “\$” and “\*” delimiters.





### 3. Commands Description

The table below summarizes the set of commands for the SL869 V2:

Command ID	Packet name	Description
\$PMTK000	PMTK_TEST	Test
\$PMTK001	PMTK_ACK	Acknowledge of packet
\$PMTK010	PMTK_SYS_MSG	Output system status message
\$PMTK101	PMTK_CMD_HOT_START	Perform a HOT restart
\$PMTK102	PMTK_CMD_WARM_START	Perform a WARM restart
\$PMTK103	PMTK_CMD_COLD_START	Perform a COLD start
\$PMTK104	PMTK_CMD_FULL_COLD_START	Perform a Full COLD start
\$PMTK161	PMTK_CMD_STANDBY_MODE	Enter standby mode
\$PMTK120	PMTK_CMD_CLEAR_FLASH_AID	Erasing aiding data stored in the flashmemory
\$PMTK127	PMTK_CMD_CLEAR_EPO	Erasing EPO data storageed in the flash memory
\$PMTK220	PMTK_SET_POS_FIX	Position fix interval
\$PMTK223	PMTK_SET_AL_DEE_CFG	Position fix configuration
\$PMTK225	PMTK_SET_PERIODIC_MODE	Periodic power saving mode settings
\$PMTK251	PMTK_SET_NMEA_BAUDRATE	Set NMEA baud rate
\$PMTK286	PMTK_SET_AIC_CMD	Active interference cancellation function
\$PMTK300	PMTK_API_SET_FIX_CTL	Set fix interval
\$PMTK301	PMTK_API_SET_DGPS_MODE	DGPS correction data source mode
\$PMTK313	PMTK_API_SET_SBAS_ENABLED	Set SBAS enabled/disabled
\$PMTK314	PMTK_API_SET_NMEA_OUTPUT	Set NMEA output
\$PMTK330	PMTK_API_SET_DATUM	Set default datum
\$PMTK331	PMTK_API_SET_DATUM_ADVANCE	Set user defined datum
\$PMTK335	PMTK_API_SET_RTC_TIME	Set RTC UTC time
\$PMTK351	PMTK_API_SET_SUPPORT_QZSS_NMEA	Support new NMEA format for QZSS
\$PMTK352	PMTK_API_SET_STOP_QZSS	Enable or disable QZSS funcrion
\$PMTK353	PMTK_API_SET_GNSS_SEARCH_MODE	NVRAM data is valid
\$PMTK355	PMTK_API_QUERY_GNSS_SEARCH_MODE	Beidou, Glonass and Galileo searching setting
\$PMTK356	PMTK_API_SET_HDOP_THRESHOLD	Set the HDOP threshold
\$PMTK357	PMTK_API_GET_HDOP_THRESHOLD	Get the HDOP threshold





'2' = Valid packet, but action failed

'3' = Valid packet, and action succeeded

**Example:**

\$PMTK001,101,0\*33<CR><LF>

### 3.3. \$PMTK010 (PMTK\_SYS\_MSG)

**Packet Meaning:**

Output system message

**Data Field:**

Msg: The system message.

'0': UNKNOWN

'1': STARTUP

:

**Example:**

\$PMTK010,001\*2E<CR><LF>

### 3.4. \$PMTK101 (PMTK\_CMD\_HOT\_START)

**Packet Meaning:**

Hot Restart: Use all available data in the NV Store.

**Data Field:**

None

**Example:**

\$PMTK101\*32<CR><LF>

### 3.5. \$PMTK102 (PMTK\_CMD\_WARM\_START)

**Packet Meaning:**

Warm Restart: Don't use Ephemeris at re-start.

**Data Field:**

None

**Example:**

\$PMTK102\*31<CR><LF>









**Data Field:**

\$PMTK225,Type, Run time, Sleep time, Second run time, Second sleep time

**Example:**

### 3.14. \$PMTK251 (PMTK\_SET\_NMEA\_BAUDRATE)

**Packet Meaning:**

Set NMEA port baud rate

**Data Field:**

Baud rate:

- 0- default
- 4800
- 9600
- 14400
- 19200
- 38400
- 57600
- 115200
- 230400
- 460800
- 921600

**Example:**

\$PMTK251,38400\*27<CR><LF> / baud rate: 38400

\$PMTK251,0\*28<CR><LF> / system default setting

### 3.15. \$PMTK286 (PMTK\_SET\_AIC\_CMD)

**Packet Meaning:**

Enable or Disable active interference cancellation function.

**Data Field:**

PMTK286,Enable

Enable: Enable or Disable

'0' = Disable

'1' = Enable



**Example:**

\$PMTK286,1\*23<CR><LF>

### 3.16. \$PMTK300 (PMTK\_API\_SET\_FIX\_CTL)

**Packet Meaning:**

Set fix interval

**Data Field:**

PMTK300,FixInterval,0,0,0,0

Fix Interval: Position fix interval [msec] [Range: 100~10000]

**Example:**

\$PMTK300,1000,0,0,0,0\*2F<CR><LF> Set fix interval 1000msec

\$PMTK001,300,3\*2C<CR><LF> Return

### 3.17. \$PMTK301 (PMTK\_API\_SET\_DGPS\_MODE)

**Packet Meaning:**

API\_Set\_DGPS\_Mode

DGPS correction data source mode.

**Data Field:**

PMTK301,Mode

Mode: DGPS data source mode.

'0': No DGPS source

'1': RTCM

'2': WAAS

**Example:**

\$PMTK301,1\*2D<CR><LF>

### 3.18. \$PMTK313 (PMTK\_API\_SET\_SBAS\_ENABLED)

**Packet Meaning:**

API\_Set\_SBAS\_Enabled

Enable to search a SBAS satellite or not.

**Data Field:**

Enabled: Enable or disable



'0' = Disable

'1' = Enable

**Example:**

\$PMTK313,1\*2E<CR><LF>

### 3.19. \$PMTK314 (PMTK\_API\_SET\_NMEA\_OUTPUT)

**Packet Meaning:**

API\_Set\_NMEA\_Out

Set NMEA sentence output frequencies.

**Data Field:**

There are totally 19 data fields that present output frequencies for the 19 supported NMEA Sentences individually.

**Supported NMEA Sentences**

0 NMEA\_SEN\_GLL, // GPGLL interval - Geographic Position - Latitude longitude

1 NMEA\_SEN\_RMC, // GPRMC interval - Recommended Minimum Specific GNSS Sentence

2 NMEA\_SEN\_VTG, // GPVTG interval - Course Over Ground and Ground Speed

3 NMEA\_SEN\_GGA, // GPGGA interval - GPS Fix Data

4 NMEA\_SEN\_GSA, // GPGSA interval - GNSS DOPS and Active Satellites

5 NMEA\_SEN\_GSV, // GPGSV interval - GNSS Satellites in View

17 NMEA\_SEN\_ZDA, // GPZDA interval – Time & Date

**Supported Frequency Setting**

0 - Disabled or not supported sentence

1 - Output once every one position fix

2 - Output once every two position fixes

3 - Output once every three position fixes

4 - Output once every four position fixes

5 - Output once every five position fixes

**Example:**

\$PMTK314,1,1,1,1,1,5,0,0,0,0,0,0,0,0,0,0,0,1,0\*2D<CR><LF>







'1' Disable

**Example:**

\$PMTK352,0\*2B<CR><LF> : Enable QZSS function

\$PMTK352,1\*2A<CR><LF> : Disable QZSS function

### 3.25. \$PMTK353 (PMTK\_API\_SET\_GNSS\_SEARCH\_MODE)

**Packet Meaning:**

This command is used to configure the receive to start searching of which satellite system.

**Data Field:**

PMTK353, GPS\_Enable, GLONASS\_Enable, GALILEO\_Enable, GALILEO\_FULL\_Enable, BEIDOU\_Enable

GPS\_Enabled: '0': disable (do not search GPS)

'1': or non-ZERO: search GPS

GLONASS\_Enabled: '0': disable (do not search GLONASS)

'1': or non-ZERO: search GPLONASS

GALILEO\_Enabled: '0': disable (do not search GALILEO)

'1': or non-ZERO: search GALILEO

GALILEO\_FULL\_Enabled: '0': disable (do not search GALILEO\_FULL mode)

'1': or non-ZERO: search GALILEO

BEIDOU\_Enabled: '0': disable (do not search BEIDOU)

'1': or non-ZERO: search BEIDOU

**Example:**

\$PMTK353,0,1,0,0,0\*2A : search GLONASS only

\$PMTK353,1,0,0,0,0\*2A : search GPS only

\$PMTK353,1,1,0,0,0\*2B : search GPS+GLONASS

\$PMTK353,1,1,1,0,0\*2A : search GPS+GLONASS+GALILEO

\$PMTK353,0,0,0,0,1\*2A : search BEIDOU only

\$PMTK353,1,0,0,0,1\*2A : search GPS+BEIDOU

### 3.26. \$PMTK355 (PMTK\_API\_QUERY\_GNSS\_SEARCH\_MODE)

**Packet Meaning:**

This command is to get GLONASS, BEIDOU and GALILEO search setting.



**Data Field:**

None

**Example:**

\$PMTK355\*31

Return \$PMTK001,355,3,0,1,0

“\$PMTK355,3, GLONASS\_Enable,BEIDOU\_Enable,GALILEO\_Enable”

The BEIDOU search mode is enabled.

### 3.27. \$PMTK356 (PMTK\_API\_SET\_HDOP\_THRESHOLD)

**Packet Meaning:**

This command is to set the HDOP threshold.

**Data Field:**

PMTK356,HDOPThreshold Set OK!

HDOPThreshold:'0': Disable this function

Other value: Enable set the HDOP Threshold.

**Example:**

\$PMTK356,0.8

Return \$PMTK356,0.8 Set OK!\*5F

### 3.28. \$PMTK357 (PMTK\_API\_GET\_HDOP\_THRESHOLD)

**Packet Meaning:**

This command is to get the HDOP threshold.

**Data Field:**

PMTK357,HDOPThreshol

HDOPThreshold:'0': Disable this function

Other value: Enable.

**Example:**

\$PMTK357

Return \$PMTK357,0.8\*39

### 3.29. \$PMTK386 (PMTK\_API\_SET\_STATIC\_NAV\_THD)

**Packet Meaning:**



**Data Field:**

PMTK356,speed\_threshold

Speed\_threshold: 0~2m/s

The minimum is 0.1m/s, the maximum is 2.0m/s

**Example:**

\$PMTK386,0.4\*19<CR><LF>

Return \$PMTK356,0.8 Set OK!\*5F

Set the static threshold for static navigation.

### 3.30. \$PMTK389 (PMTK\_API\_SET\_TCXO\_DEBUG)

**Packet Meaning:**

Set the switch of showing TCXO clock drift at every fix

**Data Field:**

PMTK389,on\_off

0=off

1=on

(turn on \$PMTK589 output at every fix)

**Example:**

\$PMTK389,1\*2D<CR><LF>

### 3.31. \$PMTK400 (PMTK\_API\_Q\_FIX\_CTL)

**Packet Meaning:**

API\_Query\_Fix\_Ctrl

**Data Field:**

None

**Return:**

PMTK\_DT\_FIX\_CTL

**Example:**

\$PMTK400\*36<CR><LF>

### 3.32. \$PMTK401 (PMTK\_API\_Q\_DGPS\_MODE)

**Packet Meaning:**









'0': No DGPS source

'1': RTCM

'2': WAAS

**Example:**

\$PMTK501,1\*2B<CR><LF>

### 3.39. \$PMTK513 (PMTK\_DT\_SBAS\_ENABLED)

**Packet Meaning:**

Enable to search a SBAS satellite or not.

**Data Field:**

Enabled: Enable or disable

'0' = Disable

'1' = Enable

**Example:**

\$PMTK513,1\*28<CR><LF>

### 3.40. \$PMTK514 (PMTK\_DT\_NMEA\_OUTPUT)

**Packet Meaning:**

NMEA sentence output frequency setting

**Data Field:**

There are totally 19 data fields that present output frequencies for the 19 supported NMEA Sentences individually.

Please refer to PMTK\_API\_SET\_NMEA\_OUTPUT for the Supported NMEA Sentences and Frequency Setting.

**Example:**

\$PMTK514,1,1,1,1,1,5,1,1,1,1,1,0,1,1,1\*2A<CR><LF>

### 3.41. \$PMTK530 (PMTK\_DT\_DATUM)

**Packet Meaning:**

Current datum used.

**Data Field:**







## 4. Messages Description

The table below summarizes the messages that are output periodically by the SL869 V2:

Message ID	Description
\$--GGA	NMEA: GNSS fix data. Time, position and fix related data for GNSS receiver.
\$--GSA	NMEA: GNSS Dilution of Precision (DOP) and active satellites
\$--GSV	NMEA: GNSS satellites in view.
\$--RMC	NMEA: Recommended minimum specific GNSS data
\$--VTG	NMEA: Course and speed information relative to the ground.

Typically the “GP” message ID reports GPS, “GL” message ID reports GLONASS satellites, “BD” message ID reports BEIDOU satellites, “GN” message ID reports multiple GNSS satellites.

All messages in the above table are output once per second. There are multiple GSA and GSV messages output each second.

In addition to periodic messages, the SL869 V2 outputs a single \$GPTXT message at start-up.





## 4.2. --GSA

This message reports Dilution of Precision (DOP) values and the PRN codes of the active satellites used in the position fix.

**Format:**

\$--GSA, <Mode1>, <Mode2>, [ <SatPRN1> ], . . . , [ <SatPRNn> ], <PDOP>, <HDOP>, <VDOP>\* <checksum> <cr> <lf>

Parameter	Format	Description
Mode1	“M” or “A”	M – Manual, forced to operate in 3D mode A – Automatic, allowed to switch between 2D and 3D mode
Mode2	Decimal, 1 digit	1 – No fix available 1 – 2D fix 2 – 3D fix
SatPRN1... SatPRNn	Decimal, 2 digits	List of GPS satellite PRN codes, or list of GLONASS satellite PRN codes, used in the position fix.
PDOP	PP.P	Position Dilution of Precision, maximum of 99.0
HDOP	HH.H	Horizontal Dilution of Precision, maximum of 99.0
VDOP	VV.V	Vertical Dilution of Precision, maximum of 99.0

**Example:**

\$GNGSA,A,3,25,11,01,18,12,32,31,22,14,30,,1.2,0.7,0.9\*28  
\$GNGSA,A,3,65,66,76,75,72,,,,,,1.2,0.7,0.9\*24





### 4.3. --GSV

This message reports the azimuth, elevation, and signal-to-noise (SNR) values for all satellites in view. These messages are output each second, one having the “GP” message ID and containing the visible GPS satellites, the other having the “GL” message ID and containing the visible GLONASS satellites, “BD” message ID and containing the visible BEIDOU satellites.

Each message is transmitted as multiple sentences, with four satellites maximum per sentence, and each sentence having the format below.

**Format:**

```
$--GSV,<GSVAmount>,<GSVNumber>,<TotSats>,[<Sat1PRN>,<Sat1Elev>,<Sat1Azim>,<Sat1C/N0>],... [<SatNPRN>,<SatNElev>,<SatNAzim>,<SatNC/N0>]*<checksum><cr><lf>
```

Parameter	Format	Description
GSVAmount	Decimal, 1 digit	Total amount of GSV sentences in this message, maximum of 4
GSVNumber	Decimal, 1 digit	Number of the specific GSV sentence within the message
TotSats	nn – Decimal, 2 digits	Total number of GPS or GLONASS satellites in view
Sat1PRN	ss – Decimal, 2 digits	PRN of first satellite.
Sat1Elev	ee – Decimal, 2 digits	Elevation of first satellite in degrees, 0 to 90
Sat1Azim	aaa – Decimal, 3 digits	Azimuth of first satellite in degrees, 0 to 359
Sat1C/N0	cc – Decimal, 2 digits	Carrier to Noise ration of first satellite in dB-Hz
...		
SatNPRN	ss – Decimal, 2 digits	PRN of Nth satellite (maximum N is 4)
SatNElev	ee – Decimal, 2 digits	Elevation of Nth satellite in degrees, 0 to 90
SatNAzim	aaa – Decimal, 3 digits	Azimuth of Nth satellite in degrees, 0 to 359
SatNC/N0	cc – Decimal, 2 digits	Carrier to Noise ration of Nth satellite in dB-Hz

**Example:**

```
$GPGSV,3,1,11,01,23,257,26,11,10,239,,14,30,079,23,16,27,175,23*7F
$GPGSV,3,2,11,20,37,311,33,22,14,146,28,23,12,294,31,25,13,040,37*7B
$GPGSV,3,3,11,30,51,156,31,31,60,026,37,32,65,305,24,,,,*48
$GLGSV,2,1,06,66,77,110,32,76,49,021,31,65,22,140,25,67,45,333,25*69
$GLGSV,2,2,06,78,18,227,,77,65,257,17,,,,,,,,*67
```





## 4.5. --VTG

This message contains the values for the following example:

**Format:**

\$--VTG, <Message ID>, <Course>, <Reference>, <Course>, <Reference>, <Speed>, <Units>, <Speed>, <Units>, <Mode>, \* <checksum> <cr> <lf>

Parameter	Format	Description
Message ID	\$GPVTG	VTG protocol header
Course	309.62	Measure heading
Reference	T	True
Course		Measure heading
Reference	M	Magnetic
Speed	0.13	Measure horizontal speed
Units	N	Knots
Speed	0.2	Measure horizontal speed
Units	K	Kilimeter per hour
Mode	A	A – Autonomous D – Differential E – DR
Checksum	*23	

**Example:**

\$GPVTG, 309.62, T, , M, 0.13, N, 0.2, K, A, \*23



## 5. Document History

Revision	Date	Changes
0	2014-01-20	Initial release
1	2014-02-04	Changed the FW version, added relative new commands.

