



# AirPrime GMM-G3, XA11xx and XM11xx

## Software User Guide



**SIERRA**  
WIRELESS®

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Rev 4.0

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## Revision History

| Revision number | Release date     | Changes   |
|-----------------|------------------|---|
| 1               | June 23, 2017    | Initial Draft   |
| 2               | January 18, 2018 | Updated Packet Type 120/838/837; removed Packet Type 447/527; added SDK commands            |
| 3.0             | April 12, 2019   | Document overhaul to include GMM-G3, and limit XA and XM variants to just XA11xx and XM11xx |
| 3.1             | April 17, 2019   | Fixed typos   |
| 4.0             | August 12, 2019  | Updated default settings for <a href="#">PGCMD229 GNSS Satellite Search Mode</a> on page 58 |

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# >> 1: MTK Packet Command

MTK Packet commands are used to set parameters for GNSS related operations such as changing GNSS satellite constellations, changing DGPS mode, etc.

*Note: When power to the device (module) is removed, any modified settings will be lost and reset back to factory defaults. If the device has a backup power supply through VBACKUP or a coin battery, the device will keep the modified setting until the backup power is exhausted.*

## Command Format

MTK Packet command format is shown in the following tables.

The maximum packet length is restricted to 255 bytes.

**Table 1-1: MTK NMEA Command Format**

| Preamble | Talker ID | Packet Type | Data Field | * | CHK1 | CHK2 | CR | LF |
|----------|-----------|-------------|------------|---|------|------|----|----|
|----------|-----------|-------------|------------|---|------|------|----|----|

**Table 1-2: Fields in MTK Packet Command Format**

| Field       | Length   | Type             | Description   |
|-------------|----------|------------------|---|
| Preamble    | 1 byte   | Character        | “\$”  |
| Talker ID   | 4 bytes  | Character String | “PMTK”  |
| Packet Type | 3 bytes  | Character String | From “000” to “999”. An identifier used to tell the decoder how to decode the packet.             |
| Data Field  | Variable |                  | A comma “,” must be inserted ahead of each data field to help the decoder process the Data Field. |
| *           | 1 byte   | Character        | The star symbol is used make the end of Data Field.   |
| CHK1, CHK2  | 2 bytes  | Character String | Checksum of the data between Preamble and “**”  |
| CR, LF      | 2 bytes  | Binary String    | Used to identify the end of a packet  |

### Sample Packet:

```
$PMTK000*32<CR><LF>
```

When the GNSS module is powered-on or restarted via a command, both `$PMTK011,MTKGPS*08<CR><LF>` and `$PMTK010,001*2E<CR><LF>` will be returned at the same time after the GNSS module has successfully completed the boot-up stage.



## Calculate the Checksum

Example:

```
$PMTK605*31<CR><LF>
```

31 is the checksum and is calculated by XOR-ing all characters between \$ and \*.  
<CR><LF> are used to identify the end of a packet.

## Reset Command Configuration

Configurations changed by MTK commands are temporary. Configurations will be set back to factory default when Full Cold Start is executed.

## >> 2: MTK Packet Types

### PMTK001 Acknowledgment

**Description:**

PMTK command acknowledgment.

**Data Field:**

PMTK001, Cmd, Flag

- **Cmd:** The command / packet type that the acknowledgment corresponds to
- **Flag:**
  - '0' = Invalid command / packet
  - '1' = Unsupported command / packet type
  - '2' = Valid command / packet, but action failed
  - '3' = Valid command / packet, and action succeeded

**Example:**

| Command                                    | Response                   |
|--|----------------------------|
| Invalid command:<br>\$PMTK604,3*2F<CR><LF> | \$PMTK001,604,1*30<CR><LF> |
| Valid command:<br>\$PMTK886,0*28<CR><LF>   | \$PMTK001,886,3*36<CR><LF> |

### PMTK010 System Message

**Description:**

System message.

**Data Field:**

PMTK010, Type

- **Type:** System message type
  - '0' = Unknown
  - '1' = Startup
  - '2' = Notification for the host aiding EPO
  - '3' = Notification for the transition to Normal mode was successful

**Example:**

| Command              | Response                 |
|----------------------|--------------------------|
| \$PMTK104*37<CR><LF> | \$PMTK010,001*2E<CR><LF> |

## PMTK011 System Text Message

### Description:

System text message.

### Data Field:

PMTK011,Msg

- **Msg:** System text message

### Example:

| Command              | Response                    |
|----------------------|-----------------------------|
| \$PMTK104*37<CR><LF> | \$PMTK011,MTKGPS*08<CR><LF> |

## PMTK101 Hot Start

### Description:

Hot Start. Use available data in NVRAM.

### Data Field:

None

### Example:

| Command              | Response  |
|----------------------|---|
| \$PMTK101*32<CR><LF> | \$PMTK011,MTKGPS*08<CR><LF><br>\$PMTK010,001*2E<CR><LF> |

## PMTK102 Warm Start

### Description:

Warm Start. Ephemeris data is not used at start.

### Data Field:

None

### Example:

| Command              | Response  |
|----------------------|---|
| \$PMTK102*31<CR><LF> | \$PMTK011,MTKGPS*08<CR><LF><br>\$PMTK010,001*2E<CR><LF> |

## PMTK103 Cold Start

**Description:**

Cold Start. Position, almanac and ephemeris data are not used at start.

**Data Field:**

None

**Example:**

| Command              | Response  |
|----------------------|---|
| \$PMTK103*30<CR><LF> | \$PMTK011,MTKGPS*08<CR><LF><br>\$PMTK010,001*2E<CR><LF> |

## PMTK104 Full Cold Start

**Description:**

Full Cold Start. In addition to cold start, this command clears system/user configuration at start and resets the module to factory default.

**Data Field:**

None

**Example:**

| Command              | Response  |
|----------------------|---|
| \$PMTK104*37<CR><LF> | \$PMTK011,MTKGPS*08<CR><LF><br>\$PMTK010,001*2E<CR><LF> |

## PMTK127 Clear EPO

**Description:**

Clears the Extended Prediction Orbit (EPO) data stored in the module.

**Data Field:**

None

**Example:**

| Command              | Response                   |
|----------------------|----------------------------|
| \$PMTK127*36<CR><LF> | \$PMTK001,127,3*34<CR><LF> |

## PMTK161 Standby Mode

### Description:

Enters standby mode for power saving.

### Data Field:

PMTK161, Type

- **Type:** Standby mode type
  - '0' = Stop mode

### Example:

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK161,0*28<CR><LF> | \$PMTK001,161,3*36<CR><LF> |

### Notes:

Send any byte to the module to wake it up from standby mode.

## PMTK183 Query Locus Status

### Description:

Queries logging status.

### Data Field:

None

### Return:

PMTKLOG, Serial#, Type, Mode, Content, Interval, Distance, Speed, Status, Log number, Percent

- **Serial#:** Logging serial number (range: 0 – 65535)
- **Type:** Logging type
  - '0' = Overlap
  - '1' = Full stop
- **Mode:** Logging mode
- **Content:** Configuration logging contents
- **Interval:** Logging interval setting (valid when Interval mode is selected)
- **Distance:** Logging distance setting (valid when Distance mode is selected)
- **Speed:** Logging speed setting (valid when Speed mode is selected)
- **Status:** Logging status
  - '0' = Logging
  - '1' = Stop logging
- **Log number:** Log data numbers
- **Percent:** Logging file used percentage (range: 0 – 100)

**Example:**

| Command              | Response                                   |
|----------------------|--|
| \$PMTK183*38<CR><LF> | \$PMTKLOG,0,0,a,31,15,0,0,1,0,0*10<CR><LF> |

## PMTK184 Erase Locus

**Description:**

Erases logged GNSS data stored in the module.

**Data Field:**

PMTK184, Type

- **Type:** Erase type
  - '1' = Erase logged internal flash data

**Example:**

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK184,1*22<CR><LF> | \$PMTK001,184,3*3D<CR><LF> |

## PMTK185 Stop Locus

**Description:**

Starts/stops locus logging.

**Data Field:**

PMTK185, Stop

- **Stop:**
  - '0' = Start logging
  - '1' = Stop logging

**Example:**

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK185,0*22<CR><LF> | \$PMTK001,185,3*3C<CR><LF> |

## PMTK186 Locus Snapshot Log

### Description:

Snapshots write log.

### Data Field:

PMTK186, Type

- **Type:**
  - '1' = Snapshot data logging

### Example:

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK186,1*20<CR><LF> | \$PMTK001,186,3*3F<CR><LF> |

## PMTK187 Configure Locus

### Description:

Configures locus settings.

### Data Field:

PMTK187, Mode, Interval

- **Mode:**
  - '1' = Interval mode
- **Interval:** Locus logging interval (unit: second; range: 1 second – 12 hours)

### Example:

| Command                  | Response                   |
|--------------------------|----------------------------|
| \$PMTK187,1,5*38<CR><LF> | \$PMTK001,187,3*3E<CR><LF> |

## PMTK220 Configure Update Rate

### Description:

Sets NMEA output update rate.

### Data Field:

PMTK220, Interval

- **Interval:** Position fix interval in milliseconds (unit: millisecond; range: 100 – 1000; default: 1000)

### Example:

| Command                   | Response                        |
|---------------------------|---------------------------------|
| \$PMTK220,1000*1F<CR><LF> | \$PMTK001,220,3,1000*1D<CR><LF> |

**Notes:**

Ensure that the baud rate is enough for the specified update rate.

- 1000 (milliseconds) = 1(sec) → 1/1 = 1Hz
- 200 (milliseconds) = 0.2 (sec) → 1/0.2 = 5 Hz
- 100 (milliseconds) = 0.1(sec) → 1/0.1 = 10 Hz

## PMTK223 Configure DEE

**Description:**

Configures Dynamic Ephemeris Extension (DEE) parameters on periodic power saving mode.

**Data Field:**

PMTK223, SV, SNR, Extension threshold, Extension gap

- **SV:** Required number of SV which satisfies the SNR condition to trigger DEE (range: 1 – 4; default: 1)
- **SNR:** SV signal SNR criteria used to trigger DEE (range: 25 – 30; default: 30)
- **Extension threshold:** Time duration of DEE (unit: millisecond; range: 40000 – 180000; default: 180000)
- **Extension gap:** Limitation between neighboring DEE (unit: millisecond; range: 40000 – 3600000; default: 60000)

**Example:**

| Command                                | Response                   |
|--|----------------------------|
| \$PMTK223,1,30,180000,60000*3C<CR><LF> | \$PMTK001,223,3*33<CR><LF> |

**Notes:**

- This command will automatically be enabled with default values when [PMTK225 Periodic Power Saving Mode](#) is used.
- This command can't be disabled.
- The effect of DEE is shown in the following figure.

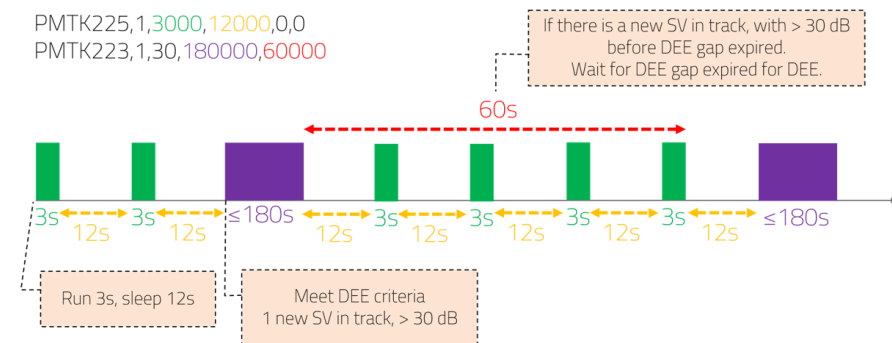


Figure 2-1: Dynamic Ephemeris Extension



## PMTK225 Periodic Power Saving Mode

### Description:

Enters standby or backup mode for power saving.

There are two stages in periodic power saving mode:

- Run stage: the module measures and calculates the position
- Sleep stage: the module may enter power saving modes

### Data Field:

PMTK225,Mode,Run time,Sleep time,2nd run time,2nd sleep time

- **Mode:** Power saving operation mode
  - '0' = Normal mode
  - '1' = Periodic backup mode
  - '2' = Periodic standby mode
  - '4' = Perpetual backup mode
  - '8' = AlwaysLocate™ standby mode
  - '9' = AlwaysLocate™ backup mode
- **Run time:** Time duration of run stage (unit: millisecond; range: 1000 – 518400000)
- **Sleep time:** Time duration of sleep stage (unit: millisecond; range: 1000 – 518400000)
- **2nd run time:** Time duration of run stage under no fix state (unit: millisecond; range: 1000 – 518400000)
- **2nd sleep time:** Time duration of sleep stage under no fix state (unit: millisecond; range: 1000 – 518400000)

### Example:

| Command   | Response                   |
|---|----------------------------|
| Periodic backup mode:<br>\$PMTK225,0*2B<CR><LF><br>\$PMTK223,1,25,180000,60000*38<CR><LF><br>\$PMTK225,1,3000,12000,18000,72000*16<br><CR><LF>  | \$PMTK001,225,3*35<CR><LF> |
| Periodic standby mode:<br>\$PMTK225,0*2B<CR><LF><br>\$PMTK223,1,25,180000,60000*38<CR><LF><br>\$PMTK225,2,3000,12000,18000,72000*16<br><CR><LF> |                            |
| AlwaysLocate™ standby mode:<br>\$PMTK225,0*2B<CR><LF><br>\$PMTK225,8*23<CR><LF>   |                            |
| AlwaysLocate™ backup mode:<br>\$PMTK225,0*2B<CR><LF><br>\$PMTK225,9*22<CR><LF>  |                            |

**Notes:**

- [PMTK223 Configure DEE](#) will automatically be enabled with default values when this command is used.
- 2nd run time and 2nd sleep time must both be set to 0 if you don't want to specify the time duration under no fix state.
- Due to hardware limitation, the module will wake up every 2047 seconds and re-enter sleep stage if the required stage duration is greater than 2047 seconds.
- AlwaysLocate™ is an intelligent controller of the module's power saving mode. Depending on the environment and motion conditions, the module can adaptively adjust the on/off time to achieve a balance of positioning accuracy and power consumption.

## PMTK250 Configure Data Port

**Description:**

Configures input/output data type and baud rate of data port (UART1).

**Data Field:**

PMTK250, Input type, Output type, Baud rate

- **Input type:** Data port input data type
  - '0' = No data input
  - '1' = RTCM input
  - '3' = MTK NMEA
- **Output type:** Data port output data type
  - '0' = No data output
  - '3' = MTK NMEA
- **Baud rate:** Possible baud rate values: 4800, 9600, 14400, 19200, 38400, 57600, 115200, 460800, 921600

**Example:**

| Command                       | Response                   |
|-------------------------------|----------------------------|
| \$PMTK250,1,3,9600*14<CR><LF> | \$PMTK001,250,3*37<CR><LF> |

## PMTK251 Configure Baud Rate

### Description:

Configures the baud rate of UART0.

### Data Field:

PMTK251, Baud rate

- **Baud rate:** Possible baud rate values: 4800, 9600, 14400, 19200, 38400, 57600, 115200, 460800, 921600

### Example:

| Command                     | Response |
|-----------------------------|----------|
| \$PMTK251,115200*1F<CR><LF> | None     |

### Notes:

Changing the baud rate is not allowed in Firmware AXN5.1.1.

## PMTK255 Sync 1PPS with NMEA

### Description:

Enables or disables fixed NMEA output time in one pulse per second (1PPS) function.

The latency range, the beginning of UART Tx and the rising edge of 1PPS, is between 465 ms – 485 ms. Refer to the following figure.

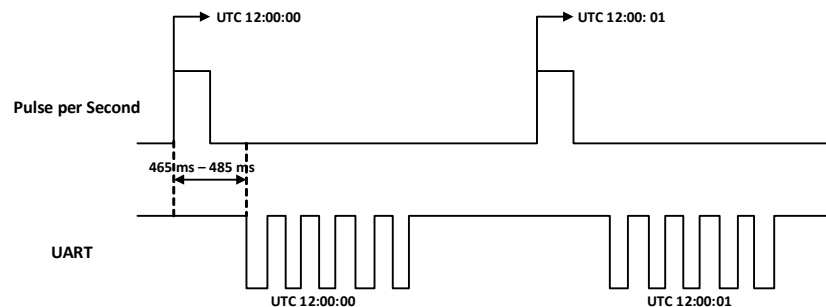


Figure 2-2: Sync 1PPS with NMEA

### Data Field:

PMTK255, Enabled

- **Enabled:**
  - '0' = Disable
  - '1' = Enable

**Example:**

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK255,1*2D<CR><LF> | \$PMTK001,255,3*32<CR><LF> |

**Notes:**

- This function is useful for a 1Hz update rate and baud rates from 14400 to 115200 bps.
- For baud rates from 4800 to 9600, it is recommended to only set the RMC sentence. If there are too many NMEA sentences output, the per-second transmission may exceed one second.

## PMTK265 Configure NMEA Decimal Precision

**Description:**

Sets number of fractional digits in NMEA.

**Data Field:**

PMTK265, Type

- **Type:**
  - '1' = 4 digits
  - '2' = 5 digits
  - '3' = 6 digits (default value)

**Example:**

| Command                | Response                          |
|------------------------|-----------------------------------|
| \$PMTK265,1*2E<CR><LF> | \$PMTK001,265,3,174584*16<CR><LF> |

## PMTK285 Configure 1PPS

**Description:**

Configures 1PPS output settings.

**Data Field:**

PMTK285, Type, Pulse width

- **Type: Availability**
  - '0' = Disable
  - '1' = After the first fix
  - '2' = 3D fix only (default value)
  - '3' = 2D/3D fix only
  - '4' = Always
- **Pulse width:** 1PPS pulse width (unit: millisecond; default: 100)

**Example:**

| Command                    | Response                   |
|----------------------------|----------------------------|
| \$PMTK285,2,100*3E<CR><LF> | \$PMTK001,285,3*3F<CR><LF> |

## PMTK286 AIC

**Description:**

The Active Interference Cancellation (AIC) feature provides effective narrow band interference and jamming elimination.

**Data Field:**

PMTK286, Enabled

- **Enabled:** Availability
  - '0' = Disable
  - '1' = Enable (default value)

**Example:**

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK286,1*23<CR><LF> | \$PMTK001,286,3*3C<CR><LF> |

## PMTK299 Debug Mode

**Description:**

Enables or disables the module's output debug message.

**Data Field:**

PMTK299, Enabled

- **Enabled:**
  - '0' = Disable
  - '1' = Enable

**Example:**

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK299,1*2D<CR><LF> | \$PMTK001,299,3*32<CR><LF> |

**Notes:**

It is recommended to use this command with a baud rate of at least 38400 bps.

## PMTK301 Configure DGPS Mode

### Description:

Configures DGPS correction data source mode.

### Data Field:

PMTK301, Mode

- **Mode:** DGPS data source mode
  - '0' = No DGPS source
  - '1' = RTCM
  - '2' = SBAS (including WAAS/EGNOS/GAGAN/MSAS) (default value)

### Example:

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK301,1*2D<CR><LF> | \$PMTK001,301,3*32<CR><LF> |

### Notes:

If you want to set DGPS mode to RTCM, use PMTK250 Configure Data Port to set the input type as RTCM first.

## PMTK306 Configure Minimum SNR

### Description:

Sets the minimum SNR of satellites used. The module will not use a satellite whose SNR is less than the specified SNR.

### Data Field:

PMTK306, Threshold

- **Threshold:** Minimum SNR of satellites used (range: 9 – 37; default: 9)

### Example:

| Command                 | Response                      |
|-------------------------|-------------------------------|
| \$PMTK306,15*1F<CR><LF> | \$PMTK001,306,3,15*1D<CR><LF> |

## PMTK308 Configure DR Counter

### Description:

Sets the number of estimated fix when entering the tunnel.

### Data Field:

PMTK308, DR counter

- **DR counter:** Number of estimated fix (range: 0 – 500; default: disable)
  - '0' = Disable

### Example:

| Command                | Response                       |
|------------------------|--------------------------------|
| \$PMTK308,3*26<CR><LF> | \$PMTK001,308,3,3,0*38<CR><LF> |

## PMTK311 Configure Minimum Elevation

### Description:

Sets the minimum elevation of satellites used. The module will not use a satellite whose elevation is less than the specified elevation.

### Data Field:

PMTK311, Threshold

- **Threshold:** Minimum elevation of satellites used (range: 0 – 20; default: 5)

### Example:

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK311,5*28<CR><LF> | \$PMTK001,311,3*33<CR><LF> |

## PMTK313 Configure SBAS

### Description:

Enables or disables the module to search SBAS satellites.

### Data Field:

PMTK313, Enabled

- **Enabled:**
  - '0' = Disable
  - '1' = Enable (default value)

### Example:

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK313,1*2E<CR><LF> | \$PMTK001,313,3*31<CR><LF> |

## PMTK314 Configure NMEA and Frequency

### Description:

Configures NMEA sentences and frequencies.

### Data Field:

PMTK314,Field0,Field1,...,Field21

| Field Index | Sentence ID | Description                                 |
|-------------|-------------|---|
| 0           | GLL         | Geographic position, latitude and longitude |
| 1           | RMC         | Recommended minimum specific GNSS data      |
| 2           | VTG         | Course over ground and ground speed         |
| 3           | GGA         | Global positioning system fix data          |
| 4           | GSA         | GNSS DOP and active satellites              |
| 5           | GSV         | GNSS satellites in view                     |
| 6 – 16      | -           | Reserved                                    |
| 17          | ZDA         | GNSS time and date                          |
| 18 – 21     | -           | Reserved                                    |

- **Field (Frequency):** range: 0 – 31
  - '0' = Disabled or not supported sentence
  - '1' = Output once per 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:

| Command  | Response                   |
|--|----------------------------|
| \$PMTK314,0,1,1,1,1,5,0,0,0,0,0,0,0,0,0,0,0,0*31<CR><LF> | \$PMTK001,314,3*36<CR><LF> |



## PMTK328 Configure Maximum HACC

### Description:

Sets the maximum horizontal accuracy (HACC). The module won't get a fix unless the horizontal accuracy is less than the specified accuracy.

### Data Field:

PMTK328, Threshold

- **Threshold:** Maximum horizontal accuracy (unit: meter; range: 30.00 – 200.00; default: disable)
  - '-1' = Disable

### Example:

| Command                 | Response                   |
|-------------------------|----------------------------|
| \$PMTK328,50*12<CR><LF> | \$PMTK001,328,3*39<CR><LF> |

## PMTK330 Configure Datum

### Description:

Configures GNSS datum.

### Data Field:

PMTK330, Type

- **Type:**
  - '0' = WGS84
  - '1' = TOKYO-M
  - '2' = TOKYO-A

### Example:

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK330,0*2E<CR><LF> | \$PMTK001,330,3*30<CR><LF> |

### Notes:

There are 222 different datums. Refer to [Available Datum](#) on page 66 for details.

## PMTK331 Configure Advanced Datum

### Description:

Configures user-defined datum.

### Data Field:

PMTK331, majA, ecc, dX, dY, dZ

- **majA:** User-defined datum semi-major axis (unit: meter; range: 0 – 7000000.000)
- **ecc:** User-defined datum eccentric (unit: meter; range: 0 – 330.000000000)
- **dX:** User-defined datum to WGS84 X-axis offset (unit: meter)
- **dY:** User-defined datum to WGS84 Y-axis offset (unit: meter)
- **dZ:** User-defined datum to WGS84 Z-axis offset (unit: meter)

### Example:

| Command   | Response                   |
|---|----------------------------|
| \$PMTK331,6377397.155,299.1528128,-148.0,507.0,685.0*16<CR><LF> | \$PMTK001,330,3*31<CR><LF> |

## PMTK352 Configure QZSS

### Description:

Enables or disables the module to search QZSS satellites.

### Data Field:

PMTK352, Disabled

- **Disabled:**
  - '0' = Enable (default value)
  - '1' = Disable

### Example:

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK352,0*2A<CR><LF> | \$PMTK001,352,3*34<CR><LF> |

## PMTK353 Configure GNSS Search Mode

### Description:

Configures GNSS satellite constellations of the module.

Four satellite constellations are supported: GPS, GLONASS, Beidou and Galileo.

### Data Field:

PMTK353, GPS, GLONASS, Galileo, Reserved, Beidou

- **GPS:**
  - '0' = Disable
  - '1' = Search GPS satellite constellation
- **GLONASS:**
  - '0' = Disable
  - '1' = Search GLONASS satellite constellation
- **Galileo:**
  - '0' = Disable
  - '1' = Search Galileo satellite constellation
- **Reserved:** Not used
- **Beidou:**
  - '0' = Disable
  - '1' = Search Beidou satellite constellation

### Example:

| Command                        | Response |
|--------------------------------|----------|
| \$PMTK353,1,1,0,0,0*2B<CR><LF> | None     |

### Notes:

- GLONASS and Beidou cannot be enabled at the same time.
- Galileo and Beidou cannot be enabled at the same time.
- This command may not take effect because SDK command [PGCMD229 GNSS Satellite Search Mode](#) on page 58 takes over the GNSS satellite constellation configuration on Firmware AXN5.1.1.

## PMTK355 Query GNSS Search Mode

### Description:

Queries the current GNSS satellite constellations of the module.

### Data Field:

None

### Return:

PMTK001,355,3,GPS,GLONASS,BeiDou,Galileo

- **GPS:**
  - '0' = Disable
  - '1' = Search GPS satellite constellation
- **GLONASS:**
  - '0' = Disable
  - '1' = Search GLONASS satellite constellation
- **Beidou:**
  - '0' = Disable
  - '1' = Search Beidou satellite constellation
- **Galileo:**
  - '0' = Disable
  - '1' = Search Galileo satellite constellation

### Example:

| Command              | Response                           |
|----------------------|------------------------------------|
| \$PMTK355*31<CR><LF> | \$PMTK001,355,3,1,1,0,0*33<CR><LF> |

## PMTK356 Configure Maximum HDOP

### Description:

Set the maximum horizontal dilution of precision (HDOP). The module will not get a fix unless the HDOP is less than the specified HDOP.

### Data Field:

PMTK356,Threshold

- **Threshold:** Maximum horizontal dilution of precision
  - '0' = Disable (default value)

### Example:

| Command                  | Response                         |
|--------------------------|----------------------------------|
| \$PMTK356,0.8*38<CR><LF> | \$PMTK356,0.8 Set OK!*5F<CR><LF> |

## PMTK357 Query Maximum HDOP

### Description:

Queries the maximum horizontal dilution of precision (HDOP).

### Data Field:

None

### Return:

PMTK357, Threshold

- **Threshold:** Maximum horizontal dilution of precision
  - '0' = Disable

### Example:

| Command              | Response                 |
|----------------------|--------------------------|
| \$PMTK357*33<CR><LF> | \$PMTK357,0.8*39<CR><LF> |

## PMTK385 Configure High Sensitivity Mode

### Description:

Enables or disables position output in high sensitivity tracking mode.

### Data Field:

PMTK385, Disabled

- **Disabled:**
  - '0' = Enable (default value)
  - '1' = Disable

### Example:

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK385,1*21<CR><LF> | \$PMTK001,385,3*3E<CR><LF> |

## PMTK386 Configure Minimum Navigation Speed

### Description:

Sets the speed threshold for static navigation. If the actual speed is less than the threshold, the module remains in the last position and the speed is zero.

### Data Field:

PMTK386, Disabled

- **Disabled:** Minimum navigation speed (unit: m/s; range: 0.10 – 2.00)
  - '0' = Disable (default value)

### Example:

| Command                  | Response                   |
|--------------------------|----------------------------|
| \$PMTK386,0.4*39<CR><LF> | \$PMTK001,386,3*3D<CR><LF> |

## PMTK400 Query Fix Control

### Description:

Queries GNSS position fix interval, duration, run interval, one-sigma estimated horizontal position accuracy, etc.

### Data Field:

None

### Return:

Refer to [PMTK500 Fix Control Acknowledgment](#) on page 37.

### Example:

| Command              | Response                              |
|----------------------|---------------------------------------|
| \$PMTK400*36<CR><LF> | \$PMTK500,1000,0,0,0.0,0.0*1A<CR><LF> |

## PMTK401 Query DGPS Mode

**Description:**

Queries the DGPS correction data source mode.

**Data Field:**

None

**Return:**

Refer to [PMTK501 DGPS Mode Acknowledgment](#) on page 37.

**Example:**

| Command              | Response               |
|----------------------|------------------------|
| \$PMTK401*37<CR><LF> | \$PMTK501,2*28<CR><LF> |

## PMTK406 Query Minimum SNR

**Description:**

Queries the minimum SNR of satellites used.

**Data Field:**

None

**Return:**

Refer to [PMTK506 Minimum SNR Acknowledgment](#) on page 38.

**Example:**

| Command              | Response                |
|----------------------|-------------------------|
| \$PMTK406*30<CR><LF> | \$PMTK506,15*19<CR><LF> |

## PMTK408 Query DR Counter

**Description:**

Queries the number of estimated fix when entering the tunnel.

**Data Field:**

None

**Return:**

Refer to [PMTK508 DR Counter Acknowledgment](#) on page 38.

**Example:**

| Command                                       | Response  |
|---|---|
| <code>\$PMTK408*3E&lt;CR&gt;&lt;LF&gt;</code> | <code>\$PMTK508,3,0*3C&lt;CR&gt;&lt;LF&gt;</code> |

## PMTK411 Query Minimum Elevation

**Description:**

Queries the minimum elevation of satellites used.

**Data Field:**

None

**Return:**

Refer to [PMTK511 Minimum Elevation Acknowledgment](#) on page 39.

**Example:**

| Command                                       | Response  |
|---|---|
| <code>\$PMTK411*36&lt;CR&gt;&lt;LF&gt;</code> | <code>\$PMTK511,5*2E&lt;CR&gt;&lt;LF&gt;</code> |



## PMTK413 Query SBAS

**Description:**

Queries whether the module is enabled to search SBAS satellites.

**Data Field:**

None

**Return:**

Refer to [PMTK513 SBAS Acknowledgment](#) on page 39.

**Example:**

| Command              | Response               |
|----------------------|------------------------|
| \$PMTK413*34<CR><LF> | \$PMTK513,1*28<CR><LF> |

## PMTK414 Query NMEA and Frequency

**Description:**

Queries NMEA sentences and frequencies.

**Data Field:**

None

**Return:**

Refer to [PMTK514 NMEA and Frequency Acknowledgment](#) on page 40.

**Example:**

| Command              | Response   |
|----------------------|--|
| \$PMTK414*33<CR><LF> | \$PMTK514,0,1,1,1,1,5,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0*37<CR><LF> |

## PMTK428 Query Maximum HACC

**Description:**

Queries the maximum horizontal accuracy (HACC).

**Data Field:**

None

**Return:**

Refer to [PMTK528 Maximum HACC Acknowledgment](#) on page 41.

**Example:**

| Command              | Response                   |
|----------------------|----------------------------|
| \$PMTK428*3C<CR><LF> | \$PMTK528,-1.00*23<CR><LF> |

## PMTK430 Query Datum

**Description:**

Queries GNSS datum.

**Data Field:**

None

**Return:**

Refer to [PMTK530 Datum Acknowledgment](#) on page 42.

**Example:**

| Command              | Response               |
|----------------------|------------------------|
| \$PMTK430*35<CR><LF> | \$PMTK530,0*28<CR><LF> |

## PMTK431 Query Advanced Datum

**Description:**

Queries user-defined datum.

**Data Field:**

None

**Return:**

Refer to [PMTK530 Datum Acknowledgment](#) on page 42.

**Example:**

| Command              | Response  |
|----------------------|---|
| \$PMTK431*34<CR><LF> | \$PMTK530,6377397.155,299.152812800,-148.0,507.0,685.0*11<CR><LF> |

## PMTK435 Query RTC Time

**Description:**

Queries the current RTC time.

**Data Field:**

None

**Return:**

Refer to [PMTK535 RTC Time Acknowledgment](#) on page 43.

**Example:**

| Command              | Response                               |
|----------------------|--|
| \$PMTK435*30<CR><LF> | \$PMTK535,2018,2,12,7,26,24*3E<CR><LF> |

## PMTK436 Query High Sensitivity Mode

**Description:**

Queries whether high sensitivity mode is enabled.

**Data Field:**

None

**Return:**

Refer to [PMTK536 High Sensitivity Mode Acknowledgment](#) on page 43.

**Example:**

| Command              | Response               |
|----------------------|------------------------|
| \$PMTK436*33<CR><LF> | \$PMTK536,0*2E<CR><LF> |

## PMTK447 Query Minimum Navigation Speed

**Description:**

Queries speed threshold for static navigation.

**Data Field:**

None

**Return:**

Refer to [PMTK527 Minimum Navigation Speed Acknowledgment](#) on page 41.

**Example:**

| Command              | Response                  |
|----------------------|---------------------------|
| \$PMTK447*35<CR><LF> | \$PMTK527,0.40*04<CR><LF> |

## PMTK500 Fix Control Acknowledgment

### Description:

The acknowledgment contains fix interval, duration, run interval, one-sigma estimated horizontal, etc.

### Data Field:

PMTK500, Fix interval, Duration, Run interval, HAcc, VAcc

- **Fix interval:** Position fix interval (unit: millisecond; range: 100 – 1000)
- **Duration:** Duration to fix for (or attempt to fix for) before switching from running mode back to a minimum power sleep mode (unit: millisecond)
- **Run interval:** Interval to come out of a minimum power sleep mode and start running in order to get a new position fix (unit: millisecond)
- **HAcc:** One-sigma estimated horizontal position accuracy mask at which point a suitable fix is deemed to have been obtained and the receiver may prematurely switch into its minimum power sleep mode (unit: meter)
- **VAcc:** One-sigma estimated vertical position accuracy mask at which point a suitable fix is deemed to have been obtained and the receiver may prematurely switch into its minimum power sleep mode (unit: meter)

### Example:

| Command              | Response                              |
|----------------------|---------------------------------------|
| \$PMTK400*36<CR><LF> | \$PMTK500,1000,0,0,0.0,0.0*1A<CR><LF> |

## PMTK501 DGPS Mode Acknowledgment

### Description:

Indicates the DGPS correction data source mode that the module is using.

### Data Field:

PMTK501, Mode

- **Mode:** DGPS correction data source mode
  - '0' = No DGPS source
  - '1' = RTCM
  - '2' = SBAS (including WAAS/EGNOS/GAGAN/MSAS)

### Example:

| Command              | Response               |
|----------------------|------------------------|
| \$PMTK401*37<CR><LF> | \$PMTK501,2*28<CR><LF> |

## PMTK506 Minimum SNR Acknowledgment

### Description:

Indicates the minimum SNR of satellites used.

### Data Field:

PMTK506, Threshold

- **Threshold:** Minimum SNR of satellites used (range: 9 – 37)
  - '0' = Minimum SNR was not set by the user

### Example:

| Command              | Response                |
|----------------------|-------------------------|
| \$PMTK406*30<CR><LF> | \$PMTK506,15*19<CR><LF> |

## PMTK508 DR Counter Acknowledgment

### Description:

Indicates the number of estimated fix when entering the tunnel.

### Data Field:

PMTK508, DR counter, Reserved

- **DR counter:** Number of estimated fix (range: 0 – 500)
  - '0' = Disable
- **Reserved:** Not used

### Example:

| Command              | Response                 |
|----------------------|--------------------------|
| \$PMTK408*3E<CR><LF> | \$PMTK508,3,0*3C<CR><LF> |

## PMTK511 Minimum Elevation Acknowledgment

### Description:

Indicates the minimum elevation of satellites used.

### Data Field:

PMTK511, Threshold

- **Threshold:** Minimum elevation of satellites used (range: 0 – 20)

### Example:

| Command              | Response               |
|----------------------|------------------------|
| \$PMTK411*36<CR><LF> | \$PMTK511,5*2E<CR><LF> |

## PMTK513 SBAS Acknowledgment

### Description:

Indicates whether the module is enabled to search SBAS satellites.

### Data Field:

PMTK513, Enabled

- **Enabled:**
  - '0' = Disable
  - '1' = Enable

### Example:

| Command              | Response               |
|----------------------|------------------------|
| \$PMTK413*34<CR><LF> | \$PMTK513,1*28<CR><LF> |

# PMTK514 NMEA and Frequency Acknowledgment

**Description:**

Indicates NMEA sentences and frequencies.

**Data Field:**

PMTK514, Field0, Field1, . . . , Field21

| Field Index | Sentence ID | Description                                 |
|-------------|-------------|---|
| 0           | GLL         | Geographic position, latitude and longitude |
| 1           | RMC         | Recommended minimum specific GNSS data      |
| 2           | VTG         | Course over ground and ground speed         |
| 3           | GGA         | Global positioning system fix data          |
| 4           | GSA         | GNSS DOP and active satellites              |
| 5           | GSV         | GNSS satellites in view                     |
| 6 – 16      | -           | Reserved                                    |
| 17          | ZDA         | GNSS time and date                          |
| 18 – 21     | -           | Reserved                                    |

- **Field (Frequency):** Range: 0 – 31
  - ‘0’ = Disabled or not supported sentence
  - ‘1’ = Output once per 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:**

| Command              | Response   |
|----------------------|--|
| \$PMTK414*33<CR><LF> | \$PMTK514,0,1,1,1,1,5,0,0,0,0,0,0,0,0,0,0,0,0,0*37<CR><LF> |



## PMTK527 Minimum Navigation Speed Acknowledgment

### Description:

Indicates the speed threshold for static navigation.

### Data Field:

PMTK527, Threshold

- **Threshold:** Minimum navigation speed (unit: m/s; range: 0.10 – 2.00)
  - '0' = Disable

### Example:

| Command              | Response                  |
|----------------------|---------------------------|
| \$PMTK447*35<CR><LF> | \$PMTK527,0.40*04<CR><LF> |

## PMTK528 Maximum HACC Acknowledgment

### Description:

Indicates the maximum horizontal accuracy (HACC).

### Data Field:

PMTK528, Threshold

- **Threshold:** Maximum horizontal accuracy (unit: meter; range: 30.00 – 200.00)
  - '-1' = Disable

### Example:

| Command              | Response                   |
|----------------------|----------------------------|
| \$PMTK428*3C<CR><LF> | \$PMTK528,-1.00*23<CR><LF> |

## PMTK530 Datum Acknowledgment

### Description:

Indicates GNSS or user-defined datum.

### Data Field:

PMTK530, Datum

- **Datum:**
  - '0' = WGS84
  - '1' = TOKYO-M
  - '2' = TOKYO-A

PMTK530, majA, ecc, dX, dY, dZ

- **majA:** User-defined datum semi-major axis (unit: meter; range: 0 – 7000000.000)
- **ecc:** User-defined datum eccentric (unit: meter; range: 0 – 330.000000000)
- **dX:** User-defined datum to WGS84 X axis offset (unit: meter)
- **dY:** User-defined datum to WGS84 Y axis offset (unit: meter)
- **dZ:** User-defined datum to WGS84 Z axis offset (unit: meter)

### Example:

| Command              | Response  |
|----------------------|---|
| \$PMTK430*35<CR><LF> | \$PMTK530,0*28<CR><LF>  |
| \$PMTK431*34<CR><LF> | \$PMTK530,6377397.155,299.152812800,-148.0,507.0,685.0*11<CR><LF> |

### Notes:

There are 222 different datums. Refer to [Available Datum](#) on page 66 for details.

## PMTK535 RTC Time Acknowledgment

### Description:

Indicates the current RTC time.

### Data Field:

PMTK535, Year, Month, Day, Hour, Min, Sec

- **Year:** Year
- **Month:** Range: 1 – 12
- **Day:** Range: 1 – 31
- **Hour:** Range: 0 – 23
- **Min:** Range: 0 – 59
- **Sec:** Range: 0 – 59

### Example:

| Command              | Response                             |
|----------------------|--------------------------------------|
| \$PMTK435*30<CR><LF> | \$PMTK535,2018,2,12,8,2,0*31<CR><LF> |

## PMTK536 High Sensitivity Mode Acknowledgment

### Description:

Indicates whether high sensitivity mode is enabled.

### Data Field:

PMTK536, Disabled

- **Disabled:**
  - '0' = Enable
  - '1' = Disable

### Example:

| Command              | Response               |
|----------------------|------------------------|
| \$PMTK436*33<CR><LF> | \$PMTK536,0*2E<CR><LF> |

## PMTK602 Query Data Port

**Description:**

Queries input/output data type and baud rate of data port (UART1).

**Data Field:**

None

**Return:**

Refer to [PMTK702 Data Port Acknowledgment](#) on page 46.

**Example:**

| Command                                       | Response   |
|---|--|
| <code>\$PMTK602*36&lt;CR&gt;&lt;LF&gt;</code> | <code>\$PMTK702,1,3,115200*1E&lt;CR&gt;&lt;LF&gt;</code> |

## PMTK605 Query Release Version

**Description:**

Queries firmware release information.

**Data Field:**

None

**Return:**

Refer to [PMTK705 Release Version Acknowledgment](#) on page 46.

**Example:**

| Command                                       | Response  |
|---|---|
| <code>\$PMTK605*31&lt;CR&gt;&lt;LF&gt;</code> | <code>\$PMTK705,AXN_5.1.1_3333_17081700,8527,<br/>XM Series,1.0*2C</code> |

## PMTK607 Query EPO Status

**Description:**

Queries the Extended Prediction Orbit (EPO) data status.

**Data Field:**

None

**Return:**

Refer to [PMTK707 EPO Status Acknowledgment](#) on page 47.

**Example:**

| Command              | Response  |
|----------------------|---|
| \$PMTK607*33<CR><LF> | \$PMTK707,28,1680,259200,1681,237600,1680,345600,1680,345600*19<CR><LF> |

## PMTK622 Query Locus Data

**Description:**

Dumps locus data log from NVRAM.

**Data Field:**

PMTK622, Type, Offset, Size

- **Type:**
  - '0' = Dump full locus flash data
  - '1' = Dump partial in use locus flash data
  - '2' = Dump specified sector's locus flash data
- **Offset:** Start address for the dump ( $0 \leq \text{offset} \leq 32$ , the unit is sector [4KB])
- **Size:** Dump length ( $0 \leq \text{offset} \leq 32$ , the unit is sector [4KB])

**Example:**

| Command                | Response  |
|------------------------|---|
| \$PMTK622,0*28<CR><LF> | \$PMTKLOX,Data1,...*Checksum<CR><LF><br>\$PMTKLOX,Data2,...*Checksum<CR><LF><br>:<br>\$PMTKLOX,2*47<CR><LF> |

## PMTK702 Data Port Acknowledgment

### Description:

Indicates the input/output data type and baud rate of the data port (UART1).

### Data Field:

PMTK702, Input type, Output type, baud rate

- **Input type:** Data port input data type
  - '0' = No data input
  - '1' = RTCM input
  - '2' = MTK NMEA
- **Output type:** Data port output data type
  - '0' = No data output
  - '3' = MTK NMEA
- **Baud rate:** Possible values are: 4800, 9600, 14400, 19200, 38400, 57600, 115200, 460800, 921600

### Example:

| Command              | Response                        |
|----------------------|---------------------------------|
| \$PMTK602*36<CR><LF> | \$PMTK702,1,3,115200*1E<CR><LF> |

## PMTK705 Release Version Acknowledgment

### Description:

Indicates firmware release information.

### Data Field:

PMTK705, Release string, Build ID, Product model, Reserved

- **Release string:** Firmware version. Refer to [Release String Details](#) on page 74 for more information
- **Build ID:** Firmware build ID
- **Product model:** Model name
- **Reserved:** Not used

### Example:

| Command              | Response   |
|----------------------|--|
| \$PMTK605*31<CR><LF> | \$PMTK705,AXN_5.1.1_3333_17081700,8527, XM Series,1.0*2C |

## PMTK707 EPO Status Acknowledgment

### Description:

Indicates the Extended Prediction Orbit (EPO) data status.

### Data Field:

PMTK707, Set, FWN, FTOW, LWN, LTOW, FCWN, FCTOW, LCWN, LCTOW

- **Set:** Total set number of EPO data stored in chip.
- **FWN** and **FTOW:** GPS week number and TOW of the first set of EPO data stored in chip respectively
- **LWN** and **LTOW:** GPS week number and TOW of the last set of EPO data stored in chip respectively
- **FCWN** and **FCTOW:** GPS week number and TOW of the first set of EPO data that are currently used respectively.
- **LCWN** and **LCTOW:** GPS week number and TOW of the last set of EPO data that are currently used respectively.

### Example:

| Command              | Response  |
|----------------------|---|
| \$PMTK607*33<CR><LF> | \$PMTK707,28,1680,259200,1681,237600,1680,345600,1680,345600*19<CR><LF> |

## PMTK837 Jamming Scan Test

### Description:

GNSS jamming scan test.

### Data Field:

PMTK837, JamScanType, jamScanNum

- **JamScanType:**
  - '0' = Enable GPS jamming scan
  - '1' = Enable GLONASS jamming scan
  - '2' = Enable Beidou jamming scan
- **JamScanNum:** Jamming scan test times

### Example:

| Command   | Response                     |
|---|------------------------------|
| GPS Jamming scan 50 times:<br>\$PMTK837,0,50*0B<CR><LF>     | \$PMTK001,837,3,0*20<CR><LF> |
| GLONASS Jamming scan 50 times:<br>\$PMTK837,1,50*0A<CR><LF> | \$PMTK001,837,3,1*21<CR><LF> |
| BeiDou Jamming scan 50 times:<br>\$PMTK837,2,50*09<CR><LF>  | \$PMTK001,837,3,2*22<CR><LF> |

## PMTK838 Jamming Detection Test

### Description:

GNSS jamming detection test command.

### Data Field:

PMTK838, Enabled

- **Enabled:**
  - '0' = Disable jamming detection message output
  - '1' = Enable jamming detection message output

### Return:

PMTKSPF, Status

- **Status:** Jamming status
  - '1' = No jamming; healthy status
  - '2' = Warning status
  - '3' = Critical status

### Example:

| Command                | Response   |
|------------------------|--|
| \$PMTK838,1*2C<CR><LF> | \$PMTK838,3,1*33<CR><LF><br>\$PMTKSPF,2*59<CR><LF> |

## PMTK869 EASY

### Description:

Embedded Assist System (EASY™) is for quick positioning/TTFB when information received from the satellites is insufficient (e.g. in weak signal).

### Data Field:

PMTK869, Mode, Enabled, Extension day

- **Mode:**
  - '0' = Query
  - '1' = Set
  - '2' = Result for the query operation
- **Enabled:**
  - '0' = Disable
  - '1' = Enable
- **Extension day:** Finished extension day (range: 0 – 3)



**Example:**

| Command                                       | Response  |
|---|---|
| Enable EASY™:<br>\$PMTK869,1,1*35<CR><LF>     | \$PMTK001,869,3*37<CR><LF>  |
| Query EASY™ Status:<br>\$PMTK869,0*29<CR><LF> | EASY™ disabled:<br>\$PMTK869,2,0,0*2B<CR><LF><br><br>EASY™ enabled, finished 1-day extension:<br>\$PMTK869,2,1,1*2B<CR><LF> |

**Notes:**

- The EASY function is enabled by default.
- VBACKUP pin must be connected to a coin-battery for this feature. Contact Sierra Wireless for more details.
- The EASY function only supports an update rate of 1Hz.

## PMTK886 Configure Navigation Mode

**Description:**

Configures navigation mode.

**Data Field:**

PMTK886, Mode

- **Mode:**
  - '0' = Normal mode; for general purpose use
  - '1' = Fitness mode; for running and walking purposes that the low-speed (<5 m/s) movement will have more effect on the position calculation.
  - '2' = Aviation mode; for high-dynamic purposes that large acceleration movement will have more effect on the position calculation.
  - '3' = Balloon mode; for high-altitude balloon purposes that vertical movement will have more effect on the position calculation.
  - '4' = Stationary mode; for stationary applications that zero dynamics is assumed.

**Example:**

| Command                | Response                   |
|------------------------|----------------------------|
| \$PMTK886,0*28<CR><LF> | \$PMTK001,886,3*36<CR><LF> |

**Notes:**

Each mode has its altitude limitation. Please choose the appropriate mode based on the table below. If your test scenario exceeds the limitation, the position calculation will be incorrect.

| <b>Mode</b> | <b>Altitude Limitation</b> |
|-------------|----------------------------|
| Normal      | 10000 m                    |
| Fitness     | 10000 m                    |
| Aviation    | 10000 m                    |
| Stationary  | 10000 m                    |
| Balloon     | 80000 m                    |

The altitude limitation is 10,000 meters except in balloon mode. For balloon mode, the altitude limitation is 80,000 meters; however, when the altitude exceeds 18,000 meters, the velocity must be less than 515 m/s.

## >> 3: SDK Commands

Sierra Wireless GNSS modules support SDK commands which are defined and developed by Sierra Wireless. These commands allow users to configure and change some default parameters of the module that can then be saved in flash memory. The configuration will not be set back to the factory defaults after Full Cold Start is executed, or when the module powers down entirely. SDK commands are only supported on flash-based GNSS modules.

### Command Format

SDK command format is shown in the following tables.

**Table 3-1: SDK Command Format**

|          |           |   |            |            |   |      |      |    |    |
|----------|-----------|---|------------|------------|---|------|------|----|----|
| Preamble | Talker ID | , | Command ID | Data Field | * | CHK1 | CHK2 | CR | LF |
|----------|-----------|---|------------|------------|---|------|------|----|----|

**Table 3-2: Fields in SDK Command Format**

| Field      | Length   | Type             | Description   |
|------------|----------|------------------|---|
| Preamble   | 1 byte   | Character        | “\$”  |
| Talker ID  | 5 bytes  | Character String | “PGCMD”   |
| ,          | 1 byte   | Character        | “,”   |
| Command ID | Variable | Character String | Identifier used to tell the decoder how to decode the packet                                      |
| Data Field | Variable |                  | A comma “,” must be inserted ahead of each data field to help the decoder process the Data Field. |
| *          | 1 byte   | Character        | The star symbol is used to mark the end of Data Field.  |
| CHK1, CHK2 | 2 bytes  | Character String | Checksum of the data between Preamble and “**”  |
| CR, LF     | 2 bytes  | Binary String    | Used to identify the end of a packet  |

**Example:**

```
$PGCMD,218,1*57<CR><LF>
```

# Initial Procedure

The initial procedure flowchart is shown in the figure below.

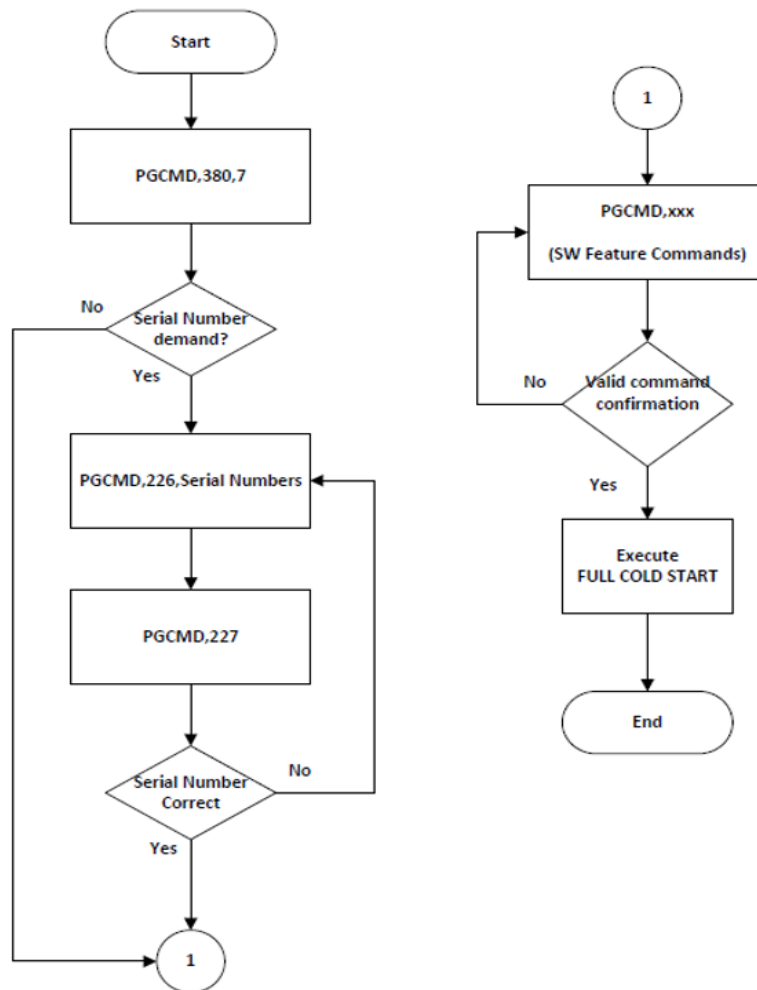


Figure 3-1: Initial SDK Procedure

**Steps:**

1. Execute [PGCMD380 Default Recovery](#) on page 62 to initialize the feature configuration to default.
2. Execute [PGCMD226 Write Serial Number](#) on page 57 to write a custom serial number into the module if needed (optional).
3. Use any of the SDK commands to change the module’s command configuration. A Full Cold Start is required before the changes take effect.

## >> 4: SDK Command Types

### PGACK SDK Acknowledgment

**Description:**

SDK command acknowledgment.

**Data Field:**

PGACK, Result

- **Result:**
  - 'Command\_fail' = Command fail
  - 'Command\_vaild' = Command accepted
  - 'No\_Change\_Data' = Configuration did not change
  - 'GetRec\_Error' = Configuration area error

**Example:**

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 218, 1*57<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

### PGCMD218 NMEA Sentence Type

**Description:**

Configures the module sentence type and saves it in the configuration. A Full Cold Start is required before changes take effect.

**Data Field:**

PGCMD, 218, Type

- **Type:**
  - '1' = NMEA mode (default value)
  - '2' = One sentence mode
  - '3' = Binary mode

**Example:**

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 218, 1*57<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

**Notes:**

Refer to [NMEA Sentence Type](#) on page 75 for more information about one sentence mode and binary mode.

## PGCMD219 Last Position Retention

### Description:

Latitude and longitude in the NMEA GGA will be kept as the last position if the module is under no fix state. A Full Cold Start is required before changes take effect.

### Data Field:

PGCMD, 219, Enabled, Type

- **Enabled:**
  - '0' = Disable (default value)
  - '1' = Enable
- **Type:**
  - '0' = 6; number of fractional digits of the NMEA sentence
  - '1' = 4; number of fractional digits of the NMEA sentence

### Example:

| Command                       | Response                          |
|-------------------------------|-----------------------------------|
| \$PGCMD, 219, 1, 0*4A<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

## PGCMD220 Decimal Length

### Description:

Configures the fractional digits of the NMEA sentence. A Full Cold Start is required before changes take effect.

### Data Field:

PGCMD, 220, Type

- **Type:**
  - '0' = 4 fractional NMEA digits (default value)
  - '1' = 6 fractional NMEA digits

### Example:

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 220, 0*5D<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

# PGCMD221 Geofencing

**Description:**

Configures the Geofencing feature. A Full Cold Start is required before changes take effect.

**Data Field:**

PGCMD, 221, Enabled

- **Enabled:**
  - '0' = Disable (default value)
  - '1' = Enable

**Return:**

PGTOP, 3, Enabled, Status, Distance, EPE 2D, Reserved

- **Enabled:**
  - '001' = No set parameters for geofencing yet
  - '002' = Enable
- **Status:** Geofencing status
  - '0' = Under no fix state
  - '1' = Within the geofencing area
  - '2' = Out of the geofencing area
  - '3' = No set parameters for geofencing yet
- **Distance:** Distance between the geofencing center and current position (unit: meter)
- **EPE 2D:** Estimated horizontal position error
- **Reserved:** Not used

**Example:**

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 221, 1*5D<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

**Notes:**

Refer to [PGCMD25 Geofencing Parameter](#) on page 63 to set detailed configurations.

## PGCMD222 Distance Calculation

### Description:

Configures the distance calculation feature. A Full Cold Start is required before changes take effect.

### Data Field:

PGCMD, 222, Enabled

- **Enabled:**
  - '0' = Disable (default value)
  - '1' = Enable

### Example:

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 222, 1*5E<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

### Notes:

Refer to [PGCMD27 Distance Calculation Parameter](#) on page 64 to set detailed configuration.

## PGCMD223 Navigation Mode

### Description:

Configures the navigation mode. A Full Cold Start is required before changes take effect.

### Data Field:

PGCMD, 223, Mode

- **Mode:**
  - '0' = Normal; vehicle (default value)
  - '1' = Fitness
  - '2' = Aviation
  - '3' = Balloon
  - '4' = Stationary

### Example:

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 223, 1*5F<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |



## PGCMD224 Speed Warn

**Description:**

Configures the speed warning. A Full Cold Start is required before changes take effect.

**Data Field:**

PGCMD, 224, Enabled

- **Enabled:**
  - '0' = Disable (default value)
  - '1' = Enable

**Example:**

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 224, 1*58<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

**Notes:**

Refer to [PGCMD200 Speed Warning Parameter](#) on page 65 to set detailed configuration.

## PGCMD226 Write Serial Number

**Description:**

Writes the serial number into the module.

**Data Field:**

PGCMD, 226, SN

- **SN:** Serial number (format: 10 characters; range: 0 – 9, a – z, A – Z)

**Example:**

| Command                             | Response                          |
|-------------------------------------|-----------------------------------|
| \$PGCMD, 226, 0123456789*6A<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

## PGCMD227 Query Serial Number

### Description:

Queries the module's serial number.

### Data Field:

None

### Return:

PGACK, FF:FF:FF:FF:FF:FF:FF:FF:FF:FF:FF (default)

PGACK, 227, X:X:X:X:X:X:X:X:X:X

### Example:

| Command                 | Response                                     |
|-------------------------|--|
| \$PGCMD, 227*46<CR><LF> | \$PGACK, 227, 0:1:2:3:4:5:6:7:8:9*52<CR><LF> |

## PGCMD229 GNSS Satellite Search Mode

### Description:

Configures the satellite constellation. A Full Cold Start is required before changes take effect.

### Data Field:

PGCMD, 229, GPS, GLONASS, Beidou, Galileo

- **GPS:**
  - '0' = Disable
  - '1' = Search GPS satellite constellation
- **GLONASS:**
  - '0' = Disable
  - '1' = Search GLONASS satellite constellation
- **Beidou:**
  - '0' = Disable
  - '1' = Search Beidou satellite constellation
- **Galileo:**
  - '0' = Disable
  - '1' = Search Galileo satellite constellation

### Default Settings:

- XM1110, XA1110 = GPS+GLONASS

### Example:

| Command                             | Response                          |
|-------------------------------------|-----------------------------------|
| \$PGCMD, 229, 1, 1, 0, 0*48<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

**Notes:**

- GLONASS and Beidou cannot be enabled at the same time.
- Galileo and Beidou cannot be enabled at the same time.

## PGCMD231 EPE Information

**Description:**

Configures the GNSS position EPE message output. This message is only supported in NMEA sentence mode. A Full Cold Start is required before changes take effect.

**Data Field:**

PGCMD, 231, Enabled

- **Enabled:**
  - '0' = Disable
  - '1' = Enable (default value)

**Example:**

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 231, 1*5C<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

## PGCMD232 Baud Rate

**Description:**

Configures the GNSS baud rate of UART0 for NMEA output and RTCM input. A Full Cold Start is required before changes take effect.

**Data Field:**

PGCMD, 232, Type

- **Type:**
  - '0' = 4800
  - '1' = 9600
  - '2' = 14400
  - '3' = 19200
  - '4' = 38400
  - '5' = 57600
  - '6' = 115200 (default value)

**Example:**

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 232, 6*58<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

## PGCMD233 Update Rate

### Description:

Sets update rate of NMEA output. A Full Cold Start is required before changes take effect.

### Data Field:

PGCMD, 233, Type

- **Type:**
  - '1' = 1 Hz (default value)
  - '2' = 5 Hz
  - '3' = 10 Hz

### Example:

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 233, 2*5D<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

### Notes:

Use the supported baud rates for the following update rates:

- 5Hz = baud rates: 19200, 38400, 57600 or 115200
- 10Hz = baud rates: 38400, 57600 or 115200

## PGCMD234 DGPS Mode

### Description:

Configures DGPS mode selection. A Full Cold Start is required before changes take effect.

### Data Field:

PGCMD, 234, Mode

- **Mode:**
  - '1' = SBAS (default value)
  - '2' = RTCM
  - '3' = Disable

### Example:

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 234, 1*59<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

### Notes:

SBAS only works with a maximum update rate of 5 Hz.

## PGCMD235 1PPS Mode

**Description:**

Sets 1PPS status and duration. A Full Cold Start is required before changes take effect.

**Data Field:**

PGCMD,235,Mode,Pulse width

- **Mode:**
  - '0' = Disable
  - '1' = After first fix only
  - '2' = After 3D fix only (default value)
  - '3' = After 2D or 3D fix
  - '4' = Always output
- **Pulse width:** 1PPS pulse width (unit: millisecond; range: 0 – 998; default: 100)

**Example:**

| Command                      | Response                         |
|------------------------------|----------------------------------|
| \$PGCMD,235,2,100*46<CR><LF> | \$PGACK,Command_vaild*1C<CR><LF> |

**Notes:**

- If the update rate is over 1Hz, 1PPS width cannot be set over 195 ms.
- “Always output” only works with a 1Hz update rate.

## PGCMD236 NMEA Period

**Description:**

Sets NMEA sentence periods. A Full Cold Start is required before changes take effect.

**Data Field:**

PGCMD,236,ZDA,GGA,GSV,GSA,VTG,RMC,GLL

- **ZDA:** GNSS time and date (range: 0 – 31; default: 0)
- **GGA:** GPS fix data (range: 0 – 31; default: 1)
- **GSV:** GNSS satellites in view (range: 0 – 31; default: 5)
- **GSA:** GNSS DOP and active satellites (range: 0 – 31; default: 1)
- **VTG:** Course over ground and ground speed (range: 0 – 31; default: 1)
- **RMC:** Recommended minimum specific GNSS data (range: 0 – 31; default: 1)
- **GLL:** Geographic position, latitude and longitude (range: 0 – 31; default: 0)

**Example:**

| Command                              | Response                         |
|--------------------------------------|----------------------------------|
| \$PGCMD,236,0,1,5,1,1,1,0*5F<CR><LF> | \$PGACK,Command_vaild*1C<CR><LF> |

## PGCMD380 Default Recovery

**Description:**

Recovers default factory configuration. A Full Cold Start is required before changes take effect.

**Data Field:**

PGCMD, 380, Type

- **Type:**
  - '7' = Reset configuration to factory setting
  - '8' = Reset serial number

**Example:**

| Command                    | Response                          |
|----------------------------|-----------------------------------|
| \$PGCMD, 380, 7*51<CR><LF> | \$PGACK, Command_vaild*1C<CR><LF> |

## >> | 5: Additional Configuration

### PGCMD25 Geofencing Parameter

**Description:**

Sets or queries geofencing parameters.

**Data Field:**

PGCMD, 25, Mode, Radius, Latitude, NS, Longitude, EW

- **Mode:**
  - '1' = Configure geofencing parameters
  - '2' = Query geofencing parameters
- **Radius:** Unit: meter (integer); range: 0 – 5000
- **Latitude:** Reference point for latitude (unit: decimal degree, 4-decimal places)
- **NS:**
  - 'N' = Latitude indication North
  - 'S' = Latitude indication South
- **Longitude:** Reference point for longitude (unit: decimal degree, 4-decimal places)
- **EW:**
  - 'E' = Longitude indication East
  - 'W' = Longitude indication West

**Return:**

PGACK, 25, Result, Radius, Latitude, NS, Longitude, EW

- **Result:**
  - '0' = Command failed
  - '1' = Command accepted
  - '2' = Query acknowledged
- **Radius:** Unit: meter (integer); range: 0 – 5000
- **Latitude:** Reference point for latitude (unit: decimal degree, 4-decimal places)
- **NS:**
  - 'N' = Latitude indication North
  - 'S' = Latitude indication South
- **Longitude:** Reference point for longitude (unit: decimal degree, 4-decimal places)
- **EW:**
  - 'E' = Longitude indication East
  - 'W' = Longitude indication West

**Example:**

| Command  | Response   |
|--|--|
| Configure:<br>\$PGCMD, 25, 1, 1234, 23, N, 120, E*7A<CR><LF> | \$PGACK, 25, 1*68<CR><LF>                                |
| Query:<br>\$PGCMD, 25, 2*68<CR><LF>                          | \$PGACK, 25, 2, 1234, 23.0000, N, 120.0000, E*7A<CR><LF> |

**Notes:**

Enable [PGCMD221 Geofencing](#) on page 55 and execute a Full Cold Start before configuring parameters.

## PGCMD27 Distance Calculation Parameter

**Description:**

Sets or queries distance calculation parameters.

**Data Field:**

PGCMD, 27, Mode, Latitude, NS, Longitude, EW

- **Mode:**
  - '1' = Set module's current position as the starting reference point
  - '2' = Set user-defined position as the starting reference point
  - '3' = Query distance between starting reference point and current position
- **Latitude:** Unit: decimal degree, 4-decimal places
- **NS:**
  - 'N' = Latitude indication North
  - 'S' = Latitude indication South
- **Longitude:** Unit: decimal degree, 4-decimal places
- **EW:**
  - 'E' = Longitude indication East
  - 'W' = Longitude indication West

**Return:**

PGACK, 27, Result, Distance

- **Result:**
  - '1' = Command failed
  - '2' = Command accepted
  - '3' = Query acknowledged
- **Distance:** Distance between starting reference position and current position

**Example:**

| Command  | Response                                |
|--|---|
| Configure:<br>\$PGCMD, 27, 2, 23.1234, N, 120.1234, E*53<br><CR><LF> | \$PGACK, 27, 2*69<CR><LF>               |
| Query:<br>\$PGCMD, 27, 3*6B<CR><LF>                                  | \$PGACK, 27, 3, 31052.36*5A<br><CR><LF> |

**Notes:**

Enable [PGCMD222 Distance Calculation](#) on page 56 and execute a Full Cold Start before configuring parameters.



## PGCMD200 Speed Warning Parameter

### Description:

Sets or queries speed warning parameters.

### Data Field:

PGCMD, 200, Mode, Enabled, Threshold

- **Mode:**
  - '0' = Configure speed warning parameters
  - '1' = Query speed warning parameters
- **Enabled:**
  - '0' = Disable speed warning
  - '1' = Enable speed warning
- **Threshold:** Speed warning threshold value (unit: km/hr; range: 0 – 1854.00)

### Return:

PGACK, 200, Mode, Result

- **Mode:**
  - '0' = Configure speed warning parameters
  - '1' = Query speed warning parameters
- **Result:**
  - '0' = Command failed
  - '1' = Command accepted

PGTOP, 200, Status, Threshold, Speed

- **Status:**
  - '0' = Parameters for speed warning not set
  - '1' = Current speed is less than threshold
  - '2' = Current speed is greater than or equal to threshold
- **Threshold:** Maximum speed
- **Speed:** Current speed

### Example:

| Command   | Response   |
|---|--|
| Configure:<br>\$PGCMD, 200, 0, 1, 123.45*71<CR><LF> | \$PGACK, 200, 0, 1*41<CR><LF>  |
| Query:<br>\$PGCMD, 200, 1*5E<CR><LF>                | \$PGTOP, 200, 1, 123.45, 21.37*69<br><CR><LF><br>\$PGACK, 200, 1, 1*40<CR><LF> |

### Notes:

- Enable [PGCMD224 Speed Warn](#) on page 57 and execute a Full Cold Start before configuring parameters.
- The speed warning will appear when the status is queried, or when the speed is greater than or equals to the maximum speed.

## >> 6: Appendix

### Available Datum

**Table 6-1: Available Datum**

| Number | Datum                    | Region   |
|--------|--------------------------|--|
| 0      | WGS1984                  | International  |
| 1      | Tokyo                    | Japan  |
| 2      | Tokyo                    | Mean for Japan, South Korea, Okinawa                                   |
| 3      | User Setting             | User Setting   |
| 4      | Adindan                  | Burkina Faso   |
| 5      | Adindan                  | Cameroon   |
| 6      | Adindan                  | Ethiopia   |
| 7      | Adindan                  | Mali   |
| 8      | Adindan                  | Mean for Ethiopia, Sudan   |
| 9      | Adindan                  | Senegal  |
| 10     | Adindan                  | Sudan  |
| 11     | Afgooye                  | Somalia  |
| 12     | Ain El Abd1970           | Bahrain  |
| 13     | Ain El Abd1970           | Saudi Arabia   |
| 14     | American Samoa1962       | American Samoa Islands   |
| 15     | Anna 1 Astro1965         | Cocos Island   |
| 16     | Antigua Island Astro1943 | Antigua (Leeward Islands)  |
| 17     | Arc1950                  | Botswana   |
| 18     | Arc1950                  | Burundi  |
| 19     | Arc1950                  | Lesotho  |
| 20     | Arc1950                  | Malawi   |
| 21     | Arc1950                  | Mean for Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, Zimbabwe |
| 22     | Arc1950                  | Swaziland  |
| 23     | Arc1950                  | Zaire  |
| 24     | Arc1950                  | Zambia   |
| 25     | Arc1950                  | Zimbabwe   |
| 26     | Arc1960                  | Mean for Kenya, Tanzania   |

**Table 6-1: Available Datum (Continued)**

| Number | Datum                         | Region                              |
|--------|-------------------------------|-------------------------------------|
| 27     | Arc1960                       | Kenya                               |
| 28     | Arc1960                       | Tanzania                            |
| 29     | Ascension Island1958          | Ascension Island                    |
| 30     | Astro Beacon E 1945           | Iwo Jima                            |
| 31     | Astro Dos 71/4                | St Helena Island                    |
| 32     | Astro Tern Island (FRIG) 1961 | Tern Island                         |
| 33     | Astronomical Station 1952     | Marcus Island                       |
| 34     | Australian Geodetic 1966      | Australia, Tasmania                 |
| 35     | Australian Geodetic 1984      | Australia, Tasmania                 |
| 36     | Ayabelle Lighthouse           | Djibouti                            |
| 37     | Bellevue (IGN)                | Efate and Erromango Islands         |
| 38     | Bermuda 1957                  | Bermuda                             |
| 39     | Bissau                        | Guinea-Bissau                       |
| 40     | Bogota Observatory            | Colombia                            |
| 41     | Bukit Rimpah                  | Indonesia (Bangka and Belitung Ids) |
| 42     | Camp Area Astro               | Antarctica (McMurdi Camp Area)      |
| 43     | Campo Inchauspe               | Argentina                           |
| 44     | Canton Astro1966              | Phoenix Island                      |
| 45     | Cape                          | South Africa                        |
| 46     | Cape Canaveral                | Bahamas, Florida                    |
| 47     | Carthage                      | Tunisia                             |
| 48     | Chatham Island Astro1971      | New Zealand (Chatham Island)        |
| 49     | Chua Astro                    | Paraguay                            |
| 50     | Corrego Alegre                | Brazil                              |
| 51     | Dabola                        | Guinea                              |
| 52     | Deception Island              | Deception Island, Antarctica        |
| 53     | Djakarta (Batavia)            | Indonesia (Sumatra)                 |
| 54     | Dos 1968                      | New Georgia Islands (Gizo Island)   |
| 55     | Easter Island 1967            | Easter Island                       |
| 56     | Estonia Coordinate System1937 | Estonia                             |
| 57     | European 1950                 | Cyprus                              |

**Table 6-1: Available Datum (Continued)**

| Number | Datum                | Region   |
|--------|----------------------|--|
| 58     | European 1950        | Egypt  |
| 59     | European 1950        | England, Channel Islands, Scotland, Shetland Islands   |
| 60     | European 1950        | England, Ireland, Scotland, Shetland Islands   |
| 61     | European 1950        | Finland, Norway  |
| 62     | European 1950        | Greece   |
| 63     | European 1950        | Iran   |
| 64     | European 1950        | Italy (Sardinia)   |
| 65     | European 1950        | Italy (Sicily)   |
| 66     | European 1950        | Malta  |
| 67     | European 1950        | Mean for Austria, Belgium, Denmark, Finland, France, West Germany, Gibraltar, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland |
| 68     | European 1950        | Mean for Austria, Denmark, France, West Germany, Netherlands, Switzerland  |
| 69     | European 1950        | Mean for Iraq, Israel, Jordan, Lebanon, Kuwait, Saudi Arabia, Syria  |
| 70     | European 1950        | Portugal, Spain  |
| 71     | European 1950        | Tunisia  |
| 72     | European 1979        | Mean for Austria, Finland, Netherlands, Norway, Spain, Sweden, Switzerland   |
| 73     | Fort Thomas 1955     | Nevis St Kitts (Leeward Islands)   |
| 74     | Gan 1970             | Republic of Maldives   |
| 75     | Geodetic Datum 1970  | New Zealand  |
| 76     | Graciosa Base SW1948 | Azores (Faial, Graciosa, Pico, Sao, Jorge, Terceira)   |
| 77     | Guam1963             | Guam   |
| 78     | Gunung Segara        | Indonesia (Kalimantan)   |
| 79     | Gux I Astro          | Guadalcanal Island   |
| 80     | Herat North          | Afghanistan  |
| 81     | Hermannskogel Datum  | Croatia-Serbia, Bosnia-Herzegovina   |
| 82     | Hjorsey 1955         | Iceland  |
| 83     | Hongkong 1963        | Hong Kong  |
| 84     | Hu Tzu Shan          | Taiwan   |
| 85     | Indian               | Bangladesh   |

**Table 6-1: Available Datum (Continued)**

| Number | Datum                        | Region                           |
|--------|------------------------------|----------------------------------|
| 86     | Indian                       | India, Nepal                     |
| 87     | Indian                       | Pakistan                         |
| 88     | Indian 1954                  | Thailand                         |
| 89     | Indian 1960                  | Vietnam (Con Son Island)         |
| 90     | Indian 1960                  | Vietnam (near 16 deg N)          |
| 91     | Indian 1975                  | Thailand                         |
| 92     | Indonesian 1974              | Indonesia                        |
| 93     | Ireland 1965                 | Ireland                          |
| 94     | ISTS 061 Astro 1968          | South Georgia Islands            |
| 95     | ISTS 073 Astro 1969          | Diego Garcia                     |
| 96     | Johnston Island 1961         | Johnston Island                  |
| 97     | Kandawala                    | Sri Lanka                        |
| 98     | Kerguelen Island 1949        | Kerguelen Island                 |
| 99     | Kertau 1948                  | West Malaysia and Singapore      |
| 100    | Kusaie Astro 1951            | Caroline Islands                 |
| 101    | Korean Geodetic System       | South Korea                      |
| 102    | LC5 Astro 1961               | Cayman Brac Island               |
| 103    | Leigon                       | Ghana                            |
| 104    | Liberia 1964                 | Liberia                          |
| 105    | Luzon                        | Philippines (Excluding Mindanao) |
| 106    | Luzon                        | Philippines (Mindanao)           |
| 107    | M'Poraloko                   | Gabon                            |
| 108    | Mahe 1971                    | Mahe Island                      |
| 109    | Massawa                      | Ethiopia (Eritrea)               |
| 110    | Merchich                     | Morocco                          |
| 111    | Midway Astro 1961            | Midway Islands                   |
| 112    | Minna                        | Cameroon                         |
| 113    | Minna                        | Nigeria                          |
| 114    | Montserrat Island Astro 1958 | Montserrat (Leeward Island)      |
| 115    | Nahrwan                      | Oman (Masirah Island)            |
| 116    | Nahrwan                      | Saudi Arabia                     |

**Table 6-1: Available Datum (Continued)**

| Number | Datum               | Region   |
|--------|---------------------|--|
| 117    | Nahrwan             | United Arab Emirates   |
| 118    | Naparima BWI        | Trinidad and Tobago  |
| 119    | North American 1927 | Alaska (excluding Aleutian Ids)  |
| 120    | North American 1927 | Alaska (Aleutian Ids East of 180 deg W)  |
| 121    | North American 1927 | Alaska (Aleutian Ids West of 180 deg W)  |
| 122    | North American 1927 | Bahamas (except San Salvador Islands)  |
| 123    | North American 1927 | Bahamas (San Salvador Islands)   |
| 124    | North American 1927 | Canada (Alberta, British Columbia)   |
| 125    | North American 1927 | Canada (Manitoba, Ontario)   |
| 126    | North American 1927 | Canada (New Brunswick, Newfoundland, Nova Scotia, Quebec)  |
| 127    | North American 1927 | Canada (Northwest Territories, Saskatchewan)   |
| 128    | North American 1927 | Canada (Yukon)   |
| 129    | North American 1927 | Canal Zone   |
| 130    | North American 1927 | Cuba   |
| 131    | North American 1927 | Greenland (Hayes Peninsula)  |
| 132    | North American 1927 | Mean for Antigua, Barbados, Barbuda, Caicos Islands, Cuba, Dominican, Grand Cayman, Jamaica, Turks Islands |
| 133    | North American 1927 | Mean for Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua                                   |
| 134    | North American 1927 | Mean for Canada  |
| 135    | North American 1927 | Mean for Conus   |
| 136    | North American 1927 | Mean for Conus (East of Mississippi River including Louisiana, Missouri, Minnesota)                        |
| 137    | North American 1927 | Mean for Conus (West of Mississippi River excluding Louisiana, Minnesota, Missouri)                        |
| 138    | North American 1927 | Mexico   |
| 139    | North American 1983 | Alaska (excluding Aleutian Ids)  |
| 140    | North American 1983 | Aleutian Ids   |
| 141    | North American 1983 | Canada   |
| 142    | North American 1983 | Conus  |
| 143    | North American 1983 | Hawaii   |
| 144    | North American 1983 | Mexico, Central America  |

**Table 6-1: Available Datum (Continued)**

| Number | Datum                              | Region   |
|--------|------------------------------------|--|
| 145    | North Sahara 1959                  | Algeria  |
| 146    | Observatorio Meteorologico 1939    | Azores (Corvo and Flores Islands)                                  |
| 147    | Old Egyptian 1907                  | Egypt  |
| 148    | Old Hawaiian                       | Hawaii   |
| 149    | Old Hawaiian                       | Kauai  |
| 150    | Old Hawaiian                       | Maui   |
| 151    | Old Hawaiian                       | Mean for Hawaii, Kauai, Maui, Oahu                                 |
| 152    | Old Hawaiian                       | Oahu   |
| 153    | Oman                               | Oman   |
| 154    | Ordnance Survey Great Britain 1936 | England  |
| 155    | Ordnance Survey Great Britain 1936 | England, Isle of Man, Wales  |
| 156    | Ordnance Survey Great Britain 1936 | Mean for England, Isle of Man, Scotland, Shetland Island, Wales    |
| 157    | Ordnance Survey Great Britain 1936 | Scotland, Shetland Islands   |
| 158    | Ordnance Survey Great Britain 1936 | Wales  |
| 159    | Pico de las Nieves                 | Canary Islands   |
| 160    | Pitcairn Astro 1967                | Pitcairn Island  |
| 161    | Point 58                           | Mean for Burkina Faso and Niger                                    |
| 162    | Pointe Noire 1948                  | Congo  |
| 163    | Porto Santo 1936                   | Porto Santo, Maderia Islands                                       |
| 164    | Provisional South American 1956    | Bolivia  |
| 165    | Provisional South American 1956    | Chile (Northern near 19 deg S)                                     |
| 166    | Provisional South American 1956    | Chile (Southern near 43 deg S)                                     |
| 167    | Provisional South American 1956    | Colombia   |
| 168    | Provisional South American 1956    | Ecuador  |
| 169    | Provisional South American 1956    | Guyana   |
| 170    | Provisional South American 1956    | Mean for Bolivia Chile, Colombia, Ecuador, Guyana, Peru, Venezuela |
| 171    | Provisional South American 1956    | Peru   |
| 172    | Provisional South American 1956    | Venezuela  |
| 173    | Provisional South Chilean 1963     | Chile (near 53 deg S) (Hito XVIII)                                 |
| 174    | Puerto Rico                        | Puerto Rico, Virgin Islands  |

**Table 6-1: Available Datum (Continued)**

| Number | Datum                | Region  |
|--------|----------------------|---|
| 175    | Pulkovo 1942         | Russia  |
| 176    | Qatar National       | Qatar   |
| 177    | Qornoq               | Greenland (South)   |
| 178    | Reunion              | Mascarene Island  |
| 179    | Rome 1940            | Italy (Sardinia)  |
| 180    | S-42 (Pulkovo 1942)  | Hungary   |
| 181    | S-42 (Pulkovo 1942)  | Poland  |
| 182    | S-42 (Pulkovo 1942)  | Czechoslovakia  |
| 183    | S-42 (Pulkovo 1942)  | Latvia  |
| 184    | S-42 (Pulkovo 1942)  | Kazakhstan  |
| 185    | S-42 (Pulkovo 1942)  | Albania   |
| 186    | S-42 (Pulkovo 1942)  | Romania   |
| 187    | S-JTSK               | Czechoslovakia (Prior 1 Jan1993)  |
| 188    | Santo (Dos) 1965     | Espirito Santo Island   |
| 189    | Sao Braz             | Azores (Sao Miguel, Santa Maria Ids)  |
| 190    | Sapper Hill 1943     | East Falkland Island  |
| 191    | Schwarzeck           | Namibia   |
| 192    | Selvagem Grande 1938 | Salvage Islands   |
| 193    | Sierra Leone 1960    | Sierra Leone  |
| 194    | South American 1969  | Argentina   |
| 195    | South American 1969  | Bolivia   |
| 196    | South American 1969  | Brazil  |
| 197    | South American 1969  | Chile   |
| 198    | South American 1969  | Colombia  |
| 199    | South American 1969  | Ecuador   |
| 200    | South American 1969  | Ecuador (Baltra, Galapagos)   |
| 201    | South American 1969  | Guyana  |
| 202    | South American 1969  | Mean for Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Trinidad and Tobago, Venezuela |
| 203    | South American 1969  | Paraguay  |
| 204    | South American 1969  | Peru  |



**Table 6-1: Available Datum (Continued)**

| <b>Number</b> | <b>Datum</b>                | <b>Region</b>                        |
|---------------|-----------------------------|--------------------------------------|
| 205           | South American 1969         | Trinidad and Tobago                  |
| 206           | South American 1969         | Venezuela                            |
| 207           | South Asia                  | Singapore                            |
| 208           | Tananarive Observatory 1925 | Madagascar                           |
| 209           | Timbalai 1948               | Brunei, E Malaysia (Sabah Sarawak)   |
| 210           | Tokyo                       | Japan                                |
| 211           | Tokyo                       | Mean For Japan, South Korea, Okinawa |
| 212           | Tokyo                       | Okinawa                              |
| 213           | Tokyo                       | South Korea                          |
| 214           | Tristan Astro 1968          | Tristam Da Cunha                     |
| 215           | Viti Levu 1916              | Fiji (Viti Levu Island)              |
| 216           | Voirol 1960                 | Algeria                              |
| 217           | Wake Island Astro 1952      | Wake Atoll                           |
| 218           | Wake-Eniwetok 1960          | Marshall Islands                     |
| 219           | WGS 1972                    | Global Definition                    |
| 220           | WGS 1984                    | Global Definition                    |
| 221           | Yacare                      | Uruguay                              |
| 222           | Zanderij                    | Suriname                             |

## Release String Details

When [PMTK605 Query Release Version](#) on page 44 is executed, you may receive an ACK such as the following:

```
$PMTK705,AXN_5.1.1_3333_17081700,8527,XM Series,1.0*2C
<CR><LF>
```

The data field 'Release string' in [PMTK705 Release Version Acknowledgment](#) on page 46 includes some extra information, the format of which is shown below:

```
AXN_X.X.X_NNNN_YYMMDDTT
```

- **X.X.X**: Firmware version
- **NNNN**: Chipset
- **YY**: Year of original firmware build
- **MM**: Month of original firmware build
- **DD**: Day of original firmware build
- **TT**: Port
  - '00' = UART
  - '18' = I2C
  - '19' = SPI

**Example:** AXN\_5.1.1\_3333\_17081700

where:

- Firmware version: 5.1.1
- Chipset: MT3333
- Year of original firmware build: 2017
- Month of original firmware build: August
- Day of original firmware build: 17th
- Port: UART

# NMEA Sentence Type

## One Sentence Mode

### Data Field:

PGTOP,2,Time,Date,Latitude,NS,Longitude,EW,Fix type,Fix mode,Altitude,Heading,Speed,Visible satellites,Used satellites,HDOP,EPE 2D

- **Time:** UTC time (format: hhmmss.sss)
- **Date:** UTC date (format: DDMMYY)
- **Latitude:** Unit: decimal degree; format: 6 decimal places
- **NS:**
  - 'N' = Latitude indication North
  - 'S' = Latitude indication South
- **Longitude:** Unit: decimal degree; format: 6 decimal places
- **EW:**
  - 'E' = Longitude indication East
  - 'W' = Longitude indication West
- **Fix type:**
  - '1' = Fix not available
  - '2' = 2D fix (<4 SVs used)
  - '3' = 3D fix (≥4 SVs used)
- **Fix mode:**
  - '0' = Fix not available
  - '1' = GPS fix
  - '2' = Differential GPS Fix
- **Altitude:** Altitude of current position in WGS84 (unit: meter; format: 2 decimal places)
- **Heading:** Measured heading (format: 2 decimal places)
- **Speed:** Horizontal 2D speed (unit: km/hr; format: 2 decimal places)
- **Visible satellites:** Satellites in view
- **Used satellites:** Satellites in use
- **HDOP:** Horizontal dilution of precision (format: 2 decimal places)
- **EPE 2D:** Estimated horizontal position error (format: 2 decimal places)

### Example:

```
$PGTOP,2,081832.000,270319,23.096168,N,120.283715,E,3,1,28.72,0.00,0.04,8,7,1.41,17.19*5F<CR><LF>
```

### Notes:

Default values when the module starts or restarts are listed in the following table.

| Field     | Default Value |
|-----------|---------------|
| Latitude  | 90.000000,N   |
| Longitude | 0.000000,E    |

| Field    | Default Value |
|----------|---------------|
| Altitude | 150.00        |
| HDOP     | 99.99         |

## Binary Mode

- **Alignment:** 1-byte alignment
- **Endianness:** Big endian
- **Packet length:** 44 bytes

**Table 6-2: Binary Mode**

| Field     | Example    | Length  | Description   |
|-----------|------------|---------|---|
| Preamble  | 0x04       | 1 byte  | Preamble  |
| Preamble  | 0x24       | 1 byte  |   |
| Time      | 0x03E6C780 | 4 bytes | UTC time<br>Format: hhmmss.sss<br>065456.000<br>$65456.000 * 1000 = 65456000 = 0x03E6C780$                      |
| Date      | 0x000446FF | 4 bytes | UTC date<br>Format: DDMMYY<br>280319<br>$= 0x000446FF$  |
| Latitude  | 0x01606B60 | 4 bytes | Unit: decimal degree; format: 6 decimal places<br>23.096160<br>$23.096160 * 1000000 = 23096160 = 0x01606B60$    |
| NS        | 0x01       | 1 byte  | '1' = North<br>'2' = South  |
| Longitude | 0x072B6234 | 4 bytes | Unit: decimal degree; format: 6 decimal places<br>120.283700<br>$120.283700 * 1000000 = 120283700 = 0x072B6234$ |
| EW        | 0x01       | 1 byte  | '1' = East<br>'2' = West  |
| Fix type  | 0x03       | 1 byte  | '1' = Fix not available<br>'2' = 2D fix (<4 SVs used)<br>'3' = 3D fix (≥4 SVs used)                             |
| Fix mode  | 0x01       | 1 byte  | '0' = Fix not available<br>'1' = GPS fix<br>'2' = Differential GPS fix  |
| Altitude  | 0x00000D14 | 4 bytes | Altitude of the current position in WGS84 (unit: centimeter)<br>3348<br>$= 0x00000D14$                          |

**Table 6-2: Binary Mode (Continued)**

| Field              | Example    | Length  | Description  |
|--------------------|------------|---------|--|
| Heading            | 0x000037E2 | 4 bytes | Measured heading (format: 2 decimal places)<br>143.06<br>$143.06 * 100 = 14306 = 0x000037E2$             |
| Speed              | 0x0000003C | 4 bytes | Horizontal 2D speed (unit: km/hr; format: 2 decimal places)<br>0.60<br>$0.60 * 100 = 0x0000003C$         |
| Visible satellites | 0x07       | 1 byte  | Satellites in view   |
| Used satellites    | 0x07       | 1 byte  | Satellites in use  |
| HDOP               | 0x0084     | 2 bytes | Horizontal dilution of precision (format: 2 decimal places)<br>1.32<br>$1.32 * 100 = 132 = 0x0084$       |
| EPE 2D             | 0x048E     | 2 bytes | Estimated horizontal position error (format: 2 decimal places)<br>11.66<br>$11.66 * 100 = 1166 = 0x048E$ |
| *                  | 0x2A       | 1 byte  | An asterisk is used to mark the end of the Data Field.   |
| Checksum           | 0xF3       | 1 byte  | Checksum is calculated by XOR-ing all bytes between Preamble and "**"                                    |
| <CR>               | 0x0D       | 1 byte  | Used to identify the end of a packet   |
| <LF>               | 0x0A       | 1 byte  |  |

**Notes:**

Default values when the module starts or restarts are listed in the following table.

| Field     | Default Value |
|-----------|---------------|
| Latitude  | 90.000000,N   |
| Longitude | 0.000000,E    |
| Altitude  | 15000         |
| HDOP      | 99.99         |