SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

NOTICE

While reasonable efforts have been made to assure the accuracy of this document, Telit assumes no liability resulting from any inaccuracies or omissions in this document, or from use of the information obtained herein. The information in this document has been carefully checked and is believed to be reliable. However, no responsibility is assumed for inaccuracies or omissions. Telit reserves the right to make changes to any products described herein and reserves the right to revise this document and to make changes from time to time in content hereof with no obligation to notify any person of revisions or changes. Telit does not assume any liability arising out of the application or use of any product, software, or circuit described herein; neither does it convey a license under its patent rights or the rights of others.

It is possible that this publication may contain references to, or information about Telit products (machines and programs), programming, or services that are not announced in your country. Such references or information must not be construed to mean that Telit intends to announce such Telit products, programming, or services in your country.

COPYRIGHTS

This instruction manual and the Telit products described in this instruction manual may be, include or describe copyrighted Telit material, such as computer programs stored in semiconductor memories or other media. Laws in the Italy and other countries preserve for Telit and its licensors certain exclusive rights for copyrighted material, including the exclusive right to copy, reproduce in any form, distribute and make derivative works of the copyrighted material. Accordingly, any copyrighted material of Telit and its licensors contained herein or in the Telit products described in this instruction manual may not be copied, reproduced, distributed, merged or modified in any manner without the express written permission of Telit. Furthermore, the purchase of Telit products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Telit, as arises by operation of law in the sale of a product.

COMPUTER SOFTWARE COPYRIGHTS

The Telit and 3rd Party supplied Software (SW) products described in this instruction manual may include copyrighted Telit and other 3rd Party supplied computer programs stored in semiconductor memories or other media. Laws in the Italy and other countries preserve for Telit and other 3rd Party supplied SW certain exclusive rights for copyrighted computer programs, including the exclusive right to copy or reproduce in any form the copyrighted computer program. Accordingly, any copyrighted Telit or other 3rd Party supplied SW computer programs contained in the Telit products described in this instruction manual may not be copied (reverse engineered) or reproduced in any manner without the express written permission of Telit or the 3rd Party SW supplier. Furthermore, the purchase of Telit products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Telit or other 3rd Party supplied SW, except for the normal non-exclusive, royalty free license to use that arises by operation of law in the sale of a product.
USAGE AND DISCLOSURE RESTRICTIONS

I. License Agreements
The software described in this document is the property of Telit and its licensors. It is furnished by express license agreement only and may be used only in accordance with the terms of such an agreement.

II. Copyrighted Materials
Software and documentation are copyrighted materials. Making unauthorized copies is prohibited by law. No part of the software or documentation may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, without prior written permission of Telit.

III. High Risk Materials
Components, units, or third-party products used in the product described herein are NOT fault-tolerant and are NOT designed, manufactured, or intended for use as on-line control equipment in the following hazardous environments requiring fail-safe controls: the operation of Nuclear Facilities, Aircraft Navigation or Aircraft Communication Systems, Air Traffic Control, Life Support, or Weapons Systems (High Risk Activities”). Telit and its supplier(s) specifically disclaim any expressed or implied warranty of fitness for such High Risk Activities.

IV. Trademarks
TELIT and the Stylized T Logo are registered in Trademark Office. All other product or service names are the property of their respective owners.

V. Third Party Rights
The software may include Third Party Right software. In this case you agree to comply with all terms and conditions imposed on you in respect of such separate software. In addition to Third Party Terms, the disclaimer of warranty and limitation of liability provisions in this License shall apply to the Third Party Right software.

TELIT HEREBY DISCLAIMS ANY AND ALL WARRANTIES EXPRESS OR IMPLIED FROM ANY THIRD PARTIES REGARDING ANY SEPARATE FILES, ANY THIRD PARTY MATERIALS INCLUDED IN THE SOFTWARE, ANY THIRD PARTY MATERIALS FROM WHICH THE SOFTWARE IS DERIVED (COLLECTIVELY “OTHER CODE”), AND THE USE OF ANY OR ALL THE OTHER CODE IN CONNECTION WITH THE SOFTWARE, INCLUDING (WITHOUT LIMITATION) ANY WARRANTIES OF SATISFACTORY QUALITY OR FITNESS FOR A PARTICULAR PURPOSE.

NO THIRD PARTY LICENSORS OF OTHER CODE SHALL HAVE ANY LIABILITY FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING WITHOUT LIMITATION LOST PROFITS), HOWEVER CAUSED AND WHETHER MADE UNDER CONTRACT, TORT OR OTHER LEGAL THEORY, ARISING IN ANY WAY OUT OF THE USE OR DISTRIBUTION OF THE OTHER CODE OR THE EXERCISE OF ANY RIGHTS GRANTED UNDER EITHER OR BOTH THIS LICENSE AND THE LEGAL TERMS APPLICABLE TO ANY SEPARATE FILES, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.
## APPLICABILITY TABLE

**PRODUCTS**

- GE310-GNSS
Contents

NOTICE ...................................................................................................................................... 2
COPYRIGHTS ............................................................................................................................ 2
COMPUTER SOFTWARE COPYRIGHTS ................................................................................ 2
USAGE AND DISCLOSURE RESTRICTIONS .......................................................................... 3
I. License Agreements ........................................................................................................ 3
II. Copyrighted Materials ................................................................................................... 3
III. High Risk Materials ..................................................................................................... 3
IV. Trademarks .................................................................................................................. 3
V. Third Party Rights ......................................................................................................... 3
APPLICABILITY TABLE ........................................................................................................... 4
CONTENTS ................................................................................................................................ 5
1. INTRODUCTION .............................................................................................................. 7
   1.1. Scope ........................................................................................................................ 7
   1.2. Audience ................................................................................................................. 7
   1.3. Contact Information, Support ................................................................................ 7
   1.4. Text Conventions ..................................................................................................... 8
   1.5. Related Documents ................................................................................................. 8
2. PRODUCT DESCRIPTION ............................................................................................... 10
   2.1. Product Overview .................................................................................................. 10
   2.2. Working Modes ...................................................................................................... 10
   2.3. EPO ....................................................................................................................... 10
3. PRODUCT FEATURES .................................................................................................. 11
   3.1. Multi-Constellation Navigation ............................................................................... 11
   3.2. Quasi-Zenith Satellite System (QZSS) ................................................................. 11
   3.3. Satellite-Based Augmentation System (SBAS) .................................................... 11
   3.4. Assisted GPS (AGPS) ........................................................................................... 11
   3.5. Static Navigation .................................................................................................... 11
   3.6. Jamming Rejection – Active Interference Cancellation (AIC) ............................... 12
   3.7. Power Management Modes ............................................................................... 13
   3.8. DATA RETENTION ................................................................................................. 17
4. GNSS AT COMMAND .................................................................................................... 18
4.1. AT+EGPSC – Power on/off GPS ................................................................. 18
4.2. AT+EGPSS – Send PMTK Command ....................................................... 18
4.3. AT+EGPSEPO – Set EPO Parameter ...................................................... 19
4.4. AT+EGPSTS – Set GPS Time Sync Parameter ....................................... 20

5. PMTK COMMANDS .................................................................................. 21
5.1. PMTK Protocol Format ........................................................................... 21
5.2. PMTK Commands .................................................................................. 22

6. NMEA OUTPUT MESSAGES .................................................................... 34
6.1. Available NMEA Messages ................................................................. 34

7. DOCUMENT HISTORY ................................................................. 35
1. INTRODUCTION

1.1. Scope

Purpose of this document is providing a detailed specification and a comprehensive listing as a reference for the available commands and NMEA protocol available on the GE310-GNSS Telit Module.

1.2. Audience

Readers of this document should be familiar with Telit modules and their ease of controlling by means of AT Commands.

1.3. Contact Information, Support

For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at:

- TS-EMEA@telit.com
- TS-AMERICAS@telit.com
- TS-APAC@telit.com
- TS-SRD@telit.com

Alternatively, use:

http://www.telit.com/support

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

http://www.telit.com

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.
1.4. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.5. Related Documents

- 80598ST10945A GE310-GNSS AT Commands User Guide
- 1VV0301564 GE310-GNSS Hardware Design Guide
This document is to describe all the GNSS commands implemented on the Telit wireless module GE310-GNSS.

**NOTE:**

(EN) The integration of the GE310 cellular module within user application shall be done according to the design rules described in this manual.

(IT) L’integrazione del modulo cellulare GE310 all’interno dell’applicazione dell’utente dovrà rispettare le indicazioni progettuali descritte in questo manuale.


(SL) Integracija GE310 modula v uporabniški aplikaciji bo morala upoštevati projektna navodila, opisana v tem priročniku.

(SP) La utilización del modulo GE310 debe ser conforme a los usos para los cuales ha sido diseñado descritos en este manual del usuario.

(FR) L’intégration du module cellulaire GE310 dans l’application de l’utilisateur sera faite selon les règles de conception décrites dans ce manuel.

(HE) האינטגרציה של המודול GE310 היחידה למערכות המבוססות במכשירים אחרים המגננים את המודל של GE310

The information presented in this document is believed to be accurate and reliable. However, no responsibility is assumed by Telit Communications S.p.A. for its use, nor any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent rights of Telit Communications S.p.A. other than for circuitry embodied in Telit products. This document is subject to change without notice.
2. PRODUCT DESCRIPTION

The GE310-GNSS module provides complete multi-constellation position, velocity, and time (PVT) engines featuring high performance, high sensitivity, and low power consumption.

The Module computes a navigation solution using Multi Constellation signals to yield better coverage, greater accuracy, and improved availability.

2.1. Product Overview

- GPS L1 C/A, Glonass L1, BeiDou B1, and QZSS with 99 search and 33 tracking channels. Galileo ready.
- SBAS corrections capable (WAAS, EGNOS, MSAS, GAGAN)
- AGPS support for extended ephemeris using local or server-based solutions:
- Jamming Rejection: Active Interference Cancellation (AIC)
- 1PPS output
- Fix reporting at 1 Hz (default). Maximum: 10Hz
- NMEA command input and data output
- One serial ports for input commands and output messages

2.2. Working Modes

The GE310-GNSS permits to use the GNSS receiver as a Stand Alone device or as Hosted to the 2G section.

This is done configuring the HW on application in the preferred mode (ref. to HW uiser Guide for details)

When the receiver is used in Hosted, all the controls are run through the Main UART of GE310 and using specific AT commands.

When the GNSS receiver is used in Stand Alone, the application is communicating directly with the GNSS receiver and it is controlled with a set of proprietary PMTK commands.

Ref to the next Chapters for the details on the AT and $PMTK commands.

2.3. EPO

EPO (Extended Prediction Orbit) is an off-line server base Assisted-GNSS (A-GNSS) solution which can improve TTFF significantly.

GE310’s EPO data supports GPS and GLONASS constellations.
3. PRODUCT FEATURES

3.1. Multi-Constellation Navigation
The GPS and GLONASS constellations are enabled by default. BeiDou and Galileo are also supported. If BeiDou is enabled, GLONASS and Galileo are disabled.
The user may enable or disable constellations via the $PMTK353 command.

3.2. Quasi-Zenith Satellite System (QZSS)
The satellites of the Japanese regional system are in a highly inclined, elliptical geosynchronous orbit, allowing continuous high-elevation coverage over Japan using only three satellites plus one geostationary satellite. SV IDs 193, 194, & 195 are supported. They provide ranging signals to augment the GPS system.
QZSS constellation usage is controlled by the $PMTK352 command and is enabled by default.

3.3. Satellite-Based Augmentation System (SBAS)
The receiver is capable of using SBAS satellites as a source of differential corrections. These systems (WAAS, EGNOS, GAGAN and MSAS) use geostationary satellites to transmit signals similar to those of GPS and in the same L1 band.
Enabling SBAS limits the maximum fix rate to 5 Hz. If disabled, the maximum is 10 Hz.
The module is enabled for SBAS by default, but can be disabled by command $PMTK313.
The GE310-GNSS can accept either SBAS corrections which are configured by the $PMTK301 command.

3.3.1. SBAS Corrections
The SBAS satellites transmit a set of differential corrections to their respective regions. The use of SBAS corrections can improve positioning accuracy.

3.4. Assisted GPS (AGPS)
Assisted GPS (or Aided GPS) is a method by which information from a source other than broadcast GPS signals is used to improve (i.e. reduce) TTFF.
The necessary ephemeris data is calculated either by the receiver itself (locally-generated ephemeris) or a server (server-generated ephemeris) and is then stored in the module.

3.5. Static Navigation
Static Navigation is an operating mode in which the receiver will freeze the position fix when the speed falls below a set threshold (indicating that the receiver is stationary).
The course and altitude are also frozen, and the speed is reported as “0”.
The navigation solution is unfrozen when the speed increases above a threshold or when the computed position exceeds a set distance (10 m) from the frozen position (indicating that the receiver is again in motion). The speed threshold can be set via the $PMTK386 command.
Set the threshold to zero to disable static navigation.
Static Navigation is disabled by default, but can be enabled by command.
3.6. Jamming Rejection – Active Interference Cancellation (AIC)

The receiver module detects and removes narrow-band interfering signals (jamming signals) without the need for external components or tuning. It rejects up to 12 CW (Continuous Wave) type signals of up to –80 dBm (total power signal levels). This feature is useful both in the design stage and during the production stage for uncovering issues related to unexpected jamming. When enabled, Jamming Rejection will increase current drain by about 1 mA, and impact on GNSS performance is low at modest jamming levels. However, at high jamming levels (e.g., –90 to –80 dBm), the RF signal sampling ADC starts to become saturated after which the GNSS signal levels start to diminish.

Jamming rejection is enabled by default, but can be disabled with the PMTK286 command.
3.7. Power Management Modes

The GNSS receiver supports operating modes that reduce overall current consumption with less frequent position fixes. Availability of GNSS signals in the operating environment will be a factor in choosing power management modes. The designer can choose a mode that provides the best trade-off of navigation performance versus power consumption.

The various power management modes can be enabled using the PMTK225 command.

3.7.1. Full Power Continuous Mode

The receiver starts in full power continuous mode when powered up. This mode uses the acquisition engine to search for all possible satellites at full performance, resulting in the highest sensitivity and the shortest possible TTFF.

The receiver then switches to the tracking engine to lower the power consumption when:

- A valid GPS/GNSS position is obtained
- The ephemeris for each satellite in view is valid

To return to Full Power mode from a low power mode, send the NMEA command:

```
$PMTK225,0*2B
```

just after the module wakes up from its previous sleep cycle.

If power is removed from Vbatt, then Time, Ephemeris, Almanac, EASY and PMTK configuration data will be lost. If Vbatt is maintained, no data will be lost.

3.7.2. Standby Modes

In these modes, the receiver stops navigation, the internal processor enters the standby state, and the current drain at main supply is substantially reduced.

STOP: GNSS baseband, RF, and TCXO are powered down
SLEEP: GNSS baseband and RF are powered down

Standby mode is entered by sending the following NMEA command:

```
$PMTK161,0*28  (STOP Mode)
$PMTK161,1*29  (SLEEP Mode)
```

To exit a Standby mode, send any byte to the host port (RX).

3.7.3. GLP Mode

In the GNSS Low Power (GLP) mode, power consumption is reduced for some time during a one second period. The module will alternate this cycling with periods of full power when necessary, for example weak signals or decoding the navigation message.

A typical current draw is 10 to 14 mA, depending on conditions.

Note that position accuracy will be reduced during GLP operation, therefore the user must determine the tradeoff between power consumption and desired accuracy.
A timeline is shown below:

**GNSS Low Power (GLP) mode diagram**

To enter the GLP mode, send the command:

$PMTK262,3

To exit the GLP mode and return to full-power mode, send the command:

$PMTK262,0

3.7.4. Periodic Modes

These modes allow autonomous power on/off control with reduced fix rate to decrease average power consumption. The main power supply pin is still on, but power distribution to internal circuits is controlled by the receiver firmware.

- **STANDBY(SLEEP):** GNSS baseband and RF are powered down.
- **BACKUP:** GNSS baseband, RF, and TCXO are powered down. RTC is powered up.

**Periodic Modes diagram**
Periodic Mode example 1

To enter a Periodic mode, send the following NMEA command(s):

$PMTK223,<SV>,<SNR>,<Extension threshold>,<Extension gap>*<checksum>  (Optional)

Where:

- SV = 1 to 4, default = 1
- SNR = 25 to 30, default = 28
- Ext. threshold = 40 000 to 180 000 ms, default = 180 000
- Ext. gap = 0 to 3 600 000 ms, default = 180 000

This is the limit between successive DEE

$PMTK225,<Type>,<Run_time>,<Sleep_time>,<2nd_run_time>,<2nd_sleep_time>*<checkum>

Where:

- Type = 1 for Periodic (backup) mode or 2 for Periodic (standby) mode
- Run_time = Full Power period (ms)
- Sleep_time = Standby period (ms)
- 2nd_run_time = Full Power period (ms) for extended acquisition if GNSS acquisition fails during Run_time
- 2nd_sleep_time = Standby period (ms) for extended sleep if GNSS acquisition fails during Run_time

Periodic Mode example 2
Example: $PMTK225,1,3000,12000,18000,72000*16
for periodic mode with 3 s navigation and 12 s sleep in backup state.

The acknowledgement response for the command is:
$PMTK001,225,3*35

To exit Periodic Sleep mode, send the NMEA command $PMTK225,0*2B
just after the module wakes up from a previous sleep cycle.

3.7.5. AlwaysLocate™ Mode

AlwaysLocate™ is an intelligent controller of the Periodic mode where the main supply pin VCC_IN is still powered, but power distribution is controlled internally. Depending on the environment and motion conditions, the module can autonomously and adaptively adjust the parameters of the Periodic mode (e.g. RF on/off ratio and fix rate) to achieve a balance in positioning accuracy and power consumption. The average current drain will vary based on conditions.

To enter an AlwaysLocate mode, send the following NMEA command:
$PMTK225,<mode>*<checksum><CR><LF>
Where mode = 8 for AlwaysLocate (standby) mode or 9 for AlwaysLocate (backup) mode

Example: $PMTK225,9*22

The acknowledgement response for the command is:
$PMTK001,225,3*35

To exit AlwaysLocate mode, send the NMEA command:
$PMTK225,0*2B
just after the module wakes up from its previous sleep cycle.
3.8. DATA RETENTION

The receiver is capable of retaining certain data elements under the various initialization types. The following table shows which data elements are saved under each type of initialization if the GNSS power supply is maintained.

<table>
<thead>
<tr>
<th>Initialization</th>
<th>Almanac</th>
<th>Ephemeris</th>
<th>EASY</th>
<th>Position</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Cycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reset (signal)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Cold Start</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cold Start</td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Warm Start</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Hot Start</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Reacquisition</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

NOTE:

Commanded parameters (e.g. UART speed, feature enables, etc.) are not preserved over a power cycle.

The standard definition of “Cold Start” does not allow time to be preserved. Use “Full Cold Start” to compare with other vendor's products' “Cold Start”.


4. GNSS AT COMMAND

The following commands can be used on the MAIN UART of GE310 module and when the GNSS receiver is connected in Hosted configuration.

4.1. AT+EGPSC – Power on/off GPS

4.1.1. Description

Power on/off GNSS receiver

4.1.2. Format

<table>
<thead>
<tr>
<th>Command</th>
<th>Possible response(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+EGPSC=&lt;state&gt;</td>
<td>OK</td>
</tr>
<tr>
<td>+CME ERROR: &lt;err&gt;</td>
<td></td>
</tr>
<tr>
<td>+EGPSP:&lt;state&gt;</td>
<td>+EGPSC:? +EGPSC:(list of supported &lt;state&gt;s)</td>
</tr>
<tr>
<td>+CME ERROR: &lt;err&gt;</td>
<td></td>
</tr>
</tbody>
</table>

4.1.3. Field

<state>:

0  power off GPS
1  power on GPS

When the command is executed the module will start to present the NMEA sentences on the Main UART.

The supported speed is 115200 bps; the standard rate is 1 sec per update.

4.2. AT+EGPSS – Send PMTK Command

4.2.1. Description

Send PMTK command to GPS receiver

4.2.2. Format

<table>
<thead>
<tr>
<th>Command</th>
<th>Possible response(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+EGPSS=&quot;&lt;pmtk&gt;&quot;</td>
<td>OK</td>
</tr>
<tr>
<td>+CME ERROR: &lt;err&gt;</td>
<td></td>
</tr>
<tr>
<td>+EGPSS?</td>
<td>Not supported</td>
</tr>
<tr>
<td>+EGPSS=?</td>
<td>Not supported</td>
</tr>
</tbody>
</table>

4.2.3. Field

<pmtk>:

PMTK command string without ‘$’ character before PMTK string
4.3. **AT+EGPSEPO – Set EPO Parameter**

4.3.1. **Description**

Open/Close EPO downloading and aiding features.

Set EPO data account

4.3.2. **Format**

<table>
<thead>
<tr>
<th>Command</th>
<th>Possible response(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+EGPSEPO=&lt;status&gt;,&lt;data account&gt;</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td>+CME ERROR: &lt;err&gt;</td>
</tr>
<tr>
<td>+EGPSEPO?</td>
<td>Not supported</td>
</tr>
<tr>
<td>+EGPSEPO=?</td>
<td>Not supported</td>
</tr>
</tbody>
</table>

4.3.3. **Field**

<status>:

1: Enable EPO

0: Disable EPO

<data account>

0-3 network data account when you send “ AT+EGDCONT=0,"IP","cmnet”

---

**NOTE:**

When you set EPO enable you must set the correct network data account.

EPO uses TCP/IP so you need to set the network data account before activating EPO:

AT+EGDCONT=0,"IP","cmnet"

Enable GPS Time Sync and EPO aiding, set the correct network data account:

AT+EGPSTS=1,0
AT+EGPSEPO=1,0
4.4. **AT+EGPSTS – Set GPS Time Sync Parameter**

4.4.1. **Description**
Open/Close GPS time sync and aiding.
Set time sync data account

4.4.2. **Format**

<table>
<thead>
<tr>
<th>Command</th>
<th>Possible response(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+EGPSTS=&lt;status&gt;,&lt;data account&gt;</td>
<td>OK, +CME ERROR: &lt;err&gt;</td>
</tr>
<tr>
<td>+EGPSTS?</td>
<td>Not supported</td>
</tr>
<tr>
<td>+EGPSTS=?</td>
<td>Not supported</td>
</tr>
</tbody>
</table>

4.4.3. **Field**

<status>:
1: Enable GPS time sync
0: Disable GPS time sync

<data account>
0-3 network data account when you send “ AT+EGDCONT=0,"IP","cmnet”

---

**NOTE:**
When you set EPO enable you must set the correct network data account.
EPO uses TCPIP so you need to set the network data account before activating EPO:
AT+EGDCONT=0,"IP","cmnet"
Enable GPS Time Sync and EPO aiding, set the correct network data account:
AT+EGPSTS=1,0
AT+EGPSEPO=1,0
5. PMTK COMMANDS
The PMTK are a set of proprietary commands usable to control the GNSS receiver.

5.1. PMTK Protocol Format
The PMTK is using a proprietary protocol with this structure:

```
$ PMTK <command> <Data Field> * <Checksum> CR LF
```

The content is the following:

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>char</td>
<td>1</td>
<td>Preamble Character; Always “$”</td>
</tr>
<tr>
<td>PMTK</td>
<td>string</td>
<td>4</td>
<td>String ID; always “PMTK”</td>
</tr>
<tr>
<td>&lt;command&gt;</td>
<td>string</td>
<td>3</td>
<td>Numeric string (from 000 to 999) identifying the command</td>
</tr>
<tr>
<td>&lt;Data Field&gt;</td>
<td>char</td>
<td>variable</td>
<td>The Data field has a variable length because depending on the specific command. A comma “,” character has to be used between each data field.</td>
</tr>
<tr>
<td>*</td>
<td>char</td>
<td>1</td>
<td>End of Data Field Marker; Always “*”</td>
</tr>
<tr>
<td>&lt;Checksum&gt;</td>
<td>char</td>
<td>2</td>
<td>Two Bytes checksum of the data between $ and * Two Bytes checksum of the data between $ and * The checksum is an XOR of all the bytes between the $ and the * (not including the delimiters themselves), and written in hexadecimal.</td>
</tr>
<tr>
<td>CR</td>
<td>char</td>
<td>1</td>
<td>Carriage Return</td>
</tr>
<tr>
<td>LF</td>
<td>char</td>
<td>1</td>
<td>Line Feed</td>
</tr>
</tbody>
</table>
5.2. PMTK Commands

5.2.1. PMTK000 – Test

5.2.1.1. Description
Test Command

5.2.1.2. Example
$PMTK000*32<CR><LF>

5.2.2. PMTK001 – PMTK Acknowledge

5.2.2.1. Description
Acknowledge to a PMTK command

5.2.2.2. Format
PMTK001,cmd, flag

5.2.2.3. Fields
<cmd>
The command / packet type the acknowledge responds.

<flag>
0 = Invalid command/packet
1 = Unsupported Command / Packet Type
2 = Valid command / packet but action failed
3 = Valid Command/Packet and action correctly completed

5.2.2.4. Example
$PMTK001,604,3*32<CR><LF>
5.2.3. PMTK101 – HOT Start

5.2.3.1. Description
The command forces the GNSS receiver to perform a Hot Start. The module will use all the data already stored in NVM.

5.2.3.2. Format
PMTK101

5.2.3.3. Fields
None

5.2.3.4. Example
$PMTK101*32<CR><LF>

5.2.4. PMTK102 – WARM Start

5.2.4.1. Description
The command forces the GNSS receiver to perform a Warm Start. The module will restart without re-using the stored Ephemerides.

5.2.4.2. Format
PMTK102

5.2.4.3. Fields
None

5.2.4.4. Example
$PMTK102*31<CR><LF>
5.2.5. **PMTK103 – COLD Start**

5.2.5.1. **Description**
The command forces the GNSS receiver to perform a Cold Start. The module will restart without using the stored Position, Almanacs and Ephemerides.

5.2.5.2. **Format**
PMTK103

5.2.5.3. **Fields**
None

5.2.5.4. **Example**
$PMTK103*30<CR><LF>

5.2.6. **PMTK104 – FULL COLD Start**

5.2.6.1. **Description**
The command forces the GNSS receiver to perform a Cold Start cleaning also the system/user configurations to the factory defaults.

5.2.6.2. **Format**
PMTK104

5.2.6.3. **Fields**
None

5.2.6.4. **Example**
$PMTK104*37<CR><LF>
5.2.7. PMTK161 – StandBy Mode

5.2.7.1. Description
Enter Stand By Mode

5.2.7.2. Format
PMTK161, <mode>

5.2.7.3. Fields
<mode>
0 = Stop Mode
1 = Sleep Mode

5.2.7.4. Example
$PMTK161,0*28<CR><LF>

5.2.8. PMTK223 – Set Period Mode Parameters

5.2.8.1. Description
The command permits to set the Period Mode parameters and need to be used followed by PMTK225.

5.2.8.2. Format
PMTK223,<SV>,<SNR>,<Extension Threshold>,<Extension Gap>

5.2.8.3. Fields
<SV>
number of satellites rise
Range: 1 to 4 (default value is 1)

<SNR>
Minimum SNR level of the rising satellites
25 to 30 (default value is 30)
< Extension Threshold >
Value in msec of Extension Threshold
40000 to 180000 ms (default value is 180000 ms)

< Extension Gap >
Value in msec of Extension Gap.
The Extension Gap is the limitation between neighbor DEE
0 to 3600000 ms (default value is 60000 ms)

5.2.8.4. Example
Example of settings in Period Mode
$PMTK225,0*2B<CR><LF> → set to Normal Mode
$PMTK223,2,25,1,180000,60000*26<CR><LF> → defines the parameters
$PMTK225,2,3000,12000,18000,72000*15<CR><LF> → enable the mode

Description of setting command $PMTK223,2,25,1,180000,60000:

- Period Mode active
- Two more satellites rise to be used
- SNR of new riding satellities is over 25db

If the above three conditions are satisfied the GNSS receiver will extend Run Time to the defined Extension Threshold (180000 ms) for decoding Ephemerides.

The last parameter (Extension Gap defined as 60000 ms) means that the interval of run time extension will be more than 60 seconds.
5.2.9. PMTK225 – Set Periodic Power Saving Mode

5.2.9.1. Description
The command permits to define the periodic Power Saving Mode settings.
In Normal mode the receiver measures and calculates positions.
In Sleep mode the receiver enters in one of the available power saving modes:
  - Periodic StandBy Mode
  - Periodic Backup Mode

5.2.9.2. Format
PMTK225,<Type>,<Run Time>,<Sleep Time>,<Second Run Time>, <Second Sleep Time>

5.2.9.3. Fields
<Type>
Defines the power saving operation mode.
0 = Normal Mode
1 = Periodic Backup Mode
2 = Periodic StandBy Mode
8 = AlwaysLocate™ StandBy Mode
9 = AlwaysLocate™ Backup Mode

<Run Time>
Duration (in ms) to fix for (or to attempt to fix for) before switching from Normal Mode to Power Saving Mode.
0 = Disabled
>= 1000 Enabled (range 1000 to 518400000)

<Sleep Time>
Interval (in ms) to exit from Power Saving and start Normal Mode to get a new Position Fix.
Accepted Values: from 1000 to 518400000

<Second Run Time>
Duration (in ms) to fix for (or to attempt to fix for) before switching from Normal Mode to Power Saving Mode.
0 = Disabled
>= 1000 Enabled (range 1000 to 518400000)
Note the <Second Run Time> should larger than <Run Time> when non-zero value.
<Second Sleep Time>
Interval (in ms) to exit from Power Saving and start Normal Mode to get a new Position Fix.
Accepted Values: from 1000 to 51840000

5.2.9.4. Example
How to enable a Periodic Backup Mode
$PMTK225,0*2B<CR><LF> → set to Normal Mode
$PMTK223,1,25,180000,60000*38<CR><LF> → defines the parameters
$PMTK225,1,3000,12000,18000,72000*16<CR><LF> → enable the mode

How to enable a Periodic StandBy Mode
$PMTK225,0*2B<CR><LF> → set to Normal Mode
$PMTK223,2,25,1,180000,60000*26<CR><LF> → defines the parameters
$PMTK225,2,3000,12000,18000,72000*15<CR><LF> → enable the mode

How to enable the AlwaysLocate™ StandBy Mode
$PMTK225,0*2B<CR><LF> → set to Normal Mode
$PMTK225,8*23<CR><LF> → enable the mode

How to enable the AlwaysLocate™ BackUp Mode
$PMTK225,0*2B<CR><LF> → set to Normal Mode
$PMTK225,9*22<CR><LF> → enable the mode
5.2.10. PMTK262 – Set GLP Power Saving Mode

5.2.10.1. Description
The command enables the GLP Power saving Mode (1Hz positioning)

5.2.10.2. Format
PMTK262,<enabled>

5.2.10.3. Fields
<enabled>
0 = disabled
3 = enabled

5.2.10.4. Example
$PMTK262,3*2B<CR><LF>

5.2.11. PMTK286 – Interference Cancellation Enable

5.2.11.1. Description
The command enables the Interference Cancellation function.

5.2.11.2. Format
PMTK286,<enabled>

5.2.11.3. Fields
<enabled>
1 = enabled
0 = disabled

5.2.11.4. Example
$PMTK286,1*23<CR><LF>
5.2.12. **PMTK301 – Set DGPS Mode**

5.2.12.1. **Description**  
The command defines the DGPS data source mode

5.2.12.2. **Format**  
PMTK301,<mode>

5.2.12.3. **Fields**  
<mode>  
0 = disabled  
2 = SBAS (including WAAS/EGNOS/GAGAN/MSAS)

5.2.12.4. **Example**  
$PMTK301,2*2E<CR><LF>

5.2.13. **PMTK313 – Set SBAS Enabled**

5.2.13.1. **Description**  
The command set the GNSS receiver to include also the SBAS satellites in its position calculation.

5.2.13.2. **Format**  
PMTK313,<enabled>

5.2.13.3. **Fields**  
<enabled>  
1 = enabled  
0 = disabled

5.2.13.4. **Example**  
$PMTK313,1*2E<CR><LF>
5.2.14. PMTK314 – Set NMEA Output

5.2.14.1. Description
The command permits to define which NMEA sentences are reported by the receiver and their output frequency.
Please refer to the next chapters for the details on the NMEA sentences.

5.2.14.2. Format
PMTK314,<GLL>,<RMC>,<VTG>,<GGA>,<GSA>,<GSV>,0,0,0,0,0,0,0,0,0,0,0,0,<ZDA>,0

5.2.14.3. Fields
<GLL>,<RMC>,<VTG>,<GGA>,<GSA>,<GSV> and <ZDA>
Each field represents an NMEA sentence and the possible configurations are the following:

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

5.2.14.4. Example
$PMTK314,0,1,1,1,1,0,0,0,0,0,0,0,0,0,0,1,0*28<CR><LF>

This command enables all the sentences with 1 position fix frequency except the GLL that is set as disabled.
The output rates for all the NMEA sentences may be restored to their default values by sending the command: $PMTK314,-1*04<CR><LF>
5.2.15. PMTK352 – Enable QZSS

5.2.15.1. Description
Since QZSS is a regional positioning service, this command allows the user to enable/disable the function.

5.2.15.2. Format
PMTK352,<disable>

5.2.15.3. Fields
<disable>
0 = enabled
1 = disable

5.2.15.4. Example
$PMTK352,0*2A<CR><LF> : enable QZSS function
$PMTK352,1*2B<CR><LF> : disable QZSS function

5.2.16. PMTK353 – Set GNSS Search Mode

5.2.16.1. Description
The command permits to select the preferred satellite system.

5.2.16.2. Format
PMTK353,<GPS>,<GLONASS>,<GALILEO>,<GALILEO FULL>,<BEIDOU>

5.2.16.3. Fields
<GPS>, <GLONASS>,<GALILEO>,<GALILEO FULL>,<BEIDOU>
1 = enabled
0 = disabled

5.2.16.4. Example
$PMTK353,0,1,0,0,0,*2A<CR><LF> : Search GLONASS satellites only
$PMTK353,1,0,0,0,0,*2A<CR><LF> : Search GLONASS satellites only
$PMTK353,1,1,0,0,0,*2B<CR><LF> : Search GPS and GLONASS satellites
$PMTK353,1,1,1,0,0,*2A<CR><LF> : Search GPS, GLONASS and Galileo satellites
$PMTK353,0,0,0,0,1,*2A<CR><LF> : Search BEIDOU satellites only
$PMTK353,1,0,0,0,1,*2B<CR><LF> : Search GPS and BEIDOU satellites

NOTE:
The GLONASS only, BEIDOU only and GALILEO only modes are for testing purpose.
Please use GPS + GLONASS or GPS + BEIDOU in real application configuration.
GLONASS and BEIDOU can not be enabled at the same time

5.2.17. PMTK386 – Set Static Navigation Threshold

5.2.17.1. Description
Set the speed threshold for static navigation. If the actual speed is below the threshold, output position will keep the same and output speed will be zero. If the threshold value is set to 0 the function is disabled

5.2.17.2. Format
PMTK386,<speed_threshold>

5.2.17.3. Fields
<speed_threshold>

0 = disabled
0.1 to 2.0 = enabled with the set threshold in ms

5.2.17.4. Example
$PMTK386,0.4*39<CR><LF> : enable Static navigation with a threshold of 0.4mS
6. NMEA OUTPUT MESSAGES

- The GE310-GNSS Message protocol is NMEA-0183.
- Default: GPS and GLONASS constellations are enabled
- Default fix rate: 1 Hz. Maximum rate is 10 Hz.
- Multiple GSA and GSV messages may be output on each cycle.

6.1. Available NMEA Messages

The following messages are available by default when the GNSS receiver is activated:

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMC</td>
<td>GNSS Recommended minimum navigation data</td>
</tr>
<tr>
<td>GGA</td>
<td>GNSS position fix data</td>
</tr>
<tr>
<td>GSA</td>
<td>GNSS Dilution of Precision (DOP) and active satellites</td>
</tr>
<tr>
<td>GSV</td>
<td>GNSS satellites in view</td>
</tr>
</tbody>
</table>

The following messages can be enabled by command (ref to PMTK314):

<table>
<thead>
<tr>
<th>Message ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLL</td>
<td>Geographic Position – Latitude &amp; Longitude</td>
</tr>
<tr>
<td>VTG</td>
<td>Course Over Ground &amp; Ground Speed</td>
</tr>
<tr>
<td>ZDA</td>
<td>Time &amp; Date</td>
</tr>
</tbody>
</table>

The following table shows the Talker IDs used:

<table>
<thead>
<tr>
<th>Talker ID</th>
<th>Constellation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD</td>
<td>BeiDou</td>
</tr>
<tr>
<td>GA</td>
<td>Galileo</td>
</tr>
<tr>
<td>GL</td>
<td>GLONASS</td>
</tr>
<tr>
<td>GP</td>
<td>GPS</td>
</tr>
<tr>
<td>QZ</td>
<td>QZSS</td>
</tr>
</tbody>
</table>

NOTE:
Some sentences may exceed the NMEA length limitation of 80 characters.
## 7. DOCUMENT HISTORY

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2018-12-18</td>
<td>First issue</td>
</tr>
<tr>
<td>1</td>
<td>2019-02-12</td>
<td>Added AT+EGPSEPO and AT+EGPSTS</td>
</tr>
<tr>
<td>2</td>
<td>2020-04-21</td>
<td>Changed AT+EGPSEPO and AT+EGPSTS note</td>
</tr>
<tr>
<td>3</td>
<td>2020-04-22</td>
<td>$PMTK command description revision</td>
</tr>
</tbody>
</table>