LC29T (AA)&LC99T (IA)

GNSS Protocol Specification

GNSS Module Series

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About the Document

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Contents

Table Index

1 Introduction

Quectel LC29T (AA) and LC99T (IA) GNSS modules are multi-constellation modules. Concurrent tracking of multi-frequency bands provides fast and accurate acquisition and makes those modules an ideal solution for timing in various vertical markets. See the table below for the actual frequency bands supported by LC29T (AA) and LC99T (IA).

Table 1: Modules and Supported Frequency Bands

Module	Frequency Band
LC29T (AA)	GPS L1, GLONASS L1, Galileo E1, BDS B1I, QZSS L1
LC99T (IA)	GPS L1/L5, GLONASS L1, Galileo E1/E5a, BDS B1I/B2a, QZSS L1/L5, NavIC (IRNSS) L5

This document describes the software commands that are used to control and modify the module configuration. The software commands are proprietary NMEA commands (PSTM Messages) defined by the chipset supplier. To report GNSS information, the modules support outputting messages in NMEA 0183 protocol format.

Table 2: Supported Protocol

Protocol	Type
NMEA 0183 V4.11	Output, ASCII, standard
	Input/output, ASCII, proprietary

NOTE

1. LC99T (IA) supports dual bands (L1 + L5).
2. Quectel assumes no responsibility if commands other than the ones listed herein are used.

2 NMEA Protocol

2.1. Structure of NMEA Protocol Messages

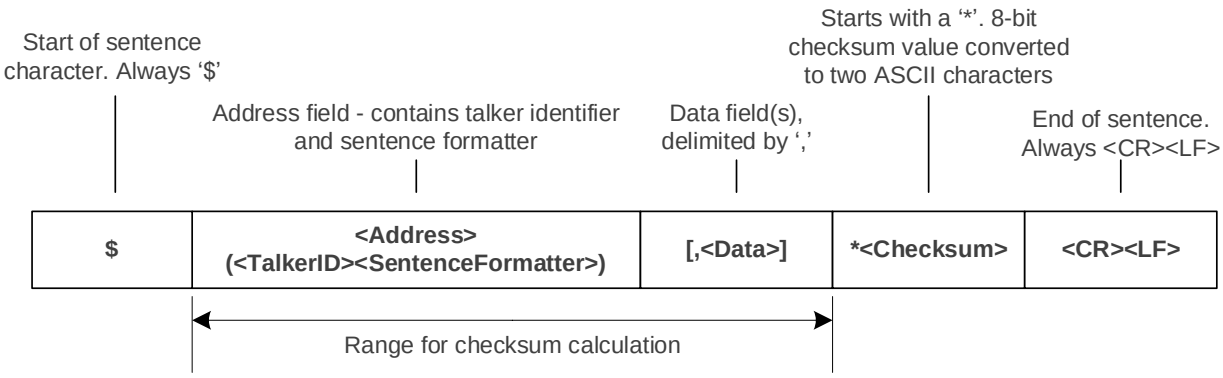

Figure 1: Structure of NMEA Protocol Message

Table 3: Structure of NMEA Protocol Message

Field	Description
$	Start of the sentence (Hex 0x24).
<Address>	**In Standard Messages:** In standard messages, this field consists of a two-character talker identifier (TalkerID) and a three-character sentence formatter (SentenceFormatter). The talker identifier serves to define the nature of the data being transmitted. For more information on the TalkerID, see *Table 4: NMEA Talker ID*. The sentence formatter is used to define data format and type. **In Proprietary Messages:** In proprietary messages, this field consists of the proprietary character **P** followed by a three-character Manufacturer's Mnemonic Code, used to identify the TALKER issuing a proprietary sentence, and any additional characters as required.
<Data>	Data fields, delimited by data field delimiter **','**.

Field	Description
	Variable length (depends on the NMEA message type).
<Checksum>	The checksum field follows the checksum delimiter character *. The checksum is the 8-bit exclusive OR of all characters in the sentence, including the comma (,) delimiter, between but not including the $ and the * delimiters.
<CR><LF>	End of the sentence (Hex 0x0D 0x0A).

Table 4: NMEA Talker ID

GNSS Constellation Configuration	TalkerID (NMEA0183 V4.11)
GPS	GP
GLONASS	GL
Galileo	GA
BDS	GB
QZSS	GQ
IRNSS	GI
Combination of Multiple Satellite Systems	GN

Sample Code for NMEAChecksum:

```
// pData is the data array of which the checksum needs to be calculated:

unsigned char QI_Check_XOR(const unsigned char *pData, unsigned int Length)
{
   unsigned char result = 0;
   unsigned int i = 0;

   if((NULL == pData) || (Length < 1))
   {
      return 0;
   }
   for(i = 0; i < Length; i++)
   {
      result ^= *(pData + i);
   }
```

```
    return result;
}
```

2.2. Standard Messages

This chapter explains the NMEA 0183 V4.11 standard messages supported by the LC29T (AA) and LC99T (IA) modules.

2.2.1. RMC

Recommended Minimum Specific GNSS Data. Time, date, position, course, and speed data provided by a GNSS receiver.

Type:

Output

Synopsis:

```
$<TalkerID>RMC,<UTC>,<Status>,<Lat>,<N/S>,<Lon>,<E/W>,<SOG>,<COG>,<Date>,<MagVar>,<MagVarDir>,<ModeInd>,<NavStatus>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
$	Character	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. Always “GN” in NMEA 0183 V4.11.
RMC	String, 3 characters	-	RMC	Recommended Minimum Specific GNSS Data.
<UTC>	hhmmss.sss	-	032753.000	Position fix UTC. hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Status>	Character	-	A	Positioning system status. A = Data valid V = Navigation receiver warning
<Lat>	ddmm.mmmmmm	-	3149.333250	Latitude. dd: Degrees (00–90) mm: Minutes (00–59)

Field	Format	Unit	Example	Description
				mmmmmm: Decimal fraction of minutes Note that this field is empty in case of an invalid value.
<N/S>	Character	-	N	North-south direction. N = North S = South Note that this field is empty in case of an invalid value.
<Lon>	dddmm.mmmmmm	-	11706.946888	Longitude. ddd: Degrees (000–180) mm: Minutes (00–59) mmmmmm: Decimal fraction of minutes Note that this field is empty in case of an invalid value.
<E/W>	Character	-	E	East-west direction. E = East W = West Note that this field is empty in case of an invalid value.
<SOG>	Numeric	Knot	0.028	Speed over ground. Variable length. Note that this field is empty in case of an invalid value.
<COG>	Numeric	Degree	0.00	Course over ground. Variable length. Maximum value: 359.99. Note that this field is empty in case of an invalid value.
<Date>	ddmmyy	-	200422	Date. dd: Day of month mm: Month yy: Year
<MagVar>	-	-	-	Magnetic variation. Not supported.
<MagVarDir>	-	-	-	Direction of magnetic variation. Not supported.
<ModeInd>	Character	-	D	Mode indicator. A = Autonomous mode. Satellite system used in non-differential mode in position fix D = Differential mode. Satellite system used in differential mode in

Field	Format	Unit	Example	Description
				position fix. Corrections from ground stations or Satellite Based Augmentation System (SBAS) M = Manual input mode N = No fix. Satellite system not used in position fix, or fix not valid
<NavStatus>	Character	-	C	Navigational status. S = Safe C = Caution U = Unsafe V = Navigational status not valid, equipment is not providing navigational status indication.
<Checksum>	Hexadecimal	-	*2F	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNRMC,032753.000,A,3149.333250,N,11706.946888,E,0.028,0.00,200422,,,D,C*2F
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **RMC** sentence as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **RMC** sentence:
   $PSTMSETPAR,32,3,0,1,0x40*48
   $PSTMSAVEPAR*58
   //Disable **RMC** sentence:
   $PSTMSETPAR,32,3,0,2,0x40*4B
   $PSTMSAVEPAR*58
2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.2.2. GGA

Global Positioning System Fix Data, Time, position and fix-related data for a GNSS receiver.

Type:

Output

Synopsis:

$<TalkerID>GGA,<UTC>,<Lat>,<N/S>,<Lon>,<E/W>,<Quality>,<NumSatUsed>,<HDOP>,<Alt>,M,<Sep>,M,<DiffAge>,<DiffStation>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Example	Description
$	Character	-	$	Each NMEA message start with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. Always "GN" in NMEA 0183 V4.11.
GGA	String, 3 characters	-	GGA	Global Positioning System Fix Data.
<UTC>	hhmmss.sss	-	034221.000	Position fix UTC. hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds Note that this field is empty in case of an invalid value.
<Lat>	ddmm.mmmmmm	-	3149.332992	Latitude. dd: Degrees (00–90) mm: Minutes (00–59) mmmmmm: Decimal fraction of minutes Note that this field is empty in case of an invalid value.
<N/S>	Character	-	N	North-south direction. N = North S = South Note that this field is empty in case of an invalid value.
<Lon>	dddmm.mmmmmm	-	11706.946415	Longitude. ddd: Degrees (000–180) mm: Minutes (00–59) mmmmmm: Decimal fraction of minutes Note that this field is empty in case of an invalid value.
<E/W>	Character	-	E	East-west direction. E = East W = West Note that this field is empty in case

Field	Format	Unit	Example	Description
				of an invalid value.
<Quality>	Numeric, 1 digit	-	2	GPS quality indicator. 0 = Fix not available or invalid 1 = GPS SPS Mode, fix valid 2 = Differential GPS, SPS Mode, or Satellite Based Augmentation System (SBAS), fix valid 3 = GPS PPS Mode, fix valid
<NumSatUsed>[1)]	Numeric, 2 digits	-	25	Number of satellites in use.
<HDOP>	Numeric	-	0.6	Horizontal dilution of precision.
<Alt>	Numeric	Meter	49.3	Altitude above mean-sea-level (geoid). Note that this field is empty in case of an invalid value.
M	Character	-	M	Unit of <Alt>. "M" = Meter.
<Sep>	Numeric	Meter	-0.3	Geoid separation (the difference between the earth ellipsoid surface and the mean-sea-level (geoid) surface defined by the reference datum used in the position solution). Note that this field is empty in case of an invalid value.
M	Character	-	M	Unit of <Sep>. "M" = Meter.
<DiffAge>	-	-	-	Differential GPS data age. Not supported.
<DiffStation>	-	-	-	Differential reference station ID. Not supported.
<Checksum>	Hexadecimal	-	*63	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNGGA,034221.000,3149.332992,N,11706.946415,E,2,25,0.6,49.3,M,-0.3,M,,*63
```

NOTE

1. The NMEA 0183 specification indicates that the **GGA** message is GPS specific. However, when the receiver is configured for multi-constellations, the content of **GGA** message will be generated from the multi-constellation solution.
2. [1)] According to the NMEA 0183 specification, the number of satellites in use is between 00 and 12. However, in the multi-constellation solution, the number of satellites in use may exceed 12.
3. **$PSTMSETPAR** can be used to enable or disable the output of **GGA** sentence as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **GGA** sentence:
   $PSTMSETPAR,32,3,0,1,0x2*7E
   $PSTMSAVEPAR*58
   //Disable **GGA** sentence:
   $PSTMSETPAR,32,3,0,2,0x2*7D
   $PSTMSAVEPAR*58
4. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.2.3. GSV

GNSS Satellites in View. The GSV sentence provides the number of satellites in view (SV), satellite ID numbers, elevation, azimuth, and SNR value, and contains maximum four satellites per transmission. Therefore, it may take several sentences to get complete information. The total number of sentences being transmitted and the sentence number are indicated in the first two data fields.

Type:

Output

Synopsis:

```
$<TalkerID>GSV,<TotalNumSen>,<SenNum>,<TotalNumSat>{,<SatID>,<SatElev>,<SatAz>,<SatCN0>},
<SignalID>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
$	Character	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GP	Talker identifier. See *Table 4: NMEA Talker ID.*
GSV	String, 3 characters	-	GSV	GNSS Satellites in View.

Field	Format	Unit	Example	Description
<TotalNumSen>	Numeric	-	2	Total number of sentences.
<SenNum>	Numeric	-	1	Sentence number. Range: 1–**<TotalNumSen>**.
<TotalNumSat>	Numeric	-	07	Total number of satellites in view.
Start of repeat block. Repeat times: 4.				
<SatID>	Numeric	-	14	Satellite ID. See *Table 6: GNSS Satellite (NMEA) Numbering*.
<SatElev>	Numeric	Degree	81	Satellite elevation. Range: 00–90. Note that this field is empty in case of an invalid value.
<SatAz>	Numeric	Degree	191	Satellite azimuth, with true north as the reference plane. Range: 000–359. Note that this field is empty in case of an invalid value.
<SatCN0>	Numeric	dB-Hz	42	Satellite SNR (C/N_0). Range 00–99. Null when not tracking.
End of repeat block.				
<SignalID>	Numeric	-	1	GNSS signal ID. See *Table 6: GNSS Satellite (NMEA) Numbering*.
<Checksum>	Hexadecimal	-	*68	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GPGSV,2,1,07,14,81,191,42,17,55,339,41,03,47,081,38,19,37,308,37,1*68
$GPGSV,2,2,07,06,35,246,37,01,29,041,37,30,16,205,,,,,,1*5F
$GLGSV,2,1,07,79,51,206,40,86,50,302,39,76,47,314,45,88,36,028,37,1*78
$GLGSV,2,2,07,69,15,268,24,68,12,135,,92,07,032,32,,,,,1*48
$GQGSV,1,1,03,03,70,052,42,07,52,161,34,02,48,155,39,,,,,1*57
$GAGSV,2,1,07,21,77,234,40,13,58,020,40,26,52,265,41,01,38,315,36,7*73
$GAGSV,2,2,07,27,33,156,37,15,11,049,24,33,,,24,,,,,7*7E
$GBGSV,3,1,12,07,85,358,40,10,73,321,38,13,46,215,37,24,44,275,39,1*77
$GBGSV,3,2,12,35,43,048,38,26,39,208,27,12,37,290,35,22,27,134,24,1*7C
$GBGSV,3,3,12,19,25,075,37,05,17,252,30,34,12,275,30,08,,,36,1*43
$GIGSV,1,1,03,04,63,189,,03,35,230,20,02,31,283,28,,,,,7*4C
$GPGSV,1,1,04,14,81,191,36,03,47,081,34,06,35,246,32,01,29,041,28,7*6C
$GAGSV,2,1,06,13,,,32,21,,,31,01,,,29,27,,,28,1*77
```

```
$GAGSV,2,2,06,26,,,31,15,,,14,,,,,,,,1*74
$GBGSV,1,1,04,26,,,24,35,,,30,24,,,32,19,,,26,5*7A
$GQGSV,1,1,03,03,70,052,31,07,52,161,33,02,48,155,32,,,,,7*59
```

NOTE

1. **GN** cannot be used for **GSV** sentences. If satellites of multiple constellations are in view, **GSV** sentences are output with the corresponding talker ID for each constellation, respectively.
2. **$PSTMSETPAR** can be used to enable or disable the output of **GSV** sentence as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **GSV** sentence:
   $PSTMSETPAR,32,3,0,1,0x80000*74
   $PSTMSAVEPAR*58
   //Disable **GSV** sentence:
   $PSTMSETPAR,32,3,0,2,0x80000*77
   $PSTMSAVEPAR*58
3. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.2.4. GSA

GNSS DOP and Active Satellites. GNSS receiver operating mode, satellites used in the navigation solution reported by the GGA sentence, and DOP values.

Type:

Output

Synopsis:

```
$<TalkerID>GSA,<Mode>,<FixMode>{,<SatID>},<PDOP>,<HDOP>,<VDOP><SystemID>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
$	Character	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. Always “GN” in NMEA 0183 V4.11.
GSA	String, 3 characters	-	GSA	GNSS DOP and Active Satellites.
<Mode>	Character	-	A	Selection of 2D or 3D fix. M = Manual, forced to operate in 2D or 3D

Field	Format	Unit	Example	Description
				mode. A = Automatic, allowed to automatically switch 2D/3D.
<FixMode>	Numeric	-	3	Fix mode. 1 = Fix not available 2 = 2D 3 = 3D
Start of repeat block. Repeat times: 12.				
<SatID>	Numeric	-	02	ID numbers of satellites used in solution. See *Table 6: GNSS Satellite (NMEA) Numbering.* Note that this field is empty in case of an invalid value.
End of repeat block.				
<PDOP>	Numeric	-	1.2	Position dilution of precision. Maximum value: 99.99.
<HDOP>	Numeric	-	0.1	Horizontal dilution of precision. Maximum value: 99.99.
<VDOP>	Numeric	-	1.0	Vertical dilution of precision. Maximum value: 99.99.
<SystemID>	Numeric	-	1	GNSS system ID. See *Table 6: GNSS Satellite (NMEA) Numbering.*
<Checksum>	Hexadecimal	-	*38	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNGSA,A,3,02,05,11,20,13,29,,,,,,,1.2,0.7,1.0,1*38
$GNGSA,A,3,90,91,82,,,,,,,,,,1.2,0.7,1.0,2*3C
$GNGSA,A,3,03,,,,,,,,,,,,1.2,0.7,1.0,5*33
$GNGSA,A,3,,,,,,,,,,,,,1.2,0.7,1.0,3*36
$GNGSA,A,3,22,19,35,13,16,06,21,29,,,,,1.2,0.7,1.0,4*34
$GNGSA,A,3,03,02,,,,,,,,,,,1.2,0.7,1.0,6*32
```

NOTE

1. If less than 12 satellites are used for navigation, the remaining **<SatID>** fields are left empty. If more than 12 satellites are used for navigation, only the IDs of the first 12 are output.
2. **$PSTMSETPAR** can be used to enable or disable the output of a **GSA** sentence as shown below.

Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
//Enable **GSA** sentence:
$PSTMSETPAR,32,3,0,1,0x4*78
$PSTMSAVEPAR*58
//Disable **GSA** sentence
$PSTMSETPAR,32,3,0,2,0x4*7B
$PSTMSAVEPAR*58

3. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.2.5. VTG

Course Over Ground & Ground Speed. The actual course and speed relative to the ground.

Type:

Output

Synopsis:

```
$<TalkerID>VTG,<COGT>,T,<COGM>,M,<SOGN>,N,<SOGK>,K,<ModeInd>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
$	Character	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. Always “GN” in NMEA 0183 V4.11.
VTG	String, 3 characters	-	VTG	Course Over Ground & Ground Speed.
<COGT>	Numeric	Degrees	0.00	Course over ground, in true north course direction. Note that this field is empty in case of an invalid value.
T	Character	-	T	Fixed field: true.
<COGM>	Numeric	Degrees	-	Course over ground (magnetic). Not supported.
M	Character	-	M	Fixed field: magnetic.
<SOGN>	Numeric	Knots	0.048	Speed over ground in knots. Note that this field is empty in case of an invalid value.

Field	Format	Unit	Example	Description
N	Character	-	N	Fixed field: knot.
<SOGK>	Numeric	km/h	0.089	Speed over ground in kilometers per hour. Note that this field is empty in case of an invalid value.
K	Character	-	K	Fixed field: kilometers per hour.
<ModeInd>	Character	-	D	Mode indicator. A = Autonomous mode. Satellite system used in non-differential mode in position fix D = Differential mode. Satellite system used in differential mode in position fix. Corrections from ground stations or Satellite Based Augmentation System (SBAS) M = Manual input mode N = Data not valid
<Checksum>	Hexadecimal	-	*2B	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNVTG,0.00,T,,M,0.048,N,0.089,K,D*2B
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **VTG** sentence as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**
   //Enable **VTG** sentence:
   $PSTMSETPAR,32,3,0,1,0x10*4D
   $PSTMSAVEPAR*58
   //Disable **VTG** sentence:
   $PSTMSETPAR,32,3,0,2,0x10*4E
   $PSTMSAVEPAR*58
2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.2.6. GLL

Geographic Position – Latitude/Longitude. Latitude and longitude of the GNSS receiver position, the time of position fix and status.

Type:

Output

Synopsis:

```
$<TalkerID>GLL,<Lat>,<N/S>,<Lon>,<E/W>,<UTC>,<Status>,<ModeInd>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
$	Character	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. Always “GN” in NMEA 0183 V4.11.
GLL	String, 3 characters	-	GLL	Geographic Position – Latitude/Longitude.
<Lat>	ddmm.mmmmmm	-	3149.332624	Latitude. dd: Degrees (00–90) mm: Minutes (00–59) mmmmmm: Decimal fraction of minutes Note that this field is empty in case of an invalid value.
<N/S>	Character	-	N	North-south direction. N = North S = South Note that this field is empty in case of an invalid value.
<Lon>	dddmm.mmmmmm	-	11706.946280	Longitude. ddd: Degrees (000–180) mm: Minutes (00–59) mmmmmm: Decimal fraction of minutes Note that this field is empty in case of an invalid value.
<E/W>	Character	-	E	East-west direction. E = East W = West Note that this field is empty in case of an invalid value.

Field	Format	Unit	Example	Description
<UTC>	hhmmss.sss	-	051051.000	Position fix UTC. hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Status>	Character	-	D	Positioning system status. A = Data valid V = Data not valid
<ModeInd>	Character	-	D	Mode indicator. A = Autonomous mode. Satellite system used in non-differential mode in position fix D = Differential mode. Satellite system used in differential mode in position fix. Corrections from ground stations or Satellite Based Augmentation System (SBAS) M = Manual input mode N = Data not valid
<Checksum>	Hexadecimal	-	*4A	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNGLL,3149.332624,N,11706.946280,E,051051.000,D,D*4A
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **GLL** sentence as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **GLL** sentence:
   $PSTMSETPAR,32,3,0,1,0x100000*4D
   $PSTMSAVEPAR*58
   //Disable **GLL** sentence:
   $PSTMSETPAR,32,3,0,2,0x100000*4E
   $PSTMSAVEPAR*58
2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.2.7. ZDA

Time & Date. UTC, day, month, year and local time zone.

Type:

Output

Synopsis:

```
$<TalkerID>ZDA,<UTC>,<Day>,<Month>,<Year>,<LocalHour>,<LocalMin>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Example	Description
$	Character	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. Always “GN” in NMEA 0183 V4.11.
ZDA	String, 3 characters	-	ZDA	Time & Date. UTC, day, month, year and local time zone.
<UTC>	hhmmss.sss	-	051634.000	Position fix UTC: hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Day>	Numeric	-	20	Day of month. Range: 01–31.
<Month>	Numeric	-	04	Month. Range: 01–12.
<Year>	Numeric	-	2022	Year.
<LocalHour>	Numeric	-	-	Local zone hours, 00 to ±13 hours. Not supported.
<LocalMin>	Numeric	-	-	Local zone minutes, 00 to +59 minutes. Not supported.
<Checksum>	Hexadecimal	-	*49	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example:

```
$GNZDA,051634.000,20,04,2022,,*49
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **ZDA** sentence as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **ZDA** sentence:
   $PSTMSETPAR,32,3,0,1,0x1000000*7D
   $PSTMSAVEPAR*58
   //Disable **ZDA** sentence:
   $PSTMSETPAR,32,3,0,2,0x1000000*7E
   $PSTMSAVEPAR*58
2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3. PSTM Messages

This chapter explains the **PSTM** messages (proprietary NMEA messages defined by the chipset supplier) supported by LC29T (AA) and LC99T (IA).

2.3.1. PSTMCOLD

Performs a cold start.

Type:

Command

Synopsis:

```
$PSTMCOLD*<Checksum><CR><LF>
```

Parameter:

None

Result:

Cold start initialization and GNSS engine restart. [1)]

Example:

```
$PSTMCOLD*1E
```

NOTE

1) The GNSS engine will be reset. It is not a system reboot.

2.3.2. PSTMWARM

Performs a warm start.

Type:

Command

Synopsis:

```
$PSTMWARM*<Checksum><CR><LF>
```

Parameter:

None

Result:

Warm start initialization and GNSS engine restart. 1)

Example:

```
$PSTMWARM*13
```

NOTE

1) The GNSS engine will be reset. It is not a system reboot.

2.3.3. PSTMHOT

Performs a hot start.

Type:

Command

Synopsis:

```
$PSTMHOT*<Checksum><CR><LF>
```

Parameter:

None

Result:

Hot start initialization and GNSS engine restart. [1)]

Example:

```
$PSTMHOT*49
```

NOTE

[1)] The GNSS engine will be reset. It is not a system reboot.

2.3.4. PSTMSRR

Executes a system reset and reboots the GNSS firmware.

Type:

Command

Synopsis:

```
$PSTMSRR*<Checksum><CR><LF>
```

Parameter:

None

Result:

- The system is reset and the GNSS firmware is rebooted.
- No message is sent as a reply.

Example:

```
$PSTMSRR*49
```

2.3.5. PSTMSAVEPAR

Saves current configuration data block to NVM.

Type:

Command

Synopsis:

```
$PSTMSAVEPAR*<Checksum><CR><LF>
```

Parameter:

None

Result:

- If successful, the module returns:

```
$PSTMSAVEPAROK*<Checksum><CR><LF>
```

- If failed, the module returns:

```
$PSTMSAVEPARERROR*<Checksum><CR><LF>
```

Example:

```
$PSTMSAVEPAR*58
$PSTMSAVEPAROK*5C
```

2.3.6. PSTMRESTOREPAR

Restores the factory setting parameters. The configuration data block stored in NVM, if present, will be invalidated. Any changed parameter will be lost.

Type:

Command

Synopsis:

```
$PSTMRESTOREPAR*<Checksum><CR><LF>
```

Parameter:

None

Result:

- If successful, the module returns:

```
$PSTMRESTOREPAROK*<Checksum><CR><LF>
```

- If failed, the module returns:

```
$PSTMRESTOREPARERROR*<Checksum><CR><LF>
```

Example:

```
$PSTMRESTOREPAR*11
$PSTMRESTOREPAROK*15
```

NOTE

The factory setting parameters will be restored and the configuration block in the NVM will be lost. A system reboot is needed to restore the factory settings, i.e. default settings.

2.3.7. PSTMPPS

Sets/gets configurations related to the PPS function. Configurations are not saved after resetting.

Type:

Set/Get

Synopsis:

```
$PSTMPPS,<CmdMode>,<CmdType>,[<Par_1>,…,<Par_N>]*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<CmdMode>	Numeric	-	Command operation mode. 1 = GET operation (to get data from PPS manager) 2 = SET operation (to set data into PPS manager)
<CmdType>	Numeric	-	Command type. 1 = PPS_IF_ON_OFF_CMD 2 = PPS_IF_OUT_MODE_CMD 4 = PPS_IF_PULSE_DELAY_CMD 5 = PPS_IF_PULSE_DURATION_CMD 6 = PPS_IF_PULSE_POLARITY_CMD 7 = PPS_IF_PULSE_DATA_CMD 8 = PPS_IF_FIX_CONDITION_CMD 9 = PPS_IF_SAT_TRHESHOLD_CMD 10 = PPS_IF_ELEVATION_MASK_CMD 11 = PPS_IF_COSTELLATION_MASK_CMD 12 = PPS_IF_TIMING_DATA_CMD 13 = PPS_IF_POSITION_HOLD_DATA_CMD

Field	Format	Unit	Description
			14 = PPS_IF_AUTO_HOLD_SAMPLES_CMD 15 = PPS_IF_TRAIM_CMD 16 = PPS_IF_TRAIM_USED_CMD 17 = PPS_IF_TRAIM_RES_CMD 18 = PPS_IF_TRAIM_REMOVED_CMD 19 = PPS_IF_REFERENCE_TIME_CMD 20 = PPS_IF_CONSTELLATION_RF_DELAY_CMD
<Par_1>,…,<Par_N>	-	-	Parameters vary depending on specific SET operations and should be configured only in SET operations.

Result:

According to the operation mode, data is retrieved from or set into the PPS manager, see the commands listed in the following sub-chapters (i.e., *Chapter 2.3.7.1 Getting PPS Data: PPS_IF_PULSE_DATA_CMD* to *Chapter 2.3.7.23 Setting PPS Data: PPS_IF_TRAIM_CMD*) for details.

- If successful for GET operations, the module returns different results. See the sub-chapters of GET operations for details.
- If successful for SET operations, the module returns:

```
$PSTMPPSOK,2,<CmdType>*<Checksum><CR><LF>
```

- If failed for both SET and GET operations, the module returns:

```
$PSTMPPSERROR*<Checksum><CR><LF>
```

2.3.7.1.Getting PPS Data: PPS_IF_PULSE_DATA_CMD

Gets the pulse information from the PPS manager.

Type:

Get

Synopsis:

```
$PSTMPPS,1,7*<Checksum><CR><LF>
```

Result:

```
$PSTMPPS,1,7,<OutMode>,<RefTime>,<PulseDelay>,<PulseDuration>,<PulsePolarity>*<Checksum><CR><LF>
```

Parameters included in the result:

Field	Format	Unit	Description
<OutMode>	Numeric	-	PPS generation mode. 0 = PPS always generated 1 = PPS generated on even seconds 2 = PPS generated on odd seconds
<RefTime>	Numeric	-	PPS reference time. 0 = UTC 1 = GPS Time 2 = GLONASS Time 3 = UTC (SU) 4 = GPS Time (from GLONASS time reference) 5 = BDS Time 6 = UTC (NTSC) 7 = Galileo Time 8 = UTC (GST) 9 = GPS Time (from Galileo time reference)
<PulseDelay>	Numeric	Nanosecond	Pulse delay.
<PulseDuration>	Numeric	Second	Pulse duration.
<PulsePolarity>	Numeric	-	Pulse polarity. 0 = Not inverted 1 = Inverted

Example:

```
$PSTMPPS,1,7*4F
$PSTMPPS,1,7,0,1,0,0.500000,0*79
```

NOTE

1. **UTC (SU)** is the Universal Time Coordinated of Russia; it is derived from GLONASS time by applying the UTC delta time downloaded from GLONASS satellites.
2. **GPS Time (from GLONASS time reference)** is the GPS time derived from GLONASS time by applying the GPS delta time downloaded from GLONASS satellites.
3. If the software is configured to work in GLONASS only mode, **UTC (SU)** is identical to **UTC** and **GPS Time (from GLONASS time reference)** is identical to **GPS Time**.
4. For **GPS Time (from Galileo time reference)**, the reference time is GPS time, but it is corrected using the parameters downloaded by Galileo.

2.3.7.2.Getting PPS Data: PPS_IF_TIMING_DATA_CMD

Gets the time information from the PPS manager.

Type:

Get

Synopsis:

```
$PSTMPPS,1,12*<Checksum><CR><LF>
```

Result:

```
$PSTMPPS,1,12,<FixCondition>,<SatTh>,<ElevationMask>,<ConstMask>,<GPS_RF_Delay>,<GLONASS_RF_Delay>*<Checksum><CR><LF>
```

Parameters included in the result:

Field	Format	Unit	Description
<FixCondition>	Numeric	-	GNSS fix condition for generating PPS signal. 0 or 1 = No fix 2 = 2D fix 3 = 3D fix
<SatTh>	Numeric	-	Minimum number of satellites for generating PPS signal.
<ElevationMask>	Numeric	Degree	Minimum satellite elevation for satellite usage in timing filtering.
<ConstMask>	Hexadecimal	-	Satellite constellation bitmask for timing filtering. Bit 0 = GPS Bit 1 = GLONASS Bit 2 = QZSS Bit 3 = Galileo Bit 7 = BDS Bit 11 = GPS L5 Bit 12 = Galileo E5a Bit 14 = BDS B2a Note that the L5 band of QZSS and NavIC is not used in timing filtering.
<GPS_RF_Delay>	Numeric	Nanosecond	GPS path RF delay.
<GLONSS_RF_Delay>	Numeric	Nanosecond	GLONASS path RF delay.

Example:

```
$PSTMPPS,1,12*7B
$PSTMPPS,1,12,0,0,10,0000588b,350,305*2D
```

NOTE

1. **<ConstMask>** enables the usage of mixed constellations satellites in the timing filtering, meaning that satellites from one constellation can be used to correct the reference time for other constellations. Benefited from this, the module can provide users with more accurate time information.
2. When the prerequisites that GPS time is selected for generating PPS signal and Bit 1 (or Bit 7) is enabled are met, GLONASS (or BDS) satellites can be used to correct the GPS reference time. Likewise, only the prerequisites that GLONASS time is selected for generating PPS signal and Bit 0 is enabled, GPS satellites can be used to correct the GLONASS reference time.

2.3.7.3.Getting PPS Data: PPS_IF_POSITION_HOLD_DATA_CMD

Gets the information about the Position Hold from the PPS manager.

Type:

Get

Synopsis:

```
$PSTMPPS,1,13*<Checksum><CR><LF>
```

Result:

```
$PSTMPPS,1,13,<OnOff>,<Lat>,<N/S>,<Lon>,<E/W>,<H_Msl>*<Checksum><CR><LF>
```

Parameters included in the result:

Field	Format	Unit	Description
<OnOff>	Numeric	-	Position Hold status. 0 = Disabled 1 = Enabled
<Lat>	ddmm.mmmmmm	-	Position Hold, position latitude in degrees. dd: Degree mm: Minutes mmmmmm: Decimal fraction of minutes
<N/S>	Character	-	North-south direction. N = North S = South

Field	Format	Unit	Description
<Lon>	dddmm.mmmmmm	-	Position Hold, position longitude in degrees. ddd: Degree mm: Minutes mmmmmm: Decimal fraction of minutes.
<E/W>	Character	-	East-west direction. E = East W = West
<H_Msl>	Numeric	-	Position Hold mean sea level altitude.

Example:

```
$PSTMPPS,1,13*7A
$PSTMPPS,1,13,0,3149.335650,N,11706.942196,E,63.7*64
```

2.3.7.4.Getting PPS Data: PPS_IF_TRAIM_CMD

Gets the TRAIM-related information from PPS manager. TRAIM is a timing calibration algorithm.

Type:

Get

Synopsis:

```
$PSTMPPS,1,15*<Checksum><CR><LF>
```

Result:

```
$PSTMPPS,1,15,<TraimEnabled>,<TraimSolution>,<AveError>,<UsedSats>,<RemovedSats>*<Checksum><CR><LF>
```

Parameters included in the result:

Field	Format	Unit	Description
<TraimEnabled>	Numeric	-	TRAIM status. 0 = Disabled 1 = Enabled
<TraimSolution>	Numeric	-	TRAIM algorithm status. 0 = Under alarm 1 = Over alarm 2 = Unknown
<AveError>	Numeric	Nanosecond	Average time error.

Field	Format	Unit	Description
<UsedSats>	Numeric	-	Number of satellites used for timing correction.
<RemovedSats>	Numeric	-	Number of satellites removed by timing correction.

Example:

```
$PSTMPPS,1,15*7C
$PSTMPPS,1,15,1,0,-1,13,4*7B
```

2.3.7.5.Getting PPS Data: PPS_IF_TRAIM_USED_CMD

Gets satellites used in the TRAIM algorithm from the PPS manager.

Type:

Get

Synopsis:

```
$PSTMPPS,1,16*<Checksum><CR><LF>
```

Result:

```
$PSTMPPS,1,16,<TraimEnabled>,<UsedSats>{,<SatID>}*<Checksum><CR><LF>
```

Parameters included in the result:

Field	Format	Unit	Description
<TraimEnabled>	Numeric	-	TRAIM status. 0 = Disabled 1 = Enabled
<UsedSats>	Numeric	-	Number of satellites used for timing correction.
Start of repeat block. Repeat <UsedSats> times.			
<SatID>	Numeric	-	List of satellites IDs.
End of repeat block.			

Example:

```
$PSTMPPS,1,16*7F
$PSTMPPS,1,16,1,15,91,156,153,24,524,154,149,173,92,168,146,15,18,518,523*65
```

2.3.7.6.Getting PPS Data: PPS_IF_TRAIM_RES_CMD

Gets satellites' residuals in the TRAIM algorithm from the PPS manager.

Type:

Get

Synopsis:

```
$PSTMPPS,1,17*<Checksum><CR><LF>
```

Result:

```
$PSTMPPS,1,17,<TraimEnabled>,<UsedSats>{,<Resi>}*<Checksum><CR><LF>
```

Parameters included in the result:

Field	Format	Unit	Description
<TraimEnabled>	Numeric	-	TRAIM status. 0 = Disabled 1 = Enabled
<UsedSats>	Numeric	-	Number of satellites used for timing correction.
Start of repeat block. Repeat <UsedSats> times.			
<Resi>	Numeric	Nanosecond	Satellite residuals. Each residual corresponds to the satellite in the used satellite list in the same position.
End of repeat block.			

Example:

```
$PSTMPPS,1,17*7E
$PSTMPPS,1,17,1,12,16,-2,0,-16,3,-3,-7,3,-8,-2,8,8*40
```

2.3.7.7.Getting PPS Data: PPS_IF_TRAIM_REMOVED_CMD

Gets the removed satellites in the TRAIM algorithm from the PPS manager.

Type:

Get

Synopsis:

```
$PSTMPPS,1,18*<Checksum><CR><LF>
```

Result:

```
$PSTMPPS,1,18,<TraimEnabled>,<RemSats>{,<SatID>}*<Checksum><CR><LF>
```

Parameters included in the result:

Field	Format	Unit	Description
<TraimEnabled>	Numeric	-	TRAIM status. 0 = Disabled 1 = Enabled
<RemSats>	Numeric	-	Number of satellites removed by timing correction.
Start of repeat block. Repeat <RemSats> times.			
<SatID>	Numeric	-	Removed satellite ID.
End of repeat block.			

Example:

```
$PSTMPPS,1,18*71
$PSTMPPS,1,18,1,4,524,161,164,92*49
```

2.3.7.8.Setting PPS Data: PPS_IF_ON_OFF_CMD

Sets PPS feature status.

Type:

Set

Synopsis:

```
$PSTMPPS,2,1,<OnOff>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<OnOff>	Numeric	-	PPS feature status. 0 = Disable PPS 1 = Enable PPS

Example:

```
$PSTMPPS,2,1,1*57
$PSTMPPSOK,2,1*4E
```

2.3.7.9.Setting PPS Data: PPS_IF_OUT_MODE_CMD

Sets PPS output mode.

Type:

Set

Synopsis:

```
$PSTMPPS,2,2,<OutMode>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<OutMode>	Numeric	-	PPS generation mode. 0 = PPS always generated 1 = PPS generated on even seconds 2 = PPS generated on odd seconds

Example:

```
$PSTMPPS,2,2,0*55
$PSTMPPSOK,2,2*4D
```

2.3.7.10.Setting PPS Data: PPS_IF_REFERENCE_TIME_CMD

Sets reference time for synchronizing PPS signal.

Type:

Set

Synopsis:

```
$PSTMPPS,2,19,<RefTime>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<RefTime>	Numeric	-	PPS reference time. 0 = UTC 1 = GPS Time 2 = GLONASS Time 3 = UTC (SU) 4 = GPS Time (from GLONASS time reference) 5 = BDS Time 6 = UTC (NTSC) 7 = Galileo Time 8 = UTC (GST) 9 = GPS Time (from Galileo time reference)

Example:

```
$PSTMPPS,2,19,1*6E
$PSTMPPSOK,2,19*77
```

NOTE

1. **UTC (SU)** is the Universal Time Coordinated of Russia; it is derived from GLONASS time by applying the UTC delta time downloaded from GLONASS satellites.
2. **GPS Time (from GLONASS time reference)** is the GPS time derived from GLONASS time by applying the GPS delta time downloaded from GLONASS satellites.
3. If the software is configured to work in GLONASS only mode, **UTC (SU)** is identical to **UTC** and **GPS Time (from GLONASS time reference)** is identical to **GPS Time**.
4. For **GPS Time (from Galileo time reference)**, the reference time is GPS time, but it is corrected using the parameters downloaded by Galileo.

2.3.7.11.Setting PPS Data: PPS_IF_PULSE_DELAY_CMD

Sets a time correction to compensate any delay on the Pulse per Second (PPS) signal caused by cables and/or RF chain.

Type:

Set

Synopsis:

```
$PSTMPPS,2,4,<PulseDelay>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<PulseDelay>	Numeric	Nanosecond	Pulse delay.

Example:

```
$PSTMPPS,2,4,10*62
$PSTMPPSOK,2,4*4B
```

2.3.7.12.Setting PPS Data: PPS_IF_CONSTELLATION_RF_DELAY_CMD

Sets the RF time delay for the satellite signal path.

Type:

Set

Synopsis:

```
$PSTMPPS,2,20,<SatType><TimeDelay>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<SatType>	Numeric	-	Satellite constellation type. 0 = GPS 1 = GLONASS 3 = Galileo 7 = BDS
<TimeDelay>	Numeric	Nanosecond	Time delay.

Example:

```
$PSTMPPS,2,20,0,350*7F
$PSTMPPSOK,2,20*7D
```

2.3.7.13.Setting PPS Data: PPS_IF_PULSE_DURATION_CMD

Sets the pulse duration of the PPS signal.

Type:

Set

Synopsis:

```
$PSTMPPS,2,5,<PulseDuration>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<PulseDuration>	Numeric	Second	Pulse duration.

Example:

```
$PSTMPPS,2,5,0.5*49
$PSTMPPSOK,2,5*4A
```

2.3.7.14.Setting PPS Data: PPS_IF_PULSE_POLARITY_CMD

Sets pulse polarity. The pulse duration is the temporal distance between the PPS rising edge and the next falling edge if polarity inversion is disabled or the temporal distance between PPS falling edge and the next rising edge if polarity inversion is enabled.

Type:

Set

Synopsis:

```
$PSTMPPS,2,6,<PulsePolarity>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<PulsePolarity>	Numeric	-	Pulse polarity. 0 = Not inverted 1 = Inverted

Example:

```
$PSTMPPS,2,6,0*51
$PSTMPPSOK,2,6*49
```

2.3.7.15.Setting PPS Data: PPS_IF_PULSE_DATA_CMD

Sets pulse data into the PPS manager.

Type:

Set

Synopsis:

```
$PSTMPPS,2,7,<OutMode>,<RefTime>,<PulseDelay>,<PulseDuration>,<PulsePolarity>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<OutMode>	Numeric	-	PPS generation mode. 0 = PPS always generated 1 = PPS generated on even seconds 2 = PPS generated on odd seconds
<RefTime>	Numeric	-	PPS reference time. 0 = UTC 1 = GPS Time 2 = GLONASS Time 3 = UTC (SU) 4 = GPS Time (from GLONASS time reference) 5 = BDS Time 6 = UTC (NTSC) 7 = Galileo Time 8 = UTC (GST) 9 = GPS Time (from Galileo time reference)
<PulseDelay>	Numeric	Nanosecond	Pulse delay.
<PulseDuration>	Numeric	Second	Pulse duration.
<PulsePolarity>	Numeric	-	Pulse polarity. 0 = Not inverted 1 = Inverted

Example:

```
$PSTMPPS,2,7,0,1,10,0.5,0*7B
$PSTMPPSOK,2,7*48
```

NOTE

1. **UTC (SU)** is the Universal Time Coordinated of Russia; it is derived from GLONASS time by applying the UTC delta time downloaded from GLONASS satellites.
2. **GPS Time (from GLONASS time reference)** is the GPS time derived from GLONASS time by applying the GPS delta time downloaded from GLONASS satellites.
3. If the software is configured to work in GLONASS only mode, **UTC (SU)** is identical to **UTC** and **GPS Time (from GLONASS time reference)** is identical to **GPS Time**.
4. For **GPS Time (from Galileo time reference)**, the reference time is GPS time, but it is corrected using the parameters downloaded by Galileo.

2.3.7.16.Setting PPS Data: PPS_IF_FIX_CONDITION_CMD

Sets GNSS fix condition for generating PPS signal.

Type:

Set

Synopsis:

```
$PSTMPPS,2,8,<FixCondition>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<FixCondition>	Numeric	-	GNSS fix condition for generating PPS signal. 0 or 1 = No fix 2 = 2D fix 3 = 3D fix

Example:

```
$PSTMPPS,2,8,1*5E
$PSTMPPSOK,2,8*47
```

2.3.7.17.Setting PPS Data: PPS_IF_SAT_THRESHOLD_CMD

Sets minimum number of satellites for generating PPS signal.

Type:

Set

Synopsis:

```
$PSTMPPS,2,9,<SatTh>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<SatTh>	Numeric	-	Minimum number of satellites for generating PPS signal.

Example:

```
$PSTMPPS,2,9,5*5B
$PSTMPPSOK,2,9*46
```

2.3.7.18.Setting PPS Data: PPS_IF_ELEVATION_MASK_CMD

Sets the minimum elevation of a satellite when it is used in timing filtering.

Type:

Set

Synopsis:

```
$PSTMPPS,2,10,<ElevationMask>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<ElevationMask>	Numeric	-	Minimum satellite elevation for timing filtering.

Example:

```
$PSTMPPS,2,10,10*57
$PSTMPPSOK,2,10*7E
```

2.3.7.19.Setting PPS Data: PPS_IF_CONSTELLATION_MASK_CMD

Selects the satellite constellation to be used in timing filtering.

Type:

Set

Synopsis:

```
$PSTMPPS,2,11,<ConstMask>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<ConstMask>	Numeric	-	Satellite constellation bitmask for timing filtering. Bit 0 = GPS Bit 1 = GLONASS Bit 2 = QZSS Bit 3 = Galileo Bit 7 = BDS Bit 11 = GPS L5 Bit 12 = Galileo E5a Bit 14 = BDS B2a Note that the L5 band of QZSS and NavIC is not used in timing filtering.

Example:

```
$PSTMPPS,2,11,22667*60
$PSTMPPSOK,2,11*7F
```

NOTE

1. **<ConstMask>** enables the usage of mixed constellations satellites in the timing filtering, meaning that satellites from one constellation can be used to correct the reference time for other constellations. Benefited from this, the module can provide users with more accurate time information.
2. When the prerequisites that GPS time is selected for generating PPS signal and Bit 1 (or Bit 7) is enabled are met, GLONASS (or BDS) satellites can be used to correct the GPS reference time. Likewise, only the prerequisites that GLONASS time is selected for generating PPS signal and Bit 0 is enabled, GPS satellites can be used to correct the GLONASS reference time.

2.3.7.20.Setting PPS Data: PPS_IF_TIMING_DATA_CMD

Sets timing data into the PPS manager.

Type:

Set

Synopsis:

```
$PSTMPPS,2,12,<FixCondition>,<SatTh>,<ElevationMask>,<ConstMask>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<FixCondition>	Numeric	-	GNSS fix condition for generating PPS signal. 0 or 1 = No fix 2 = 2D fix 3 = 3D fix
<SatTh>	Numeric	-	Minimum number of satellites for generating PPS signal.
<ElevationMask>	Numeric	-	Minimum satellite elevation for satellite usage in timing filtering.
<ConstMask>	Numeric	-	Satellite constellation bitmask for timing filtering. Bit 0 = GPS Bit 1 = GLONASS Bit 2 = QZSS Bit 3 = Galileo Bit 7 = BDS Bit 11 = GPS L5 Bit 12 = Galileo E5a Bit 14 = BDS B2a Note that the L5 band of QZSS and NavIC is not used in timing filtering.

Example:

```
$PSTMPPS,2,12,0,0,10,22667*4E
$PSTMPPSOK,2,12*7C
```

NOTE

1. **<ConstMask>** enables the usage of mixed constellations satellites in the timing filtering, meaning that satellites from one constellation can be used to correct the reference time for other constellations. Benefited from this, the module can provide users with more accurate time information.
2. When the prerequisites that GPS time is selected for generating PPS signal and Bit 1 (or Bit 7) is enabled are met, GLONASS (or BDS) satellites can be used to correct the GPS reference time. Likewise, only the prerequisites that GLONASS time is selected for generating PPS signal and Bit 0 is enabled, GPS satellites can be used to correct the GLONASS reference time.

2.3.7.21.Setting PPS Data: PPS_IF_POSITION_HOLD_DATA_CMD

Sets the information about the Position Hold in the PPS manager.

Type:

Set

Synopsis:

```
$PSTMPPS,2,13,<OnOff>,<Lat>,<N/S>,<Lon>,<E/W>,<H_Msl>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<OnOff>	Numeric	-	Position Hold status. 0 = Disabled 1 = Enabled
<Lat>	ddmm.mmmmmm	-	Position Hold, position latitude in degrees. dd: Degree mm: Minutes mmmmmm: Decimal fraction of minutes
<N/S>	Character	-	North-south direction. N = North S = South
<Lon>	dddmm.mmmmmm	-	Position Hold, position longitude in degrees. ddd: Degree mm: Minutes mmmmmm: Decimal fraction of minutes
<E/W>	Character	-	East-west direction. E = East W = West
<H_Msl>	Numeric	-	Position Hold, mean sea level altitude.

Example:

```
$PSTMPPS,2,13,1,3149.339242,N,11706.952207,E,004.01*60
$PSTMPPSOK,2,13*7D
```

2.3.7.22.Setting PPS Data: PPS_IF_AUTO_HOLD_SAMPLES_CMD

Sets the number of position samples for the auto position algorithm.

Type:

Set

Synopsis:

```
$PSTMPPS,2,14,<Auto_PH_Samples>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Auto_PH_Samples>	Numeric	-	Number of position samples for the auto position algorithm. If the number of samples is set to "0", the Auto Position Hold feature is disabled. Position average evaluation is restarted every time the command is executed.

Example:

```
$PSTMPPS,2,14,3600*57
$PSTMPPSOK,2,14*7A
```

NOTE

Auto Position Hold is a feature that the receiver calculates the average position over a period of time until a predefined number of position samples for the auto position algorithm has been reached. Afterwards the receiver automatically enters position hold status and the timing features will be activated. Progress during Auto Position Hold can be monitored with **$PSTMPOSHOLD** message.

2.3.7.23.Setting PPS Data: PPS_IF_TRAIM_CMD

Sets the time error threshold for satellites removal in the TRAIM algorithm. Satellites which have a time error bigger than the TRAIM threshold are not used for time correction. The TRAIM threshold is also used to raise the TRAIM alarm if the time correction error is bigger than TRAIM threshold.

Type:

Set

Synopsis:

```
$PSTMPPS,2,15,<TraimEnabled>,<Alarm>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<TraimEnabled>	Numeric	-	TRAIM status. 0 = TRAIM disabled 1 = TRAIM enabled
<Alarm>	Numeric	Second	TRAIM alarm (scientific notation is allowed).

Example:

```
$PSTMPPS,2,15,1,1.5E-8*34
$PSTMPPSOK,2,15*7B
```

NOTE

If the default value is not given for any parameter in a Set command, you can query it with the corresponding Get command provided that the default setting has not been changed by Set command. If the default setting had been changed by Set command, contact Quectel Technical Support (support@quectel.com) to get the default setting if necessary.

2.3.8. PSTMPPSDATA

Outputs the PPS (Pulse Per Second) data.

Type:

Output

Synopsis:

```
$PSTMPPSDATA,<OnOff>,<PPS_Valid>,<SyncValid>,<OutMode>,<RefTime>,<RefConst>,<PulseDuration>,<PulseDelay>,<GPS_Delay>,<GLONASS_Delay>,<BDS_Delay>,<GalileoDelay>,<InvertedPolarity>,<FixCond>,<SatTh>,<ElevMask>,<ConstMask>,<RefSec>,<FixStatus>,<UsedSats>,<GPS_UTC_DeltaS>,<GPS_UTC_DeltaNs>,<GLONASS_UTC_DeltaNs>,<GalileoUTC_DeltaNs>,<QuantizationError>,<PPS_ClockFreq>,<TcxoClockFreq><BDS_UTC_DeltaTime_S>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<OnOff>	Numeric	-	PPS signal status. 0 = OFF 1 = ON
<PPS_Valid>	Numeric	-	Global PPS validity flag.

Field	Format	Unit	Description
			0 = Invalid 1 = Valid
<SyncValid>	Numeric	-	PPS synchronization validity. 0 = Invalid 1 = Valid
<OutMode>	Numeric	-	PPS generation mode. 0 = PPS always generated 1 = PPS generated on even seconds 2 = PPS generated on odd seconds
<RefTime>	Numeric	-	PPS refence time. 0 = UTC 1 = GPS Time 2 = GLONASS Time 3 = UTC (SU) 4 = GPS Time (from GLONASS time reference) 5 = BDS Time 6 = UTC (NTSC) 7 = Galileo Time 8 = UTC (GST) 9 = GPS Time (from Galileo time reference)
<RefConst>	Numeric	-	Refence constellation. 0 = GPS 1 = GLONASS 3 = Galileo 7 = BDS
<PulseDuration>	Numeric	Second	Pulse duration.
<PulseDelay>	Numeric	Nanosecond	Pulse delay.
<GPS_Delay>	Numeric	Nanosecond	GPS path RF delay.
<GLONASS_Delay>	Numeric	Nanosecond	GLONASS path RF delay.
<BDS_Delay>	Numeric	Nanosecond	BDS path RF delay.
<GalileoDelay>	Numeric	Nanosecond	Galileo path RF delay.
<InvertedPolarity>	Numeric	-	Pulse polarity inversion. 0 = Not inverted 1 = Inverted
<FixCond>	Numeric	-	Selected GNSS fix condition for generating PPS signal. 0 or 1 = No fix

Field	Format	Unit	Description
			2 = 2D fix 3 = 3D fix
<SatTh>	Numeric	-	Selected minimum number of satellites for generating PPS signal.
<ElevMask>	Numeric	-	Selected minimum satellite elevation for time correction.
<ConstMask>	Numeric	-	Satellite constellation bitmask for timing filtering. Bit 0 = GPS Bit 1 = GLONASS Bit 2 = QZSS Bit 3 = Galileo Bit 7 = BDS Bit 11 = GPS L5 Bit 12 = Galileo E5a Bit 14 = BDS B2a Note that the L5 band of QZSS and NavIC is not used in timing filtering.
<RefSec>	Numeric	-	Second to which the reported PPS data is applied. According to configured reference time, it could be a UTC, GPS, GLONASS or BDS time second.
<FixStatus>	Numeric	-	GNSS position fix status when the time has been corrected. 1 = No fix 3 = 3D fix
<UsedSats>	Numeric	-	Used satellites for time correction.
<GPS_UTC_DeltaS>	Numeric	Second	UTC–GPS leap seconds.
<GPS_UTC_DeltaNs>	Numeric	Nanosecond	UTC–GPS delta time.
<GLONASS_UTC_DeltaNs>	Numeric	Nanosecond	UTC–GLONASS delta time.
<GalileoUTC_DeltaNs>	Numeric	Nanosecond	UTC–Galileo delta time.
<QuantizationError>	Numeric	Second	Quantization error.
<PPS_ClockFreq>	Numeric	Hz	PPS clock frequency.
<Tcxo_ClockFreq>	Numeric	Hz	TCXO clock frequency.
<BDS_UTC_DeltaTime_S>	Numeric	Second	UTC–BDS leap seconds.

Example:

```
$PSTMPPSDATA,1,1,1,0,1,0,0.500000,0,350,305,357,841,0,0,0,10,22667,32,3,15,18,0,0,0,5.191e-09,65473971.84,26000005.36,4*24
```

NOTE

1. **<ConstMask>** enables the usage of mixed constellations satellites in the timing filtering, meaning that satellites from one constellation can be used to correct the reference time for other constellations. Benefited from this, the module can provide users with more accurate time information.
2. When the prerequisites that GPS time is selected for generating PPS signal and Bit 1 (or Bit 7) is enabled are met, GLONASS (or BDS) satellites can be used to correct the GPS reference time. Likewise, only the prerequisites that GLONASS time is selected for generating PPS signal and Bit 0 is enabled, GPS satellites can be used to correct the GLONASS reference time.
3. **UTC (SU)** is the Universal Time Coordinated of Russia; it is derived from GLONASS time applying the UTC delta time downloaded from GLONASS satellites.
4. **GPS Time (from GLONASS time reference)** is the GPS time derived from GLONASS time applying the GPS delta time downloaded from GLONASS satellites.
5. If the software is configured to work in GLONASS only mode, **UTC (SU)** is identical to **UTC** and **GPS Time (from GLONASS time reference)** is identical to **GPS Time**.
6. For **GPS Time (from Galileo time reference)**, the reference time is GPS time, but it is corrected using the parameters downloaded by Galileo.
7. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMPPSDATA** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **$PSTMPPSDATA**:
   $PSTMSETPAR,32,3,0,1,0x200000*4E
   $PSTMSAVEPAR*58
   //Disable **$PSTMPPSDATA**:
   $PSTMSETPAR,32,3,0,2,0x200000*4D
   $PSTMSAVEPAR*58
8. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3.9. PSTMPOSHOLD

Outputs the Position Hold status and position.

Type:

Output

Synopsis:

```
$PSTMPOSHOLD,<OnOff>,<Lat>,<N/S>,<Lon>,<E/W>,<Alt>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<OnOff>	Numeric	-	Position Hold status. 0 = Disabled 1 = Enabled
<Lat>	ddmm.mmmmmm	-	Latitude in degrees. dd: Degree mm: Minutes mmmmmm: Decimal fraction of minutes
<N/S>	Character	-	North-south direction. N = North S = South
<Lon>	dddmm.mmmmmm	-	Longitude in degrees. ddd: Degree mm: Minutes mmmmmm: Decimal fraction of minutes
<E/W>	Character	-	East-west direction. E = East W = West
<Alt>	Numeric	Meter	Height above mean sea level.

Example:

```
$PSTMPOSHOLD,0,3149.332411,N,11706.944452,E,071.24*4E
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMPOSHOLD** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **$PSTMPOSHOLD**:
   $PSTMSETPAR,32,3,0,1,0x4000000*78
   $PSTMSAVEPAR*58
   //Disable **$PSTMPOSHOLD**:
   $PSTMSETPAR,32,3,0,2,0x4000000*7B
   $PSTMSAVEPAR*58
2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3.10. PSTMTRAIMSTATUS

Outputs the TRAIM algorithm status.

Type:

Output

Synopsis:

```
$PSTMTRAIMSTATUS,<TraimEnabled>,<TraimSolution>,<Alarm>,<AveError>,<UsedSats>,<Removed Sats>,<RefSecond>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<TraimEnabled>	Numeric	-	TRAIM status. 0 = Disabled 1 = Enabled
<TraimSolution>	Numeric	-	TRAIM algorithm status. 0 = Under Alarm 1 = Over Alarm 2 = Unknown
<Alarm>	Numeric	Nanosecond	Time error threshold.
<AveError>	Numeric	Nanosecond	Average time error.
<UsedSats>	Numeric	-	Number of satellites used for timing correction.
<RemovedSats>	Numeric	-	Number of satellites removed by timing correction.
<RefSecond>	Numeric	-	Second at which the PPS signal is generated based on reported TRAIM status.

Example:

```
$PSTMTRAIMSTATUS,1,0,15,2,7,4,18*5C
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMTRAIMSTATUS** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **$PSTMTRAIMSTATUS**:
   $PSTMSETPAR,32,3,0,1,0x2000000*7E
   $PSTMSAVEPAR*58
   //Disable **$PSTMTRAIMSTATUS**:

$PSTMSETPAR,32,3,0,2,0x2000000*7D
$PSTMSAVEPAR*58

2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3.11. PSTMTRAIMUSED

Outputs the ID of satellite(s) used for timing correction.

Type:

Output

Synopsis:

```
$PSTMTRAIMUSED,<TraimEnabled>,<UsedSats>{,<SatID>}*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<TraimEnabled>	Numeric	-	TRAIM status. 0 = Disabled 1 = Enabled
<UsedSats>	Numeric	-	Number of satellites used for timing correction.
Start of repeat block. Repeat <UsedSats> times.			
<SatID>	Numeric	-	Satellite ID.
End of repeat block.			

Example:

```
$PSTMTRAIMUSED,1,7,87,78,161,871,162,872,511*41
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMTRAIMUSED** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **$PSTMTRAIMUSED**:
   $PSTMSETPAR,32,3,0,1,0x2000000*7E
   $PSTMSAVEPAR*58
   //Disable **$PSTMTRAIMUSED**:
   $PSTMSETPAR,32,3,0,2,0x2000000*7D

$PSTMSAVEPAR*58
2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3.12. PSTMTRAIMRES

Outputs the time error residuals for satellites used for timing correction.

Type:

Output

Synopsis:

```
$PSTMTRAIMRES,<TraimEnabled>,<UsedSats>{,<Resi>}*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<TraimEnabled>	Numeric	-	TRAIM status. 0 = Disabled 1 = Enabled
<UsedSats>	Numeric	-	Number of satellites used for timing correction.
Start of repeat block. Repeat <UsedSats> times.			
<Resi>	Numeric	-	Time error residuals for satellites reported in **$PSTMTRAIMUSED** message. Each residual refers to the satellite in the same message position.
End of repeat block.			

Example:

```
$PSTMTRAIMRES,1,7,4,-24,1,9,3,-2,7*3B
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMTRAIMRES** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **$PSTMTRAIMRES**:
   $PSTMSETPAR,32,3,0,1,0x2000000*7E
   $PSTMSAVEPAR*58
   //Disable **$PSTMTRAIMRES**:
   $PSTMSETPAR,32,3,0,2,0x2000000*7D

$PSTMSAVEPAR*58

2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3.13. PSTMTRAIMREMOVED

Outputs the satellite removed by the timing correction algorithm.

Type:

Output

Synopsis:

```
$PSTMTRAIMREMOVED,<TraimEnabled>,<RemSats>{,<SatID>}*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<TraimEnabled>	Numeric	-	TRAIM status. 0 = Disabled 1 = Enabled
<RemSats>	Numeric	-	Number of removed satellites.
Start of repeat block. Repeat <RemSats> times.			
<SatID>	Numeric	-	Removed satellites ID.
End of repeat block.			

Example:

```
$PSTMTRAIMREMOVED,1,4,69,506,152,153*23
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMTRAIMREMOVED** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **$PSTMTRAIMREMOVED**:
   $PSTMSETPAR,32,3,0,1,0x2000000*7E
   $PSTMSAVEPAR*58
   //Disable **$PSTMTRAIMREMOVED**:
   $PSTMSETPAR,32,3,0,2,0x2000000*7D
   $PSTMSAVEPAR*58

2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3.14. PSTMUTC

Outputs the UTC time, date and time offset parameters.

Type:

Output

Synopsis:

```
$PSTMUTC,<UTC_Time>,<UTC_Date>,<UTC_TimeStamp>,<GPS_UTC_Leap>,<GPS_UTC_Validity>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<UTC_Time>	hhmmss.sss	-	UTC time of fix, example: 160836.000. ".sss" is the fraction of seconds, which assumes non-zero values when the fix rate is higher than 1 Hz.
<UTC_Date>	ddmmyyyy	-	Date. dd: Day of month mm: Month yyyy: Year
<UTC_TimeStamp>	Numeric	Second	UTC time expressed as number of seconds since January 6th, 1980.
<GPS_UTC_Leap>	Numeric	Second	UTC to GPS time offset.
<GPS_UTC_Validity>	Numeric	-	UTC to GPS time offset validity. 0 = Invalid 1 = Read from NVM 2 = Valid

Example:

```
$PSTMUTC,040242.000,25062022,1340164962,18,2*5A
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMUTC** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **$PSTMUTC**:

$PSTMSETPAR,32,6,0,1,0x4*7D
$PSTMSAVEPAR*58
//Disable **$PSTMUTC**:
$PSTMSETPAR,32,6,0,2,0x4*7E
$PSTMSAVEPAR*58

2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3.15. PSTMCPU

Outputs the real-time CPU usage and the CPU speed setting.

Type:

Output

Synopsis:

```
$PSTMCPU,<CPU_Usage>,<PLL_ON_OFF>,<CPU_Speed>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<CPU_Usage>	Numeric	-	CPU usage in percent (%).
<PLL_ON_OFF>	Numeric	-	PLL enabling/disabling status. 0 = PLL disabled 1 = PLL enabled -1 = Not supported
<CPU_Speed>	Numeric	MHz	CPU clock frequency.

Example:

```
$PSTMCPU,51.47,0,261*5C
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMCPU** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
//Enable **$PSTMCPU**:
$PSTMSETPAR,32,3,0,1,0x800000*44
$PSTMSAVEPAR*58
//Disable **$PSTMCPU**:
$PSTMSETPAR,32,3,0,2,0x800000*47

$PSTMSAVEPAR*58
2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3.16. PSTMTG

Outputs time and satellite information.

Type:

Output

Synopsis:

```
$PSTMTG,<WN>,<TOW>,<Reserved>,<CPU_Time>,<TimeValid>,<NCO>,<ConfigStatus>,<ConstMask>,<TimeBestSatType>,<TimeMasterSatType>,<TimeMasterWN>,<TimeMasterTOW>,<TimeMasterValidity>,<TG_AUX_Flags>,<ClockBias>,<MFREQ_ConfigMask>,<LeapSec>,<PPS_Edge>,<MTB_MS>,<MTB_Timestamp>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<WN>	Numeric	-	Week number.
<TOW>	Numeric	Second	Time of week.
<Reserved>	Numeric	-	-
<CPU_Time>	Numeric	-	CPU time.
<TimeValid>	Numeric	-	Valid time. 0 = No time 1 = Time read from flash 2 = TOW time (week number not available) 3 = Time set by user 4 = Time set by user RTC 5 = Approximate RTC time 6 = Accurate RTC time 7 = Approximate time 8 = Accurate time 9 = Position time 10 = Ephemeris time
<NCO>	Numeric	Hz	Estimated receiver clock drift. If clock steering is enabled, this value shall be used in the Doppler calculation (instead of the

Field	Format	Unit	Description
			nominal values).
<ConfigStatus>	Hexadecimal	-	Configuration status: ● Byte 0: Kalman filter configuration. Note that 0 means feature is disabled and 1 means feature is enabled for all bits, unless otherwise specified. Bit 0: Walking mode Bit 1: Stop detection Bit 2: Frequency ramp Bit 3: Velocity estimator model 1 = Multiple model 0 = Single model Bit 4: Velocity estimator filter 1 = Slow 0 = Fast Bit 5: FDE status ● Byte 1: Global configuration. Bit 0–3: Front-end frequency 1 = 48 MHz 0 = 26 MHz Bit 4–6: **$PSTMTG, $PSTMTS** version Bit 7: Clock steering indicator 1 = Steered 0 = No
<ConstMask>	Numeric	-	Bitmask where each bit means a specific constellation is enabled or disabled. Bit 0: GPS Bit 1: GLONASS Bit 2: QZSS Bit 3: Galileo Bit 7: BDS Bit 10: IRNSS L5 Bit 11: GPS L5 Bit 12: Galileo E5a Bit 14: BDS B2a Bit 16: QZSS L5
<TimeBestSatType>	Numeric	-	Selected best time satellite type.
<TimeMasterSatType>	Numeric	-	Master time satellite type.
<TimeMasterWN>	Numeric	-	Master time week number.

Field	Format	Unit	Description
<TimeMasterTOW>	Numeric	Second	Master time TOW.
<TimeMasterValidity>	Numeric	-	Master week number time validity.
<TG_AUX_Flags>	Numeric	-	Additional flags and status. Bit 0: TCXO jump detected Bit 1: Earth rotation correction in satellite position 0 = Legacy 1 = Without earth rotation Bit 2: Spectral inversion 0 = Legacy (BDS inverted) 1 = Spectral inversion internally compensated Bit 3: Clock bias validity 0 = Invalid (legacy) 1 = Valid Bit 4: Indicates presence of **<PPS_Edge>** field Bit 5: Satellite data 0 = Satellite data present 1 = No satellite data in **$PSTMTS** Bit 6: MTB timestamp 0 = No MTB timestamp 1 = Observable MTB timestamp present Bit 7: OSCI32 output status 0 = Output disabled 1 = Normal output Bit 8–31: Reserved
<ClockBias>	Numeric	Meter	Estimated receiver clock bias.
<MFREQ_ConfigMask>	Numeric	-	Multi-frequency configuration mask.
<LeapSec>	Numeric	Second	Leap seconds. 0 = Unknown -1 = Invalid Other values = Valid data
<PPS_Edge>	Numeric	-	PPS edge counter @ 64F0 resolution.
<MTB_MS>	Numeric	Millisecond	Master time-base. Number of milliseconds since time reference.
<MTB_Timestamp>	Numeric	Picosecond	Master time-base. Fixed-point fractional precision in picosecond.

Example:

```
$PSTMTG,2215,537572.00000000,0,3013755261,9,-47509.1666,a000,88205,0,0,2215,537572.00000000,9,254,2.907,-2147399539,18,4016774297,2945875,304162685*5C
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMMTG** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **$PSTMTG**:
   $PSTMSETPAR,32,4,0,1,0x100*7A
   $PSTMSAVEPAR*58
   //Disable **$PSTMTG**:
   $PSTMSETPAR,32,4,0,2,0x100*79
   $PSTMSAVEPAR*58
2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3.17. PSTMTS

Repeatedly outputs GNSS raw data for each tracked satellite and is used for calculating a fix.

Type:

Output

Synopsis:

```
$PSTMTS,<DSP_Dat>,<SatID>,<PSR>,<Freq>,<CP>,<DSP_Flags>,<SatCN0>,<T_Tim>,<CodeNoise>,<PhaseNoise>,<CycleSlipCnt>,<GLONASS_Slot>,<Elev>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<DSP_Dat>	Numeric	-	DSP data available. Bit 0 = 2nd band follows Bit 1 = Main band
<SatID>	Numeric	-	Satellite Identifier.
<PSR>	Numeric	Meter	Pseudo range.
<Freq>	Numeric	-	Satellite tracking frequency offset.
<CP>	Numeric	Cycle	Carrier phase measurement.

Field	Format	Unit	Description
<DSP_Flags>	Numeric	-	DSP bit flags. Bit 0: Parameter status 1 = Available Bit 1: Preamble locked 1 = Locked Bit 2–3: Multi-path indicator 0 = No indication 3 = Strong indication Bit 4: Loss of lock indicator Bit 5–6: Reserved Bit 7: Preamble polarity 0 = Normal 1 = Reserved Bit 8: Half cycle ambiguity 0 = Fixed 1 = Not fixed Bit 9–13:Reserved Bit 14: Main or dual frequency 1 = Main frequency (L1) 0 = Dual frequency (L5) Bit 15: Cycle slip indicator (at current epoch vs previous one) 1 = Occurred Bit 16–21: Reserved Bit 22–24: Code alarm value Bit 25: Spoofing
<SatCN0>	Numeric	dB-Hz	Satellite carrier to noise ratio.
<T_Tim>	Numeric	Second	Track time of satellite.
<CodeNoise>	Numeric	-	Moving average of the code-loop discriminator error in arbitrary units. Typical absolute value < 2000.
<PhaseNoise>	Numeric	-	Moving average of the error used to update the carrier loop in arbitrary units. Typical range: 1–10000.
<CycleSlipCnt>	Numeric	-	Total Cycle Slip Counter.
<GLONASS_Slot>	Numeric	-	GLONASS satellite slot number (1–24), if available; otherwise 0.
<Elev>	Numeric	Degree	Elevation degree.

Example:

```
$PSTMTS,2,72,21950007.875,-47644.02,-117294202.404,21635,42,77210,-167,1241,1,11,27*0C
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMMTS** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR**.
   //Enable **$PSTMTS**:
   $PSTMSETPAR,32,4,0,1,0x200*79
   $PSTMSAVEPAR*58
   //Disable **$PSTMTS**:
   $PSTMSETPAR,32,4,0,2,0x200*7A
   $PSTMSAVEPAR*58
2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

2.3.18. PSTMSBAS

Outputs SBAS satellite data.

Type:

Output

Synopsis:

```
$PSTMSBAS,<Status>,<SatTrk>,<SatID>,<Elev>,<Azim>,<SatCN0>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Status>	Numeric	-	SBAS Status. 0 = No SBAS used 1 = SBAS used
<SatTrk>	Numeric	-	Whether the SBAS satellite is tracked. 0 = SBAS satellite is not tracked. 1 = SBAS satellite is tracked, decoding is ongoing. 2 = SBAS satellite is tracked and decoded. Differential mode is on.
<SatID>	Numeric	-	SBAS satellite ID.
<Elev>	Numeric	Degree	SBAS satellite elevation.
<Azim>	Numeric	Degree	SBAS satellite azimuth.

Field	Format	Unit	Description
<SatCN0>	Numeric	dB-Hz	SBAS satellite signal strength CN0.

Example:

```
$PSTMSBAS,1,2,129,45,141,19*1D
```

NOTE

1. **$PSTMSETPAR** can be used to enable or disable the output of **$PSTMSBAS** as shown below. Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMSETPAR.**
   //Enable **$PSTMSBAS**:
   $PSTMSETPAR,32,3,0,1,0x4000*48
   $PSTMSAVEPAR*58
   //Disable **$PSTMSBAS**:
   $PSTMSETPAR,32,3,0,2,0x4000*4B
   $PSTMSAVEPAR*58
2. After issuing the enable/disable command, the module needs to be restarted for the command to take effect.

3 Appendix A References

Table 5: Terms and Abbreviations

Abbreviation	Description
2D	2 Dimension
3D	3 Dimension
C/N0	Carrier-to-Noise Ratio
COG	Course over Ground
COGM	Course over Ground (in Magnetic North Course Direction)
COGT	Course over Ground (in True North Course Direction)
CPU	Central Processing Unit
DOP	Dilution of Precision
DSP	Digital Signal Processing
FDE	False Detection Exclusion
GGA	Global Positioning System Fix Data
GLL	Geographic Position - Latitude and Longitude
GLONASS	Global Navigation Satellite System (Russia)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GSA	GPS DOP and Active Satellites
GST	Galileo System Time
GSV	GNSS Satellites in View
HDOP	Horizontal Dilution of Precision

Abbreviation	Description
IRNSS	Indian Regional Navigation Satellite System
MTB	Master Time-Base
NavIC	Navigation with Indian Constellation
NCO	Numerically Controlled Oscillator
NMEA	NMEA (National Marine Electronics Association) 0183 Interface Standard
NTSC	National Time Service Center
NVM	Non-Volatile Memory
PDOP	Position Dilution of Precision
PLL	Phase Locked Loop
PPS	Pulse Per Second
QZSS	Quasi-Zenith Satellite System
RF	Radio Frequency
RMC	Recommended Minimum Specific GNSS Data
RTC	Real-Time Clock
SBAS	Satellite-Based Augmentation System
SNR	Signal to Noise Ratio
SOG	Speed over Ground
SPS	Standard Positioning Service
TCXO	Temperature Compensated Crystal Oscillator
TOW	Time of Week
TRAIM	Time Receiver Autonomous Integrity Monitoring
UTC	Coordinated Universal Time
VDOP	Vertical Dilution of Precision
VTG	Course Over Ground & Ground Speed

Abbreviation	Description
ZDA	Time & Date

4 Appendix B GNSS Satellites (NMEA) Numbering

Table 6: GNSS Satellite (NMEA) Numbering

GNSS Type	System ID	Satellite ID	Signal ID	Signal Channel
GPS	1	01–99 01–32 are reserved for GPS 33–64 are reserved for SBAS 65–99 are undefined	1 7	L1 C/A L5-I
GLONASS	2	01–99 33–64 are reserved for SBAS 65–99 are reserved for GLONASS	1	L1 C/A
Galileo	3	01–99 01–36 are reserved for Galileo 37–64 are reserved for SBAS 65–99 are undefined	1 7	E5a E1
BDS	4	01–99 01–64 are reserved for BDS 65–99 are undefined	1 5	B1I B2a
QZSS	5	01–99 01–10 are reserved for QZSS 55–63 are reserved for SBAS 64–99 are undefined	1 7	L1 C/A L5-I
IRNSS	6	01–99 01–15 are reserved for IRNSS 33–64 are reserved for SBAS 16–32 and 65–99 are undefined	7	L5

NOTE

Table above is only applicable to standard NMEA messages.

5 Appendix C Other Basic Commands

5.1. Query Software Version

```
$PSTMGETPAR,1,63*3B
$PSTMGETPAR,1,P63,0,LC99TIANR01A01V02*01
```

NOTE

Contact Quectel Technical Support (support@quectel.com) for more details about **$PSTMGETPAR**.

5.2. Change Baud Rate

The following NMEA commands are used to change the baud rate:

Synopsis:

```
$PSTMSETPAR,1,15,0,0,<Baudrate>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Baudrate>	Hexadecimal	bps	0xA = 115200 0xB = 230400 0xC = 460800 0xD = 921600

Example:

```
$PSTMSETPAR,1,15,0,0,0xA*0B
$PSTMSETPAROK,P01,L15,F00,0000000a*11
$PSTMSAVEPAR*58
```

NOTE

After issuing all commands in the example of changing baud rate, the module must be restarted for the command to take effect.