LC29H&LC79H Series
GNSS Protocol Specification

GNSS Module Series

Version: 1.1

Date: 2022-08-26

Status: Released

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About the Document

Document Information	
Title	**LC29H&LC79H Series GNSS Protocol Specification**
Subtitle	GNSS Module Series
Document Type	GNSS Protocol Specification
Document Status	Released

Revision History

Version	Date	Description
-	2021-03-18	Creation of the document
1.0	2021-08-19	First official release
1.1	2022-08-26	Numerous changes were made to this document. It should be read in its entirety.

Contents

Table Index

1 Introduction

Quectel LC29H and LC79H series GNSS modules support GPS, GLONASS, Galileo, BDS and QZSS constellations. Concurrent tracking of GPS L1 C/A, GLONASS L1, Galileo E1, BDS B1I, QZSS L1 C/A, GPS L5, Galileo E5a, BDS B2a and QZSS L5 frequency bands [1] provides fast and accurate acquisition and makes these modules ideal solutions for positioning and navigation in various vertical markets.

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

This document is applicable to the following Quectel GNSS modules and variants:

Table 1: Applicable Modules and Variants Supported

Module	Variant
LC29H series	LC29H (AA)
	LC29H (BA)
	LC29H (CA)
	LC29H (DA)
	LC29H (EA)*
LC79H series	LC79H (AL)
	LC79H (BA)

> **NOTE**
>
> 1. Quectel assumes no responsibility if commands other than the ones listed herein are used.
> 2. [1] LC79H (BA) supports concurrent tracking of GPS L1 C/A, GLONASS L1, Galileo E1, BDS B1I and QZSS L1 C/A.

1.1. Special Mark

Table 2: Special Mark

Mark	Definition
*	Unless otherwise specified, when an asterisk (*) is used after a function, feature, interface, pin name, or argument, it indicates that the function, feature, interface, pin, or argument is under development and currently not supported; and the asterisk (*) after a model indicates that the model sample is currently unavailable.

2 NMEA Protocol

2.1. Structure of NMEA Protocol Messages
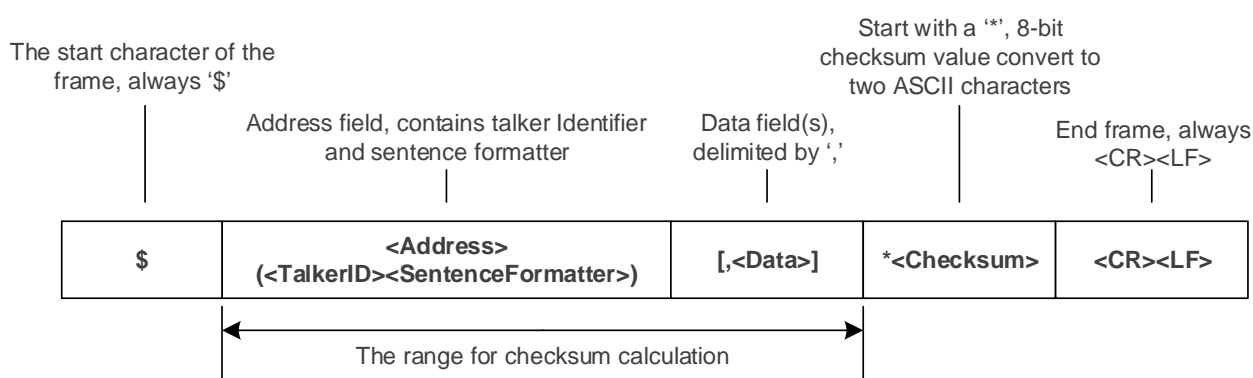
Figure 1: Structure of NMEA Protocol Messages

Table 3: Structure of NMEA Protocol Messages

Field	Description
$	Start of the sentence (Hex 0x24).
<Address>	**In Standard Messages:** In NMEA 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 NMEA 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 comma (**,**).
	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 (NMEA 0183 V3.01)	TalkerID (NMEA 0183 V4.10)
GPS	GP	GP
GLONASS	GL	GL
Galileo	GA	GA
BDS	GB	GB
QZSS	GP	GP
Combination of Multiple Satellite Systems	GN	GN

NOTE

The TalkerID of QZSS in NMEA 0183 V4.10 is GQ for LC29H (BA, CA, DA, EA*).

2.2. Standard Messages

This chapter explains the NMEA 0183 V3.01 and NMEA 0183 V4.10 standard messages supported by the 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:

Format for NMEA 0183 V3.01:

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

Format for NMEA 0183 V4.10 (default):

$<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
$	-	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. See *Table 4: NMEA Talker ID*.
RMC	String, 3 characters	-	RMC	Recommended Minimum Specific GNSS Data.
<UTC>	hhmmss.sss	-	093316.000	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	-	3149.332558	Latitude. dd: Degrees (00–90) mm: Minutes (00–59) mmmmmm: Decimal fraction of minutes (variable length) Note that this field is empty in case of an invalid value.
<N/S>	Character	-	N	Latitude direction. N = North S = South Note that this field is empty in case of an invalid value.
<Lon>	dddmm.mmmmmm	-	11706.912570	Longitude. ddd: Degrees (000–180) mm: Minutes (00–59) mmmmmm: Decimal fraction of

Field	Format	Unit	Example	Description
				minutes Note that this field is empty in case of an invalid value.
<E/W>	Character	-	E	Longitude direction. E = East W = West Note that this field is empty in case of an invalid value.
<SOG>	Numeric	Knot	0.00	Speed over ground. Variable length. Note that this field is empty in case of an invalid value.
<COG>	Numeric	Degree	237.67	Course over ground. Variable length. Maximum value: 359.99. Note that this field is empty in case of an invalid value.
<Date>	ddmmyy	-	140122	Date. dd: Day of month mm: Month yy: Year
<MagVar>	-	-	-	Magnetic variation. Not supported.
<MagVarDir>	-	-	-	The direction of magnetic variation. Not supported.
<ModeInd>	Character	-	A	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). E = Estimated (dead reckoning) mode. F = Float RTK. Satellite system used in RTK mode with floating integers. M = Manual input mode. N = No fix. Satellite system not used in position fix, or fix not valid. R = Real Time Kinematic (RTK). Satellite system used in RTK mode with fixed integers.

Field	Format	Unit	Example	Description
<NavStatus>	Character	-	V	Navigational status. Not supported. Always "V" (Invalid. The device cannot provide navigational status indication). Please note that this parameter is only available in NMEA 0183 V4.10 and above.
<Checksum>	Hexadecimal	-	0B	Checksum
<CR><LF>	Character	-	-	Carriage return and line feed.

Example for NMEA 0183 V3.01:

$GNRMC,093423.000,A,3149.332006,N,11706.913200,E,0.01,0.00,140122,,,A*79

Example for NMEA 0183 V4.10:

$GNRMC,093316.000,A,3149.332558,N,11706.912570,E,0.00,237.67,140122,,,A,V*0B

2.2.2. GGA

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

Type:

Output

Synopsis:

Format for NMEA 0183 V3.01:

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

Format for NMEA 0183 V4.10 (default):

$<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
$	-	-	$	Each NMEA message starts with **$**.

Field	Format	Unit	Example	Description
<TalkerID>	String, 2 characters	-	GN	Talker identifier. See *Table 4: NMEA Talker ID*.
GGA	String, 3 characters	-	GGA	Global Positioning System Fix Data.
<UTC>	hhmmss.sss	-	093316.000	Position fix UTC. hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Lat>	ddmm.mmmmmm	-	3149.332558	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	Latitude direction. N = North S = South Note that this field is empty in case of an invalid value.
<Lon>	dddmm.mmmmmm	-	11706.912570	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	Longitude direction. E = East W = West Note that this field is empty in case of an invalid value.
<Quality>	Numeric, 1 digit	-	1	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 4 = Real Time Kinematic (RTK) System used in RTK mode with

Field	Format	Unit	Example	Description
				fixed integers 5 = Float RTK. Satellite system used in RTK mode, floating integers. 6 = Estimated (dead reckoning) mode
<NumSatUsed> [1]	Numeric, 2 digits	-	28	Number of satellites in use.
<HDOP>	Numeric	-	0.67	Horizontal dilution of precision. Variable length. Note that this field is empty in case of an invalid value.
<Alt>	Numeric	Meter	54.481	Altitude above mean-sea-level (geoid). Variable length. Note that this field is empty in case of an invalid value.
M	Character	-	M	Unit of <Alt>. "M" = meter.
<Sep>	Numeric	Meter	-0.337	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). Variable length. 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	-	*5D	Checksum
<CR><LF>	Character	-	-	Carriage return and line feed.

Example for NMEA 0183 V3.01:

$GNGGA,093423.000,3149.332006,N,11706.913200,E,1,22,0.75,45.346,M,-0.337,M,,*56

Example for NMEA 0183 V4.10:

$GNGGA,093316.000,3149.332558,N,11706.912570,E,1,28,0.67,54.481,M,-0.337,M,,*5D

> **NOTE**
>
> 1. The NMEA 0183 specification indicates that **GGA** messages are GPS specific. However, when the receiver is configured for multi-constellations, the content of **GGA** messages 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.

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 it 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:

Format for NMEA 0183 V3.01:

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

Format for NMEA 0183 V4.10 (default):

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

Parameter:

Field	Format	Unit	Example	Description
$	-	-	$	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.
<TotalNumSen>	Numeric	-	3	Total number of sentences. Range: 1–9.
<SenNum>	Numeric	-	1	Sentence number. Range: 1–**<TotalNumSen>**.

<TotalNumSat>	Numeric	-	11	Total number of satellites in view.
Start of repeat block. Repeat times: 1–4.				
<SatID>	Numeric	-	08	Satellite ID. See *Table 8: GNSS Numbering*.
<SatElev>	Numeric	Degree	76	Satellite elevation. Range: 00–90.
<SatAz>	Numeric	Degree	353	Satellite azimuth, with true north as the reference plane. Range: 000–359.
<SatCN0>	Numeric	dB-Hz	46	Satellite C/N$_0$. Range 00–99. Null when not tracking.
End of repeat block.				
<SignalID>	Numeric	-	1	GNSS signal ID. See *Table 8: GNSS Numbering*. Please note that this parameter is only available in NMEA V4.10 or higher.
<Checksum>	Hexadecimal	-	*5C	Checksum
<CR><LF>	Character	-	-	Carriage return and line feed.

Example for NMEA 0183 V3.01:

```
$GPGSV,3,1,12,08,75,355,46,195,68,113,44,194,64,081,42,199,51,162,36*47
$GPGSV,3,2,12,27,45,037,44,21,44,156,43,16,30,072,39,30,18,317,38*72
$GPGSV,3,3,12,03,,,19,04,,,37,09,,,40,07,,,43*7C
$GPGSV,2,1,08,08,75,355,38,195,68,113,38,194,64,081,38,199,51,162,38*4C
$GPGSV,2,2,08,27,45,037,38,30,18,317,31,04,,,29,09,,,32*70
$GLGSV,1,1,04,86,63,182,32,85,59,041,42,76,36,333,41,66,07,278,*6A
$GAGSV,1,1,00*68
$GAGSV,1,1,00*68
$GBGSV,3,1,12,29,82,083,41,07,64,319,41,09,54,220,40,36,47,113,45*66
$GBGSV,3,2,12,06,45,201,39,39,34,192,40,01,,,38,30,,,40*69
$GBGSV,3,3,12,16,,,41,05,,,31,02,,,36,13,,,35*6E
$GBGSV,1,1,04,29,82,083,36,36,47,113,36,39,34,192,32,30,,,28*5F
```

Example for NMEA 0183 V4.10:

```
$GPGSV,3,1,11,08,76,353,46,195,68,113,44,194,64,080,42,199,51,162,37,1*5C
$GPGSV,3,2,11,27,45,037,43,07,44,315,43,21,43,156,44,16,30,071,39,1*6B
$GPGSV,3,3,11,09,28,244,40,04,20,206,37,30,,,38,1*6F
$GPGSV,2,1,08,08,76,353,35,195,68,113,34,194,64,080,33,199,51,162,34,8*5A
$GPGSV,2,2,08,27,45,037,33,09,28,244,28,04,20,206,26,30,,,27,8*5E
$GLGSV,1,1,03,85,59,042,41,76,35,333,40,66,07,279,32,1*43
$GAGSV,1,1,00,7*73
```

$GAGSV,1,1,00,1*75
$GBGSV,4,1,13,07,64,319,41,40,61,345,43,36,47,113,43,06,45,201,40,1*7E
$GBGSV,4,2,13,16,41,195,41,35,40,213,45,26,17,313,39,56,,,19,1*49
$GBGSV,4,3,13,57,,,37,01,,,39,02,,,36,60,,,40,1*7B
$GBGSV,4,4,13,03,,,40,1*73
$GBGSV,1,1,04,40,61,345,32,36,47,113,32,35,40,213,29,26,17,313,23,5*79

NOTE

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.

2.2.4. 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:

Format for NMEA 0183 V3.01:

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

Format for NMEA 0183 V4.10 (default):

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

Parameter:

Field	Format	Unit	Example	Description
$	-	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. See *Table 4: NMEA Talker ID*.
GSA	String, 3 characters	-	GSA	GNSS DOP and Active Satellites.
<Mode>	Character	-	A	Auto selection of 2D or 3D fix: M = Manual, forced to operate in 2D or 3D mode. A = Automatic, allowed to automatically

				switch to 2D/3D.
<FixMode>	Numeric	-	3	Fix mode. 1 = Fix not available 2 = 2D 3 = 3D
Start of repeat block. Repeat times: 12.				
<SatID>	Numeric	-	08	ID numbers of satellites used in solution. See *Table 8: GNSS Numbering*. Note that this field is empty in case of an invalid value.
End of repeat block.				
<PDOP>	Numeric	-	1.03	Position dilution of precision. Maximum value: 99.00. Note that this field is empty in case of an invalid value.
<HDOP>	Numeric	-	0.67	Horizontal dilution of precision. Maximum value: 99.00. Note that this field is empty in case of an invalid value.
<VDOP>	Numeric	-	0.78	Vertical dilution of precision. Maximum value: 99.00. Note that this field is empty in case of an invalid value.
<SystemID>	Numeric	-	1	GNSS system ID. See *Table 8: GNSS Numbering*. Please note that this parameter is only available in NMEA 4.10 or higher.
<Checksum>	Hexadecimal	-	*3E	Checksum
<CR><LF>	Character	-	-	Carriage return and line feed.

Example for NMEA 0183 V3.01:

```
$GPGSA,A,3,08,195,194,199,27,21,16,30,,,,,1.09,0.75,0.79*3C
$GLGSA,A,3,86,85,76,,,,,,,,,,1.09,0.75,0.79*18
$GAGSA,A,3,,,,,,,,,,,,,1.09,0.75,0.79*17
$GBGSA,A,3,07,09,36,06,39,,,,,,,,1.09,0.75,0.79*13
```

Example for NMEA 0183 V4.10:

```
$GNGSA,A,3,08,195,194,199,27,07,21,16,09,04,,,1.03,0.67,0.78,1*3E
$GNGSA,A,3,85,76,66,,,,,,,,,,1.03,0.67,0.78,2*02
```

$GNGSA,A,3,,,,,,,,,,,,1.03,0.67,0.78,3*0F
$GNGSA,A,3,07,40,36,06,16,35,26,,,,,1.03,0.67,0.78,4*0D

NOTE

If less than 12 satellites are used for navigation, the remaining **<SatID>** fields are left empty. If more than 12 satellites are used, multiple **GSA** sentences containing all satellite IDs will be output.

2.2.5. VTG

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

Type:

Output

Synopsis:

Format for NMEA 0183 V3.01:

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

Format for NMEA 0183 V4.10 (default):

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

Parameter:

Field	Format	Unit	Example	Description
$	-	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. See *Table 4: NMEA Talker ID*.
VTG	String, 3 characters	-	VTG	Course Over Ground & Ground Speed.
<COGT>	Numeric	Degrees	237.67	Course over ground, in true north course direction. Note that this field is empty in case of an invalid value.
T	Character	-	T	Course over ground. (degrees true, fixed field)
<COGM>	Numeric	Degrees	-	Course over ground (magnetic). Not supported.
M	Character	-	M	Course over ground. (degrees magnetic, fixed field)

Field	Format	Unit	Example	Description
<SOGN>	Numeric	Knots	0.00	Speed over ground in knots. Variable length. Note that this field is empty in case of an invalid value.
N	Character	-	N	Speed over ground (knots, fixed field).
<SOGK>	Numeric	km/h	0.00	Speed over ground in kilometers per hour. Variable length. Note that this field is empty in case of an invalid value.
K	Character	-	K	Speed over ground. (kilometers per hour, fixed field).
<ModeInd>	Character	-	A	Mode indicator: A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode F = Float RTK. Satellite system used in real time kinematic mode with floating integers. M = Manual input mode N = No fix. Satellite system not used in position fix, or fix not valid.
<Checksum>	Hexadecimal	-	*24	Checksum
<CR><LF>	Character	-	-	Carriage return and line feed.

Example for NMEA 0183 V3.01:

$GNVTG,0.00,T,,M,0.01,N,0.02,K,A*20

Example for NMEA 0183 V4.10:

$GNVTG,237.67,T,,M,0.00,N,0.00,K,A*24

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:

Format for NMEA 0183 V3.01:

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

Format for NMEA 0183 V4.10 (default):

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

Parameter:

Field	Format	Unit	Example	Description
$	-	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. See *Table 4: NMEA Talker ID*.
GLL	String, 3 characters	-	GLL	Geographic Position – Latitude/Longitude.
<Lat>	ddmm.mmmmmm	-	3149.332558	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	Latitude direction. N = North S = South Note that this field is empty in case of an invalid value.
<Lon>	dddmm.mmmmmm	-	11706.912570	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	Longitude direction. E = East W = West Note that this field is empty in case of an invalid value.
<UTC>	hhmmss.sss	-	093316.000	Position fix UTC. hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59)

Field	Format	Unit	Example	Description
				sss: Decimal fraction of seconds
<Status>	Character	-	A	Positioning system status. A = Data valid V = Data not valid
<ModeInd>	Character	-	A	Mode indicator. A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode F = Float RTK. Satellite system used in real time kinematic mode with floating integers M = Manual input mode N = No fix. Satellite system not used in position fix, or fix not valid.
<Checksum>	Hexadecimal	-	*45	Checksum
<CR><LF>	Character	-	-	Carriage return and line feed.

Example for NMEA 0183 V3.01:

$GNGLL,3149.332006,N,11706.913200,E,093423.000,A,A*4B

Example for NMEA 0183 V4.10:

$GNGLL,3149.332558,N,11706.912570,E,093316.000,A,A*45

2.2.7. ZDA

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

Type:

Output

Synopsis:

Format for NMEA 0183 V3.01:

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

Format for NMEA 0183 V4.10 (default):

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

Parameter:

Field	Format	Unit	Example	Description
$	-	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. See *Table 4: NMEA Talker ID*.
ZDA	String, 3 characters	-	ZDA	Time & Date. UTC, day, month, year and local time zone.
<UTC>	hhmmss.sss	-	093316.000	Position fix UTC. hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Day>	Numeric	-	14	Day of month. Range: 01–31.
<Month>	Numeric	-	01	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	-	*40	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example for NMEA 0183 V3.01:

$GNZDA,093423.000,14,01,2022,,*41

Example for NMEA 0183 V4.10:

$GNZDA,093316.000,14,01,2022,,*40

NOTE

ZDA is not supported for LC29H (BA, CA, DA, EA*).

2.2.8. GRS

GNSS range residuals. This sentence supports Receiver Autonomous Integrity Monitoring (RAIM). Range

residuals can be computed in two ways for this process. The basic measurement integration cycle of most navigation filters generates a set of residuals and uses these to update the position state of the receiver.

Type:

Output

Synopsis:

Format for NMEA 0183 V3.01:

$<TalkerID>GRS,<UTC>,<Mode>{,<Resi>}*<Checksum><CR><LF>

Format for NMEA 0183 V4.10 (default):

$<TalkerID>GRS,<UTC>,<Mode>{,<Resi>},<SystemID>,<SignalID>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Example	Description
$	-	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. See *Table 4: NMEA Talker ID*.
GRS	String, 3 characters	-	GRS	GNSS range residuals.
<UTC>	hhmmss.sss	-	061549.000	Position fix UTC. hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<Mode>	Numeric	-	1	Computation method used. 0 = Residuals were used to calculate the position given in the matching GGA or GNS sentence. 1 = Residuals were recomputed after the GGA or GNS position was computed.
Start of repeat block. Repeat time: 12.				
<Resi>	Numeric	m	6.2	Range residuals for SVs used in navigation. Range: -999 to 999. Note that this field is empty in case of an invalid value.
End of repeat block.				
<SystemID>	Numeric	-	1	GNSS system ID.

Field	Format	Unit	Example	Description
				See *Table 8: GNSS Numbering*. Please note that this parameter is only available in NMEA 0183 V4.10 or higher.
<SignalID>	Numeric	-	1	GNSS signal ID. See *Table 8: GNSS Numbering*. Please note that this parameter is only available in NMEA 0183 V4.10 or higher.
<Checksum>	Hexadecimal	-	*6F	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example for NMEA 0183 V3.01:

```
$GNGRS,072520.000,1,-4.5,-133,-6.9,2.3,-4.3,-144,-4.9,-4.4,-2.2,-131,-76.7,-3.3*61
$GNGRS,072520.000,1,-4.5,,,,-4.3,,,-4.4,,,,-3.3*64
$GNGRS,072520.000,1,-2.3,0.3,-2.0,,,,,,,,*4C
$GNGRS,072520.000,1,-3.9,-4.6,3.0,-15.1,0.7,,,,,,*58
$GNGRS,072520.000,1,-3.9,-4.6,3.0,-15.1,0.7,,,,,,*58
$GNGRS,072520.000,1,-4.1,0.3,-0.2,6.1,-4.3,3.8,-0.2,-10.3,-6.6,1.8,12.2,-15.5*79
$GNGRS,072520.000,1,6.5,-6.3,1.9,-4.1,-141,0.5,,,,,*5B
$GNGRS,072520.000,1,-4.1,0.3,-0.2,,,,-0.2,,-6.6,,12.2,*55
$GNGRS,072520.000,1,,,1.9,,,0.5,,,,,*6F
```

Example for NMEA 0183 V4.10:

```
$GNGRS,061549.000,1,6.2,-7.5,0.4,-0.7,0.8,-8.6,4.0,4.1,7.7,7.2,2.0,-6.3,1,1*6F
$GNGRS,061549.000,1,-4.8,5.2,-82.4,1.7,,,,,,,,,1,1*5C
$GNGRS,061549.000,1,6.2,-7.5,,,0.8,-8.6,,4.1,,,,,1,8*4D
$GNGRS,061549.000,1,-4.8,5.2,,,,,,,,,,,1,8*40
$GNGRS,061549.000,1,-2.5,11.2,-16.4,-1.5,,,,,,,,,2,1*43
$GNGRS,061549.000,1,-9.8,8.0,8.0,74.7,-16.2,-6.2,-101,,,,,,3,7*5F
$GNGRS,061549.000,1,-9.8,8.0,8.0,74.7,-16.2,-6.2,,,,,,,3,1*44
$GNGRS,061549.000,1,-0.6,-2.0,-6.4,1.0,12.7,7.8,-18.0,3.3,-5.3,16.5,-7.6,-91.2,4,1*4D
$GNGRS,061549.000,1,-3.8,5.9,-0.4,1.1,-107,-5.2,,,,,,,4,1*76
$GNGRS,061549.000,1,-0.6,-2.0,-6.4,,,,3.3,,,,,4,4*44
$GNGRS,061549.000,1,-3.8,5.9,-0.4,1.1,,,,,,,,,4,4*6C
```

NOTE

1. **GRS** is not supported for LC29H (BA, CA, DA, EA*).
2. The SV order matches the order of the satellite ID numbers in **GSA** sentence. If the range residual exceeds +99.9 meters, then the decimal part is dropped, resulting in an integer. The maximum value

for **<Resi>** is +999.

3. If less than 12 satellites are used for navigation, the remaining **<Resi>**s are left empty. If more than 12 satellites are used, multiple **GRS** sentences containing all **<Resi>**s will be output.

2.2.9. GST

GNSS Pseudorange Error Statistics. This sentence supports Receiver Autonomous Integrity Monitoring (RAIM). Pseudorange measurement error statistics can be translated in the position domain in order to give statistical measures of the quality of the position solution.

Type:

Output

Synopsis:

Format for NMEA 0183 V3.01:

$<TalkerID>GST,<UTC>,<RMS_D>,<MajorD>,<MinorD>,<Orient>,<LatD>,<LonD>,<AltD>*<Checksum><CR><LF>

Format for NMEA 0183 V4.10 (default):

$<TalkerID>GST,<UTC>,<RMS_D>,<MajorD>,<MinorD>,<Orient>,<LatD>,<LonD>,<AltD>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Example	Description
$	-	-	$	Each NMEA message starts with **$**.
<TalkerID>	String, 2 characters	-	GN	Talker identifier. See *Table 4: NMEA Talker ID*.
GST	String, 3 characters	-	GST	GNSS pseudorange error statistics.
<UTC>	hhmmss.sss	-	061549.000	Position fix UTC. hh: Hours (00–23) mm: Minutes (00–59) ss: Seconds (00–59) sss: Decimal fraction of seconds
<RMS_D>	Numeric	Meter	8.2	RMS value of the standard deviation of the range inputs to the navigation process.
<MajorD>	Numeric	Meter	2.6	Standard deviation of semi-major axis of error ellipse.

Field	Format	Unit	Example	Description
<MinorD>	Numeric	Meter	2.4	Standard deviation of semi-minor axis of error ellipse.
<Orient>	Numeric	Degree	74.7	Orientation of semi-major axis of error ellipse.
<LatD>	Numeric	Meter	2.4	Standard deviation of latitude error.
<LonD>	Numeric	Meter	2.6	Standard deviation of longitude error.
<AltD>	Numeric	Meter	8.5	Standard deviation of altitude error.
<Checksum>	Hexadecimal	-	*45	Checksum.
<CR><LF>	Character	-	-	Carriage return and line feed.

Example for NMEA 0183 V3.01:

$GNGST,072520.000,6.5,2.9,2.3,98.2,2.3,2.9,11.2*79

Example for NMEA 0183 V4.10:

$GNGST,061549.000,8.2,2.6,2.4,74.7,2.4,2.6,8.5*45

NOTE

GST is not supported for LC29H (BA, CA, DA, EA*).

2.3. PAIR Messages

This chapter explains PAIR messages (proprietary NMEA messages defined by the chipset supplier). "**P**" means proprietary message, and "**AIR**" means the command defined by the chipset supplier.

2.3.1. Packet Type: 001 PAIR_ACK

Acknowledges a PAIR command. An acknowledgement packet **$PAIR001** is returned to inform the sender that the receiver has received the packet.

Type:

Output

Synopsis:

$PAIR001,<CommandID>,<Result>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<CommandID>	Numeric	-	Type of command/packet to be acknowledged.
<Result>	Numeric	-	0 = Command has been successfully sent. 1 = Command is being processed. Please wait for the result. 2 = Command sending failed. 3 = <CommandID> is not supported 4 = Command parameter error. Out of range/Some parameters were lost/Checksum error. 5 = MNL service is busy. You can try again soon.

Example:

$PAIR001,004,0*3F

2.3.2. Packet Type: 002 PAIR_GNSS_SUBSYS_POWER_ON

Powers on the GNSS system, including DSP, RF, PE and clock.

Type:

Command

Synopsis:

$PAIR002*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message.

Example:

$PAIR002*38
$PAIR001,002,1*38
$PAIR001,002,0*39

2.3.3. Packet Type: 003 PAIR_GNSS_SUBSYS_POWER_OFF

Powers off the GNSS system, including DSP, RF, PE and clock.

Type:

Command

Synopsis:

$PAIR003*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message.

Example:

$PAIR003*39
$PAIR001,003,1*39
$PAIR001,003,0*38

NOTE

1. If the module receives **$PAIR382,1*2E** before **$PAIR003*39**, and **$PAIR001,382,0*32** is returned correctly, then it can still receive other commands. Otherwise, any other commands will not be received.
2. For software versions supporting I2C communication, the module can receive commands after sending **$PAIR003*39**.

2.3.4. Packet Type: 004 PAIR_GNSS_SUBSYS_HOT_START

Performs a hot start (uses all available data in the NVRAM). Normally a hot start means that the GNSS module has been powered down for less than 2 hours (RTC must be alive) with its ephemeris still valid. Therefore, there is no need to download an ephemeris again upon a hot start, thus making this startup method the fastest.

Type:

Command

Synopsis:

$PAIR004*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message.

Example:

$PAIR004*3E
$PAIR001,004,0*3F

2.3.5. Packet Type: 005 PAIR_GNSS_SUBSYS_WARM_START

Performs a warm start. A warm start means that the GNSS module remembers only rough time, position, and almanac data, and thus needs to download an ephemeris before it can fix a position.

Type:

Command

Synopsis:

$PAIR005*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message.

Example:

$PAIR005*3F
$PAIR001,005,0*3E

2.3.6. Packet Type: 006 PAIR_GNSS_SUBSYS_COLD_START

Performs a cold start, which means that there is no location information stored in the receiver, including time, position, and almanacs and ephemeris data.

Type:

Command

Synopsis:

$PAIR006*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message.

Example:

$PAIR006*3C
$PAIR001,006,0*3D

2.3.7. Packet Type: 007 PAIR_GNSS_SUBSYS_FULL_COLD_START

Performs a cold start and clears system and user configurations at the start, i.e., resets the module to its factory settings. Upon a full cold start, the module loses all data on the previous position. Therefore, it needs to search over the full frequency spectrum for all visible satellites before it can fix a position.

Type:

Command

Synopsis:

$PAIR007*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message.

Example:

$PAIR007*3D
$PAIR001,007,0*3C

2.3.8. Packet Type: 010 PAIR_REQUEST_AIDING

Notifies the expiration of GNSS aiding data stored in the module. This message is automatically output when the module powers on.

Type:

Output

Synopsis:

$PAIR010,<Type>,<GNSS_System>,<WN>,<TOW>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Type>	Numeric	-	Type of data to be updated. 0 = EPO data 1 = Time 2 = Location
<GNSS_System>	Numeric	**-**	Type of required GNSS data. 0 = GPS data 1 = GLONASS data 2 = Galileo data 3 = BDS data 4 = QZSS data
<WN>	Numeric	Week	Week Number (accommodating roll-over).
<TOW>	Numeric	Second	Time of Week.

Example:

$PAIR010,0,0,2044,369413*33

> **NOTE**
>
> The GNSS system sends this message automatically. Do not send **$PAIR010** manually.

2.3.9. Packet Type: 050 PAIR_COMMON_SET_FIX_RATE

Sets position fix interval.

Type:

Set

Synopsis:

$PAIR050,<Time>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Time>	Numeric	Millisecond	Position fix interval. Range: 100–1000. Default value: 1000.

Result:

Returns **$PAIR001** message.

Example:

$PAIR050,1000*12
$PAIR001,050,0*3E

NOTE

1. If the default value is not given for any parameter in a Set command, you can query it with the corresponding Get command when the default setting has not been changed. If the default setting had been changed with the Set command, contact Quectel Technical Support (support@quectel.com) for the default setting.
2. If the set frequency is greater than 1 Hz, only **RMC** and **GGA** massages will be output at the set frequency, whereas **VTG** and **GLL** messages will not be output. Other NMEA messages are kept output at 1 Hz.
3. For LC29H (BA) with LC29HBANR01A01S_CSA4 or higher software versions, LC29H (CA) with LC29HCANR01A01S_DSA4 or higher software versions, as well as LC29H (EA*****) modules:
   1) **<Time>** can be set only to 100 or 1000.
   2) **$PAIR050** will take effect after you reboot the module.
4. **$PAIR050** is not supported for LC29H (BA) with LC29HBANR01A01S_CSA2 or higher software versions, LC29H (CA) with LC29HCANR01A01S_DSA2 or LC29HCANR01A01S_DTB2 or their higher versions, as well as LC29H (DA) modules.

2.3.10. Packet Type: 051 PAIR_COMMON_GET_FIX_RATE

Gets the position fix interval.

Type:

Get

Synopsis:

$PAIR051*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR051,<Time>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<Time>	Numeric	Millisecond	Position fix interval. Range: 100–1000. Default value: 1000.

Example:

$PAIR051*3E
$PAIR001,051,0*3F
$PAIR051,1000*13

> **NOTE**
>
> This command is not supported for LC29H (BA) with LC29HBANR01A01S_CSA2 or higher software versions, LC29H (CA) with LC29HCANR01A01S_DSA2 or LC29HCANR01A01S_DTB2 or their higher versions, as well as LC29H (DA) modules.

2.3.11. Packet Type: 058 PAIR_COMMON_SET_MIN_SNR

Sets the minimum SNR of satellites in use. If the minimum SNR threshold is set, the module will not use the satellites with SNR below the threshold.

Type:

Set

Synopsis:

$PAIR058,<MIN_SNR>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<MIN_SNR>	Numeric	dB	Minimum SNR threshold of satellites in use. Range: 9–37. Default value: 9

Result:

Returns **$PAIR001** message.

Example:

$PAIR058,15*1F
$PAIR001,058,0*36

> **NOTE**
>
> This command is not supported for LC29H (BA, CA, DA, EA*).

2.3.12. Packet Type: 059 PAIR_COMMON_GET_MIN_SNR

Gets the minimum SNR of satellites in use.

Type:

Get

Synopsis:

$PAIR059*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR059,<MIN_SNR>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<MIN_SNR>	Numeric	dB	Minimum SNR threshold of satellites in use. Range: 9–37. Default value: 9.

Example:

```
$PAIR059*36
$PAIR001,059,0*37
$PAIR059,15*1E
```

> **NOTE**
>
> This command is not supported for LC29H (BA, CA, DA, EA*).

2.3.13. Packet Type: 062 PAIR_COMMON_SET_NMEA_OUTPUT_RATE

Sets the output rate of standard NMEA sentences of each type.

Type:

Set

Synopsis:

```
$PAIR062,<Type>,<OutputRate>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Type>	Numeric	-	Type of standard NMEA sentence. -1 = Reset the output rates of all types of sentences to default values 0 = NMEA_SEN_GGA 1 = NMEA_SEN_GLL 2 = NMEA_SEN_GSA 3 = NMEA_SEN_GSV 4 = NMEA_SEN_RMC 5 = NMEA_SEN_VTG 6 = NMEA_SEN_ZDA 7 = NMEA_SEN_GRS 8 = NMEA_SEN_GST

			Message output rate setting.
<OutputRate>	Numeric	-	0 = Disable sentence output
			N = Output message once every N position fix(es)
			Range of N: 0–20. Default value: 1.

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR062,0,3*3D
$PAIR001,062,0*3F
```

> **NOTE**
>
> 1. LC29H (BA, CA, DA, EA*) only supports setting **<Type>** to 0–5.
> 2. LC29H (BA, CA, DA, EA*) only supports setting **<OutputRate>** to 0 or 1.

2.3.14. Packet Type: 063 PAIR_COMMON_GET_NMEA_OUTPUT_RATE

Gets the output rate of standard NMEA sentences of each type.

Type:

Get

Synopsis:

```
$PAIR063,<Type>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Type>	Numeric	-	Type of standard NMEA sentence. -1 = Return the output rates of all types of standard NMEA sentences 0 = NMEA_SEN_GGA 1 = NMEA_SEN_GLL 2 = NMEA_SEN_GSA 3 = NMEA_SEN_GSV 4 = NMEA_SEN_RMC 5 = NMEA_SEN_VTG 6 = NMEA_SEN_ZDA

		7 = NMEA_SEN_GRS	
		8 = NMEA_SEN_GST	

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR063,<Type>,<OutputRate>*<Checksum><CR><LF>

Parameters included in the result:

Field	Format	Unit	Description
<Type>	Numeric	-	Type of standard NMEA sentence. 0 = NMEA_SEN_GGA 1 = NMEA_SEN_GLL 2 = NMEA_SEN_GSA 3 = NMEA_SEN_GSV 4 = NMEA_SEN_RMC 5 = NMEA_SEN_VTG 6 = NMEA_SEN_ZDA 7 = NMEA_SEN_GRS 8 = NMEA_SEN_GST
<OutputRate>	Numeric	-	Message output rate setting. 0 = Disabled or not supported. N = Output message once every N position fix(es) Range of N: 1–20.

Example:

$PAIR063,0*23
$PAIR001,063,0*3E
$PAIR063,0,3*3C

> **NOTE**
>
> LC29H (BA, CA, DA, EA*) only supports setting **<Type>** to 0–5.

2.3.15. Packet Type: 066 PAIR_COMMON_SET_GNSS_SEARCH_MODE

Sets the GNSS search mode. The setting is valid when the NVRAM data are valid.

Type:

Set

Synopsis:

$PAIR066,<GPS_Enabled>,<GLONASS_Enabled>,<Galileo_Enabled>,<BDS_Enabled>,<QZSS_Enabled>,<Reserved>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<GPS_Enabled>	Numeric	-	0 = Disable (DO NOT search for GPS satellites) 1 = Search for GPS satellites
<GLONASS_Enabled>	Numeric	-	0 = Disable (DO NOT search for GLONASS satellites) 1 = Search for GLONASS satellites
<Galileo_Enabled>	Numeric	-	0 = Disable (DO NOT search for Galileo satellites) 1 = Search for Galileo satellites
<BDS_Enabled>	Numeric	-	0 = Disable (DO NOT search for BDS satellites) 1 = Search for BDS satellites
<QZSS_Enabled>	Numeric	-	0 = Disable (DO NOT search for QZSS satellites) 1 = Search for QZSS satellites
<Reserved>	Numeric	-	Always "0"

Result:

Returns **$PAIR001** message.

Example:

//Search for GPS + GLONASS + Galileo + BDS satellites:
$PAIR066,1,1,1,1,0,0*3A
$PAIR001,066,0*3B

NOTE

1. QZSS is always enabled by default.
2. Supported GNSS search modes:
    - GPS only
    - GPS + QZSS
    - GPS + GLONASS
    - GPS + QZSS + GLONASS
    - GPS + Galileo
    - GPS + QZSS + Galileo

<Reserved>	Numeric	-	Always "0".

Example:

```
$PAIR067*3B
$PAIR001,067,0*3A
$PAIR067,1,1,1,1,1,0*3A
```

> **NOTE**
>
> This command is not supported for LC29H (BA, CA, DA, EA*).

2.3.17. Packet Type: 070 PAIR_COMMON_SET_STATIC_THRESHOLD

Sets the static navigation speed threshold. If the actual speed is below the threshold, the output position remains unchanged and the output speed is 0. If the threshold value is set to 0, this function is disabled.

Type:

Set

Synopsis:

```
$PAIR070,<SpeedThreshold>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<SpeedThreshold>	Numeric	dm/s	Speed threshold. Range: 0–20. Default value: 0.

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR070,4*25
$PAIR001,070,0*3C
```

This command is not supported for LC29H (BA, CA, DA, EA*).

2.3.18. Packet Type: 071 PAIR_COMMON_GET_STATIC_THRESHOLD

Gets the static navigation speed threshold.

Type:

Get

Synopsis:

$PAIR071*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR071,<SpeedThreshold>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<SpeedThreshold>	Numeric	m/s	Static navigation speed threshold. Range: 0–2. Default value: 0.

Example:

$PAIR071*3C
$PAIR001,071,0*3D
$PAIR071,0.4*3A

This command is not supported for LC29H (BA, CA, DA, EA*).

2.3.19. Packet Type: 072 PAIR_COMMON_SET_ELEV_MASK

Sets satellite elevation mask.

Type:

Set

Synopsis:

$PAIR072,<Degree>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Degree>	Numeric	Degree	Satellite elevation mask. Range: -90 to 90. Default value: 5.

Result:

Returns **$PAIR001** message.

Example:

$PAIR072,5*26
$PAIR001,072,0*3E

> **NOTE**
>
> 1. The satellites below the elevation mask are not used for positioning.
> 2. This command is not supported for LC29H (BA, CA, DA, EA*).

2.3.20. Packet Type: 073 PAIR_COMMON_GET_ELEV_MASK

Gets satellite elevation mask.

Type:

Get

Synopsis

$PAIR073*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR073,<Degree>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<Degree>	Numeric	Degree	Satellite elevation mask Range: -90 to 90.

Example:

$PAIR073*3E
$PAIR001,073,0*3F
$PAIR073,5*27

> **NOTE**
>
> This command is not supported for LC29H (BA, CA, DA, EA*).

2.3.21. Packet Type: 074 PAIR_COMMON_SET_AIC_ENABLE

Enables/disables the active interference cancellation (AIC) function. For details about AIC function, see *documents [1]* and *[2]*.

Type:

Set

Synopsis

$PAIR074,<Enabled>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Enabled>	Numeric	-	Enable/disable AIC function.

| 0 = Disable |
| 1 = Enable (default) |

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR074,1*24
$PAIR001,074,0*38
```

2.3.22. Packet Type: 075 PAIR_COMMON_GET_AIC_STATUS

Queries the status of active interference cancellation (AIC) function.

Type:

Get

Synopsis

```
$PAIR075*<Checksum><CR><LF>
```

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

```
$PAIR075,<Status>*<Checksum><CR><LF>
```

Parameter included in the result:

Field	Format	Unit	Description
<Status>	Numeric	-	Status of AIC function. 0 = Disabled 1 = Enabled

Example:

```
$PAIR075*38
$PAIR001,075,0*39
```

$PAIR075,1*25

2.3.23. Packet Type: 080 PAIR_COMMON_SET_NAVIGATION_MODE

Sets navigation mode.

Type:

Set

Synopsis:

$PAIR080,<NavMode>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<NavMode >	Numeric	-	Navigation mode. 0 = Normal mode. For general purposes. (Default) 1 = Fitness mode. Used for running and walking purposes, making low-speed movement (< 5 m/s) more impactful on position calculation. 2 = Reserved. 3 = Reserved. 4 = Stationary mode. For stationary applications where zero dynamics is assumed. 5 = Drone mode. Used for drone applications with equivalent dynamics range and vertical acceleration at different flight phases (for example, hovering, cruising). 6 = Reserved. 7 = Swimming mode. Used for swimming purposes to smooth the trajectory and improve the accuracy of distance calculation. 8 = Reserved. 9 = Bike mode. For sharing bike applications.

Result:

Returns **$PAIR001** message.

Example:

$PAIR080,1*2F
$PAIR001,080,0*33

2.3.24. Packet Type: 081 PAIR_COMMON_GET_NAVIGATION_MODE

Queries navigation mode.

Type:

Get

Synopsis:

$PAIR081*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR081,<NavMode>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<NavMode>	Numeric	-	Navigation mode. 0 = Normal mode. For general purposes. (Default) 1 = Fitness mode. Used for running and walking purposes, making low-speed movement (< 5 m/s) more impactful on position calculation. 2 = Reserved. 3 = Reserved. 4 = Stationary mode. For stationary applications where zero dynamics is assumed. 5 = Drone mode. Used for drone applications with equivalent dynamics range and vertical acceleration at different flight phases (for example, hovering, cruising). 6 = Reserved. 7 = Swimming mode. Used for swimming purposes to smooth the trajectory and improve the accuracy of distance calculation. 8 = Reserved. 9 = Bike mode. For sharing bike applications.

Example:

```
$PAIR081*33
$PAIR001,081,0*32
$PAIR081,0*2F
```

2.3.25. Packet Type: 086 PAIR_COMMON_SET_DEBUGLOG_OUTPUT

Enables/disables debug log output in binary format.

Type:

Set

Synopsis

```
$PAIR086,<Status>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Status>	Numeric	-	Debug log output setting. 0 = Disable (default) 1 = Enable with full debug log output 2 = Enable with lite debug log output

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR086,1*29
$PAIR001,086,0*35
```

2.3.26. Packet Type: 087 PAIR_COMMON_GET_DEBUGLOG_OUTPUT

Queries the debug log output setting.

Type:

Get

Synopsis

```
$PAIR087*<Checksum><CR><LF>
```

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR087,<Status>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<Status>	Numeric	-	Debug log output setting. 0 = Disabled 1 = Enabled with full debug log output 2 = Enabled with lite debug log output

Example:

$PAIR087*35
$PAIR001,087,0*34
$PAIR087,0*29

2.3.27. Packet Type: 100 PAIR_COMMON_SET_NMEA_OUTPUT_MODE

Sets output mode of standard NMEA sentences.

Type:

Set

Synopsis:

$PAIR100,<NMEA_Mode>,<Res>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<NMEA_Mode>	Numeric	-	Output mode of standard NMEA sentences. 0 = Disabled 1 = ASCII NMEA 0183 V4.10 output enabled (default) 2 = ASCII NMEA 0183 V3.01 output enabled

<Res>	Numeric	-	Reserved. Default value: 0.

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR100,1,0*3A
$PAIR001,100,0*3A
```

NOTE

For LC29H (BA, CA, DA, EA*), standard NMEA sentences are output in NMEA 0183 V4.10 format and this command is not supported.

2.3.28. Packet Type: 101 PAIR_COMMON_GET_NMEA_OUTPUT_MODE

Queries output mode of standard NMEA sentences.

Type:

Get

Synopsis:

```
$PAIR101*<Checksum><CR><LF>
```

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

```
$PAIR101,<NMEA_Mode>,<Res>*<Checksum><CR><LF>
```

Parameters included in the result:

Field	Format	Unit	Description
<NMEA_Mode>	Numeric	-	Output mode of standard NMEA sentences. 0 = Disabled

			1 = ASCII NMEA 0183 V4.10 output enabled (default)
			2 = ASCII NMEA 0183 V3.01 output enabled
<Res>	Numeric	-	Reserved. Default value: 0.

Example:

```
$PAIR101*3A
$PAIR001,101,0*3B
$PAIR101,1,0*3B
```

> **NOTE**
>
> This command is not supported for LC29H (BA, CA, DA, EA*).

2.3.29. Packet Type: 104 PAIR_COMMON_SET_DUAL_BAND

Enables/disables the Dual Band feature when the GNSS system is powered off.

Type:

Set

Synopsis:

```
$PAIR104,<DualBandEnabled>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<DualBandEnabled>	Numeric	-	Enable/disable the Dual Band feature. 0 = Disable 1 = Enable (default)

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR104,0*23
$PAIR001,104,0*3E
```

> **NOTE**
>
> 1. This command is not supported for LC79H (BA) and LC29H (BA, CA, DA, EA*).
> 2. Before setting the Dual Band feature by **$PAIR104**, send **$PAIR382,1*2E** and **$PAIR003*39** in sequence to power off the GNSS system. After the Dual Band feature has been set, send **$PAIR002*38** to power on the module.

2.3.30. Packet Type: 105 PAIR_COMMON_GET_DUAL_BAND

Queries whether the Dual Band feature is enabled or disabled.

Type:

Get

Synopsis:

$PAIR105*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR105,<Enabled>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<Enabled>	Numeric	-	Status of the Dual Band feature. 0 = Disabled 1 = Enabled

Example:

$PAIR105*3E
$PAIR001,105,0*3F
$PAIR105,1*23

2.3.31. Packet Type: 382 PAIR_TEST_LOCK_SYSTEM_SLEEP

Enables/disables the locking of Sleep mode. The CPU core will lock into the power off mode after the command is sent.

Type:

Set

Synopsis:

$PAIR382,<Enabled>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Enabled>	Numeric	-	Sleep mode locking setting. 0 = Disabled (default) 1 = Enabled

Result:

Returns **$PAIR001** message.

Example:

$PAIR382,1*2E
$PAIR001,382,0*32

NOTE

1. This configuration will not be saved in the flash or RTC RAM. Please send this command every time after the GNSS subsystem or main power reboots.
2. The module can still receive commands if it receives **$PAIR382,1*2E** before **$PAIR003*39** and **$PAIR001,382,0*32** is returned correctly. Otherwise, any other commands cannot be received.

2.3.32. Packet Type: 391 PAIR_TEST_JAMMING_DETECT

Enables/disables jamming detection. Jamming status messages will be returned when jamming detection

is enabled.

Type:

Set/Output

Synopsis:

$PAIR391,<CmdType>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<CmdType>	Numeric	-	Enable/disable jamming detection. 0 = Disable (default) 1 = Enable

Result:

Returns **$PAIR001** message and enable **$PAIRSPF** message output periodically (at 1 Hz).

Query result message format:

$PAIRSPF,<Status>*<Checksum><CR><LF>
$PAIRSPF5,<Status>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<Status>	Numeric	-	Jamming status. 0 = Unknown status 1 = No jamming, good status 2 = Warning status 3 = Critical status

Example:

$PAIR391,1*2C
$PAIR001,391,0*30
//Unknown status:
$PAIRSPF,0*53
$PAIRSPF5,0*66
//Good status:
$PAIRSPF,1*52
$PAIRSPF5,1*67
//Warning status:

```
$PAIRSPF,2*51
$PAIRSPF5,2*64
//Critical status:
$PAIRSPF,3*50
$PAIRSPF5,3*65
```

NOTE

1. The **$PAIRSPF,<Status>*<Checksum><CR><LF>** sentence indicates L1 jamming status.
2. The **$PAIRSPF5,<Status>*<Checksum><CR><LF>** sentence indicates L5 jamming status. This message will not be output when only L1 band signals are received and tracked.
3. The module starts jamming detection once the feature is enabled.
   - If there is no jamming, **$PAIRSPF,1*52**, or **$PAIRSPF,1*52** and **$PAIRSPF5,1*62**, will be reported to indicate good status (**<Status>** = 1).
   - In case of continuous jamming, the jamming status will change from 1 to 2 and finally to 3.
     1) When no position fix has been completed: module status is 1 right after the jamming detection is enabled, and then changes to 2 when jamming is detected. During this process, the module keeps attempting to get a fix; if the anti-jamming repair fails, the jamming status changes to 3 at last.
     2) After a successful position fix: jamming status is 1 right after jamming detection is enabled, and changes to 2 and 3 consecutively when jamming is detected.

2.3.33. Packet Type: 400 PAIR_DGPS_SET_MODE

Sets the DGPS correction data source.

Type:

Set

Synopsis:

```
$PAIR400,<Mode>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Mode>	Numeric	-	DGPS data source. 0 = No DGPS data source 1 = RTCM 2 = SBAS (including WAAS/EGNOS/GAGAN/MSAS) (default)

Result:

Retuns **$PAIR001** message.

Example:

```
$PAIR400,2*20
$PAIR001,400,0*3F
```

NOTE

Since DGPS feature is not supported by LC29H (BA, CA, DA, EA*), this command is not supported either.

2.3.34. Packet Type: 401 PAIR_DGPS_GET_MODE

Queries the DGPS correction data source.

Type:

Get

Synopsis:

```
$PAIR401*<Checksum><CR><LF>
```

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

```
$PAIR401,<Mode>*<Checksum><CR><LF>
```

Parameter included in the result:

Field	Format	Unit	Description
<Mode>	Numeric	-	DGPS data source. 0 = No DGPS data source 1 = RTCM 2 = SBAS (including WAAS/EGNOS/GAGAN/MSAS)

Example:

```
$PAIR401*3F
$PAIR001,401,0*3E
$PAIR401,2*21
```

> **NOTE**
>
> This command is not supported by LC29H (BA, CA, DA, EA*).

2.3.35. Packet Type: 410 PAIR_SBAS_ENABLE

Enables/disables SBAS satellite search. SBAS supports wide-area or regional augmentation through geostationary satellite broadcast messages. The geostationary satellites broadcast GNSS integrity and correction data with the assistance of multiple ground stations that are located at accurately-surveyed points.

Type:

Set

Synopsis

```
$PAIR410,<Enabled>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Enabled>	Numeric	-	Enable or disable the search of SBAS satellites. 0 = Disable 1 = Enable (default)

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR410,1*22
$PAIR001,410,0*3E
```

> **NOTE**
>
> 1. When the navigation mode is Fitness or Swimming mode (see command **$PAIR080**), SBAS is not supported.
> 2. Since SBAS feature is not supported by LC29H (BA, CA, DA, EA*), this command is not supported either.

2.3.36. Packet Type: 411 PAIR_SBAS_GET_STATUS

Queries the status of SBAS satellite search.

Type:

Get

Synopsis

$PAIR411*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR411,<Enabled>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<Enabled>	Numeric	-	Status of SBAS satellite search. 0 = Disabled 1 = Enabled

Example:

$PAIR411*3E
$PAIR001,411,0*3F
$PAIR411,1*23

NOTE

1. When the navigation mode is Fitness or Swimming mode (see command **$PAIR080**), SBAS is not supported.
2. This command is not supported by LC29H (BA, CA, DA, EA*).

2.3.37. Packet Type: 432 PAIR_RTCM_SET_OUTPUT_MODE

Sets RTCM output mode.

Type:

Set

Synopsis

$PAIR432,<Mode>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Mode>	Numeric	-	RTCM output mode setting. -1 = Disable outputting RTCM (default) 0 = Enable output RTCM3 with message type MSM4 1 = Enable output RTCM3 with message type MSM7

Result:

Returns **$PAIR001** message.

Example:

$PAIR432,1*22
$PAIR001,432,0*3E

NOTE

LC79H (BA) module does not support this command.

2.3.38. Packet Type: 433 PAIR_RTCM_GET_OUTPUT_MODE

Queries RTCM output mode.

Type:

Get

Synopsis

$PAIR433*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR433,<Mode>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<Mode>	Numeric	-	RTCM output mode setting. -1 = Outputting RTCM disabled 0 = Outputting RTCM3 with message type MSM4 enabled 1 = Outputting RTCM3 with message type MSM7 enabled

Example:

$PAIR433*3E
$PAIR001,433,0*3F
$PAIR433,-1*0E

> **NOTE**
>
> LC79H (BA) module does not support this command.

2.3.39. Packet Type: 434 PAIR_RTCM_SET_OUTPUT_ANT_PNT

Enables/disables outputting stationary antenna reference point in RTCM format.

Type:

Set

Synopsis

$PAIR434,<Enable>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Enable>	Numeric	-	Enable/disable outputting outputting stationary antenna reference point (message type 1005). 0 = Disable (default) 1 = Enable

Result:

Returns **$PAIR001** message.

Example:

$PAIR434,1*24
$PAIR001,434,0*38

> **NOTE**
>
> LC79H (BA) module does not support this command.

2.3.40. Packet Type: 435 PAIR_RTCM_GET_OUTPUT_ANT_PNT

Queries the setting of outputting stationary antenna reference point in RTCM format.

Type:

Get

Synopsis

$PAIR435*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR435,<Enable>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<Enable>	Numeric	-	Status of outputting stationary antenna reference point (message type 1005). 0 = Disabled 1 = Enabled

Example:

$PAIR435*38
$PAIR001,435,0*39
$PAIR435,1*25

> **NOTE**
>
> LC79H (BA) module does not support this command.

2.3.41. Packet Type: 436 PAIR_RTCM_SET_OUTPUT_EPHEMERIS

Enables/disables outputting satellite ephemeris in RTCM format.

Type:

Set

Synopsis

$PAIR436,<Enable>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Enable>	Numeric	-	Enable/disable outputting satellite ephemeris. 0 = Disable (default) 1 = Enable

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR436,1*26
$PAIR001,436,0*3A
```

> **NOTE**
>
> LC79H (BA) module does not support this command.

2.3.42. Packet Type: 437 PAIR_RTCM_GET_OUTPUT_EPHEMERIS

Queries the status of satellite ephemeris in RTCM format.

Type:

Get

Synopsis

```
$PAIR437*<Checksum><CR><LF>
```

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

```
$PAIR437,<Enable>*<Checksum><CR><LF>
```

Parameter included in the result:

Field	Format	Unit	Description
<Enable>	Numeric	-	Status of outputting satellite ephemeris. 0 = Disabled 1 = Enabled

Example:

```
$PAIR437*3A
$PAIR001,437,0*3B
$PAIR437,1*27
```

> **NOTE**
>
> LC79H (BA) module does not support this command.

2.3.43. Packet Type: 490 PAIR_EASY_ENABLE

Enables/disables EASY function.

Type:

Set

Synopsis:

$PAIR490,<Enabled>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Enabled>	Numeric	-	EASY function setting. 0 = Disable 1 = Enable (default)

Result:

Returns **$PAIR001** message.

Example:

$PAIR490,1*2A
$PAIR001,490,0*36

> **NOTE**
>
> Since EASY feature is not supported by LC29H (BA, CA, DA, EA*), this command is not supported either.

2.3.44. Packet Type: 491 PAIR_EASY_GET_STATUS

Queries the status of EASY function.

Type:

Get

Synopsis:

$PAIR491*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message and the query result.

Query result message format:

$PAIR491,<Enabled>,<Status>*<Checksum><CR><LF>

Parameters included in the result:

Field	Format	Unit	Description
<Enabled>	Numeric	-	EASY function setting. 0 = Disabled 1 = Enabled
<Status>	Numeric	-	EASY data extension status. 0 = Not finished 1 = 1-day extension finished 2 = 2-day extension finished 3 = 3-day extension finished

Example:

$PAIR491*36
$PAIR001,491,0*37
$PAIR491,1,0*37

NOTE

1. If EASY function is disabled, only the **<Enabled>** value will be returned after executing this command.
2. This command is not supported by LC29H (BA, CA, DA, EA*).

2.3.45. Packet Type: 511 PAIR_NVRAM_SAVE_NAVIGATION_DATA

Saves current navigation data from RTC RAM to flash.

Type:

Command

Synopsis

$PAIR511*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message.

Example:

$PAIR511*3F
$PAIR001,511,1*3F
$PAIR001,511,0*3E

> **NOTE**
>
> 1. If the backup domain cannot be powered after the power supply of the module is cut off, this command needs to be sent every time the parameters are modified.
> 2. In case the position fix rate is greater than 1 Hz, power off the GNSS system with **$PAIR382,1*2E** and **$PAIR003*39** in sequence before sending this command. After sending **$PAIR511*3F**, send **$PAIR002*38** to re-power the module. This limitation does not apply to fix rate below 1 Hz.

2.3.46. Packet Type: 513 PAIR_NVRAM_SAVE_SETTING

Saves the current configurations from RTC RAM to flash.

Type:

Command

Synopsis:

$PAIR513*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR513*3D
$PAIR001,513,0*3C
```

> **NOTE**
>
> 1. If the backup domain cannot be powered after the power supply of the module is cut off, this command needs to be sent every time the parameters are modified.
> 2. In case the position fix rate is greater than 1 Hz, power off the GNSS system with **$PAIR382,1*2E** and **$PAIR003*39** in sequence before sending this command. After sending **$PAIR513*3D**, send **$PAIR002*38** to re-power the module. This limitation does not apply to fix rate below 1 Hz.

2.3.47. Packet Type: 650 PAIR_LOW_POWER_ENTRY_RTC_MODE

Shuts down the GNSS system, except the clock. The CPU core will be set to the Backup mode after the command is sent, in which it cannot receive any commands. For details about Backup mode, see *documents [1]* and *[2]*.

Type:

Set

Synopsis:

```
$PAIR650,<Second>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<Second>	Numeric	Second	Time to stay in Backup mode before exiting. Range: 0 and 10–62208000 (2 years); 0 means entering the Backup mode without any timer.

Result:

● If there is no error, the module will be set to Backup mode and cannot receive any commands.
● In case of any command parameter error, the **$PAIR001** message will be returned.

Example:

```
$PAIR650,1*24
```

$PAIR001,650,4*3C

NOTE

Refer to *documents [1]* and *[2]* for details about entering/exiting the Backup mode.

2.3.48. Packet Type: 690 PAIR_PERIODIC_SET_MODE

Sets Periodic Power Saving mode configurations.

Type:

Set

Synopsis:

$PAIR690,<Mode>,<FirstRun>,<FirstSleep>,<SecondRun>,<SecondSleep>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Mode>	Numeric	-	State of Periodic Power Saving mode. 0 = Disabled (default) 1 = Smart periodic mode enabled 2 = Strict periodic mode enabled
<FirstRun>	Numeric	Second	Run time. Range: 3–518400.
<FirstSleep>	Numeric	Second	Sleep time. Range: 3–518400.
<SecondRun>	Numeric	Second	Second run time. Range: 0 or 3–518400.
<SecondSleep>	Numeric	Second	Second sleep time. Range: 0 or 3–518400.

Result:

Returns a **$PAIR001** message.

Example:

$PAIR690,1,21,39,48,72*28
$PAIR001,690,0*34

> **NOTE**
>
> 1. **<FirstRun>:** Interval in seconds after exiting the Sleep mode and getting a new position fix.
> 2. **<FirstSleep>:** Duration in seconds for staying in the Sleep mode after getting a fix (or attempting to get a fix).
> 3. **<SecondRun>:** GNSS module will use "second run time" instead of "first run time" setting when there is no signal. The second run time can be "0" only when the second sleep time is "0".
> 4. **<SecondSleep>:** GNSS module will use "second sleep time" instead of "first sleep time" setting when there is no signal. The second sleep time can be "0" only when the second run time is "0".

2.3.49. Packet Type: 691 PAIR_PERIODIC_GET_MODE

Queries Periodic Power Saving Mode configurations.

Type:

Get

Synopsis:

$PAIR691*<Checksum><CR><LF>

Parameter:

None

Result:

Returns a **$PAIR001** message and the query result.

Query result message format:

$PAIR691,<Mode>,<FirstRun>,<FirstSleep>,<SecondRun>,<SecondSleep>*<Checksum><CR><LF>

Parameters included in the result:

Field	Format	Unit	Description
<Mode>	Numeric	-	State of Periodic Power Saving mode. 0 = Disabled 1 = Smart periodic mode enabled 2 = Strict periodic mode enabled
<FirstRun>	Numeric	Second	Run time. Range: 3–518400.
<FirstSleep>	Numeric	Second	Sleep time. Range: 3–518400.

<SecondRun>	Numeric	Second	Second run time. Range: 0 or 3–518400.
<SecondSleep>	Numeric	Second	Second sleep time. Range: 0 or 3–518400.

Example:

```
$PAIR691*34
$PAIR001,691,1*34
$PAIR001,691,0*35
$PAIR691,0,3,12,18,72*14
```

2.3.50. Packet Type: 752 PAIR_PPS_SET_CONFIG_CMD

Sets PPS configurations.

Type:

Set

Synopsis:

```
$PAIR752,<PPSType>,<PPSPulseWidth>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<PPSType>	Numeric	-	PPS pulse type. 0 = Disable 1 = After the first fix 2 = 3D fix only (default) 3 = 2D/3D fix only 4 = Always
<PPSPulseWidth>	Numeric	Millisecond	PPS Pulse Width. Range: 1–999. Default value: 100.

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR752,2,100*39
$PAIR001,752,0*3B
```

2.3.51. Packet Type: 830 PAIR_RAW_ENABLE

Enables/disables outputting binary raw measurement.

Type:

Set

Synopsis:

$PAIR830,<Enable>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<Enable>	Numeric	-	Raw measurement output setting. 0 = Disabled 1 = Raw measurement 2 = Raw measurement + SV information + PVT (including time offset data between GPS and GLONASS/Galileo/BDS)

Result:

Returns **$PAIR001** message.

Example:

$PAIR830,1*2C
$PAIR001,830,0*30

2.3.52. Packet Type: 831 PAIR_RAW_GET_STATUS

Gets the binary raw measurement output setting.

Type:

Get

Synopsis:

$PAIR831*<Checksum><CR><LF>

Parameter:

None

Result:

Returns **$PAIR001** and the query result.

Query result message format:

$PAIR831,<Enable>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<Enable>	Numeric	-	Raw measurement output setting. 0 = Disabled 1 = Raw measurement 2 = Raw measurement + SV information + PVT (including time offset data between GPS and GLONASS/Galileo/BDS)

Example:

$PAIR831*30
$PAIR001,831,0*31
$PAIR831,1*2D

2.3.53. Packet Type: 864 PAIR_IO_SET_BAUDRATE

Sets the baud rate of UART interface.

Type:

Set

Synopsis:

$PAIR864,<PortType>,<PortIndex>,<Baudrate>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<PortType>	Numeric	-	Hardware port type. 0 = UART
<PortIndex>	Numeric	-	Hardware port index. 0 = UART0
<Baudrate>	Numeric	bps	Baud rate. 4800

	9600
	19200
	38400
	57600
	115200
	230400
	460800
	921600
	3000000

Result:

Returns **$PAIR001** message.

Example:

$PAIR864,0,0,115200*1B
$PAIR001,864,0*31

NOTE

1. The module must be rebooted after changing the port baud rate, and the change will take effect after the reboot.
2. For LC29H series and LC79H (AL) modules, messages may be lost when the output baud rate is lower than 115200 bps.
3. For LC79H (BA), messages may be lost when the output baud rate is lower than 9600 bps.

2.3.54. Packet Type: 865 PAIR_IO_GET_BAUDRATE

Gets the baud rate of UART interface.

Type:

Get

Synopsis:

$PAIR865,<PortType>,<PortIndex>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<PortType>	Numeric	-	Hardware port type. 0 = UART

<PortIndex>	Numeric	-	Hardware port index. 0 = UART0

Result:

Returns **$PAIR001** and the query result.

Query result message format:

$PAIR865,<Baudrate>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<Baudrate>	Numeric	bps	Baud rate. 4800 9600 19200 38400 57600 115200 230400 460800 921600 3000000

Example:

$PAIR865,0,0*31
$PAIR001,865,0*30
$PAIR865,115200*1A

2.3.55. Packet Type: 866 PAIR_IO_SET_FLOW_CONTROL

Sets UART flow control.

Type:

Set

Synopsis:

$PAIR866,<PortType>,<PortIndex>,<FlowControl>*<Checksum><CR><LF>

Parameter:

Field	Format	Unit	Description
<PortType>	Numeric	-	Hardware port type. 0 = UART
<PortIndex>	Numeric	-	Hardware port index. 0 = UART0
<FlowControl>	Numeric	-	Flow control setting. 0 = Flow control disabled (default) 1 = Software flow control enabled 2 = Hardware flow control enabled

Result:

Returns **$PAIR001** message.

Example:

```
$PAIR866,0,0,1*2F
$PAIR001,866,0*33
```

> **NOTE**
>
> The module must be rebooted after changing the port baud rate, and the change will take effect after the reboot.

2.3.56. Packet Type: 867 PAIR_IO_GET_FLOW_CONTROL

Gets UART flow control setting.

Type:

Get

Synopsis:

```
$PAIR867,<PortType>,<PortIndex>*<Checksum><CR><LF>
```

Parameter:

Field	Format	Unit	Description
<PortType>	Numeric	-	Hardware port type. 0 = UART

<PortIndex>	Numeric	-	Hardware port index. 0 = UART0

Result:

Returns **$PAIR001** and the query result.

Query result message format:

$PAIR867,<FlowControl>*<Checksum><CR><LF>

Parameter included in the result:

Field	Format	Unit	Description
<FlowControl>	Numeric	-	Flow control setting. 0 = Flow control disabled 1 = Software flow control enabled 2 = Hardware flow control enabled

Example:

$PAIR867,0,0*33
$PAIR001,867,0*32
$PAIR867,0*2F

3 RTCM Protocol

The LC79H (AL) and LC29H series modules support the RTCM protocol which is in accordance with RTCM STANDARD 10403.3 DIFFERENTIAL GNSS (GLOBAL NAVIGATION SATELLITE SYSTEMS) SERVICES - VERSION 3. This protocol is used to transfer GNSS raw measurement data and is available from *https://www.rtcm.org/*.

Table 5: Supported RTCM3 Messages

Message Type	Mode	Message Name
1005	Output	Stationary RTK Reference Station ARP.
1019	Output	GPS Ephemerides.
1020	Output	GLONASS Ephemerides.
1042	Output	BDS Satellite Ephemeris Data.
1044	Output	QZSS Ephemerides.
1046	Output	Galileo I/NAV Satellite Ephemeris Data.
1074	Output	GPS MSM4.
1077	Output	GPS MSM7.
1084	Output	GLONASS MSM4.
1087	Output	GLONASS MSM7.
1094	Output	Galileo MSM4.
1097	Output	Galileo MSM7.
1114	Output	QZSS MSM4.
1117	Output	QZSS MSM7.
1124	Output	BDS MSM4.
1127	Output	BDS MSM7.

NOTE

1. The **$PAIR432** command can enable/disable MSM4/MSM7 (1074, 1077, 1084, 1087, 1094, 1097,1114, 1117, 1124 and 1127) messages if the corresponding constellation is enabled.
2. The **$PAIR434** command can enable/disable Stationary RTK Reference Station ARP (1005) message.
3. The **$PAIR436** command can enable/disable ephemeris (1019, 1020, 1042, 1044 and 1046) messages if the corresponding constellation is enabled.

4 Appendix A References

Table 6: Related Documents

Document Name
[1] Quectel_LC29H_Series_Hardware_Design
[2] Quectel_LC79H_Hardware_Design

Table 7: Terms and Abbreviations

Abbreviation	Description
2D	2 Dimension
3D	3 Dimension
ACK	Acknowledgement
AIC	Active Interference Cancellation
ARP	Antenna Reference Point
BDS	BeiDou Navigation Satellite System
DGPS	Differential Global Positioning System
DOP	Dilution of Precision
DSP	Digital Signal Processing
EGNOS	European Geostationary Navigation Overlay Service
EPO	Extended Prediction Orbit
GAGAN	GPS-aided GEO Augmented Navigation
Galileo	Galileo Satellite Navigation System (EU)
GGA	Global Positioning System Fix Data
GLL	Geographic Position – Latitude/Longitude

GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRS	GNSS Range Residuals
GSA	GNSS DOP and Active Satellites
GST	GNSS Pseudorange Error Statistics
GSV	GNSS Satellites in View
RMS	Root Mean Square
HDOP	Horizontal Dilution of Precision
ID	Identifier
MNL	MTK Navigation Lib
MSAS	Multi-functional Satellite Augmentation System
NMEA	NMEA (National Marine Electronics Association) 0183 Interface Standard
NVRAM	Non-Volatile Random Access Memory
PAIR	Proprietary Protocol of MTK
PDOP	Position Dilution of Precision
PE	Positioning Engine
PPS	Pulse Per Second
QZSS	Quasi-Zenith Satellite System
RF	Radio Frequency
RMC	Recommended Minimum Specific GNSS Data
RTC	Real-time Clock
RTK	Real Time Kinematic
SBAS	Satellite-Based Augmentation System
SNR	Signal-to-noise Ratio
SV	Satellites in View
PVT	Position, Velocity, and Timing
UART	Universal Asynchronous Receiver/Transmitter
ULP	Ultra-Low Power

UTC	Coordinated Universal Time
VDOP	Vertical Dilution of Precision
VTG	Course Over Ground and Ground Speed
WAAS	Wide Area Augmentation System
ZDA	Time & Date

5 Appendix B GNSS Numbering

Table 8: GNSS Numbering

GNSS Type	System ID	Satellite ID	Signal ID
GPS	1	1–32	1 = L1 C/A 8 = L5
GLONASS	2	65–88	1 = L1
Galileo	3	1–36	1 = E5a 7 = E1
BDS	4	1–63	1 = B1I 5 = B2a
QZSS	5	193–199	1 = L1 C/A 8 = L5
SBAS	-	33–51	-

NOTE

QZSS Satellite ID numbers range from 1 to 10 for LC29H (BA, CA, DA, EA*).