

# LC29H (BS) GNSS Protocol Specification

**GNSS Module Series**

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# About the Document

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# 1 Introduction

Quectel LC29H (BS) GNSS module supports 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 provides fast and accurate acquisition and makes this module the ideal solution for a base station and for generating RTK corrections.

This document describes the software commands that are used to control and modify the module configuration. The software commands are NMEA proprietary commands defined by Quectel (PQTM commands) and the chipset supplier (PAIR messages). To report GNSS information, the module supports outputting messages in RTCM format.

The Quectel LC29H (BS) is designed to be used as a GNSS base station. The module supports the following protocols:

**Table 1: Supported Protocols**

Protocol	Type
NMEA 0183 V3.10/V4.10	Input/output, ASCII, proprietary
RTCM 10403.3	Output, binary

**NOTE**

Quectel assumes no responsibility if commands other than the ones listed herein are used.

# 2 NMEA Protocol

## 2.1. Structure of NMEA Protocol Messages

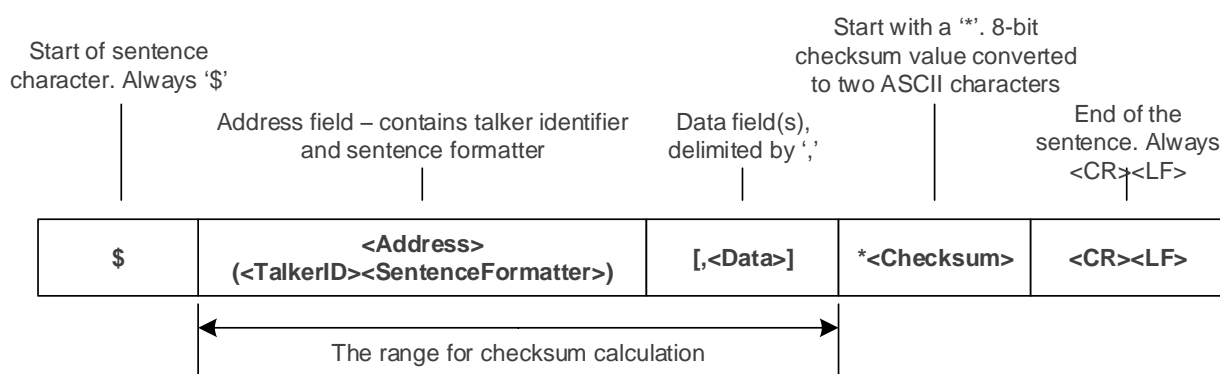


Figure 1: Structure of NMEA Protocol Messages

Table 2: Structure of NMEA Protocol Messages

Field	Description
\$	Start of the sentence (Hex 0x24).
<Address>	<b>In Proprietary Messages:</b> In NMEA proprietary messages, this field consists of the proprietary character <b>P</b> 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 ‘,’. Variable length (depends on the NMEA message type).
<Checksum>	Checksum field follows the checksum delimiter character ‘*’. Checksum is the 8-bit exclusive OR of all characters in the sentence, including the ‘,’ the field delimiter, between but not including the ‘\$’ and the ‘*’ delimiters.
<CR><LF>	End of the sentence (Hex 0x0D 0x0A).



## 2.2. PQTM Messages

This chapter explains the **PQTM** messages (proprietary NMEA messages defined by Quectel) supported by LC29H (BS).

### 2.2.1. PQTMCFGSVIN

Sets/gets the survey-in feature. The base station receiver (i.e., the module) must work in static mode, which can be entered via Survey-in mode or Fixed mode.

The Survey-in mode (**<Mode>** = 1) determines the receiver’s position by building a weighted mean of all valid 3D positioning solutions. You can set values of **<MinDur>** and **<3D\_AccLimit>** to define the minimum observation time and 3D position standard deviation used for the position estimation.

The Fixed mode (**<Mode>** = 2) requires user to manually enter the receiver position coordinates. Any error in the base station position will translate directly into rover position error.

**Type:**

Set/Get

**Synopsis:**

```
//Set:
$PQTMCFGSVIN,W,<Mode>,<MinDur>,<3D_AccLimit>,<ECEF_X>,<ECEF_Y>,<ECEF_Z>*<Checksum>
<><CR><LF>
//Get:
$PQTMCFGSVIN,R*<Checksum><CR><LF>
```

**Parameter:**

Field	Format	Unit	Description
<Mode>	Numeric	-	Configure the receiver mode. 0 = Disable 1 = Survey-in mode 2 = Fixed mode (ARP position is given in ECEF.)
<MinDur>	Numeric	Second	Survey-in minimum duration. Range: 0–86400. Default value: 43200.
<3D_AccLimit>	Numeric	Meter	Limit 3D positioning accuracy in survey-in mode. Default value: 15.0. If this field is 0, it means there is no limit.
<ECEF_X>	Numeric	Meter	WGS84 ECEF X coordinate. Default value: 0.0.

Field	Format	Unit	Description
<ECEF_Y>	Numeric	Meter	WGS84 ECEF Y coordinate. Default value: 0.0.
<ECEF_Z>	Numeric	Meter	WGS84 ECEF Z coordinate. Default value: 0.0.

**Result:**

- If successful, the module returns:

```
//Response to Set command:
$PQTMCFGSVIN,OK*<Checksum><CR><LF>
//Response to Get command:
$PQTMCFGSVIN,OK,<Mode>,<MinDur>,<3D_AccLimit>,<ECEF_X>,<ECEF_Y>,<ECEF_Z>*<Checksum><CR><LF>
```

- If failed, the module returns:

```
$PQTMCFGSVIN,ERROR,<ErrCode>*<Checksum><CR><LF>
```

**Parameter included in the result:**

Field	Format	Unit	Description
<ErrCode>	Numeric	-	Error code. 1 = Invalid parameters.

**Example:**

```
//Set:
$PQTMCFGSVIN,W,2,0,0.0,-2472446.4619,4828304.1363,3343730.2653*34
$PQTMCFGSVIN,OK*70
//Get:
$PQTMCFGSVIN,R*26
$PQTMCFGSVIN,OK,2,0,0.0,-2472446.4619,4828304.1363,3343730.2653*67
```

**2.2.2. PQTMSAVEPAR**

Saves the configurations set via **\$PQTM** commands to NVM. Reset the module after executing this command.

**Type:**

Command

**Synopsis:**

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

**Parameter:**

None

**Result:**

- If successful, the module returns:

```
$PQTMSAVEPAR,OK*72
```

- If failed, the module returns:

```
$PQTMSAVEPAR,ERROR,<ErrCode>*<Checksum><CR><LF>
```

**Parameter included in the result:**

Field	Format	Unit	Description
<ErrCode>	Numeric	-	Error code. 1 = Invalid parameters

**Example:**

```
$PQTMSAVEPAR*5A
$PQTMSAVEPAR,OK*72
```

**2.2.3. PQTMRESTOREPAR**

Restores all parameters set via **\$PQTM** commands to default values.

**Type:**

Command

**Synopsis:**

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

**Parameter:**

None

**Result:**

- If successful, the module returns:

```
$PQTMRESTOREPAR,OK*3B
```

- If failed, the module returns:

```
$PQTMRESTOREPAR,ERROR,<ErrCode>* <Checksum><CR><LF>
```

**Parameter included in the result:**

Field	Format	Unit	Description
<ErrCode>	Numeric	-	Error code. 1 = Invalid parameters

**Example:**

```
$PQTMRESTOREPAR*13
$PQTMRESTOREPAR,OK*3B
```

### 2.2.4. PQTMVERNO

Queries the firmware version information.

**Type:**

Command

**Synopsis:**

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

**Parameter:**

None

**Result:**

- If successful, the module returns:

```
$PQTMVERNO,<VerStr>,<BuildDate>,<BuildTime>* <Checksum><CR><LF>
```

- If failed, the module returns:

```
$PQTMVERNO,ERROR,<ErrCode>* <Checksum><CR><LF>
```

Parameters included in the result:

Field	Format	Unit	Description
<VerStr>	String	-	Version string.
<BuildDate>	yyyy/mm/dd	-	Firmware build date.
<BuildTime>	hh:mm:ss	-	Firmware build time.
<ErrCode>	Numeric	-	Error code. 1 = Invalid parameters

Example:

```
$PQTMVERNO*58
$PQTMVERNO,LC29HBSNR01A01S,2022/08/31,15:22:59*27
```

## 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	-	Result type. 0 = Command has been successfully sent. 1 = Command is being processed. Please wait for the result.

Field	Format	Unit	Description
			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:**

```
$PAIR001,006,0*3D
```

**2.3.2. 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-3 messages 0 = Enable outputting RTCM-3 MSM4 messages 1 = Enable outputting RTCM-3 MSM7 messages

**Result:**

Returns \$PAIR001 message.

**Example:**

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

**2.3.3. 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 = Disable outputting RTCM-3 messages 0 = Enable outputting RTCM-3 MSM4 messages 1 = Enable outputting RTCM-3 MSM7 messages

**Example:**

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

**2.3.4. 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 stationary RTK reference station ARP (message type 1005). 0 = Disable <u>1</u> = Enable

**Result:**

Returns \$PAIR001 message.

**Example:**

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

**2.3.5. 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 RTK reference station ARP (message type 1005).



Field	Format	Unit	Description
			0 = Disabled 1 = Enabled

Example:

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

### 2.3.6. 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 in RTCM format. 0 = Disable <u>1</u> = Enable

Result:

Returns \$PAIR001 message.

Example:

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

### 2.3.7. 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 in RTCM format. 0 = Disabled 1 = Enabled

**Example:**

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

# 3 RTCM Protocol

The LC29H (BS) module supports the RTCM protocol according to *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.rtcn.org/>.

## 3.1. Supported RTCM Messages

The LC29H (BS) module supports outputting RTCM-3 messages listed below.

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

Message Type	Mode	Message Name
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 3: Terms and Abbreviations**

Abbreviation	Description
ACK	Acknowledgement
ARP	Antenna Reference Point
ASCII	American Standard Code for Information Interchange
BDS	BeiDou Navigation Satellite System
ECEF	Earth Centered Earth Fixed
Galileo	Galileo Satellite Navigation System (EU)
GLONASS	Global Navigation Satellite System (Russia)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
MNL	MTK Navigation Lib
MSM	Multiple Signal Messages
NMEA	NMEA (National Marine Electronics Association) 0183 Interface Standard
NVM	Non-Volatile Memory
PAIR	Proprietary Protocol of MTK
QZSS	Quasi-Zenith Satellite System
RTCM	Radio Technical Commission for Maritime Services
RTK	Real-Time Kinematic
WGS84	World Geodetic System 1984

# 5 Appendix B Special Characters

Table 4: Special Characters

Special Character	Definition
<...>	Parameter name. Angle brackets do not appear in the message.
[...]	Optional field of a message. Square brackets do not appear in the message.
{...}	Repeated field of a message. Curly brackets do not appear in the message.
<u>Underline</u>	Default setting of a parameter.