

L70-R Series GPS

Protocol Specification

GPS Module Series

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About the Document

History

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2.0	2015-07-09	Connie ZHOU	<ol style="list-style-type: none"> 1. Added Packet Type 869 2. Deleted Packet Type 183, 184, 185, 223, 225, 313, 413, 513 and 622 3. Modified parameter for Packet Type 301
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1 Introduction

L70-R series module includes L70-R and L70-RL variants. It is a collection of full-featured GPS module with super sensitivity. It is characteristic by low power consumption and compact size. The module supports autonomous GPS C/A. It can be used in positioning, navigation and other industries.

This document describes the software aspects of L70-R series module. L70-R series supports NMEA 0183 standard commands. MTK NMEA extended packet is supported to control and configure L70-R series GPS module.

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2 Standard NMEA Packet Protocol

L70-R series supports NMEA 0183 standard messages. The following table shows the structure of a NMEA 0183 standard message.

Table 1: Structure of NMEA Message

Field	Length (Bytes)	Description
\$	1	Each NMEA message starts with '\$'
Talker ID	1~2	'GP' for a GPS receiver
NMEA Message ID	3	NMEA message ID
Data Field	Variable, depend on the NMEA message type	Data fields, delimited by comma ','
*	1	End character of data field
Checksum	2	A hexadecimal number calculated by exclusive OR of all characters between '\$' and '*'
<CR><LF>	2	Each NMEA message ends with 'CR' and 'LF'

NOTE

The default output message of L70-R series has the following six sentences: RMC, VTG, GGA, GSA, GSV and GLL.

2.1. GPRMC

RMC: recommended minimum position data (including position, velocity and time).

Example:

```
$GPRMC,104749.000,A,3150.7846,N,11711.9256,E,0.16,48.45,230516,,,A*5D<CR><LF>
```

Field	Description
-------	-------------

\$	Each NMEA message starts with '\$'
GPRMC	Message ID
UTC Time	Time in format 'hhmmss.sss'
Data Valid	'V'=Invalid 'A'=Valid
Latitude	Latitude in format 'ddmm.mmmm' (degree and minutes)
N/S	'N'=North 'S'=South
Longitude	Longitude in format 'dddmm.mmmm' (degree and minutes)
E/W	'E'=East 'W'=West
Speed	Speed over ground in knots
COG	Course over ground in degree
Date	Date in format 'ddmmyy'
Magnetic Variation	Magnetic variation in degree, not being output
E/W	Magnetic variation E/W indicator, not being output
Positioning Mode	'N'=No fix 'A'=Autonomous GPS fix 'D'=Differential GPS fix
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

2.2. GPVTG

VTG: track made good and ground speed.

Example:

\$GPVTG,0.0,T,,M,0.0,N,0.1,K,A*0C<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'

GPVTG	Message ID
COG (T)	Course over ground (true) in degree
T	Fixed field, true
COG (M)	Course over ground (magnetic), not being output
M	Fixed field, magnetic
Speed	Speed over ground in knots
N	Fixed field, knots
Speed	Speed over ground in km/h
K	Fixed field, km/h
Positioning Mode	'N'=No fix 'A'=Autonomous GPS fix 'D'=Differential GPS fix
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

2.3. GPGGA

GGA: global positioning system fix data. It is the essential fix data which provides 3D location and accuracy data.

Example:

```
$GPGGA,104750.000,3150.7855,N,11711.9258,E,1,6,1.73,54.9,M,0.0,M,,*59<CR><LF>
```

Field	Description
\$	Each NMEA message starts with '\$'
GPGGA	Message ID
UTC Time	Time in format 'hhmmss.sss'
Latitude	Latitude in format 'ddmm.mmmm' (degree and minutes)

N/S	'N'=North 'S'=South
Longitude	Longitude in format 'dddmm.mmmm' (degree and minutes)
E/W	'E'=East 'W'=West
Fix Status	'0'=Invalid '1'=GPS fix '2'=DGPS fix
Number of SV	Number of satellites being used (0~12)
HDOP	Horizontal Dilution Of Precision
Altitude	Altitude in meters according to WGS84 ellipsoid
M	Fixed field, meter
GeoID Separation	Height of GeoID (mean sea level) above WGS84 ellipsoid, meter
M	Fixed field, meter
DGPS Age	Age of DGPS data in seconds, empty if DGPS is not used
DGPS Station ID	DGPS station ID, empty if DGPS is not used
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

2.4. GPGSA

GSA: GPS DOP and Active Satellites. It provides details on the fix, including the numbers of the satellites being used and the DOP. At most the first 12 satellite IDs are outputted.

Example:

```
$GPGSA,A,3,18,25,12,193,24,15,22,14,,,,,1.47,1.17,0.89*37<CR><LF>
```

Field	Description
\$	Each NMEA message starts with '\$'
GPGSA	Message ID

Mode	Auto selection of 2D or 3D fix 'M'=Manual, forced to switch 2D/3D mode 'A'=Allowed to automatically switch 2D/3D mode
Fix Status	'1'=No fix '2'=2D fix '3'=3D fix
Satellite Used 1	Satellite used on channel 1
Satellite Used 2	Satellite used on channel 2
Satellite Used 3	Satellite used on channel 3
Satellite Used 4	Satellite used on channel 4
Satellite Used 5	Satellite used on channel 5
Satellite Used 6	Satellite used on channel 6
Satellite Used 7	Satellite used on channel 7
Satellite Used 8	Satellite used on channel 8
Satellite Used 9	Satellite used on channel 9
Satellite Used 10	Satellite used on channel 10
Satellite Used 11	Satellite used on channel 11
Satellite Used 12	Satellite used on channel 12
PDOP	Position Dilution Of Precision
HDOP	Horizontal Dilution Of Precision
VDOP	Vertical Dilution Of Precision
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

2.5. GPGSV

GSV: GPS Satellites in View. One GSV sentence can only provide data for at most 4 satellites, so several sentences might be required for the full information. Since GSV includes satellites that are not used as

part of the solution, GSV sentence contains more satellites than GGA does.

Example:

```
$GPGSV,3,1,12,01,05,060,18,02,17,259,43,04,56,287,28,09,08,277,28*77<CR><LF>
```

```
$GPGSV,3,2,12,10,34,195,46,13,08,125,45,17,67,014,,20,32,048,24*74<CR><LF>
```

```
$GPGSV,3,3,12,23,13,094,48,24,04,292,24,28,49,178,46,32,06,037,22*7D<CR><LF>
```

Field	Description
\$	Each NMEA message starts with '\$'
GPGSV	Message ID
Number of Message	Number of messages, total number of GPGSV messages being output (1~3)
Sequence Number	Sequence number of this entry (1~3)
Satellites in View	Total satellites in view
Satellite ID 1	Satellite ID
Elevation 1	Elevation in degree (0~90)
Azimuth 1	Azimuth in degree (0~359)
SNR 1	Signal to Noise Ratio in dBHz (0~99), empty if not tracking
Satellite ID 2	Satellite ID
Elevation 2	Elevation in degree (0~90)
Azimuth 2	Azimuth in degree (0~359)
SNR 2	Signal to Noise Ratio in dBHz (0~99), empty if not tracking
Satellite ID 3	Satellite ID
Elevation 3	Elevation in degree (0~90)
Azimuth 3	Azimuth in degree (0~359)
SNR 3	Signal to Noise Ratio in dBHz (0~99), empty if not tracking
Satellite ID 4	Satellite ID
Elevation 4	Elevation in degree (0~90)
Azimuth 4	Azimuth in degree (0~359)
SNR 4	Signal to Noise Ratio in dBHz (0~99), empty if not tracking
*	End character of data field

Checksum	Hexadecimal checksum
<CR><LF>	Each of message

2.6. GPGLL

GLL: Geographic Latitude and Longitude. It contains position information, time of position fix and status.

Example:

```
$GPGLL,3150.7855,N,11711.9258,E,104750.000,A,A*57<CR><LF>
```

Field	Description
\$	Each NMEA message starts with '\$'
GPGLL	Message ID
Latitude	Latitude in format 'ddmm.mmmm' (degree and minutes)
N/S	'N'=North 'S'=South
Longitude	Longitude in format 'dddmm.mmmm' (degree and minutes)
E/W	'E'=East 'W'=West
UTC Time	Time in format 'hhmmss.sss'
Data Valid	'V'=Invalid 'A'=Valid
Positioning Mode	'N'=No fix 'A'=Autonomous GPS fix 'D'=Differential GPS fix
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3 MTK NMEA Packet Protocol

This chapter introduces the MTK NMEA packet protocol, which is a set of extension messages of the standard NMEA packet protocol. These messages are used to control and configure L70-R series GPS module. The following table shows the structure of a MTK NMEA packet.

Table 2: Structure of MTK NMEA Packet

Filed		Length(Bytes)	Description
\$		1	Each NMEA message starts with '\$'
Talker ID		1	'P' for proprietary message
NMEA	Data type	3	Always 'MTK' to indicate MTK proprietary message
Data Filed	Packet type	3	Packet type, from '000' to '999'
	Packet data	Variable, depend on the packet type	Data fields, delimited by comma ','
*		1	End character of data field
Checksum		2	A hexadecimal number calculated by exclusive OR of all characters between '\$' and '*'
<CR><LF>		2	Each NMEA message ends with 'CR' and 'LF'

3.1. Packet Type: 010 PMTK_SYS_MSG

This message is used to automatically output system messages of GPS module.

Data Field:

None

Example:

\$PMTK010,001*2E<CR><LF>

Field	Description
-------	-------------

\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	010
Message	System message '0'=Unknown '1'=Startup '2'=Notification for the host aiding EPO '3'=Notification for the transition to normal mode is successfully done
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.2. Packet Type: 011 PMTK_TXT_MSG

This message is used to automatically output system messages of GPS module.

Data Field: None Example: \$PMTK011,MTKGPS*08<CR><LF>	
Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	011
Message	MTKGPS
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.3. Packet Type: 001 PMTK_ACK

Acknowledgement of PMTK command. In order to inform the sender whether the receiver has received the packet, an acknowledge packet PMTK_ACK should return after the receiver receives a packet.

Some commands will cause the GPS module to restart or change the baud rate. There is no PMTK_ACK for those commands as listed below.

- PMTK_CMD_HOT_START
- PMTK_CMD_WARM_START
- PMTK_CMD_COLD_START
- PMTK_CMD_FULL_COLD_START
- PMTK_SET_NMEA_BAUDRATE

Data Field:

\$PMTK001,Cmd,Flag

Example:

\$PMTK001,869,3*37<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	001
Command	The packet type that the acknowledge responds
Flag	'0'=Invalid packet
	'1'=Unsupported packet type
	'2'=Valid packet, but action failed
	'3'=Valid packet, action succeeded
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.4. Packet Type: 101 PMTK_CMD_HOT_START

This message is used to hot start the GPS module (use all available data in the NV store). Normally hot start means the GPS module was powered down less than 3 hours (RTC must be alive) and its ephemeris

is still valid. As there is no need for downloading ephemeris, it is the fastest startup method.

Data Field:

None

Example:

\$PMTK101*32<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	101
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.5. Packet Type: 102 PMTK_CMD_WARM_START

This message is used to warm start the GPS module. Warm start means the GPS module has approximate information of time, position and coarse data on satellite positions. But it needs to download ephemeris until it can get a fix. Using this message will enable the GPS module to be warm-restarted without using the ephemeris data in NV.

Data Field:

None

Example:

\$PMTK102*31<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	102
*	End character of data field
Checksum	Hexadecimal checksum

<CR><LF>	Each of message
----------	-----------------

3.6. Packet Type: 103 PMTK_CMD_COLD_START

This message is used to cold start the GPS module. Using this message will enable the GPS module to be cold-restarted without using any prior location information, including time, position, almanacs and ephemeris data.

Data Field:

None

Example:

\$PMTK103*30<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	103
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.7. Packet Type: 104 PMTK_CMD_FULL_COLD_START

This message is essentially a cold restart, but additionally it will clear system and user configurations at re-start. That is, reset the GPS module to the factory status. Full cold start means that the GPS module has no information on last location. It needs to search the full time and frequency space, and also all possible satellite numbers before it can get a fix.

Data Field:

None

Example:

\$PMTK104*37<CR><LF>

Field	Description
-------	-------------

\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	104
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.8. Packet Type: 161 PMTK_CMD_STANDBY_MODE

This message is used to enter standby mode for power saving.

Data Field:
\$PMTK161,Type
Example:
\$PMTK161,0*28<CR><LF>
Response:
\$PMTK001,161,3*36<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	161
Type	'0'=Stop mode
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.9. Packet Type: 220 PMTK_SET_POS_FIX

This message is used to set position fix interval.

Data Field:
\$PMTK220, Interval
Example:
\$PMTK220,1000*1F<CR><LF>
Response:
\$PMTK001,220,3*30<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	220
Interval	Position fix interval [msec]. [Range: 100~10000]
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.10. Packet Type: 251 PMTK_SET_NMEA_BAUDRATE

This message is used to set NMEA port baud rate. Using PMTK251 command to setup baud rate setting, the setting will back to default value when full cold start command is issued.

Data Field:
\$PMTK251,Baudrate
Example:
\$PMTK251,38400*27<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	251
Baud Rate	Baud rate setting: 9600 - default setting 4800 9600 14400

	19200
	38400
	57600
	115200
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.11. Packet Type: 255 PMTK_SET_SYNC_PPS_NMEA

This message is used to enable or disable fix NMEA output time behind PPS function. (Default off)

Data Field:

\$PMTK255,Enable

Example:

\$PMTK255,0*2C<CR><LF>

Response:

\$PMTK001,255,3*32<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	255
Enable	'0'=Disable '1'=Enable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.12. Packet Type: 285 PMTK_SET_PPS_CONFIG

This message is used to set PPS type.

Data Field:
\$PMTK285,Type,PPSPulseWidth
Example:
\$PMTK285,4,100*38<CR><LF>
Response:
\$PMTK001,285,3*3F<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	285
Type	'0'=Disable '1'=After the first fix '2'=3D fix only '3'=2D/3D fix only '4'=Always
PPSPulseWidth	2~998 (Unit: ms)
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.13. Packet Type: 286 PMTK_SET_AIC_ENABLED

This message is used to enable or disable AIC function. It is suggested to set cold start command first and then PMTK command.

Data Field:
\$PMTK286,Enable
Example:
\$PMTK286,0*22<CR><LF>
Response:
\$PMTK001,286,3*3C<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'

PMTK	MTK proprietary message
Packet Type	286
Enable	'0'=Disable '1'=Enable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.14. Packet Type: 301 PMTK_API_SET_DGPS_MODE

This message is used to configure the source mode of DGPS correction data.

Data Field:
\$PMTK301,Mode
Example:
\$PMTK301,1*2D<CR><LF>
Response:
\$PMTK001,301,3*32<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	301
Mode	DGPS data source mode. '0'=No DGPS source '1'=RTCM mode
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.15. Packet Type: 314 PMTK_API_SET_NMEA_OUTPUT

This message is used to set NMEA sentence output frequencies. There are totally 19 data fields that present output frequencies for the 19 supported NMEA sentences individually.

Supported Frequency Settings:

- 0 - Disabled or not supported sentence
- 1 - Output once every one position fix
- 2 - Output once every two position fixes
- 3 - Output once every three position fixes
- 4 - Output once every four position fixes
- 5 - Output once every five position fixes

Data Field:

None

Example:

The module only output RMC once every one position fix.

\$PMTK314,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0*29<CR><LF>

Response:

\$PMTK001,314,3*36<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	314
0 GLL	GLL interval - Geographic Position - Latitude longitude
1 RMC	RMC interval - Recommended Minimum Specific GPS Sentence
2 VTG	VTG interval - Course Over Ground and Ground Speed
3 GGA	GGA interval - GPS Fix Data
4 GSA	GSA interval - GPS DOPS and Active Satellites
5 GSV	GSV interval - GPS Satellites in View
6 Reserved	Always 0
7 Reserved	Always 0
8 Reserved	Always 0

9 Reserved	Always 0
10 Reserved	Always 0
11 Reserved	Always 0
12 Reserved	Always 0
13 Reserved	Always 0
14 Reserved	Always 0
15 Reserved	Always 0
16 Reserved	Always 0
17 ZDA	ZDA interval - Time and Date
18 Reserved	Always 0
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

The following message can be used to restore the system default setting:

Example:

\$PMTK314,-1*04<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	314
Restore	Always -1
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.16. Packet Type: 351 PMTK_API_SET_SUPPORT_QZSS_NMEA

The receiver supports the new NMEA format for QZSS. The command allows users to enable or disable QZSS NMEA format. QZSS NMEA format is disabled by default.

Data Field:

\$PMTK351,Enable

Example:

\$PMTK351,1*28<CR><LF>

Response:

\$PMTK001,351,3*37<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	351
QZSS_Enable	'0'=Disable '1'=Enable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.17. Packet Type: 352 PMTK_API_SET_STOP_QZSS

QZSS is regional positioning service. This command is used to enable or disable QZSS function. QZSS function is enabled by default.

Data Field:

\$PMTK352,Enable

Example:

\$PMTK352,0*2A<CR><LF>

Response:

\$PMTK001,352,3*34<CR><LF>

Field	Description
-------	-------------

\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	352
QZSS_Enable	'0'=Enable '1'=Disable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.18. Packet Type: 386 PMTK_API_SET_STATIC_NAV_THD

This message is used to set the speed threshold for static navigation. If the actual speed is below the threshold, output position will keep the same and output speed will be zero. If the threshold value is set as 0, this function is disabled.

Data Field:
\$PMTK386,Speed_threshold
Example:
\$PMTK386,0.3*3E<CR><LF>
Response:
\$PMTK001,386,3*3D<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	386
Speed_threshold	0~2m/s
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.19. Packet Type: 400 PMTK_API_Q_FIX_CTL

This message is used to query the rate of position fixing activity.

Refer to PMTK_API_SET_FIX_CTL for setting the rate.

Refer to PMTK_DT_FIX_CTL for the result of query.

Data Field:

None

Example:

\$PMTK400*36<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	400
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.20. Packet Type: 401 PMTK_API_Q_DGPS_MODE

This message is used to query the setting of DGPS mode.

Refer to PMTK_API_SET_DGPS_MODE for setting the DGPS mode.

Refer to PMTK_DT_DGPS_MODE for the result of query.

Data Field:

None

Example:

\$PMTK401*37<CR><LF>

Field	Description
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\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	401
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.21. Packet Type: 414 PMTK_API_Q_NMEA_OUTPUT

This message is used to query the current NMEA sentence output frequencies.

Refer to PMTK_API_SET_NMEA_OUTPUT for the frequencies setting.

Refer to PMTK_DT_NMEA_OUTPUT for the result of query.

Data Field: None Example: \$PMTK414*33<CR><LF>	
Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	414
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.22. Packet Type: 605 PMTK_Q_RELEASE

This message is used to query the firmware release information.

Refer to PMTK_DT_RELEASE for the result of query.

Data Field: None Example: \$PMTK605*31<CR><LF>	
Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	605
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.23. Packet Type: 500 PMTK_DT_FIX_CTL

This message is the response to PMTK_API_Q_FIX_CTL.

Data Field: \$PMTK500,Fix interval Example: \$PMTK500,1000,0,0,0,0*1A<CR><LF>	
Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	500
Fix Interval	Position fix interval [msec]. [Range: 100~10000].
Reserved	Always 0
Reserved	Always 0
Reserved	Always 0

Reserved	Always 0
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.24. Packet Type: 501 PMTK_DT_DGPS_MODE

This message is the response to PMTK_API_Q_DGPS_MODE.

Data Field: \$PMTK501,Mode Example: \$PMTK501,1*2B<CR><LF>	
Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	501
Mode	DGPS data source mode. '0'=No DGPS source '1'=RTCM mode
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.25. Packet Type: 514 PMTK_DT_NMEA_OUTPUT

This message is the response to PMTK_API_Q_NMEA_OUTPUT.

Data Field: None Example:	
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\$PMTK514,1,1,1,1,1,1,0,0,0,0,0,0,0,0,0,0*2E<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	514
0 GLL	GLL interval - Geographic Position - Latitude longitude
1 RMC	RMC interval - Recommended Minimum Specific GPS Sentence
2 VTG	VTG interval - Course Over Ground and Ground Speed
3 GGA	GGA interval - GPS Fix Data
4 GSA	GSA interval - GPS DOPS and Active Satellites
5 GSV	GSV interval - GPS Satellites in View
6 Reserved	
7 Reserved	
8 Reserved	
9 Reserved	
10 Reserved	
11 Reserved	
12 Reserved	
13 Reserved	
14 Reserved	
15 Reserved	
16 Reserved	
17 ZDA	ZDA interval - Time and Date
18 Reserved	Always 0
*	End character of data field

Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.26. Packet Type: 705 PMTK_DT_RELEASE

This message is the response to PMTK_Q_RELEASE.

Data Field: \$PMTK705, Release string, Build ID, Product Model(,SDK Version) Example: \$PMTK705,AXN_2.32_3337_15010801,0000,*,*2D<CR><LF>	
Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	705
Release String	Firmware release name and version 3318: Mcore_x.x 3329: AXN_x.x 3339: AXN_x.x 3333: AXN_x.x 3337: AXN_x.x
Build ID	Build ID set in CoreBuilder for firmware version control
Product Model	Product Model set in CoreBuilder for product identification
SDK Version (Optional)	Showing SDK version if the firmware is used for SDK
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.27. Packet Type: 869 PMTK_EASY_ENABLE

This message is used to enable or disable EASY function, and it can also be used to query whether EASY is enabled or disabled.

Data Field:
\$PMTK869,CmdType[, Enabled]

Example:
\$PMTK869,1,1*35<CR><LF>

Response:
\$PMTK001,869,3*37<CR><LF>

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	869
CmdType	'0'=Query '1'=Set '2'=Result for Query operation
Enabled	'0'=Disable '1'=Enable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

3.28. Packet Type: 886 PMTK_FR_MODE

This message is used to set navigation mode.

Data Field:
\$PMTK886,CmdType

Example:
\$PMTK886,3*2B<CR><LF>

Response:
\$PMTK001,886,3*36

Field	Description
\$	Each NMEA message starts with '\$'
PMTK	MTK proprietary message
Packet Type	886
CmdType	'0'=Normal mode: For general purpose '1'=Fitness mode: For running and walking purpose that the low-speed (<5m/s) movement will have more effect on the position calculation. '2'=Aviation mode: For high-dynamic purpose that the large-acceleration movement will have more effect on the position calculation. '3'=Balloon mode: For high-altitude balloon purpose that the vertical movement will have more effect on the position calculation.
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4 Appendix A References

Table 3: Related Documents

SN	Document Name	Remark
[1]	Quectel_L70-R_Series_Hardware_Design	L70-R Series Hardware Design
[2]	Quectel_L70-R_Series_EVB_User_Guide	L70-R Series EVB User Guide
[3]	Quectel_L70-R_Series_Reference_Design	L70-R Series Reference Design

Table 4: Terms and Abbreviations

Abbreviation	Description
AGPS	Assisted Global Positioning System
AIC	Active Interference Cancellation
DGPS	Differential Global Positioning System
EASY	Embedded Assist System
GGA	NMEA: Global Positioning System Fix Data
GLL	NMEA: Geographic Position – Latitude/Longitude
GPS	Global Navigation Satellite System
GSA	NMEA: GPS DOP and Active Satellites
GSV	NMEA: GPS Satellites in View
HDOP	Horizontal Dilution of Precision
NMEA	National Marine Electronics Association
PDOP	Position Dilution of Precision
PMTK	Private protocol of MTK

PPS	Pulse Per Second
RMC	NMEA: Recommended Minimum Position Data
UTC	Universal Time Coordinated
VDOP	Vertical Dilution of Precision
VTG	NMEA: Track Made Good and Ground Speed

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5 Default Configurations

Table 5: Default Configurations

Item	Default
NMEA port baud rate	9600bps
Datum	WGS84
Rate of position fixing	1HZ
DGPS mode	Off
EASY	Enabled
NMEA output messages	RMC, VTG, GGA, GSA, GSV and GLL
AIC	On