L10

Quectel GPS Engine

GPS Protocol Specification

L10_GPS_Protocol_V1.01

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Contents

Contents 2

Table Index..4

0. Revision History 5

1. Introduction...6

    1.1. Reference...6

    1.2. Terms and abbreviations...6

2. NMEA Message Structure...7

3. Standard NMEA Protocol 8

    3.1. RMC 8

    3.2. VTG...8

    3.3. GGA 9

    3.4. GSA 10

    3.5. GSV 11

    3.6. GLL 12

    3.7. ZDA...12

    3.8. TXT...13

4. MTK NMEA Packet Protocol..15

    4.1. Packet Type: 000 PMTK_TEST...16

    4.2. Packet Type: 010 PMTK_SYS_MSG 16

    4.3. Packet Type: 001 PMTK_ACK..16

    4.4. Packet Type: 101 PMTK_CMD_HOT_START...17

    4.5. Packet Type: 102 PMTK_CMD_WARM_START...18

    4.6. Packet Type: 103 PMTK_CMD_COLD_START 18

    4.7. Packet Type: 104 PMTK_CMD_FULL_COLD_START 18

    4.8. Packet Type: 120 PMTK_CMD_CLEAR_FLASH_AID 19

    4.9. Packet Type: 251 PMTK_SET_NMEA_BAUDRATE 19

    4.10. Packet Type: 300 PMTK_API_SET_FIX_CTL...20

    4.11. Packet Type: 301 PMTK_API_SET_DGPS_MODE..20

    4.12. Packet Type: 313 PMTK_API_SET_SBAS_ENABLED 21

    4.13. Packet Type: 314 PMTK_API_SET_NMEA_OUTPUT 21

    4.14. Packet Type: 330 PMTK_API_SET_DATUM...22

    4.15. Packet Type: 331 PMTK_API_SET_DATUM_ADVANCE..23

    4.16. Packet Type: 340 PMTK_API_SET_ANTENNA_CONTROL.......................................23

    4.17. Packet Type: 400 PMTK_API_Q_FIX_CTL 24

    4.18. Packet Type: 401 PMTK_API_Q_DGPS_MODE...24

    4.19. Packet Type: 413 PMTK_API_Q_SBAS_ENABLED 25

    4.20. Packet Type: 414 PMTK_API_Q_NMEA_OUTPUT...25

    4.21. Packet Type: 430 PMTK_API_Q_DATUM...25

    4.22. Packet Type: 431 PMTK_API_Q_DATUM_ADVANCE..26

Table Index

0. Revision History

Revision	Date	Author	Description of change
1.00	2009-08-10	Eagle LIU	Initial
1.01	2009-11-26	Ella HUANG	1. Delete commands relative to USER_OPTION 2. Add note in 4.2 Packet Type: 010 PMTK_SYS_MSG

1. Introduction

L10 is a full featured GPS module with super sensitivity while low power consumption and compact size.   It supports location and navigation applications and could be widely used for tracking and tracing, telemetry, GIS application and security etc.

This document describes the software aspects of L10. L10 supports NMEA 0183 standard V3.01 with backward compatibility.   MTK NMEA extended packet is supported to control and configure L10 GPS module.

1.1. Reference

Table 1: Reference

SN	Document name	Remark
[1]	L10_HD	Hardware design document of L10 module

1.2. Terms and abbreviations

Table 2: Terms and abbreviations

Abbreviation	Description
GPS	Global Positioning System
NMEA	National Marine Electronics Association
PMTK	MTK Private Protocol
RMC	Recommended Minimum Specific GNSS Data
VTG	Course over Ground and Ground Speed
GGA	Global positioning system fix data
GSA	GNSS DOP and Active Satellites
GSV	GNSS Satellites in View
GLL	Geographic Position – Latitude/Longitude
ZDA	Time and Date
PDOP	Position Dilution of Precision
HDOP	Horizontal Dilution of Precision
VDOP	Vertical Dilution of Precision
GNSS	Global Navigation Satellite System
SBAS	Satellite-based Augmentation System
RTCM	Radio Technical Commission for Maritime Services
WAAS	Wide Area Augmentation System

2. NMEA Message Structure

L10 supports NMEA 0813 standard V3.01. The following table shows the structure of a NMEA protocol message.

Table 3: Structure of NMEA message

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

3. Standard NMEA Protocol

3.1. RMC

RMC, Recommended Minimum sentence C, the essential GPS data (including position, velocity and time).   The output of this message is dependent on the currently selected datum. The default datum is WGS84.

Example:	
$GPRMC,041139.000,A,3110.2908,N,12123.2348,E,0.44,128.49,300709,,,A*65<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 GNSS fix** **'D' = Differential GNSS fix**
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

3.2. VTG

VTG, course over ground and ground speed.

Example:

$GPVTG,128.49,T,,M,0.44,N,0.81,K,A*32<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 GNSS fix
	'D' = Differential GNSS fix
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

3.3. GGA

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

Example: $GPGGA,041140.000,3110.2907,N,12123.2353,E,1,5,1.42,58.7,M,8.0,M,,*57<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 (SPS)
	'2' = DGPS fix
	'3' = PPS fix
	'4' = Real Time Kinematic
	'5' = Float RTK

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

3.4. GSA

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

Example:	
$GPGSA,A,3,14,06,16,31,23,,,,,,,,1.66,1.42,0.84*0F<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
GPGSA	Message ID
Mode	Auto selection of 2D or 3D fix
	'M' = Manual, forced to operate in 2D or 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

3.5. GSV

GSV, GNSS Satellites in View, shows data about the satellites that might be found based on its viewing mask and almanac data. It also shows current ability to track this data. One GSV sentence only can provide data for up to 4 satellites and thus there may need to be 3 sentences for the full information. GSV sentence contains more satellites than GGA might indicate since GSV includes satellites that are not used as part of the solution.

Example:	
$GPGSV,3,1,11,31,58,006,19,16,52,238,28,14,45,136,35,29,34,071,*75<CR><LF>	
$GPGSV,3,2,11,32,34,276,16,20,20,296,,30,12,046,,06,09,189,36*7F<CR><LF>	
$GPGSV,3,3,11,23,05,319,22,22,02,174,38,26,01,137,20*4F<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 ration 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 ration 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 ration 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 ration in dBHz (0 ~ 99), empty if not tracking
*	End character of data field
Checksum	Hexadecimal checksum

<CR><LF>	Each of message

3.6. GLL

GLL, Geographic Latitude and Longitude, contains position information, time of position fix and status.   The output of this message is dependent on the currently selected datum.   The default datum is WGS84.

Example:	
$GPGLL,3110.2908,N,12123.2348,E,041139.000,A,A*59<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 GNSS fix
	'D' = Differential GNSS fix
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

3.7. ZDA

ZDA, time and date.

Example:	
$GPZDA,041140.000,30,07,2009,,*59<CR><LF>	
Field	**Description**
$	**Each NMEA message starts with '$'**
GPZDA	**Message ID**
UTC time	**Time in format 'hhmmss.sss'**
Day	**Day in format 'dd'**
Month	**Month in format 'mm'**
Year	**Year in format 'yyyy'**

Local zone hours	**Local zone hours, not supported, empty**
Local zone minutes	**Local zone minutes, not supported, empty**
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

3.8. TXT

This message is used to output information.

Field	Description
$	**Each NMEA message starts with '$'**
GPTXT	**Message ID**
XX	**Total number of messages in this transmission. (01 ~ 99)**
YY	**Message number in this transmission. (01 ~ 99)**
ZZ	**Severity of the message** **'00' = ERROR** **'01' = WARNING** **'02' = NOTICE** **'07' = USER**
Text message	**Output information**
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

At the startup, information including product model, software version and antenna status will be output once.

The notification of the antenna status will be sent out whenever the antenna status change is detected.

Information of product model at startup

Example: $GPTXT,01,01,02,MOD=QUECTEL-L10*09<CR><LF>
$GPTXT,XX,YY,ZZ,MOD=*Product_Model**CS<CR><LF>
Product model information starts with 'MOD'.

Information of software version at startup

Example: $GPTXT,01,01,02,SW=AXN_1.30,0000*4C<CR><LF>
$GPTXT,XX,YY,ZZ,SW=ReleaseString_BuildID,(SDK_Version)*CS<CR><LF>

> Software version information starts with 'SW', including release string, build ID and SDK version if proper.

Notifications of antenna status change.　　These messages are sent out only once per antenna status change.

Example:
$GPTXT,01,01,02,ANTSTATUS=SHORT*6D<CR><LF>
$GPTXT,01,01,02,ANTSTATUS=OPEN*2B<CR><LF>
$GPTXT,01,01,02,ANTSTATUS=OK*3B<CR><LF>
$GPTXT,XX,YY,ZZ,ANTSTATUS=*Antenna_Status*CS<CR><LF>**
ANTSTATUS=DONOTKNOW, if can not determine the status of the antenna
ANTSTATUS=SHORT, if short circuit state is detected
ANTSTATUS=OPEN, if open circuit state is detected
ANTSTATUS=OK, if antenna status go back to normal

4. MTK NMEA Packet Protocol

In this chapter, we introduce the MTK NMEA packet protocol, which is a set of extension messages of the standard NMEA protocol.   These messages are used to control and configure L10 GPS module.

MTK NMEA packet protocol message follows the standard NMEA message structure as below table.

Table 4: Structure of MTK NMEA packet

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

The maximum length of each packet is restricted to 255 bytes.

In general, an MTK NMEA packet can be presented as following table

$	PMTK	Packet Type	Packet Data	*checksum	<CR><LF>

MTK NMEA packet includes 5 kinds of messages:

Command message, including 'CMD' and 'SET' packet type, used to control and configure the GPS module.

Acknowledge of command message.

Query message, all 'Q' packet type, used to query the current setting.

Response to query, all 'DT' packet type, response to the query message with the current settings.

Misc: other messages, including 'TEST', 'SYS' packet type.

4.1. Packet Type: 000 PMTK_TEST

This is the test packet.

Example: $PMTK000*32<CR><LF>	
Field	**Description**
$	**Each NMEA message starts with '$'**
PMTK	**MTK proprietary message**
Packet type	**000**
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

4.2. Packet Type: 010 PMTK_SYS_MSG

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

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

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

Note ：PMTK_SYS_MSG packet indicates the module started up. Please make sure communication with module after getting PMTK_SYS_MSG packet. Otherwise, the commands put before PMTK_SYS_MSG packet are invalid.

4.3. Packet Type: 001 PMTK_ACK

Acknowledge 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 restart or change the baud rate.   There is no PMTK_ACK for those commands as listed below.

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PMTK_CMD_HOT_START
PMTK_CMD_WARM_START
PMTK_CMD_COLD_START
PMTK_CMD_FULL_COLD_START
PMTK_SET_NMEA_BAUDRATE
PMTK_API_SET_USER_OPTION

Example: $PMTK001,604,3*32<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**

4.4. 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's the fastest startup method.

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**

4.5. 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 force the GPS warm restarted without using the ephemeris data in NV.

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**

4.6. Packet Type: 103 PMTK_CMD_COLD_START

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

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**

4.7. Packet Type: 104 PMTK_CMD_FULL_COLD_START

This message is essentially a cold restart, but additionally clear system and user configurations at re-start. That is, reset the GPS module to the factory status.   Full cold start means 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.

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

4.8. Packet Type: 120 PMTK_CMD_CLEAR_FLASH_AID

This message will erase all aiding data stored in the flash memory.

Example:	
$PMTK120*31<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message
Packet type	120
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.9. Packet Type: 251 PMTK_SET_NMEA_BAUDRATE

This message is used to set NMEA port baud rate.

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:
	0 – default setting
	4800
	9600
	14400
	19200
	38400
	57600
	115200
*	End character of data field

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

4.10. Packet Type: 300 PMTK_API_SET_FIX_CTL

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

Example: $PMTK300,1000,0,0,0,0*1C<CR><LF>	
Field	**Description**
$	**Each NMEA message starts with '$'**
PMTK	**MTK proprietary message**
Packet type	**300**
Fix interval	**Position fix interval [msec]. Must be greater than 200.**
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**

4.11. Packet Type: 301 PMTK_API_SET_DGPS_MODE

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

Example: $PMTK301,1*2D<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** **'2' = WAAS**
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

4.12. Packet Type: 313 PMTK_API_SET_SBAS_ENABLED

This message enables to search a SBAS satellite or not.   SBAS (Satellite Based Augmentation Systems) is a system that supports wide-area or regional augmentation through geostationary satellite broadcast messages.   The geostationary satellite broadcast GPS integrity and correction data with the assistance of multiple ground stations which are located at accurately-surveyed points.

Example:	
$PMTK313,1*2E<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message
Packet type	313
Enable	'0' = Disable '1' = Enable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.13. 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 Setting
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

Example:	
$PMTK314,1,1,1,1,1,5,0,0,0,0,0,0,0,0,0,0,0,1,0*2D<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message
Packet type	314
0 GLL	GPGLL interval - Geographic Position - Latitude longitude
1 RMC	GPRMC interval - Recommended Minimum Specific GNSS Sentence
2 VTG	GPVTG interval - Course Over Ground and Ground Speed

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3 GGA	GPGGA interval - GPS Fix Data
4 GSA	GPGSA interval - GNSS DOPS and Active Satellites
5 GSV	GPGSV interval - GNSS 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	GPZDA interval – Time and Date
18 Reserved	Always 0
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

To restore the system default setting, use below message:

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

4.14. Packet Type: 330 PMTK_API_SET_DATUM

This message is used to set default datum.   L10 supports 219 different datums.   The default datum is WGS84.   The total datums list in the Appendix A.

Example:	
$PMTK330,0*2E<CR><LF>	
Field	Description
$	Each NMEA message starts with '$'

PMTK	MTK proprietary message
Packet type	330
Datum	Index of selected datum, refer to Appendix A.
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.15. Packet Type: 331 PMTK_API_SET_DATUM_ADVANCE

This message is used to set user defined datum.

Example: $PMTK331,6377397.155,299.1528128,-148.0,507.0,685.0*16<CR><LF>	
Field	Description
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message
Packet type	331
majA	User defined datum semi-major axis [m]
ecc	User defined datum eccentric [m]
dX	User defined datum to WGS84 X axis offset [m]
dY	User defined datum to WGS84 Y axis offset [m]
dZ	User defined datum to WGS84 Z axis offset [m]
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.16. Packet Type: 340 PMTK_API_SET_ANTENNA_CONTROL

This message is used to set the control setting of antenna supervision.　By this message, L10 will supervise the status of the antenna and control its power supply.　When there is a status change of the antenna, there is a standard NMEA TXT message sent out with the current antenna status automatically.

L10 supports both short circuit detection and open circuit detection.　If short circuit is detected, L10 will cut off the power supply of the antenna and wait for 1 minute to recover the power supply.

Example: $PMTK340,1*28<CR><LF>	
Field	Description
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message

Packet type	340
Enable	'0' = Disable antenna supervision
	'1' = Enable antenna supervision
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.17. 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 the query.

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

4.18. 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 the query.

Example:	
$PMTK401*37<CR><LF>	
Field	**Description**
$	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

4.19. Packet Type: 413 PMTK_API_Q_SBAS_ENABLED

This message is used to query the setting of SBAS.
Refer to PMTK_API_SET_SBAS_ENABLE for SBAS setting.
Refer to PMTK_DT_SBAS_ENABLED for the result of the query.

Example:	
$PMTK413*34<CR><LF>	
Field	**Description**
$	**Each NMEA message starts with '$'**
PMTK	**MTK proprietary message**
Packet type	**413**
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

4.20. 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 the query.

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**

4.21. Packet Type: 430 PMTK_API_Q_DATUM

This message is used to query the current datum.
Refer to PMTK_API_SET_DATUM for the setting of datum.
Refer to PMTK_DT_DATUM for the result of the query.

Example:	
$PMTK430*35<CR><LF>	
Field	**Description**
$	**Each NMEA message starts with '$'**

PMTK	MTK proprietary message
Packet type	430
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.22. Packet Type: 431 PMTK_API_Q_DATUM_ADVANCE

This message is used to query the user defined datum.

Refer to PMTK_API_SET_DATUM_ADVANCE for the setting of user defined datum.

Refer to PMTK_DT_DATUM for the result of the query.

Example:	
$PMTK431*34<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message
Packet type	431
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.23. Packet Type: 440 PMTK_API_Q_ANTENNA_CONTROL

This message is used to query the current antenna control setting.

Refer to PMTK_API_SET_ANTENNA_CONTROL for control setting.

Refer to PMTK_DT_ANTENNA_CONTROL for the result of the query.

Example:	
$PMTK440*32<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message
Packet type	440
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.24. Packet Type: 441 PMTK_API_Q_ANTENNA_STATUS

This message is used to query the current antenna status.

Refer to PMTK_DT_ANTENNA_STATUS for the result of the query.

Example:	
$PMTK441*33<CR><LF>	
Field	**Description**
$	**Each NMEA message starts with '$'**
PMTK	**MTK proprietary message**
Packet type	**441**
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

4.25. Packet Type: 448 PMTK_API_Q_NMEA_MESSAGE

This message is used to query a specific NMEA message, including GGA, GLL, GSA, GSV, GRS, GST, RMC, VTG and ZDA.   The requested message will be sent only once per query.

Example:	
$PMTK448,4*22<CR><LF>	
Field	**Description**
$	**Each NMEA message starts with '$'**
PMTK	**MTK proprietary message**
Packet type	**448**
NMEA message ID	**'1' = GLL**
	'2' = RMC
	'3' = VTG
	'4' = GGA
	'5' = GSA
	'6' = GSV
	'7' = ZDA
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

4.26. 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 the query.

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

4.27. Packet Type: 500 PMTK_DT_FIX_CTL

This message is the response to PMTK_API_Q_FIX_CTL.

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]. Greater than 200.
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

4.28. Packet Type: 501 PMTK_DT_DGPS_MODE

This message is the response to PMTK_API_Q_DGPS_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
	'2' = WAAS
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.29. Packet Type: 513 PMTK_DT_SBAS_ENABLED

This message is the response to PMTK_API_Q_SBAS_ENABLED.

Example:	
$PMTK513,1*28<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message
Packet type	513
Enable	'0' = Disable
	'1' = Enable
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.30. Packet Type: 514 PMTK_DT_NMEA_OUTPUT

This message is the response to PMTK_API_Q_NMEA_OUTPUT.

Example:	
$PMTK514,1,1,1,1,1,5,1,1,1,1,1,0,1,1,1,1,1,1*2A<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message
Packet type	514
0 GLL	GPGLL interval - Geographic Position - Latitude longitude
1 RMC	GPRMC interval - Recommended Minimum Specific GNSS Sentence
2 VTG	GPVTG interval - Course Over Ground and Ground Speed
3 GGA	GPGGA interval - GPS Fix Data
4 GSA	GPGSA interval - GNSS DOPS and Active Satellites
5 GSV	GPGSV interval - GNSS 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	**GPZDA interval – Time and Date**
18 Reserved	
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

4.31. Packet Type: 530 PMTK_DT_DATUM

This message is the response to PMTK_API_Q_DATUM.

Example:	
$PMTK530,0*28<CR><LF>	
Field	**Description**
$	**Each NMEA message starts with '$'**
PMTK	**MTK proprietary message**
Packet type	**530**
Datum	**Index of the current datum, refer to Appendix A.**
*	**End character of data field**
Checksum	**Hexadecimal checksum**
<CR><LF>	**Each of message**

This message is the response to PMTK_API_Q_DATUM_ADVANCE

Example:	
$PMTK530, 6377397.155, 299.1528128, -148.0, 507.0,685.0*11<CR><LF>	
Field	**Description**
$	**Each NMEA message starts with '$'**
PMTK	**MTK proprietary message**
Packet type	**530**
majA	**User defined datum semi-major axis [m]**
ecc	**User defined datum eccentric [m]**
dX	**User defined datum to WGS84 X axis offset [m]**
dY	**User defined datum to WGS84 Y axis offset [m]**
dZ	**User defined datum to WGS84 Z axis offset [m]**

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

4.32. Packet Type: 540 PMTK_DT_ANTENNA_CONTROL

This message is the response to PMTK_API_Q_ANTENNA_CONTROL.

Example: $PMTK540,1*2E<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message
Packet type	540
Enable	'0' = Disable antenna supervision '1' = Enable antenna supervision
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.33. Packet Type: 541 PMTK_DT_ANTENNA_STATUS

This message is the response to PMTK_API_Q_ANTENNA_STATUS.

Example: $PMTK541,04,01*37<CR><LF>	
Field	**Description**
$	Each NMEA message starts with '$'
PMTK	MTK proprietary message
Packet type	541
Antenna status	Current status of the antenna '1' = DONTKNOW '2' = OK '3' = SHORT '4' = OPEN
Antenna supply	Current status of the antenna power supply '0' = OFF '1' = ON '2' = DONTKNOW
*	End character of data field
Checksum	Hexadecimal checksum
<CR><LF>	Each of message

4.34. Packet Type: 705 PMTK_DT_RELEASE

This message is the response to PMTK_Q_RELEASE.

Example:	
$PMTK705,AXN_1.30,0000,QUECTEL,*7B<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
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**

5. Default Settings

Table 5: Default Settings

Item	Default
NMEA port baud rate	**9600bps**
Datum	**WGS84**
Rate of position fixing	**1Hz**
DGPS mode	**Disable**
SBAS enable	**Disable**
NMEA output rate	**Output once every one position fix for RMC, VTG, GGA, GSA, GSV, GLL**
Antenna control	**'1', Enable both short circuit detection and open circuit detection, and the power supply control.**

Appendix A

Table 6: Datum Region

No	Datum	Region
0	WGS1984	International
1	Tokyo	Japan
2	Tokyo	Mean For Japan, South Korea, Okinawa
3	User Setting	User Setting
4	Adindan	Burkina Faso
5	Adindan	Cameroon
6	Adindan	Ethiopia
7	Adindan	Mali
8	Adindan	Mean For Ethiopia, Sudan
9	Adindan	Senegal
10	Adindan	Sudan
11	Afgooye	Somalia
12	Ain El Abd 1970	Bahrain
13	Ain El Abd 1970	Saudi Arabia
14	American Samoa 1962	American Samoa Islands
15	Anna 1 Astro1965	Cocos Island
16	Antigua Island Astro 1943	Antigua(Leeward Islands)
17	Arc1950	Botswana
18	Arc1950	Burundi
19	Arc1950	Lesotho
20	Arc1950	Malawi
21	Arc1950	Mean For Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, Zimbabwe
22	Arc1950	Swaziland
23	Arc1950	Zaire
24	Arc1950	Zambia
25	Arc1950	Zimbabwe
26	Arc1960	Mean For Kenya Tanzania
27	Arc1960	Kenya
28	Arc1960	Tamzamia
29	Ascension Island 1958	Ascension Island
30	Astro Beacon E 1945	Iwo Jima
31	Astro Dos 71/4	St Helena Island
32	Astro Tern Island (FRIG) 1961	Tern Island

33	Astronomical Station 1952	Marcus Island
34	Australian Geodetic 1966	Australia, Tasmania
35	Australian Geodetic 1984	Australia, Tasmania
36	Ayabelle Lighthouse	Djibouti
37	Bellevue (IGN)	Efate and Erromango Islands
38	Bermuda 1957	Bermuda
39	Bissau	Guuinea-Bissau
40	Bogota Observatory	Colombia
41	Bukit Rimpah	Indonesia(Bangka and Belitung Ids)
42	Camp Area Astro	Antarctica(McMurdi Camp Area)
43	Campo Inchauspe	Argentina
44	Canton Astro1966	Phoenix Island
45	Cape	South Africa
46	Cape Canaveral	Bahamas, Florida
47	Carthage	Tunisia
48	Chatham Island Astro 1971	New Zealand(Chatham Island)
49	Chua Astro	Paraguay
50	Corrego Alegre	Brazil
51	Dabola	Guinea
52	Deception Island	Island, Antarctia
53	Djakarta (Batavia)	Indonesia(Sumatra)
54	Dos 1968	New Georgia Islands (Gizo Island)
55	Easter Island 1967	Easter Island
56	Estonia Coordinate System 1937	Estonia
57	European 1950	Cyprus
58	European 1950	Egypt
59	European 1950	England, Channel Islands, Scotland, Shetland Islands
60	European 1950	England, Ireland, Scotland, Shetland Islands
61	European 1950	Finland, Norway
62	European 1950	Greece
63	European 1950	Iran
64	European 1950	Italy (Sardinia)
65	European 1950	Italy (Slcily)
66	European 1950	Malta

67	European 1950	Mean For Austria, Belgium,Denmark, Finland, France, W Germany, Gibraltar, Greece, Italy, Luxembourg, Netherlands, Norway, Portuga,l Spain, Sweden, Switzerland
68	European 1950	Mean For Austria, Debnmark, France, W Germany, Netherland, Switzerland
69	European 1950	Mean For Irag, Israel, Jordan, Lebanon, Kuwait, Saudi Arabia, Syria
70	European 1950	Portugal, Spain
71	European 1950	Tunisia,
72	European 1979	Mean For Austria, Finland ,Netherlands ,Norway, Spain, Sweden, Switzerland
73	Fort Thomas 1955	Nevis St Kitts (Leeward Islands)
74	Gan 1970	Republic Of Maldives
75	Geodetic Dataum 1970	New Zealand
76	Graciosa Base SW 1948	Azores (Faial, Graciosa, Pico, Sao, Jorge, Terceria)
77	Guam1963	Guam
78	Gunung Segara	Indonesia (Kalimantan)
79	Gux l Astro	Guadalcanal Island
80	Herat North	Afghanistan
81	Hermannskogel Datum	Croatia-Serbia, Bosnia-Herzegoivna
82	Hjorsey 1955	Iceland
83	Hongkong 1963	Hongkong
84	Hu Tzu Shan	Taiwan
85	Indian	Bangladesh
86	Indian	India,Nepal
87	Indian	Pakistan
88	Indian 1954	Thailand
89	Indian 1960	Vietnam (Con Son Island)
90	Indian 1960	Vietnam (Near 16 deg N)
91	Indian 1975	Thailand
92	Indonesian 1974	Indonesian
93	Ireland 1965	Ireland
94	ISTS 061 Astro 1968	South Georgia Islands

95	ISTS 073 Astro 1969	Diego Garcia
96	Johnston Island 1961	Johnston Island
97	Kandawala	Sri Lanka
98	Kerguelen Island 1949	Kerguelen Island
99	Kertau 1948	West Malaysia and Singapore
100	Kusaie Astro 1951	Caroline Islands
101	Korean Geodetic System	South Korea
102	LC5 Astro 1961	Cayman Brac Island
103	Leigon	Ghana
104	Liberia 1964	Liberia
105	Luzon	Philippines (Excluding Mindanao)
106	Luzon	Philippines (Mindanao)
107	M'Poraloko	Gabon
108	Mahe 1971	Mahe Island
109	Massawa	Ethiopia (Eritrea)
110	Merchich	Morocco
111	Midway Astro 1961	Midway Islands
112	Minna	Cameroon
113	Minna	Nigeria
114	Montserrat Island Astro 1958	Montserrat (Leeward Island)
115	Nahrwan	Oman (Masirah Island)
116	Nahrwan	Saudi Arabia
117	Nahrwan	United Arab Emirates
118	Naparima BWI	Trinidad and Tobago
119	North American 1927	Alaska (Excluding Aleutian Ids)
120	North American 1927	Alaska (Aleutian Ids East of 180 degW)
121	North American 1927	Alaska (Aleutian Ids West of 180 degW)
122	North American 1927	Bahamas (Except San Salvador Islands)
123	North American 1927	Bahamas (San Salvador Islands)
124	North American 1927	Canada (Alberta, British Columbia)
125	North American 1927	Canada (Manitoba, Ontario)
126	North American 1927	Canada (New Brunswick, Newfoundland, Nova Scotia, Qubec)
127	North American 1927	Canada (Northwest Territories, Saskatchewan)

128	North American 1927	Canada (Yukon)
129	North American 1927	Canal Zone
130	North American 1927	Cuba
131	North American 1927	Greenland (Hayes Peninsula)
132	North American 1927	Mean For Antigua, Barbados, Barbuda, Caicos Islands, Cuba, Dominican, Grand Cayman, Jamaica, Turks Islands
133	North American 1927	Mean For Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua
134	North American 1927	Mean For Canada
135	North American 1927	Mean For Conus
136	North American 1927	Mean For Conus (East of Mississippi, River Including Louisiana, Missouri, Minnesota)
137	North American 1927	Mean For Conus (West of Mississippi, Rive Excluding Louisiana, Minnesota, Missouri)
138	North American 1927	Mexico
139	North American 1983	Alaska (Excluding Aleutian Ids)
140	North American 1983	Aleutian Ids
141	North American 1983	Canada
142	North American 1983	Conus
143	North American 1983	Hahawii
144	North American 1983	Mexico, Central America
145	North Sahara 1959	Algeria
146	Observatorio Meteorologico 1939	Azores (Corvo and Flores Islands)
147	Old Egyptian 1907	Egypt
148	Old Hawaiian	Hawaii
149	Old Hawaiian	Kauai
150	Old Hawaiian	Maui
151	Old Hawaiian	Mean For Hawaii, Kauai, Maui, Oahu
152	Old Hawaiian	Oahu
153	Oman	Oman
154	Ordnance Survey Great Britian 1936	England
155	Ordnance Survey Great Britian 1936	England, Isle of Man, Wales

156	Ordnance Survey Great Britian 1936	Mean For England ,Isle of Man, Scotland, Shetland Island, Wales
157	Ordnance Survey Great Britian 1936	Scotland, Shetland Islands
158	Ordnance Survey Great Britian 1936	Wales
159	Pico de las Nieves	Canary Islands
160	Pitcairn Astro 1967	Pitcairn Island
161	Point 58	Mean For Burkina Faso and Niger
162	Pointe Noire 1948	Congo
163	Porto Santo 1936	Porto Santo, Maderia Islands
164	Provisional South American 1956	Bolovia
165	Provisional South American 1956	Chile (Northern Near 19 deg S)
166	Provisional South American 1956	Chile (Southern Near 43 deg S)
167	Provisional South American 1956	Colombia
168	Provisional South American 1956	Ecuador
169	Provisional South American 1956	Guyana
170	Provisional South American 1956	Mean For Bolivia Chile,Colombia, Ecuador, Guyana, Peru, Venezuela
171	Provisional South American 1956	Peru
172	Provisional South American 1956	Venezuela
173	Provisional South Chilean 1963	Chile (Near 53 deg S) (Hito XVIII)
174	Puerto Rico	Puerto Rico, Virgin Islands
175	Pulkovo 1942	Russia
176	Qatar National	Qatar
177	Qornoq	Greenland (South)
178	Reunion	Mascarene Island
179	Rome 1940	Italy (Sardinia)
180	S-42 (Pulkovo 1942)	Hungary
181	S-42 (Pulkovo 1942)	Poland
182	S-42 (Pulkovo 1942)	Czechoslavakia
183	S-42 (Pulkovo 1942)	Lativa
184	S-42 (Pulkovo 1942)	Kazakhstan
185	S-42 (Pulkovo 1942)	Albania
186	S-42 (Pulkovo 1942)	Romania
187	S-JTSK	Czechoslavakia (Prior 1 Jan1993)
188	Santo (Dos) 1965	Espirito Santo Island

189	Sao Braz	Azores (Sao Miguel, Santa Maria Ids)
190	Sapper Hill 1943	East Falkland Island
191	Schwarzeck	Namibia
192	Selvagem Grande 1938	Salvage Islands
193	Sierra Leone 1960	Sierra Leone
194	South American 1969	Argentina
195	South American 1969	Bolivia
196	South American 1969	Brazial
197	South American 1969	Chile
198	South American 1969	Colombia
199	South American 1969	Ecuador
200	South American 1969	Ecuador (Baltra, Galapagos)
201	South American 1969	Guyana
202	South American 1969	Mean For Argentina, Bolivia, Brazil,Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Trinidad and Tobago, Venezuela
203	South American 1969	Paraguay
204	South American 1969	Peru
205	South American 1969	Trinidad and Tobago
206	South American 1969	Venezuela
207	South Asia	Singapore
208	Tananarive Observatory 1925	Madagascar
209	Timbalai 1948	Brunei, E Malaysia (Sabah Sarawak)
210	Tokyo	Japan
211	Tokyo	Mean For Japan, South Korea, Okinawa
212	Tokyo	Okinawa
213	Tokyo	South Korea
214	Tristan Astro 1968	Tristam Da Cunha
215	Viti Levu 1916	Fiji (Viti Levu Island)
216	Voirol 1960	Algeria
217	Wake Island Astro 1952	Wake Atoll
218	Wake-Eniwetok 1960	Marshall Islands
219	WGS 1972	Global Definition
220	WGS 1984	Global Definition
221	Yacare	Uruguay
222	Zanderij	Suriname

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