

smart  
positioning



REV 1.0

## ***NMEA Manual for Fastrax IT500 Series GPS receivers***

NMEA command manual for modules based on MediaTek  
chipset

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Fastrax Ltd.

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## CHANGE LOG

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## COMPLEMENTARY READING

The following reference documents are complementary reading for this document:

Ref. #	File name	Document name
1	MTK_NMEA_Packet_0.8_Customer Version.pdf	MTK NMEA Packet User Manual, Customer Version

# 1 GENERAL INFO

## 1.1 Output Valid flags (UP500)

Note: This chapter concerns only UP500 antenna module and does not concern IT500 module.

It is important to notice that current UP500 receiver firmware output position coordinates in RMC and GGA messages even if the position is flagged as invalid in the NMEA RMC message.

This is contrary to most other GPS receivers and the consequence is that a trace displayed on a map might look inaccurate. The advantage for some applications is that you do get some kind of position even if you know the output is not validated.

This is a feature that can very easily be filtered by monitoring Valid "A" flag and invalid "V" flag in the RMC message.

Here is an example of a NOT VALID output fix:

```
$GPRMC,000040.026,V,6016.3376,N,02458.3604,E,0.00,0.00,060180,,N*73
```

```
$GPVTG,0.00,T,,M,0.00,N,0.00,K,N*32
```

```
$GPGGA,000041.026,6016.3376,N,02458.3604,E,0,0,,130.5,M,19.5,M,,*42
```

```
$GPGSA,A,1,,,,,,,,,,,,,*1E
```

```
$GPGSV,1,1,00*79
```

And here is an example of a VALID output fix:

```
$GPRMC,065343.000,A,6016.3204,N,02458.3279,E,0.02,0.00,190309,,A*69
```

```
$GPVTG,0.00,T,,M,0.02,N,0.03,K,A*3C
```

```
$GPGGA,065344.000,6016.3206,N,02458.3278,E,1,7,1.06,29.3,M,19.5,M,,*6A
```

```
$GPGSA,A,3,03,22,16,21,27,06,08,,,,,1.33,1.06,0.81*01
```

```
$GPGSV,3,1,12,06,66,201,48,03,65,236,48,22,56,163,48,21,30,090,42*7E
```

```
$GPGSV,3,2,12,37,21,183,,08,14,331,34,16,13,204,33,27,09,026,33*76
```

```
$GPGSV,3,3,12,07,03,296,30,19,,,45,18,,,48,15,,,37*4C
```

## 2 NMEA COMMANDS

Nmea commands are used to change or query settings of the module.

### **Command Length:**

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

### **Commands Contents:**

**Preamble:** One byte character.

‘\$’

**NMEA ID:** This will identify for the NMEA parser that it is command for MediaTek.

Four bytes character string.

“PMTK”

**Command Number:** Three bytes character string.

From “000” to “999”

An identifier used to tell the decoder how to decode the command

**DataField:** The DataField has variable length depending on the command type.

A comma symbol ‘,’ must be inserted ahead each data filed to help the decoder process the DataField.

\*: 1 byte character.

The star symbol is used to mark the end of DataField.

**CHK1, CHK2:** Two bytes character string.

CHK1 and CHK2 are the checksum of the data between Preamble and “\*”.

**CR, LF:** Two bytes binary data.

The two bytes are used to identify the end of a command.

### **Sample Command:**

```
$PMTK000*32<CR><LF>
```

### 2.1 PMTK\_TEST

#### **Command purpose:**

Testing the communication command.

**Command type:** 000

#### **DataField:**

None

#### **Example:**

```
$PMTK000*32<CR><LF>
```

### 2.2 PMTK\_ACK

#### **Command purpose:**

Acknowledge of PMTK command

**Command number:** 001



**DataField:**

*PMTK001,Cmd,Flag*

Cmd: The command / packet type the acknowledge responds.

Flag:           0 = Invalid command / packet.

                  1 = Unsupported command / packet type

                  2 = Valid command / packet, but action failed

                  3 = Valid command / packet, and action succeeded

**Example:**

\$PMTK001,604,3\*32<CR><LF>

## 2.3      **Startup message**

**Command purpose:**

Output system message

**Command number:** 010

**DataField:**

Msg: The system message.

'0': UNKNOWN

'1': STARTUP

**Example:**

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

## 2.4      **PMTK\_CMD\_HOT\_START**

**Command purpose:**

Hot Restart: Use all available data in the NV Store.

**Command number:** 101

**DataField:**

None

**Example:**

```
$PMTK101*32<CR><LF>
```

## 2.5 **PMTK\_CMD\_WARM\_START**

**Command purpose:**

Warm Restart: Don't use Ephemeris at re-start.

**Command number:** 102

**DataField:**

None

**Example:**

```
$PMTK102*31<CR><LF>
```

## 2.6 **PMTK\_CMD\_COLD\_START**

**Command purpose:**

Cold Restart: Don't use Time, Position, Almanacs and Ephemeris data at re-start.

**Command number:** 101

**DataField:**

None

**Example:**

```
$PMTK103*30<CR><LF>
```

## 2.7 **PMTK\_CMD\_FULL\_COLD\_START**

**Command purpose:**

Full Cold Restart: It's essentially a Cold Restart, but additionally clear system/user configurations at re-start. That is, reset the receiver to the factory status.

**Command number:** 101

**DataField:**

None

**Example:**

```
$PMTK104*37<CR><LF>
```

## 2.8 PMTK\_SET\_NMEA\_BAUDRATE

**Command purpose:**

Set NMEA port baudrate

**Command number:** 251

**DataField:**

*PMTK251,Baudrate*

Baudrate: Baudrate setting

0 – default setting

4800

9600

14400

19200

38400

57600

115200

**Example:**

```
$PMTK251,38400*27<CR><LF>
```

## 2.9 PMTK\_API\_SET\_FIX\_CTL

**Command purpose:**

*API\_Set\_Fix\_Ctl*

This parameter controls the rate of position fixing activity.

**Command number:** 300

DataField:

*PMTK300,FixInterval,0,0,0,0*

FixInterval: Position fix interval [msec]. Must be larger than 200.

**Example:**

```
$PMTK300,1000,0,0,0,0*1C<CR><LF>
```

## 2.10 PMTK\_API\_SET\_DGPS\_MODE

**Command purpose:**

API\_Set\_Dgps\_Mode

DGPS correction data source mode.

**Command number:** 301

**DataField:**

*PMTK301,Mode*

Mode: DGPS data source mode.

'0': No DGPS source

'1': RTCM

'2': WAAS

**Example:**

```
$PMTK301,1*2D<CR><LF>
```

## 2.11 PMTK\_API\_SET\_SBAS\_ENABLED

**Command purpose:**

API\_Set\_Sbas\_Enabled

Enable to search a SBAS satellite or not.

**Command number:** 313

**DataField:**

Enabled: Enable or disable

'0' = Disable

'1' = Enable

**Example:**

```
$PMTK313,1*2E<CR><LF>
```

## 2.12 PMTK\_API\_SET\_NMEA\_OUTPUT

**Command purpose:**

API\_Set\_NMEA\_Out

Set NMEA sentence output frequencies.

**Command number:** 314

**DataField:**

There are totally 19 data fields that present output frequencies for the 19 supported NMEA sentences individually.

Supported NMEA Sentences

- 0 NMEA\_SEN\_GLL, // GPGLL interval - Geographic Position - Latitude longitude
- 1 NMEA\_SEN\_RMC, // GPRMC interval - Recommended Minimum Specific GNSS Sentence
- 2 NMEA\_SEN\_VTG, // GPVTG interval - Course Over Ground and Ground Speed
- 3 NMEA\_SEN\_GGA, // GPGGA interval - GPS Fix Data
- 4 NMEA\_SEN\_GSA, // GPGSA interval - GNSS DOPS and Active Satellites
- 5 NMEA\_SEN\_GSV, // GPGSV interval - GNSS Satellites in View
- 6 NMEA\_SEN\_GRS, // GPGRS interval - GNSS Range Residuals
- 7 NMEA\_SEN\_GST, // GPGST interval - GNSS Pseudorange Errors Statistics
- 13 NMEA\_SEN\_MALM, // PMTKALM interval - GPS almanac information
- 14 NMEA\_SEN\_MEPH, // PMTKEPH interval - GPS ephemeris information
- 15 NMEA\_SEN\_MDGP, // PMTKDGP interval - GPS differential correction information
- 16 NMEA\_SEN\_MDBG, // PMTKDBG interval - MTK debug information
- 17 NMEA\_SEN\_ZDA, // GPZDA interval - Time & Date

18 NMEA\_SEN\_MCHN, // PMTKCHN interval – GPS channel status

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:**

```
$PMTK314,1,1,1,1,1,5,1,1,1,1,1,0,1,1,1,1,1*2C<CR><LF>
```

This command set GLL output frequency to be outputting once every 1 position fix, and RMC to be outputting once every 1 position fix, and so on.

You can also restore the system default setting via issue:

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

## 2.13 PMTK\_API\_SET\_DATUM

**Command purpose:**

API\_Set\_Datum

Set default datum.

**Command number:** 314

**DataField:**

*PMTK330,Datum*

Datum: 0: WGS84

1: TOKYO-M

2: TOKYO-A

Support 219 different datums. The total datums list in the Ref. #1,Appendix A.

**Example:**

```
$PMTK330,0*2E<CR><LF>
```

## 2.14 PMTK\_API\_SET\_USER\_OPTION

### Command purpose:

API\_Set\_Flash\_User\_Option

Write the user setting to the flash to override the default setting. Maximum 8 times without erase the chip.

**Command number:** 390

### DataField:

*PMTK390, Lock, Update\_Rate, Baud\_Rate, GLL\_Period, RMC\_Period, VTG\_Period, GSA\_Period, GSV\_Period, GGA\_Period, ZDA\_Period, MCHN\_Period, Datum, DGPS\_Mode, RTCM\_Baud\_Rate*

Lock: nonzero: freeze the setting; 0: allow further setting

Update\_Rate: 1~5 (Hz)

Baud\_Rate: 115200, 57600, 38400, 19200, 14400, 9600, 4800

RTCM\_Baud\_Rate: 115200, 57600, 38400, 19200, 14400, 9600, 4800

XXX\_Period: NMEA sentence output period

DGPS\_Mode: 0 (disable), 1 (RTCM), 2 (SBAS)

Datum: We support more than 200 datum. Please refer to Appendix A for the supported datum list.

The typical value is: 0 (WGS84), 1 (Tokyo-M), 2 (Tokyo-A)

### Example:

```
$PMTK390,1,1,38400,1,1,1,1,1,1,0,0,2,9600*0B<CR><LF>
```

### 2.14.1 Setting 4800 baud rate

Please note that with default NMEA message mask the 4800 baud rate is not enough in conditions where there is lot of satellites tracked. GSV messages might have four lines and exceed the capacity of 4800 bit/second.

```
$PMTK390,0,1,4800,0,1,0,1,1,1,0,0,2,9600*38
```

and back to default 9600:

```
$PMTK390,0,1,9600,0,1,0,1,1,1,0,0,2,4800*38
```

### 2.14.2 Setting 5 Hz baud rate

Command for setting the 5 Hz and same time changing baud rate to 38400.

Higher baud rate is needed in order to allow 5 times more load on the serial port.

```
$PMTK390,0,5,38400,0,1,0,1,1,1,0,0,0,2,9600*0F
```

And Back to normal mode:

```
$PMTK390,0,1,9600,0,1,0,1,1,1,0,0,0,2,38400*0B
```

Remember to feed Carrier Return <CR> and Line Feed <LF> after the command(Terminal program setting).

Note: Those settings above are set to non-volatile flash memory. It is

restricted to change the settings only 8 times/module. If exceeding the limit, settings cannot be changed until module is re-flashed.

### 2.14.3 Setting 10 Hz baud rate

Command for setting the 10 Hz and same time changing baud rate to 38400.

Note: This setting works only for module IT500.

Higher baud rate is needed in order to allow 10 times more load on the serial port.

```
$PMTK390,0,10,57600,0,1,0,1,1,1,0,0,0,2,9600*30
```

And Back to normal mode:

```
$PMTK390,0,1,9600,0,1,0,1,1,1,0,0,0,2,57600*00
```

Remember to feed Carrier Return <CR> and Line Feed <LF> after the command(Terminal program setting).

Note: Those settings above are set to non-volatile flash memory. It is restricted to change the settings only 8 times/module. If exceeding the limit, settings cannot be changed until module is re-flashed.



### 3 QUERY COMMANDS

These commands are for querying the settings on the receiver.

#### 3.1 PMTK\_API\_Q\_FIX\_CTL

**Command purpose:**

API\_Query\_Fix\_Ctl

**Command number:** 400

**DataField:**

None

**Return:**

PMTK\_DT\_FIX\_CTL

**Example:**

\$PMTK400\*36<CR><LF>

#### 3.2 PMTK\_API\_Q\_DGPS\_MODE

**Command purpose:**

API\_Query\_Dgps\_Mode

**Command number:** 401

**DataField:**

None

**Return:**

PMTK\_DT\_DGPS\_MODE

**Example:**

\$PMTK401\*37<CR><LF>

#### 3.3 PMTK\_API\_Q\_SBAS\_ENABLED

**Command purpose:**

API\_Query\_Sbas\_Enabled

**Command number:** 413

**DataField:**

None

**Return:**

PMTK\_DT\_SBAS\_ENABLED

**Example:**

\$PMTK413\*34<CR><LF>

### 3.4 PMTK\_API\_Q\_NMEA\_OUTPUT

**Command purpose:**

API\_Query\_NMEA\_Out

Query current NMEA sentence output frequencies.

**Command number:** 414

**DataField:**

None

**Return:**

PMTK\_DT\_NMEA\_OUTPUT

**Example:**

\$PMTK414\*33<CR><LF>

### 3.5 PMTK\_API\_Q\_DATUM

**Command purpose:**

API\_Query\_Datum

**Command number:** 430

Query default datum

**DataField:**

None

**Return:**

PMTK\_DT\_DATUM

**Example:**

\$PMTK430\*35<CR><LF>

### 3.6 PMTK\_API\_GET\_USER\_OPTION

**Command purpose:**

API\_Get\_Flash\_User\_Option

Returns the current user setting from the flash memory.

**Command number:** 490

**DataField:**

None

**Return:**

PMTK\_DT\_FLASH\_USER\_OPTION

**Example:**

\$PMTK490\*3F<CR><LF>

## 4 REPLY MESSAGES

These messages reply to command messages 300 – 390.

### 4.1 PMTK\_DT\_FIX\_CTL

**Command purpose:**

These parameters control the rate of position fixing activity.

**Command number:** 500

**DataField:**

FixInterval: Position fix interval. (msec). [ >= 200]

**Example:**

```
$PMTK500,1000,0,0,0,0*1A<CR><LF>
```

### 4.2 PMTK\_DT\_DGPS\_MODE

**Command purpose:**

DGPS Data Source Mode

**Command number:** 501

**DataField:**

Mode: DGPS data source mode

'0': No DGPS source

'1': RTCM

'2': WAAS

**Example:**

```
$PMTK501,1*2B<CR><LF>
```

### 4.3 PMTK\_DT\_SBAS\_ENABLED

**Command purpose:**

Enable to search a SBAS satellite or not.

**Command number:** 513

**DataField:**

Enabled: Enable or disable

'0' = Disable

'1' = Enable

**Example:**

```
$PMTK513,1*28<CR><LF>
```

#### 4.4 PMTK\_DT\_NMEA\_OUTPUT

**Command purpose:**

NMEA sentence output frequency setting

**Command number:** 514

**DataField:**

There are totally 19 data fields that present output frequencies for the 19 supported NMEA sentences individually.

Please refer to PMTK\_API\_SET\_NMEA\_OUTPUT for the Supported NMEA Sentences and Frequency Setting.

**Example:**

```
$PMTK514,1,1,1,1,1,5,1,1,1,1,1,1,0,1,1,1,1,1*2A<CR><LF>
```

#### 4.5 PMTK\_DT\_DATUM

**Command purpose:**

Current datum used.

**Command number:** 530

**DataField:**

*PMTK530,Datum*

Datum: 0: WGS84

1: TOKYO-M

2: TOKYO-A

**Example:**

```
$PMTK530,0*28<CR><LF>
```

## 4.6 PMTK\_DT\_FLASH\_USER\_OPTION

**Command purpose:**

The user setting in the flash memory.

**Command number:** 590

**DataField:**

There are totally 11 data fields that present the followings:

1. Available number of times for recording the user setting.
2. Update\_Rate: 1~5
3. NMEA baud rate in bps
- 4~11: NMEA sentence output period (GLL, RMC, VTG, GSA, GSV, GGA, ZDA, MCHN)
- 12: Datum
- 13: DGPS mode: 0 (disable), 1 (RTCM), 2 (SBAS)
- 14: RTCM baud rate in bps

**Example:**

```
$PMTK590,0,1,9600,1,1,0,1,5,1,0,0,0,2,9600*2A<CR><LF>
```

## 5 FIRMWARE VERSION

### 5.1 PMTK\_Q\_RELEASE

**Command purpose:**

Query the firmware release information.

**Command number:** 605

**DataField:**

NONE

**Return:**

PMTK\_DT\_RELEASE

**Example:**

\$PMTK605\*31<CR><LF>