GlobalTop Technology Inc.

List of Advanced Functions

V1.1

GlobalTop Tech Inc.
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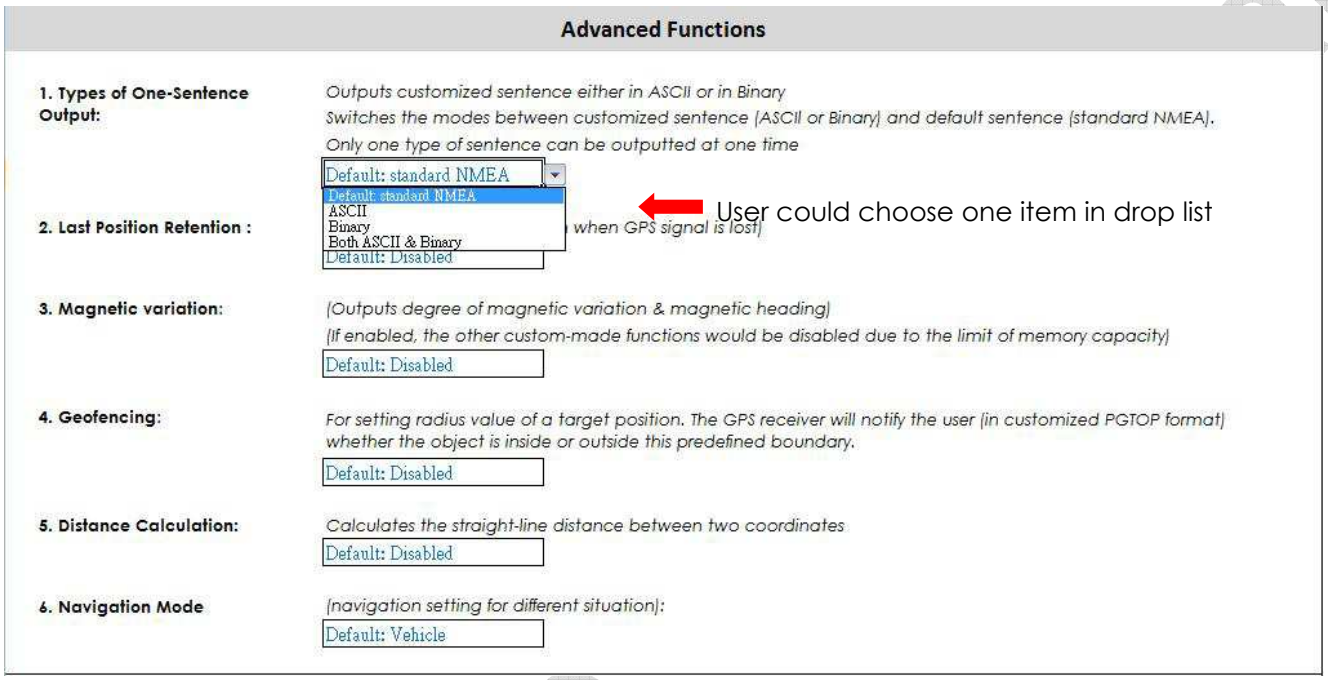
Revision History

Revision	Date	Author	Description
V1.0	2015.11.03	Hector	1st Release
V1.1	2016.04.22	Hector	2nd Release

GlobalTop Customized Packet Protocol

Any advanced function can be chosen from Gtop-Firmware Check List. Please refer to the figure shown below:



In order to inform the sender whether the receiver has received the packet "**PGCMD**", an acknowledgement packet "**PGACK**" must be returned after the receiver receives a packet.

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GlobalTop Customized Packet Format

Preamble	Talker ID	Pkt Type	Date Field	*	CHK	CR	LF

Field	Length	Type	Description
Preamble	1 byte		"$"
Talker ID	5 byte		"PGCMD" or "PGACK"
Packet Type	3 byte		From "000" to "999", an identifier is used to tell the user how to decode the packet
Data Field	variable		A "," must be inserted before each data field to help decoder process the Data Field
*	1 byte		Asterisk is used to make the end of Data Field
CHK	1 byte		Checksum of the data between preamble "," and "*"
CR, LF	2 byte		Used to identify the end of a packet

*Sample Packet: $PGCMD,21,1*6F<CR><LF>*

Note: if the power on the device (module) is removed, all settings once modified would be lost and would be returned to factory default. The backup power supply such as VBACKUP or coin battery would keep up the device until the power exhausts.

1.Types of One-Sentence

One-sentence outputs customized sentence either in ASCII or in Binary.
The mode of one-sentence can be switched between customized sentence (ASCII or Binary) and default sentence (standard NMEA). Note that **only one type of sentence can be outputted at one time**.

3 modes for One-Sentence:

1. One-Sentence in Binary type
2. One-Sentence in ASCII type
3. Standard NMEA Sentence

The format of One-Sentence (Binary and ASCII) is shown in Table1 and Table2:

Table 1 Customized Data Format

Name	Example	Units	Description
Preamble header	$PGTOP		Preamble header
Function Type	2		2➔One Sentence
UTC Time	015649.614		hhmmss.sss
Date	241110		ddmmyy:2010.11.24 ➔ 241110
Latitude	23.098645	degre	Latitude (in decimal degrees) dd.dddddd
N/S Indicator	N		N➔North or S➔South
Longitude	120.284445	degre	Longitude (in decimal degrees) ddd.dddddd
E/W Indicator	E		E➔East or W ➔West
Fix Quality	3		1➔ GPS No fix 2➔ 2D GPS fix 3➔ 3D GPS fix
Fix Mode	1		0➔ GPS No fix 1➔ GPS fix without DGPS mode 2➔ GPS fix with DGPS mode
Altitude	39.95	meter	Altitude of current position
Course over	58.16	degre	Course over ground(in degree)
Speed over ground	0.62	km/hr	Ground Speed(horizontal)
Satellites in viewed	5		Number of satellite in viewed

Satellite in used	3		Number of satellite in used
HDOP	0.95		Horizontal Dilution of Precision
EPE	1.65	meter	Estimated position error
Checksum	*53		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Example:

❖ $PGTOP,2,015649.614,241110,23.098645,N,120.284445,E,3,1,39.95,58.16,0.62,5,3,0.95,1.65*53 <CR><LF>

Table 2 Customized Data Format

Name	Example	Units	Description
Preamble	0x04 0x24	2 bytes	Preamble header
Function Type	0x02		2➔One Sentence
UTC Time	0x03 0xDF 0x12 0xD8	4 bytes MSB to LSB	UTC Time(hhmmss.sss) 064951.000*(10^3)=64951000➔0x03DF12D8
Date	0x00 0x01 0x3C 0x72	4 bytes	Date(ddmmyy) 20101008 ➔81010 ➔0x00013C72
Latitude	0x01 0x60 0x74 0xCC	4 bytes	Latitude (in decimal degrees) 23.098572*(10^6)=23098572➔0x016074CC
N/S Indicator	0x01	1 byte	0x01➔North or 0x02 ➔South
Longitude	0x07 0x2B 0x64 0xDF	4 bytes	Longitude (in decimal degrees) 120.284383*(10^6)=120284383 ➔0x072B64DF
E/W Indicator	0x01	1 byte	0x01➔East or 0x02 ➔West

Fix Quality	0x03	1 byte	0x01 :GPS No Fix 0x02 :2D GPS Fix 0x03 :3D GPS Fix
Fix Mode	0x01	1 byte	0x00 ➔GPS No Fix 0x01 ➔GPS Fix without DGPS mode 0x02 ➔GPS Fix with DGPS mode
Altitude	0x00 0x00 0x0F 0x9B	4 bytes	Altitude of current position (meter) 39.95➔39.95*100=3995➔0x00000F9B
Course over ground	0x00 0x00 0x16 0xB8	4 bytes	Course over ground(in degree) 58.16➔58.16*100=5816➔0x000016B8
Speed over ground	0x00 0x00 0x00 0x3E	4 bytes	Ground Speed(km/hr) 0.62➔0.62*100=62➔0x0000003E
Satellites in view	0x0A	1 byte	Number of satellite is in viewed
Satellites in used	0x09	1 byte	Number of satellite is in used
HDOP	0x00 0x69	2 bytes	Horizontal Dilution of Precision 1.05 ➔ 1.05*100=105➔0x0069
EPE	0x01 0x0D	2 bytes	Estimated position error (meter) 2.69 ➔2.69*100=269➔0x010D
Asterisk	0x2A	1 byte	
Checksum	0x47	1 byte	
End Word	0x0D 0x0A	2 bytes	End of message termination (ASCII 13, ASCII 10)

Table 3 Customized Command Format

Name	Example	Units	Description
Message ID	$PGCMD		Customized header of command
Number of command	21		This number represents which command is used
Selection of mode	1		Option of mode 1➔**One-Sentence(Binary)** mode 2➔**One Sentence(ASCII)** mode 3➔**Standard NMEA Sentence** mode
Checksum	*6F		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Example:

- $PGCMD,21,1*6F<CR><LF>
- $PGCMD,21,2*6C<CR><LF>
- $PGCMD,21,3*6D<CR><LF>

Note 1: When choosing Standard NMEA mode, the period of sentence will be GGA(1), GSA(1), GSV(5), RMC(1), VTG(1),GLL(0),ZDA(0). On the other hand, customers can request factory default to be customized values for their products.

Note 2: The command has different parameter and acknowledgement. Please refer to Table 4.

Table 4 Customized Acknowledgement Format

Name	Example	Units	Description
Message ID	$PGACK		Customized header of command
Number	21		This number represents which acknowledgement is used
Status	1		Option of status: 1➔ **One-Sentence(Binary)** mode be set 2➔**One-Sentence(ASCII)** be set 3➔**Standard NMEA Sentence** mode be set -1➔Mode switch fail
Checksum	*6C		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Example:

- $PGACK,21,1*6C<CR><LF>
- $PGACK,21,2*6F<CR><LF>
- $PGACK,21,3*6E<CR><LF>
- $PGACK,21,-1*41<CR><LF>

2.Last Position Retention

"Last Position Retention" is a convenient yet elegant solution that allows the module to continue output its last known position in the event of losing GPS satellite fix (e.g. when an object is inside tunnel or when satellite signal is jammed by Solar flare or GPS jammers). This simple feature helps designer save time and resources during GPS development.

GGA -- Global Positioning System Fixed Data. Time, Position and fix related data

Table 5 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	064951.00		hhmmss.ss
Latitude	**2307.12562**		**ddmm.mmmmm**
N/S Indicator	**N**		**N➔North or S➔South**
Longitude	**12016.44382**		**dddmm.mmmmm**
E/W Indicator	**E**		**E➔ East or W➔ West**
Position Fix Indicator	**1**		**See Table 6**
Satellites Used	8		
HDOP	0.95		Horizontal Dilution of Precision
MSL Altitude	39.9	meters	Antenna Altitude above/below mean-sea-level
Units	M	meters	Units of antenna altitude
Geoidal Separation	17.8	meters	
Units	M	meters	Units of geoid separation
Age of Diff. Corr.		second	Null
Checksum	*65		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Example:

GPS Fix:

- $GPGGA,220508.000,**5025.4016,N,00335.8328,W,1**,5,1.86,-50.5,M,50.5,M,,*51

GPS NoFix:

- $GPGGA,220515.000,**5025.4016,N,00335.8328,W,0**,0,,,M,,M,,*65

Table 6 Position Fix Indicator

Value	Description
0	Fix not available
1	GPS fix
2	Differential GPS fix

RMC—Recommended Minimum Navigation Information

Table 7 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	064951.00		hhmmss.ss
Status	**A**		**A➔ data valid or V➔ data not valid**
Latitude	**2307.12562**		**ddmm.mmmmm**
N/S Indicator	**N**		**N➔ North or S➔ South**
Longitude	**12016.44382**		**dddmm.mmmmm**
E/W Indicator	**E**		**E➔ East or W➔ West**
Speed over Ground	0.034	knots	
Course over Ground			Null
Date	260406		ddmmyy
Magnetic Variation		degrees	Null
Mode	A		A ➔ Autonomous mode D ➔ Differential mode E ➔ Estimated mode
Checksum	*55		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Example:

GPS Fix:

- $GPRMC,220508.000,**A**,**5025.4016,N,00335.8328,W**,0.00,229.08,140230,,,A*71

GPS NoFix:

- $GPRMC,220515.000,**V**,**5025.4016,N,00335.8328,W**,0.00,229.08,140230,,,N*65

3.Magnetic Variation

This feature enables the GNSS module to output degree of magnetic variation & measured magnetic heading embedded in NMEA sentence. This is particularly useful in aviation, marine and military GNSS navigation devices where bearing is used to determine direction and navigation.

Table 8 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	021723.600		hhmmss.sss
Status	A		A➔Data valid or V➔Data not valid
Latitude	2305.9159		ddmm.mmmmmm
N/S Indicator	N		N➔North or S➔South
Longitude	12017.0600		dddmm.mmmmmm
E/W Indicator	E		E➔East or W➔West
Speed Over Ground	0.1	knots	
Course Over Ground	299.18	degrees	True
Date	261009		ddmmyy
Magnetic Variation	**3.03**	**degrees**	
	W	**direction**	**E ➔East or W➔ West**
Mode	A		A➔Autonomous mode D➔Differential mode E➔Estimated mode
Checksum	*5B		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Example:

$GPRMC,021723.600,A,2305.9159,N,12017.0600,E,0.13,299.18,261009,3.03,W,A*22

Table 9 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	299.18		Measured heading
Reference	T		True
Course	**302.20**		**Measured heading (use True value minus magnetic value)**
Reference	**M**		**Magnetic**
Speed	0.13	knots	Measured horizontal speed
Units	N		Knots
Speed	0.23	km/hr	
Units	K	degrees	True
Mode	A		A➔Autonomous mode D➔Differential mode E➔Estimated mode
Checksum	*28		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

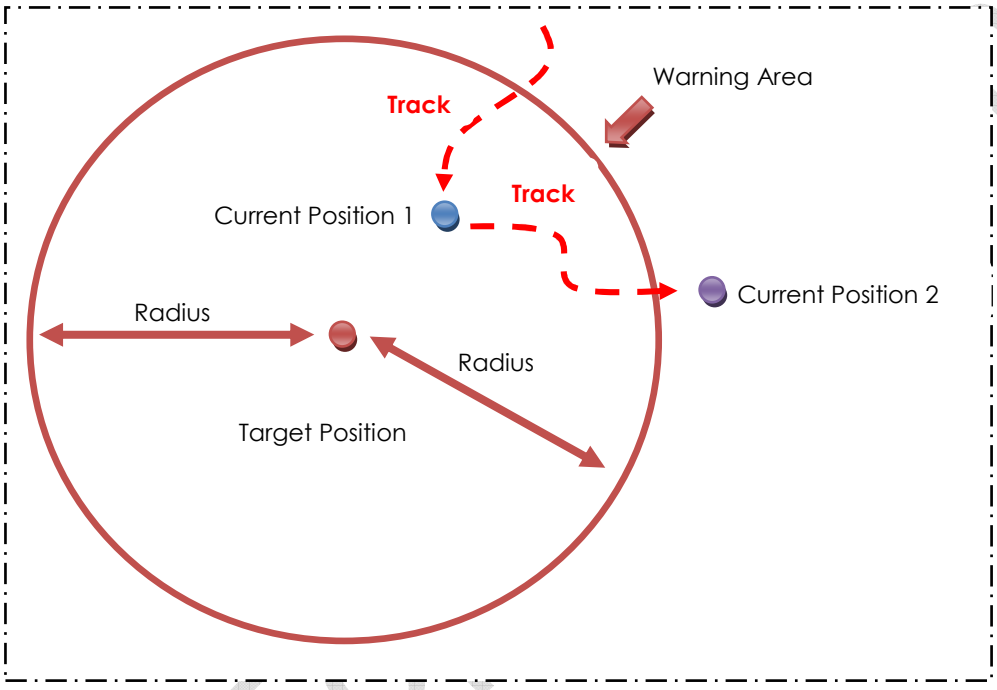
Note: If this feature is enabled, other customized functions would be disabled due to the limit of memory capacity

Example:

$GPVTG,299.18,T,302.20,M,0.13,N,0.23,K,A*28<CR><LF>

4.Geofencing

With this customized function, users and system designers can define a circular perimeter by variable sizes using a point of interest as its center point. The module will then intelligently inform the host processor through serial protocol whether or not the current receiver's position is outside or inside the Geofencing zone.



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The feature provides additional customized sentence for Standard NMEA. Please refer to table below for details.

Table 10 Customized Data Format

Name	Example	Units	Description
Preamble header	$PGTOP		Preamble header
Function Type	3		3➔Geofencing
Mode	001		Option of status: 001➔Geo Fencing is not used 002➔Geo Fencing is used
Position Status	1		Options of status: 0➔GPS fix is not available 1➔Current Position is inside of warning area 2➔Current Position is outside of warning area 3➔Geo Fencing is not used
Distance	23.09	meter	The distance between current position and target position
EPE	1.65	meter	Estimated position error
Navigation Distance	16	meter	The minimum of target distance.
Checksum	*52		
End word	<CR><LF>		End of message termination (ASCII 13, ASCII 10)

Note: Navigation distance means the recommend value of target distance for **Geofencing**. The value is calculated by EPE. Take 1.65 as an example for EPE(the number would be various by calculation from the module). First, multiply the number by ten; then round up the number and we will get the value of 16. The value will be used as reference for setting the minimum value.

Example:

- $PGTOP,3,001,1,23.09,1.65,16*52<CR><LF>

This feature supports customized command. The format is shown in below.

Table 11 Customized Command Format

Name	Example	Units	Description
Message ID	$PGCMD		Customized command header
Command Number	25		This number represents which command is used
Mode	1		Options of mode: 1➔ Set value of **Radius** for Geo Fencing 2➔ Query value of **Radius** and **Coordinate**
Target radius	50	meter	Value of radius, It supports 1~5000
Latitude	23.098572	degree	Latitude (dd.dddddd)
N/S Indicator	N		Direction Indicator: N➔North or S➔South
Longitude	120.284383	degree	Longitude (ddd.dddddd)
E/W Indicator	E		Direction Indicator: E➔East or W➔West
Checksum	*7C		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Note 1: The command has different parameter and acknowledge. The format of acknowledgement is shown in Table 12.

Note 2: When user set zero value of radius, it means disable the 『**Geofencing**』function.

Example:

- $PGCMD,25,1,50,23.098572,N,120.284383,E*7C<CR><LF>
- $PGCMD,25,2*68<CR><LF>

Table 12 Customized Acknowledgement Format

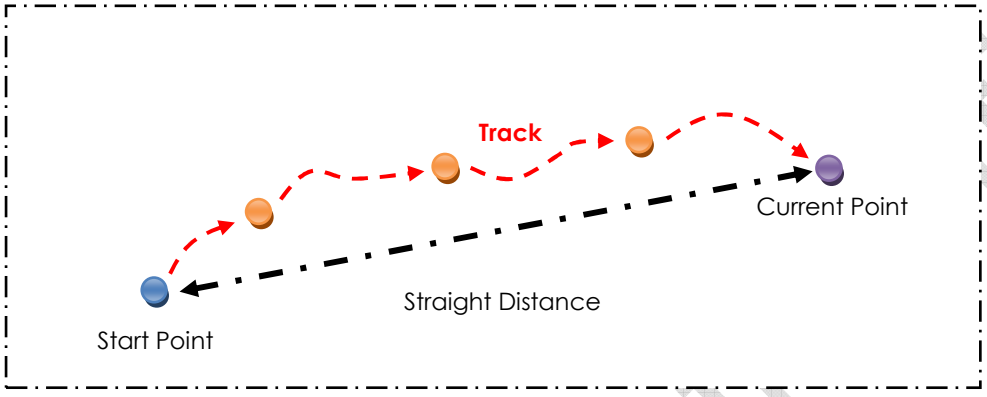
Name	Example	Units	Description
Message ID	$PGACK		Customized acknowledgement header
Number	25		This number represents which acknowledgement is used
Status	1		Option of status: -1➔ It means parameter error or out range of radius 1➔ It means which **Radius** and **Coordinate** is set 2➔ It means which **Radius** and **Coordinate** is used
Radius	50	meter	Value of radius, It supports 1~5000.
Latitude	23.098572	degree	Latitude (dd.dddddd)
N/S Indicator	N		Direction Indicator: N➔North or S➔South
Longitude	120.284383	degree	Longitude (ddd.dddddd)
E/W Indicator	E		Direction Indicator: E➔East or W➔West
Checksum	*70		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Example:

- $PGACK,25,1,50,23.118753,N,120.274000,E*70<CR><LF>
- $PGACK,25,2,50,23.118753,N,120.274000,E*73<Cr><LF>

5.Distance Calculation

Distance calculation is to specify the exact line-of-sight distance between current location and other points of interests. This calculation is done internally within the GNSS module and it can help decrease the calculation loading on the main processor.



This feature supports customized command. The format of command is shown in the table below.

Table 13 Customized Command Format

Name	Example	Units	Description
Message ID	$PGCMD		Customized command header
Command Number	27		This number represents which command is used
Mode	1		Options of modes: 1 ➔ Set current coordinate as **Start Point** 2 ➔ Set customized coordinate as **Start Point** 3 ➔ To calculate distance between start point and current point. 4 ➔ To query coordinate of **Start Point**
Latitude	23.098572	degree	Latitude (dd.dddddd)
N/S Indicator	N		Direction Indicator N➔North or S➔South
Longitude	120.284383	degree	Longitude (ddd.dddddd)
E/W Indicator	E		Direction Indicator E➔East or W➔West
Checksum	*69		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Note: The command has different parameter and acknowledgement. The format of acknowledgement is shown in Table 14.

Example:

- $PGCMD,27,1*69<CR><LF>
- $PGCMD,27,2,23.098572,N,120.284383,E*54<CR><LF>
- $PGCMD,27,3*6B<CR><LF>
- $PGCMD,27,4*6C<CR><LF>

Table 14 Customized Acknowledgement

Name	Example	Units	Description
Message ID	$PGACK		Customized acknowledgement header
Number	27		This number represents which acknowledgement is used
Status	1		Options of status: 1 ➔It means which coordinate is set by user 2 ➔ It means distance is calculated by start point and current point 3 ➔ GPS Fix is not available. -1➔ It means function set fail
Distance	125.28	meter	The distance between start point and current point
Latitude	23.098572	degree	Latitude (dd.dddddd)
N/S Indicator	N		Direction Indicator N➔North or S➔South
Longitude	120.284383	degree	Longitude (ddd.dddddd)
E/W Indicator	E		Direction Indicator E➔East or W➔West
Checksum	*FF		
<CR> <LF>			End of message termination

Example:

- $PGACK,27,1,23.098572,N,120.284383,E*54<CR><LF>
- $PGACK,27,2,125.28*57<CR><LF>
- $PGACK,27,3*68<CR><LF>

6.Navigation Mode

Navigation mode allows user to choose suitable mode for various fields of application (vehicle, pedestrian, aircraft, hot-air balloon…etc.)

Other customized mode is available upon request. The format is shown in the table below.

Table 15 Customized Command Format

Name	Example	Units	Description
Message ID	$PGCMD		Customized command header
Command Number	34		This number represents which command is used
Mode	1		Option of mode: 0 ➔ Vehicle 1 ➔ Pedestrian 2 ➔ Aircraft 3 ➔ Hot-air Balloon 99 ➔ To query which mode is set
Checksum	*69		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Note 1: The command has different parameter and acknowledgement. The format of acknowledgement is shown in Table 16.

Note 2: The settings will return to default if user inserts reboot command or does system reboot.

Note 3: Navigation Mode Description:

Vehicle: For general purpose, for Car.

Pedestrian mode: For running and walking purpose that the low-speed (< 5m/s) movement will have more effect on the position calculation.

Aircraft: For high-dynamic purpose that the large-acceleration movement will have more effect on the position calculation.

Hot-air Balloon: For high-altitude balloon purpose that the vertical movement will have more effect on the position calculation.

Example:

- $PGCMD,34,0*6A<CR><LF>
- $PGCMD,34,1*6B<CR><LF>
- $PGCMD,34,2*68<CR><LF>
- $PGCMD,34,3*69<CR><LF>
- $PGCMD,34,99*5A<CR><LF>

Table 16 Customized Acknowledgement

Name	Example	Units	Description
Message ID	$PGACK		Customized acknowledgement header
Number	34		This number represents which acknowledgement is used
Status	1		Option of status: 0 ➔ It means vehicle mode be set successfully 2 ➔ It means Aircraft mode be set successfully 3 ➔ It means Hot-air Balloon mode be set successfully -1➔ It means function set fail
Checksum	*68		
<CR> <LF>			End of message termination (ASCII 13, ASCII 10)

Example:

- $PGACK,34,0*69<CR><LF>
- $PGACK,34,2*6B<CR><LF>
- $PGACK,34,3*6A<CR><LF>
- $PGACK,34,-1*45<CR><LF>

Notice:

How to calculate the checksum value

Example: **$**PGCMD,21,1***6F** <**CR**><**LF**>

"**6F**" is the checksum, and it is calculated by Xor all characters between **$** and *****.

CR, LF：Two bytes binary data

The two bytes are used to identify the end of a packet

How to convert decimal value to hex value

All items will be converted from decimal to hex before outputting from One-Sentence (Binary Type). The example is shown below:

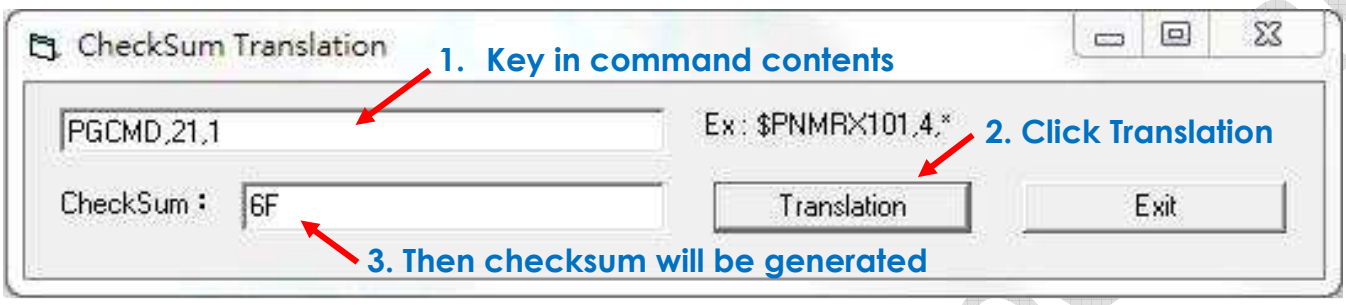
- $(79)_{10}=(4F)_{16}$
- $(120)_{10} = (78)_{16}$
- $(64951000)_{10}=(03DF12D8)_{16}$

Decimal Hex Conversion Chart:
http://www.binaryhexconverter.com/decimal-to-hex-convert

Decimal	Hexadecimal
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

How to acquire checksum value by using checksum tool.

Example: $PGCMD,21,1*6F<CR><LF>



Command setting

Those command packets last along with power. If the power on the device (module) is removed, all settings once modified would be lost and would be returned to factory default. If user prefers customized factory default for the module, please contact us at: sales@gtop-tech.com

Special customization support

Other customization services not addressed in this document may be available upon request. Please contact us at sales@gtop-tech.com and we will be more than happy to serve you.