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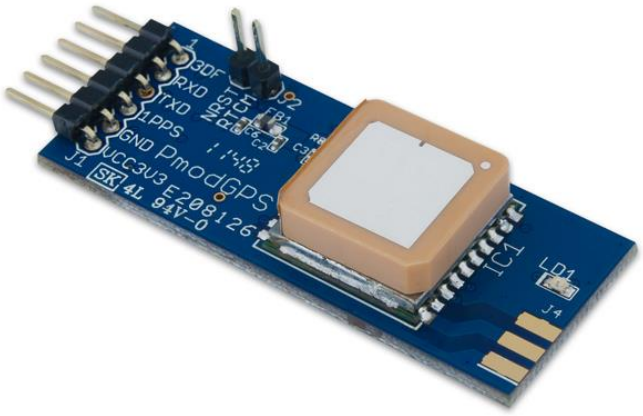
PmodGPS™ Reference Manual

Revised April 12, 2016
This manual applies to the PmodGPS rev. A

Overview

The PmodGPS can add satellite positioning accuracy to any embedded system. The PmodGPS features a GlobalTop FGPMMOPA6H GPS antenna module that utilizes the MediaTek GPS MT3329.



The PmodGPS.

Features include:

- Ultra-sensitive GPS module (-165 dBm)
- Add 3m 2D satellite positioning accuracy to any embedded system
- Low power consumption
- Up to 10Hz update rate
- NMEA (default) and RTCM protocols available
- Small PCB size for flexible designs 2.0 in × 0.8 in (5.0 cm × 2.0 cm)
- 6-pin Pmod port with UART interface
- Library and example code available in resource center

1 Functional Description

The PmodGPS uses a standard 6-pin port and communicates via a 2-wire Universal Asynchronous Receiver/Transmitter (UART.) The PmodGPS also has a 2-pin port for control of the NRST pin to the module and the Radio Technical Commission for Maritime services, or RTCM pin for Differential Global Positioning System (DGPS) data using RTCM protocols.

Note: The PmodGPS arrives with the RTCM feature inactive, to enable RTCM capabilities users should contact GlobalTop at: www.gtop-tech.com.

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2 Interfacing with the Pmod

The PmodGPS uses UART protocol for data transmission and reception. The interface operates at a default baud rate of 9.6 kBd, 8 data bits, no parity, and with single stop bits. However, users can change the baud rate to predefined values that range from 4.8 kBd to 115.2 kBd.

The reset pin (NRST) on J2 allows normal operation in active low. If users toggle the NRST pin it will completely reset the module. This reset performs similar to a power cycling of the device. The 1 PPS pin on J1 provides a one pulse-per-second output synchronized with GPS time (see the timing diagram in Fig. 1).

The 3DF pin on J1 indicates the status of the user's positional fix. When the module has a constant fix (2D or 3D) this pin stays low, if the module is unable to get a fix then the pin will toggle every second. (See Fig. 2) LD1 also follows this same behavior pattern in order to give the user a visual representation.

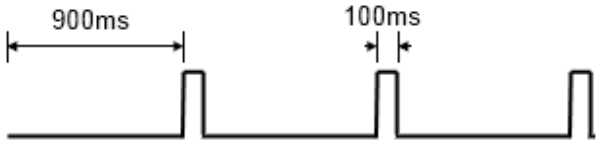

Figure 1. 1PPS Pin Timing Diagram.

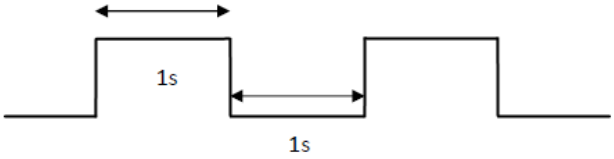

Figure 2. 3DF Pin output without a fix.

The PmodGPS also comes equipped with a coin cell retainer for a 12.5 mm coin cell battery. Users can significantly reduce the amount of time that it takes to acquire the first positional fix by installing a 3V coin cell battery. With the battery installed the module can also perform a hot start or a warm start instead of cold starting where users have to supply power to the VCC.

Note: The ground square solder pad of the coin cell retainer may develop an oxide build up that will keep the battery from making a good connection. Users should simply scuff up the square solder pad inside J3 to remove any buildup. Oxide buildup may also occur if there has not been a battery in the retainer for a while.

A cold start takes one or two minutes while outside in good conditions, and can take several minutes more if conditions are worse or the module is indoors. A hot start takes three to five seconds and a warm start varies depending on how long the module has sat unpowered. Users can hot start the PmodGPS only if it has acquired a fix within approximately the last two hours and with accessible backup power (coin cell battery) connected to the coin cell retainer. A warm start occurs when the battery is connected but the module has been without power for more than two hours.

Users may utilize an external antenna at their discretion by installing a Linx Technologies Inc. CONSMA 003.062 module on header J4. The antenna can speed up acquisition of GPS signal in some conditions, especially if the antenna is outdoors and the module is indoors.

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The PmodGPS uses sentences based on National Marine Electronics Association (NMEA) protocols for data output. Each NMEA message begins with a ($) dollar sign. The next five characters are the talker ID and the arrival alarm. The PmodGPS talker ID is "GP" and the arrival alarm is the specific sentence output descriptor. Individual comma separated data fields follow these five characters. After the data fields there is an asterisk followed by a checksum. Each sentence should end with <CR><LF>. For example output sentences refer to tables two through six at the end of this manual.

User may configure some of the PmodGPS characteristics by writing command packets to the module. However, these functions are more advanced and not all of the command packets are openly distributed. Users may change the baud rate to 38.4kBd (minimum baud for 10Hz data acquisition) by issuing the following command over the UART:

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

The "*27" corresponds to a checksum, if users want to substitute a different baud rate, then they must calculate a new checksum using GlobalTop's Checksum Tool. The command for changing the data acquisition from 1Hz to 10Hz is:

"$PMTK226,3,30*4<CR><LF>"

The same checksum process for changing the baud rate applies to this change too. Contact GlobalTop for more information on the individual command packets, their complete command list, or see their FAQ for how to change the baud rate.

Any external power applied to the PmodGPS must be within 2.7V and 5.25V; however, it is recommended that Pmod is operated at 3.3V.

Connector J1		
Pin	**Signal**	**Description**
1	3DF	3D-Fix Indicator
2	RX	Receive
3	TX	Transmit
4	1PPS	1 Pulse Per Second
5	GND	Power Supply Ground
6	VCC	Power Supply (3.3v)
Connector J2		
Pin	**Signal**	**Description**
1	~RST	Reset (active low)
2	RTCM	DGPS data pin (contact GlobalTop for use)

Table 1. Interface connector signal descriptions.

Note: Refer to the GlobalTop FGPMMOPA6H datasheet at *here* for more information on the GPS module interface.

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3 Output Sentences

Example	Description
$GPGGA	Message ID
064951.000	UTC Time (hhmmss.sss)
2307.1256	Latitude (ddmm.mmmm)
N	N/S indicator
12016.4438	Longitude (dddmm.mmmm)
E	E/W indicator
1	Position Fix Indicator
8	Satellites used
0.95	HDOP
39.9	MSL Altitude
M	Units
17.8	Geoidal Separation
M	Units
	Age of Diff. Corr.
*65	Checksum
<CR><LF>	End of message indicator

Table 2. GGA.

```
$GPGGA,064951.000,2307.1256,N,12016.4438,E,1,8,0.95,39.9,M,17.8,M,,*65<CR><LF>
```

Example	Description
$GPGSA	Message ID
A	Mode1 (see GlobalTop manual)
3	Mode2 (see GlobalTop manual)
29	Satellite used (CH1)
21	Satellite used (CH2)
….	
	Satellite Used (Ch12)
2.32	PDOP
0.95	HDOP
2.11	VDOP
*00	Checksum
<CR><LF>	End of message indicator

Table 3. GSA.

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$GPGSA,A,3,29,21,26,15,18,09,06,10,,,,, 2.32,0.95,2.11*00<CR><LF>

Example	Description
$GPGSV	Message ID
3	Number of Messages
1	Message Number
09	Satellites in View
29	Satellite ID (CH1)
36	Elevation (CH1)
029	Azimuth (CH1)
42	SNR (C/No)
….	
15	Satellite ID CH(4)
21	Elevation (CH4)
321	Azimuth (CH4)
39	SNR (C/No)
*7D	Checksum
<CR><LF>	End of message indicator

Table 4. GSV.

$GPGSV,3,1,09,29,36,029,42,21,46,314,43, 26,44,020,43,15,21,321,39*7D<CR><LF>

Example	Description
$GPRMC	Message ID
064951.000	UTC Time (hhmmss.sss)
A	Status (A = data valid)
2307.1256	Latitude (ddmm.mmmm)
N	N/S indicator
12016.4438	Longitude (dddmm.mmmm)
E	E/W indicator
0.03	Speed over ground (knots)
165.48	Course over ground (degrees)
260406	Date (ddmmyy)
3.05	Magnetic Variation (degrees)
W	E/W indicator
A	Mode (see GlobalTop manual)
*55	Checksum
<CR><LF>	End of message indicator

Table 5. RMC.

$GPRMC,064951.000,A,2307.1256,N,12016.4438,E,0.03,165.48,260406,3.05,W,A*55<CR><LF>

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Example	Description
$GPVTG	Message ID
165.48	Course (degrees)
T	Reference (true or false)
	Course (degrees)
M	Reference (Magnetic)
0.03	Speed
N	Units (N = knots)
0.06	Speed
K	Units (K = km/hr)
A	Mode (see GlobalTop manual)
*37	Checksum
<CR><LF>	End of message indicator

Table 6. VTG.

```
$GPVTG,165.48,T,,M,0.03,N,0.06,K,A*37<CR><LF>
```

4 Physical Dimensions

The pins on the pin header are spaced 100 mil apart. The PCB is 2.0 inches long on the sides parallel to the pins on the pin header and 0.8 inches long on the sides perpendicular to the pin header.

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