

Application Note: GPS Data

The FGPMMPA6B GPS Module is the GPS chip used on the Ultimate GPS Breakout v3 circuit. What's appealing about this is its low cost and high resolution, up to -165dBm. The GPS can be configured to output a variety of ways.

Table-1: NMEA Output Sentence	
Option	Description
GGA	Time, position and fix type data.
GSA	GPS receiver operating mode, active satellites used in the position solution and DOP values.
GSV	The number of GPS satellites in view satellite ID numbers, elevation, azimuth, and SNR values.
RMC	Time, date, position, course and speed data. Recommended Minimum Navigation Information.
VTG	Course and speed information relative to the ground.

Figure 1: Output options

We will most likely use RMC output because this hosts the most relevant data to our project.

Table-8: RMC Data Format			
Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC Time	064951.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2307.1256		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12016.4438		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed over Ground	0.03	knots	
Course over Ground	165.48	degrees	True
Date	260406		ddmmyy
Magnetic Variation	3.05,W	degrees	E=east or W=west (Need GlobalTop Customization Service)
Mode	A		A= Autonomous mode D= Differential mode E= Estimated mode
Checksum	*55		
<CR> <LF>			End of message termination

Figure 2: Output sequence

Below in figure 3 is a picture of the Ultimate GPS Breakout v3 with its 9 ports clearly labeled. The “PPS” port outputs the pulse-per-second which is an ultra-accurate time signal. The “VIN” port is an input port for the circuit to operate ranging from 3.3V to 5V. The “GND” port is used as ground. The “RX” port is used as an input port for firmware updates. The “TX” port is an output port for retrieving the GPS data and is refreshed at a rate of 10Hz. The “FIX” port is an output port to connect to an external LED indicator showing if the GPS has a fix on the appropriate amount of satellites to retrieve accurate data. As an alternative to the “FIX” port, there is also an onboard red LED that has a frequency of 1Hz when it is establishing connections and 4Hz when an fix is established. There is an option to mount a battery on the belly of the circuit. The port “VBAT” outputs the battery voltage. The input port “EN” turns the circuit on and off, pulled high turns it on, pulled low turns it off. The last port is an output port and outputs 3.3V when the circuit is powered on.

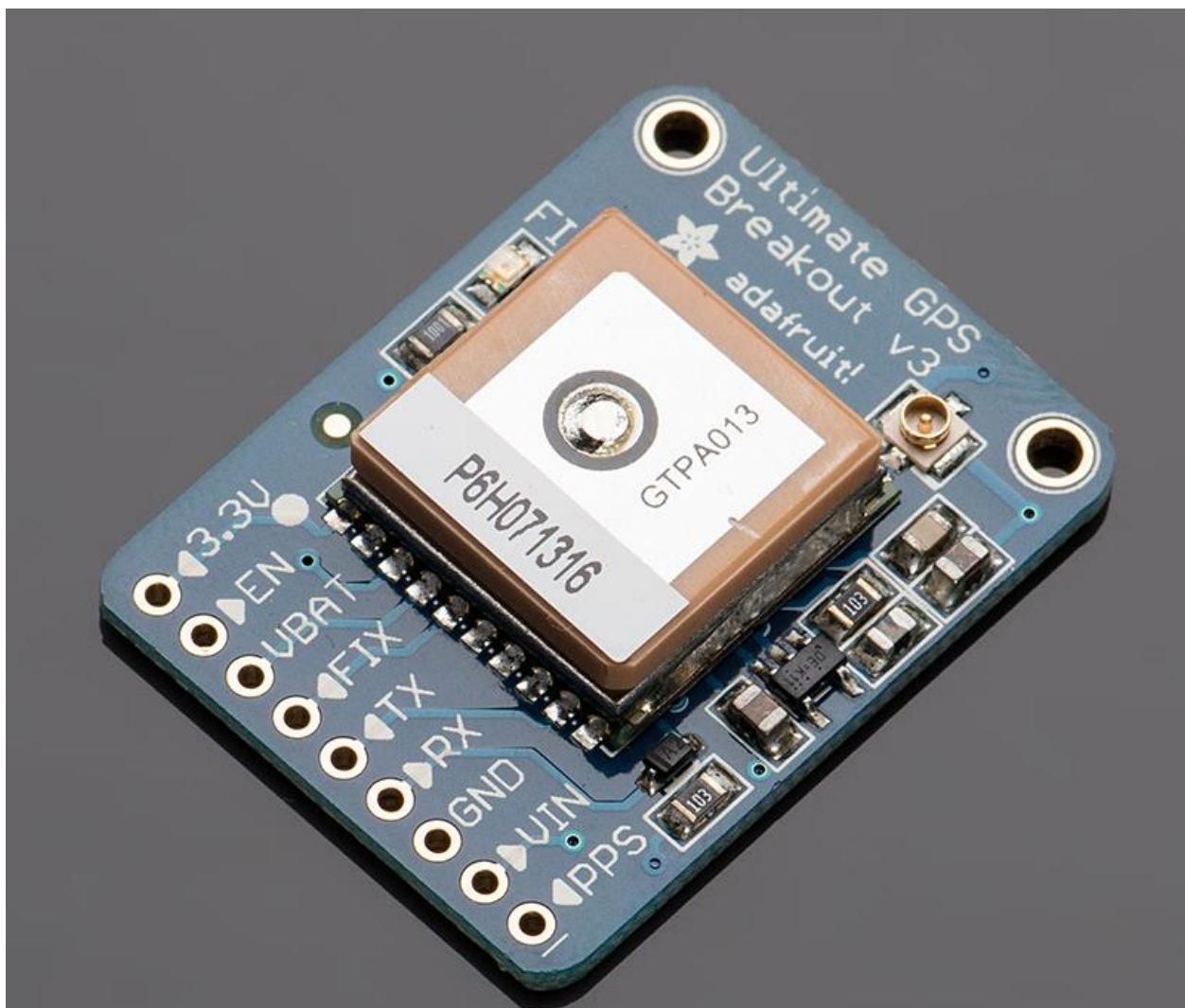


Figure 3: Picture of the Ultimate GPS Breakout v3

Below are some specifications of the Ultimate GPS Breakout v3.

Specifications:

Module specs:

- Satellites: 22 tracking, 66 searching
- Patch Antenna Size: 15mm x 15mm x 4mm
- Update rate: 1 to 10 Hz
- Position Accuracy: 1.8 meters
- Velocity Accuracy: 0.1 meters/s
- Warm/cold start: 34 seconds
- Acquisition sensitivity: -145 dBm
- Tracking sensitivity: -165 dBm
- Maximum Altitude for PA6H: tested at 27,000 Meters
- Maximum Velocity: 515m/s
- Vin range: 3.0-5.5VDC
- MTK3339 Operating current: 25mA tracking, 20 mA current draw during navigation
- Output: NMEA 0183, 9600 baud default
- DGPS/WAAS/EGNOS supported
- FCC E911 compliance and AGPS support (Offline mode : EPO valid up to 14 days)
- Up to 210 PRN channels
- Jammer detection and reduction
- Multi-path detection and compensation

This circuit will be connected to the Beaglebone Black via a breadboard. The Beaglebone will then be programmed to retrieve data from the “TX” port whenever a time, position and velocity measurement is needed. Particularly the latitude, longitude, UTC time and course over ground measurements from the RMC data output will be recorded and used. This information combined with the information from the USRP1 phase information should give a relatively accurate approximation of the location of the RF source.