GPS-002 GPS Module Manual

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Version Information

Version	Date	Modified By	Introduction
1.1	03.2016	Kim	Release

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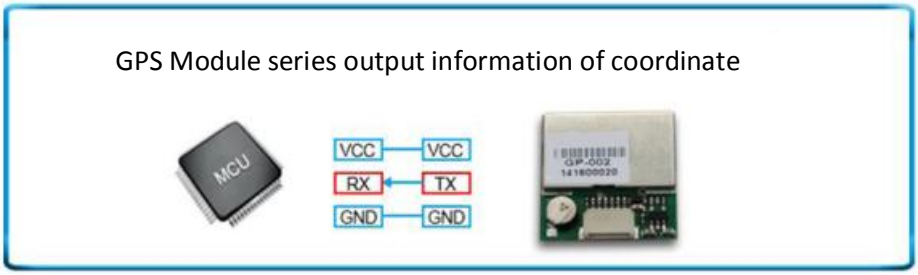
1. General Description

The GP-002 is a complete GPS engine module that features super sensitivity, ultra low power and small form factor. The GPS signal is applied to the antenna input of module, and a complete serial data message with position, velocity and time information is presented at the serial interface with NMEA protocol or custom protocol.

Its –165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible before. The small form factor and low power consumption make the module easy to integrate into portable device like PNDs, mobile phones, cameras and vehicle navigation systems. Typical application seen below:



Applications

- LBS (Location Based Service)
- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone

Features

- Build on high performance, low-power MT3337chipset
- Ultra high sensitivity: -165dBm
- Extremely fast TTF Fat low signal level
- Built in high gain LNA
- Low power consumption: Max 20mA@3.3V
- Operating voltage: 3.0—5V
- 6 Pin HSG to 4P HSG Connector: UART (3.0COMS)
- Operating temperature range:-40to85℃
- Patch Antenna Size:18.4(w)mmX18.4(d)mmX4(h)mm
- Small form factor:22x22x5.5mm
- Line long:50mm
- RoHS compliant (Lead-free)

2. Performance Specification

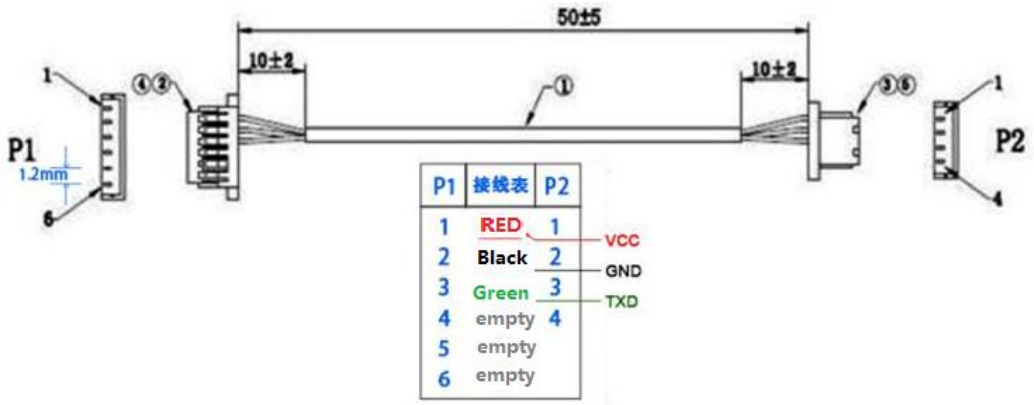
Parameter	Specification	
Receiver Type	L1 frequency band, 22tracking/66acquisition-channel	
Sensitivity	Tracking	-165dBm
	Acquisition	-163dBm(hot)
		-148dBm(cold)
Accuracy	Position	5m CEP without SA
	Velocity	0.1m/s without SA
	Timing (PPS)	1mS RMS
Acquisition Time	Cold Start	38s
	Warm Start	35s
	Hot Start	1s
	Re-Acquisition	<1s
Power Consumption	Tracking	20mA @3.3V
	Acquisition	20mA
	Sleep/Standby	TBD
NavigationDataUpdate Rate	1Hz	
Operational Limits	Altitude	Max 18,000m
	Velocity	Max 515m/s
	Acceleration	Less than 4g

2.1 Interface Configuration

- **Power Supply:** Regulated power for the GP-002 is required. The input voltage Vcc should be 3.0—5.0V, maximum, current is no less than 20mA. Suitable decoupling must be provided by external decoupling circuitry.

- **UART Ports:** The module supports two full duplex serial channels UART. All serial connections are at 3.3V CMOS logic levels, if need different voltage levels, use appropriate level shifters. The data format is however fixed: X, N, 8, 1, i.e. X baud rate, no parity, eight data bits and one stop bit, no other data formats are supported, LSB is sent first. The modules default baud rate is set up 9600bps. UART is used e.g. for booting and NMEA interface.

2.2 1.2mm HSG Connector



2.3 Absolute Maximum Rating

Parameter	Symbol	Min	Max	Units
Power Supply Volt	Vcc	3.0	5	**V**
Input Pin Voltage I/O	TXD	**-0.3**	3.0	V
Storage Temperature	Tstg	-40	85	°C
Humidity			95	%

Note: Absolute maximum ratings are stress ratings only, and functional operation at the maxims is not guaranteed. Stress beyond the limits specified in this table may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the operating conditions tables as follow.

2.4 Operating Conditions

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power supply voltage	Vcc		**3.0**	**3.3**	**5**	**V**
Powersupplyvoltageripple	Vcc_PP	Vcc=3.3V			40	mV
Consumption current	Icc	Vcc=3.3V		20	20	mA
Input high voltage	VIH		0.7xVcc		Vcc+1.0	V
Input low voltage	VIL		-0.3		0.3xVcc	**V**
Output high voltage	VOH		0.8xVcc		Vcc	**V**
Output low voltage	VOL		0		0.2xVcc	**V**
Operating temperature	Topr		-40		85	°C

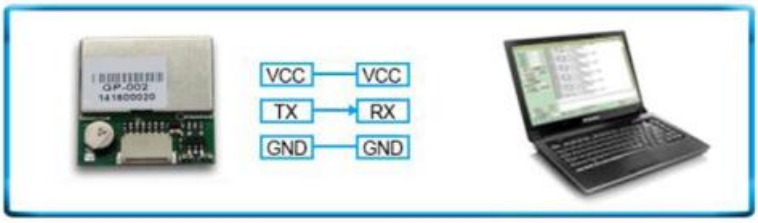
3. NMEA 0183 Protocol

The NMEA protocol is an ASCII-based protocol, Records start with a $ and with carriage return/line feed. GPS specific messages all start with $GPxxx where xxx is a three-letter identifier of the message data that follows. NMEA messages have a checksum, which allows detection of corrupted data transfers. The Label Jet GP-001 supports the following NMEA-0183 messages:GGA, GLL, GSA, GSV, RMC and VTG.

Table 1: NMEA-0183 Output Messages

NMEA Record	DESCRIPTION
GGA	Global positioning system fixed data
GLL	Geographic position—latitude/longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed

When the module power on, we can get the information through a serial port.



3.1 GGA-Global Positioning System Fixed Data

Table 2 contains the values of the following example:

$GPGGA, 161229.487,3723.2475,N, 12158.3416,W, 1,07,1.0,9.0,M.0000*18

Table 2: GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
Latitude	3723.2457		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
ositionFix Indicator	1		See Table 2-1
Satellites UsedRange	07		0 to 66
HDOPHorizontal	1.0		Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoids Separation		meters	
Units	M	meters	
Age of Diff.Corr.		second	Null fields when DGPS is not Used
Diff.Ref.Station ID	0000		
Checksum	*18		
<CR> <LF>			End of message termination

Table 2-1: Position Fix Indicators

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3	GPS PPS Mode, fix valid

3.2 GLL-Geographic Position-Latitude/Longitude

Table 3 contains the values of the following example:

$GPGLL , 3723.2475, N,12158.3416, W,161229.487, A*2C.

Table 3: GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	3723.2457		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Checksum	*2C		
<CR> <LF>			End of message termination

3.3 GSA-GNSS DOP and Active Statellietes

Table 4 contains the values of the following example:

$GPGSA , A, 3, 07, 02, 26,27, 09, 04,15, , , , , , 1.8,1.0,1.5*33.

Table 4: GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 4-2
Mode 2	3		See Table 4-1
Satellite Used	07		Sv on Channel 1
Satellite Used	02		Sv on Channel 2
…	…		…
Satellite Used			Sv on Channel 66
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*18		
<CR> <LF>			End of message termination

Table 4-1: Mode 1

Value	Description
1	Fix not available
2	2D
3	3D

Table 4-2: Mode 2

Value	Description
M	Manual-forced to operate in 2D or 3D mode
A	Automatic-allowed to automatically switch 2D/3D

3.4 GSV-GNSS Satellites in View

Table 5 contains the values of the following example:

$GPGSV , 2, 1, 07, 07, 79,048, 42, 02, 51,062, 43, 26, 36,256, 42, 27, 27, 138,42*71
$GPGSV, 2, 2, 07, 09, 23,313, 42, 04, 19, 159, 41, 15,12,041, 42*41.

Table 5: GGA Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Message	2		Range 1 to 3
Message Number	1		Range 1 to 3
Satellites in View	07		
Satellite ID	07		Channel 1(Range 1 to 32)
Elevation	79	degrees	Channel 1(Maximum 90)
Azinmuth	048	degrees	Channel 1(True, Range 0 to 359)
SNR(C/NO)	42	dBHz	Range 0 to 99,null when not tracking
...	...		...
Satellite ID	27		Channel 4(Range 1 to 32)
Elevation	27	degrees	Channel 4(Maximum 90)
Azimuth	138	degrees	Channel 4(True, Range 0 to 359)
SNR(C/NO)	42	dBHz	Range 0 to 99, null when not tracking
Checksum	*71		
<CR> <LF>			End of message termination

Depending on the number of satellites tracked multiple messages of GSV data may be required.

3.5 RMC-Recommended Minimum Specific GNSS Data

Table 6 contains the values of the following example:

$GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13,309.62, 120598,, *10

Table 6: RMC Data Format

Name	Example	Units	Description
Message ID	$GP RMC		RMC protocol header
UTS Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.2457		ddmm.mmmm
N/S indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	Knots	
Course Over	309.62	Degrees	True
Ground			
Date	120598		Dummy
Magnetic variation		Degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

3.6 VTG-Course Over Ground and Ground Speed

Table 7 contains the values of the following example:

$GPVTG, 309.62, T, M, 0.13, N, 0.2, K*6E

Table 7: VTG Data Format

Name	Example	Units	Description
Message ID	$GP VTG		VTG protocol header
Course	309.62	Degrees	Measured heading
Reference	T		True
Course		Degrees	Measured heading
Reference	M		Magnetic
Speed	0.13	Knots	Measured horizontal speed
Units	N		Knots
Speed Over Ground	0.13	Knots	
Speed	0.2	Km/hr	Measured horizontal speed
Units	K		Kilometer per hour
Checksum	*6E		
<CR> <LF>			End of message termination

4 Latitude and longitude conversion

After positioning in GPS module output NMEA interface containing the location information, including the latitude and longitude information, for example:
$GPGGA,054514.000,**2238.5260,N,11401.9686,E**,1,7,1.27,89.2,M,-2.3,M,,*7F
$GPGSA,A,3,08,23,10,28,09,04,02,,,,,,1.52,1.27,0.84*01
$GPGSV,3,1,10,28,73,159,42,42,50,128,36,04,49,276,44,10,31,191,43*75
$GPGSV,3,2,10,02,17,252,38,08,14,192,41,09,12,195,38,23,07,108,35*74
$GPRMC,054514.000,A,**2238.5260,N,11401.9686,E**,0.14,183.83,270913,,,A*6B

Now we get the longitude and latitude information in NMEA， how to —translate them as a map of latitude and longitude coordinates? You can complete the following steps:

1． 1. N（North）2238.5260

（1）2238.5260÷100=22.385260（round-off）=22

（2）385260÷60=6421

Get the latitude coordinates: N22.642100°

2. E（East）11401.9686

（1）11401.9686÷100=114.019686（round-off）=114

（2）019686÷60=0328.1

Get the longitude coordinates :E114.032810°