NMEA Strings Reference

NMEA stands for National Marine Electronics Association, a marine electronics organization. This organization sets the standard for communication between marine electronics. Their NMEA 0183 standard is used for GPS communication. This communication involves sending ASCII sentences containing the information requested; these are called NMEA sentences.

NMEA sentences have a three-letter prefix that defines the device using the sentence type. Since the MegaSat is using NMEA sentences for GPS communication, we will be receiving sentences that have the prefix "$GP." Following the "$GP" prefix are three letters that define the sentence type. Some examples of these three letters are "RMC," "GGA," and "VTG." At the end of NMEA sentence is a carriage return. Between the prefix letters and the carriage return is the GPS data. This data is separated by commas and can include things like longitude, latitude, altitude, speed, and number of satellites being tracked.

Types of NMEA Sentences

Using the Adafruit Ultimate GPS Logger Shield, there are 6 different NMEA sentences that are available. These are the RMC, GGA, GGL, VTG, GAS, and GSV sentences. The rest of this section goes over the information contained in each of these NMEA sentences.

RMC: Recommended Minimum

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Layout:    $GPRMC,hhmmss,A,llll.ll,a,yyyy.yy,a,x.x,x.x,ddmmyy,x.x,a,A*hh
Position:              1     ,2,  3  ,4,   5     ,6, 7  , 8 ,     9     , 10,11,12,13
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1:	hhmmss.ss	Time of fix hh:mm:ss UTC
2:	A	Signal status. A = Active Signal. V = Void, no signal.
3:	llll.ll	Latitude: ll degrees 07.038 minutes
4:	a	Direction. N = North. S = South.
5:	yyyy.yy	Longitude: 11 degrees 31.000 minutes
6:	a	Direction. E = East. W = West.
7:	x.x	Speed over ground, knots
8:	x.x	Track angle (degrees, True)
9:	ddmmyy	Date of fix
10:	x.x	Magnetic variation 20.3 degrees
11:	a	Magnetic variation direction
12:	A	Positioning system mode indicator. A = autonomous. D = differential. E = estimated. M = manual input. N = data not valid.
13:	*4A	Checksum

GGA: Time, Position, and Fix Data

Layout: $GPGGA,hhmmss,llll.ll,a,yyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh
Position: 1 , 2 ,3, 4 ,5,6, 7, 8 , 9 ,10, 11,12,13, 14 ,15

1:	hhmmss.ss	Time of fix hh:mm:ss UTC
2:	llll.ll	Latitude: ll degrees 07.038 minutes
3:	a	Direction. N = North. S = South.
4:	yyyy.yy	Longitude: 11 degrees 31.000 minutes.
5:	a	Direction. E = East. W = West.
6:	x	Fix quality: 0 = no fix. 1 = GPS fix. 2 = Differential GPS fix. 4 = Real-Time Kinematic (RTK) fixed integers. 5 = RTK float integers. 6 = Dead reckoning. 7 = Manual input mode. 8 = Simulator. 9 = WAAS.
7:	xx	Number of satellites being tracked
8:	x.x	Horizontal dilution of position
9:	x.x	Altitude
10:	M	Meters (units for 10)
11:	x.x	Relationship between geoid and WGS84 ellipsoid
12:	M	Meters (units for 11)
13:	x.x	Time (seconds) since last DGPS update
14:	xxxx	DGPS station ID number
15:	*hh	Checksum

GLL: Geographic Latitude and Longitude

Layout: $GPGLL,llll.ll,a,yyyy.yy,a,hhmmss,A*hh
Position: 1 ,2, 3 ,4, 5 , 6, 7

1:	llll.ll	Latitude: ll degrees ll.ll minutes
2:	a	Direction: N = North. S = South.
3:	yyyy.yy	Longitude: 11 degrees 31.000 minutes.
4:	a	Direction: E = East. W = West.
5:	hhmmss.ss	Time of fix hh:mm:ss UTC
6:	A	Signal status: A = Active Signal. V = Void, no signal.
7:	*hh	Checksum

VTG: Track Made Good and Speed Over Ground

Layout: $GPVTG,x.x,T,x.x,M,x.x,N,x.x,K,A*hh
Position: 1 ,2, 3 ,4, 5 , 6, 7 ,8, 9,10

1: x.x	Track made good (degrees true)
2: T	T = track made good relative to true north
3: x.x	Track made good (degrees magnetic)
4: M	Magnetic
5: x.x	Ground speed (knots)
6: N	N = knots
7: x.x	Ground speed (km/hr)
8: K	K = kilometers/hr
9: A	Positioning system mode indicator. A = autonomous. D = differential. E = estimated. M = manual input. N = data not valid.
10: *hh	Checksum

Track made good is the actual track of the GPS device, taking into account wind and other things that have influenced its track.

GSA: GPS Dilution of Precision and Active Satellites

Layout: $GPGSA,A,X,x,x,x,x,x,x,x,x,x,x,x, x.x,x.x,x.x,*hh
Position: 1,2,3,4,…….,13, 14, 15, 16,18

1: A	Mode 1: A = Automatic. M = Manual.
2: X	Mode 2: 1 = no fix. 2 = 2D fix. 3 = 3D fix.
3-13: x	PRNs of satellites used for fix
14: x.x	PDOP (dilution of precision)
15: x.x	HDOP (horizontal dilution of precision)
16: x.x	VDOP (vertical dilution of precision)
17: *hh	Checksum

GSV: Satellite Information

Layout: $GPGSV,T,a,a,x,xx,xxx,x,y,yy,yyy,y,z,zz,zzz,z,a,aa,aaa,a*hh
Position: 1,2,3,4, 5 , 6 ,7,8, ……,11,12,…..,15,16,….,19,20

1: T	Total number of sentences for full data
2: a	Sentence number (a of T)
3: a	Number of satellites in view
4: x	Satellite PRN
5: xx	Elevation (degrees) 90° max
6: xxx	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
7: x	SNR (signal to noise ratio)
8-11: y	Information about second satellite, same format as 4-7
12-15: z	Information about third satellite, same format as 4-7
16-19: a	Information about fourth satellite, same format as 4-7
20: *hh	Checksum

NMEA Sentences Examples

RMC: Recommended Minimum

$GPRMC,213415.000,A,3024.7490,N,09110.7014,W,1.18,26.06,250719,,,A*4A

1:	213415.000	Time of fix 21:34:15 UTC
2:	A	Signal status. A = Active Signal. V = Void, no signal.
3:	3024.7490	Latitude: 30 degrees 24.7490 minutes
4:	N	North
5:	09110.7014	Longitude: 91 degrees 10.7014 minutes
6:	W	West
7:	1.18	Speed over ground, knots
8.	26.06	Track angle (degrees, True)
9:	250719	Date of fix: July 25, 2019
10:		Magnetic variation
11:		Magnetic variation direction
12:	A	Positioning system mode indicator. A = autonomous.
13:	*4A	Checksum

GGA: Time, Position, and Fix Data

$GPGGA,213918.000,3024.7495,N,09110.7011,W,1,04,1.83,160.6,M,-25.9,M,,*56

1:	213918.000	Time of fix 21:39:18 UTC
2:	3024.7495	Latitude: 30 degrees 24.7495 minutes
3:	N	North
4:	09110.7011	Longitude: 91 degrees 10.7011 minutes.
5:	W	West
6:	1	Fix quality: GPS fix
7:	04	Number of satellites being tracked
8:	1.83	Horizontal dilution of position
9:	160.6	Altitude
10:	M	Meters
11:	-25.9	Height of geoid
12:	M	Meters
13:		Time (seconds) since last DGPS update
14:		DGPS station ID number
15:	*56	Checksum

GLL: Geographic Latitude and Longitude

$GPGLL,3024.7471,N,09110.7130,W,214559.000,A,A*49

1:	3024.7471	Latitude: 30 degrees 24.7471 minutes
2:	N	North
3:	09110.7130	Longitude: 91 degrees 10.7130 minutes.
4:	W	West
5:	214559.000	Time of fix 21:45:59 UTC
6:	A	Signal status: Active Signal
7:	*49	Checksum

VTG: Track Made Good and Speed Over Ground

$GPVTG,93.85,T,,M,0.35,N,0.64,K,A*0E

1:	93.85	Track made good (degrees true)
2:	T	T = track made good relative to true north
3:		Track made good (degrees magnetic)
4:	M	Magnetic
5:	0.35	Ground speed (knots)
6:	N	N = knots
7:	0.64	Ground speed (km/hr)
8:	K	K = kilometers/hr
9:	A	Positioning system mode indicator. A = autonomous.
10:	*0E	Checksum

GAS: GPS Dilution of Precision and Active Satellites

$GPGSA,A,3,15,05,29,13,,,,,,,,,2.13,1.88,0.99*0B

1:	A	Mode 1: Automatic
2:	3	Mode 2: 3D fix
3:	15	PRN of satellite used for fix
4:	05	PRN of satellite used for fix
5:	29	PRN of satellite used for fix
6:	13	PRN of satellite used for fix
7-13:		PRNs of satellites used for fix
14:	2.13	PDOP (dilution of precision)
15:	1.88	HDOP (horizontal dilution of precision)
16:	0.99	VDOP (vertical dilution of precision)
17:	*0B	Checksum

GSV: Satellite Information

S1: $GPGSV,3,1,11,29,73,300,28,13,50,104,24,15,50,168,25,05,39,040,22*7B
S2: $GPGSV,3,2,11,02,29,089,,21,20,303,,25,19,227,,20,12,250,*7F
S3: $GPGSV,3,3,11,12,07,191,15,26,04,311,,42,,,*75

S1:

1: 3	Total number of sentences for full data
2: 1	Sentence number (a of T)
3: 11	Number of satellites in view
4: 29	Satellite PRN
5: 73	Elevation (degrees) 90° max
6: 300	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
7: 28	SNR (signal to noise ratio)
8: 13	Satellite PRN
9: 50	Elevation (degrees) 90° max
10: 104	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
11: 24	SNR (signal to noise ratio)
12: 15	Satellite PRN
13: 50	Elevation (degrees) 90° max
14: 168	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
15: 25	SNR (signal to noise ratio)
16: 05	Satellite PRN
17: 39	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
18: 040	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
19: 22	SNR (signal to noise ratio)
20: *7B	Checksum

S2:

1: 3	Total number of sentences for full data
2: 2	Sentence number (a of T)
3: 11	Number of satellites in view
4: 02	Satellite PRN
5: 29	Elevation (degrees) 90° max
6: 089	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
7:	SNR (signal to noise ratio)
8: 21	Satellite PRN
9: 20	Elevation (degrees) 90° max
10: 303	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
11:	SNR (signal to noise ratio)
12: 25	Satellite PRN
13: 19	Elevation (degrees) 90° max
14: 227	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
15:	SNR (signal to noise ratio)
16: 20	Satellite PRN

17: 12	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
18: 250	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
19:	SNR (signal to noise ratio)
20: *7B	Checksum

S3:

1: 3	Total number of sentences for full data
2: 3	Sentence number (a of T)
3: 11	Number of satellites in view
4: 12	Satellite PRN
5: 07	Elevation (degrees) 90° max
6: 191	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
7: 15	SNR (signal to noise ratio)
8: 26	Satellite PRN
9: 04	Elevation (degrees) 90° max
10: 311	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
11:	SNR (signal to noise ratio)
12: 42	Satellite PRN
13:	Elevation (degrees) 90° max
14:	Azimuth (degrees from True North) 0° ≤ x ≤ 359°
15:	SNR (signal to noise ratio)
16: *7B	ChecksuM