NMEA-0183 Protocol Description

Created by Mihai (AKA NutDog)
Original source of this document was:
http://www.remember.ro

Version 2.20, January 2004

1. NMEA Output Messages

Table 1.1 – 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 gfround and ground speed

A. GGA – Global Positioning System Fixed Data

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

Table 1.2 – GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
Latitude	3727.2475		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
Position fix indicator	1		See table 1.3
Satellites used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoid Separation		meters	
Units	M	meters	
Age of Diff. Corr.		second	Null field when DGPS is not used
Dif. Ref. Station ID			
Checksum	*18		
<CR><LF>			End of message termination

Table 1.3 – Position Fix Indicator

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

B. GLL – Geographic Position – Latitude/Longitude

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

Table 1.4 – GLL Data Format

Name	**Example**	**Units**	**Description**
Message ID	$GPGLL		GLL protocol header
Latitude	3723.2475		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

C. GSA – GNSS DOP and Active Satellites

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

Table 1.5 – GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See table 1.6
Mode 2	3		See table 1.7
Satellite used	07		Sv on channel 1
Sateliite used	02		Sv on channel 2
...			
Satellite used			Sv on channel 12
PDOP	1.8		Position dilution of precision
HDOP	1.0		Horizontal dilution of precision
VDOP	1.5		Vertical dilution of precision
Checksum	*33		
<CR><LF>			End of message termination

Table 1.6 – Mode 1

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

Table 1.7 - Mode 2

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

D. GSV – GNSS Satellites in view

$GPGSV,2,2,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42*71

Table 1.8 – GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of messages	2		Range 1 to 3
Message number	1		Range 1 to 3
Satellites to view	07		
Satellite ID	01		Channel 1 (Range 1 to 32)
Elevation	79	degrees	Chanel 1 (Maximum 90)
Azimuth	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	degreees	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

E. RMC – Recommended Minimum Specific GNSS Data

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

Table 1.9 – RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC position	161229.487		hhmmss.sss
Status	A		A=data valid or V data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation		degrees	E=east or W=west
Checksum	*10		
<CR><LF>			End of message termination

F. VTG – Course Over Ground and Ground Speed

$GPVTG,309.62,T,,M,0.13,N,0,2,K*6E

Table 1.10

Name	Example	Units	Description
Message ID	$GPVTG		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	0.2	km/hr	Measured horizontal speed
Units	K		Kilometer per hour
Checksum	*6E		
<CR><LF>			End of message termination

2. NMEA Input Messages

NMEA input messages are provided to allow you to control the GPS unit while in NMEA protocol.

Transport Message

Start Sequence	Payload	Checksum	End Sequence
$PSRF<MID>[1]	Data[2]	*CKSUM[3]	<CR><LF>[4]

1. Message identifier consisting of three numeric characters. Input messages begin at MID 100.
2. Message specific data. Refer to a specific message section <data>...<data> definition.
3. CKSUM is a two-hex character checksum as defined in the NMEA specifications. Use of checksums is required on all input messages.
4. **Each message is terminated using Carriage Return (CR) and Line Feed (LF) which is \r\n which is hex 0D0A. Because \r\n are not printable ASCII characte\rs, they are ammited from the example strings, but must be sent to terminate the message and cause the receiver to process the input mesage.**

SiRF NMEA Input Messages

Message	Message Identifier (MID)	Description
SetSerialPort	100	Set port A parameters and protocol
NavigationInitialization	101	Parameters required for start using X/Y/Z
SetDGPSPort	102	Set PORT B paramaters for DGPS input
Query/Rate Control	103	Query standard NMEA message and/or set output rate
LLANavigationInitialization	104	Parameters required for start using Lat/Lon/Alt (input coordinates must be WGS84)
Development Data On/Off	105	Development Data messages On/Off

1. SetSerialPort

This command message is used to set the protocol (SiRF binary or NMEA) and/or the communication parameters (baud, data bits, stop bits, parity).When a valid message is received, the parameters are stored in battery-backed SRAM and then the GPS unit restarts using the saved parameters.

Table 2.1 – Set Serial Port Data Format

Name	Example	Units	Description
Message ID	$PSRF100		PSRF100 protocol header
Protocol	0		0=SiRF Binary, 1=NMEA
Baud	9600		4800, 9600, 19200, 38400
Data bits	8		8, 7
Stop bits	1		0, 1
Parity	0		0=None, 1=Odd, 2=Even
Checksum	*0C		
<CR><LF>			End of message termination

2. ***Navigation Initialization***

This command is used to initialize the module for a warm start, by providing current position (in X, Y, Z coordinates), clock offset and time. This enables the GPS unit to search for the correct satellite signales at the correct signal parameters. Correct initialization parameters enable the GPS unit to acquire signals quickly.

$PSRF101,-2686700,-4304200,3851624,95000,497260,921,12,3*22

Table 2.2 – Navigation Initialization Data Format

Name	Example	Units	Description
Message ID	$PSRF101		PSRF101 protocol header
ECEF X	-2686700	meters	X coordinate position
ECEF Y	-4304200	meters	Y coordinate position
ECEF Z	3851624	meters	Z coordinate position
ClkOffset	95000	Hz	Clock Offset of GPS unit (use 0 for last saved value if available. If this in unavailable, a default value of 96,000 will be used)
TimeOfWeek	497260	seconds	GPS Time Of Week
WeekNo	921		GPS Week Number
ChannelCount	12		Range 1 to 12
ResetCfg	3		See table 2.3
Checksum	*22		
<CR><LF>			End of message termination

Table 2.3 – Reset configuration

Hex	Description
0x01	Data Valid – Warm/Hot Starts=1
0x02	Clear Ephemeris – Warm Start=1
0x04	Clear Memory – Cold Start=1

3. SetDGPSPort

This command is used to control serial port B which is an input-only serial port used to receive RTCM differential corections. Differential receivers may output correction using different comunications parametters. The default communications parameters for port B are 9600 baud, 8 data bits, stop bit, and no parity. If a DGPS receiver is used which has different communication parameters, use this command to allow the receiver to correctly decode the data. When a valid message is received, the parameters are stored in battery-backed SRAM ant then the receiver restarts using the saved.

$PSRF102,9600,8,1,0*3C

Table 2.4 – Set DGPS Port Data Format

Name	Example	Units	Description
Message ID	$PSRF102		PSRF102 protocol header
Baud	9600		4800, 9600, 19200, 38400
Data bits	8		8, 7
Stop bits	1		0, 1
Parity	0		0=None, 1=Odd, 2=Even
Checksum	*3C		
<CR><LF>			End of message termination

4. Quey/Rate Control

This command is used to control the output of standard NMEA messages GGA, GLL, GSA, GSV, RMC and VTG. Using this command message, standard NMEA messages may be polled once, or setup for periodic output. Checksums may also be enabled or disabled depending on the needs of the receiving program. NMEA message settings are saved in battery-backed memory for each entry when the message is accepted.

$PSRF103,00,01,00,01*25

Table 2.5 – Query/Rate control data format

Name	Example	Units	Description
MessageID	$PSRF103		PSRF103 protocol header
Msg	00		See table 2.6
Mode	01		0=SetRate, 1=Query
Rate	00	seconds	Output – off=0, max=255
CksumEnable	01		0=Disable Checksum, 1=Enable Checksum
Checksum	*25		
<CR><LF>			End of message termination

Table 2.6 – Messages

Value	Description
0	GGA
1	GLL
2	GSA
3	GSV
4	RMC
5	VTG

5. LLANavigation Initialization

This command is used to initialize the module for a warm start, by providing current position (in latitude, longitude and altitude coordinates), clock offset and time. This enables the receiver to search for the correct satellite signals at the correct signal parameters. Correct initialization parameters enable the receiver to aquire signals quickly.

$PSRF104,37.3875111,-121.97232,0,95000,237759,922,12,3*3A

Table 2.7 – Navigation Initialization Data Format

Name	Example	Units	Description
Message ID	$PSRF104		PSRF104 protocol header
Lat	37.3875111	degrees	Latitude position (Range 90 to –90)
Lon	-121.97232	degrees	Longitude position (Range 180 to –180)
Alt	0	meters	Altitude position
ClkOffset	95000	Hz	Clock Offset of the GPS Unit
TimeOfWeek	237759	seconds	GPS Time Of Week
WeekNo	922		GPS Week Number
ChannelCount	12		Range 1 to 12
ResetCfg	3		See table 2.8
Checksum	*3A		
<CR><LF>			End of message termination

Table 2.8 – Reset Configuration

Hex	Description
0x01	Data Valid – Warm/Hot Starts=1
0x02	Clear Ephemeris – Warm Start=1
0x04	Clear Memory – Cold Start=1

6. Development On/Off

Use this command to enable development data information if you are having trouble getting commands accepted. Invalid commands generate debug information that enables the user to determine the source of the command rejection. Common reasons for input command rejection are invalid checksum parameter out of specified range.

Table 2.9 – Development Data On/Off Data Format

Name	Example	Units	Description
Message ID	$PSRF105		PSRF105 protocol header
Debug	1		0=Off, 1=On
Checksum	*3E		
<CR><LF>			End of message termination