NAVMAN

NMEA Reference Manual

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NMEA
Reference Manual

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Preface

All SiRF product support a subset of the NMEA-0183 standard for interfacing marine electronic devices as defined by the National Marine Electronics Association.

The *NMEA Reference Manual* provides details of NMEA messages developed and defined by SiRF. It does not provide information about the complete NMEA-0183 interface standard.

Who Should Use This Guide

This manual was written assuming the user has a basic understanding of interface protocols and their use.

How This Guide Is Organized

Chapter 1, “Output Messages” defines SiRF developed NMEA output messages.

Chapter 2, “Input Messages” defines SiRF developed NMEA input messages.

Related Manuals

You can refer to the following for more information:

- *NMEA-0183 Standard For Interfacing Marine Electronic Devices.*

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Output Messages 1

Table 1-1 lists each of the NMEA output messages specifically developed and defined by SiRF for use within SiRF products.

Table 1-1 NMEA Output Messages

Option	Description
GGA	Time, position and fix type data.
GLL	Latitude, longitude, UTC time of position fix and status.
GSA	GPS receiver operating mode, 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.
MSS	Signal-to-noise ratio, signal strength, frequency, and bit rate from a radio-beacon receiver.
RMC	Time, date, position, course and speed data.
VTG	Course and speed information relative to the ground.
ZDA	PPS timing message (synchronized to PPS)
150	OK to send message

A full description and definition of the listed NMEA messages are provided by the next sections of this chapter.

Table 1-2 provides a summary of supported SiRF NMEA output messages by the specific SiRF platforms.

Table 1-2 Supported NMEA output messages

	SiRF Software Options		
Message	**GSW2**	**SiRFXTrac**	**SiRFLoc**
GGA	Yes	Yes	Yes
GLL	Yes	Yes	Yes
GSA	Yes	Yes	Yes
GSV	Yes	Yes	Yes
MSS	Yes	No	No

Table 1-2 Supported NMEA output messages

Message	SiRF Software Options		
	GSW2	SiRFXTrac	SiRFLoc
RMC	Yes	Yes	Yes
VTG	Yes	Yes	Yes
ZDA	2.3.2 and above	No	No
150	2.3.2 and above	No	No

GGA —Global Positioning System Fixed Data

Table 1-3 contains the values for the following example:

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

Table 1-3 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Time	161229.487		hhmmss.sss
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
Position Fix Indicator	1		See Table 1-4
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 fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR> <LF>			End of message termination

Table 1-4 Position Fix Indicator

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3-5	Not supported
6	Dead Reckoning Mode, fix valid

Note – A valid position fix indicator is derived from the SiRF Binary M.I.D. 2 position mode 1. See the SiRF Binary Reference Manual.

GLL—Geographic Position - Latitude/Longitude

Table 1-5 contains the values for the following example:

$GPGLL,3723.2475,N,12158.3416,W,161229.487,A,A*41

Table 1-5 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 Time	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Mode	A		A=Autonomous, D=DGPS, E=DR
Checksum	*41		
<CR> <LF>			End of message termination

GSA—GNSS DOP and Active Satellites

Table 1-6 contains the values for the following example:

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

Table 1-6 GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 1-7
Mode 2	3		See Table 1-8
Satellite Used[1]	07		Sv on Channel 1
Satellite Used[1]	02		Sv on Channel 2
....			....
Satellite Used[1]			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

1. Satellite used in solution.

Table 1-7 Mode 1

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

Table 1-8 Mode 2

Value	Description
1	Fix Not Available
2	2D (<4SV's used)
3	3D (>3SV's used)

GSV—GNSS Satellites in View

Table 1-9 contains the values for 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 1-9 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages[1]	2		Range 1 to 3
Message Number[1]	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)
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	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

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

MSS—MSK Receiver Signal

Table 1-10 contains the values for the following example:

$GPMSS,55,27,318.0,100,1,*57

Table 1-10 MSS Data Format

Name	Example	Units	Description
Message ID	$GPMSS		MSS protocol header
Signal Strength	55	dB	SS of tracked frequency
Signal-to-Noise Ratio	27	dB	SNR of tracked frequency
Beacon Frequency	318.0	kHz	Currently tracked frequency
Beacon Bit Rate	100		bits per second
Channel Number	1		The channel of the beacon being used if a multi-channel beacon receiver is used.
Checksum	*57		
<CR> <LF>			End of message termination

Note – The MSS NMEA message can only be polled or scheduled using the MSK NMEA input message. See “MSK—MSK Receiver Interface” on page 2-9.

RMC—Recommended Minimum Specific GNSS Data

Table 1-11 contains the values for the following example:

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

Table 1-11 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status[1]	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 Indicator	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation[2]		degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

1. A valid status is derived from the SiRF Binary M.I.D 2 position mode 1. See the SiRF Binary Reference Manual.
2. SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

VTG—Course Over Ground and Ground Speed

Table 1-12 contains the values for the following example:

$GPVTG,309.62,T, ,M,0.13,N,0.2,K,A*23

Table 1-12 VTG Data Format

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[1]
Speed	0.13	knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Mode	A		A=Autonomous, D=DGPS, E=DR
Checksum	*23		
<CR> <LF>			End of message termination

1. SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

ZDA—SiRF Timing Message

Outputs the time associated with the current 1 PPS pulse. Each message will be output within a few hundred ms after the 1 PPS pulse is output and will tell the time of the pulse that just occurred.

Table 1-13 contains the values for the following example:

$GPZDA,181813,14,10,2003,00,00*4F

Table 1-13 ZDA Data Format

Name	Example	Units	Description
Message ID	$GPZDA		ZDA protocol header
UTC Time	181813		Either using valid IONO/UTC or estimated from default leap seconds
Day	14		01 TO 31
Month	10		01 TO 12
Year	2003		1980 to 2079
Local zone hour	00	knots	Offset from UTC (set to 00)
Local zone minutes	00		Offset from UTC (set to 00)
Checksum			
<CR> <LF>			End of message termination

150—OkToSend

This message is being sent out during the trickle power mode to communicate with outside program such as SiRFDemo to indicate whether the receiver is awake or not.

Table 1-14 contains the values for the following example:

1. OkToSend

$PSRF150,1*3F

2. not OkToSend

$PSRF150,0*3E

Table 1-14 OkToSend Message Data Format

Name	Example	Units	Description
Message ID	$PSRF150		PSRF150 protocol header
OkToSend	1		1=OK to send, 0=not OK to send
Checksum	*3F		
<CR> <LF>			End of message termination

Input Messages 2

NMEA input messages are provided to allow you to control the Evaluation Receiver while in NMEA protocol mode. The Evaluation Receiver may be put into NMEA mode by sending the SiRF Binary protocol message “Switch to NMEA Protocol - Message I.D. 129” (see the SiRF Binary Reference Manual). This can be done using a user program or using the SiRFdemo software and selecting Switch to NMEA Protocol from the Action menu (see the Evaluation Kit User’s Guide). If the receiver is in SiRF Binary mode, all NMEA input messages are ignored. Once the receiver is put into NMEA mode, the following messages may be used to command the module.

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 for <data>...<data> definition.
3. CKSUM is a two-hex character checksum as defined in the NMEA specification. Use of checksums is required on all input messages.
4. Each message is terminated using Carriage Return (CR) Line Feed (LF) which is \r\n which is hex 0D 0A. Because \r\n are not printable ASCII characters, they are omitted from the example strings, but must be sent to terminate the message and cause the receiver to process that input message.

Note – All fields in all proprietary NMEA messages are required, none are optional. All NMEA messages are comma delimited.

NMEA Input Messages

Message	MID[1]	Description
SetSerialPort	100	Set PORT A parameters and protocol
NavigationInitialization	101	Parameters required for start using X/Y/Z[2]
SetDGPSPort	102	Set PORT B parameters 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[3]
Development Data On/Off	105	Development Data messages On/Off
Select Datum	106	Selection of datum to be used for coordinate transformations.
MSK Receiver Interface	MSK	Command message to a MSK radio-beacon receiver.

1. Message Identification (MID).
2. Input coordinates must be WGS84.
3. Input coordinates must be WGS84.

Note – NMEA input messages 100 to 106 are SiRF proprietary NMEA messages. The MSK NMEA string is as defined by the NMEA 0183 standard.

Table 2-1 provides a summary of supported SiRF NMEA input messages by the specific SiRF platforms.

Table 2-1 Supported NMEA input messages

	SiRF Software Options		
Message ID	**GSW2**	**SiRFXTrac**	**SiRFLoc**
100	Yes	Yes	Yes
101	Yes	No	Yes
102	Yes	No	No
103	Yes	Yes	Yes
104	Yes	No	Yes
105	Yes	Yes	Yes
106	Yes	Yes	Yes
MSK	Yes	No	No

100—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). Generally, this command is used to switch the module back to SiRF Binary protocol mode where a more extensive command message set is available. When a valid message is received, the parameters are stored in battery-backed SRAM and then the Evaluation Receiver restarts using the saved parameters.

Table 2-2 contains the input values for the following example:

Switch to SiRF Binary protocol at 9600,8,N,1

$PSRF100,0,9600,8,1,0*0C

Table 2-2 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
DataBits	8		8,7[1]
StopBits	1		0,1
Parity	0		0=None, 1=Odd, 2=Even
Checksum	*0C		
<CR> <LF>			End of message termination

1. SiRF protocol is only valid for 8 data bits, 1stop bit, and no parity.

101—NavigationInitialization

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

Table 2-3 contains the input values for the following example:

Start using known position and time.

$PSRF101,-2686700,-4304200,3851624,96000,497260,921,12,3*1C

Table 2-3 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	96000	Hz	Clock Offset of the Evaluation Receiver[1]
TimeOfWeek	497260	seconds	GPS Time Of Week
WeekNo	921		GPS Week Number
ChannelCount	12		Range 1 to 12
ResetCfg	3		See Table 2-4 and Table 2-5
Checksum	*1C		
<CR> <LF>			End of message termination

1. Use 0 for last saved value if available.If this is unavailable, a default value of 96,000 will be used.

Table 2-4 Reset Configuration - Non SiRFLoc Platforms

Hex	Description
0x01	Hot Start— All data valid
0x02	Warm Start—Ephemeris cleared
0x03	Warm Start (with Init)—Ephemeris cleared, initialization data loaded
0x04	Cold Start—Clears all data in memory
0x08	Clear Memory—Clears all data in memory and resets receiver back to factory defaults

Table 2-5 Reset Configuration - SiRFLoc Specific

Hex	Description
0x00	Perform a hot start using internal RAM data. No initialization data will be used.
0x01	Use initialization data and begin in start mode. Unceretainties are 5 sec time accuracy and 300 km position accuracy. Ephemeris data in SRAM is used.
0x02	No initialization data is used, ephemeris data is cleared, and warm start performed using remaining data in RAM.
0x03	Initialization data is used, ephemeris data is cleared, and warm start performed using remaining data in RAM.
0x04	No initialization data is used. Position, time and ephemeris are cleared and a cold start is performed.
0x08	No initialization data is used. Internal RAM is cleared and a factory reset is performed.

102—SetDGPSPort

This command is used to control the serial port used to receive RTCM differential corrections. Differential receivers may output corrections using different communication parameters. 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 and then the receiver restarts using the saved parameters.

Table 2-6 contains the input values for the following example:

Set DGPS Port to be 9600,8,N,1.

$PSRF102,9600,8,1,0*12

Table 2-6 Set DGPS Port Data Format

Name	Example	Units	Description
Message ID	$PSRF102		PSRF102 protocol header

Table 2-6 Set DGPS Port Data Format

Name	Example	Units	Description
Baud	9600		4800, 9600, 19200, 38400
DataBits	8		8,7
StopBits	1		0,1
Parity	0		0=None, 1=Odd, 2=Even
Checksum	*12		
<CR> <LF>			End of message termination

103—Query/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.

Table 2-7 contains the input values for the following examples:

1. Query the GGA message with checksum enabled

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

2. Enable VTG message for a 1 Hz constant output with checksum enabled

   $PSRF103,05,00,01,01*20

3. Disable VTG message

   $PSRF103,05,00,00,01*21

Table 2-7 Query/Rate Control Data Format (See example 1)

Name	Example	Units	Description
Message ID	$PSRF103		PSRF103 protocol header
Msg	00		See Table 2-8
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 2-8 Messages

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

Table 2-8 Messages

Value	Description
6	MSS (If internal beacon is supported)
7	Not defined
8	ZDA (if 1PPS output is supported)
9	Not defined

Note – In TricklePower mode, update rate is specified by the user. When you switch to NMEA protocol, message update rate is also required. The resulting update rate is the product of the TricklePower Update rate and the NMEA update rate (i.e., TricklePower update rate = 2 seconds, NMEA update rate = 5 seconds, resulting update rate is every 10 seconds, (2 X 5 = 10)).

104—LLANavigationInitialization

This command is used to initialize the Evaluation Receiver 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 acquire signals quickly.

Table 2-9 contains the input values for the following example:

Start using known position and time.

$PSRF104,37.3875111,-121.97232,0,96000,237759,1946,12,1*07

Table 2-9 LLA 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	96000	Hz	Clock Offset of the Evaluation Receiver[1]
TimeOfWeek	237759	seconds	GPS Time Of Week
WeekNo	1946		Extended GPS Week Number (1024 added)
ChannelCount	12		Range 1 to 12
ResetCfg	1		See Table 2-10
Checksum	*07		
<CR> <LF>			End of message termination

1. Use 0 for last saved value if available. If this is unavailable, a default value of 96,000 will be used.

Table 2-10 Reset Configuration

Hex	Description
0x01	Hot Start— All data valid
0x02	Warm Start—Ephemeris cleared
0x03	Warm Start (with Init)—Ephemeris cleared, initialization data loaded
0x04	Cold Start—Clears all data in memory
0x08	Clear Memory—Clears all data in memory and resets receiver back to factory defaults

105—Development Data 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 or parameter out of specified range.

Table 2-11 contains the input values for the following examples:

1. Debug On

   $PSRF105,1*3E

2. Debug Off

   $PSRF105,0*3F

Table 2-11 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

106—Select Datum

GPS receivers perform initial position and velocity calculations using an earth-centered earth-fixed (ECEF) coordinate system. Results may be converted to an earth model (geoid) defined by the selected datum. The default datum is WGS 84 (World Geodetic System 1984) which provides a worldwide common grid system that may be translated into local coordinate systems or map datums. (Local map datums are a best fit to the local shape of the earth and not valid worldwide.)

Table 2-12 contains the input values for the following examples:

1. Datum select TOKYO_MEAN

   $PSRF106,178*32

Table 2-12 Select Datum Data Format

Name	Example	Units	Description
Message ID	$PSRF106		PSRF106 protocol header

Table 2-12 Select Datum Data Format

Name	Example	Units	Description
Datum	178		21=WGS84 178=TOKYO_MEAN 179=TOKYO_JAPAN 180=TOKYO_KOREA 181=TOKYO_OKINAWA
Checksum	*32		
<CR> <LF>			End of message termination

MSK—MSK Receiver Interface

Table 2-13 contains the values for the following example:

$GPMSK,318.0,A,100,M,2,*45

Table 2-13 RMC Data Format

Name	Example	Units	Description
Message ID	$GPMSK		MSK protocol header
Beacon Frequency	318.0	kHz	Frequency to use
Auto/Manual Frequency[1]	A		A : Auto, M : Manual
Beacon Bit Rate	100		Bits per second
Auto/Manual Bit Rate[1]	M		A : Auto, M : Manual
Interval for Sending $--MSS[2]	2	sec	Sending of MSS messages for status

1. If Auto is specified the previous field value is ignored.
2. When status data is not to be transmitted this field is null.

Note – The NMEA messages supported by the Evaluation Receiver does not provide the ability to change the DGPS source. If you need to change the DGPS source to internal beacon, then this must be done using the SiRF binary protocol and then switched to NMEA.