



## *NMEA Reference Manual*

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# Preface

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

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*

This manual contains the following chapters:

**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 document for more information:

- *NMEA-0183 Standard For Interfacing Marine Electronic Devices*
- *SiRF Binary Protocol Reference Manual*
- *SiRF Evaluation Kit User Guide*
- *SiRF System Development Kit User Guide*



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# Output Messages



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.  |
| 151    | GPS Data and Extended Ephemeris Mask   |
| 152    | Extended Ephemeris Integrity   |
| 154    | Extended Ephemeris ACK   |

A full description of the listed NMEA messages are provided in the following sections.

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

Table 1-2 Supported NMEA Output Messages

| Message | SiRF Software Options |                        |                        |                      |                             |
|---------|-----------------------|------------------------|------------------------|----------------------|-----------------------------|
|         | GSW2 <sup>1</sup>     | SiRFDrive <sup>1</sup> | SiRFXTrac <sup>1</sup> | SiRFLoc <sup>1</sup> | GSW3<br>GSW3LT <sup>1</sup> |
| GGA     | Yes                   | Yes                    | Yes                    | Yes                  | Yes                         |
| GLL     | Yes                   | Yes                    | Yes                    | Yes                  | Yes                         |
| GSA     | Yes                   | Yes                    | Yes                    | Yes                  | Yes                         |
| GSV     | Yes                   | Yes                    | Yes                    | Yes                  | Yes                         |
| MSS     | Yes                   | No                     | No                     | No                   | Yes <sup>2</sup>            |
| RMC     | Yes                   | Yes                    | Yes                    | Yes                  | Yes                         |
| VTG     | Yes                   | Yes                    | Yes                    | Yes                  | Yes                         |
| ZDA     | 2.3.2 and above       | No                     | No                     | No                   | No                          |
| 150     | 2.3.2 and above       | No                     | No                     | No                   | No                          |
| 151     | 2.5 and above         | No                     | 2.3 and above          | No                   | 3.2.0 and above             |
| 152     | 2.5 and above         | No                     | 2.3 and above          | No                   | 3.2.0 and above             |
| 154     | 2.5 and above         | No                     | 2.3 and above          | No                   | 3.2.0 and above             |

1. GSW2 and SiRFDrive software only output NMEA version 2.20 (and earlier). SiRFXTrac, GSW3, and GSW3LT software have conditional defines (UI\_NMEA\_VERSION\_XXX) to allow a choice between NMEA 2.20 and 3.00. The file NMEA\_SIF.H contains the NMEA version defines.

2. MSS message for GSW3 and GSW3LT is empty since they do not support BEACON.

## GGA—Global Positioning System Fixed Data

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**Note** – Fields marked in italic *red* apply only to NMEA version 2.3 (and later) in this NMEA message description.

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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     | <i>Dead Reckoning Mode, fix valid</i> |

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

## GLL—Geographic Position - Latitude/Longitude

**Note** – Fields marked in italic *red* apply only to NMEA version 2.3 (and later) in this NMEA message description.

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  |
| <i>Mode</i>   | <i>A</i>   |       | <i>A=Autonomous, D=DGPS, E=DR<br/>(Only present in NMEA version 3.00)</i> |
| Checksum      | *41        |       |   |
| <CR> <LF>     |            |       | End of message termination  |

## GSA—GNSS DOP and Active Satellites

**Note** – Fields marked in italic *red* apply only to NMEA version 2.3 (and later) in this NMEA message description.

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 <sup>1</sup> | 07      |       | Sv on Channel 1                  |
| Satellite Used <sup>1</sup> | 02      |       | Sv on Channel 2                  |
| ....                        |         |       | ....                             |
| Satellite Used <sup>1</sup> |         |       | 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     | 2D Automatic—allowed to automatically switch 2D/3D |

Table 1-8 Mode 2

| Value | Description       |
|-------|-------------------|
| 1     | Fix not available |
| 2     | 2D (<4 SVs used)  |
| 3     | 3D (>3 SVs 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 <sup>1</sup> | 2       |         | Range 1 to 3                          |
| Message Number <sup>1</sup>     | 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

**Note** – Fields marked in *italic red* apply only to NMEA version 2.3 (and later) in this NMEA message description.

This message for GSW3 and GSW3LT is empty since they do not support BEACON.

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  |
| <i>Channel Number</i> | <i>1</i> |       | <i>The channel of the beacon being used if a multi-channel beacon receiver is used</i> |
| 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 2-11.

## RMC—Recommended Minimum Specific GNSS Data

**Note** – Fields marked in italic *red* apply only to NMEA version 2.3 (and later) in this NMEA message description.

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 <sup>1</sup>              | 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 <sup>2</sup>  |            | degrees | E=east or W=west                  |
| East/West Indicator <sup>2</sup> | E          |         | E=east                            |
| <i>Mode</i>                      | <i>A</i>   |         | <i>A=Autonomous, D=DGPS, E=DR</i> |
| 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 Protocol 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

**Note** – Fields marked in *italic red* apply only to NMEA version 2.3 (and later) in this NMEA message description.

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 <sup>1</sup>             |
| Speed       | 0.13     | knots   | Measured horizontal speed         |
| Units       | N        |         | Knots                             |
| Speed       | 0.2      | km/hr   | Measured horizontal speed         |
| Units       | K        |         | Kilometers per hour               |
| <i>Mode</i> | <i>A</i> |         | <i>A=Autonomous, D=DGPS, E=DR</i> |
| 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 is output within a few hundred ms after the 1 PPS pulse is output and tells 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  | hhmmss | The UTC time units are as follow:<br>hh = UTC hours from 00 to 23<br>mm = UTC minutes from 00 to 59<br>ss = UTC seconds from 00 to 59<br>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      | hour   | Offset from UTC (set to 00)   |
| Local zone minutes | 00      | minute | Offset from UTC (set to 00)   |
| Checksum           | *4F     |        |   |
| <CR> <LF>          |         |        | End of message termination  |

## 150—OkToSend

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

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

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     |

## 151—GPS Data and Extended Ephemeris Mask

Message ID 151 is used by GSW2 (2.5 or above), SiRFXTrac (2.3 or above), and GSW3 (3.2.0 or above), and GSW3LT software. An example of the message is provided below. Note that the parentheses "(" and ")" are NOT part of the message; they are used to delimit description of a field. The field of checksum consists of two hex digits representing the exclusive or of all characters between, but not including, the \$ and \*.

\$PSRF151,(GPS\_TIME\_VALID\_FLAG),(GPS Week),(GPS TOW),  
(EPH\_REQ\_MASK\_HEX)\*(checksum)<CR><LF>

Table 1-15 contains the parameter definitions and example values.

Table 1-15 GPS Data and Ephemeris Mask - Message 151

| Name                | Example       | Units       | Description   |
|---------------------|---------------|-------------|---|
| Message ID          | \$PSRF151     |             | PSRF151 protocol header.  |
| GPS_TIME_VALID_FLAG | 0, 1, 2, or 3 | N/A         | LSB bit 0 = 1, GPS week is valid.<br>LSB bit 0 = 0, GPS week is not valid.<br>LSB bit 1 = 1, GPS TOW is valid.<br>LSB bit 1 = 0, GPS TOW is not valid.  |
| GPS Week            | 1324          | week number | Extended week number (variable length field).   |
| GPS TOW             |               | 0.1 second  | GPS Time Of Week (variable length field).   |
| EPH_REQ_MASK        | 0x40000001    | N/A         | Mask to indicate the satellites for which new ephemeris is needed. Eight characters preceded by the following characters, "0x", are used to show this 32-bit mask (in hex). The leading bit is for satellite PRN 32, and the last bit is for satellite PRN 1. |
| <CR> <LF>           |               |             | End of message termination.   |

## 152—Extended Ephemeris Integrity

Message ID 152 is used by GSW2 (2.5 or above), SiRFXTrac (2.3 or above), and GSW3 (3.2.0 or above), and GSW3LT software. An example of the message is provided below. Note that the parentheses "(" and ")" are NOT part of the message; they are used to delimit description of a field. The field of checksum consists of two hex digits representing the exclusive or of all characters between, but not including, the \$ and \*.

\$PSRF152, (SAT\_POS\_VALIDITY\_FLAG), (SAT\_CLK\_VALIDITY\_FLAG), (SAT\_HEALTH\_FLAG)\*(checksum) <CR><LF>

Table 1-16 contains the parameter definitions and example values.

Table 1-16 Extended Ephemeris Integrity - Message 152

| Name                  | Example    | Units | Description  |
|-----------------------|------------|-------|--|
| Message ID            | \$PSRF152  |       | PSRF152 protocol header  |
| SAT_POS_VALIDITY_FLAG | 0x10000041 | N/A   | This is a 10 character field representing the debug flag in hex with lead-in "0x". (e.g., 0x00F00000). 1 = invalid position found, 0 = valid position. SVID 1 validity flag is in LSB and subsequent bits will have validity flags for SVIDs in increasing order up to SVID 32 whose validity flag will be in MSB. |
| SAT_CLK_VALIDITY_FLAG | 0x10000041 | N/A   | This is a 10 character field representing the debug flag in hex with lead-in "0x". (e.g., 0x00F00000). 1 = invalid clock found, 0 = valid clock. SVID 1 validity flag is in LSB and subsequent bits will have validity flags for SVIDs in increasing order up to SVID 32 whose validity flag will be in MSB.       |
| SAT_HEALTH_FLAG       | 0x10000041 | N/A   | This is a 10 character field representing the debug flag in hex with lead-in "0x". (e.g., 0x00F00000). 1 = unhealthy satellite, 0 = healthy satellite. SVID 1 health flag is in the LSB and subsequent bits will have health flags for SVIDs in increasing order up to SVID 32 whose validity flag will be in MSB. |
| <CR> <LF>             |            |       | End of message termination.  |

## 154—Extended Ephemeris ACK

Message ID 154 is used by GSW2 (2.5 or above), SiRFXTrac (2.3 or above), and GSW3 (3.2.0 or above), and GSW3LT software. This message is returned when Messages ID 107, 108, or 110 (input messages) is received. Refer to Chapter 2, "Input Messages" for more details on Messages ID 107, 108, and 110.

An example of the message is provided below. Note that the parentheses "(" and ")" are NOT part of the message; they are used to delimit description of a field. The field of checksum consists of two hex digits representing the exclusive or of all characters between, but not including, the \$ and \*.

\$PSRF154, (ACK Message ID)\*(checksum) <CR><LF>

Table 1-17 contains the parameter definitions and example values.

*Table 1-17* Extended Ephemeris ACK - Message 154

| <b>Name</b> | <b>Example</b> | <b>Units</b> | <b>Description</b>                                |
|-------------|----------------|--------------|---|
| Message ID  | \$PSRF154      |              | PSRF154 protocol header.                          |
| ACK ID      | 110            | N/A          | Message ID of the message to ACK (107, 108, 110). |
| <CR> <LF>   |                |              | End of message termination.                       |

### *Reserved - Message ID 225*

This output message is SiRF proprietary except for sub ID 6.

## Input Messages



NMEA input messages enable 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 Protocol Reference Manual*). This can be done by using a user program or by using the SiRFSDemo software and selecting Switch to NMEA Protocol from the Action menu (see the *SiRF Evaluation Kit User Guide* or the *SiRFDemo User 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

Table 2-1 describes the transport message parameters.

Table 2-1 Transport Message Parameters

| Start Sequence           | Payload           | Checksum            | End Sequence           |
|--------------------------|-------------------|---------------------|------------------------|
| \$PSRF<MID> <sup>1</sup> | Data <sup>2</sup> | *CKSUM <sup>3</sup> | <CR> <LF> <sup>4</sup> |

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

Table 2-2 describes the NMEA input messages.

Table 2-2 NMEA Input Messages

| Message                          | MID <sup>1</sup> | Description  |
|----------------------------------|------------------|--|
| SetSerialPort                    | 100              | Set PORT A parameters and protocol                           |
| NavigationInitialization         | 101              | Parameters required for start using X/Y/Z <sup>2</sup>       |
| 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 <sup>3</sup> |
| Development Data On/Off          | 105              | Development Data messages On/Off                             |
| Select Datum                     | 106              | Selection of datum to be used for coordinate transformations |
| Extended Ephemeris Proprietary 1 | 107              | Extended Ephemeris Proprietary message                       |
| Extended Ephemeris Proprietary 2 | 108              | Extended Ephemeris Proprietary message                       |
| Extended Ephemeris Debug         | 110              | Extended Ephemeris Debug                                     |
| Marketing Software Configuration | 200              | Selection of Marketing Software Configurations               |
| 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 2-3 provides a summary of supported SiRF NMEA input messages by the specific SiRF platforms.

Table 2-3 Supported NMEA Input Messages

| Message ID       | SiRF Software Options |           |                  |         |                  |
|------------------|-----------------------|-----------|------------------|---------|------------------|
|                  | GSW2                  | SiRFDrive | SiRFXTrac        | SiRFLoc | GSW3 GSW3LT      |
| 100              | Yes                   | Yes       | Yes              | Yes     | Yes              |
| 101              | Yes                   | Yes       | Yes <sup>1</sup> | Yes     | Yes <sup>1</sup> |
| 102              | Yes                   | Yes       | No               | No      | Yes              |
| 103              | Yes                   | Yes       | Yes              | Yes     | Yes              |
| 104              | Yes                   | Yes       | Yes <sup>1</sup> | Yes     | Yes <sup>1</sup> |
| 105              | Yes                   | Yes       | Yes              | Yes     | Yes              |
| 106              | Yes                   | Yes       | Yes              | Yes     | Yes              |
| 107              | 2.5 and above         | No        | 2.3 and above    | No      | Yes              |
| 108              | 2.5 and above         | No        | 2.3 and above    | No      | Yes              |
| 110              | 2.5 and above         | No        | 2.3 and above    | No      | 3.2.0 and above  |
| 200 <sup>2</sup> | No                    | No        | No               | No      | No               |
| MSK              | Yes                   | Yes       | No               | No      | Yes <sup>3</sup> |

1. Position and time are not available, consequently warm start init is ignored.

2. Only with GSC2xr chip.

3. MSK message for GSW3 and GSW3LT are empty since they do not support BEACON

## 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, and 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 the Evaluation Receiver restarts using the saved parameters.

Table 2-4 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 2-4 Set Serial Port Data Format

| Name       | Example   | Units | Description   |
|------------|-----------|-------|---|
| Message ID | \$PSRF100 |       | PSRF100 protocol header                                 |
| Protocol   | 0         |       | 0=SiRF binary, 1=NMEA                                   |
| Baud       | 9600      |       | 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 |
| DataBits   | 8         |       | 8,7 <sup>1</sup>  |
| 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, 1 stop 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.

For GSW3, GSW3LT, and SiRFXTrac software, position and time inputs are not possible and consequently warm start init is ignored.

Table 2-5 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 2-5 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 <sup>1</sup> |
| TimeOfWeek | 497260    | seconds | GPS Time Of Week                                     |

Table 2-5 Navigation Initialization Data Format (Continued)

| Name         | Example | Units | Description                 |
|--------------|---------|-------|-----------------------------|
| WeekNo       | 921     |       | GPS Week Number             |
| ChannelCount | 12      |       | Range 1 to 12               |
| ResetCfg     | 3       |       | See Table 2-6 and Table 2-7 |
| 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 is used.

Table 2-6 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 the receiver back to factory defaults |

Table 2-7 Reset Configuration - SiRFLoc Specific

| Hex  | Description  |
|------|--|
| 0x00 | Perform a hot start using internal RAM data. No initialization data is used.   |
| 0x01 | Use initialization data and begin in start mode. Uncertainties are 5 seconds 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 that 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 the receiver restarts using the saved parameters.

For GSW3 and GSW3LT software, this message does not provide DGPS parameter.

Table 2-8 contains the input values for the following example:

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

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

Table 2-8 Set DGPS Port Data Format

| Name       | Example   | Units | Description   |
|------------|-----------|-------|---|
| Message ID | \$PSRF102 |       | PSRF102 protocol header                                 |
| Baud       | 9600      |       | 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 |
| 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 2-9 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 2-9 Query/Rate Control Data Format (See example 1)

| Name        | Example   | Units   | Description                           |
|-------------|-----------|---------|---------------------------------------|
| Message ID  | \$PSRF103 |         | PSRF103 protocol header               |
| Msg         | 00        |         | See Table 2-10                        |
| 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 2-10 Messages

| Value | Description                           |
|-------|---------------------------------------|
| 0     | GGA                                   |
| 1     | GLL                                   |
| 2     | GSA                                   |
| 3     | GSV                                   |
| 4     | RMC                                   |
| 5     | VTG                                   |
| 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 switching to NMEA protocol, the 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.

For GSW3, GSW3LT, and SiRFXTrac software, position and time inputs are not possible and consequently warm start init is ignored.

Table 2-11 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 2-11 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 <sup>1</sup> |
| 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 2-12                                       |
| Checksum     | *07        |         |  |

Table 2-11 LLA Navigation Initialization Data Format

| Name      | Example | Units | Description                |
|-----------|---------|-------|----------------------------|
| <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 is used.

Table 2-12 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 you to determine the source of the command rejection. Common reasons for input command rejection are invalid checksum or parameter out of specified range.

Table 2-13 contains the input values for the following examples:

### 1. Debug On

```
$PSRF105,1*3E
```

### 2. Debug Off

```
$PSRF105,0*3F
```

Table 2-13 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 2-14 contains the input values for the following examples:

1. Datum select TOKYO\_MEAN

\$PSRF106,178\*32

Table 2-14 Select Datum Data Format

| Name       | Example   | Units | Description   |
|------------|-----------|-------|---|
| Message ID | \$PSRF106 |       | PSRF106 protocol header   |
| Datum      | 178       |       | 21=WGS84<br>178=TOKYO_MEAN<br>179=TOKYO_JAPAN<br>180=TOKYO_KOREA<br>181=TOKYO_OKINAWA |
| Checksum   | *32       |       |   |
| <CR> <LF>  |           |       | End of message termination  |

### 107—Extended Ephemeris Proprietary 1

This message is reserved for SiRF extended ephemeris usage only. The content of this message is proprietary. See also Chapter 1, “Output Messages” Message ID 154.

Table 2-15 contains the message parameter definitions.

Table 2-15 Extended Ephemeris Proprietary 1

| Name               | Example   | Units | Description                |
|--------------------|-----------|-------|----------------------------|
| Message ID         | \$PSRF107 |       | PSRF107 protocol header    |
| Extended Ephemeris |           |       | Proprietary message        |
| Checksum           |           |       |                            |
| <CR> <LF>          |           |       | End of message termination |

### 108—Extended Ephemeris Proprietary 2

This message is reserved for SiRF extended ephemeris usage only. The content of this message is proprietary. See also Chapter 1, “Output Messages” Message ID 154.

Table 2-16 contains the message parameter definitions.

Table 2-16 Extended Ephemeris Proprietary 2

| Name               | Example   | Units | Description                |
|--------------------|-----------|-------|----------------------------|
| Message ID         | \$PSRF108 |       | PSRF108 protocol header    |
| Extended Ephemeris |           |       | Proprietary message        |
| Checksum           |           |       |                            |
| <CR> <LF>          |           |       | End of message termination |

## 110—Extended Ephemeris Debug

This message contains a debug flag. See also Chapter 1, “Output Messages” Message ID 154.

Table 2-17 contains the message parameter definitions.

Table 2-17 Extended Ephemeris Debug

| Name       | Example    | Units | Description  |
|------------|------------|-------|--|
| Message ID | \$PSRF110  |       | PSRF110 protocol header.   |
| DEBUG_FLAG | 0x01000000 |       | This is a 10 character field representing the debug flag in hex with leading “0x”.<br>If the first byte is set to 0x01 (i.e., Debug_Flag = 0x01000000), the GPS sensor ignores all internal broadcast ephemeris. |
| Checksum   |            |       |  |
| <CR> <LF>  |            |       | End of message termination.  |

## 200—Marketing Software Configuration

**Note** – This message ID 200 is used only with GSC2xr chip.

This input message overrides the Marketing Software Configuration as defined in bits [3:2] of the GSC2xr chip configuration register. The valid input values mapped to the Marketing Software Configuration are described in the next table.

| Mapping      |   |
|--------------|---|
| Input Values | Marketing Software Configuration                                    |
| 0            | 1   |
| 1            | 2   |
| 2            | 3   |
| 3            | 4   |
| 4            | Standard GSW2 and GSW2x software default configuration <sup>1</sup> |

1. The default configuration is SiRF Binary at 38400 bps using UART A and RTCM at 9600 bps using UART B.

Table 2-18 contains the input values for the following example:

Set receiver to Standard GSW2 Default Configuration.

Example:

```
$PSRF200,4*3D
```

Table 2-18 GSC2xr Marketing Software Configuration

| Name                         | Example   | Units | Description  |
|------------------------------|-----------|-------|--|
| Message ID                   | \$PSRF200 |       | PSRF200 protocol header  |
| Software Configuration Value | 4         |       | 0=Marketing Software Configuration #1<br>1=Marketing Software Configuration #2<br>2=Marketing Software Configuration #3<br>3=Marketing Software Configuration #4<br>4=GSW2 and GSW2x Default Configuration |
| Checksum                     | *3D       |       |  |
| <CR> <LF>                    |           |       | End of message termination   |

Table 2-19 GSC2xr Marketing Software Configurations

| New Config                               | Nav Status | Config 4                             | Config 3                          | Config 2                          | Config 1  |
|--|------------|--------------------------------------|-----------------------------------|-----------------------------------|---|
| UARTA                                    |            | NMEA v2.2                            | NMEA v2.2                         | SiRF Binary                       | NMEA v2.2   |
| UARTB                                    |            | RTCM                                 | RTCM                              | NMEA v2.2                         | SiRF Binary   |
| Build                                    |            | GSWx2.4.0 and greater                | GSWx2.4.0 and greater             | GSWx2.4.0 and greater             | GSWx2.4.0 and greater, Adaptive Trickle-Power @ 300,1 |
| UARTA Baud                               |            | 4800 n, 8, 1                         | 19200 n, 8, 1                     | 57600 n, 8, 1                     | 4800 n, 8, 1  |
| UARTB Baud                               |            | 9600 n, 8, 1                         | 9600 n, 8, 1                      | 115200 n, 8, 1                    | 38400 n, 8, 1   |
| SiRF Binary Output Messages <sup>1</sup> |            | 2, 4, 9, 13, 18, 27, 41, 52          | 2, 4, 9, 13, 18, 27, 41, 52       | 2, 4, 9, 13, 18, 27, 41, 52       | 2, 4, 9, 13, 18, 27, 41, 52                           |
| NMEA Messages                            |            | RMC, GGA, VTG, GSA (GSV@ 1/5Hz), ZDA | GGA, GLL, GSA, GSV, RMC, VTG, ZDA | GGA, GLL, GSA, GSV, RMC, VTG, ZDA | GGA, GLL, GSA, GSV, RMC, VTG, ZDA                     |
| GPIO A (GPIO 1)                          | No Nav     | On                                   | On                                | On                                | On  |
|  | Nav        | 100ms on, 1Hz                        | 100ms on, 1Hz                     | 100ms on, 1Hz                     | 100ms on, 1Hz   |
| GPIO B (GPIO 3)                          | No Nav     | Off                                  | Off                               | Off                               | Off   |
|  | Nav        | 100ms on, 1Hz                        | 100ms on, 1Hz                     | 100ms on, 1Hz                     | 100ms on, 1Hz   |
| GPIO C (GPIO 13)                         | No Nav     | On                                   | On                                | On                                | On  |
|  | Nav        | 1s on, 1s off                        | 1s on, 1s off                     | 1s on, 1s off                     | 1s on, 1s off   |
| GPIO D (GPIO 2)                          | No Nav     | Off                                  | Off                               | Off                               | Off   |
|  | Nav        | On                                   | On                                | On                                | On  |
| Static Filter                            |            | Off                                  | Off                               | Off                               | Off   |
| Track Smoothing                          |            | On                                   | On                                | On                                | On  |
| WAAS                                     |            | Disabled                             | Enabled                           | Enabled                           | Disabled  |
| DR                                       |            | Off                                  | Off                               | Off                               | Off   |

1. SiRF Binary Messages: 2 - Measured Nav Data, 4 - Measured Track Data, 9 - Through Put, 13 - Visible List, 18 - OK to Send, 27 - DGPS Status, 41 - Geodetic Nav Data, 52 - 1 PPS Time Message.

## MSK—MSK Receiver Interface

Table 2-20 contains the values for the following example:

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

Table 2-20 RMC Data Format

| Name                                      | Example | Units | Description                        |
|---|---------|-------|------------------------------------|
| Message ID                                | \$GPMSK |       | MSK protocol header                |
| Beacon Frequency                          | 318.0   | kHz   | Frequency to use                   |
| Auto/Manual Frequency <sup>1</sup>        | A       |       | A : Auto, M : Manual               |
| Beacon Bit Rate                           | 100     |       | Bits per second                    |
| Auto/Manual Bit Rate <sup>1</sup>         | M       |       | A : Auto, M : Manual               |
| Interval for Sending \$--MSS <sup>2</sup> | 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, use the SiRF binary protocol and then switch to NMEA.

---





## ADDITIONAL AVAILABLE PRODUCT INFORMATION

| Part Number | Description                           |
|-------------|---------------------------------------|
| 1050-0042   | NMEA Reference Manual                 |
| 1050-0041   | SiRF Binary Protocol Reference Manual |

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### NMEA Reference Manual

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