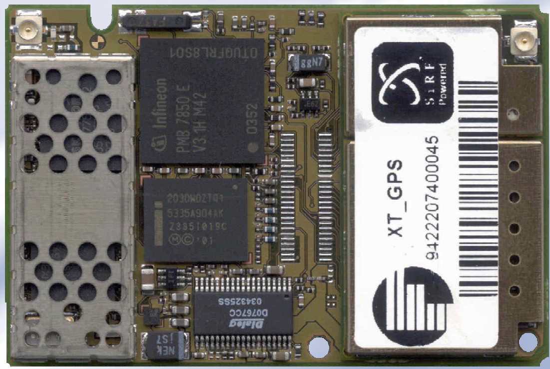
SIEMENS
mobile



XT55

GPS Command Specification

Version: 02
DocID: XT55_gps_command_spec_V02

User's Guide

Document Name:	**XT55 GPS Command Specification**
Version:	**02**
Date:	**March 15, 2004**
DocId:	**XT55_gps_command_spec_V02**
Status:	**Confidential/Draft**

General note

Product is deemed accepted by Recipient and is provided without interface to Recipient's products. The Product constitutes pre-release version and code and may be changed substantially before commercial release. The Product is provided on an "as is" basis only and may contain deficiencies or inadequacies. The Product is provided without warranty of any kind, express or implied. To the maximum extent permitted by applicable law, Siemens further disclaims all warranties, including without limitation any implied warranties of merchantability, fitness for a particular purpose and noninfringement of third-party rights. The entire risk arising out of the use or performance of the Product and documentation remains with Recipient. This Product is not intended for use in life support appliances, devices or systems where a malfunction of the product can reasonably be expected to result in personal injury. Applications incorporating the described product must be designed to be in accordance with the technical specifications provided in these guidelines. Failure to comply with any of the required procedures can result in malfunctions or serious discrepancies in results. Furthermore, all safety instructions regarding the use of mobile technical systems, including GSM products, which also apply to cellular phones must be followed. Siemens AG customers using or selling this product for use in any applications do so at their own risk and agree to fully indemnify Siemens for any damages resulting from illegal use or resale. To the maximum extent permitted by applicable law, in no event shall Siemens or its suppliers be liable for any consequential, incidental, direct, indirect, punitive or other damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information or data, or other pecuniary loss) arising out the use of or inability to use the Product, even if Siemens has been advised of the possibility of such damages. Subject to change without notice at any time.

Contents

Tables

0 Document History

Preceding document: "XT55 NMEA Input/Output Messages User's Guide" Version 01
New document: "XT55 GPS Command Specification" Version 02

Chapter	Page	What is new
---	---	Renamed document title from XT55 NMEA Input/Output Messages User's Guide to XT55 GPS Command Specification

1 NMEA Input/Output Messages

The SiRFstarIIe/LP Evaluation Receiver is capable of outputting data in the NMEA-0183 format as defined by the National Marine Electronics Association (NMEA), Standard for Interfacing Marine Electronic Devices, Version 2.20, January 1, 1997.

1.1 NMEA Output Messages

Table 1 lists each of the NMEA output messages supported by the SiRFstarIIe/LP Evaluation Receiver and a brief description.

Table 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.

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

1.1.1 GGA — Global Positioning System Fixed Data

Table 2 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 2: 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 3

Name	Example	Units	Description
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude[3]	9.0	meters	
Units	M	meters	
Geoid Separation[1]		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 3: 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	GPS PPS Mode, fix valid

Note: **A valid position fix indicator is derived from the SiRF Binary M.I.D. 2 position mode 1. See “Mode 1” on page 41.**

3 SiRF Technology Inc. does not support geoid corrections. Values are WGS84 ellipsoid heights.

1.1.2 GLL — Geographic Position - Latitude/Longitude

Table 4 contains the values for the following example:

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

Table 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

1.1.2.1 GSA — GNSS DOP and Active Satellites

Table 5 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 5: GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 6
Mode 2	3		See Table 7
Satellite Used[3]	07		Sv on Channel 1
Satellite Used[3]	02		Sv on Channel 2
....			....
Satellite Used[3]			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

3 Satellite used in solution.

Table 6: Mode 1

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

Table 7: Mode 2

Value	Description
1	Fix Not Available
2	2D
3	3D

1.1.3 GSV — GNSS Satellites in View

Table 8 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 8: GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages[4]	2		Range 1 to 3
Message Number[4]	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

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

1.1.4 MSS — MSK Receiver Signal

Table 9 contains the values for the following example:

```
$GPMSS,55,27,318.0,100,*66
```

Table 9: 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

Note: **The MSS NMEA message can only be polled or scheduled using the MSK NMEA input message. See 1.2.7 on page 20.**

1.1.5 RMC — Recommended Minimum Specific GNSS Data

Table 10 contains the values for the following example:

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

Table 10: RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status[5]	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[6]		degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

5 A valid status is derived from the SiRF Binary M.I.D 2 position mode 1. See " Table 64: Mode 1" on page -45.

6 SiRF Technology Inc. does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.

1.1.6 VTG — Course Over Ground and Ground Speed

Table 11 contains the values for the following example:

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

Table 11: 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[7]
Speed	0.13	knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Checksum	*6E		
<CR> <LF>			End of message termination

7 SiRF Technology Inc. does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.

1.2 NMEA Input Messages

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 (see Chapter **2.1.3)** using a user program or using the SiRFdemo software and selecting Switch to NMEA Protocol from the Action menu. 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.

Table 12: Transport Message

Start Sequence	Payload	Checksum	End Sequence
$PSRF<MID>[8]	Data[9]	*CKSUM[10]	<CR> <LF>[11]

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

Table 13: NMEA Input Messages

Message	MID[12]	Description
SetSerialPort	100	Set PORT A parameters and protocol
NavigationInitialization	101	Parameters required for start using X/Y/Z[13]
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[14]
Development Data On/Off	105	Development Data messages On/Off
MSK Receiver Interface	MSK	Command message to a MSK radio-beacon receiver.

Note: **NMEA input messages 100 to 105 are SiRF proprietary NMEA messages. The MSK NMEA string is as defined by the NMEA 0183 standard.**

8 Message Identifier consisting of three numeric characters. Input messages begin at MID 100.

9 Message specific data. Refer to a specific message section for <data>...<data> definition.

10 CKSUM is a two-hex character checksum as defined in the NMEA specification. Use of checksums is required on all input messages.

11 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.

12 Message Identification (MID).

13 Input coordinates must be WGS84.

14 Input coordinates must be WGS84.

1.2.1 100 — 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 14 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 14: 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[15]
StopBits	1		0,1
Parity	0		0=None, 1=Odd, 2=Even
Checksum	*0C		
<CR> <LF>			End of message termination

1.2.2 101 — 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 15 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 15: 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[16]
TimeOfWeek	497260	seconds	GPS Time Of Week

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

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

Name	Example	Units	Description
WeekNo	921		GPS Week Number
ChannelCount	12		Range 1 to 12
ResetCfg	3		See Table 16
Checksum	*1C		
<CR> <LF>			End of message termination

Table 16: 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

1.2.3 102 — 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 17 contains the input values for the following example:

```
Set DGPS Port to be 9600,8,N,1.
$PSRF102,9600,8,1,0*12
```

Table 17: Set DGPS Port Data Format

Name	Example	Units	Description
Message ID	$PSRF102		PSRF102 protocol header
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

1.2.4 103 — 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 18 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 18: Query/Rate Control Data Format (See example 1)

Name	Example	Units	Description
Message ID	$PSRF103		PSRF103 protocol header
Msg	00		See table 17
Mode	01		0=SetRate, 1=Query
Rate	00	seconds	Outputoff=0, max=255
CksumEnable	01		0=Disable Checksum, 1=Enable Checksum
Checksum	*25		
<CR> <LF>			End of message termination

Table 19: Messages

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

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 = 2s, NMEA update rate = 5s, resulting update rate is every 10 seconds, (2 X 5s = 10s)).

1.2.5 104 — 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 20 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 20: 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[17]
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 19
Checksum	*07		
<CR> <LF>			End of message termination

Table 21: 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

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

1.2.6 105 — 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 22 contains the input values for the following examples:

1. Debug On
   `$PSRF105,1*3E`
2. Debug Off
   `$PSRF105,0*3F`

Table 22: 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

1.2.7 MSK — MSK Receiver Interface

Table 23 contains the values for the following example:
`$GPMSK,318.0,A,100,M,2,*45`

Table 23: RMC Data Format

Name	Example	Units	Description
Message ID	$GPMSK		MSK protocol header
Beacon Frequency	318.0	kHz	Frequency to use
Auto/Manual Frequency[18]	A		A : Auto, M : Manual
Beacon Bit Rate	100		Bits per second
Auto/Manual Bit Rate[18]	M		A : Auto, M : Manual
Interval for Sending $--MSS[19]	2	sec	Sending of MSS messages for status

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.

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

2 The SiRF Binary Protocol

The SiRF binary protocol is the standard interface protocol used by the SiRFstarIIe/LP Evaluation Receiver and other SiRF products.

This serial communication protocol is designed to include:

- Reliable transport of messages
- Ease of implementation
- Efficient implementation
- Independence from payload

Protocol Layers

Table 24: Transport Message

Start Sequence	Payload Length	Payload	Message Checksum	End Sequence
0xA0[20], 0xA2	Two-bytes (15-bits)	Up to 2^{10} -1 (<1023)	Two-bytes (15-bits)	0xB0, 0xB3

Transport

The transport layer of the protocol encapsulates a GPS message in two start characters and two stop characters. The values are chosen to be easily identifiable and unlikely to occur frequently in the data. In addition, the transport layer prefixes the message with a two-byte (15-bit) message length and a two-byte (15-bit) checksum. The values of the start and stop characters and the choice of a 15-bit value for length and checksum ensure message length and checksum can not alias with either the stop or start code.

Message Validation

The validation layer is of part of the transport, but operates independently. The byte count refers to the payload byte length. The checksum is a sum on the payload.

Payload Length

The payload length is transmitted high order byte first followed by the low byte.

High Byte	Low Byte
< 0x7F	Any value

Even though the protocol has a maximum length of (2^{15}-1) bytes, practical considerations require the SiRF GPS module implementation to limit this value to a smaller number. The SiRF receiving programs (e.g., SiRFdemo) may limit the actual size to something less than this maximum.

Payload Data

The payload data follows the payload length. It contains the number of bytes specified by the payload length. The payload data may contain any 8-bit value.

Where multi-byte values are in the payload data neither the alignment nor the byte order are defined as part of the transport although SiRF payloads will use the big- endian order.

20 0xYY denotes a hexadecimal byte value. 0xA0 equals 160.

Checksum

The checksum is transmitted high order byte first followed by the low byte. This is the so-called big-endian order.

High Byte	Low Byte
< 0x7F	Any value

The checksum is 15-bit checksum of the bytes in the payload data. The following pseudo code defines the algorithm used.

Let message to be the array of bytes to be sent by the transport.

```
Let msgLen be the number of bytes in the message array to be
transmitted.
Index = first
checkSum = 0
while index < msgLen
checkSum = checkSum + message[index]
checkSum = checkSum AND (2^15-1).
```

2.1 Input Messages for SiRF Binary Protocol

Table 25 lists the message list for the SiRF input messages.

Table 25: SiRF Messages - Input Message List

Hex	ASCII	Name	Description
0x55	85	Transmit Serial Message	User definable message
0x80	128	Initialize Data Source	Receiver initialization and associated parameters
0x81	129	Switch to NMEA Protocol	Enable NMEA messages, output rate and baud rate
0x82	130	Set Almanac (upload)	Sends an existing almanac file to the receiver
0x84	132	Poll Software Version	Polls for the loaded software version
0x85	133	DGPS Source Control	DGPS correction source and beacon receiver information
0x86	134	Set Main Serial Port	Baud rate, data bits, stop bits, and parity
0x87	135	Switch Protocol	Obsolete
0x88	136	Mode Control	Navigation mode configuration
0x89	137	DOP Mask Control	DOP mask selection and parameters
0x8A	138	DGPS Mode	DGPS mode selection and timeout value
0x8B	139	Elevation Mask	Elevation tracking and navigation masks
0x8C	140	Power Mask	Power tracking and navigation masks
0x8D	141	Editing Residual	Not implemented
0x8E	142	Steady-State Detection - Not Used	Not implemented
0x8F	143	Static Navigation	Configuration for static operation
0x90	144	Poll Clock Status	Polls the clock status
0x91	145	Set DGPS Serial Port	DGPS port baud rate, data bits, stop bits, and parity
0x92	146	Poll Almanac	Polls for almanac data
0x93	147	Poll Ephemeris	Polls for ephemeris data
0x94	148	Flash Update	On the fly software update
0x95	149	Set Ephemeris (upload)	Sends an existing ephemeris to the receiver
0x96	150	Switch Operating Mode	Test mode selection, SV ID, and period.
0x97	151	Set TricklePower Parameters	Push to fix mode, duty cycle, and on time
0x98	152	Poll Navigation Parameters	Polls for the current navigation parameters
0xA5	165	Set UART Configuration	Protocol selection, baud rate, data bits, stop bits, and parity
0xA6	166	Set Message Rate	SiRF Binary message output rate
0xA7	167	Low Power Acquisition Parameters	Low power configuration parameters
0xA8	168	Poll Command Parameters	Poll for parameters:

Hex	ASCII	Name	Description
			0x80 : Receiver initialization and associated parameters. 0x85 : DGPS correction source and beacon receiver information 0x88 : Navigation mode configuration 0x89 : DOP mask selection and parameters 0x8A : DGPS mode selection and timeout values 0x8B : Elevation tracking and navigation masks 0x8C : Power tracking and navigation masks 0x8F : Static navigation configuration 0x97 : Low power parameters
0xB6	182	Set UART Configuration	Obsolete

2.1.1 Transmit Serial Message - Message I.D. 85

Message I.D. 85 is a user configurable SiRF Binary string with variable payload and variable payload length.

Example:

```
A0A2xxxx — Start Sequence and Payload Length
xxxxxxxx...... — Payload
xxxxB0B3 — Message Checksum and End Sequence
```

Table 26: Initialize Data Source

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		55		ASCII 85
User defined	Variable				User defined

Payload Length: variable length

2.1.2 Initialize Data Source - Message I.D. 128

Table 27 contains the input values for the following example:
Warm start the receiver with the following initialization data:

```
ECEF XYZ
(-2686727 m, -4304282 m, 3851642 m), Clock Offset (75,000 Hz), Time of
Week (86,400 sec), Week Number (924), and Channels (12). Raw track
data enabled, Debug data enabled.
```

Example:

```
A0A20019 — Start Sequence and Payload Length
80FFD700F9FFBE5266003AC57A000124F80083D600039C0C33 — Payload
0A91B0B3 — Message Checksum and End Sequence
```

Table 27: Initialize Data Source

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		80		ASCII 128
ECEF X	4		FFD700F	meters	
ECEF Y	4		FFBE5266	meters	
ECEF Z	4		003AC57A	meters	
Clock Offset	4		000124F8	Hz	
Time of Week	4	*100	0083D600	seconds	
Week Number	2		039C		
Channels	1		0C		Range 1-12
Reset Config.	1		33		See table 25

Payload Length: 25 bytes

Table 28: Reset Configuration Bitmap

Bit	Description
0	Data valid flagset warm/hot start
1	Clear ephemerisset warm start
2	Clear memoryset cold start
3	Factory Reset
4	Enable raw track data (YES=1, NO=0)
5	Enable debug data for SiRF binary protocol (YES=1, NO=0)
6	Enable debug data for NMEA protocol (YES=1, NO=0)
7	Reserved (must be 0)

Note: If Nav Lib data is ENABLED then the resulting messages are enabled. Clock Status (MID 7), 50 BPS (MID 8), Raw DGPS (17), NL Measurement Data (MID 28), DGPS Data (MID 29), SV State Data (MID 30), and NL Initialize Data (MID 31). All messages are sent at 1Hz. If SiRFdemo is used to enable Nav Lib data, the baud rate will be automatically set to 57600 by SiRFdemo.

2.1.3 Switch To NMEA Protocol - Message I.D. 129

Table 29 contains the input values for the following example:

```
Request the following NMEA data at 4800 baud:
GGA – ON at 1 sec, GLL – OFF, GSA – ON at 5 sec,
GSV – ON at 5 sec, MSS – ON at 1 sec, RMC – OFF, VTG-OFF
```

Example:

```
A0A20018 — Start Sequence and Payload Length
810201010001050105010001000100010001000112C0 — Payload
016AB0B3 — Message Checksum and End Sequence
```

Table 29: Switch To NMEA Protocol

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		81		ASCII 129
Mode	1		02		
GGA Message[21]	1		01	sec	See Appendix 1.1 for format.
Checksum[22]	1		01		
GLL Message	1		00	sec	See Appendix 1.1 for format.
Checksum	1		01		
GSA Message	1		05	sec	See Appendix 1.1 for format.
Checksum	1		01		
GSV Message	1		05	sec	See Appendix 1.1 for format.
Checksum	1		01		
MSS Message	1		01	sec	See Appendix 1.1 for format.
Checksum	1		01		
RMC Message	1		00	sec	See Appendix 1.1 for format.
Checksum:	1		01		
VTG Message	1		00	sec	See Appendix 1.1 for format.
Checksum	1		01		
Unused Field	1		00		
Unused Field	1		01		
Unused Field	1		00		
Unused Field	1		01		
Unused Field	1		00		
Unused Field	1		01		
Unused Field	1		00		
Unused Field	1		01		
Baud Rate	2		12C0		38400, 19200,9600,4800,2400

Payload Length: 24 bytes

In Trickle Power 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 Trickle Power Update rate and the NMEA update rate (i.e. Trickle Power update rate = 2s, NMEA update rate = 5 seconds, resulting update rate is every 10 seconds, (2 X 5 = 10)).

Note: **To switch back to the SiRF protocol, you must send a SiRF NMEA message to revert to SiRF binary mode. (See Appendix 1.2.1 for more information).**

21 A value of 0x00 implies NOT to send message, otherwise data is sent at 1 message every X seconds requested (i.e., to request a message to be sent every 5 seconds, request the message using a value of 0x05.) Maximum rate is 1/255s.

22 A value of 0x00 implies the checksum NOT transmitted with the message (not recommended). A value of 0x01 will have a checksum calculated and transmitted as part of the message (recommended).

2.1.4 Set Almanac – Message I.D. 130

This command enables the user to upload an almanac file to the Evaluation Receiver.

Example:

```
A0A20380 – Start Sequence and Payload Length
82xx…………………      – Payload
xxxxB0B3 – Message Checksum and End Sequence
```

Table 30: Set Almanac Message

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		82		ACSII 130
Almanac	896		00		Reserved

Payload Length: 897 bytes

The almanac data is stored in the code as a 448 element array of INT16 values. These 448 elements are partitioned as 32 x 14 elements where the 32 represents the satellite number minus 1 and the 14 represents the number of INT16 values associated with this satellite. The data is actually packed and the exact format of this representation and packing method can be extracted from the ICD-GPS-2000 document. The ICD-GPS- 2000 document describes the data format of each GPS navigation sub-frame and is available on the web at http://www.arinc.com/gps

2.1.5 Poll Software Version – Message I.D. 132

Table 31 contains the input values for the following example:

```
Poll the software version
```

Example:

```
A0A20002 — Start Sequence and Payload Length
8400 — Payload
0084B0B3 — Message Checksum and End Sequence
```

Table 31: Software Version

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		84		ACSII 132
Control	1		00		Not used

Payload Length: 2 bytes

2.1.6 DGPS Source - Message I.D. 133

This command allows the user to select the source for DGPS corrections. Options available are:

```
External RTCM Data (any serial port)
WAAS (subject to WAAS satellite availability)
Internal DGPS beacon receiver
```

Example 1: Set the DGPS source to External RTCM Data

```
A0A200007 — Start Sequence and Payload Length
85020000000000 — Payload
0087B0B3 — Checksum and End Sequence
```

Table 32: DGPS Source Selection (Example 1)

Name	Bytes	Scale	Hex	Units	Decimal	Description
Message I.D.	1		85		133	Message Identification
DGPS Source	1		00		0	See table 31. DGPS Source Selections
Internal Beacon Frequency	4		00000 000	Hz	0	See table 32. Internal Beacon Search Settings
Internal Beacon Bit Rate	1		0	BPS	0	See table 32. Internal Beacon Search Settings

Payload Length: 7 bytes

Example 2: Set the DGPS source to Internal DGPS Beacon Receiver

```
Search Frequency 310000, Bit Rate 200
A0A200007 — Start Sequence and Payload Length
85030004BAF0C802 — Payload
02FEB0B3 — Checksum and End Sequence
```

Table 33: DGPS Source Selection (Example 2)

Name	Bytes	Scale	Hex	Units	Decimal	Description
Message I.D.	1		85		133	Message Identification.
DGPS Source	1		03		3	See table 31. DGPS Source Selections.
Internal Beacon Frequency	4		0004B AF0	Hz	310000	See table 32. Internal Beacon Search Settings.
Internal Beacon Bit Rate	1		C8	BPS	200	See table 32. Internal Beacon Search Settings.

Payload Length: 7 bytes

Table 34: DGPS Source Selections

DGPS Source	Hex	Decimal	Description
None	00	0	DGPS corrections are not used (even if available).
WAAS	01	1	Uses WAAS Satellite (subject to availability).
External RTCM Data	02	2	External RTCM input source (i.e., Coast Guard Beacon).
Internal DGPS Beacon Receiver	03	3	Internal DGPS beacon receiver.
User Software	04	4	Corrections provided using a module interface routine in a custom user application.

Table 35: Internal Beacon Search Settings

Search Type	Frequency[23]	Bit Rate[24]	Description
Auto Scan	0	0	Auto scanning of all frequencies and bit rates are performed.
Full Frequency scan	0	None zero	Auto scanning of all frequencies and specified bit rate are performed.
Full Bit Rate Scan	None Zero	0	Auto scanning of all bit rates and specified frequency are performed.
Specific Search	Non Zero	Non zero	Only the specified frequency and bit rate search are performed.

2.1.7 Set Main Serial Port - Message I.D. 134

Table 36 contains the input values for the following example:

```
Set Main Serial port to 9600,n,8,1.
```

Example:

```
A0A20009 — Start Sequence and Payload Length
860000258008010000 — Payload
0134B0B3 — Message Checksum and End Sequence
```

Table 36: Set Main Serial Port

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		86		decimal 134
Baud	4		00002580		38400,19200,9600,4800,2400,1200
Data Bits	1		08		8,7
Stop Bit	1		01		0,1
Parity	1		00		None=0, Odd=1, Even=2
Pad	1		00		Reserved

Payload Length: 9 bytes

23 Frequency Range is 283500 to 325000 Hz.

24 Bit Rate selection is 25, 50, 100 and 200 BPS.

2.1.8 Switch Protocol - Message I.D. 135

This message is obsolete and is no longer used or supported.

2.1.9 Mode Control - Message I.D. 136

Table 37 contains the input values for the following example:

```
3D Mode = Always, Alt Constraining = Yes, Degraded Mode = clock then
direction, TBD=1, DR Mode = Yes, Altitude = 0, Alt Hold Mode = Auto,
Alt Source =Last Computed, Coast Time Out = 20, Degraded Time Out=5,
DR Time Out = 2, Track Smoothing = Yes
```

Example:

```
A0A2000E — Start Sequence and Payload Length
880101010101000000002140501 — Payload
00A9B0B3 — Message Checksum and End Sequence
```

Table 37: Mode Control

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		88		ASCII 136
3D Mode	1		01		1 (always true=1)
Alt Constraint					Not Used
Degraded Mode	1		01		See table 35
TBD	1		01		Reserved
DR Mode	1		01		YES=1, NO=0
Altitude	2		0000	meters	range -1,000 to 10,000
Alt Hold Mode	1		00		Auto=0, Always=1,Disable=2
Alt Source	1		02		Last Computed=0,Fixed to=1
Coast Time Out					Not Used
Degraded Time Out	1		05	seconds	0 to 120
DR Time Out	1		01	seconds	0 to 120
Track Smoothing	1		01		YES=1, NO=0

Payload Length: 14 bytes

Table 38: Degraded Mode Byte Value

Byte Value	Description
0	Use Direction then Clock Hold
1	Use Clock then Direction Hold
2	Direction (Curb) Hold Only
3	Clock (Time) Hold Only
4	Disable Degraded Modes

2.1.10 DOP Mask Control - Message I.D. 137

Table 39 contains the input values for the following example:

```
Auto Pdop/Hdop, Gdop =8 (default), Pdop=8,Hdop=8
```

Example:

```
A0A20005 — Start Sequence and Payload Length
8900080808 — Payload
00A1B0B3 — Message Checksum and End Sequence
```

Table 39: DOP Mask Control

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		89		ASCII 137
DOP Selection	1		00		See table 37
GDOP Value	1		08		Range 1 to 50
PDOP Value	1		08		Range 1 to 50
HDOP Value	1		08		Range 1 to 50

Payload Length: 5 bytes

Table 40: DOP Selection

Byte Value	Description
0	Auto PDOP/HDOP
1	PDOP
2	HDOP
3	GDOP
4	Do Not Use

2.1.11 DGPS Control - Message I.D. 138

Table 41 contains the input values for the following example:

```
Set DGPS to exclusive with a time out of 30 seconds.
```

Example:

```
A0A20003 — Start Sequence and Payload Length
8A011E — Payload
00A9B0B3 — Message Checksum and End Sequence
```

Table 41: DGPS Control

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		8A		ASCII 138
DGPS Selection	1		01		See table 39
DGPS Time Out:	1		1E	seconds	Range 0 to 255

Payload Length: 3 bytes

Table 42: DGPS Selection

Byte Value	Description
0	Auto
1	Exclusive
2	Never Use

Note: Configuration of the DGPS mode using MID 138 only applies to RTCM corrections received from an external RTCM source or internal or external beacon. It does not apply to WAAS operation.

2.1.12 Elevation Mask – Message I.D. 139

Table 43 contains the input values for the following example:

```
Set Navigation Mask to 15.5 degrees (Tracking Mask is defaulted to 5
degrees).
```

Example:

```
A0A20005 — Start Sequence and Payload Length
8B0032009B — Payload
0158B0B3 — Message Checksum and End Sequence
```

Table 43: Elevation Mask

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		8B		ASCII 139
Tracking Mask	2	*10	0032	degrees	Not implemented
Navigation Mask	2	*10	009B	degrees	Range -20.0 to 90.0

Payload Length: 5 bytes

2.1.13 Power Mask - Message I.D. 140

Table 44 contains the input values for the following example:

```
Navigation mask to 33 dBHz (tracking default value of 28)
```

Example:

```
A0A20003 — Start Sequence and Payload Length
8C1C21 — Payload
00C9B0B3 — Message Checksum and End Sequence
```

Table 44: Power Mask

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		8C		ASCII 140
Tracking Mask	1		1C	dBHz	Not implemented
Navigation Mask	1		21	dBHz	Range 20 to 50

Payload Length: 3 bytes

2.1.14 Editing Residual – Message I.D. 141

This message is defined as Editing Residual but has not been implemented.

2.1.15 Steady State Detection - Message I.D. 142

This message is defined as Steady State Detection but has not been implemented.

2.1.16 Static Navigation – Message I.D. 143

This command allows the user to enable or disable static navigation to the Evaluation Receiver.

Example:

```
A0A20002 – Start Sequence and Payload Length
8F01 – Payload
xxxxB0B3 – Message Checksum and End Sequence
```

Table 45: Static Navigation

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		8F		ACSII 143
Static Navigation Flag	1		01		ASCII 1

Payload Length: 2 bytes

Table 46: Message ID 143 Description

Name	Description
Message ID	Message ID number.
Static Navigation Flag	Valid values: 1 enable static navigation 0 disable static navigation

2.1.17 Poll Clock Status – Message I.D. 144

Table 47 contains the input values for the following example:

```
Poll the clock status.
```

Example:

```
A0A20002 — Start Sequence and Payload Length
9000 — Payload
0090B0B3 — Message Checksum and End Sequence
```

Table 47: Clock Status

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		90		ACSII 144
Control	1		00		Not used

Payload Length: 2 bytes

2.1.18 Set DGPS Serial Port - Message I.D. 145

Table 48 contains the input values for the following example:

```
Set DGPS Serial port to 9600,n,8,1.
```

Example:

```
A0A20009 — Start Sequence and Payload Length
910000258008010000 — Payload
013FB0B3 — Message Checksum and End Sequence
```

Table 48: Set DGPS Serial Port

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		91		ASCII 145
Baud	4		00002580		38400,19200,9600,4800,2400,1200
Data Bits	1		08		8,7
Stop Bit	1		01		0,1
Parity	1		00		None=0, Odd=1, Even=2
Pad	1		00		Reserved

Payload Length: 9 bytes

Note: **Setting the DGPS serial port using MID 145 will effect Com B only regardless of the port being used to communicate with the Evaluation Receiver.**

2.1.19 Poll Almanac - Message I.D. 146

Table 49 contains the input values for the following example:

```
Poll for the Almanac.
```

Example:

```
A0A20002 — Start Sequence and Payload Length
9200 — Payload
0092B0B3 — Message Checksum and End Sequence
```

Table 49: Almanac

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		92		ASCII 146
Control	1		00		Not used

Payload Length: 2 bytes

2.1.20 Poll Ephemeris - Message I.D. 147

Table 50 contains the input values for the following example:

```
Poll for Ephemeris Data for all satellites.
```

Example:

```
A0A20003 — Start Sequence and Payload Length
930000 — Payload
0092B0B3 — Message Checksum and End Sequence
```

Table 50: Ephemeris

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		93		ASCII 147
Sv I.D.[25]	1		00		Range 0 to 32
Control	1		00		Not used

Payload Length: 3 bytes

25 A value of 0 requests all available ephemeris records, otherwise the ephemeris of the Sv I.D. is requested.

2.1.21 Flash Update - Message I.D. 148

This command allows the user to command the Evaluation Receiver to go into internal boot mode without setting the boot switch. Internal boot mode allows the user to re-flash the embedded code in the receiver.

Note: **It is highly recommended that all hardware designs should still provide access to the boot pin in the event of a failed flash upload.**

Example:
```
A0A20001 – Start Sequence and Payload Length
94 – Payload
0094B0B3 – Message Checksum and End Sequence
```

Table 51: Flash Update

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		94		ASCII 148

Payload Length: 1 bytes

2.1.22 Set Ephemeris – Message I.D. 149

This command enables the user to upload an ephemeris file to the Evaluation Receiver.

Example:
```
A0A2005B – Start Sequence and Payload Length
95………………….     – Payload
xxxxB0B3 – Message Checksum and End Sequence
```

Table 52: Ephemeris

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		95		ASCII 149
Ephemeris Data	90		00		Reserved

Payload Length: 91 bytes

The ephemeris data for each satellite is stored as a two dimensional array of [3][15] UNIT16 elements. The 3 represents three separate sub-frames. The data is actually packed and the exact format of this representation and packing method can be extracted from the ICD-GPS-2000 document. The ICD-GPS-2000 document describes the data format of each GPS navigation sub-frame and is available on the web at http://www.arinc.com/gps.

2.1.23 Switch Operating Modes - Message I.D. 150

Table 53 contains the input values for the following example:

```
Sets the receiver to track a single satellite on all channels.
```

Example:

```
A0A20007 — Start Sequence and Payload Length
961E510006001E — Payload
0129B0B3 — Message Checksum and End Sequence
```

Table 53: Switch Operating Modes

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		96		ASCII 150
Mode	2		1E51		0=normal, 1E51=Testmode1, 1E52=Testmode2, 1E53=Not Supported
SvID	2		0006		Satellite to Track
Period	2		001E	seconds	Duration of Track

Payload Length: 7 bytes

2.1.24 Set TricklePower Parameters - Message I.D. 151

Table 54 contains the input values for the following example:

```
Sets the receiver into low power Modes.
```

Example: Set receiver into Trickle Power at 1 hz update and 200 msec On Time.

```
A0A20009 — Start Sequence and Payload Length
97000000C8000000C8 — Payload
0227B0B3 — Message Checksum and End Sequence
```

Table 54: Set Trickle Power Parameters

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		97		ASCII 151
Push To Fix Mode	2		0000		ON = 1, OFF = 0
Duty Cycle	2	*10	00C8	%	% Time ON. A duty cycle of 1000 (100%) means continuous operation.
Milli Seconds On Time	4		000000C8	msec	range 200 - 900 msec

Payload Length: 9 bytes

On-times of 700, 800, and 900 msec are invalid if an update rate of 1 second is selected.

Computation of Duty Cycle and On Time

The Duty Cycle is the desired time to be spent tracking. The On Time is the duration of each tracking period (range is 200 - 900 msec). To calculate the TricklePower update rate as a function of Duty Cycle and On Time, use the following formula:

```
Off Time = On Time - (Duty Cycle * On Time)
                  Duty Cycle

Update rate = Off Time + On Time
```

Note: **It is not possible to enter an on-time > 900 msec.**

Following are some examples of selections:

Table 55: Example of Selections for Trickle Power Mode of Operation

Mode	On Time (msec)	Duty Cycle (%)	Update Rate(1/Hz)
Continuous	1000	100	1
Trickle Power	200	20	1
Trickle Power	200	10	2
Trickle Power	300	10	3
Trickle Power	500	5	10

Note: To confirm the receiver is performing at the specified duty cycle and msec On Time, see "The 12-Channel Signal Level View Screen" on page .., "Using the SiRFdemo Software". The C/No data bins will be fully populated at 100% duty and only a single C/No data bin populated at 20% duty cycle. Your position should be updated at the computed update rate.

Table 56: TricklePower Supported Modes

	Update Rates (seconds)									
On Time (msec)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
200	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
500	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
600	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
700		✓	✓	✓	✓	✓	✓	✓	✓	✓
800		✓	✓	✓	✓	✓	✓	✓	✓	✓
900		✓	✓	✓	✓	✓	✓	✓	✓	✓

Push-to-Fix

In this mode the receiver will turn on every 30 minutes to perform a system update consisting of a RTC calibration and satellite ephemeris data collection if required (i.e., a new satellite has become visible) as well as all software tasks to support SnapStart in the event of an NMI. Ephemeris collection time in general takes 18 to 30 seconds. If ephemeris data is not required then the system will re-calibrate and shut down. In either case, the amount of time the receiver remains off will be in proportion to how long it stayed on:

```
Off period = On Period*(1-Duty Cycle)
             Duty Cycle
```

The off period has a possible range between 10 and 7200 seconds. The default is 1800 seconds.

2.1.25 Poll Navigation Parameters - Message I.D. 152

Table 57 contains the input values for the following example:

Example: Poll receiver for current navigation parameters.

```
A0A20002 — Start Sequence and Payload Length
9800 — Payload
0098B0B3 — Message Checksum and End Sequence
```

Table 57: Poll Receiver for Navigation Parameters

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		98		ASCII 152
Reserved	1		00		Reserved

Payload Length: 2 bytes

2.1.26 Set UART Configuration - Message I.D. 165

Table 58 contains the input values for the following example:

```
Example: Set port 0 to NMEA with 9600 baud, 8 data bits, 1 stop bit,
no parity. Set port 1 to SiRF binary with 57600 baud, 8 data bits, 1
stop bit, no parity. Do not configure ports 2 and 3.
```

Example:

```
A0A20031 — Start Sequence and Payload Length
A50001010000258008010000000100000000E1000801000000FF050500000000000
0000000FF0505000000000000000000 — Payload
0452B0B3 — Message Checksum and End Sequence
```

Table 58: Set UART Configuration

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		A5		Decimal 165
Port	1		00		For UART 0
In Protocol[26]	1		01		For UART 0
Out Protocol	1		01		For UART 0 (Set to in protocol)
Baud Rate[27]	4		00002580		For UART 0
Data Bits[28]	1		08		For UART 0
Stop Bits[29]	1		01		For UART 0
Parity[30]	1		00		For UART 0
Reserved	1		00		For UART 0
Reserved	1		00		For UART 0
Port	1		01		For UART 1
In Protocol	1		00		For UART 1
Out Protocol	1		00		For UART 1
Baud Rate	4		0000E100		For UART 1
Data Bits	1		08		For UART 1
Stop Bits	1		01		For UART 1
Parity	1		00		For UART 1
Reserved	1		00		For UART 1
Reserved	1		00		For UART 1
Port	1		FF		For UART 2
In Protocol	1		05		For UART 2
Out Protocol	1		05		For UART 2
Baud Rate	4		00000000		For UART 2
Data Bits	1		00		For UART 2
Stop Bits	1		00		For UART 2
Parity	1		00		For UART 2
Reserved	1		00		For UART 2
Reserved	1		00		For UART 2
Port	1		FF		For UART 3
In Protocol	1		05		For UART 3
Out Protocol	1		05		For UART 3

26 0 = SiRF Binary, 1 = NMEA, 2 = ASCII, 3 = RTCM, 4 = User1, 5 = No Protocol.

27 Valid values are 1200, 2400, 4800, 9600, 19200, 38400, and 57600.

28 Valid values are 7 and 8.

29 Valid values are 1 and 2.

30 0 = None, 1 = Odd, 2 = Even.

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Baud Rate	4		00000000		For UART 3
Data Bits	1		00		For UART 3
Stop Bits	1		00		For UART 3
Parity	1		00		For UART 3
Reserved	1		00		For UART 3
Reserved	1		00		For UART 3

Payload Length: 49 bytes

2.1.27 Set Message Rate - Message I.D. 166

Table 59 contains the input values for the following example:

```
Set message ID 2 to output every 5 seconds starting immediately.
```

Example:

```
A0A20008 — Start Sequence and Payload Length
A601020500000000 — Payload
00AEB0B3 — Message Checksum and End Sequence
```

Table 59: Set Message Rate

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		A6		decimal 166
Send Now[31]	1		01		Poll message
MID to be set	1		02		
Update Rate	1		05	sec	Range = 1 - 30
Reserved	1		00		Not used
Reserved	1		00		No used
Reserved	1		00		Not used
Reserved	1		00		Not used

Payload Length: 8 bytes

31 0 = No, 1 = Yes, if no update rate the message will be polled.

2.1.28 Set Low Power Acquisition Parameters - Message I.D. 167

Table 60 contains the input values for the following example:

```
Set maximum off and search times for re-acquisition while receiver is
in low power.
```

Example:

```
A0A2000D — Start Sequence and Payload Length
A7000075300001D4C00000003C — Payload
031DB0B3 — Message Checksum and End Sequence
```

Table 60: Set Low Power Acquisition Parameters

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		A7		decimal 167
Max Off Time	4		00007530	msec	Maximum time for sleep mode
Max Search Time	4		0001D4C0	msec	Max. satellite search time
Push-to-Fix Period	4		0000003C	sec	Push-to-Fix cycle period

Payload Length: 13 bytes

2.1.29 Poll Command Parameters – Message I.D. 168

Table 61 contains the input values for the following example:
Queries the receiver to send specific response messages for one of the following messages:

```
0x80, 0x85, 0x88, 0x89, 0x8A, 0x8B, 0x8C, 0x8F, and 0x97.
```

Example:

```
A0A20002 – Start Sequence and Payload Length
A897-Payload
013FB0B3-Message Checksum and End Sequence
```

Table 61: Poll Command Parameters

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		A8		ASCII 168
Poll Msg ID	1		97		Requesting Msg ID 0x97

Payload Length: 2 bytes

2.1.30 Set UART Configuration - Message I.D. 182

This message is obsolete and is no longer used or supported.

2.2 Output Messages for SiRF Binary Protocol

Note: **All output messages are received in BINARY format. SiRFdemo interprets the binary data and saves it to the log file in ASCII format.**

Table 62 lists the message list for the SiRF output messages.

Table 62: SiRF Messages - Output Message List

Hex	ASCII	Name	Description
0 x 02	2	Measured Navigation Data	Position, velocity, and time
0 x 03	3	True Tracker Data	Not Implemented
0 x 04	4	Measured Tracking Data	Satellite and C/No information
0 x 05	5	Raw Track Data	Not supported by SiRFstarII
0 x 06	6	SW Version	Receiver software
0 x 07	7	Clock Status	Current clock status
0 x 08	8	50 BPS Subframe Data	Standard ICD format
0 x 09	9	Throughput	Navigation complete data
0 x 0A	10	Error ID	Error coding for message failure
0 x 0B	11	Command Acknowledgment	Successful request
0 x 0C	12	Command NAcknowledgment	Unsuccessful request
0 x 0D	13	Visible List	Auto Output
0 x 0E	14	Almanac Data	Response to Poll
0 x 0F	15	Ephemeris Data	Response to Poll
0 x 10	16	Test Mode 1	For use with SiRFtest (Test Mode 1)
0 x 11	17	Differential Corrections	Received from DGPS broadcast
0 x 12	18	OkToSend	CPU ON / OFF (Trickle Power)
0 x 13	19	Navigation Parameters	Response to Poll
0 x 14	20	Test Mode 2	Additional test data (Test Mode 2)
0 x 1C	28	Nav. Lib. Measurement Data	Measurement Data
0 x 1D	29	Nav. Lib. DGPS Data	Differential GPS Data
0 x 1E	30	Nav. Lib. SV State Data	Satellite State Data
0 x 1F	31	Nav. Lib. Initialization Data	Initialization Data
0 x FF	255	Development Data	Various status messages

2.2.1 Measure Navigation Data Out - Message I.D. 2

Output Rate: 1 Hz
Table 63 lists the binary and ASCII message data format for the measured navigation data.

Example:

```
A0A20029 — Start Sequence and Payload Length
02FFD6F78CFFBE536E003AC004000000003000104A00036B039780E3
0612190E160F04000000000000 — Payload
09BBB0B3 — Message Checksum and End Sequence
```

Table 63: Measured Navigation Data Out - Binary & ASCII Message Data Format

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		02			2
X-position	4		FFD6F78C	m		-2689140
Y-position	4		FFBE536E	m		-4304018
Z-position	4		003AC004	m		3850244
X-velocity	2	*8	0000	m/sec	Vx÷8	0
Y-velocity	2	*8	0003	m/sec	Vy÷8	0.375
Z-velocity	2	*8	0001	m/sec	Vz÷8	0.125
Mode 1	1		04	Bitmap[32]		4
DOP[33]	1	*5	A		÷5	2.0
Mode 2	1		00	Bitmap[34]		0
GPS Week	2		036B			875
GPS TOW	4	*100	039780E3	seconds	÷100	602605.79
SVs in Fix	1		06			6
CH 1 PRN	1		12			18
CH 2 PRN	1		19			25
CH 3 PRN	1		0E			14
CH 4 PRN	1		16			22
CH 5 PRN	1		0F			15
CH 6 PRN	1		04			4
CH 7 PRN	1		00			0
CH 8 PRN	1		00			0
CH 9 PRN	1		00			0
CH 10 PRN	1		00			0
CH 11 PRN	1		00			0
CH 12 PRN	1		00			0

Payload Length: 41 bytes

32 For further information, go to table 61.
33 Dilution of precision (DOP) field contains the HDOP value only.
34 For further information, go to table 62.

Note: **Binary units scaled to integer values need to be divided by the scale value to receive true decimal value (i.e., decimal X_{vel} = binary X_{vel} ÷ 8).**

Table 64: Mode 1

Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Bit(s) Name	DGPS	DOP-Mask	ALTMODE		TPMODE	PMODE		

Bit(s) Name	**Name**	**Value**	**Description**
PMODE	Position mode	0	No navigation solution
		1	1 satellite solution
		2	2 satellite solution
		3	3 satellite solution
		4	>3 satellite solution
		5	2D point solution (Least square)
		6	3D point solution (Least square)
		7	Dead reckoning
TPMODE	Trickle power mode	0	Full power position
		1	Trickle power position
ALTMODE	Altitude mode	0	No altitude hold
		1	Altitude used from filter
		2	Altitude used from user
		3	Forced altitude (from user)
DOPMASK	DOP mask status	0	DOP mask not exceeded
		1	DOP mask exceeded
DGPS	DGPS status	0	No DGPS position
		1	DGPS position

Table 65: Mode 2

Mode 2		**Description**
Hex	**ASCII**	
0 x 00	0	Solution not validated
0 x 01	1	DR Sensor Data
0 x 02	2	Validated (1)[35], Unvalidated (0)
0 x 04	4	If set, Dead Reckoning (Time Out)
0 x 08	8	If set, output edited by UI (i.e., DOP Mask exceeded)
0 x 10	16	Reserved
0 x 20	32	Reserved
0 x 40	64	Reserved
0 x 80	128	Reserved

35 For validated and unvalidated definitions, see "The 12-Channel Signal Level View Screen" on page .., table .., "Using the SiRFdemo Software".

2.2.2 True Tracker Data - Message I.D. 3

This message is defined as True Tracker data but has not been implemented.

2.2.3 Measured Tracker Data Out - Message I.D. 4

Output Rate: 1 Hz
Table 63 lists the binary and ASCII message data format for the measured tracker data.

Example:

```
A0A200BC — Start Sequence and Payload Length
04036C0000937F0C0EAB46003F1A1E1D1D191D1A1A1D1F1D59423F1A1A... —
Payload
....B0B3 — Message Checksum and End Sequence
```

Table 66: Measured Tracker Data Out

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		04	None		4
GPS Week	2		036C			876
GPS TOW	4	s*100	0000937F	sec	S÷100	37759
Chans	1		0C			12
1st SVid	1		0E			14
Azimuth	1	Az*[2/3]	AB	deg	÷[2/3]	256.5
Elev	1	El*2	46	deg	÷2	35
State	2		003F	Bitmap[36]		0 x 3F
C/No 1	1		1A			26
C/No 2	1		1E			30
C/No 3	1		1D			29
C/No 4	1		1D			29
C/No 5	1		19			25
C/No 6	1		1D			29
C/No 7	1		1A			26
C/No 8	1		1A			26
C/No 9	1		1D			29
C/No 10	1		1F			31
2nd SVid	1		1D			29
Azimuth	1	Az*[2/3]	59	deg	÷[2/3]	89
Elev	1	El*2	42	deg	÷2	66
State	2		3F	Bitmap[37]		63
C/No 1	1		1A			26
C/No 2	1		1A			63
....						

Payload Length: 188 bytes

36 For further information, see table 64 for TrktoNAVStruct.trk_status field definition.

37 For further information, see table 64 for TrktoNAVStruct.trk_status field definition.

Note: **Message length is fixed to 188 bytes with nontracking channels reporting zero values.**

Table 67: TrktoNAVStruct.trk_status Field Definition

Field Definition	Hex Value	Description
ACQ_SUCCESS	0x0001	Set, if acq/reacq is done successfully
DELTA_CARPHASE_VALID	0x0002	Set, Integrated carrier phase is valid
BIT_SYNC_DONE	0x0004	Set, Bit sync completed flag
SUBFRAME_SYNC_DONE	0x0008	Set, Subframe sync has been done
CARRIER_PULLIN_DONE	0x0010	Set, Carrier pullin done
CODE_LOCKED	0x0020	Set, Code locked
ACQ_FAILED	0x0040	Set, Failed to acquire S/V
GOT_EPHEMERIS	0x0080	Set, Ephemeris data available

For complete information about possible tracking status messages, see "The 12-Channel Signal Level View Screen" on page .., "Using the SiRFdemo Software".

2.2.4 Raw Tracker Data Out - Message I.D. 5

This message is not supported by the SiRFstarII architecture.

2.2.5 Software Version String (Response to Poll) - Message I.D. 6

Output Rate: Response to polling message

Example:

```
A0A20015 — Start Sequence and Payload Length
0606312E322E30444B495431313920534D0000000000 — Payload
0382B0B3 — Message Checksum and End Sequence
```

Table 68: Software Version String

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		06			6
Character	20		[38]			[39]

Payload Length: 21 bytes

Note: **Convert to symbol to assemble message (i.e., 0 x 4E is 'N'). These are low priority task and are not necessarily output at constant intervals.**

38 06312E322E30444B495431313920534D0000000000
39 1.2.0DKit119 SM

2.2.6 Response: Clock Status Data - Message I.D. 7

Output Rate: 1 Hz or response to polling message

Example:

```
A0A20014 — Start Sequence and Payload Length
0703BD0215492408000122310004728l4D4DAEF — Payload
0598B0B3 — Message Checksum and End Sequence
```

Table 69: Clock Status Data Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		07			7
GPS Week	2		03BD			957
GPS TOW	4	*100	02154924	sec	÷100	349494.12
Svs	1		08			8
Clock Drift	4		00012231	Hz		74289
Clock Bias	4		0004728	nano sec		128743715
Estimated GPS Time	4		14D4DAEF	milli sec		349493999

Payload Length: 20 bytes

2.2.7 50 BPS Data – Message I.D. 8

Output Rate: As available (12.5 minute download time)

Example:

```
A0A2002B — Start Sequence and Payload Length
08001900C0342A9B688AB0113FDE2D714FA0A7FFFACC5540157EFFEEDFFFA
80365A867FC67708BEB5860F4 — Payload
15AAB0B3 — Message Checksum and End Sequence
```

Table 70: 50 BPS Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		08			8
Channel	1		00			0
Sv I.D	1		19			25
Word[10]	40					

Payload Length: 43 bytes per subframe (5 subframes per page)

Note: **Data is logged in ICD format (available from www.navcen.uscg.mil). The ICD specification is 30-bit words. The output above has been stripped of parity to give a 240 bit frame instead of 300 bits.**

2.2.8 CPU Throughput – Message I.D. 9

Output Rate: 1 Hz

Example:

```
A0A20009 — Start Sequence and Payload Length
09003B0011001601E5 — Payload
0151B0B3 — Message Checksum and End Sequence
```

Table 71: CPU Throughput

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		09			9
SegStatMax	2	*186	003B	milli sec	÷186	.3172
SegStatLat	2	*186	0011	milli sec	÷186	.0914
AveTrkTime	2	*186	0016	milli sec	÷186	.1183
Last MS	2		01E5	milli sec		485

Payload Length: 9 bytes

2.2.9 Error ID Data – Message I.D. 10

Output Rate: Every measurement cycle (Full Power / Continuous: 1Hz)

Error ID: 2

Code Define Name: ErrId_CS_SVParity

Error ID Description: Satellite subframe # failed parity check.

Example:

```
A0A2000D – Start Sequence and Payload Length
0A000200020000000100000002 – Payload
0011B0B3 – Message Checksum and End Sequence
```

Table 72: Error ID 2 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			
	2		0002			
	2		0002			
)	4		00000001			
No	4		00000002			

Payload Length: 13 bytes

Table 73: Error ID 2 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
Satellite ID	Satellite or Space Vehicle (SV) I.D. number or Pseudo-random Noise (PRN) number.
Subframe No	The associated subframe number that failed the parity check. Valid subframe number is 1 through 5.

Error ID: 9
Code Define Name: ErrId_RMC_GettingPosition
Error ID Description: Failed to obtain a position for acquired satellite ID.

Example:
```
A0A20009 – Start Sequence and Payload Length
0A0009000100000001 – Payload
0015B0B3 – Message Checksum and End Sequence
```

Table 74: Error ID 9 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		0009			9
Count	2		0002			2
Satellite ID	4		00000001			1

Payload Length: 9 bytes

Table 75: Error ID 9 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
Satellite ID	Satellite or Space Vehicle (SV) I.D. number or Pseudo-random Noise (PRN) number.

Error ID: 10
Code Define Name: ErrId_RXM_TimeExceeded
Error ID Description: Conversion of Nav Pseudo Range to Time of Week (TOW) for tracker exceeds limits: Nav Pseudo Range > 6.912e5 (1 week in seconds) || Nav Pseudo Range < -8.64e4.

Example:
```
A0A20009 – Start Sequence and Payload Length
0A000A000100001234 – Payload
005BB0B3 – Message Checksum and End Sequence
```

Table 76: Error ID 10 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		000A			10
Count	2		0001			1
Pseudo Range	4		00001234			4660

Payload Length: 9 bytes

Table 77: Error ID 10 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
Pseudo Range	Pseudo Range

Error ID: 11
Code Define Name: ErrId_RXM_TDOPOverflow
Error ID Description: Convert pseudo range rate to doppler frequency exceeds limit.

Example:
```
A0A20009 – Start Sequence and Payload Length
0A000B0001xxxxxxxx – Payload
xxxxB0B3 – Message Checksum and End Sequence
```

Table 78: Error ID 11 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		000B			11
Count	2		0001			1
Doppler Frequency	4		xxxxxxxx			xxxxxxxx

Payload Length: 9 bytes

Table 79: Error ID 11 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
Doppler Frequency	Doppler Frequency

Error ID: 12
Code Define Name: ErrId_RXM_ValidDurationExceeded
Error ID Description: Satellite's ephemeris age has exceeded 2 hours (7200 s).

Example:

```
A0A2000D – Start Sequence and Payload Length
0A000C0002xxxxxxxxaaaaaaaa – Payload
xxxxB0B3 – Message Checksum and End Sequence
```

Table 80: Error ID 12 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		000C			12
Count	2		0002			2
Satellite ID	4		xxxxxxxx			xxxxxxxx
Age Of Ephemeris	4		aaaaaaaa	seconds		aaaaaaaa

Payload Length: 13 bytes

Table 81: Error ID 12 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
Satellite ID	Satellite or Space Vehicle (SV) I.D. number or Pseudo-random Noise (PRN) number
Age Of Ephemeris	The Satellite's Ephemeris Age in seconds.

Error ID: 13
Code Define Name: ErrId_STRTP_BadPostion
Error ID Description: SRAM position is bad during a cold start.

Example:

```
A0A20011 – Start Sequence and Payload Length
0A000D0003xxxxxxxxaaaaaaaabbbbbbbb – Payload
xxxxB0B3 – Message Checksum and End Sequence
```

Table 82: Error ID 13 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		000D			13
Count	2		0003			3
X	4		xxxxxxxx			xxxxxxxx
Y	4		aaaaaaaa			aaaaaaaa
Z	4		bbbbbbbb			bbbbbbbb

Payload Length: 17 bytes

Table 83: Error ID 13 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
X	X position in ECEF.
Y	Y position in ECEF.
Z	Z position in ECEF.

Error ID: 4097 or 0x1001
Code Define Name: ErrId_MI_VCOClockLost
Error ID Description: VCO lost lock indicator.

Example:

```
A0A20009 – Start Sequence and Payload Length
0A1001000100000001 – Payload
001DB0B3 – Message Checksum and End Sequence
```

Table 84: Error ID 4097 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		1001			4097
Count	2		0001			1
VCOLost	4		00000001			1

Payload Length: 9 bytes

Table 85: Error ID 4097 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
VCOLost	VCO lock lost indicator. If VCOLost != 0, then send failure message.

Error ID: 4099 or 0x1003
Code Define Name: ErrId_MI_FalseAcqReceiverReset
Error ID Description: Nav detect false acquisition, reset receiver by calling NavForceReset routine.

Example:

```
A0A20009 – Start Sequence and Payload Length
0A1003000100000001 – Payload
001FB0B3 – Message Checksum and End Sequence
```

Table 86: Error ID 4099 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		1003			4099
Count	2		0001			1
InTrkCount	4		00000001			1

Payload Length: 9 bytes

Table 87: Error ID 4099 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
InTrkCount	False acquisition indicator. If InTrkCount </= 1, then send failure message and reset receiver.

Error ID: 4104 or 0x1008
Code Define Name: ErrId_STRTP_SRAMCksum
Error ID Description: Failed SRAM checksum during startup.

- Four field message indicates receiver control flags had checksum failures.
- Three field message indicates clock offset's checksum failure or clock offset value is out of range.
- Two field message indicates position and time checksum failure forces a cold start.

Example:

```
A0A2xxxx – Start Sequence and Payload Length
0A10080004xxxxxxxaaaaaaaa00000000cccccccc – Payload
xxxxB0B3 – Message Checksum and End Sequence
```

Table 88: Error ID 4104 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		1008			4104
Count	2		0004 or 0003 or 0002			4 or 3 or 2
Computed Receiver Control Checksum	4		xxxxxxxx			xxxx
Battery-Backed Receiver Control Checksum	4		aaaaaaaa			aaaa
Battery-Backed Receiver Control OpMode	4		00000000			0
Battery-Backed Receiver Control Channel Count	4		cccccccc			cccc
Compute Clock Offset Checksum	4		xxxxxxxx			xxxx
Battery-Backed Clock Offset Checksum	4		aaaaaaaa			aaaa
Battery-Backed Clock Offset	4		bbbbbbbb			bbbb
Computed Position Time Checksum	4		xxxxxxxx			xxxx
Battery-Backed Position Time Checksum	4		aaaaaaaa			aaaa

Payload Length: 21, 17, or 11 bytes

Table 89: Error ID 4104 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
Computed Receiver Control Checksum	Computed receiver control checksum of SRAM.Data.Control structure.
Battery-Backed	Battery-backed receiver control checksum stored in

Receiver Control Checksum	SRAM.Data.DataBuffer. CntrlChkSum.
Battery-Backed Receiver Control OpMode	Battery-backed receiver control checksum stored in SRAM.Data.Control.OpMode. Valid OpMode values are as follows: OP_MODE_NORMAL = 0, OP_MODE_TESTING = 0x1E51, OP_MODE_TESTING2 = 0x1E52, OP_MODE_TESTING3 = 0x1E53.
Battery-Backed Receiver Control Channel Count Compute Clock Offset Checksum	Battery-backed receiver control channel count in SRAM.Data.Control.ChannelCnt. Valid channel count values are 0-12. Computed clock offset checksum of SRAM.Data.DataBuffer.clkOffset.
Battery-Backed Clock Offset Checksum	Battery-backed clock offset checksum of SRAM.Data.DataBuffer.clkChkSum.
Battery-Backed Clock Offset Computed Position Time Checksum	Battery-backed clock offset value stored in SRAM.Data.DataBuffer,clkOffset. Computed position time checksum of SRAM.Data.DataBuffer.postime[1].
Battery-Backed Position Time Checksum	Battery-backed position time checksum of SRAM.Data.DataBuffer.postimeChkSum[1].

Error ID: 4105 or 0x1009
Code Define Name: ErrId_STRTP_RTCTimeInvalid
Error ID Description: Failed RTC SRAM checksum during startup. If one of the double buffered SRAM.Data.LastRTC elements is valid and RTC days is not 255 days, then GPS time and week number computed from the RTC is valid. If not, this RTC time is invalid.

Example:
```
A0A2000D – Start Sequence and Payload Length
0A10090002xxxxxxxaaaaaaaa – Payload
xxxxB0B3 – Message Checksum and End Sequence
```

Table 90: Error ID 4105 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		1009			4105
Count TOW	2 4		0002 xxxxxxxx	 seconds		2 xxxx
Week Number	4		aaaaaaaa			aaaa

Payload Length: 13 bytes

Table 91: Error ID 4105 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count TOW	Number of 32 bit data in message. GPS time of week in seconds. Range 0 to 604800 seconds.
Week Number	GPS week number.

Error ID: 4106 or 0x100A

Code Define Name: ErrId_KFC_BackupFailed_Velocity
Error ID Description: Failed battery-backing position because of ECEF velocity sum was greater than equal to 3600.

Example:

```
A0A20005 – Start Sequence and Payload Length
0A100A0000 – Payload
0024B0B3 – Message Checksum and End Sequence
```

Table 92: Error ID 4106 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		100A			4106
Count	2		0000			0

Payload Length: 5 bytes

Table 93: Error ID 4106 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.

Error ID: 4107 or 0x100B

Code Define Name: ErrId_KFC_BackupFailed_NumSV
Error ID Description: Failed battery-backing position because current navigation mode is not KFNav and not LSQFix.

Example:

```
A0A20005 – Start Sequence and Payload Length
0A100B0000 – Payload
0025B0B3 – Message Checksum and End Sequence
```

Table 94: Error ID 4107 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		100B			4107
Count	2		0000			0

Payload Length: 5 bytes

Table 95: Error ID 4107 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.

Error ID: 8193 or 0x2001

Code Define Name: ErrId_MI_BufferAllocFailure

Error ID Description: Buffer allocation error occurred. Does not appear to be active because uartAllocError variable never gets set to a non-zero value in the code.

Example:

```
A0A20009 – Start Sequence and Payload Length
0A2001000100000001 – Payload
002DB0B3 – Message Checksum and End Sequence
```

Table 96: Error ID 8193 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		2001			8193
Count	2		0001			1
uartAllocError	4		00000001			1

Payload Length: 9 bytes

Table 97: Error ID 8193 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
uartAllocError	Contents of variable used to signal UART buffer allocation error.

Error ID: 8194 or 0x2002
Code Define Name: ErrId_MI_UpdateTimeFailure
Error ID Description: PROCESS_1SEC task was unable to complete upon entry. Overruns are occurring.

Example:
```
A0A2000D – Start Sequence and Payload Length
0A2002000200000001000000064 – Payload
0093B0B3 – Message Checksum and End Sequence
```

Table 98: Error ID 8194 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10
Error ID	2		2002			8194
Count	2		0002			2
Number of in process errors.	4		00000001			1
Millisecond errors	4		00000064			100

Payload Length: 13 bytes

Table 99: Error ID 8194 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.
Number of in process errors	Number of one second updates not complete on entry.
Millisecond errors	Millisecond errors caused by overruns.

Error ID: 8195 or 0x2003
Code Define Name: ErrId_MI_MemoryTestFailed
Error ID Description: Failure of hardware memory test. Does not appear to be active because MemStatus variable never gets set to a non-zero value in the code.

Example:
```
A0A20005 – Start Sequence and Payload Length
0A20030000 – Payload
002DB0B3 – Message Checksum and End Sequence
```

Table 100: Error ID 8195 Message

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0A			10

Error ID	2		2003			8195
Count	2		0000			0

Payload Length: 5 bytes

Table 101: Error ID 8195 Message Description

Name	Description
Message ID	Message ID number.
Error ID	Error ID (see Error ID description above).
Count	Number of 32 bit data in message.

2.2.10 Command Acknowledgment – Message I.D. 11

Output Rate: Response to successful input message
This is successful almanac (message ID 0x92) request example:

```
A0A20002 — Start Sequence and Payload Length
0B92 — Payload
009DB0B3 — Message Checksum and End Sequence
```

Table 102: Command Acknowledgment

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0B			11
Ack. I.D.	1		92			146

Payload Length: 2 bytes

2.2.11 Command NAcknowledgment – Message I.D. 12

Output Rate: Response to rejected input message
This is an unsuccessful almanac (message ID 0x92) request example:

```
A0A20002 — Start Sequence and Payload Length
0C92 — Payload
009EB0B3 — Message Checksum and End Sequence
```

Table 103: Command NAcknowledgment

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0C			12
NAck. I.D.	1		92			146

Payload Length: 2 bytes

2.2.12 Visible List – Message I.D. 13

Output Rate: Updated approximately every 2 minutes

Note: **This is a variable length message. Only the number of visible satellites are reported (as defined by Visible Svs in table 99).**

Example:

```
A0A2002A — Start Sequence and Payload Length
0D081D002A00320F009C0032.... — Payload
....B0B3 — Message Checksum and End Sequence
```

Table 104: Visible List

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0D			13
Visible Svs	1		08			8
CH 1 - Sv I.D.	1		10			16
CH 1 - Sv Azimuth	2		002A	degrees		42
CH 1 - Sv Elevation	2		0032	degrees		50
CH 2 - Sv I.D.	1		0F			15
CH 2 - Sv Azimuth	2		009C	degrees		156
CH 2 - Sv Elevation	2		0032	degrees		50
.....						

Payload Length: Variable

2.2.13 Almanac Data - Message I.D. 14

Output Rate: Response to poll

Example:

```
A0A2001E — Start Sequence and Payload Length
0E0111014128FF630D51FD5900A10CC111B454B909098C6CE7
14............... — Payload
09E5B0B3 — Message Checksum and End Sequence
```

Table 105: Almanac Data

Name	Bytes	Binary (Hex)		Notes
		Scale	Example	
Message I.D.	1		0E	
SV I.D.	1		01	Satellite PRN Number[40]
Almanac Week & Status	2		1101	First 10 bits is the Almanac week. Next 5 bits have a zero value. Last bit is 1.
Almanac Data	24		....	This information is taken from the 50BPS navigation message broadcast by the satellite.

40 Each satellite almanac entry is output in a single message.

Name	Bytes	Binary (Hex)		Notes
		Scale	Example	
				This information is the last 8 words in the 5th subframe but with the parity removed.[41]
Package Checksum	2		4CA1	This is the checksum of the preceding data in the payload. It is calculated by arranging the previous 26 bytes as 13 half-words and then summing them.[42]

Payload Length: 30 bytes

The data is actually packed and the exact format of this representation and packing method can be extracted from the ICD-GPS-2000 document. The ICD-GPS-2000 document describes the data format of each GPS navigation sub-frame and is available on the web at http://www.arinc.com/gps.

2.2.14 Ephemeris Data (Response to Poll) – Message I.D. 15

The ephemeris data that is polled from the receiver is in a special SiRF format based on the ICD- GPS -200 format for ephemeris data. Refer to the supplied utility program calcpsr.exe for decoding of this data.

2.2.15 Test Mode 1 - Message I.D. 16

Output Rate: Variable - set by the period as defined in message ID 150

Example:

```
A0A20011 — Start Sequence and Payload Length
100015001E000588B800C81B5800040001 — Payload
02D8B0B3 — Message Checksum and End Sequence
```

Table 106: Test Mode 1 Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		10			16
SV ID	2		0015			21
Period	2		001E	sec		30
Bit Sync Time	2		0005	sec		5
Bit Count	2		88B8			35000
Poor Status	2		00C8			200
Good Status	2		1B58			7000
Parity Error Count	2		0004			4
Lost VCO Count	2		0001			1

Payload Length: 17 bytes

41 There are 25 possible pages in subframe 5. Pages 1 through 24 contain satellite specific almanac information which is output as part of the almanac data. Page 25 contains health status flags and the almanac week number.

42 This checksum is not used for serial I/O data integrity. It is used internally for ensuring that almanac information is valid.

Table 107: Detailed Description of Test Mode 1 Data

Name	Description
Message I.D.	Message I.D. number.
SV ID	The number of the satellite being tracked.
Period	The total duration of time (in seconds) that the satellite is tracked.
Bit Sync Time	The time it takes for channel 0 to achieve the status of 37.
Bit Count	The total number of data bits that the receiver is able to demodulate during the test period. As an example, for a 20 second test period, the total number of bits that can be demodulated by the receiver is 12000 (50BPS x 20sec x 12 channels).
Poor Status	This value is derived from phase accumulation time. Phase accumulation is the amount of time a receiver maintains phase lock. Every 100msec of loss of phase lock equates to 1 poor status count. As an example, the total number of status counts for a 60 second period is 7200 (12 channels x 60 sec x 10 sec).
Good Status	This value is derived from phase accumulation time. Phase accumulation is the amount of time a receiver maintains phase lock. Every 100msec of phase lock equates to 1 good status count.
Parity Error Count	The number of word parity errors. This occurs when the transmitted parity word does not match the receivers parity check.
Lost VCO Count	The number of 1 msec VCO lost lock was detected. This occurs when the PLL in the RFIC loses lock. A significant jump in crystal frequency and / or phase causes a VCO lost lock.

2.2.16 Differential Corrections - Message I.D. 17

Message I.D. 17 provides the RTCM data received from a DGPS source. The data is sent as a SiRF Binary message and is based on the RTCM SC-104 format. For more information see *RTCM Recommended Standards for Differential GNSS* by the Radio *Technical Commission for Maritime Services*.

2.2.17 OkToSend - Message I.D. 18

Output Rate: Trickle Power CPU on/off indicator

Example:

```
A0A20002 — Start Sequence and Payload Length
1200 — Payload
0012B0B3 — Message Checksum and End Sequence
```

Table 108: Almanac Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message I.D.	1		12			12
Send Indicator[43]	1		00			00

Payload Length: 2 bytes

43 0 implies that CPU is about to go OFF, OkToSend==NO, 1 implies CPU has just come ON, OkToSend==YES

2.2.18 Navigation Parameters (Response to Poll) – Message I.D. 19

Output Rate: 1 Response to Poll

Example:

```
A0A20018 – Start Sequence and Payload Length
13010000000011E3C0104001E004B1E00000500016400C8 – Payload
022DB0B3 – Message Checksum and End Sequence
```

Table 109: Navigation Parameters

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		13			19
Reserved	4					
Altitude Hold Mode	1		00			0
Altitude Hold Source	1		00			0
Altitude Source Input	2		0000	meters		0
Degraded Mode[44]	1		01			1
Degraded Timeout	1		1E	seconds		30
DR Timeout	1		3C	seconds		60
Track Smooth Mode	1		01			1
Static Navigation	1					
3SV Least Squares	1					
Reserved	4					
DOP Mask Mode[45]	1		04			4
Navigation Elevation Mask	2					
Navigation Power Mask	1					
Reserved	4					
DGPS Source	1					
DGPS Mode[46]	1		00			0
DGPS Timeout	1		1E	seconds		30
Reserved	4					
LP Push-to-Fix	1					
LP On-time	4					
LP Interval	4					

44 See table 34.
45 See table 36.
46 See table 38.

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
LP User Tasks Enabled	1					
LP User Task Interval	4					
LP Power Cycling Enabled	1					
LP Max. Acq. Search Time	4					
LP Max. Off Time	4					
Reserved	4					
Reserved	4					

Payload Length: 65 bytes

2.2.19 Test Mode 2 - Message I.D. 20

Output Rate: Variable - set by the period as defined in message ID 150

Example:

```
A0A20033 — Start Sequence and Payload Length
140001001E00023F70001F0D290000000000601C600051B0E000EB41A000000000000
0 000000000000000000000000000000 — Payload
0316B0B3 — Message Checksum and End Sequence
```

Table 110: Test Mode 2 Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		14			20
SV ID	2		0001			1
Period	2		001E	sec		30
Bit Sync Time	2		0002	sec		2
Bit Count	2		3F70			13680
Poor Status	2		001F			31
Good Status	2		0D29			3369
Parity Error Count	2		0000			0
Lost VCO Count	2		0000			0
Frame Sync Time	2		0006	sec		6
C/No Mean	2	*10	01C6		÷10	45.4
C/No Sigma	2	*10	0005		÷10	0.5
Clock Drift	2	*10	1B0E	Hz	÷10	692.6
Clock Offset	4	*10	000EB41A	Hz	÷10	96361.0
Reserved	2		0000			

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Reserved	4		00000000			
Reserved	4		00000000			
Reserved	4		00000000			
Reserved	4		00000000			
Reserved	4		00000000			

Payload Length: 51 bytes

Table 111: Detailed Description of Test Mode 2 Data

Name	Description
Message I.D.	Message I.D. number.
SV ID	The number of the satellite being tracked.
Period	The total duration of time (in seconds) that the satellite is tracked.
Bit Sync Time	The time it takes for channel 0 to achieve the status of 37.
Bit Count	The total number of data bits that the receiver is able to demodulate during the test period. As an example, for a 20 second test period, the total number of bits that can be demodulated by the receiver is 12000 (50BPS x 20sec x 12 channels).
Poor Status	This value is derived from phase accumulation time. Phase accumulation is the amount of time a receiver maintains phase lock. Every 100msec of loss of phase lock equates to 1 poor status count. As an example, the total number of status counts for a 60 second period is 7200 (12 channels x 60 sec x 10 sec)
Good Status	This value is derived from phase accumulation time. Phase accumulation is the amount of time a receiver maintains phase lock. Every 100msec of phase lock equates to 1 good status count.
Parity Error Count	The number of word parity errors. This occurs when the transmitted parity word does not match the receivers parity check.
Lost VCO Count	The number of 1 msec VCO lost lock was detected. This occurs when the PLL in the RFIC loses lock. A significant jump in crystal frequency and / or phase will cause a VCO lost lock.
Frame Sync	The time it takes for channel 0 to reach a 3F status.
C/No Mean	Calculated average of reported C/No by all 12 channels during the test period.
C/No Sigma	Calculated sigma of reported C/No by all 12 channels during the test period.
Clock Drift	Difference in clock frequency from start and end of the test period.
Clock Offset	The internal clock offset.

2.2.20 Navigation Library Measurement Data - Message I.D. 28

Output Rate: Every measurement cycle (full power / continuous: 1Hz)

Example:

```
A0A20038 – Start Sequence and Payload Length
1C00000660D015F143F62C4113F42F417B235CF3FBE95E468C6964B8FBC582415
CF1C375301734.....03E801F400000000 – Payload
1533B0B3 – Message Checksum and End Sequence
```

Table 112: Measurement Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message I.D.	1		1C			28
Channel	1		00			0
Time Tag	4		000660D0	milli-sec		135000
Satellite ID	1		15			20
GPS Software Time	8		F143F62C 4113F42F	milli-sec		2.4921113 696e+005
Pseudo-range	8		417B235C F3FBE95E	m		2.1016756 638e+007
Carrier Frequency	4		468C6964	m/sec		1.6756767 578e+004
Carrier Phase	8		B8FBC582 415CF1C3	m		4.4345542 262e+004
Time in Track	2		7530	milli-sec		10600
Sync Flags	1		17			23
C/No 1	1		34	dB-Hz		43
C/No 2	1			dB-Hz		43
C/No 3	1			dB-Hz		43
C/No 4	1			dB-Hz		43
C/No 5	1			dB-Hz		43
C/No 6	1			dB-Hz		43
C/No 7	1			dB-Hz		43
C/No 8	1			dB-Hz		43
C/No 9	1			dB-Hz		43
C/No 10	1			dB-Hz		43
Delta Range Interval	2		03E801F4	m		1000
Mean Delta Range Time	2		01F4	milli-sec		500
Extrapolation Time	2		0000	milli-sec		
Phase Error Count	1		00			0
Low Power Count	1		00			0

Payload Length: 56 bytes

Table 113: Sync Flag Fields

Bit Fields	Description
[0]	**Coherent Integration Time** 0 = 2ms 1 = 10ms
[2:1]	**Synch State** 00 = Not aligned 01 = Consistent code epoch alignment 10 = Consistent data bit alignment 11 = No millisecond errors
[4:3]	**Autocorrelation Detection State** 00 = Verified not an autocorrelation 01 = Testing in progress 10 = Strong signal, autocorrelation detection not run 11 = Not used

Table 114: Detailed Description of the Measurement Data

Name	Description
Message I.D.	Message I.D. number.
Channel	Receiver channel number for a given satellite being searched or tracked.
Time Tag	This is the Time Tag in milliseconds of the measurement block in the receiver software time.
Satellite ID	Satellite or Space Vehicle (SV) I.D. number or Pseudo-random Noise (PRN) number.
GPS Software Time	This is GPS Time or Time of Week (TOW) estimated by the software in milliseconds.
Pseudo-range	This is the generated pseudo range measurement for a particular SV.
Carrier Frequency	This is can be interpreted in two ways: 1) The delta-pseudo range normalized by the reciprocal of the delta pseudo range measurement interval. 2) The frequency from the AFC loop. If, for example, the delta pseudo range interval computation for a particular channel is zero, then it can be the AFC measurement, otherwise it is a delta-pseudo range computation.
Carrier Phase	This is the integrated carrier phase given in meters.
Time in Track	The Time in Track counts how long a particular SV has been in track. For any count greater than zero (0), a generated pseudo range is present for a particular channel. The length of time in track is a measure of how large the pull-in error may be.
Sync Flags	This byte contains two a two bit fields that report the integration interval and sync value achieved for a particular channel. 1. **Bit 0:** Coherent Integration Interval (0 = 2 milliseconds, 1 = 10 milli seconds) 2. **Bits:** (1 2) = Synchronization 3. **Bit:** (2 1) Value: {0 0} Not Aligned Value: {0 1} Consistent Code Epoch Alignment

Name	Description
	Value: {1 0} Consistent Data Bit Alignment Value: {1 1} No Millisecond Errors
C/No 1	This array of Carrier To Noise Ratios is the average signal power in dB- Hz for each of the 100-millisecond intervals in the previous second or last epoch for each particular SV being track in a channel. First 100 millisecond measurement
C/No 2	Second 100 millisecond measurement
C/No 3	Third 100 millisecond measurement
C/No 4	Fourth 100 millisecond measurement
C/No 5	Fifth 100 millisecond measurement
C/No 6	Sixth 100 millisecond measurement
C/No 7	Seventh 100 millisecond measurement
C/No 8	Eighth 100 millisecond measurement
C/No 9	Ninth 100 millisecond measurement
C/No 10	Tenth 100 millisecond measurement
Delta Range Interval	This is the delta-pseudo range measurement interval for the preceding second. A value of zero indicated that the receiver has an AFC measurement or no measurement in the Carrier Frequency field for a particular channel.
Mean Delta Range Time	This is the mean calculated time of the delta-pseudo range interval in milliseconds measured from the end of the interval backwards
Extrapolation Time	This is the pseudo range extrapolation time in milliseconds, to reach the common Time tag value.
Phase Error Count	This is the count of the phase errors greater than 60 Degrees measured in the preceding second as defined for a particular channel.
Low Power Count	This is the low power measurements for signals less than 28 dB-Hz in the preceding second as defined for a particular channel

2.2.21 Navigation Library DGPS Data - Message I.D. 29

Output Rate: Every measurement cycle (full power / continuous : 1Hz)

Example:

```
A0A2001A – Start Sequence and Payload Length
1D000F00B501BFC97C673CAAAAAB3FBFFE1240A0000040A00000 – Payload
0956B0B3 – Message Checksum and End Sequence
```

Table 115: Measurement Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message I.D.	1		1D			29
Satellite ID	2		000F			15

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
IOD	2		00B5			181
Source[47]	1		01			1
Pseudo-range Correction	4		BFC97C67	m		3217652839
Pseudo-range rate Correction	4		3CAAAA AB	m/sec		1017817771
Correction Age	4		3FBFFE12	sec		1069547026
Reserved	4					
Reserved	4					

Payload Length: 26 bytes

2.2.22 Navigation Library SV State Data - Message I.D. 30

Output Rate: Every measurement cycle (full power / continuous : 1Hz)

Example:

```
A0A20053 — Start Sequence and Payload Length
1E15....2C64E99D01....408906C8 — Payload
2360B0B3 — Message Checksum and End Sequence
```

Table 116: SV State Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message I.D.	1		1E			30
Satellite ID	1		15			21
GPS Time	8			sec		
Position X	8			m		
Position Y	8			m		
Position Z	8			m		
Velocity X	8			m/sec		
Velocity Y	8			m/sec		
Velocity Z	8			m/sec		
Clock Bias	8			sec		
Clock Drift	4		2C64E99D	s/s		744810909
Ephemeris Flag[48]	1		01			1
Reserved	4					
Reserved	4					
Ionospheric Delay	4		408906C8	m		1082721992

Payload Length: 83 bytes

47 0 = Use no corrections, 1 = Use WAAS channel, 2 = Use external source, 3 = Use Internal Beacon, 4 = Set DGPS Corrections

48 0 = no valid SV state, 1 = SV state calculated from ephemeris, 2 = Satellite state calculated from almanac

2.2.23 Navigation Library Initialization Data - Message I.D. 31

Output Rate: Every measurement cycle (full power / continuous : 1Hz)

Example:

```
A0A20054 – Start Sequence and Payload Length
1F....00000000000001001E000F....00....000000000F....00....02....043402
....
....02 – Payload
0E27B0B3 – Message Checksum and End Sequence
```

Table 117: Measurement Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message I.D.	1		1F			31
Reserved	1					
Altitude Mode[49]	1		00			0
Altitude Source	1		00			0
Altitude	4		00000000	m		0
Degraded Mode[50]	1		01			1
Degraded Timeout	2		001E	sec		30
Dead-reckoning Timeout	2		000F	sec		15
Reserved	2					
Track Smoothing Mode[51]	1		00			0
Reserved	1					
Reserved	2					
Reserved	2					
Reserved	2					
DGPS Selection[52]	1		00			0
DGPS Timeout	2		0000	sec		0
Elevation Nav. Mask	2		000F			15
Reserved	2					
Reserved	1					
Reserved	2					
Reserved	1					

49 0 = Use last know altitude 1 = Use user input altitude 2 = Use dynamic input from external source

50 0 = Use direction hold and then time hold 1 = Use time hold and then direction hold 2 = Only use direction hold 3 = Only use time hold 4 = Degraded mode is disabled

51 0 = True 1 = False

52 0 = Use DGPS if available 1 = Only navigate if DGPS corrections are available 2 = Never use DGPS corrections

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Reserved	2					
Static Nav. Mode[53]	1		00			0
Reserved	2					
Position X	8			m		
Position Y	8			m		
Position Z	8			m		
Position Init. Source[54]	1		02			2
GPS Time	8					
GPS Week	2		0434			1076
Time Init. Source[55]	1		02			2
Drift	8					
Drift Init. Source[56]	1		02			2

Payload Length: 84 bytes

2.2.24 Development Data – Message I.D. 255

Output Rate: Receiver generated

Example:

```
A0A2.... — Start Sequence and Payload Length
FF.... — Payload
....B0B3 — Message Checksum and End Sequence
```

Table 118: Development Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		FF			255

Payload Length: Variable

Note: **MID 255 is output when SiRF binary is selected and development data is enabled. The data output using MID 255 is essential for SiRF assisted troubleshooting support.**

53 0 = True 1 = False

54 0 = ROM position 1 = User position 2 = SRAM position 3 = Network assisted position

55 0 = ROM time 1 = User time 2 = SRAM time 3 = RTC time 4 = Network assisted time

56 0 = ROM clock 1 = User clock 2 = SRAM clock 3 = Calibration clock 4 = Network assisted clock

2.3 Additional Information

2.3.1 TricklePower Operation in DGPS Mode

When in TricklePower mode, serial port DGPS corrections are supported. The CPU goes into sleep mode but will wake up in response to any interrupt. This includes UARTs. Messages received during the TricklePower 'off' period are buffered and processed when the receiver awakens for the next TricklePower cycle.

2.3.2 GPS Week Reporting

Since Aug, 22, 1999, the GPS week roll from 1023 weeks to 0 weeks is in accordance with the ICD-GPS-200 specifications. To maintain roll over compliance, SiRF reports the ICD GPS week between 0 and 1023. If the user needs to have access to the Extended GPS week (ICD GPS week + 1024) this information is available through the Clock Status Message (007) under the Poll menu.

2.3.3 NMEA Protocol in TricklePower Mode

The NMEA standard is generally used in continuous update mode at some predefined rate. This mode is perfectly compatible with all SiRF TricklePower and Push-to-Fix modes of operations. There is *no* mechanism in NMEA that indicates to a host application when the receiver is on or in standby mode. If the receiver is in standby mode (chip set OFF, CPU in standby), then no serial communication is possible for output of NMEA data or receiving SiRF proprietary NMEA input commands. To establish reliable communication, the user must repower the receiver and send commands while the receiver is in full-power mode (during start-up) and prior to reverting to TricklePower operation. Alternatively, the host application could send commands (i.e., poll for position) repeatedly until the request has been completed. The capability to create communication synchronization messages in NMEA mode is available through the System Development Kit (SDK).

In Trickle-Power mode, the user is required to select an update rate (seconds between data output) and OnTime (milli-seconds the chip set is on). When the user changes to NMEA mode, the option to set the output rate for each of the selected NMEA messages is also required. These values are multiplied by the TricklePower update rate value as shown in Table 119.

Table 119: NMEA Data Rates Under Trickle Power Operation

Power Mode	Continuous	Trickle Power	Trickle Power	Trickle Power
Update Rate	1 every second	1 every second	1 every 5 seconds	1 every 8 seconds
On Time	1000	200	400	600
NMEA Update Rate	1 every second	1 every 5 seconds	1 every 2 seconds	1 every 5 seconds
Message Output Rate	1 every second	1 every 5 seconds	1 every 10 seconds	1 every 40 seconds

Note: **The On Time of the chip set has no effect on the output data rates.**