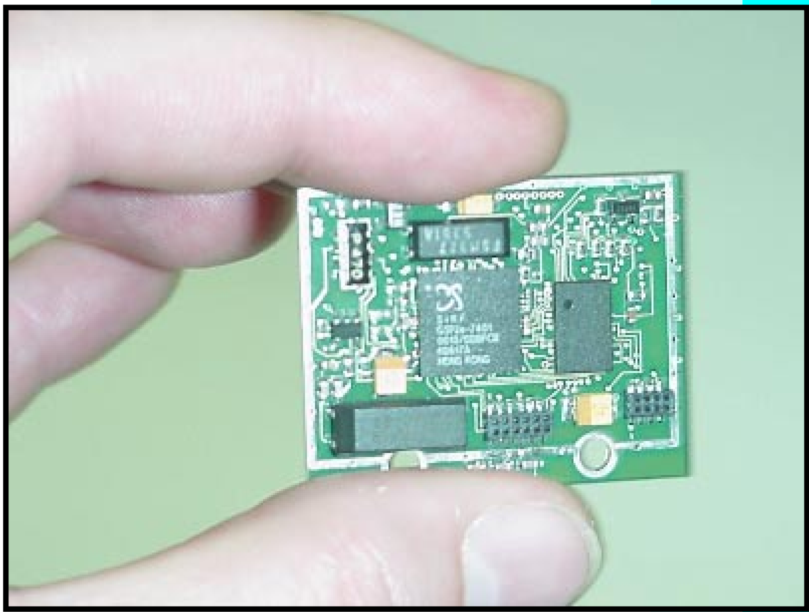
SENA GPS



GPS RECEIVER ALBATROS

USER'S MANUAL

MU-ALB-036-SN

MAYO 2001

ISSUE: 1
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1 INTRODUCTION

The **Albatros** OEM GPS Receiver from SENA GPS is a new OEM GPS receiver product that features the revolutionary SiRFStar-II chipset. This complete 12-channel, provides a vastly superior position accuracy performance in a much smaller package. The SiRFStar-II architecture builds on the high-performance SiRFStar-I core, adding an acquisition accelerator, differential GPS processor, multipath mitigation hardware and satellite-tracking engine. **Albatros** delivers major advancements in GPS performance, accuracy, integration, computing power and flexibility.

2 PRODUCT DESCRIPCION

2.1 PRODUCT PRESENTATION

2.1.1 SiRFStar-II Architecture Highlights

2.1.1.1 Industry Leading GPS Performance

- Builds on high performance SiRFstar-1 core
- Signal acquisition using 1920 time/frequency search channels
- Satellite signal tracking engine to perform GPS acquisition and tracking functions without CPU intervention
- Multipath-mitigation hardware
- Cold Start in under 45 seconds

2.1.1.2 Low Power

- Advanced Trickle Power mode for power savings to 98% with no extra parts (The Trickle Power mode allows to maintain the 1-sec update rate, yet the chip set enters a sleep mode for almost 90% of each 1-sec cycle)
- Extreme low power in power down mode, but capable of very fast starts

2.1.1.3 Maximizes GPS Position Availability

- SingleSat updates in reduced visibility
- Superior urban canyon performance
- FoliageLock for weak signal tracking

2.1.2 SiRFStar-II Family Highlights

2.1.2.1 GSP2e Highly Integrated Digital IC

- Enhanced GPS core
- Integrated ARM7TDMI up to 50 MHz
- Supports 16 and 32 bit data bus operation
- Separate internal and external buses
- On-chip 1Mb EDO DRAM for GPS navigation
- Instruction cache to improve throughput
- Integrated high-precision Real-Time Clock
- Extensive GPS receiver Peripherals including 2 UARTS, High Speed Serial Bus, battery-backed SRAM, GPIO

2.1.2.2 GRF2I - Cost Effective RFIC

- On-chip VCO and reference oscillator
- Single stage down-conversion
- Integrated IF filter
- Integrated LNA
- Simplified digital interfaces

2.1.2.3 GSW2 Modular Software

- Easily integrated into existing systems
- 60% CPU throughput available for user tasks
- Tunable performance in all applications
- Robust development environment

2.2 ELECTRICAL CHARACTERISTICS

2.2.1 Absolute maximum ratings

Parameter	Symbol	Min	Max	Units
Power supply voltage	VDD	-0.3	3.6	V
Input Pin Voltage	VIN	-0.3	5.0	V
Output Pin Voltage	VOUT	-0.3	VDD + 0.3	V

Warning – Stressing the device beyond the "Absolute Maximum Ratings" may cause permanent damage. These are stress ratings only. Operation beyond the "Operating Conditions" is not recommended and extended exposure beyond the "Operating Conditions" may affect device reliability.

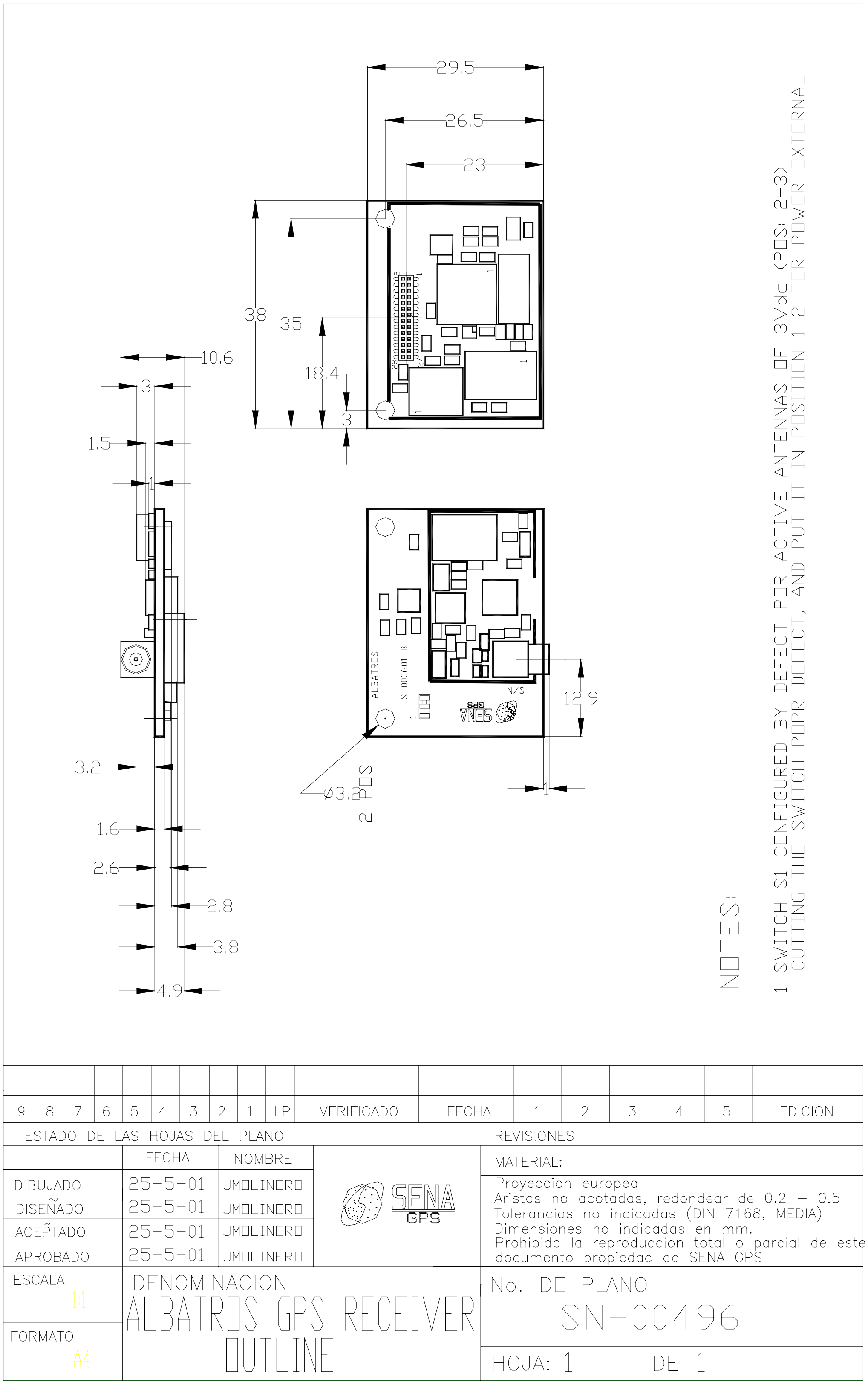
2.2.2 DC Characteristics

Parameter	Symbol	Min	Max	Conditions	Units
Power supply voltage	Vdd	3.15	3.6		V
Input High Level	Vih	0.7xVdd	5.0	All pins except BOOT and RST	V
Input High Level for BOOT	Vih_{BOOT}	0.8xVdd	5.0		V
Input High Level for RST	Vih_{RST}	1.45	5.0	Vdd = 3.15V (1.2V @ Vdd = 3.3V)	V
Input Low Level	Vil	0	0.3xVdd	All pins except RST	V
Input Low Level for RST	Vil_{RST}	0	0.25	Vdd = 3.6V (0.8V @Vdd = 3.3V)	V
Output high level	Voh	2.4		Ioh = 2mA	V
Output low level	Vol		0.4	Iol = 2mA	V
Input Leakage current	Ii	-1	1		µA
Input Capacitance			3		pF
Output Capacitance			3		pF
Backup voltage	VBK	1.8	3.6	VDD = 0 V, Ibk_{typ} = 10µA	V

2.3 PHYSICAL CHARACTERISTICS

Size	11 x 29.5 x 38 mm.
Weight	9 gm.

PCB LAYOUT:


29.5
26.5
23
38
35
18.4
3
10.6
3
1.5
1
3.2
1.6
2.6
2.8
3.8
4.9
12.9
1
ø3.2 2 POS
ALBATROS
S-000601-B
N/S
NOTES:
1 SWITCH S1 CONFIGURED BY DEFECT FOR ACTIVE ANTENNAS OF 3Vdc (POS: 2-3)
CUTTING THE SWITCH POPR DEFECT, AND PUT IT IN POSITION 1-2 FOR POWER EXTERNAL
9 8 7 6 5 4 3 2 1 LP VERIFICADO FECHA 1 2 3 4 5 EDICION
ESTADO DE LAS HOJAS DEL PLANO
REVISIONES
FECHA NOMBRE
MATERIAL:
DIBUJADO 25-5-01 JMOLINERO
DISEÑADO 25-5-01 JMOLINERO
ACEPTADO 25-5-01 JMOLINERO
APROBADO 25-5-01 JMOLINERO
SENA GPS
Proyeccion europea
Aristas no acotadas, redondear de 0.2 - 0.5
Tolerancias no indicadas (DIN 7168, MEDIA)
Dimensiones no indicadas en mm.
Prohibida la reproduccion total o parcial de este
documento propiedad de SENA GPS
ESCALA 1:1
DENOMINACION
ALBATROS GPS RECEIVER
OUTLINE
No. DE PLANO
SN-00496
FORMATO A4
HOJA: 1 DE 1

2.4 ENVIRONMENTAL CONDITIONS

Operating Temperature	-40°C to +85°C
Operating Humidity	5% to 95% R.H., Non Condensing, at +60°C
Shock	20g (11 ms Sawtooth)
Vibration	4 g

2.5 FUNCTIONS

The **Albatros** OEM GPS Receiver provides two 3.3V serial ports.
Serial port A:

- Output of the GPS position and parameters (velocity, tracked satellites, etc).
- GPS configuration (output type, serial port velocity, etc).
- Software downloading (see page 7.2).

Serial port B:

- RTCM Input.

3 INSTALLATION

3.1 PRODUCT INSTALLATION

Caution : the device must be protected from electrostatic discharges. Use a grounded area when manipulating the device.

The **Albatros** OEM GPS Receiver must be tied firmly to the main user board with two 2.5mm screws through the 3mm holes, in order to avoid physical stress of the data connector.

3.2 CONNECTING ANTENNAS

The provided connector reference is done on page 4.1.

The **Albatros** OEM GPS Receiver may use active or passive antennas of 1575.42 MHz (L1 frequency).

The antenna can be quite close to the receiver in case of a mobile battery-powered GPS equipment.

4 INTERFACES DESCRIPTION

4.1 CONNECTORS

The **Albatros** OEM GPS Receiver provides two connectors :

4.1.1 RF Interface Connector

MCX Jack Coaxial Connector Johnson P/N 133-3711-301 Mates with MCX Plug Connector e.g. Johnson 133-3402-001 (RG-178 coax) 3.0V center conductor bias for active antenna

4.1.2 Data Interface Connector

CONNECTOR HEADER, Female, 2X14 pin, 1mm step. CLM-114-02-F-DV, SAMTEC Mates with FTMH-114-03-F-DV-ES

The pin 1 is marked on the board

Pin	Signal Name	In/Out	Description
1	INP2/JTAGEN	I	General Purpose Input 2/Debugger Selection. 68K Pull-up resistor to VCC.
2	CTS-A	I	Clear To Send for Serial Port B
3	RTS-A	O	Request To Send for Serial Port B
4	OUT6	O	General Purpose Output 6
5	OUT5	O	General Purpose Output 5
6	INP3	I	General Purpose Input 3
7	OUT1	O	General Purpose Output 1. 10K Pull-down resistor.
8	OUT2	O	General Purpose Output 2
9	OUT3	O	General Purpose Output 3
10	WAKEUP	O	Wakeup (from sleep mode,) Active Low
11	VCC	I	3.15 to 3.6 VDC Input Power
12	TX-A	O	3.3V Serial Transmit Data, Port A, GPS Data, NMEA output
13	RX-A	I	3.3V Serial Receive Data, Port A, Load SW update
14	TX-B	O	3.3V Serial Transmit Data, Port B, RTCM
15	RX-B	I	3.3V Serial Receive Data, Port B, RTCM
16	OUT4	O	General Purpose Output 4
17	VBK	I	SRAM and RTC Backup Battery Voltage. 1.8 to 3.6 VDC. 10uA Typical. Backup battery is necessary to allow snap/hot/warm start of the module.
18	INP1	I	General Purpose Input 1
19	RST	I	Manual Reset, Active low
20	VANT	I	5 VDC optional input power for active antenna[1]
21	GND	I	Power and Signal Ground
22	BOOTSEL	I	Boot Select Input. 70K pull-down to GND. Must be left open for normal operation, and tied to VCC on low-to-high transition of RST for software downloading.
23	JTRST	I	Debug Restart Input
24	JTDI	I	Debug Data Input. 10K pull-up resistor to VCC
25	JTMS	I	Debug Control. 10K pull-up resistor to VCC
26	JTCK	I	Debug Clock Input. 10K pull-up resistor to VCC
27	JTDO	O	Debug Data Output. 10K pull-up resistor to VCC
28	ICERST	I/O	Debug Device Restart

1 : Antenna power is defined by the configuration strap S1. The default configuration (1-2) is for a 3.3 V antenna. It is necessary to change S1 setting to (2-3) to allow 5V antennas to be used.

5 OUTPUT PROTOCOLS

The **Albatros** OEM GPS Receiver can use two different protocols to output GPS data.

5.1 SIRF BINARY PROTOCOL

The SiRF Binary Protocol is the more complete interface protocol used by the **Albatros** GPS Receiver and other SENA GPS and SiRF products.

This serial communication protocol is designed to include:

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

5.1.1 Protocol Layers

Transport Message

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

1. 0xYY denotes a hexadecimal byte value. 0xA0 equals 160.

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) check sum. The values of the start and stop characters and the choice of a 15-bit value for length and check sum ensure message length and check sum 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 check sum is a sum on the payload.

5.1.2 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 **Albatros** GPS module implementation to limit this value to a smaller number.

5.1.3 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.

5.1.4 Checksum

The check sum 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).

5.1.5 Input Messages for SiRF Binary Protocol

Note: All input messages are sent in **BINARY** format.

Table 5.1.5-a lists the message list for the SiRF input messages.

Table 5.1.5-a SiRF Messages - Input Message List

Hex	ASCII	Name
0 x 80	128	Initialize Data Source
0 x 81	129	Switch to NMEA Protocol
0 x 82	130	Set Almanac (upload)
0 x 84	132	Software Version (Poll)
0 x 85	133	DGPS Source Control
0 x 86	134	Set Main Serial Port
0 x 87	135	Set Protocol
0 x 88	136	Mode Control
0 x 89	137	DOP Mask Control
0 x 8A	138	DGPS Mode
0 x 8B	139	Elevation Mask
0 x 8C	140	Power Mask
0 x 8D	141	Editing Residual
0 x 8E	142	Steady-State Detection - Not Used
0 x 8F	143	Static Navigation
0 x 90	144	Clock Status (Poll)
0 x 91	145	Set DGPS Serial Port
0 x 92	146	Almanac (Poll)
0 x 93	147	Ephemeris (Poll)
0 x 95	149	Set Ephemeris (upload)
0 x 96	150	Switch Operating Mode
0 x 97	151	Set Low Power operation
0 x 98	152	Navigation Parameters (Poll)
0 x A7	167	Low Power Acquisition Parameters

5.1.5.1 Initialize Data Source - Message I.D. 128

Table 5.1.5.1-a 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 s), 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 5.1.5.1-a Initialize Data Source

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		80		ASCII 128
ECEF X	4		FFD700F9	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		01		See Table 5.1.5.1.-b

Payload Length: 25 bytes

Table 5.1.5.1-b Reset Configuration Bitmap

Bit	Description
0	Data valid flag—set warm/hot start
1	Clear ephemeris—set warm start
2	Clear memory—set cold start
3	Factory Reset
4	Enable debug output data for navigation library (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 1 Hz and the baud rate will be automatically set to 57600.

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

Table 5.1.5.2-a 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, RMC-OFF, VTG-OFF

Example:

A0A20018—Start Sequence and Payload Length

810201010001050105010001000100010001000 1000112C0—Payload

016AB0B3—Message Checksum and End Sequence

Table 5.1.5.2-a Switch To NMEA Protocol

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		81		ASCII 129
Mode	1		02	1/s	Alwavs 0x02 to switch to NMEA mode
GGA Message[1]	1		01		See Appendix A for format
Checksum[2]	1		01		
GLL Message	1		00	1/s	See Appendix A for format
Checksum	1		01		
GSA Message	1		05	1/s	See Appendix A for format
Checksum	1		01		
GSV Message	1		05	1/s	See Appendix A for format
Checksum	1		01		
MSS Message	1		00	1/s	Should alwavs be 0 (DGPS not available)
Checksum	1		01		
RMC Message	1		00	1/s	See Appendix A for format.
Checksum	1		01		
VTG Message	1		00	1/s	See Appendix A for format.
Checksum	1		01		
Unused Field	1		00		Recommended value
Unused Field	1		01		Recommended value
Unused Field	1		00		Recommended value
Unused Field	1		01		Recommended value
Unused Field	1		00		Recommended value
Unused Field	1		01		Recommended value
Unused Field	1		00		Recommended value
Unused Field	1		01		Recommended value
Baud Rate	2		12C0		38400,19200,9600,4800,2400

Payload Length: 24 bytes.

1. 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.

2. 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).

Note: 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 = 2 seconds, NMEA update rate = 5 seconds, resulting update rate is every 10 seconds, (2 X 5)

5.1.5.3 Set Almanac – Message I.D. 130

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

5.1.5.4 Software Version – Message I.D. 132

Table 5.1.5.4-a 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 5.1.5.4-a Software Version

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		84		ASCII 132
TBD	1		00		Reserved

Payload Length: 2 bytes

Current version of the receiver software will be returned in response to this message, in a zero-terminated string format.

5.1.5.5 DGPS Source - Message I.D. 133

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

External RTCM Data (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 5.1.5.5-a DGPS Source Selection (Example 1)

Name	Bytes	Scale	Hex	Units	Decimal	Description
Message ID	1		85		133	Message Identification
DGPS Source	1		00		0	See Table B-8. DGPS Source Selections
Internal Beacon Frequency	4		00000000	Hz	0	See Table B-9. Internal Beacon Search Settings
Internal Beacon Bit Rate	1		0	BPS	0	See Table B-9. 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 5.1.5.5-b DGPS Source Selection (Example 2)

Name	Bytes	Scale	Hex	Units	Decimal	Description
Message ID	1		85		133	Message Identification
DGPS Source	1		03		3	See Table 5.1.5.5-c. DGPS Source Selections
Internal Beacon Frequency	4		0004BAF0	Hz	3140000	See Table 5.1.5.5-d. Internal Beacon Search Settings
Internal Beacon Bit Rate	1		C8	BPS	200	See Table 5.1.5.5-d. Internal Beacon Search Settings

Payload Length: 7 Bytes

Table 5.1.5.5-c DGPS Source Selections

DGPS Source	Hex	Decimal	Description
None	00	0	DGPS corrections will not be 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

Table 5.1.5.5-d Internal Beacon Search Settings

Search Type	Frequency 1	Bit Rate 2	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.

1. Frequency Range is 283500 to 325000 Hz.
2. Bit Rate selection is 25, 50, 100 and 200 BPS.

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

Table 5.1.5.6-a 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 5.1.5.6-a 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

5.1.5.7 Mode Control - Message I.D. 136

Table 5.1.5.7-a 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 5.1.5.7-a 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 5.1.5.7-b
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 = disabled. 1 to 120 otherwise
Track Smoothing	1		01		YES=1, NO=0

Payload Length: 14 bytes

Table 5.1.5.7-b 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.

5.1.5.8 DOP Mask Control - Message I.D. 137

Table 5.1.5.8-a 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 5.1.5.8-a DOP Mask Control

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		89		ASCII 137
DOP Selection	1		00		See Table 5.1.5.8-b
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 5.1.5.8-b DOP Selection

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

5.1.5.9 DGPS Control - Message I.D. 138

Table 5.1.5.9-a 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 5.1.5.9-a DGPS Control

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		8A		ASCII 138
DGPS Selection	1		01		See Table 5.1.5.9-b
DGPS Time Out	1		1E	seconds	Range 1 to 120

Payload Length: 3 bytes

Table 5.1.5.9-b DGPS Selection

Byte Value	Description
0	Auto
1	Exclusive
2	Never Use

5.1.5.10 Elevation Mask – Message I.D. 139

Table 5.1.5.10-a 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 5.1.5.10-a Elevation Mask

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

Payload Length: 5 bytes

5.1.5.11 Power Mask - Message I.D. 140

Table 5.1.5.11-a 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 5.1.5.11-a Power Mask

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		8C		ASCII 140
Tracking Mask	1		1C	dBHz	Not currentlv implemented
Navigation Mask	1		21	dBHz	Range 28 to 50.

Payload Length: 3 bytes

5.1.5.12 Editing Residual– Message I.D. 141

Note: Not implemented

5.1.5.13 Steady State Detection - Message I.D. 142

Note: Not implemented

5.1.5.14 Static Navigation– Message I.D. 143

Note: Not supported

5.1.5.15 Poll Clock Status – Message I.D. 144

Clock status message will be returned in response to this message.

Table 5.1.5.15-a 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 5.1.5.15-a Clock Status

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		90		ASCII 144
TBD	1		00		Reserved

Payload Length: 2 bytes

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

Table 5.1.5.16-a contains the input values for the following example:

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

The DGPS serial port is the serial port B of the **Albatros** GPS receiver

Example:

A0A20009—Start Sequence and Payload Length

910000258008010000—Payload

013FB0B3—Message Checksum and End Sequence

Table 5.1.5.16-a 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

5.1.5.17 Poll Almanac - Message I.D. 146

In response to this message receiver will return 32 almanac data packets, one for each SVID available.

Table 5.1.5.17-a 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 5.1.5.17-a Almanac

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		92		ASCII 146
TBD	1		00		Reserved

Payload Length: 2 bytes

5.1.5.18 Poll Ephemeris - Message I.D. 147

In response to this message, the receiver will return an MID_Ephemeris message with the ephemeris data for the requested SV. SV numbers range from 1-32 inclusive. If SVID 0 is requested, the module will respond by sending ephemeris data for all SV's.

Table 5.1.5.18-a 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 5.1.5.18-a Ephemeris

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		93		ASCII 147
Sv I.D[1]	1		00		Range 0 to 32
TBD	1		00		Reserved

Payload Length: 3 bytes

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

5.1.5.19 Switch Operating Modes - Message I.D. 150

This command is reserved for manufacturing testing purposes only.

5.1.5.20 Set Trickle Power Parameters - Message I.D. 151

Table 5.1.5.20-a 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 ms On Time.

A0A20009—Start Sequence and Payload Length

97000000C8000000C8—Payload

0227B0B3—Message Checksum and End Sequence

Table 5.1.5.20-a 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
Milliseconds On Time	4		000000C8	ms	range 200 - 900 ms

Payload Length: 9 bytes

If an update rate of 1 second is selected, then the on-time greater than 600ms is invalid.

5.1.5.21 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 ms). To calculate the Trickle Power update rate as a function of Duty Cycle and On Time, use the following formula:

$$\text{Off Time} = \text{On Time} - \frac{(\text{Duty Cycle} * \text{On Time})}{\text{Duty Cycle}}$$

$$\text{Update rate} = \text{Off Time} + \text{On Time}$$

Note: On Time inputs of > 900 ms will default to 1000 ms.

Following are some examples of selections:

Table 5.1.5.21-a Example of Selections for Trickle Power Mode of Operation

Mode	On Time (ms)	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 ms On Time, see "The 12-Channel Signal Level View Screen" 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 5.1.5.21-b Trickle Power Mode Support

On Time (ms)	Update Rate (sec)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
200	Y[1]	Y	Y	Y	Y	Y	Y	Y	Y	Y
300	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
400	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
500	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
600	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
700	N[2]	Y	Y	Y	Y	Y	Y	Y	Y	Y
800	N[2]	Y	Y	Y	Y	Y	Y	Y	Y	Y
900	N[2]	Y	Y	Y	Y	Y	Y	Y	Y	Y

1. Y = Yes (Mode supported)
2. 2. N = No (Duty cycle >50% = FP)

5.1.5.22 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:

$$\text{Off period} = \frac{\text{On Period}*(1\text{-Duty Cycle})}{\text{Duty Cycle}}$$

Off Period is limited to 30 minutes. The duty cycle will not be less than approximately On Period/1800, or about 1%. Push-to-Fix keeps the ephemeris for all visible satellites up to date so position/velocity fixes can generally be computed within SnapStart times (when requested by the user) on the order of 3 seconds.

5.1.5.23 Poll Navigation Parameters - Message I.D. 152

Table 5.1.5.23-a 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 5.1.5.23-a 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

5.1.5.24 Set Message Rate - Message I.D. 166

Table 5.1.5.24-a 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 5.1.5.24-a Set Message Rate

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		A6		Decimal 166
Send Now 1	1		01		Poll message
MID to be set	1		02		
Update Rate	1		05	sec	Range = 1 - 30
TBD	1		00		Reserved
TBD	1		00		Reserved
TBD	1		00		Reserved
TBD	1		00		Reserved

Payload Length: 8 bytes

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

5.1.5.25 Low Power Acquisition - Message I.D. 167

Table 5.1.5.25-a contains the input values for the following example:

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

Example: A0A20019—Start Sequence and Payload Length

A7000075300001D4C00000000000000000000000000000000000—Payload

02E1B0B3—Message Checksum and End Sequence

Table 5.1.5.25-a Set Low Power Acquisition Parameters

Name	Bytes	Binary (Hex)		Units	Description
		Scale	Example		
Message ID	1		A7		Decimal 167
Max Off Time	4		00007530	ms	Maximum time for sleep mode
Max Search Time	4		0001D4C0	ms	Max. satellite search time
TBD	4		00000000		Reserved
TBD	4		00000000		Reserved
TBD	4		00000000		Reserved
TBD	4		00000000		Reserved

Payload Length: 25 bytes

5.1.6 Output Messages for SiRF Binary Protocol

Table 5.1.6-a lists the message list for the SiRF output messages.

Table 5.1.6-a 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	Raw measurement data
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 Data	For use with test [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 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

1. Test is production testing software tool.

5.1.6.1 Measured Navigation Data Out - Message I.D. 2

Output Rate: 1 Hz

Table 5.1.6.1-a lists the binary and ASCII message data format for the measured navigation data.

Example: A0A20029—Start Sequence and Payload Length

02FFD6F78CFFBE536E003AC00400030104A0003 6B039780E3

0612190E160F04000000000000—Payload

09BBB0B3—Message Checksum and End Sequence

Table 5.1.6.1-a 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	00	m/s	Vx%8	0
Y-velocity	2	*8	03	m/s	Vx%8	0.375
Z-velocity	2	*8	01	m/s	Vx%8	0.125
Mode[1]	1		04	Bitmap[1]		4
DOP[2]	1	*5	A		/5	2.0
Mode[2]	1		00	Bitmap[3]		0
GPS Week	2		036B			875
GPS TOW	4	*100	039780E3	seconds	¸/100	602605.79
SVs in Fix	1		06			6
CH 1	1		12			18
CH 2	1		19			25
CH 3	1		0E			14
CH 4	1		16			22
CH 5	1		0F			15
CH 6	1		04			04
CH 7	1		00			00
CH 8	1		00			00
CH 9	1		00			00
CH 10	1		00			00
CH 11	1		00			00
CH 12	1		00			00

Payload Length: 41 bytes.

1. For further information, go to Table 5.1.6.1-b.
2. Dilution of precision (DOP) field contains the HDOP value only.
3. For further information, go to Table B-38.

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 5.1.6.1-b Mode 1

Mode 1		Description
Hex	**ASCII**	
0 x 00	0	No Navigation Solution
0 x 01	1	1 Satellite Solution
0 x 02	2	2 Satellite Solution
0 x 03	3	3 Satellite Solution (2D)
0 x 04	4	>=4 Satellite Solution (3D)
0 x 05	5	2D Point Solution (Least Square)
0 x 06	6	3D Point Solution (Least Square)
0 x 07	7	Dead Reckoning
0 x 08	8	Trickle Power Position
0 x 10	16	Altitude Used From Filter
0 x 20	32	Altitude Used From User
0 x 30	48	Forced Altitude (From User)
0 x 40	64	DOP Mask Exceeded
0 x 80	128	DGPS Position

Example: A value of 0 x 84 (132) is a DGPS >4 Satellite Solution (3D).

Table 5.1.6.1-c Mode 2

Mode 2		Description
Hex	ASCII	
0 x 00	0	Sensor Data
0 x 01	1	Validated (1), Unvalidated (0
0 x 02	2	if set, Dead Reckoning (Time Out)
0 x 03	3	if set, Output Edited by UI (i.e., DOP Mask exceeded)
0 x 04	4	Reserved
0 x 05	5	Reserved
0 x 06	6	Reserved
0 x 07	7	Reserved

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

Output Rate: 1 Hz

Table 5.1.6.2-a 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 5.1.6.2-a 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	s	S/100	37759
Channels	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[1]		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 1		63
C/No 1	1		1A			26
C/No 2	1		1A			63
....						

Payload Length: 188 bytes.

1. For further information, go to Table 5.1.6.2-b.

Note: Message length is fixed to 188 bytes with non tracking channels reporting zero values.

Table 5.1.6.2-b 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

Note: When a channel is fully locked and all data is valid, the status shown is 0 x BF.

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

GPS Pseudo-Range and Integrated Carrier Phase Computations Using SiRF Binary Protocol

This section describes the necessary steps to compute the GPS pseudo-range, pseudo-range rate, and integrated carrier phase data that can be used for post processing applications such as alternative navigation filters. This data enables the use of third party software to calculate and apply differential corrections based on the SiRF binary protocol.

SiRF Binary Data Messages

The Albatros GPS provides a series of output messages as described in this Guide.

This is the raw data message required to compute the pseudo-range and carrier data. The ephemeris data can be polled by the user or requested at specific intervals with customized software. Currently, there is no support for the automatic saving of the ephemeris when an update ephemeris is decoded.

Output Rate: 1 Hz

Table 5.1.6.3-a lists the binary and ASCII message data format for the raw tracker data.

Example:

A0A20033—Start Sequence and Payload Length

05000000070013003F00EA1BD4000D039200009 783000DF45E

000105B5FF90F5C200002428272723272424272 9 05000000070013003F—Payload

0B2DB0B3—Message Checksum and End Sequence

Note: The data that is sent from the GPS Receiver is in binary format, the PC communication program converts the data to ASCII for the log file. Data is NOT output in ASCII format.

Table 5.1.6.3-a Raw Tracker Data Out

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		05			5
Channel	4		00000007			7
SVid	2		0013			19
State	2		003F	Bitmap[1]		0 x 3F
Bit Number	4		00EA1BD4	bit		15342548
Millisecond Number	2		000D	ms		13
Chip Number	2		0392	chip		914
Code Phase	4	2 16	00009783	chip	/2 16	38787
Carrier Doppler	4	2 10	000DF45E	radians/2 ms	/2 10	914526
Receiver Time Tag	4		000105B5	ms		66997
Delta Carrier 2	4	2 10	FF90F5C2	cycles	/2 10	-7277118
Search Count	2		0000			0
C/No 1	1		24	dBHz		36
C/No 2	1		28	dBHz		40
C/No 3	1		27	dBHz		39
C/No 4	1		27	dBHz		39
C/No 5	1		23	dBHz		35
C/No 6	1		27	dBHz		39
C/No 7	1		24	dBHz		36
C/No 8	1		27	dBHz		36
C/No 9	1		29	dBHz		39
C/No 10	1		29	dBHz		41
Power Bad Count	1		05			5
Phase Bad Count	1		07			7
Accumulation Time	2		0013	ms		19
Track Loop Time	2		003F			63

Payload Length: 51 bytes.

1. For further information, go to Table 5.1.6.2-b.
2. Multiply by (1000 / 4pi) $/2^{16}$ to convert to Hz.

> **Note**: The status is reflected by the value of all bits as the receiver goes through each stage of satellite acquisition. The status will have a 0xBF value when a channel is fully locked and all data is valid.

Message ID: Each SiRF binary message is defined based on the ID.

Channel: Receiver channel where data was measured (range 1-12).

SVID: PRN number of the satellite on current channel.

State: Current channel tracking state (see Table 5.1.6.2-b).

Bit Number: Number of GPS bits transmitted since Sat-Sun midnight (in Greenwich) at a 50 bps rate.

Millisecond Number: Number of milliseconds of elapsed time since the last received bit (20 ms between bits).

Chip Number: Current C/A code symbol being transmitted (range 0 to 1023 chips; 1023 chips = 1 ms).

Code Phase: Fractional chip of the C/A code symbol at the time of sampling (scaled by 2 -16 , = 1/65536).

Carrier Doppler: The current value of the carrier frequency as maintained by the tracking loops.

> **Note**: The Bit Number, Millisecond Number, Chip Number, Code Phase, and Carrier Doppler are all sampled at the same receiver time.

Receiver Time Tag: This is the count of the millisecond interrupts from the start of the receiver (power on) until the measurement sample is taken.
The ms interrupts are generated by the receiver clock.

Delta Carrier Phase: The difference between the carrier phase (current) and the carrier phase (previous). Units are in carrier cycles with the LSB = 0.00185 carrier cycles. The delta time for the accumulation must be known.

> **Note**: Carrier phase measurements are not necessarily in sync with code phase measurement for each measurement epoch.

Search Count: This is the number of times the tracking software has completed full satellite signal searches

C/No: Ten measurements of carrier to noise ratio (C/No) values in dBHz at input to the receiver. Each value represents 100 ms of tracker data and its sampling time is not necessarily in sync with the code phase measurement.

Power Loss Count: The number of times the power detectors fell below the threshold between the present code phase sample and the previous code phase sample. This task is performed every 20 ms (max count is 50).

Phase Loss Count: The number of times the phase lock fell below the threshold between the present code phase sample and the previous code phase sample. This task is performed every 20 ms (max count is 50).

Integration Interval: The time in ms for carrier phase accumulation. This is the time difference (as calculated by the user clock) between the Carrier Phase (current) and the Carrier Phase (previous).

Track Loop Iteration: The tracking Loops are run at 2 ms and 10 ms intervals. Extrapolation values for each interval is 1 ms and 5 ms for range computations.

5.1.6.4 Software Version String - Message I.D. 6

Output Rate: Response to polling message

Example:

A0A20015—Start Sequence and Payload Length

0606312E322E30444B49543131392053 4D0000000000—Payload

0382B0B3—Message Checksum and End Sequence

Table 5.1.6.4-a Software Version String

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		06			6
Character	20		1			2

Payload Length: 21 bytes.

1. 06312E322E30444B49543131392053 4D0000000000
2. 1.2.0DKit119 SM

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.

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

Output Rate: 1 Hz or response to polling message

Example: A0A20014—Start Sequence and Payload Length

0703BD021549240822317923DAEF—Payload

0598B0B3—Message Checksum and End Sequence

Table 5.1.6.5-a 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	s	/100	349494.12
Svs	1		08			8
Clock Drift	4		2231	Hz		74289
Clock Bias	4		7923	nano s		128743715
Estimated GPS Time	4		DAEF	milli s		349493999

Payload Length: 20 bytes

5.1.6.6 50 BPS Data – Message I.D. 8

Output Rate: As available (12.5 minute download time)

Example: A0A2002B—Start Sequence and Payload Length

08001900C0342A9B688AB0113FDE2D714FA0A7F FFACC5540157EFFEEDFFFA

80365A867FC67708BEB5860F4—Payload

15AAB0B3—Message Checksum and End Sequence

Table 5.1.6.6-a 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.

5.1.6.7 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 5.1.6.7-a CPU Throughput

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

Payload Length: 9 bytes

5.1.6.8 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 5.1.6.8-a 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

5.1.6.9 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 5.1.6.9-a 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

5.1.6.10 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 5.1.6.10-a). Maximum is 12 satellites.

Example: A0A2002A—Start Sequence and Payload Length

0D081D002A00320F009C0032....—Payload

....B0B3—Message Checksum and End Sequence

Table 5.1.6.10-a 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
......						

5.1.6.11 Almanac Data - Message I.D. 14

Output Rate: Response to poll

Example: A0A203A1—Start Sequence and Payload Length

0E01....—Payload

....B0B3—Message Checksum and End Sequence

Table 5.1.6.11-a Almanac Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		0E			14
Sv I.D	1		01			1
AlmanacData[14][2]	28					

Payload Length: 30 bytes

Note: Each almanac entry is output in a single message.

5.1.6.12 Ephemeris Data – 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.

5.1.6.13 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 5.1.6.13-a OkToSend parameters

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		12			18
Send Indicator[1]	1		00			00

Payload Length: 2 bytes.

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

5.1.6.14 Navigation Parameters – Message I.D. 19

Output Rate:1 Response to Poll

Example:

A0A20018—Start Sequence and Payload Length

130100000000011E3C0104001E004B1E0000050 0016400C8—Payload

022DB0B3—Message Checksum and End Sequence

Table 5.1.6.14-a 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[1]	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[2]	1		04			4
Navigation Elevation Mask	2					
Navigation Power Mask	1					
Reserved	4					
DGPS Source	1					
DGPS Mode[3]	1		00			0
DGPS Timeout	1		1E	seconds		30
Reserved	4					
LP Push-to-Fix	1					
LP On-time	4					
LP Interval	4					
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.

1. See Table 5.1.5.7-a.
2. See Table 5.1.5.8-a.
3. See Table 5.1.5.9-a.

5.1.6.15 Navigation Measurement Data - Message I.D. 28

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

Example:

A0A20038—Start Sequence and Payload Length

1C00000660D015F143F62C4113F42FF3FBE95E4 17B235C468C6964B8FBC5824

15CF1C375301734.....03E801F400000000—Payload

1533B0B3—Message Checksum and End Sequence

Table 5.1.6.15-a Measurement Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		1C			28
Channel	1		00			
Time Tag	4		000660D0	ms		
Satellite ID	1		15			
GPS Software Time	8		F143F62C4113F42F	ms		
Pseudo-range	8		F3FBE95E417B235C	m		
Carrier Frequency	4		468C6964			
Carrier Phase	8		B8FBC582415CF1C3			
Time in Track	2		7530	ms		
Sync Flags	1		17			
C/No 1	1	34				
C/No 2	1					

C/No 3	1					
C/No 4	1					
C/No 5	1					
C/No 6	1					
C/No 7	1					
C/No 8	1					
C/No 9	1					
C/No 10	1					
Delta Range Interval	2		03E801F4	m		
Mean Delta Range Time	2		01F4	ms		
Extrapolation Time	2		0000	ms		
Phase Error Count	1		00			
Low Power Count	1		00			

Payload Length: 56 bytes.

5.1.6.16 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 5.1.6.16-a Measurement Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		1D			29
Satellite ID	2		000F			15
IOD	2		00B5			181
Source[1]	1		01			1
Pseudo-range Correction	4		BFC97C67	m		3217652839
Pseudo-range rate Correction	4		3CAAAAAB	m/s		1017817771
Correction Age	4		3FBFFE12	s		1069547026
Reserved	4					
Reserved	4					

Payload Length: 26 bytes.

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

5.1.6.17 Navigation 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 5.1.6.17-a SV State Data

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

Payload Length: 83 bytes

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

5.1.6.18 Navigation 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 5.1.6.18-a Navigation initialization Data

Name	Bytes	Binary (Hex)		Units	ASCII (Decimal)	
		Scale	Example		Scale	Example
Message ID	1		1F			31
Reserved	1					
Altitude Mode [1]	1		00			0
Altitude Source	1		00			0
Altitude	4		00000000			0
Degraded Mode[2]	1		01			1
Degraded Timeout	2		001E			30
Dead-reckoning Timeout	2		000F			15
Reserved	2					
Track Smoothing Mode[3]	1		00			0
Reserved	1					
Reserved	2					
Reserved	2					
Reserved	2					
DGPS Selection [4]	1		00			0
DGPS Timeout	2		0000			0
Elevation Nav. Mask	2		000F			15
Reserved	2					
Reserved	1					
Reserved	2					
Reserved	1					
Reserved	2					
Static Nav. Mode[5]	1		00			0

Reserved	2					
Position X	8					
Position Y	8					
Position Z	8					
Position Init. Source[6]	1		02			2
GPS Time	8					
GPS Week	2		0434			1076
Time Init. Source[7]	1		02			2
Drift	8					
Drift Init. Source[8]	1		02			2

Payload Length: 84 bytes

1. 0 = Use last know altitude 1 = Use user input altitude 2 = Use dynamic input from external source
2. 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
3. 0 = True 1 = False
4. 0 = Use DGPS if available 1 = Only navigate if DGPS corrections are available 2 = Never use DGPS corrections
5. 0 = True 1 = False
6. 0 = ROM position 1 = User position 2 = SRAM position 3 = Network assisted position
7. 0 = ROM time 1 = User time 2 = SRAM time 3 = RTC time 4 = Network assisted time
8. 0 = ROM clock 1 = User clock 2 = SRAM clock 3 = Calibration clock 4 = Network assisted clock

5.1.6.19 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 5.1.6.19-a 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.

5.2 NMEA PROTOCOL

The NMEA protocol is compatible with the format NMEA-0183 defined by the National Marine Electronics Association, Standard for Interfacing Marine Electronic Devices, version 2.20, 01/01/1997.

5.2.1 NMEA Output Messages

Table 5.2.1-a lists each of the NMEA output messages supported by the **Albatros** GPS Receiver and a brief description.

Table 5.2.1-a 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.

5.2.1.1 GGA —Global Positioning System Fixed Data

Table 5.2.1.1-a 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 5.2.1.1-a 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 5.2.1.1-b
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude 1	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

1. The Albatros GPS Receiver does not support geoid corrections. Values are WGS84 ellipsoid heights.

Table 5.2.1.1-b 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.

5.2.1.2 GLL—Geographic Position - Latitude/Longitude

Table 5.2.1.2-a contains the values for the following example:

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

Table 5.2.1.2-a 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

5.2.1.3 GSA—GNSS DOP and Active Satellites

Table 5.2.1.3-a 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 5.2.1.3-a GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 5.2.1.3-b
Mode 2	3		See Table 5.2.1.3-c
Satellite Used[1]	07		Sv on Channel 1
Satellite Used[1]	02		Sv on Channel 2
....	....		
Satellite Used[1]			Sv on Channel 12
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*33		
<CR> <LF>			End of message termination

1. Satellite used in solution.

Table 5.2.1.3-b Mode 1

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

Table 5.2.1.3-c Mode 2

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

5.2.1.4 GSV—GNSS Satellites in View

Table 5.2.1.4-a 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 5.2.1.4-a GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages[1]	2		Range 1 t o 3
Message Number[1]	1		Range 1 t o 3
Satellites in View	07		
Satellite ID	07		Channel 1 (Range 1 to 32)
Elevation	79	degrees	Channel 1 (Maximum 90)
Azimuth	048	degrees	Channel 1 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
....	....	....	....
Satellite ID	27		Channel 4 (Range 1 to 32)
Elevation	27	degrees	Channel 4 (Maximum 90)
Azimuth	138	degrees	Channel 4 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
Checksum	*71		
<CR> <LF>			End of message termination

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

5.2.1.5 MSS—MSK Receiver Signal

Table 5.2.1.5-a contains the values for the following example:

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

Table 5.2.1.5-a 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 "MSK—MSK Receiver Interface".

5.2.1.6 RMC—Recommended Minimum Specific GNSS Data

Table 5.2.1.6-a contains the values for the following example:

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

Table 5.2.1.6-a RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W 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[1]		degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

1. The Albatros GPS receiver does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.

5.2.1.7 VTG—Course Over Ground and Ground Speed

Table 5.2.1.7-a contains the values for the following example:

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

Table 5.2.1.7-a VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	309.62	degrees	Measured heading
Reference	T		True
Course degrees			Measured heading
Reference	M		Magnetic 1
Speed	0.13		knots Measured horizontal speed
Units	N		Knots
Speed	0.2	km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Checksum	*6E		
<CR> <LF>			End of message termination.

1. The Albatros GPS receiver does not support magnetic declination. All "course over ground" data are geodetic WGS84 directions.

5.2.2 NMEA Input Messages

NMEA input messages are provided to allow you to control the **Albatros** while in NMEA protocol mode. The GPS Receiver may be put into NMEA mode by sending the SiRF Binary protocol message "Switch To NMEA Protocol - Message I.D. 129" using a user program 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.

Transport Message

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

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

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

NMEA Input Messages

Message	MID[1]	Description
SetSerialPort	100	Set PORT A parameters and protocol
NavigationInitialization	101	Parameters required for start using X/Y/Z[2]
SetDGPSPort	102	Set PORT B parameters for DGPS input
Query/Rate Control	103	Query standard NMEA message and/or set output rate
LLANavigationInitialization	104	Parameters required for start using Lat/Lon/Alt[3]
Development Data On/Off	105	Development Data messages On/Off
MSK Receiver Interface	MSK	Command message to a MSK radio-beacon receiver.

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

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

5.2.2.1 100—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 **Albatros** GPS Receiver restarts using the saved parameters.

Table 5.2.2.1-a 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 5.2.2.1-a 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[1]	8		8,7
StopBits	1		0,1
Parity	0		0=None, 1=Odd, 2=Even
Checksum	*0C		
<CR> <LF>			End of message termination.

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

5.2.2.2 101—Navigation Initialization

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

Table 5.2.2.2-a 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 5.2.2.2-a 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 Albatros GPS[1]
TimeOfWeek	497260	seconds	GPS Time Of Week
WeekNo	921		GPS Week Number
ChannelCount	12		Range 1 to 12
ResetCfg	3		See Table 5.2.2.2-b
Checksum	*1C		
<CR> <LF>			End of message termination

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

Table 5.2.2.2-b 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.

5.2.2.3 102—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 5.2.2.3-a contains the input values for the following example:

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

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

Table 5.2.2.3-a 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.

5.2.2.4 103—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 5.2.2.4-a 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 5.2.2.4-a Query/Rate Control Data Format (See example 1.)

Name	Example	Units	Description
Message ID	$PSRF103		PSRF103 protocol header
Msg	00		See Table 5.2.2.4-b
Mode	01		0=SetRate, 1=Query
Rate	00	seconds	Output—off=0, max=255
CksumEnable	01		0=Disable Checksum, 1=Enable Checksum
Checksum	*25		
<CR> <LF>			End of message termination

Table 5.2.2.4-b Messages

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

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

5.2.2.5 104—LLA Navigation Initialization

This command is used to initialize the **Albatros** GPS 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 5.2.2.5-a 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 5.2.2.5-a 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[1]
TimeOfWeek	237759	seconds	GPS Time Of Week
WeekNo	1946		Extended GPS Week Number (1024 added)
ChannelCount	12		Range 1 to 12
ResetCfg	1		See Table 5.2.2.5-b
Checksum	*07		
<CR> <LF>			End of message termination

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

Table 5.2.2.5-b 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.

5.2.2.6 105—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 5.2.2.6-a contains the input values for the following examples:

1. Debug On

   $PSRF105,1*3E

2. Debug Off

   $PSRF105,0*3F

Table 5.2.2.6-a 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

5.2.2.7 MSK—MSK Receiver Interface

Table 5.2.2.7-a contains the values for the following example:

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

Table 5.2.2.7-a RMC Data Format

Name	Example	Units	Description
Message ID	$GPMSK		MSK protocol header
Beacon Frequency	318.0	kHz	Frequency to use
Auto/Manual Frequency 1	A		A : Auto, M : Manual
Beacon Bit Rate	100		Bits per second
Auto/Manual Bit Rate 1	M		A : Auto, M : Manual
Interval for Sending $--MSS 2	2	s	Sending of MSS messages for status.153

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

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

6 TECHNICAL DATA

Receiver		L1, C/A code
Channels		12
Maximum Solution Update Rate		10/second (1/second standard)
Satellite Reacquisition Time		100mS
SnapStart		< 2 seconds
HotStart		< 8 seconds average
Warm Start		< 38 seconds average
Cold Start		< 45 seconds average
Minimum signal tracked		-175 dBW
Maximum altitude		< 60,000 feet
Maximum velocity		< 1,000 knots
Power Consumption:	**normal mode**	440 mW (135 mA)
	Stand by	75 mW (23 mA)
	Trickle Power	30 mW (9 mA)
Voltage		3.15 - 3.6V (5V I/O tolerant)
Protocols		NMEA v2.2, SiRF Binary,
Position Accuracy		100 meter 2d RMS. SA on 1 - 5 meter, DGPS corrected

7 MAINTENANCE

7.1 TROUBLESHOOTING

7.1.1 The GPS receiver does not output data

The default protocol on port A is the NMEA protocol, at 4800,8,N,1.

The alternate protocol on port B is the SiRF protocol, at 19200,8,N,1.

The communication port B does not output anything : it is only designed to receive differential corrections.

If the GPS receiver does not output any data on the port A, check connections and alimentation. Note that the serial ports are not RS232 electrically compatible. The serial ports output 3.3V electric levels, and in order to connect the receiver to a RS232 device, it is necessary to use a 3.3V RS232 driver (for example MAX3232).

7.1.2 The GPS does not see any satellite

The antenna must be placed outside any building, with a good visibility of the sky. Trees and buildings affect signal quality.

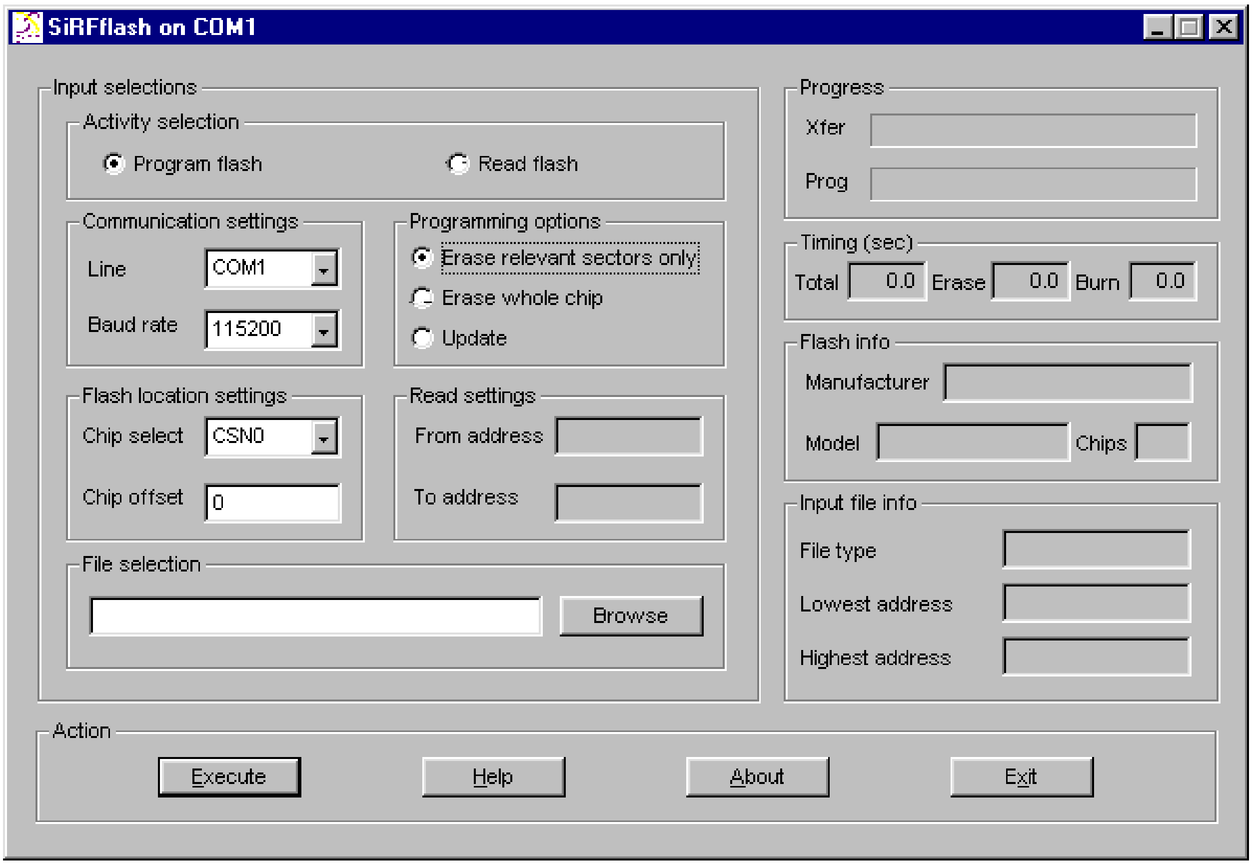
The antenna must not be covered with conductor materials (metal case, metallic paint, etc).

Check the antenna connector. Avoid connecting and removing frequently the antenna, thus it could damage the RF connector.

7.2 SOFTWARE DOWNLOADING

The **Albatros** OEM GPS Receiver allows software actualizations. Follow these steps to download the new software image in the receiver.

- Turn the GPS power off.
- Connect pins 11 and 22 of the data connector together.
- Connect the serial port A to a PC with Windows 95/98/2000/Me. Note : you cannot use a direct connection between the GPS Receiver ant the PC since the electric levels are not the same (3.3V for the GPS, RS232 for the PC).
- Execute the program SiRFFlash.exe. You will get the following screen :



- In Communication settings, select the COM port to use in the PC.

- In File selection, type the name of the image to download.
- Turn the GPS power on.
- Click on Execute, and wait for download completion.
- Turn the GPS power off.
- Disconnect pins 11 and 22 of the data connector.

8 WARRANTY

CERTIFICATE OF WARRANTY

MODEL: **ALBATROS**
SERIAL NUMBER:
DATE OF SALE:
DATE OF INSTALATION:
BUYER NAME:
ADRESS:
CITY:

SENA GPS, S.A. GUARANTEES THIS EQUIPMENT AGAINST ANY MANUFACTURING DEFECT FOR A PERIOD OF ONE YEAR AFTER THE DATE OF PURCHASE, INCLUDING COMPONENTS AND LABOUR REQUIRED FOR FACTORY REPLACEMENT OF THE DEFECTIVE PIECES

EXCLUDED FROM THIS GUARANTEE ARE PROBLEMS DUE TO INCORRECT INSTALLATION, MISUSE OR MISHANDLING OF THE EQUIPMENT. INTERNAL MANIPULATION BY PERSONS OTHER THAN THE MANUFACTURER OR HIS AUTHORIZED TECHNICAL ASSISTANCE SERVICES SHALL ALSO VOID THIS WARRANTY.

IN THE CASE OF DAMAGE, SEND THE EQUIPMENT DULY PACKAGED, POSTAGE PAID, WITH A COPY OF THE PURCHASE INVOICE OR THE WARRANTY CERTIFICATE. WE ACCEPT NO RESPONSIBILITY FOR POSSIBLE DAMAGE OCCURRING DURING TRANSPORT.

TECHNICAL SERVICE	**SIGNATURE**	**DATE**

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9 GENERAL INFORMATION

Service and information is avalable on SENA GPS web site:

http://www.senagps.com

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