Application Note AN0003

Binary Messages

Of

SkyTraq Venus 5 GPS Receiver

Ver 0.3

Feb. 1, 2007

Binary Message Protocol

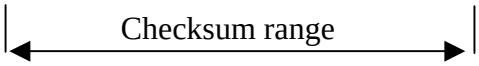
The Skytraq binary message protocol manual provides the detailed descriptions on the SkyTraq binary protocol serving as a communicating interface between SkyTraq GPS receivers and an external host such as PC, Notebook and mobile personal device. It is a standard protocol used by all SkyTraq devices and provides users a satisfactory control over the GPS receivers.

The SkyTraq GPS receiver outputs standard NMEA messages during normal operation. This NMEA messages may be a scheduled output at a specified rate subject to user's requests. The SkyTraq binary message protocol is designed with cares on reliable transmissions of data, ease & efficiency of implement, and payload independence mechanism, which ensure users to retrieve data in a most effective & flexible way. The overall binary protocol messages can be categorized as input and output messages. Input messages provide the functionality to users to control the behavior of the GPS receiver and to retrieve the detailed information of the GPS status in real-time. Output messages, on the other hand, are information strings that GPS receiver responses to requests from hosts and can optionally periodically reports the Position, Velocity and Time (PVT) via NMEA or binary messages.

BINARY MESSAGE STRUCTURE

Message Format

The following picture shows the structure of a binary message.



Start of Sequence	Payload Length (PL)	Payload		Checksum (CS)	End of Sequence
		Message ID	Message Body		
0xA0, 0xA1	Two bytes	Message ID: 1 bytes; Payload up to 65535 bytes		One byte	0x0D, 0x0A

The syntax of the message is shown below.

<0xA0,0xA1><PL><Message ID><Message Body><CS><0x0D,0x0A>

Start of Sequence

This field contains two bytes of values 0xA0, 0xA1 which indicate start of Messages.

Payload Length

The payload length (PL) field contains 16 bits of value which indicates the length of payload.

Payload

The payload field consists of 2 sub-fields, Message ID and Message Body. Message ID field defines the message ID.

Sub-Field	Values
Message ID	0x01~0xFF
Message Body	Data Bytes

Checksum

Checksum (CS) field is transmitted in all messages. The checksum field is the last field in a message before the end of sequence field. The checksum is the 8-bit exclusive OR of only the payload bytes which start from Message ID until the last byte prior to the checksum byte. A reference to the calculation of CS is provided

below,

CS = 0, N=PL;
For n = 0 to N
CS = CS ^ <Payload Byte # n>

End of Sequence

This field contains two bytes of values 0x0D, 0x0A which indicate end of Messages.

Data Byte Ordering

All payloads in binary protocol are transferred in little-endian format. The low order byte is transmitted first followed by the high order byte for data size larger than a byte (e.g. UINT32, DPFP).

Data Type Definition

UINT8	8 bit unsigned integer
UINT16	16 bit unsigned integer
UINT32	32 bit unsigned integer
SINT8	8 bit signed integer
SINT16	16 bit signed integer
SINT32	32 bit signed integer
SPFP	32 bit single precision floating point number
DPFP	64 bit double precision floating point number

MESSAGE FLOW

Host can perform actions to GPS receiver by issuing a request or a set message. The message flow between Host and GPS receiver is designed under the considerations of certain reliable transmission. SkyTraq binary message protocol requires an ACK response from the GPS receiver upon receiving a successful input message and on the other hand, requires a NACK response from the receiver to a failed input message. Figure 1 shows a message flow that a host requests information from GPS receiver and the GPS receiver responses with an ACK and information respectively. Figure 2 shows a message flow with un-successful input message. Therefore, all requests (input messages) will have a corresponding ACK or NACK to be related with. However, output messages will not require the host to confirm by an ACK or NACK back in current design.

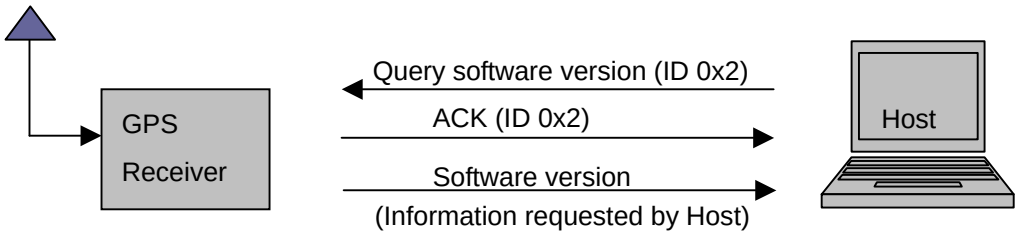


Figure 1

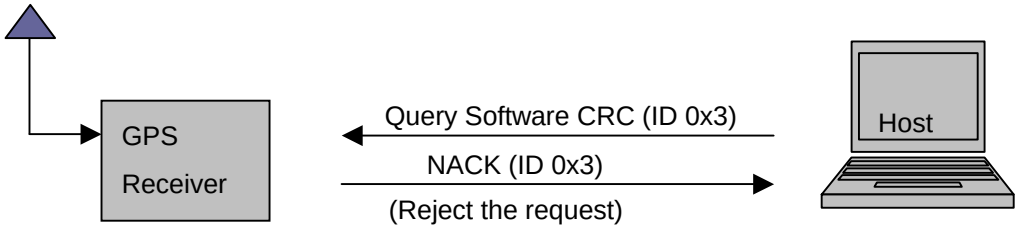


Figure 2

MESSAGE LIST

This section provides brief information about available SkyTraq binary input and output messages shown in a tabular list. All the messages are listed by Message ID. Full descriptions of input and output messages will be described in later Sections.

Input System Messages				
ID(Hex)	ID(Decimal)	Attribute	Name	Descriptions
0x1	1	Input	System Restart	Force System to restart
0x2	2	Input	Query Software version	Query revision information of software
0x3	3	Input	Query Software CRC	Query the CRC of the software
0x4	4	Input	Set Factory Defaults	Set system to factory default values
0x5	5	Input	Configure Serial Port	Set up serial port COM, baud rate, data bits, stop bits and parity
0x6	6	Input	Reserved	Reserved
0x7	7	Input	Reserved	Reserved
0x8	8	Input	Configure NMEA	Configure NMEA output message
0x9	9	Input	Configure Output Message Format	Configure the output message format from GPS receiver
Input GPS Messages				
ID(Hex)	ID(Decimal)	Attribute	Name	Descriptions
0x30	48	Input	Get ephemeris	Retrieve ephemeris data of the GPS receiver
0x31	49	Input	Set ephemeris	Set ephemeris data to the GPS receiver
Output System Messages				
ID(Hex)	ID(Decimal)	Attribute	Name	Descriptions
0x80	128	Output	Software version	Software revision of the receiver
0x81	129	Output	Software CRC	Software CRC of the receiver
0x82	130	Output	Reserved	Reserved
0x83	131	Output	ACK	ACK to a successful input message
0x84	132	Output	NACK	Response to an unsuccessful input message
Output GPS Messages				
ID(Hex)	ID(Decimal)	Attribute	Name	Descriptions
0xB1	177	Output	GPS Ephemeris Data	Ephemeris data of the GPS receiver

INPUT MESSAGES

SYSTEM RESTART – Force System to restart (0x1)

This is a request message which will reset and restart the GPS receiver. This command is issued from the host to GPS receiver and GPS receiver should respond with an ACK or NACK. The payload length is 15 bytes.

Structure:

<0xA0,0xA1>< PL><01>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 0F 01 01 D6 07 0C 12 08 32 29 C4 09 70 30 64 00 35 0D 0A

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	01		UINT8	-
2	Start Mode	01	00 = System Reset, Mode No Change 01 = System Reset, Hot start 02 = System Reset, Warm start 03 = System Reset, Cold start 04 = Test mode	UINT8	
3-4	UTC Year	D607	>= 1980	UINT16	
5	UTC Month	0C	1 ~ 12	UINT8	
6	UTC Day	12	1 ~ 31	UINT8	
7	UTC Hour	08	0 ~ 23	UINT8	
8	UTC Minute	32	0 ~ 59	UINT8	
9	UTC Second	19	0 ~ 59	UINT8	
10-11	Latitude	C409	Between – 9000 and 9000 > 0: North Hemisphere < 0: South Hemisphere	SINT16	1/100 degree
12-13	Longitude	7030	Between – 18000 and 18000 > 0: East Hemisphere < 0: West Hemisphere	SINT16	1/100 degree
14-15	Altitude	6400	Between –1000 and 18300	SINT16	Meter
Payload Length : 15 bytes					

QUERY SOFTWARE VERSION – Query revision information of loaded software (0x2)

This is a request message which is issued from the host to GPS receiver to retrieve loaded software version. The GPS receiver should respond with an ACK along with information on software version when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><02>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 02 00 02 0D 0A

1 2

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	02		UINT8	
2	Software Type	00	00 = Reserved 01 = System code	UINT8	
Payload Length : 2 bytes					

QUERY SOFTWARE CRC – Query CRC information of loaded software (0x3)

This is a request message which is issued from the host to GPS receiver to retrieve loaded software CRC. The GPS receiver should respond with an ACK along with information on software version when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><02>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 03 00 03 0D 0A

1 2

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	03		UINT8	
2	Software Type	00	00 = Reserved 01 = System code	UINT8	
Payload Length : 2 bytes					

SET FACTORY DEFAULTS – Set the system to factory default values (0x4)

This is a request message which is issued from the host to GPS receiver. It will reset the GPS receiver's internal parameters to factory default values. The GPS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The user data will be erased and filled with factory default values. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><04>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 04 00 04 0D 0A

1 2

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	04		UINT8	
2	Type	00	00 = Reserved 01 = reboot after setting to factory defaults	UINT8	
Payload Length : 2 bytes					

CONFIGURE SERIAL PORT – Set up serial port property (0x5)

This is a request message which will configure the serial COM port, baud rate. This command is issued from the host to GPS receiver and GPS receiver should respond with an ACK or NACK. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><05>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 05 00 00 00 05 0D 0A

1 2 3 4

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	05		UINT8	
2	COM port	00	00 = COM 1	UINT8	
3	Baud Rate	00	0: 4800 1: 9600 2: 19200 3: 38400 4: 57600 5: 115200	UINT8	
4	Attributes	00	0: update to SRAM 1: update to both SRAM & FLASH	UINT8	
Payload Length : 4 bytes					

CONFIGURE NMEA MESSAGE – Configure NMEA message interval (0x8)

This is a request message which will set NMEA message configuration. This command is issued from the host to GPS receiver and GPS receiver should respond with an ACK or NACK. The payload length is 9 bytes.

Structure:

<0xA0,0xA1>< PL><08>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 09 08 01 01 01 00 01 00 00 00 08 0D 0A

1 2 3 4 5 6 7 8 9

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	08		UINT8	
2	GGA Interval	01	0 ~255, 0: disable	UINT8	Second
3	GSA Interval	01	0 ~255, 0: disable	UINT8	Second
4	GSV Interval	01	0 ~255, 0: disable	UINT8	Second
5	GLL Interval	00	0 ~255, 0: disable	UINT8	Second
6	RMC Interval	01	0 ~255, 0: disable	UINT8	Second
7	VTG Interval	00	0 ~255, 0: disable	UINT8	Second
8	ZDA Interval	00	0 ~255, 0: disable	UINT8	Second
9	Attributes	00	0: update to SRAM 1: update to both SRAM & FLASH	UINT8	
Payload Length : 9 bytes					

CONFIGURE MESSAGE TYPE – Configure and select output message type (0x9)

This is a request message which will change the GPS receiver output message type. This command is issued from the host to GPS receiver and GPS receiver should respond with an ACK or NACK. The payload length is 3 bytes.

Structure:

<0xA0,0xA1>< PL><09>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 09 00 00 09 0D 0A

1 2 3

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	09		UINT8	
2	Type	00	00 : No output 01 : NMEA message 02 : Binary Message	UINT8	
3	Attributes	00	0: update to SRAM 1: update to both SRAM & FLASH	UINT8	
Payload Length : 3 bytes					

Get Ephemeris – Get ephemeris used of firmware (0x30)

This is a request message which is issued from the host to GPS receiver to retrieve ephemeris data. The GSP receiver should respond with an ACK along with information on ephemeris when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><30>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 30 00 30 0D 0A

1 2

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	30		UINT8	
2	SV #	00	0: means all SVs 1~32 : mean for the particular SV	UINT8	
Payload Length : 2 bytes					

Set Ephemeris – Set ephemeris to GPS firmware (0x31)

This is a request message which is issued from the host to GPS receiver to set ephemeris data (open an ephemeris file) to GPS receiver. The GSP receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 87 bytes.

Structure:

<0xA0,0xA1>< PL><31>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 57 31 00 02 00 77 88 04 61 10 00 00 00 00 00 00 00 00 00 00 00 00 DB DF 59 A6 00 00 1E 0A

1 2 3 …… 28 29

47 7C 00 77 88 88 DF FD 2E 35 A9 CD B0 F0 9F FD A7 04 8E CC A8 10 2C A1 0E 22 31 59 A6 74 00 77

30 31 . ……... 62 63

89 0C FF A3 59 86 C7 77 FF F8 26 97 E3 B9 1C 60 59 C3 07 44 FF A6 37 DF F0 B0 5E 0D 0A

64 65 …….. 86 87

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	31		UINT8	
2-3	SV id	0x1	Satellite id	UINT16	
4	SubFrameData[0][0]	00	Eph data subframe 1	UINT8	
5	SubFrameData[0][1]	00	Eph data subframe 1	UINT8	
6	SubFrameData[0][2]	00	Eph data subframe 1	UINT8	
7	SubFrameData[0][3]	00	Eph data subframe 1	UINT8	
8	SubFrameData[0][4]	00	Eph data subframe 1	UINT8	
9	SubFrameData[0][5]	00	Eph data subframe 1	UINT8	
10	SubFrameData[0][6]	00	Eph data subframe 1	UINT8	
11	SubFrameData[0][7]	00	Eph data subframe 1	UINT8	
12	SubFrameData[0][8]	00	Eph data subframe 1	UINT8	
13	SubFrameData[0][9]	00	Eph data subframe 1	UINT8	
14	SubFrameData[0][10]	00	Eph data subframe 1	UINT8	
15	SubFrameData[0][11]	00	Eph data subframe 1	UINT8	
16	SubFrameData[0][12]	00	Eph data subframe 1	UINT8	
17	SubFrameData[0][13]	00	Eph data subframe 1	UINT8	
18	SubFrameData[0][14]	00	Eph data subframe 1	UINT8	
19	SubFrameData[0][15]	00	Eph data subframe 1	UINT8	
20	SubFrameData[0][16]	00	Eph data subframe 1	UINT8	
21	SubFrameData[0][17]	00	Eph data subframe 1	UINT8	
22	SubFrameData[0][18]	00	Eph data subframe 1	UINT8	
23	SubFrameData[0][19]	00	Eph data subframe 1	UINT8	

24	SubFrameData[0][20]	00	Eph data subframe 1	UINT8	
25	SubFrameData[0][21]	00	Eph data subframe 1	UINT8	
26	SubFrameData[0][22]	00	Eph data subframe 1	UINT8	
27	SubFrameData[0][23]	00	Eph data subframe 1	UINT8	
28	SubFrameData[0][24]	00	Eph data subframe 1	UINT8	
29	SubFrameData[0][25]	00	Eph data subframe 1	UINT8	
30	SubFrameData[0][26]	00	Eph data subframe 1	UINT8	
31	SubFrameData[0][27]	00	Eph data subframe 1	UINT8	
32~59	SubFrameData[1][0~27]	00	Eph data subframe 2, same as field 4-31	UINT8	
60-87	SubFrameData[2][0~27]	00	Eph data subframe 3, same as field 4-31	UINT8	
Payload Length : 87 bytes					

OUTPUT MESSAGES

SOFTWARE VERSION – Software version of the GPS receiver (0x80)

This is a response message which provides the software version of the GPS receiver. This message is sent from the GPS receiver to host. The example below output the SkyTraq software version as 01.01.01-01.03.14-07.01.18 on System image. The payload length is 14 bytes.

Structure:

<0xA0,0xA1>< PL><80>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 0E 80 01 00 01 01 01 00 01 03 0E 00 07 01 12 98 0D 0A

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	80		UINT8	
2	Software Type	00	0: Reserved 1: System code	UINT8	
3-6	Kernel Version	00010001	X1.Y1.Z1 = SkyTraq Kernel Version Ex. X1=01, Y1=00, Z1=01 (1.0.1)	UINT32	
7-10	ODM version	00010307	X1.Y1.Z1 = SkyTraq Version Ex. X1=01, Y1=03, Z1=01 (1.3.1)	UINT32	
11-14	Revision	00060C0F	YYMMDD = SkyTraq Revision Ex. YY=06, MM=01, DD=10 (060110)	UINT32	
Payload Length : 14 bytes					

SOFTWARE CRC – Software CRC of the GPS receiver (0x81)

This is a response message which provides the software CRC of the GPS receiver. This message is sent from the GPS receiver to host. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><81>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 81 01 98 76 6E 0D 0A

1 2 3 4

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	81		UINT8	
2	Software Type	00	0: Reserved 1: System code	UINT8	
3-4	CRC	9876	CRC value	UINT16	
Payload Length : 4 bytes					

ACK – Acknowledgement to a Request Message (0x83)

This is a response message which is an acknowledgement to a request message. The payload length is 2 bytes

Structure:

<0xA0,0xA1>< PL><83>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 83 02 81 0D 0A

1 2

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	83		UINT8	
2	ACK ID	02	Message ID of the request message	UINT8	
Payload Length : 2 bytes					

NACK – Response to an unsuccessful request message (0x84)

This is a response message which is a response to an unsuccessful request message. This is used to notify the Host that the request message has been rejected. The payload length is 2 bytes

Structure:

<0xA0,0xA1>< PL><84>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 84 01 82 0D 0A

1 2

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	84		UINT8	
2	ACK ID	01	Message ID of the request message	UINT8	
Payload Length : 2 bytes					

GPS Ephemeris data – ephemeris data of the GSP receiver (0xB1)

This is a response message which provides the Ephemeris Data of the GPS receiver to Host. The Host will save the ephemeris data as an ephemeris file. This message is sent from the GPS receiver to host. The payload length is 87 bytes.

Structure:

<0xA0,0xA1>< PL><B1>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 57 B1 00 02 00 77 88 04 61 10 00 00 00 00 00 00 00 00 00 00 00 00 DB DF 59 A6 00 00 1E 0A

1 2 3 …… 28 29

47 7C 00 77 88 88 DF FD 2E 35 A9 CD B0 F0 9F FD A7 04 8E CC A8 10 2C A1 0E 22 31 59 A6 74 00 77

30 31 . ……... 62 63

89 0C FF A3 59 86 C7 77 FF F8 26 97 E3 B9 1C 60 59 C3 07 44 FF A6 37 DF F0 B0 5E 0D 0A

64 65 …….. 86 87

Field	Name	Example(hex)	Description	Type	Unit
1	Message ID	B1		UINT8	
2-3	SV id	0x1	Satellite id	UINT16	
4	SubFrameData[0][0]	00	Eph data subframe 1	UINT8	
5	SubFrameData[0][1]	00	Eph data subframe 1	UINT8	
6	SubFrameData[0][2]	00	Eph data subframe 1	UINT8	
7	SubFrameData[0][3]	00	Eph data subframe 1	UINT8	
8	SubFrameData[0][4]	00	Eph data subframe 1	UINT8	
9	SubFrameData[0][5]	00	Eph data subframe 1	UINT8	
10	SubFrameData[0][6]	00	Eph data subframe 1	UINT8	
11	SubFrameData[0][7]	00	Eph data subframe 1	UINT8	
12	SubFrameData[0][8]	00	Eph data subframe 1	UINT8	
13	SubFrameData[0][9]	00	Eph data subframe 1	UINT8	
14	SubFrameData[0][10]	00	Eph data subframe 1	UINT8	
15	SubFrameData[0][11]	00	Eph data subframe 1	UINT8	
16	SubFrameData[0][12]	00	Eph data subframe 1	UINT8	
17	SubFrameData[0][13]	00	Eph data subframe 1	UINT8	
18	SubFrameData[0][14]	00	Eph data subframe 1	UINT8	
19	SubFrameData[0][15]	00	Eph data subframe 1	UINT8	
20	SubFrameData[0][16]	00	Eph data subframe 1	UINT8	
21	SubFrameData[0][17]	00	Eph data subframe 1	UINT8	
22	SubFrameData[0][18]	00	Eph data subframe 1	UINT8	
23	SubFrameData[0][19]	00	Eph data subframe 1	UINT8	

24	SubFrameData[0][20]	00	Eph data subframe 1	UINT8	
25	SubFrameData[0][21]	00	Eph data subframe 1	UINT8	
26	SubFrameData[0][22]	00	Eph data subframe 1	UINT8	
27	SubFrameData[0][23]	00	Eph data subframe 1	UINT8	
28	SubFrameData[0][24]	00	Eph data subframe 1	UINT8	
29	SubFrameData[0][25]	00	Eph data subframe 1	UINT8	
30	SubFrameData[0][26]	00	Eph data subframe 1	UINT8	
31	SubFrameData[0][27]	00	Eph data subframe 1	UINT8	
32~59	SubFrameData[1][0~27]	00	Eph data subframe 2, same as field 4-31	UINT8	
60-87	SubFrameData[2][0~27]	00	Eph data subframe 3, same as field 4-31	UINT8	
Payload Length : 87 bytes					

Change Log

Ver 0.3, Feb 1, 2007

1. Format of system restart command (Start Mode field) has been changed.
2. Add Kernel version to the output software version message.
3. Add GPS ephemeris related commands.
4. Change version number of this document to be the same as GUI view version number.

Ver 0.2, Dec 20, 2006

1. modify some examples

Ver 0.1, Nov 29, 2006

1. Initial release.

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