

Application Note AN0028

Binary Messages

Of

SkyTraq Venus 8 GNSS Receiver

Ver 1.4.40

Oct 13, 2016

Binary Message Protocol

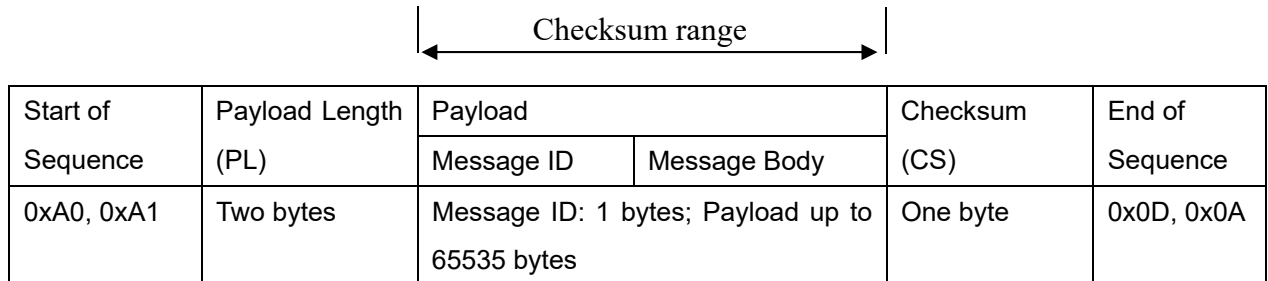
The SkyTraq binary message protocol manual provides the detailed descriptions on the SkyTraq binary protocol serving as a communicating interface between SkyTraq GNSS receivers and an external host such as PC, Notebook and mobile personal device. It is a standard protocol used by all SkyTraq devices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

The SkyTraq GNSS 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 GNSS receiver and to retrieve the detailed information of the GNSS status in real-time. Output messages, on the other hand, are information strings that GNSS 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.



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 (ID) | 0x01~0xFF |
| Message Body | Data Bytes |

Message Body

The Message Body may further consist of 2 sub-fields, Sub-Message ID (Sub-ID) and Sub-Message Body.

| Sub-Field | Values |
|-----------|--------|
| | |

| | |
|---------------------|------------|
| Sub-Message ID(SID) | 0x01~0xFF |
| Sub-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,

$$CS = 0, N=PL;$$

$$\text{For } n = 0 \text{ to } N$$

$$CS = CS \oplus \langle \text{Payload Byte } \# n \rangle$$

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 big-endian format. The high order byte is transmitted first followed by the low 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 GNSS receiver by issuing a request or a set message. The message flow between Host and GNSS receiver is designed under the considerations of certain reliable transmission. SkyTraq binary message protocol requires an ACK response from the GNSS 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 GNSS receiver and the GNSS receiver responds 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.

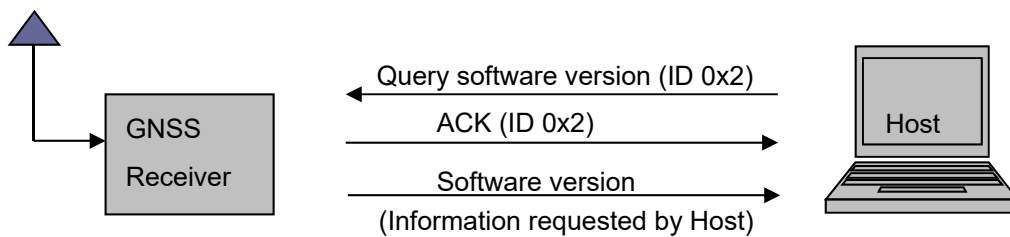


Figure 1

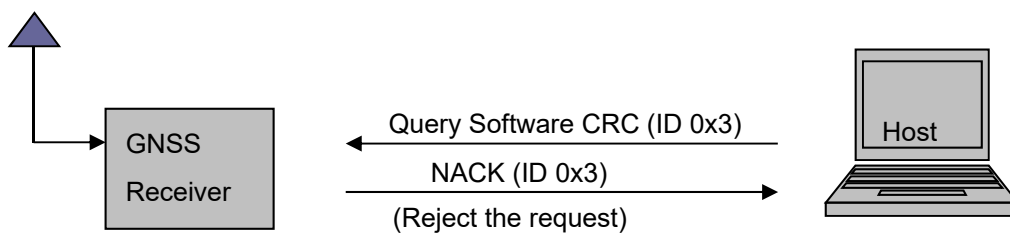


Figure 2

MESSAGE LIST

This section provides brief information about available SkyTraq binary input, output and sub-id 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 Message Type | Configure and select the output message type |
| 0xB | 11 | Input | Software Image Download | Software image download to system flash |
| 0xC | 12 | Input | Configure Power Mode | Set system power mode |
| 0xE | 14 | Input | Configure Position Update Rate | Configure the position update rate of GNSS system |
| 0x10 | 16 | Input | Query Position Update Rate | Query the position update rate of GNSS system |
| 0x11 | 17 | Input | Configure Navigation Data Message Interval | Configure the navigation output message interval |
| 0x15 | 21 | Input | Query Power Mode | Query the power mode status of GNSS receiver |
| Input GNSS Messages | | | | |
| ID (Hex) | ID (Decimal) | Attribute | Name | Descriptions |
| 0x29 | 41 | Input | Configure Datum | Configure Datum of the GNSS receiver |
| 0x2A | 42 | Input | Configure DOP Mask | Configure values of DOP mask |
| 0x2B | 43 | Input | Configure Elevation and CNR Mask | Configure values of Elevation and CNR Mask |
| 0x2D | 45 | Input | Query Datum | Query datum used by the GNSS receiver |

| | | | | |
|--------------------|----|-------|--|--|
| 0x2E | 46 | Input | Query DOP Mask | Query the information of DOP mask used by GNSS receiver |
| 0x2F | 47 | Input | Query Elevation and CNR Mask | Query the values of elevation mask and CNR mask used by GNSS receiver |
| 0x30 | 48 | Input | Get GPS Ephemeris | Retrieve GPS ephemeris data of the GNSS receiver |
| 0x39 | 57 | Input | Configure Position Pinning | Enable or disable position pinning of GNSS receiver |
| 0x3A | 58 | Input | Query Position Pinning | Query position pinning status of the GNSS receiver |
| 0x3B | 59 | Input | Configure Position Pinning Parameters | Set position pinning parameters of GNSS receiver |
| 0x41 | 65 | Input | Set GPS Ephemeris | Set GPS ephemeris data to the GNSS receiver |
| 0x44 ^{*1} | 68 | Input | Query 1PPS Timing | Query 1PPS timing of the GNSS receiver |
| 0x45 | 69 | Input | Configure 1PPS Cable Delay | Configure cable delay of 1PPS timing |
| 0x46 | 70 | Input | Query 1PPS Cable Delay | Query 1PPS cable delay of GNSS receiver |
| 0x4B | 75 | Input | Configure NMEA talker ID | Configure NMEA talker ID of GNSS receiver |
| 0x4F | 79 | Input | Query NMEA talk ID | Query NMEA talker ID of GNSS receiver |
| 0x50 | 80 | Input | Get GPS Almanac | Retrieve GPS almanac data of the GNSS receiver |
| 0x51 | 81 | Input | Set GPS Almanac | Set GPS almanac data to the GNSS receiver |
| 0x54 ^{*1} | 84 | Input | Configure 1PPS Timing | Configure 1PPS timing of GNSS receiver |
| 0x5B | 91 | Input | Get GLONASS Ephemeris | Retrieve GLONASS ephemeris data of the GNSS receiver |
| 0x5C | 92 | Input | Set GLONASS Ephemeris | Set GLONASS ephemeris data to the GNSS receiver |
| 0x5D | 93 | Input | Get GLONASS Almanac | Retrieve GLONASS almanac data of the GNSS receiver |
| 0x5E | 94 | Input | Set GLONASS Almanac | Set GLONASS almanac data to the GNSS receiver |
| 0x5F | 95 | Input | Get GLONASS Time Correction Parameters | Retrieve GLONASS time correction parameters τ_C and τ_{GPS} of the GNSS receiver |

| 0x60 | 96 | Input | Set GLONASS Time Correction Parameters | Set GLONASS time correction parameters τ_C and τ_{GPS} to the GNSS receiver |
|----------------------|---------------------|-----------|---|---|
| Messages with Sub-ID | | | | |
| ID/Sub-ID (Hex) | ID/Sub-ID (Decimal) | Attribute | Name | Descriptions |
| 0x62/0x1 | 98/1 | Input | Configure SBAS | Configure SBAS parameters of GNSS receiver |
| 0x62/0x2 | 98/2 | Input | Query SBAS Status | Query SBAS status of GNSS receiver |
| 0x62/0x3 | 98/3 | Input | Configure QZSS | Configure QZSS parameters of GNSS receiver |
| 0x62/0x4 | 98/4 | Input | Query QZSS Status | Query QZSS status of GNSS receiver |
| 062/0x80 | 98/128 | Output | SBAS Status | SBAS status of GNSS receiver |
| 062/0x81 | 98/129 | Output | QZSS Status | QZSS status of GNSS receiver |
| 0x63/0x1 | 99/1 | Input | Configure SAEE | Configure SAEE of GNSS receiver |
| 0x63/0x2 | 99/2 | Input | Query SAEE | Query SAEE of GNSS receiver |
| 0x63/0x80 | 99/128 | Output | SAEE status | SAEE status of GNSS receiver |
| 0x64/0x1 | 100/1 | Input | Query Boot Status | Query boot status of GNSS receiver |
| 0x64/0x2 | 100/2 | Input | Configure Extended NMEA Message Interval | Configure extended NMEA message interval of GNSS Receiver |
| 0x64/0x3 | 100/3 | Input | Query Extended NMEA Message Interval | Query extended NMEA message interval of GNSS receiver |
| 0x64/0x6 | 100/6 | Input | Configure Interference Detection | Configure interference detection of GNSS receiver |
| 0x64/0x7 | 100/7 | Input | Query Interference Detection Status | Query interference detection status of GNSS receiver |
| 0x64/0xA | 100/10 | Input | Configure GPS parameter search engine number | Configure parameter search engine number of GPS receiver |
| 0x64/0xB | 100/11 | Input | Query GPS Parameter Search Engine Number | Query parameter search engine number of GPS receiver |
| 0x64/0x11 | 100/17 | Input | Configure Position Fix Navigation Mask | Configure the position fix mask of GNSS receiver |
| 0x64/0x12 | 100/18 | Input | Query Position Fix Navigation Mask | Query the position fix of GNSS receiver |
| 0x64/0x15 | 100/21 | Input | Configure UTC Reference Time Sync to GPS Time | Configure UTC reference time to GPS receiver to synchronize to GPS time |

| | | | | |
|-----------|---------|--------|---|---|
| 0x64/0x16 | 100/22 | Input | Query UTC Reference Time Sync to GPS Time | Query the UTC reference time of GPS receiver set to synchronize to GPS time |
| 0x64/0x17 | 100/23 | Input | Configure GNSS Navigation Mode | Configure the navigation mode of GNSS receiver |
| 0x64/0x18 | 100/24 | Input | Query GNSS Navigation Mode | Query the navigation mode of GNSS receiver |
| 0x64/0x19 | 100/25 | Input | Configure GNSS constellation type for navigation solution | Configure the GNSS constellation type used for navigation solution |
| 0x64/0x1A | 100/26 | Input | Query GNSS constellation type for navigation solution | Query the GNSS constellation type used for navigation solution |
| 0x64/0x1F | 100/31 | Input | Configure GPS/UTC leap seconds | Configure GPS/UTC leap seconds of GNSS receiver |
| 0x64/0x20 | 100/32 | Input | Query GPS Time | Query GPS time of GNSS receiver |
| 0x64/0x27 | 100/39 | Input | Configure GNSS Datum Index | Configure GNSS datum index of GNSS receiver |
| 0x64/0x28 | 100/40 | Input | Query GNSS Datum Index | Query GNSS datum index of GNSS receiver |
| 0x64/0x2F | 100/47 | Input | Configure GNSS Geo-Fencing Data | Configure geo-fencing data to GNSS receiver |
| 0x64/0x30 | 100/48 | Input | Query GNSS Geo-Fencing Data | Query geo-fencing data of GNSS receiver |
| 0x64/0x31 | 100/49 | Input | Query GNSS Geo-Fencing Result | Query geo-fencing result of GNSS receiver |
| 0x64/0x80 | 100/128 | Output | GNSS Boot Status | Boot status of the GNSS receiver |
| 0x64/0x81 | 100/129 | Output | Extended NMEA Message Interval | Extended NMEA message interval of GNSS receiver |
| 0x64/0x83 | 100/131 | Output | Interference Detection Status | Interference detection status of GNSS receiver |
| 0x64/0x85 | 100/133 | Output | GPS Parameter search engine number | Parameter search engine number of GPS receiver |
| 0x64/0x88 | 100/136 | Output | Position Fix Navigation Mask | Position fix navigation mask of GNSS receiver |
| 0x64/0x8B | 100/139 | Output | GNSS Navigation Mode | Navigation mode of GNSS receiver |
| 0x64/0x8C | 100/140 | Output | GNSS constellation type for navigation solution | Replying the GNSS constellation type used for navigation solution |
| 0x64/0x8E | 100/142 | Output | GPS Time | GPS time of GNSS receiver |

| | | | | |
|-------------------------------|---------------------|------------------|---------------------------------|---|
| 0x64/0x92 | 100/146 | Output | GNSS Datum Index | Datum Index of GNSS receiver |
| 0x64/0x96 | 100/150 | Output | GNSS Geo-Fencing Data | Geo-Fencing Data of GNSS receiver |
| 0x64/0x97 | 100/151 | Output | GNSS Geo-Fencing Result | Geo-Fencing Result of GNSS receiver |
| 0x65/0x1 | 101/1 | Input | Configure 1PPS Pulse Width | Configure 1PPS pulse width of GNSS receiver |
| 0x65/0x2 | 101/2 | Input | Query 1PPS Pulse Width | Query 1PPS pulse width of GNSS receiver |
| 0x65/0x3 | 101/3 | Input | Configure 1PPS Frequency Output | Configure 1PPS frequency output of GNSS receiver |
| 0x65/0x4 | 101/4 | Input | Query 1PPS Frequency Output | Query 1PPS frequency output of GNSS receiver |
| 0x65/0x80 | 101/128 | Output | 1PPS Pulse Width | 1PPS pulse width of GNSS receiver |
| 0x65/0x81 | 101/129 | Output | GNSS 1PPS Frequency Output | 1PPS frequency output of GNSS receiver |
| 0x67/0x1 | 103/1 | Input | Set Beidou Ephemeris Data | Set BEIDOU ephemeris data to the GNSS receiver |
| 0x67/0x2 | 103/2 | Input | Get Beidou Ephemeris Data | Retrieve BEIDOU ephemeris data of the GNSS receiver |
| 0x67/0x3 | 103/3 | Input | Set Beidou Almanac Data | Set BEIDOU almanac data to the GNSS receiver |
| 0x67/0x4 | 103/4 | Input | Get Beidou Almanac Data | Retrieve BEIDOU almanac data of the GNSS receiver |
| 0x67/0x80 | 103/128 | Output | Beidou Ephemeris Data | Beidou ephemeris data of the GNSS receiver |
| 0x67/0x81 | 103/129 | Output | Beidou Almanac Data | Beidou almanac data of the GNSS receiver |
| 0x6A/0x1 | 106/1 | Input | Configure RTK Mode | Configure Real Time Kinematic mode of GNSS receiver |
| 0x6A/0x2 | 106/2 | Input | Query RTK Mode | Query Real Time Kinematic mode of GNSS receiver |
| 0x6A/0x80 | 106/128 | Output | RTK Mode | Real Time Kinematic mode of GNSS 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 |
| 0x86 | 134 | Output | Position Update Rate | Position update rate of GNSS system |
| 0x90 | 144 | Output | GLONASS Ephemeris Data | GLONASS ephemeris data of the GNSS receiver |
| 0x91 | 145 | Output | GLONASS Almanac Data | GLONASS almanac data of the GNSS receiver |
| 0x92 | 146 | Output | GLONASS Time Correction Parameters | GLONASS time correction parameters τ_C and τ_{GPS} |
| 0x93 | 147 | Output | GNSS NMEA Talker ID | NMEA Talker ID of GNSS receiver |
| Output GNSS Messages | | | | |
| ID (Hex) | ID (Decimal) | Attribute | Name | Descriptions |
| 0xA8 | 168 | Output | Navigation Data Message | Output user navigation data in binary format |
| 0xAE | 174 | Output | GNSS Datum | Datum used by the GNSS receiver |
| 0xAF | 175 | Output | GNSS DOP Mask | DOP Mask used by the GNSS receiver |
| 0xB0 | 176 | Output | Elevation and CNR Mask | Elevation and CNR Mask used by the GNSS receiver |
| 0xB1 | 177 | Output | GPS Ephemeris Data | GPS ephemeris data of the GNSS receiver |
| 0xB4 | 180 | Output | GNSS Position Pinning Status | Position pinning status of the GNSS receiver |
| 0xB9 | 185 | Output | GNSS Power Mode Status | Power mode status of GNSS receiver |
| 0xBB | 187 | Output | GNSS 1PPS Cable Delay | 1PPS cable delay of the GNSS receiver |
| 0xBE | 190 | Output | GPS Almanac Data | GPS almanac data of the GNSS receiver |
| 0xC2 ^{*1} | 194 | Output | GNSS 1PPS Timing | 1PPS timing information of the GNSS receiver |

*1: supported only in Venus838LPx-T, S1216F8-T timing mode receivers.

INPUT MESSAGES

SYSTEM RESTART – Force System to restart (0x1)

This is a request message which will reset and restart the GNSS receiver. This command is issued from the host to GNSS receiver and GNSS 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 07 D8 0B 0E 08 2E 03 09 C4 30 70 00 64 16 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 = Reserved 01 = System Reset, Hot start 02 = System Reset, Warm start 03 = System Reset, Cold start 04 = Reserved | UINT8 | |
| 3-4 | UTC Year | 07D8 | >= 1980 | UINT16 | |
| 5 | UTC Month | 0B | 1 ~ 12 | UINT8 | |
| 6 | UTC Day | 0E | 1 ~ 31 | UINT8 | |
| 7 | UTC Hour | 08 | 0 ~ 23 | UINT8 | |
| 8 | UTC Minute | 2E | 0 ~ 59 | UINT8 | |
| 9 | UTC Second | 03 | 0 ~ 59 | UINT8 | |
| 10-11 | Latitude | 09C4 | Between – 9000 and 9000 > 0: North Hemisphere < 0: South Hemisphere | SINT16 | 1/100 degree |
| 12-13 | Longitude | 3070 | Between – 18000 and 18000 > 0: East Hemisphere < 0: West Hemisphere | SINT16 | 1/100 degree |
| 14-15 | Altitude | 0064 | 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 GNSS receiver to retrieve loaded software version. The GNSS receiver should respond with an ACK along with information of software version, “**SOFTWARE VERSION, ID: 0x80**”, 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 GNSS receiver to retrieve loaded software CRC. The GNSS receiver should respond with an ACK along with information of software CRC, “**SOFTWARE CRC, ID: 0x81**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><03>< 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 GNSS receiver. It will reset the GNSS receiver’s internal parameters to factory default values. The GNSS receiver should respond with an ACK when succeeded and should respond with a 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 GNSS receiver and GNSS 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 6: 230400 7: 460800 8: 921600 | UINT8 | |
| 4 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH 2. temporarily | 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 GNSS receiver and GNSS 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 GNSS receiver output message type. This command is issued from the host to GNSS receiver and GNSS 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 | | | | | |

SOFTWARE IMAGE DOWNLOAD – Download software image to system flash (0xB)

This is a request message which is issued from the host to GNSS receiver to download image to system flash. The GNSS receiver should respond with an ACK when succeeded and should respond with a NACK when failed. The payload length is 6 bytes.

Structure:

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

Example:

A0 A1 00 06 0B 07 00 00 00 00 0C 0D 0A
 1 2 3 4 5 6

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-------------------|--------------|--|--------|------|
| 1 | Message ID | 0B | | UINT8 | |
| 2 | Baud | 07 | 0: 4800 1: 9600 2: 19200 3: 38400 4: 57600 5: 115200 6: 230400 7: 460800 8: 921600 | UINT8 | |
| 3 | Flash Type | 00 | 0: default, auto 1: QSPI Winbond 2. QSPI EON 3: Parallel Flash NUMONYX 4. Parallel Flash EON | UINT8 | |
| 4-5 | Flash ID | 00 00 | If field 3 is not 0, then need to specify the flash ID | UINT16 | |
| 6 | Buffer Used Index | 00 | 0:8k 1:16K 2:24K 3:32K | UINT8 | |
| Payload Length : 6 bytes | | | | | |

CONFIGURE SYSTEM POWER MODE –Set the power mode of GNSS system (0xC)

This is a request message which is issued from the host to GNSS receiver to configure the system power mode. By default power save mode is enabled, to reduce current consumption by the search engine. The GNSS receiver should respond with an ACK when succeeded and should respond with a NACK when failed. The payload length is 3 bytes.

Structure:

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

Example:

A0 A1 00 03 0C 00 00 0C 0D 0A
 1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|---|-------|------|
| 1 | Message ID | 0C | | UINT8 | |
| 2 | Mode | 00 | 00 = Normal (disable) 01 = Power Save (enable) | UINT8 | |
| 3 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH 2: temporarily enabled | UINT8 | |
| Payload Length : 3 bytes | | | | | |

CONFIGURE SYSTEM POSITION RATE – Configure the position update rate of GNSS system (0xE)

This is a request message which is issued from the host to GNSS receiver to configure the system position update rate. Receivers with position rate 4 or higher needs to configure baud rate to 38400 or higher value. The GNSS receiver should respond with an ACK when succeeded and should respond with a NACK when failed. The payload length is 3 bytes.

Structure:

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

Example:

A0 A1 00 03 0E 01 00 0F 0D 0A
 1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|--|-------|------|
| 1 | Message ID | 0E | | UINT8 | |
| 2 | Rate | 01 | Value with 1, 2, 4, 5, 8, 10, 20, 25, 40, 50 01: 1Hz update rate Note: value with 4 ~10 should work with baud rate 38400 or higher, value with 20 should work with baud rate 115200 or higher, value with 40, 50 should work with 230400 | UINT8 | |
| 3 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 3 bytes | | | | | |

QUERY POSITION UPDATE RATE – Query the position update rate of GNSS system (0x10)

This is a request message which is issued from the host to GNSS receiver to query position update rate. The GNSS receiver should respond with an ACK along with information of position update rate, “**POSITION UPDATE RATE, ID: 0x86**”, when succeeded and should respond with an NACK when failed. The payload length is 1 byte.

Structure:

<0xA0,0xA1>< PL><10>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 01 10 10 0D 0A

1

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 10 | | UINT8 | |
| Payload Length : 1 byte | | | | | |

CONFIGURE NAVIGATION DATA MESSAGE INTERVAL – Configure binary navigation data message interval (0x11)

This is a request message which will set navigation data message interval. The navigation message is one of SkyTraq binary messages. This command is issued from the host to GNSS receiver and GNSS receiver should respond with an ACK or NACK. The payload length is 3 bytes.

Structure:

<0xA0,0xA1>< PL><11>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 11 01 00 10 0D 0A

1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-----------------------------|--------------|---|-------|--------|
| 1 | Message ID | 11 | | UINT8 | |
| 2 | Navigation Message Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 3 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 3 bytes | | | | | |

QUERY POWER MODE – Query status of power mode of GNSS receiver (0x15)

This is a request message which is issued from the host to GNSS receiver to query power mode status. The GNSS receiver should respond with an ACK along with power mode status, “**GNSS POWER MODE STATUS, ID: 0xB9**”, when succeeded and should respond with a NACK when failed. The payload length is 1 byte.

Structure:

<0xA0,0xA1>< PL><15>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 01 15 15 0D 0A

1

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 15 | | UINT8 | |
| Payload Length : 1 byte | | | | | |

CONFIGURE DATUM – Configure datum used for GNSS position transformation (0x29)

This is a request message which will setup parameters used for GNSS position transformation. This command is issued from the host to GNSS receiver and GNSS receiver should respond with an ACK or NACK. The payload length is 19 bytes.

Structure:

<0xA0,0xA1>< PL><29>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 13 29 00 13 07 FF 7A FF 97 FE D9 00 7D DF 39 00 46 F4 10 00 CE 0D 0A
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

| Field | Name | Example(hex) | Description | Type | Unit |
|---------------------------|---------------------|--------------|---|--------|-------|
| 1 | Message ID | 29 | | UINT8 | |
| 2-3 | index | 0013 | Refer to Appendix B for available Datum | UINT16 | |
| 4 | Ellip idx | 07 | Refer to Appendix A for available Value | UINT8 | |
| 5-6 | Delta X | FF7A | Refer to Appendix A and B for available Delta X | SINT16 | Meter |
| 7-8 | Delta Y | FF97 | Refer to Appendix A and B for available Delta Y | SINT16 | Meter |
| 9-10 | Delta Z | FED9 | Refer to Appendix A and B for available Delta Z | SINT16 | Meter |
| 11-14 | Semi-major axis | 007DDF39 | Refer to Appendix A | UINT32 | |
| 15-18 | Inversed Flattening | 0046F410 | Refer to Appendix A | UINT32 | |
| 19 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 19 bytes | | | | | |

- In order to reduce number of bytes to send in the configure datum command, the Semi-Major Axis is to be deducted by 6,370,000, with the result multiplied by 1,000.
 Thus if converting 6,378,249.145 the result would be: 6,378,249.145 – 6,370,000 equals 8,249.145 And converting 8,249.145 x 1000 to hex is 007DDF39.
- Same as for Inversed Flattening which is to be deducted by 293; with the result multiplied by 10,000,000 then converted to hex.
- The exception is: the Inversed Flattening for Ellipsoid index 20 and 23 will lose precision after deducting by 293, multiply by 10,000,000 and convert to hex. Therefore, upon receiving the configure datum command, our firmware will use the internal hardcoded inversed flattening values for of 20 and 23, regardless of what is sent in the set datum command.

CONFIGURE DOP MASK – Configure values of DOP mask (0x2A)

This is a request message which will set the GNSS receiver DOP mode and its corresponding mask. This command is issued from the host to GNSS receiver and GNSS receiver should respond with an ACK or NACK. If either value of PDOP, HDOP or GDOP is not valid, the GNSS receiver will respond with an NACK. The payload length is 9 bytes.

Structure:

<0xA0,0xA1>< PL><2A>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 09 2A 01 00 32 00 32 00 32 00 19 0D 0A
 1 2 3 4 5 6 7 8 9

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-----------------|--------------|---|--------|------|
| 1 | Message ID | 2A | | UINT8 | |
| 2 | DOP Mode Select | 01 | 00 : Disable 01 : Auto mode, PDOP when 3-D fix and HDOP when 2-D fix 02 : PDOP only 03 : HDOP only 04 : GDOP only | UINT8 | |
| 3-4 | PDOP Value | 0032 | Valid values between 0.5~30 Valid input value 5 ~ 300 | UINT16 | 0.1 |
| 5-6 | HDOP Value | 0032 | Valid values between 0.5~30 Valid input value 5 ~ 300 | UINT16 | 0.1 |
| 7-8 | GDOP Value | 0032 | Valid values between 0.5~30 Valid input value 5 ~ 300 | UINT16 | 0.1 |
| 9 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 9 bytes | | | | | |

CONFIGURE ELEVATION AND CNR MASK – Configure values of elevation and CNR mask (0x2B)

This is a request message which will configure the satellite elevation and CNR mask of GNSS receiver. This command is issued from the host to GNSS receiver and GNSS receiver should respond with an ACK or NACK. If either value of elevation or CNR mask is not valid, the GNSS receiver will respond with an NACK. The payload length is 5 bytes.

Structure:

<0xA0,0xA1>< PL><2B>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 05 2B 01 05 0A 00 25 0D 0A
 1 2 3 4 5

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-------------------------------|--------------|---|-------|--------|
| 1 | Message ID | 2B | | UINT8 | |
| 2 | Elevation and CNR Mode Select | 01 | 00 : Disable 01 : Elevation and CNR both 02 : Elevation only 03 : CNR only | UINT8 | |
| 3 | Elevation Mask | 05 | Valid values between 3~85 | UINT8 | Degree |
| 4 | CNR Mask | 0A | Valid values between 0~40 | UINT8 | dB |
| 5 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 5 bytes | | | | | |

QUERY DATUM – Query datum used by the GNSS receiver (0x2D)

This is a request message which is issued from the host to GNSS receiver to retrieve used datum information. The GNSS receiver should respond with an ACK along with the datum information, “**GNSS DATUM, ID: 0xAE**”, when succeeded and should respond with an NACK when failed. The payload length is 1 byte.

Structure:

<0xA0,0xA1>< PL><2D>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 01 2D 2D 0D 0A

1

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 2D | | UINT8 | |
| Payload Length : 1 byte | | | | | |

QUERY DOP MASK – Query information of DOP mask used by the GNSS receiver (0x2E)

This is a request message which is issued from the host to GNSS receiver to retrieve information of DOP mask. The GNSS receiver should respond with an ACK along with DOP mask information, **“GNSS DOP MASK, ID: 0xAF”**, when succeeded and should respond with an NACK when failed. The payload length is 1 byte.

Structure:

<0xA0,0xA1>< PL><2E>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 01 2E 2E 0D 0A

1

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 2E | | UINT8 | |
| Payload Length : 1 byte | | | | | |

QUERY ELEVATION AND CNR MASK – Query elevation and CNR mask used by the GNSS receiver (0x2F)

This is a request message which is issued from the host to GNSS receiver to retrieve information of elevation and CNR mask. The GNSS receiver should respond with an ACK along with elevation and CNR mask information, **“GNSS ELEVATION AND CNR MASK, ID: 0xB0”**, when succeeded and should respond with an NACK when failed. The payload length is 1 byte.

Structure:

<0xA0,0xA1>< PL><2F>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 01 2F 2F 0D 0A

1

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 2F | | UINT8 | |
| Payload Length : 1 byte | | | | | |

GET GPS EPHEMERIS – Get GPS ephemeris used of GNSS receiver (0x30)

This is a request message which is issued from the host to GNSS receiver to retrieve GPS ephemeris data. The GNSS receiver should respond with an ACK along with information of ephemeris, **“GPS EPHEMERIS DATA, ID: 0xB1”**, 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 | | | | | |

CONFIGURE POSITION PINNING – Enable or disable position pinning of GNSS receiver (0x39)

This is a request message which is issued from the host to GNSS receiver to configure the system position pinning. The GNSS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 3 bytes.

Structure:

<0xA0,0xA1>< PL><39>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 39 01 01 39 0D 0A
1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------------|--------------|---|-------|------|
| 1 | Message ID | 39 | | UINT8 | |
| 2 | Position pinning | 01 | 0: default 1: enable 2: disable | UINT8 | |
| 3 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 3 bytes | | | | | |

QUERY POSITION PINNING – Query position pinning status of GNSS receiver (0x3A)

This is a request message which is issued from the host to GNSS receiver to query position pinning status. The GNSS receiver should respond with an ACK along with position pinning status, “**GNSS POSITION PINNING STATUS, ID: 0xB4**”, when succeeded and should respond with an NACK when failed. The payload length is 1 byte.

Structure:

<0xA0,0xA1>< PL><3A>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 01 3A 3A 0D 0A

1

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 3A | | UINT8 | |
| Payload Length : 1 byte | | | | | |

CONFIGURE POSITION PINNING PARAMETERS – Set position pinning parameters of GNSS receiver (0x3B)

This is a request message which is issued from the host to GNSS receiver to configure the system position pinning parameters. The GNSS receiver should respond with an ACK when succeeded and should respond with a NACK when failed. The payload length is 12 bytes.

Structure:

<0xA0,0xA1>< PL><3B>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 0C 3B 00 02 00 0A 00 08 00 2D 01 F4 01 E2 0D 0A
 1 2 3 4 5 6 7 8 9 10 11

| Field | Name | Example(hex) | Description | Type | Unit |
|---------------------------|--------------------|--------------|---|--------|--------|
| 1 | Message ID | 3B | | UINT8 | |
| 2-3 | Pinning speed | 0002 | | UINT16 | Km/Hr |
| 4-5 | Pinning cnt | 000A | | UINT16 | Second |
| 6-7 | Unpinning speed | 0008 | | UINT16 | Km/Hr |
| 8-9 | Unpinning cnt | 002D | | UINT16 | Second |
| 10-11 | Unpinning distance | 01F4 | | UINT16 | Meter |
| 12 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 12 bytes | | | | | |

SET GPS EPHEMERIS – Set GPS ephemeris to GNSS receiver (0x41)

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

Structure:

<0xA0,0xA1>< PL><41>< message body><CS><0x0D,0x0A>

Example:

```
A0 A1 00 57 41 00 02 00 77 88 04 61 10 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 DB DF 59 A6 00 00 1E
    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

0A 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
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

77 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 2E 0D 0A
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
```

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|---------------------|--------------|---------------------|--------|------|
| 1 | Message ID | 41 | | UINT8 | |
| 2-3 | SV id | 0002 | Satellite id | UINT16 | |
| 4 | SubFrameData[0][0] | 77 | Eph data subframe 1 | UINT8 | |
| 5 | SubFrameData[0][1] | 88 | Eph data subframe 1 | UINT8 | |
| 6 | SubFrameData[0][2] | 04 | Eph data subframe 1 | UINT8 | |
| 7 | SubFrameData[0][3] | 61 | Eph data subframe 1 | UINT8 | |
| 8 | SubFrameData[0][4] | 10 | 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] | DB | Eph data subframe 1 | UINT8 | |

| | | | | | |
|---------------------------|-----------------------|----|--|-------|--|
| 22 | SubFrameData[0][18] | DF | Eph data subframe 1 | UINT8 | |
| 23 | SubFrameData[0][19] | 59 | Eph data subframe 1 | UINT8 | |
| 24 | SubFrameData[0][20] | A6 | 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] | 1E | Eph data subframe 1 | UINT8 | |
| 28 | SubFrameData[0][24] | 0A | Eph data subframe 1 | UINT8 | |
| 29 | SubFrameData[0][25] | 47 | Eph data subframe 1 | UINT8 | |
| 30 | SubFrameData[0][26] | 7C | Eph data subframe 1 | UINT8 | |
| 31 | SubFrameData[0][27] | 00 | Eph data subframe 1 | UINT8 | |
| 32~59 | SubFrameData[1][0~27] | | Eph data subframe 2, same as field 4-31 | UINT8 | |
| 60-87 | SubFrameData[2][0~27] | | Eph data subframe 3, same as field 4-31 | UINT8 | |
| Payload Length : 87 bytes | | | | | |

QUERY 1PPS TIMING – Query 1PPS timing of the GNSS receiver (0x44) ^{*1}

This is a request message which is issued from the host to GNSS receiver to query 1PPS timing information. The GPS receiver should respond with an ACK along with information of 1PPS timing, “**GNSS 1PPS TIMING, ID: 0xC2**”, when succeeded and should respond with an NACK when failed. The payload length is 1 byte.

Structure:

<0xA0,0xA1>< PL><44>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 01 44 44 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 44 | | UINT8 | |
| Payload Length : 1 byte | | | | | |

*1: supported only in Venus838LPx-T, S1216F8-T timing mode receivers.

CONFIGURE 1PPS CABLE DELAY – Configure cable delay of 1PPS timing (0x45)

This is a request message which will set the cable delay of 1PPS timing to the GNSS receiver. This command is issued from the host to GNSS receiver and GNSS receiver should respond with an ACK or NACK. If value of cable delay is not valid, the GNSS receiver will respond with an NACK. The payload length is 6 bytes.

Structure:

<0xA0,0xA1>< PL><45>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 06 45 00 00 00 00 00 45 0D 0A
 1 2 3 4 5 6

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-------------|--------------|--|--------|-------------|
| 1 | Message ID | 45 | | UINT8 | - |
| 2-5 | Cable Delay | 00000000 | Cable delay adjustment for 1PPS Valid input value -500000~+500000 | SINT32 | 1/100 ns |
| 6 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 6 bytes | | | | | |

QUERY 1PPS CABLE DELAY – Query 1PPS cable delay of the GNSS receiver (0x46)

This is a request message which is issued from the host to GNSS receiver to query 1PPS cable delay. The GNSS receiver should respond with an ACK along with information of 1PPS cable delay, “**GNSS 1PPS CABLE DELAY, ID: 0xBB**”, when succeeded and should respond with an NACK when failed. The payload length is 1 byte.

Structure:

<0xA0,0xA1>< PL><46>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 01 46 46 0D 0A

1

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 46 | | UINT8 | |
| Payload Length : 1 byte | | | | | |

CONFIGURE NMEA TALKER ID – Configure NMEA talker ID of GNSS receiver (0x4B) *1

This is a request message which will configure the type of talker ID (GP mode or GN mode) used in the NMEA output. This command is issued from the host to the receiver and the receiver should respond with an ACK or NACK. The payload length is 3 bytes.

Structure:

<0xA0,0xA1>< PL><4B>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 4B 01 01 4B 0D 0A
 1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|---|-------|------|
| 1 | Message ID | 4B | | UINT8 | |
| 2 | Talker ID type | 01 | 0: GP mode 1: GN mode | UINT8 | |
| 3 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 3 bytes | | | | | |

*1 supported only in Flash V8 version

GPS/GLONASS Receiver

| Mode 1 Talker ID GN (default) | | Mode 2 Talker ID GP | |
|--|---|----------------------------------|---|
| \$GNGGA | Time, position, and fix related data of the receiver. | \$GPGGA | Time, position, and fix related data of the receiver. |
| \$GNGLL | Position, time and fix status. | \$GPGLL | Position, time and fix status. |
| \$GNGSA \$GPGSA \$GLGSA | Used to represent the ID's of satellites which are used for position fix. When both GPS and GLONASS satellites are used in position solution, a \$GNGSA sentence is used for GPS satellites and another \$GNGSA sentence is used for GLONASS satellites. When only GPS satellites are used for position fix, a single \$GPGSA sentence is output. When only GLONASS satellites are used, a single \$GLGSA sentence is output. | \$GPGSA \$GLGSA | Used to represent the ID's of satellites which are used for position fix. When GPS satellites are used for position fix, \$GPGSA sentence is output. When GLONASS satellites are used for position fix, \$GLGSA sentence is output. |
| \$GPGSV \$GLGSV | Satellite information about elevation, azimuth and CNR, \$GPGSV is used for GPS satellites, while \$GLGSV is used for GLONASS satellites | \$GPGSV \$GLGSV | Satellite information about elevation, azimuth and CNR, \$GPGSV is used for GPS satellites, while \$GLGSV is used for GLONASS satellites |
| \$GNRMC | Time, date, position, course and speed data. | \$GPRMC | Time, date, position, course and speed data. |
| \$GNVTG | Course and speed relative to the ground. | \$GPVTG | Course and speed relative to the ground. |
| \$GNZDA | UTC, day, month and year and time zone. | \$GPZDA | UTC, day, month and year and time zone. |

GPS/Beidou Receiver

| Mode 1 Talker ID GN (default) | | Mode 2 Talker ID GP | |
|--|--|----------------------------------|--|
| \$GNGGA | Time, position, and fix related data of the receiver. | \$GPGGA | Time, position, and fix related data of the receiver. |
| \$GNGLL | Position, time and fix status. | \$GPGLL | Position, time and fix status. |
| \$GNGSA \$GPGSA \$BDGSA | Used to represent the ID's of satellites which are used for position fix. When both GPS and Beidou satellites are used in position solution, a \$GNGSA sentence is used for GPS satellites and another \$GNGSA sentence is used for Beidou satellites. When only GPS satellites are used for position fix, a single \$GPGSA sentence is output. When only Beidou satellites are used, a single \$BDGSA sentence is output. | \$GPGSA \$BDGSA | Used to represent the ID's of satellites which are used for position fix. When GPS satellites are used for position fix, \$GPGSA sentence is output. When Beidou satellites are used for position fix, \$BDGSA sentence is output. |
| \$GPGSV \$BDGSV | Satellite information about elevation, azimuth and CNR, \$GPGSV is used for GPS satellites, while \$BDGSV is used for Beidou satellites | \$GPGSV \$BDGSV | Satellite information about elevation, azimuth and CNR, \$GPGSV is used for GPS satellites, while \$BDGSV is used for Beidou satellites |
| \$GNRMC | Time, date, position, course and speed data. | \$GPRMC | Time, date, position, course and speed data. |
| \$GNVTG | Course and speed relative to the ground. | \$GPVTG | Course and speed relative to the ground. |
| \$GNZDA | UTC, day, month and year and time zone. | \$GPZDA | UTC, day, month and year and time zone. |

QUERY NMEA TALKER ID – Query NMEA talker ID of GNSS receiver (0x4F) ^{*1}

This is a request message which is issued from the host to GNSS receiver to query the talker ID. The GNSS receiver should respond with an ACK along with information of talker ID, “**GNSS NMEA TALKER ID, ID: 0x93**”, when succeeded and should respond with an NACK when failed. The payload length is 1 byte.

Structure:

<0xA0,0xA1>< PL><4F>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 01 4F 4F 0D 0A

1

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 4F | | UINT8 | |
| Payload Length : 1 byte | | | | | |

*1 supported only in Flash V8 version

GET GPS ALMANAC – Get GPS almanac used of GNSS receiver (0x50)

This is a request message which is issued from the host to GNSS receiver to retrieve GPS almanac data. The GNSS receiver should respond with an ACK along with information of almanac, **“GPS ALMANAC DATA, ID: 0xBE”**, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><50>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 50 00 50 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|---|-------|------|
| 1 | Message ID | 50 | | UINT8 | |
| 2 | SV # | 00 | 0: means all SVs 1~32 : mean for the particular SV | UINT8 | |
| Payload Length : 2 bytes | | | | | |

SET GPS ALMANAC – Set GPS almanac to GNSS receiver (0x51)

This is a request message which is issued from the host to GNSS receiver to set GPS almanac data (open an almanac file) to GNSS receiver. The GNSS receiver should respond with an ACK when succeeded and should respond with a NACK when failed. The payload length is 52 bytes.

Structure:

<0xA0,0xA1>< PL><51>< message body><CS><0x0D,0x0A>

Example:

```
A0 A1 00 34 51 00 01 4B CA A2 AE 3F 89 EE C1 3E E3 CF 59 BE A1 20 22 3B 74 38 00 3F 76 1C 04 B2
    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

05 52 43 B7 40 00 00 00 00 00 07 B0 00 00 01 03 1E 00 04 00 00 00 CA 0D 0A
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
```

| Field | Name | Example(hex) | Description | Type | Unit |
|---------------------------|--------------|--------------|---|--------|------|
| 1 | Message ID | 41 | | UINT8 | |
| 2-3 | SV ID | 0x0001 | Satellite id | UINT16 | |
| 4-51 | Almanac Data | | Almanac data of satellite SV ID | UINT8 | |
| 52 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 52 bytes | | | | | |

CONFIGURE 1PPS TIMING – Configure 1PPS timing of the GNSS receiver (0x54)*1

This is a request message which will configure 1PPS timing of the GNSS receiver. This command is issued from the host to GNSS receiver and GNSS receiver should respond with an ACK or NACK. If value of survey length is not valid, the GPS receiver will respond with an NACK. The payload length is 31 bytes.

Structure:

<0xA0,0xA1>< PL><54>< message body><CS><0x0D,0x0A>

Example:

```
A0 A1 00 1F 54 00 00 00 07 D0 00 00 00 1E 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 9C 0D 0A
  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
                                28 29 30 31
```

| Field | Name | Example(hex) | Description | Type | Unit |
|---------------------------|--------------------|------------------|---|--------|------|
| 1 | Message ID | 54 | | UINT8 | - |
| 2 | Timing Mode | 00 | 00 = Timing PVT Mode 01 = Timing Survey Mode 02 = Timing Static Mode | UINT8 | |
| 3-6 | Survey Length | 000007D0 | Survey length when in Timing Survey Mode not used when in other mode. Valid values between 60~1209600 | UINT32 | |
| 7-10 | Standard Deviation | 0000001E | Standard Deviation when in Timing Survey Mode not used when in other mode. Valid values between 3~100 | UINT32 | |
| 11-18 | Latitude | 0000000000000000 | Latitude in double in Timing Static Mode not used when in other mode. | DPFP | |
| 19-26 | Longitude | 0000000000000000 | Longitude in double in Timing Static Mode not used when in other mode. | DPFP | |
| 27-30 | Altitude | 00000000 | Altitude in float in Timing Static Mode not used when in other mode. | SPFP | |
| 31 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 31 bytes | | | | | |

*1: supported only in Venus838LPx-T, S1216F8-T timing mode receivers.

Remark:

When using PVT Mode, precision 1PPS won't be generated with less than 4 satellites.

When using Survey Mode, survey length need to be given, the receiver will survey its location for number of specified points, and then change to Static Mode such that precision 1PPS will still be generated with 1 satellite in view.

Use Static Mode when location is known, latitude/longitude/altitude need to be set, and receiver will generate precision 1PPS output down to 1 satellite in view.

For attribute setting specifying "update to SRAM", it will make the setting take effect in the current session. Later if the receiver is turned off and SRAM / RTC backup supply source is still provided, then upon power up receiver will go into survey process if Survey Mode was chosen, or pinned to a fixed location if Static Mode was chosen. If without backup supply source and recycling power, the receiver will start in the default Survey Mode.

For attribute setting specifying "update to both SRAM and Flash", it will make the setting take effect in the current session. Later if the receiver is turned off then upon power up receiver will go into survey process if Survey Mode was chosen, or pinned to a fixed location if Static Mode was chosen.

GET GLONASS EPHEMERIS – GET GLONASS EPHEMERIS USED OF THE GNSS RECEIVER (0X5B)

This is a request message which is issued from the host to the receiver to retrieve GLONASS ephemeris data. The receiver should respond with an ACK along with information of ephemeris, “**GLONASS EPHEMERIS DATA, ID: 0x90**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><5B>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 5B 01 5A 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------------------|--------------|---|-------|------|
| 1 | Message ID | 5B | | UINT8 | |
| 2 | GLONASS SV slot number | 01 | 0: means all SVs 1~32 : mean for the particular SV | UINT8 | |
| Payload Length : 2 bytes | | | | | |

SET GLONASS EPHEMERIS – Set GLONASS ephemeris to the GNSS receiver (0x5C)

This is a request message which is issued from the host to the receiver to set GLONASS ephemeris data (open an ephemeris file) to the receiver. The receiver should respond with an ACK when succeeded and should respond with a NACK when failed. The payload length is 43 bytes.

Structure:

<0xA0,0xA1>< PL><5C>< message body><CS><0x0D,0x0A>

Example:

```
A0 A1 00 2B 5C 01 01 01 07 43 0F AC 06 89 A2 01 9A 02 17 60 28 75 47 01 16 FE B5 03 80 06 9C CB
    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

CC 92 6A C0 42 04 09 94 79 20 00 00 20 11 85 2F 0D 0A
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
```

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|---------------------|--------------|--|-------|------|
| 1 | Message ID | 5C | | UINT8 | |
| 2 | Slot number | 01 | GLONASS SV slot number | UINT8 | |
| 3 | K number | 01 | GLONASS SV frequency number (-7 ~ +6) | SINT8 | |
| 4 | glo_eph_data0_byte0 | 01 | Stuffing zeros and bit 85 - bit 81 (LSB) of string 1 | UINT8 | |
| 5 | glo_eph_data0_byte1 | 07 | bit 80 (MSB)- bit 73 (LSB) of string 1 | UINT8 | |
| 6 | glo_eph_data0_byte2 | 43 | bit 72 (MSB)- bit 65 (LSB) of string 1 | UINT8 | |
| 7 | glo_eph_data0_byte3 | 0F | bit 64 (MSB)- bit 57 (LSB) of string 1 | UINT8 | |
| 8 | glo_eph_data0_byte4 | AC | bit 56 (MSB)- bit 49 (LSB) of string 1 | UINT8 | |
| 9 | glo_eph_data0_byte5 | 06 | bit 48 (MSB)- bit 41 (LSB) of string 1 | UINT8 | |
| 10 | glo_eph_data0_byte6 | 89 | bit 40 (MSB)- bit 33 (LSB) of string 1 | UINT8 | |
| 11 | glo_eph_data0_byte7 | A2 | bit 32 (MSB)- bit 25 (LSB) of string 1 | UINT8 | |
| 12 | glo_eph_data0_byte8 | 01 | bit 24 (MSB)- bit 17 (LSB) of string 1 | UINT8 | |
| 13 | glo_eph_data0_byte9 | 9A | bit 16 (MSB)- bit 09 (LSB) of string 1 | UINT8 | |
| 14 | glo_eph_data1_byte0 | 02 | Stuffing zeros and bit 85 - bit 81 (LSB) of string 2 | UINT8 | |
| 15 | glo_eph_data1_byte1 | 17 | bit 80 (MSB)- bit 73 (LSB) of string 2 | UINT8 | |
| 16 | glo_eph_data1_byte2 | 60 | bit 72 (MSB)- bit 65 (LSB) of string 2 | UINT8 | |
| 17 | glo_eph_data1_byte3 | 28 | bit 64 (MSB)- bit 57 (LSB) of string 2 | UINT8 | |
| 18 | glo_eph_data1_byte4 | 75 | bit 56 (MSB)- bit 49 (LSB) of string 2 | UINT8 | |

| | | | | | |
|---------------------------|--|----|---|-------|--|
| 19 | glo_eph_data1_byte5 | 47 | bit 48 (MSB)- bit 41 (LSB) of string 2 | UINT8 | |
| 20 | glo_eph_data1_byte6 | 01 | bit 40 (MSB)- bit 33 (LSB) of string 2 | UINT8 | |
| 21 | glo_eph_data1_byte7 | 16 | bit 32 (MSB)- bit 25 (LSB) of string 2 | UINT8 | |
| 22 | glo_eph_data1_byte8 | FE | bit 24 (MSB)- bit 17 (LSB) of string 2 | UINT8 | |
| 23 | glo_eph_data1_byte9 | B5 | bit 16 (MSB)- bit 09 (LSB) of string 2 | UINT8 | |
| 24-33 | glo_eph_data2_byte0 - glo_eph_data2_byte9 | | Stuffing-zeros and bit 85 - bit 09 of string 3 | | |
| 34-43 | glo_eph_data3_byte0 - glo_eph_data3_byte9 | | Stuffing-zeros and bit 85 - bit 09 of string 4 | | |
| Payload Length : 43 bytes | | | | | |

GET GLONASS ALMANAC – Get GLONASS almanac used of the GNSS receiver (0x5D)

This is a request message which is issued from the host to the receiver to retrieve GLONASS almanac data. The receiver should respond with an ACK along with information of almanac, **“GLONASS EPHEMERIS DATA, ID: 0x91”**, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><5D>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 5D 00 5D 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|---------------------|--------------|---|-------|------|
| 1 | Message ID | 5D | | UINT8 | |
| 2 | GLONASS slot number | 00 | 0: means all SVs 1~32 : mean for the particular SV | UINT8 | |
| Payload Length : 2 bytes | | | | | |

SET GLONASS ALMANAC DATA – Set GLONASS almanac to the GNSS receiver (0x5E)

This is a request message which is issued from the host to the receiver to set GLONASS almanac data (open an almanac file) to the receiver. The receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 26 bytes.

Structure:

<0xA0,0xA1>< PL><5E>< message body><CS><0x0D,0x0A>

Example: N/A

A0 A1 00 1A 5E 01 06 00 23 06 A1 09 A9 6E A4 0D 4A 81 CE 07 11 F4 9A 7A 9E 98 17 A8 C2 00 C6 0D
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

0A

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|---------------------|--------------|---|--------|------|
| 1 | Message ID | 5E | | UINT8 | |
| 2 | Slot number | 01 | GLONASS SV slot number | UINT8 | |
| 3 | GLONASS N4 | 06 | GLONASS non-immediate information N4 | UINT8 | |
| 4-5 | GLONASS NA | 0023 | GLONASS non-immediate information NA | UINT16 | |
| 6 | glo_alm_data1_byte0 | 06 | Stuffing zeros and bit 85 - bit 81 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 7 | glo_alm_data1_byte1 | A1 | bit 80 (MSB)- bit 73 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 8 | glo_alm_data1_byte2 | 09 | bit 72 (MSB)- bit 65 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 9 | glo_alm_data1_byte3 | A9 | bit 64 (MSB)- bit 57 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 10 | glo_alm_data1_byte4 | 6E | bit 56 (MSB)- bit 49 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 11 | glo_alm_data1_byte5 | A4 | bit 48 (MSB)- bit 41 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 12 | glo_alm_data1_byte6 | 0D | bit 40 (MSB)- bit 33 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 13 | glo_alm_data1_byte7 | 4A | bit 32 (MSB)- bit 25 (LSB) of string 6/8/10/12/14 | UINT8 | |

| | | | | | |
|---------------------------|---------------------|----|---|-------|--|
| 14 | glo_alm_data1_byte8 | 81 | bit 24 (MSB)- bit 17 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 15 | glo_alm_data1_byte9 | CE | bit 16 (MSB)- bit 09 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 16 | glo_alm_data2_byte0 | 07 | Stuffing zeros and bit 85- bit 81 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 17 | glo_alm_data2_byte1 | 11 | bit 80 (MSB)- bit 73 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 18 | glo_alm_data2_byte2 | F4 | bit 72 (MSB)- bit 65 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 19 | glo_alm_data2_byte3 | 9A | bit 64 (MSB)- bit 57 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 20 | glo_alm_data2_byte4 | 7A | bit 56 (MSB)- bit 49 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 21 | glo_alm_data2_byte5 | 9E | bit 48 (MSB)- bit 41 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 22 | glo_alm_data2_byte6 | 98 | bit 40 (MSB)- bit 33 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 23 | glo_alm_data2_byte7 | 17 | bit 32 (MSB)- bit 25 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 24 | glo_alm_data2_byte8 | A8 | bit 24 (MSB)- bit 17 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 25 | glo_alm_data2_byte9 | C2 | bit 16 (MSB)- bit 09 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 26 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 26 bytes | | | | | |

GET GLONASS TIME CORRECTION PARAMETERS – Get GLONASS time correction parameters (0x5F)

This is a request message which is issued from the host to the receiver to retrieve GLONASS time correction data. The receiver should respond with an ACK along with information of time correction, “**GLONASS TIME CORRECTION, ID: 0x92**”, when succeeded and should respond with an NACK when failed. The payload length is 1 byte.

Structure:

<0xA0,0xA1>< PL><5F>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 5F 5F 0D 0A
1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 5F | | UINT8 | |
| Payload Length : 1 byte | | | | | |

SET GLONASS TIME CORRECTION PARAMETERS – Set GLONASS time correction parameters to the GNSS receiver (0x60)

This is a request message which is issued from the host to the receiver to set GLONASS time correction data (τ_{GPS} and τ_C) to the receiver. The receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 10 bytes.

Structure:

<0xA0,0xA1>< PL><60>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 0A 60 FF FF FF BF 00 00 00 14 00 34 0D 0A
 1 2 3 4 5 6 7 8 9 10

| Field | Name | Example(hex) | Description | Type | Unit |
|---------------------------|--------------|--------------|---|--------|---------------|
| 1 | Message ID | 60 | | UINT8 | |
| 2-5 | τ_C | FFFFFFBF | GLONASS time scale correction to UTC(SU) time | SINT32 | 2^{-31} sec |
| 6-9 | τ_{GPS} | 00000014 | Correction to GPS time relative to GLONASS time | SINT32 | 2^{-30} sec |
| 10 | attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 10 bytes | | | | | |

MESSAGES WITH Sub-ID^{*1}

*1: Message ID with range from 0x60~0x6F contains both input and output messages.

CONFIGURE SBAS – Configure SBAS parameters of GNSS receiver (ID: 0x62, SID: 0x1)

This is a request message which is issued from the host to GNSS receiver to configure SBAS parameters. The GNSS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 9 bytes.

Structure:

<0xA0,0xA1>< PL><62><01>< message body><CS><0x0D,0x0A>

Example:

```
A0 A1 00 09 62 01 01 01 08 01 03 07 00 6E 0D 0A
    1  2  3  4  5  6  7  8  9
```

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|-----------------------------|--------------|--|-------|------|
| 1 | Message ID | 62 | | UINT8 | |
| 2 | Message Sub-ID | 01 | | UINT8 | |
| 3 | Enable | 01 | 0: disable SBAS system 1: enable SBAS system | UINT8 | |
| 4 | Ranging | 01 | 0: do not use SBAS satellite for navigation 1: use SBAS satellite for navigation 2: auto mode determined by receiver whether ranging will use or not ^{*1} | UINT8 | |
| 5 | Ranging URA Mask | 08 | Default:8, range 0~15 | UINT8 | |
| 6 | Correction | 01 | 0: disable the correction 1: enable the correction | UINT8 | |
| 7 | Number of tracking channels | 03 | Value: 0~3 Set how many channels are reserved for SBAS tracking | UINT8 | |
| 8 | Subsystem mask | 07 | Allows selectively enabling/disabling SBAS satellites Bit0: WAAS, 1: enable; 0: disable Bit1: EGNOS, 1: enable; 0: disable Bit2: MSAS, 1: enable; 0: disable | UINT8 | |

| | | | | | |
|--------------------------|------------|----|--|-------|--|
| | | | Bit3: GAGAN, 1: enable; 0: disable Bit7: All SBAS PRN 120~138 ^{*1} | | |
| 9 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 9 bytes | | | | | |

*1 supported only in Flash V8 version

QUERY SBAS STATUS – Query SBAS status of GNSS receiver (ID: 0x62, SID: 0x2)

This is a request message which is issued from the host to GNSS receiver to query SBAS status. The GNSS receiver should respond with an ACK along with SBAS status, “**SBAS STATUS, ID: 0x62, SID: 0x80**”, when succeeded and should respond with an NACK when failed. The payload length is 2 byte.

Structure:

<0xA0,0xA1>< PL><62><02>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 62 02 60 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 62 | | UINT8 | |
| 2 | Message Sub-ID | 02 | | UINT8 | |
| Payload Length : 2 byte | | | | | |

CONFIGURE QZSS – Configure QZSS of GNSS receiver (ID: 0x62, SID: 0x3)

This is a request message which is issued from the host to GNSS receiver to configure QZSS parameters. The GNSS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 5 bytes.

Structure:

<0xA0,0xA1>< PL><62><03>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 05 62 03 01 03 00 63 0D 0A
 1 2 3 4 5

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-----------------------------|--------------|--|-------|------|
| 1 | Message ID | 62 | | UINT8 | |
| 2 | Message Sub-ID | 03 | | UINT8 | |
| 3 | Enable | 01 | 0: disable QZSS system 1: enable QZSS system | UINT8 | |
| 4 | Number of tracking channels | 03 | Value: 1~3 Set how many channels are used for QZSS tracking, default: 1 | UINT8 | |
| 5 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 5 bytes | | | | | |

QUERY QZSS STATUS – Query QZSS status of GNSS receiver (ID: 0x62, SID: 0x4)

This is a request message which is issued from the host to GNSS receiver to query QZSS status. The GNSS receiver should respond with an ACK along with QZSS status, “**QZSS STATUS, ID: 62, SID: 0x81**”, when succeeded and should respond with an NACK when failed. The payload length is 2 byte.

Structure:

<0xA0,0xA1>< PL><62><04>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 62 04 66 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|-------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 62 | | UINT8 | |
| 2 | Message Sub-ID | 04 | | UINT8 | |
| Payload Length : 2 byte | | | | | |

SBAS STATUS – SBAS status of GNSS receiver (ID: 0x62, SID: 0x80)

This is a response message to “**QUERY SBAS STATUS, ID: 0x62, SID: 0x2**” which provides the SBAS status of GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 8 bytes.

Structure:

<0xA0,0xA1>< PL><62><80>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 08 62 80 01 01 08 01 03 07 EF 0D 0A
 1 2 3 4 5 6 7 8

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-----------------------------|--------------|---|-------|------|
| 1 | Message ID | 62 | | UINT8 | |
| 2 | Message Sub-ID | 80 | | UINT8 | |
| 3 | Enable | 01 | 0: disable SBAS system 1: enable SBAS system | UINT8 | |
| 4 | Ranging | 01 | 0: do not use SBAS satellite for navigation 1: use SBAS satellite for navigation 2: auto mode determined by receiver ^{*1} | UINT8 | |
| 5 | Ranging URA Mask | 08 | Range 0~15 default 8 | UINT8 | |
| 6 | Correction | 01 | 0: disable the correction 1: enable the correction | UINT8 | |
| 7 | Number of tracking channels | 03 | Value: 0~3 Set how many channels are reserved for SBAS tracking | UINT8 | |
| 8 | Subsystem mask | 07 | Allows selectively enabling/disabling SBAS satellites Bit0: WAAS, 1: enable; 0: disable Bit1: EGNOS, 1: enable; 0: disable Bit2: MSAS, 1: enable; 0: disable Bit3: GAGAN, 1: enable; 0: disable Bit7: All SBAS PRN 120~138 ^{*1} | UINT8 | |
| Payload Length : 8 bytes | | | | | |

*1 supported only in Flash V8 version

QZSS STATUS – QZSS status of GNSS receiver (ID: 0x62, SID: 0x81)

This is a response message to “**QUERY QZSS STATUS, ID: 0x62, SID: 0x4**” which provides the QZSS status of GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><62><81>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 62 81 01 03 E1 0D 0A

1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-----------------------------|--------------|--|-------|------|
| 1 | Message ID | 62 | | UINT8 | |
| 2 | Message Sub-ID | 81 | | UINT8 | |
| 3 | Enable | 01 | 0: disable QZSS system 1: enable QZSS system | UINT8 | |
| 4 | Number of tracking channels | 03 | Value: 1~3 Set how many channels are used for QZSS tracking | UINT8 | |
| Payload Length : 4 bytes | | | | | |

CONFIGURE SAE – configure SAE of GNSS receiver (ID: 0x63, SID: 0x1)

This is a request message which is issued from the host to GNSS receiver to configure enable or disable self-aided ephemeris estimation (SAEE). The GNSS receiver should respond with an ACK when succeeded and should respond with a NACK when failed. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><63><01>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 63 01 01 01 62 0D 0A
 1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|--|-------|------|
| 1 | Message ID | 63 | | UINT8 | |
| 2 | Message Sub-ID | 01 | | UINT8 | |
| 3 | Enable | 01 | 0: SAE mode default ROM version decided by HW power-on latch 1: SAE enable 2: SAE disable | UINT8 | |
| 4 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 4 bytes | | | | | |

QUERY SAE STATUS – Query SAE status of GNSS receiver (ID: 0x63, SID: 0x2)

This is a request message which is issued from the host to GNSS receiver to query self-aided ephemeris estimation (SAEE) status. The GNSS receiver should respond with an ACK along with SAE status, “**SAEE STATUS, ID: 63, SID: 0x80**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><63><0x2>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 63 02 61 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 63 | | UINT8 | |
| 2 | Message Sub-ID | 02 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

SAEE STATUS – SAE status of GNSS receiver (ID: 0x63, SID: 0x80)

This is a response message to “**QUERY SAE STATUS, ID: 0x63, SID: 0x2**” which provides the self-aided ephemeris estimation (SAEE) status of GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 3 bytes.

Structure:

<0xA0,0xA1>< PL><63><80>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 63 80 01 E2 0D 0A
1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|---|-------|------|
| 1 | Message ID | 63 | | UINT8 | |
| 2 | Message Sub-ID | 80 | | UINT8 | |
| 3 | Status | 01 | 0: SAE mode default ROM version decided by HW power-on latch 1: SAE enable 2: SAE disable | UINT8 | |
| Payload Length : 3 bytes | | | | | |

QUERY GNSS BOOT STATUS – Query boot status of GNSS receiver (ID: 0x64, SID: 0x1)

This is a request message which is issued from the host to GNSS receiver to query boot status. The GNSS receiver should respond with an ACK along with boot status, “**GNSS BOOT STATUS, ID: 64, SID: 0x80**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><01>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 01 65 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 01 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

CONFIGURE EXTENDED NMEA MESSAGE INTERVAL – Configure extended NMEA message Interval of GNSS receiver (ID: 0x64, SID: 0x2)

This is a request message which will set NMEA message interval configuration. This command is issued from the host to GNSS receiver and GNSS receiver should respond with an ACK or NACK. The payload length is 15 bytes.

Structure:

<0xA0,0xA1>< PL><64><02>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 0F 64 02 01 01 03 01 01 01 01 00 00 00 00 01 64 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 | 64 | | UINT8 | |
| 2 | Message Sub-ID | 02 | | UINT8 | |
| 3 | GGA Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 4 | GSA Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 5 | GSV Interval | 03 | 0 ~255, 0: disable | UINT8 | Second |
| 6 | GLL Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 7 | RMC Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 8 | VTG Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 8 | ZDA Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 10 | GNS Interval | 00 | 0 ~255, 0: disable | UINT8 | Second |
| 11 | GBS Interval | 00 | 0 ~255, 0: disable | UINT8 | Second |
| 12 | GRS Interval | 00 | 0 ~255, 0: disable | UINT8 | Second |
| 13 | DTM Interval | 00 | 0 ~255, 0: disable | UINT8 | Second |
| 14 | GST Interval | 00 | 0 ~255, 0: disable | UINT8 | Second |
| 15 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 15 bytes | | | | | |

QUERY EXTENDED NMEA MESSAGE INTERVAL – Query extended NMEA message interval of GNSS receiver (ID: 0x64, SID: 0x3)

This is a request message which is issued from the host to GNSS receiver to query extended nmea message interval. The GNSS receiver should respond with an ACK along with nmea message interval, “**EXTENDED NMEA MESSAGE INTERVAL, ID: 0x64, SID: 0x81**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><03><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 03 67 0D 0A
 1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 03 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

CONFIGURE INTERFERENCE DETECTION – Configure the interference detection of GNSS receiver (ID: 0x64, SID: 0x6)

This is a request message which is issued from the host to GNSS receiver to configure interference detect control. The GNSS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><64><06>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 64 06 01 00 E1 0D 0A
 1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-----------------------------|--------------|---|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 06 | | UINT8 | |
| 3 | Interference Detect Control | 01 | 0: disable 1: enable | UINT8 | |
| 4 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 4 bytes | | | | | |

QUERY INTERFERENCE DETECTION STATUS – Query the status of interference detection of the GNSS receiver (ID: 0x64, SID: 0x7)

This is a request message which is issued from the host to GNSS receiver to query interference detection status. The GNSS receiver should respond with an ACK along with information of interference detection status, **“INTERFERENCE DETECTION STATUS, ID: 0x64, SID: 0x83”**, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><07>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 07 63 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 07 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

CONFIGURE GPS PARAMETER SEARCH ENGINE NUMBER – Configure the parameter search engine number of GPS receiver (ID: 0x64, SID: 0xA) *1

This is a request message which is issued from the host to GPS receiver to configure the number of the parameter search engine. The GPS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><64><0A>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 64 0A 01 01 6E 0D 0A
 1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------------|--------------|---|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 0A | | UINT8 | |
| 3 | Search engine number | 01 | 0: PSE_MODE_DEFAULT ROM version decided by HW power-on latch, FLASH version : by SW define 1: PSE_MODE_LOW (2 PSE) 2: PSE_MODE_MID (4 PSE) 3: PSE_MODE_HIGH (6 PSE) 4: PSE_MODE_FULL (8 PSE) | UINT8 | |
| 4 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 4 bytes | | | | | |

Note *1: Supported for GPS single-mode receiver only.

QUERY GPS PARAMETER SEARCH ENGINE NUMBER – Query the parameter search engine number of the GPS receiver (ID: 0x64, SID: 0xB)

This is a request message which is issued from the host to GPS receiver to query parameter search engine number. The GPS receiver should respond with an ACK along with information of GPS parameter search engine number, **“GPS PARAMETER SEARCH ENGINE NUMBER, ID 0x64, SID 0xB”**, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><0B>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 0B 6F 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 0B | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

CONFIGURE POSITION FIX NAVIGATION MASK – Configure the position fix navigation mask of GNSS receiver (ID: 0x64, SID: 0x11)

This is a request message which is issued from the host to GNSS receiver to configure the 2D or 3D position fix navigation mask. The GNSS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 5 bytes.

Structure:

<0xA0,0xA1>< PL><64><11>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 05 64 11 00 00 00 75 0D 0A
 1 2 3 4 5

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|--------------------------------|--------------|---|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 11 | | UINT8 | |
| 3 | First fix navigation mask | 00 | 0: 3D 1: 2D | UINT8 | |
| 4 | Subsequent fix navigation mask | 00 | 0: 3D 1: 2D | UINT8 | |
| 5 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 5 bytes | | | | | |

QUERY POSITION FIX NAVIGATION MASK – Query the position fix navigation mask of GNSS receiver (ID: 0x64, SID: 0x12)

This is a request message which is issued from the host to GNSS receiver to query position fix navigation mask. The GNSS receiver should respond with an ACK along with information of navigation mask **“POSITION FIX NAVIGATION MASK, ID: 0x64, SID: 0x88”**, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><12>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 12 76 0D 0A
 1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 12 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

CONFIGURE UTC REFERENCE TIME SYNC TO GPS TIME – Configure the UTC reference time to GPS receiver to synchronize to GPS time (ID: 0x64, SID: 0x15) ^{*1}

This is a request message which is issued from the host to GPS receiver to configure the UTC reference time that is used to synchronize to GPS time. The GPS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 8 bytes.

Structure:

<0xA0,0xA1>< PL><64><15>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 64 15 01 07 DD 01 01 00 AA 0D 0A
 1 2 3 4 5 6 7 8

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|---|--------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 15 | | UINT8 | |
| 3 | Enable | 01 | 0: Disable 1: Enable | UINT8 | |
| 4-5 | UTC Year | 07DD | UTC year | UINT16 | |
| 6 | UTC Month | 01 | UTC month | UINT8 | |
| 7 | UTC Day | 01 | UTC day | UINT8 | |
| 8 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 8 bytes | | | | | |

*1 supported only in Flash V8 version

The time of week is transmitted by GPS satellites, but only the bottom 10 bits of the week number are transmitted. This means valid range is from 0 to 1023, until it reaches 1023 after which it will "roll over" back to zero. The 1st week rollover occurred in 1999 and the 2nd will be in 2019.

How to decide default week rollover times?

SkyTraq receivers solve this problem by assuming that all week numbers must be at least as large as a reference rollover week number. This reference rollover week number is hard-coded into the firmware at compile time and is normally set a few weeks before the software is completed, but it can be adjusted by command "Configure UTC Reference Time Sync to GPS Time".

For example :

User just input reasonable UTC time they want, SkyTraq receivers will transform this reference time to proper week rollover times automatically.

It is important to set the reference rollover week number appropriately when supplying SkyTraq receivers with simulated signals, especially when the scenarios are in the past.

QUERY UTC REFERENCE TIME SYNC TO GPS TIME – Query the UTC reference time of GPS receiver set to synchronize to GPS time (ID: 0x64, SID: 0x16) ^{*1}

This is a request message which is issued from the host to GPS receiver to query UTC reference time of GPS receiver that set to synchronize to GPS time. The GPS receiver should respond with an ACK along with GPS UTC reference time, **“GPS UTC REFERENCE TIME, ID: 0x64, SID: 0x8A”**, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><16>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 16 72 0D 0A
 1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 16 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

*1 supported only in Flash V8 version

CONFIGURE GNSS NAVIGATION MODE – Configure the navigation mode of GNSS receiver (ID: 0x64, SID: 0x17)

This is a request message which is issued from the host to GNSS receiver to configure the system navigation mode. The GNSS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><64><17>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 64 17 00 00 73 0D 0A
 1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-----------------|--------------|--|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 17 | | UINT8 | |
| 3 | Navigation mode | 00 | 0: auto 1: pedestrian 2: car 3: marine 4: balloon 5: airborne | UINT8 | |
| 4 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 4 bytes | | | | | |

QUERY GNSS NAVIGATION MODE – Query the navigation mode of GNSS receiver (ID: 0x64, SID: 0x18)

This is a request message which is issued from the host to GNSS receiver to query navigation mode. The GNSS receiver should respond with an ACK along with navigation mode, “**GNSS NAVIGATION MODE, ID: 0x64, SID: 0x8B**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><18>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 18 7C 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 18 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

CONFIGURE GNSS CONSTELLATION TYPE FOR NAVIGATION SOLUTION – Set the GNSS constellation type for navigation solution (ID: 0x64, SID: 0x19)

This is a request message which is issued from the host to GNSS receiver to configure the GNSS constellation type for navigation solution. The GNSS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is 5 bytes.

Structure:

<0xA0,0xA1>< PL><64><19>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 05 64 19 00 09 00 74 0D 0A
 1 2 3 4 5

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|--------------------|--------------|---|--------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 19 | | UINT8 | |
| 3-4 | Constellation Type | 00 09 | Bit 0: GPS Bit 1: Glonass Bit 2: Galileo Bit 3: Beidou | UINT16 | |
| 5 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 5 bytes | | | | | |

QUERY GNSS CONSTELLATION TYPE FOR NAVIGATION SOLUTION – Query the GNSS constellation type for navigation solution (ID: 0x64, SID: 0x1A)

This is a request message which is issued from the host to GNSS receiver to query GNSS constellation type for navigation solution. The GNSS receiver should respond with an ACK along with constellation type, “**GNSS CONSTELLATION TYPE FOR NAVIGATION SOLUTION, ID 0x64, SID 0x8C**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><1A>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 1A 7E 0D 0A
1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 1A | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

CONFIGURE GPS/UTC LEAP SECONDS – Configure GPS/UTC leap seconds of GNSS receiver (ID: 0x64, SID: 0x1F) ^{*1}

This is a request message which is issued from the host to GNSS receiver to configure GPS/UTC leap seconds. The GNSS receiver should respond with an ACK when succeeded and should respond with a NACK when failed. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><64><1F>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 64 1F 10 01 6A 0D 0A
 1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|---|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub ID | 1F | | UINT8 | |
| 3 | Leap seconds | 10 | Leap seconds | SINT8 | |
| 4 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 4 bytes | | | | | |

*1 supported only in Flash V8 version

QUERY GPS TIME – Query GPS time of GNSS receiver (ID: 0x64, SID: 0x20) ^{*1}

This is a request message which is issued from the host to GNSS receiver to query GPS time. The GNSS receiver should respond with an ACK along with GPS time, "**GPS TIME, ID: 0x64, SID: 0x8E**", when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><0x20>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 20 44 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub ID | 20 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

*1 supported only in Flash V8 version

CONFIGURE GNSS DATUM INDEX – Configure the datum index of GNSS receiver (ID: 0x64, SID: 0x27) *1

This is a request message which is issued from the host to configure the datum index to GNSS receiver. The GNSS receiver should respond with an ACK when succeeded and should respond with a NACK when failed. The payload length is 5 bytes.

Structure:

<0xA0,0xA1>< PL><64><27>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 64 27 00 DC 01 9E 0A
1 2 3 4 5

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-------------|--------------|---|--------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 27 | | UINT8 | |
| 3-4 | Datum index | 00DC | Datum index, range 0~220. Please refer to Appendix B. | UINT16 | |
| 5 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 5 bytes | | | | | |

*1 supported only in Flash V8 version

QUERY GNSS DATUM INDEX – Query the datum index of the GNSS receiver (ID: 0x64, SID: 0x28) *1

This is a request message which is issued from the host to GNSS receiver to query datum index. The GNSS receiver should respond with an ACK along with information of datum index **“GNSS DATUM INDEX, ID: 0x64, SID: 0x92”**, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><28>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 28 4C 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 28 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

*1 supported only in Flash V8 version

CONFIGURE GNSS GEO-FENCING DATA – Configure geo-fencing data to GNSS receiver (ID: 0x64, SID: 0x2F) ¹

This is a request message which is issued from the host to configure the geo-fencing data to GNSS receiver. The GNSS receiver should respond with an ACK when succeeded and should respond with an NACK when failed. The payload length is maximum 164 bytes.

Structure:

<0xA0,0xA1>< PL><64><2F>< message body><CS><0x0D,0x0A>

Example:

```
A0 A1 00 44 64 2F 00 04 40 38 C8 E5 BF 18 FC 73 40 5E 40 90 38 79 65 94 40 38 C8 E9 C1 87 15 D6
    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

40 5E 40 92 D5 3D 3C 54 40 38 C8 F1 8D 47 37 07 40 5E 40 92 24 BC 08 40 40 38 C8 ED 64 06 8F BC
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

40 5E 40 8F 70 E0 2B BE 06 0D 0A
61 62 63 64 65 66 67 68
```

| Field | Name | Example (hex) | Description | Type | Unit |
|-------|------------------|----------------------|---|-------|--------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 2F | | UINT8 | |
| 3 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| 4 | Number of points | 04 | Number of points of a polygon Maximum number: 10 | UINT8 | |
| 5-12 | Latitude | 4038C8E5 BF18FC73 | Latitude in double of polygon points #1 | DPFP | degree |
| 13-20 | Longitude | 405E4090 38796594 | Longitude in double of polygon points #1 | DPFP | degree |
| 21-28 | Latitude | 4038C8E9 C18715D6 | Latitude in double of polygon points #2 | DPFP | degree |
| 29-36 | Longitude | 405E4092 D53D3C54 | Longitude in double of polygon points #2 | DPFP | degree |
| 37-44 | Latitude | 4038C8F1 8D473707 | Latitude in double of polygon points #3 | DPFP | degree |

| | | | | | |
|---|-----------|----------------------|--|------|--------|
| 45-52 | Longitude | 405E4092 24BC0840 | Longitude in double of polygon points #3 | DPFP | degree |
| 53-60 | | 4038C8ED 64068FBC | Latitude in double of polygon points #4 | DPFP | degree |
| 61-68 | | 405E408F 70E02BBE | Longitude in double of polygon points #4 | DPFP | degree |
| | | | | | |
| 5+((ndx-1)*16) ~ 12+((ndx-1)*16) | Latitude | | Latitude in double of polygon points #ndx | DPFP | degree |
| 13+((ndx-1)*16) ~ 20+((ndx-1)*16) | Longitude | | Longitude in double of polygon points #ndx | DPFP | degree |
| Payload Length : maximum 164 bytes, ndx = number of polygon points, maximum 10 points | | | | | |

*1 supported only in Flash V8 version

QUERY GNSS GEO-FENCING DATA – Query geo-fencing data of the GNSS receiver (ID: 0x64, SID: 0x30) *1

This is a request message which is issued from the host to GNSS receiver to query geo-fencing data. The GNSS receiver should respond with an ACK along with geo-fencing data **“GNSS GEO-FENCING DATA, ID: 0x64, SID: 0x96”**, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><30>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 30 54 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 30 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

*1 supported only in Flash V8 version

QUERY GNSS GEO-FENCING RESULT – Query geo-fencing result of the GNSS receiver (ID: 0x64, SID: 0x31)

*1

This is a request message which is issued from the host to GNSS receiver to query geo-fencing result. The GNSS receiver should respond with an ACK along with information of geo-fencing result “**GNSS GEO-FENCING RESULT, ID: 0x64, SID: 0x97**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><64><31>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 64 31 55 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 31 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

*1 supported only in Flash V8 version

GNSS BOOT STATUS – Boot status of GNSS receiver (ID: 0x64, SID: 0x80)

This is a response message to “**QUERY GNSS BOOT STATUS, ID: 0x64, SID: 0x1**” which provides the boot status of GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><64><80>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 64 80 00 01 E5 0D 0A
 1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|--|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 80 | | UINT8 | |
| 3 | Status | 00 | 0: Boot from flash OK 1: Boot from ROM due to flash boot failure | UINT8 | |
| 4 | Flash Type | 01 | 00: ROM Bit 1: Winbond-type QSPI Flash Bit 2: EON-type QSPI Flash Bit 3: Parallel Flash | UINT8 | |
| Payload Length : 4 bytes | | | | | |

EXTENDED NMEA MESSAGE INTERVAL– Extended NMEA message interval of the GNSS receiver (ID: 0x64, SID: 0x81)

This is a response message to “**QUERY EXTENDED NMEA MESSAGE INTERVAL, ID: 0x64, SID: 0x3**” which provides the extended NMEA message interval of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 14 bytes.

Structure:

<0xA0,0xA1>< PL><64><81>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 0E 64 81 01 01 03 01 01 01 01 00 00 00 00 00 E6 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 | 64 | | UINT8 | |
| 2 | Message Sub-ID | 81 | | UINT8 | |
| 3 | GGA Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 4 | GSA Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 5 | GSV Interval | 03 | 0 ~255, 0: disable | UINT8 | Second |
| 6 | GLL Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 7 | RMC Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 8 | VTG Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 9 | ZDA Interval | 01 | 0 ~255, 0: disable | UINT8 | Second |
| 10 | GNS Interval | 00 | 0 ~255, 0: disable | UINT8 | Second |
| 11 | GBS Interval | 00 | 0 ~255, 0: disable | UINT8 | Second |
| 12 | GRS Interval | 00 | 0 ~255, 0: disable | UINT8 | Second |
| 13 | DTM Interval | 00 | 0 ~255, 0: disable | UINT8 | Second |
| 14 | GST Interval | 00 | 0 ~255, 0: disable | UINT8 | Second |
| Payload Length : 14 bytes | | | | | |

INTERFERENCE DETECTION STATUS – Interference detection status of GNSS receiver (ID: 0x64, SID: 0x83)

This is a response message to “**QUERY INTERFERENCE DETECTION STATUS, ID: 0x64, SID: 0x7**” which provides the status of interference detection of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><64><83>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 64 83 01 01 E7 0D 0A
1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|--------------------------------|--------------|--|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 83 | | UINT8 | |
| 3 | Interference Detection Control | 01 | Interference detection control status 0: disable 1: enable | UINT8 | |
| 4 | Interference Status | 01 | 0: unknown 1: no interference 2: lite 3: critical | UINT8 | |
| Payload Length : 4 bytes | | | | | |

GPS PARAMETER SEARCH ENGINE NUMBER – Number of parameter search engine of GPS receiver (ID: 0x64, SID: 0x85)

This is a response message to “**QUERY GPS PARAMETER SEARCH ENGINE NUMBER, ID: 0x64, SID: 0xB**” which provides the number of parameter search engine of the GPS receiver. This message is sent from the GPS receiver to host. The payload length is 3 bytes.

Structure:

<0xA0,0xA1>< PL><64><85>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 64 85 01 E0 0D 0A
 1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------------|--------------|---|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 0A | | UINT8 | |
| 3 | Search engine number | 01 | 0: PSE_MODE_DEFAULT ROM version decided by HW power-on latch, FLASH version : by SW define 1: PSE_MODE_LOW (2 PSE) 2: PSE_MODE_MID (4 PSE) 3: PSE_MODE_HIGH (6 PSE) 4: PSE_MODE_FULL (8 PSE) | UINT8 | |
| Payload Length : 3 bytes | | | | | |

POSITION FIX NAVIGATION MASK – Position fix navigation Mask of GNSS receiver (ID: 0x64, SID: 0x88)

This is a response message to “**QUERY POSITION FIX NAVIGATION MASK, ID: 0x64, SID: 0x12**”, which provides the position fix navigation mask of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><64><88>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 64 88 00 00 EC 0D 0A

1 2 3 4 5

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|--------------------------------|--------------|----------------|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 88 | | UINT8 | |
| 3 | First fix navigation mask | 00 | 0: 3D 1: 2D | UINT8 | |
| 4 | Subsequent fix navigation mask | 00 | 0: 3D 1: 2D | UINT8 | |
| Payload Length : 4 bytes | | | | | |

GPS UTC REFERENCE TIME – UTC reference time of the GPS receiver (ID: 0x64, SID: 0x8A) ^{*1}

This is a response message to “**QUERY GPS UTC REFERENCE TIME, ID: 0x64, SID: 0x16**” which provides the UTC reference time of the GPS receiver that synchronizes to GPS time. This message is sent from the GPS receiver to host. The payload length is 7 bytes.

Structure:

<0xA0,0xA1>< PL><64><8A>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 64 8A 01 07 DD 01 01 35 0D 0A
1 2 3 4 5 6 7

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------------------|--------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 8A | | UINT8 | |
| 3 | Enable | 01 | 0: enable 1: disable | UINT8 | |
| 4-5 | UTC Year | 07DD | UTC year | UINT16 | |
| 6 | UTC Month | 01 | UTC month | UINT8 | |
| 7 | UTC Day | 01 | UTC day | UINT8 | |
| Payload Length : 7 bytes | | | | | |

*1 supported only in Flash V8 version

GNSS NAVIGATION MODE – Navigation mode of the GNSS receiver (ID: 0x64, SID: 0x8B)

This is a response message to “**QUERY GNSS NAVIGATION MODE, ID: 0x64, SID: 0x18**” which provides the navigation mode of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 3 bytes.

Structure:

<0xA0,0xA1>< PL><64><8B>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 64 8B 00 EF 0D 0A

1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-----------------|--------------|--|-------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Message Sub-ID | 8B | | UINT8 | |
| 3 | Navigation mode | 00 | 0: auto 1: prdestrian 2: car 3: marine 4: balloon 5: airborne | UINT8 | |
| Payload Length : 3 bytes | | | | | |

GNSS CONSTELLATION TYPE FOR NAVIGATION SOLUTION – GNSS constellation type for navigation solution (ID: 0x64, SID: 0x8C)

This is a response message to “**QUERY GNSS CONSTELLATION TYPE FOR NAVIGATION SOLUTION, ID 0x64, SID 0x1A**” which provides the GNSS constellation type of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><64><8C>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 64 8C 00 09 E1 0D 0A
 1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-----------------|--------------|---|--------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 8C | | UINT8 | |
| 3-4 | Navigation mode | 00 09 | Bit 0: GPS Bit 1: Glonass Bit 2: Galileo Bit 3: Beidou | UINT16 | |
| Payload Length : 4 bytes | | | | | |

GPS TIME – GPS time of GNSS receiver (ID: 0x64, SID: 0x8E) *1

This is a response message to “**QUERY GPS TIME, ID: 0x64, SID: 0x20**”, which provides the GPS time of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 15 bytes.

Structure:

<0xA0,0xA1>< PL><64><8E>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 64 8E 1B 27 5A DD 00 0B B2 3D 06 F7 10 10 03 27 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 | 64 | | UINT8 | |
| 2 | Sub ID | 8E | | UINT8 | |
| 3-6 | Time of week | 1B275ADD | Time of week in unit of millisecond | UINT32 | ms |
| 7-10 | Sub time of week | 000BB23D | Millisecond fraction of tow in unit of nanosecond | UINT32 | ns |
| 11-12 | Week number | 06F7 | Week number | UINT16 | |
| 13 | Default leap seconds | 10 | Default GPS/UTC leap seconds | SINT08 | sec |
| 14 | Current leap seconds | 10 | Current GPS/UTC leap seconds | SINT08 | sec |
| 15 | Valid | 03 | BIT0: GPS time of week, 1: valid; 0: invalid BIT1: GPS week number, 1: valid; 0: invalid BIT2: GPS leap seconds from subfram4 page 18, 1: valid; 0: invalid | UINT08 | |
| Payload Length : 15 bytes | | | | | |

*1 supported only in Flash V8 version

GNSS DATUM INDEX – Datum index of GNSS receiver (ID: 0x64, SID: 0x92) ^{*1}

This is a response message to “**QUERY GNSS DATUM INDEX, ID: 0x64, SID: 0x28**”, which provides the datum index of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><64><92>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 64 92 00 00 06 0D 0A
1 2 3 4 5

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-------------|--------------|--|--------|------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 92 | | UINT8 | |
| 3-4 | Datum index | 0000 | Datum index, range 0-220. Please refer to Appendix B | UINT16 | |
| Payload Length : 4 bytes | | | | | |

*1 supported only in Flash V8 version

GNSS GEO-FENCING DATA – Geo-fencing data of GNSS receiver (ID: 0x64, SID: 0x96) **1

This is a response message to “**QUERY GNSS GEO-FENCING DATA, ID: 0x64, SID: 0x30**”, which provides the geo-fencing data of GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is maximum 163 bytes..

Structure:

<0xA0,0xA1>< PL><64><96>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 43 64 96 04 40 38 C8 E5 BF 18 FC 73 40 5E 40 90 38 79 65 94 40 38 C8 E9 C1 87 15 D6 40
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

5E 40 92 D5 3D 3C 54 40 38 C8 F1 8D 47 37 07 40 5E 40 92 24 BC 08 40 40 38 C8 ED 64 06 8F BC 40
 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

5E 40 8F 70 E0 2B BE 1A 0D 0A
 61 62 63 64 65 66 67

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|------------------|----------------------|---|-------|--------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 96 | | UINT8 | |
| 3 | Number of points | 04 | Number of points of a polygon Maximum number: 10 | UINT8 | |
| 4-11 | Latitude | 4038C8E5 BF18FC73 | Latitude in double of polygon points #1 | DPFP | degree |
| 12-19 | Longitude | 405E4090 38796594 | Longitude in double of polygon points #1 | DPFP | degree |
| 20-27 | Latitude | 4038C8E9 C18715D6 | Latitude in double of polygon points #2 | DPFP | degree |
| 28-35 | Longitude | 405E4092 D53D3C54 | Longitude in double of polygon points #2 | DPFP | degree |
| 36-43 | Latitude | 4038C8F1 8D473707 | Latitude in double of polygon points #3 | DPFP | degree |
| 44-51 | Longitude | 405E4092 24BC0840 | Longitude in double of polygon points #3 | DPFP | degree |
| 52-59 | Latitude | 4038C8ED 64068FBC | Latitude in double of polygon points #4 | DPFP | degree |
| 60-67 | Longitude | 405E408F | Longitude in double of polygon | DPFP | degree |

| | | | | | |
|---|-----------|----------|--|------|--------|
| | | 70E02BBE | points #4 | | |
| | | | | | |
| 4+((ndx-1)*16) ~ 11+((ndx-1)*16) | Latitude | | Latitude in double of polygon points #ndx | DPFP | degree |
| 12+((ndx-1)*16) ~ 19+((ndx-1)*16) | Longitude | | Longitude in double of polygon points #ndx | DPFP | degree |
| Payload Length : maximum 163 bytes, ndx = number of polygon points, maximum 10 points | | | | | |

*1 supported only in Flash V8 version

GNSS GEO-FENCING RESULT – Geo-fencing result of GNSS receiver (ID: 0x64, SID: 0x97) *1

This is a response message to “**QUERY GNSS GEO-FENCING RESULT, ID: 0x64, SID: 0x31**”, which provides the geo-fencing result of GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 19 bytes..

Structure:

<0xA0,0xA1>< PL><64><97>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 13 64 97 00 40 38 C8 FD C1 61 5E C0 40 5E 40 AB C5 15 48 67 8A 0D 0A
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

| Field | Name | Example(hex) | Description | Type | Unit |
|---------------------------|------------|----------------------|---|-------|--------|
| 1 | Message ID | 64 | | UINT8 | |
| 2 | Sub ID | 97 | | UINT8 | |
| 3 | Result | 00 | 0: current GNSS position fix is out of configured polygon 1: current GNSS position fix within configured polygon | UINT8 | |
| 4-11 | Latitude | 4038C8FD C1615EC0 | Latitude in double of current GNSS position fix | DPFP | degree |
| 12-19 | Longitude | 405E40AB C5154867 | Longitude in double of current GNSS position fix | DPFP | degree |
| Payload Length : 19 bytes | | | | | |

*1 supported only in Flash V8 version

CONFIGURE 1PPS PULSE WIDTH – Configure 1PPS pulse width of GNSS receiver (ID: 0x65, SID: 0x1)

This is a request message which will set the pulse width of 1PPS timing to the GNSS receiver. This command is issued from the host to GNSS receiver and GNSS receiver should respond with an ACK or NACK. If value of pulse width is not valid, the GNSS receiver will respond with an NACK. The payload length is 7 bytes.

Structure:

<0xA0,0xA1>< PL><65><01>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 07 65 01 00 00 00 01 00 65 0D 0A
 1 2 3 4 5 6 7

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|--|--------|------|
| 1 | Message ID | 65 | | UINT8 | - |
| 2 | Message Sub-ID | 01 | | UINT8 | |
| 3-6 | Pulse Width | 00 00 00 01 | Pulse width of 1PPS timing Valid value between 1~100000 | UINT32 | us |
| 7 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 7 bytes | | | | | |

QUERY 1PPS PULSE WIDTH – Query 1PPS pulse width of GNSS receiver (ID: 0x65, SID: 0x2)

This is a request message which is issued from the host to GNSS receiver to query 1PPS pulse width. The GNSS receiver should respond with an ACK along with information of 1PPS pulse width, “**1PPS PULSE WIDTH, ID: 0x65, SID: 0x80**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><65><02>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 65 02 67 0D 0A

1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 65 | | UINT8 | |
| 2 | Message Sub-ID | 02 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

CONFIGURE 1PPS FREQUENCY OUTPUT – Configure frequency output of 1PPS (ID: 0x65, SID: 0x3)^{*1}

This is a request message which will set the frequency output of 1PPS to the GNSS receiver. This command is issued from the host to GNSS receiver and GNSS receiver should respond with an ACK or NACK. If value of frequency is not valid, the GNSS receiver will respond with an NACK. The payload length is 7 bytes.

Structure:

<0xA0,0xA1>< PL><65><03>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 06 65 03 00 00 00 01 01 66 0D 0A
1 2 3 4 5 6 7

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------------|--------------|--|--------|------|
| 1 | Message ID | 65 | | UINT8 | - |
| 2 | Sub ID | 03 | | UINT8 | |
| 3-6 | Frequency output | 00000001 | Frequency output of 1PPS Valid value between 0~10000000 | UINT32 | Hz |
| 7 | Attributes | 01 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 7 bytes | | | | | |

*1 supported only in Flash V8 version

QUERY 1PPS FREQUENCY OUTPUT – Query 1PPS frequency output of the GNSS receiver (ID: 0x65, SID: 0x4)^{*1}

This is a request message which is issued from the host to GNSS receiver to query 1PPS frequency. The GPS receiver should respond with an ACK along with information of 1PPS FREQUENCY, “**1PPS FREQUENCY OUTPUT ID 0x65, SID 0x81**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><65><04>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 65 04 61 0D 0A
1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 65 | | UINT8 | |
| 2 | Sub ID | 04 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

*1 supported only in Flash V8 version

1PPS PULSE WIDTH – 1PPS pulse width of GNSS receiver (ID: 0x65, SID: 0x80)

This is a response message to “**QUERY 1PPS PULSE WIDTH, ID: 0x65, SID: 0x2**” which provides the 1PPS pulse width of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 6 bytes.

Structure:

<0xA0,0xA1>< PL><65><80>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 06 65 80 00 00 00 01 E4 0D 0A
 1 2 3 4 5 6

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|---------------------------------|--------|------|
| 1 | Message ID | 65 | | UINT8 | - |
| 2 | Message Sub-ID | 80 | | UINT8 | |
| 3-6 | Pulse Width | 00 00 00 01 | Pulse Width of 1PPS timing mode | UINT32 | us |
| Payload Length : 6 bytes | | | | | |

1PPS FREQUENCY OUTPUT – 1PPS frequency of the GNSS receiver (ID: 0x65, SID: 0x81) *1

This is a response message to “**QUERY 1PPS FREQUENCY OUTPUT, ID: 0x65, SID: 0x4**”, which provides the 1PPS frequency of the GPS receiver. This message is sent from the GNSS receiver to host. The payload length is 6 bytes.

Structure:

<0xA0,0xA1>< PL><65><81>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 06 65 81 00 00 00 01 E5 0D 0A
1 2 3 4 5 6

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|-------------------|--------|------|
| 1 | Message ID | 65 | | UINT8 | - |
| 2 | Sub ID | 81 | | UINT8 | |
| 3-6 | Frequency | 00000001 | Frequency of 1PPS | UINT32 | Hz |
| Payload Length : 6 bytes | | | | | |

*1 supported only in Flash V8 version

SET BEIDOU EPHEMERIS – Set Beidou ephemeris to GNSS receiver (ID: 0x67, SID: 0x01)

This is a request message which is issued from the host to GNSS receiver to set Beidou ephemeris data (open an ephemeris file) to GNSS receiver. The GNSS receiver should respond with an ACK when succeeded and should respond with a NACK when failed. There are 2 types of ephemeris corresponding to 2 types of Beidou satellites, GEO satellite and MEO/IGSO satellite. The GEO payload length is 126 bytes and the MEO/IGSO payload length is 87 bytes.

Structure:

<0xA0,0xA1>< PL><67><01>< message body><CS><0x0D,0x0A>

Example for GEO type of satellites:

```

a0 a1 00 7e 67 01 00 04 00 01 00 00 00 01 07 2c c1 60 f4 00 00 00 00 00 00 00 00 00 00 00 00
  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

00 00 00 00 00 00 00 00 00 00 00 00 00 1c b1 40 00 00 00 1c 3c 50 00 04 37 f8 0a 08 00 00 00 58 80 4e d4
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

4d 22 34 60 04 00 00 00 5c b0 ec c8 ba d8 c0 00 00 00 00 00 b0 ff f5 e4 78 2c 04 e9 28 00 00 00
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92

24 ff 07 a8 04 7f fc ff e9 00 00 00 e4 e3 ce 8c c5 2c 24 4a 1c 00 00 00 08 30 c8 00 00 00 00 00
93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124

00 00 5b 0d 0a
125126
    
```

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|--------------------|--------------|---|--------|------|
| 1 | Message ID | 67 | | UINT8 | |
| 2 | Sub ID | 01 | | UINT8 | |
| 3-4 | SV id | 0004 | Satellite id | UINT16 | |
| 5 | Type | 00 | 0: GEO satellite 1: MEO/IGSO satellite | | |
| 6 | valid | 01 | 0: not valid 1: valid | UINT8 | |
| 7 | SubFrameData[0][0] | | Eph data subframe 1 | UINT8 | |
| 8 | SubFrameData[0][1] | | Eph data subframe 1 | UINT8 | |
| 9 | SubFrameData[0][2] | | Eph data subframe 1 | UINT8 | |
| 10 | SubFrameData[0][3] | | Eph data subframe 1 | UINT8 | |

| | | | | | |
|---|-----------------------|--|---|-------|--|
| 11 | SubFrameData[0][4] | | Eph data subframe 1 | UINT8 | |
| 12 | SubFrameData[0][5] | | Eph data subframe 1 | UINT8 | |
| 13 | SubFrameData[0][6] | | Eph data subframe 1 | UINT8 | |
| 14 | SubFrameData[0][7] | | Eph data subframe 1 | UINT8 | |
| 15 | SubFrameData[0][8] | | Eph data subframe 1 | UINT8 | |
| 16 | SubFrameData[0][9] | | Eph data subframe 1 | UINT8 | |
| 17 | SubFrameData[0][10] | | Eph data subframe 1 | UINT8 | |
| 18 | SubFrameData[0][11] | | Eph data subframe 1 | UINT8 | |
| 19~30 | SubFrameData[1][0~11] | | Eph data subframe 2, same as field 7-18 for GEO satellite | UINT8 | |
| 31-42 | SubFrameData[2][0~11] | | Eph data subframe 2, same as field 7-18 for GEO satellite | UINT8 | |
| 43-54 | SubFrameData[3][0~11] | | Eph data subframe 3, same as field 7-18 for GEO satellite | UINT8 | |
| 55-66 | SubFrameData[4][0~11] | | Eph data subframe 4, same as field 7-18 for GEO satellite | UINT8 | |
| 67-78 | SubFrameData[5][0~11] | | Eph data subframe 5, same as field 7-18 for GEO satellite | UINT8 | |
| 79-90 | SubFrameData[6][0~11] | | Eph data subframe 6, same as field 7-18 for GEO satellite | UINT8 | |
| 91-102 | SubFrameData[7][0~11] | | Eph data subframe 7, same as field 7-18 for GEO satellite | UINT8 | |
| 103-114 | SubFrameData[8][0~11] | | Eph data subframe 8, same as field 7-18 for GEO satellite | UINT8 | |
| 115-126 | SubFrameData[9][0~11] | | Eph data subframe 9, same as field 7-18 for GEO satellite | UINT8 | |
| Payload Length : 126 bytes for GEO type of satellites | | | | | |

Example of MEI/IGSO type of satellites:

```

a0 a1 00 57 67 01 00 06 01 01 00 00 00 10 72 f0 16 18 c0 00 00 00 00 00 00 00 01 ff d8 63
  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

ff fc b9 fc 84 00 01 44 ff f3 70 81 b8 20 b2 30 20 7c 75 c4 0b 6a 80 ff ff f0 fe b2 b8 a9 e9 54
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

00 07 80 b1 34 6c ff ff fc ff ff fc ff ff f8 d0 98 74 8c 16 52 cc ad 98 c8 55 0d 0a
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87

```

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|-----------------------|--------------|---|--------|------|
| 1 | Message ID | 67 | | UINT8 | |
| 2 | Sub ID | 01 | | UINT8 | |
| 3-4 | SV id | 0006 | Satellite id | UINT16 | |
| 5 | Type | 01 | 0: GEO satellite 1: MEO/IGSO satellite | | |
| 6 | valid | 01 | 0: not valid 1: valid | UINT8 | |
| 7 | SubFrameData[0][0] | | Eph data subframe 1 | UINT8 | |
| 8 | SubFrameData[0][1] | | Eph data subframe 1 | UINT8 | |
| 9 | SubFrameData[0][2] | | Eph data subframe 1 | UINT8 | |
| 10 | SubFrameData[0][3] | | Eph data subframe 1 | UINT8 | |
| 11 | SubFrameData[0][4] | | Eph data subframe 1 | UINT8 | |
| 12 | SubFrameData[0][5] | | Eph data subframe 1 | UINT8 | |
| 13 | SubFrameData[0][6] | | Eph data subframe 1 | UINT8 | |
| 14 | SubFrameData[0][7] | | Eph data subframe 1 | UINT8 | |
| 15 | SubFrameData[0][8] | | Eph data subframe 1 | UINT8 | |
| 16 | SubFrameData[0][9] | | Eph data subframe 1 | UINT8 | |
| 17 | SubFrameData[0][10] | | Eph data subframe 1 | UINT8 | |
| 18 | SubFrameData[0][11] | | Eph data subframe 1 | UINT8 | |
| 19 | SubFrameData[0][12] | | Eph data subframe 1 | UINT8 | |
| 20 | SubFrameData[0][13] | | Eph data subframe 1 | UINT8 | |
| 21 | SubFrameData[0][14] | | Eph data subframe 1 | UINT8 | |
| 22 | SubFrameData[0][15] | | Eph data subframe 1 | UINT8 | |
| 23 | SubFrameData[0][16] | | Eph data subframe 1 | UINT8 | |
| 24 | SubFrameData[0][17] | | Eph data subframe 1 | UINT8 | |
| 25 | SubFrameData[0][18] | | Eph data subframe 1 | UINT8 | |
| 26 | SubFrameData[0][19] | | Eph data subframe 1 | UINT8 | |
| 27 | SubFrameData[0][20] | | Eph data subframe 1 | UINT8 | |
| 28 | SubFrameData[0][21] | | Eph data subframe 1 | UINT8 | |
| 29 | SubFrameData[0][22] | | Eph data subframe 1 | UINT8 | |
| 30 | SubFrameData[0][23] | | Eph data subframe 1 | UINT8 | |
| 31 | SubFrameData[0][24] | | Eph data subframe 1 | UINT8 | |
| 32 | SubFrameData[0][25] | | Eph data subframe 1 | UINT8 | |
| 33 | SubFrameData[0][26] | | Eph data subframe 1 | UINT8 | |
| 34~60 | SubFrameData[1][0~26] | | Eph data subframe 2, same as field 7-33 for MEO/IGSO satellite | UINT8 | |
| 61-87 | SubFrameData[2][0~26] | | Eph data subframe 3, same as field 7-33 for MEO/IGSO satellite | UINT8 | |

Payload Length : 87 bytes for MEO/IGSO type of satellites

GET BEIDOU EPHEMERIS – Get Beidou ephemeris data used of GNSS receiver (ID: 0x67, SID: 0x02)

This is a request message which is issued from the host to GNSS receiver to retrieve ephemeris data. The GNSS receiver should respond with an ACK along with information of ephemeris, “**BEIDOU EPHEMERIS DATA, ID 0x67, SID 0x80**”, when succeeded and should respond with an NACK when failed. The payload length is 3 bytes.

Structure:

<0xA0,0xA1>< PL><67><02>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 67 02 00 65 0D 0A

1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|---|-------|------|
| 1 | Message ID | 67 | | UINT8 | |
| 2 | Sub ID | 02 | | UINT8 | |
| 3 | SV # | 00 | 0: means all SVs 1~32 : mean for the particular SV | UINT8 | |
| Payload Length : 3 bytes | | | | | |

SET BEIDOU ALMANAC – Set Beidou almanac to GNSS receiver (ID: 0x67, SID: 0x03)

This is a request message which is issued from the host to GNSS receiver to set Beidou almanac data (open an almanac file) to GNSS receiver. The GNSS receiver should respond with an ACK when succeeded and should respond with a NACK when failed. The payload length is 53 bytes.

Structure:

<0xA0,0xA1>< PL><67><03>< message body><CS><0x0D,0x0A>

Example:

```
A0 A1 00 34 67 03 00 01 4C 20 D9 38 C0 05 B0 00 C0 19 42 48 C0 2A 57 B3 39 9D 40 00 3C E1 B4 2C
    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

30 FB 53 D1 B9 A7 00 00 2E 20 00 00 00 01 F0 00 00 01 02 0E 00 03 00 00 00 47 0D 0A
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
```

| Field | Name | Example(hex) | Description | Type | Unit |
|---------------------------|--------------|--------------|---|--------|------|
| 1 | Message ID | 67 | | UINT8 | |
| 2 | Sub ID | 03 | | UINT8 | |
| 3-4 | SV ID | 0001 | Satellite id | UINT16 | |
| 5-52 | Almanac Data | | Almanac data of satellite SV ID | UINT8 | |
| 53 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 53 bytes | | | | | |

GET BEIDOU ALMANAC – Get Beidou almanac used of GNSS receiver (ID: 0x67, SID: 0x04)

This is a request message which is issued from the host to GNSS receiver to retrieve Beidou2 almanac data. The GNSS receiver should respond with an ACK along with information of Beidou2 almanac, **“BEIDOU ALMANAC DATA, ID, ID 0x67, SID 0x82”**, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><67><04>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 67 04 00 63 0D 0A
 1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|---|-------|------|
| 1 | Message ID | 67 | | UINT8 | |
| 2 | Sub ID | 04 | | UINT8 | |
| 2 | SV # | 00 | 0: means all SVs 1~37 : mean for the particular SV | UINT8 | |
| Payload Length : 2 bytes | | | | | |

BEIDOU EPHEMERIS DATA – Beidou ephemeris data of the GNSS receiver (ID: 0x67, SID: 0x80)

This is a response message to “GET BEIDOU EPHEMERIS, ID 0x67, SID 0x02”, which provides the Beidou ephemeris data of the GNSS receiver to Host. The Host will save the ephemeris data as an ephemeris file. This message is sent from the GNSS receiver to host. There are 2 types of ephemeris corresponding to 2 types of Beidou satellites, GEO satellite and MEO/IGSO satellite. The GEO payload length is 126 bytes and the MEO/IGSO payload length is 87 bytes.

Structure:

<0xA0,0xA1>< PL><67><80>< message body><CS><0x0D,0x0A>

Example of GEO type of satellites:

```
A0 A1 00 7E 67 80 00 01 00 01 00 00 00 01 07 2C C1 62 38 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

00 00 00 00 00 00 00 00 3F F5 DC 7A 60 00 00 00 24 F9 90 00 04 1B E4 FE 80 00 00 00 58 50 21 B4
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

4D 20 EC 00 00 00 00 00 94 B0 9E C8 BA FE 70 FF FC 00 00 00 90 FF EE 34 78 2C 04 AE 54 00 00 00
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92

5C FF 12 BC FF 32 40 00 19 00 00 00 EC D6 B2 9C 48 2E 50 77 F0 00 00 00 B8 2D C8 00 00 00 00 00
93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124

00 00 B5 0D 0A
125126
```

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|--------------------|--------------|---|--------|------|
| 1 | Message ID | 67 | | UINT8 | |
| 2 | Sub ID | 80 | | UINT8 | |
| 3-4 | SV id | 0001 | Satellite id | UINT16 | |
| 5 | Type | 00 | 0: GEO satellite 1: MEO/IGSO satellite | UINT8 | |
| 6 | valid | 01 | 0: not valid 1: valid | UINT8 | |
| 7 | SubFrameData[0][0] | | Eph data subframe 1 | UINT8 | |
| 8 | SubFrameData[0][1] | | Eph data subframe 1 | UINT8 | |
| 9 | SubFrameData[0][2] | | Eph data subframe 1 | UINT8 | |
| 10 | SubFrameData[0][3] | | Eph data subframe 1 | UINT8 | |
| 11 | SubFrameData[0][4] | | Eph data subframe 1 | UINT8 | |

| | | | | | |
|---|-----------------------|--|--|-------|--|
| 12 | SubFrameData[0][5] | | Eph data subframe 1 | UINT8 | |
| 13 | SubFrameData[0][6] | | Eph data subframe 1 | UINT8 | |
| 14 | SubFrameData[0][7] | | Eph data subframe 1 | UINT8 | |
| 15 | SubFrameData[0][8] | | Eph data subframe 1 | UINT8 | |
| 16 | SubFrameData[0][9] | | Eph data subframe 1 | UINT8 | |
| 17 | SubFrameData[0][10] | | Eph data subframe 1 | UINT8 | |
| 18 | SubFrameData[0][11] | | Eph data subframe 1 | UINT8 | |
| 19~30 | SubFrameData[1][0~11] | | Eph data subframe 2, same as field 7-18 for GEO satellite | UINT8 | |
| 31-42 | SubFrameData[2][0~11] | | Eph data subframe 2, same as field 7-18 for GEO satellite | UINT8 | |
| 43-54 | SubFrameData[3][0~11] | | Eph data subframe 3, same as field 67-18 for GEO satellite | UINT8 | |
| 55-66 | SubFrameData[4][0~11] | | Eph data subframe 4, same as field 7-18 for GEO satellite | UINT8 | |
| 67-78 | SubFrameData[5][0~11] | | Eph data subframe 5, same as field 7-18 for GEO satellite | | |
| 79-90 | SubFrameData[6][0~11] | | Eph data subframe 6, same as field 7-18 for GEO satellite | | |
| 91-102 | SubFrameData[7][0~11] | | Eph data subframe 7, same as field 7-18 for GEO satellite | | |
| 103-114 | SubFrameData[8][0~11] | | Eph data subframe 8, same as field 7-18 for GEO satellite | | |
| 115-126 | SubFrameData[9][0~11] | | Eph data subframe 9, same as field 7-18 for GEO satellite | | |
| Payload Length : 126 bytes for GEO type of satellites | | | | | |

Example for MEI/IGSO type of satellites:

```

A0 A1 00 57 67 80 00 06 01 01 00 00 00 10 72 F0 16 18 C0 00 00 00 00 00 00 00 01 FF D8 63
  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

FF FC B9 FC 84 00 01 44 FF F3 70 81 B8 20 B2 30 20 7C 75 C4 0B 6A 80 FF FF F0 FE B2 B8 A9 E9 54
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

00 07 80 B1 34 6C FF FF FC FF FF FC FF FF FC FF F8 D0 98 74 8C 16 52 CC AD 98 C8 D4 0D 0A
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87

```

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|------------|--------------|-------------|-------|------|
| 1 | Message ID | 67 | | UINT8 | |

| | | | | | |
|---|-----------------------|------|---|--------|--|
| 2 | Sub ID | 80 | | UINT8 | |
| 3-4 | SV id | 0006 | Satellite id | UINT16 | |
| 5 | Type | 01 | 0: GEO satellite 1: MEO/IGSO satellite | UINT8 | |
| 6 | valid | 01 | 0: not valid 1: valid | UINT8 | |
| 7 | SubFrameData[0][0] | | Eph data subframe 1 | UINT8 | |
| 8 | SubFrameData[0][1] | | Eph data subframe 1 | UINT8 | |
| 9 | SubFrameData[0][2] | | Eph data subframe 1 | UINT8 | |
| 10 | SubFrameData[0][3] | | Eph data subframe 1 | UINT8 | |
| 11 | SubFrameData[0][4] | | Eph data subframe 1 | UINT8 | |
| 12 | SubFrameData[0][5] | | Eph data subframe 1 | UINT8 | |
| 13 | SubFrameData[0][6] | | Eph data subframe 1 | UINT8 | |
| 14 | SubFrameData[0][7] | | Eph data subframe 1 | UINT8 | |
| 15 | SubFrameData[0][8] | | Eph data subframe 1 | UINT8 | |
| 16 | SubFrameData[0][9] | | Eph data subframe 1 | UINT8 | |
| 17 | SubFrameData[0][10] | | Eph data subframe 1 | UINT8 | |
| 18 | SubFrameData[0][11] | | Eph data subframe 1 | UINT8 | |
| 19 | SubFrameData[0][12] | | Eph data subframe 1 | UINT8 | |
| 20 | SubFrameData[0][13] | | Eph data subframe 1 | UINT8 | |
| 21 | SubFrameData[0][14] | | Eph data subframe 1 | UINT8 | |
| 22 | SubFrameData[0][15] | | Eph data subframe 1 | UINT8 | |
| 23 | SubFrameData[0][16] | | Eph data subframe 1 | UINT8 | |
| 24 | SubFrameData[0][17] | | Eph data subframe 1 | UINT8 | |
| 25 | SubFrameData[0][18] | | Eph data subframe 1 | UINT8 | |
| 26 | SubFrameData[0][19] | | Eph data subframe 1 | UINT8 | |
| 27 | SubFrameData[0][20] | | Eph data subframe 1 | UINT8 | |
| 28 | SubFrameData[0][21] | | Eph data subframe 1 | UINT8 | |
| 29 | SubFrameData[0][22] | | Eph data subframe 1 | UINT8 | |
| 30 | SubFrameData[0][23] | | Eph data subframe 1 | UINT8 | |
| 31 | SubFrameData[0][24] | | Eph data subframe 1 | UINT8 | |
| 32 | SubFrameData[0][25] | | Eph data subframe 1 | UINT8 | |
| 33 | SubFrameData[0][26] | | Eph data subframe 1 | UINT8 | |
| 34~60 | SubFrameData[1][0~26] | | Eph data subframe 2, same as field 7-33 for MEO/IGSO satellite | UINT8 | |
| 61-87 | SubFrameData[2][0~26] | | Eph data subframe 3, same as field 7-33 for MEO/IGSO satellite | UINT8 | |
| Payload Length : 87 bytes for MEO/IGSO type of satellites | | | | | |

BEIDOU ALMANAC DATA – BEIDOU almanac data of the GNSS receiver (ID: 0x67, SID: 0x81)

This is a response message to “GET BEIDOU ALMANAC, ID: 0x67, SID: 0x04” which provides the Beidou almanac data of the GNSS receiver to Host. The Host will save the almanac data as an almanac file. This message is sent from the GNSS receiver to host. The payload length is 53 bytes.

Structure:

<0xA0,0xA1>< PL><67><81>< message body><CS><0x0D,0x0A>

Example:

```
A0 A1 00 35 67 81 30 00 01 4C 20 D9 38 C0 05 B0 00 C0 19 42 48 C0 2A 57 B3 39 9D 40 00 3C E1 B4
    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

2C 30 FB 53 D1 B9 A7 00 00 2E 20 00 00 00 01 F0 00 00 01 02 0E 00 03 00 00 F5 0D 0A
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
```

| Field | Name | Example(hex) | Description | Type | Unit |
|---------------------------|--------------|--------------|---------------------------------|--------|------|
| 1 | Message ID | 67 | | UINT8 | |
| 2 | Sub ID | 81 | | UINT8 | |
| 3 | Almanac Size | 30 | 48 bytes of each SV | | |
| 4-5 | SV ID | 0001 | Satellite id | UINT16 | |
| 6-53 | Almanac Data | | Almanac data of satellite SV ID | UINT8 | |
| Payload Length : 53 bytes | | | | | |

CONFIGURE RTK MODE – Configure Real Time Kinematic mode of GNSS receiver (ID: 0x6A, SID: 0x1) ^{*1}

This is a request message which will Real Time Kinematic mode to the GNSS receiver. This command is issued from the host to GNSS receiver and GNSS receiver should respond with an ACK or NACK. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><6A><01>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 6A 01 00 00 6B 0D 0A
 1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|---|-------|------|
| 1 | Message ID | 6A | | UINT8 | - |
| 2 | Message Sub-ID | 01 | | UINT8 | |
| 3 | RTK Mode | 00 | 0: RTK rover mode 1: RTK base mode | UINT8 | |
| 4 | Attributes | 00 | 0: update to SRAM 1: update to both SRAM & FLASH | UINT8 | |
| Payload Length : 4 bytes | | | | | |

*1 supported only in Flash V8 version

QUERY RTK MODE – Query Real Time Kinematic mode of GNSS receiver (ID: 0x6A, SID: 0x2) ^{*1}

This is a request message which is issued from the host to GNSS receiver to query Real Time Kinematic mode. The GNSS receiver should respond with an ACK along with mode of RTK, “**RTK MODE, ID: 0x6A, SID: 0x80**”, when succeeded and should respond with an NACK when failed. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><6A><02>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 6A 02 68 0D 0A

1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|-------------|-------|------|
| 1 | Message ID | 6A | | UINT8 | |
| 2 | Message Sub-ID | 02 | | UINT8 | |
| Payload Length : 2 bytes | | | | | |

*1 supported only in Flash V8 version

RTK MODE – Real Time Kinematic mode of the GNSS receiver (ID: 0x6A, SID: 0x80) *1

This is a response message to “**QUERY RTK MODE, ID: 0x6A, SID: 0x2**”, which provides the Real Time Kinematic mode of the GPS receiver. This message is sent from the GNSS receiver to host. The payload length is 3 bytes.

Structure:

<0xA0,0xA1>< PL><6A><80>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 03 6A 80 00 EA 0D 0A
 1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|---------------------------------------|-------|------|
| 1 | Message ID | 6A | | UINT8 | - |
| 2 | Sub ID | 80 | | UINT8 | |
| 3 | RTK Mode | 00 | 0: RTK rover mode 1: RTK base mode | UINT8 | |
| Payload Length : 3 bytes | | | | | |

*1 supported only in Flash V8 version

OUTPUT MESSAGES

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

This is a response message to “**QUERY SOFTWARE VERSION, ID: 0x2**” which provides the software version of the GNSS receiver. This message is sent from the GNSS 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 | 00010101 | X1.Y1.Z1 = SkyTraq Kernel Version Ex. X1=01, Y1=00, Z1=01 (1.0.1) | UINT32 | |
| 7-10 | ODM version | 0001030E | X1.Y1.Z1 = SkyTraq Version Ex. X1=01, Y1=03, Z1=0E (1.3.14) | UINT32 | |
| 11-14 | Revision | 00070112 | YYMMDD = SkyTraq Revision Ex. YY=07, MM=01, DD=12 (070118) | UINT32 | |
| Payload Length : 14 bytes | | | | | |

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

This is a response message to “**QUERY SOFTWARE CRC, ID: 0x3**” which provides the software CRC of the GNSS receiver. This message is sent from the GNSS 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 ^{*1} | 02 | Message ID of the request message | UINT8 | |
| Payload Length : 2 bytes | | | | | |

*1: ACK ID may further consist of message ID and message sub-ID which will become 3 bytes of ACK message.

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 | NACK ID ^{*1} | 01 | Message ID of the request message | UINT8 | |
| Payload Length : 2 bytes | | | | | |

*1: NACK ID may further consist of message ID and message sub-ID which will become 3 bytes of NACK message.

POSITON UPDATE RATE – Position Update rate of the GNSS system (0x86)

This is a response message to “**QUERY POSITION UPDATE RATE, ID: 0x10**” which provides the position update rate of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><86>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 86 01 87 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-------------|--------------|-------------|-------|------|
| 1 | Message ID | 86 | | UINT8 | |
| 2 | Update Rate | 01 | 01: 1Hz | UINT8 | |
| Payload Length : 2 bytes | | | | | |

GLONASS EPHEMERIS DATA – GLONASS ephemeris data of the GLONASS/GPS receiver (0x90)

This is a response message to “**GET GLONASS EPHEMERIS, ID: 0x5B**” which provides the GLONASS Ephemeris Data of the receiver to the host. The Host may save the ephemeris data as an ephemeris file. This message is sent from the receiver to host. The payload length is 43 bytes.

Structure:

<0xA0,0xA1>< PL><90>< message body><CS><0x0D,0x0A>

Example:

```
A0 A1 00 2B 90 01 01 01 07 43 0F AC 06 89 A2 01 9A 02 17 60 28 75 47 01 16 FE B5 03 80 06 9C CB
    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

CC 92 6A C0 42 04 09 94 79 20 00 00 20 11 85 E3 0D 0A
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
```

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|---------------------|--------------|--|-------|------|
| 1 | Message ID | 90 | | UINT8 | |
| 2 | Slot number | 01 | GLONASS SV slot number | UINT8 | |
| 3 | K number | 01 | GLONASS SV frequency number (-7 ~ +6) | SINT8 | |
| 4 | glo_eph_data0_byte0 | 01 | Stuffing zeros and bit 85 - bit 81 (LSB) of string 1 | UINT8 | |
| 5 | glo_eph_data0_byte1 | 07 | bit 80 (MSB)- bit 73 (LSB) of string 1 | UINT8 | |
| 6 | glo_eph_data0_byte2 | 43 | bit 72 (MSB)- bit 65 (LSB) of string 1 | UINT8 | |
| 7 | glo_eph_data0_byte3 | 0F | bit 64 (MSB)- bit 57 (LSB) of string 1 | UINT8 | |
| 8 | glo_eph_data0_byte4 | AC | bit 56 (MSB)- bit 49 (LSB) of string 1 | UINT8 | |
| 9 | glo_eph_data0_byte5 | 06 | bit 48 (MSB)- bit 41 (LSB) of string 1 | UINT8 | |
| 10 | glo_eph_data0_byte6 | 89 | bit 40 (MSB)- bit 33 (LSB) of string 1 | UINT8 | |
| 11 | glo_eph_data0_byte7 | A2 | bit 32 (MSB)- bit 25 (LSB) of string 1 | UINT8 | |
| 12 | glo_eph_data0_byte8 | 01 | bit 24 (MSB)- bit 17 (LSB) of string 1 | UINT8 | |
| 13 | glo_eph_data0_byte9 | 9A | bit 16 (MSB)- bit 09 (LSB) of string 1 | UINT8 | |
| 14 | glo_eph_data1_byte0 | 02 | Stuffing zeros and bit 85 - bit 81 (LSB) of string 2 | UINT8 | |
| 15 | glo_eph_data1_byte1 | 17 | bit 80 (MSB)- bit 73 (LSB) of string 2 | UINT8 | |
| 16 | glo_eph_data1_byte2 | 60 | bit 72 (MSB)- bit 65 (LSB) of string 2 | UINT8 | |
| 17 | glo_eph_data1_byte3 | 28 | bit 64 (MSB)- bit 57 (LSB) of string 2 | UINT8 | |
| 18 | glo_eph_data1_byte4 | 75 | bit 56 (MSB)- bit 49 (LSB) of string 2 | UINT8 | |
| 19 | glo_eph_data1_byte5 | 47 | bit 48 (MSB)- bit 41 (LSB) of string 2 | UINT8 | |

| | | | | | |
|---------------------------|--|----|---|-------|--|
| 20 | glo_eph_data1_byte6 | 01 | bit 40 (MSB)- bit 33 (LSB) of string 2 | UINT8 | |
| 21 | glo_eph_data1_byte7 | 16 | bit 32 (MSB)- bit 25 (LSB) of string 2 | UINT8 | |
| 22 | glo_eph_data1_byte8 | FE | bit 24 (MSB)- bit 17 (LSB) of string 2 | UINT8 | |
| 23 | glo_eph_data1_byte9 | B5 | bit 16 (MSB)- bit 09 (LSB) of string 2 | UINT8 | |
| 24-33 | glo_eph_data2_byte0 - glo_eph_data2_byte9 | | Stuffing-zeros and bit 85 - bit 09 of string 3 | | |
| 34-43 | glo_eph_data3_byte0 - glo_eph_data3_byte9 | | Stuffing-zeros and bit 85 - bit 09 of string 4 | | |
| Payload Length : 43 bytes | | | | | |

GLONASS ALMANAC DATA – GLONASS almanac data of the GNSS receiver (0x91)

This is a response message to “**GET GLONASS ALMANAC, ID: 0x5D**” which provides the GLONASS almanac data of the receiver to Host. The Host may save the almanac data as a file. This message is sent from the receiver to the host. The payload length is 25 bytes.

Structure:

<0xA0,0xA1>< PL><91>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 19 91 01 06 00 23 06 A1 09 A9 6E A4 0D 4A 81 CE 07 11 F4 9A 7A 9E 98 17 A8 C2 09 0D 0A
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|---------------------|--------------|---|--------|------|
| 1 | Message ID | 91 | | UINT8 | |
| 2 | Slot number | 01 | GLONASS SV slot number | UINT8 | |
| 3 | N4 | 06 | GLONASS non-immediate information N4 | UINT8 | |
| 4-5 | NA | 0023 | GLONASS non-immediate information NA | UINT16 | |
| 6 | glo_alm_data1_byte0 | 06 | Stuffing zeros and bit 85 - bit 81 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 7 | glo_alm_data1_byte1 | a1 | bit 80 (MSB)- bit 73 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 8 | glo_alm_data1_byte2 | 09 | bit 72 (MSB)- bit 65 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 9 | glo_alm_data1_byte3 | A9 | bit 64 (MSB)- bit 57 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 10 | glo_alm_data1_byte4 | 6E | bit 56 (MSB)- bit 49 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 11 | glo_alm_data1_byte5 | A4 | bit 48 (MSB)- bit 41 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 12 | glo_alm_data1_byte6 | 0D | bit 40 (MSB)- bit 33 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 13 | glo_alm_data1_byte7 | 4A | bit 32 (MSB)- bit 25 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 14 | glo_alm_data1_byte8 | 81 | bit 24 (MSB)- bit 17 (LSB) of string 6/8/10/12/14 | UINT8 | |
| 15 | glo_alm_data1_byte9 | CE | bit 16 (MSB)- bit 09 (LSB) of string | UINT8 | |

| | | | | | |
|---------------------------|---------------------|----|---|-------|--|
| | | | 6/8/10/12/14 | | |
| 16 | glo_alm_data2_byte0 | 07 | Stuffing zeros and bit 85 - bit 81 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 17 | glo_alm_data2_byte1 | 11 | bit 80 (MSB)- bit 73 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 18 | glo_alm_data2_byte2 | F4 | bit 72 (MSB)- bit 65 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 19 | glo_alm_data2_byte3 | 9A | bit 64 (MSB)- bit 57 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 20 | glo_alm_data2_byte4 | 7A | bit 56 (MSB)- bit 49 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 21 | glo_alm_data2_byte5 | 9E | bit 48 (MSB)- bit 41 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 22 | glo_alm_data2_byte6 | 98 | bit 40 (MSB)- bit 33 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 23 | glo_alm_data2_byte7 | 17 | bit 32 (MSB)- bit 25 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 24 | glo_alm_data2_byte8 | A8 | bit 24 (MSB)- bit 17 (LSB) of string 7/9/11/13/15 | UINT8 | |
| 25 | glo_alm_data2_byte9 | C2 | bit 16 (MSB)- bit 09 (LSB) of string 7/9/11/13/15 | UINT8 | |
| Payload Length : 25 bytes | | | | | |

GLONASS TIME CORRECTION PARAMETERS – GLONASS time correction parameters (0x92)

This is a response message to “GET GLONASS TIME CORRECTION, ID: 0x5F” which provides the GLONASS time correction data of the receiver to the host. The Host may save the data as a file. This message is sent from the receiver to host. The payload length is 9 bytes.

Structure:

<0xA0,0xA1>< PL><92>< message body><CS><0x0D,0x0A>

Example:

a0 a1 00 09 92 ff ff ff bf 00 00 00 14 c6 0d 0a
 1 2 3 4 5 6 7 8 9

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|--------------|--------------|---|--------|---------------|
| 1 | Message ID | 92 | | UINT8 | |
| 2-5 | τ_c | ffffffbf | GLONASS time scale correction to UTC(SU) time | SINT32 | 2^{-31} sec |
| 6-9 | τ_{GPS} | 00000014 | Correction to GPS time relative to GLONASS time | SINT32 | 2^{-30} sec |
| Payload Length : 9 bytes | | | | | |

GNSS NMEA TALKER ID – NMEA talker ID of GNSS receiver (0x93) *1

This is a response message to “**QUERY NMEA TALKER ID, ID: 0x4F**” which provides the type of NMEA talker id of GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><93>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 93 01 92 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|----------------|--------------|--------------------------|-------|------|
| 1 | Message ID | 93 | | UINT8 | |
| 2 | Talker ID type | 01 | 0: GP mode 1: GN mode | UINT8 | |
| Payload Length : 2 bytes | | | | | |

*1 supported only in Flash V8 version

NAVIGATION DATA MESSAGE – Message of user navigation data in binary format (0xA8)

This is a response message which provides data of user navigation solution in binary format. This message is sent from the GNSS receiver to host. The payload length is 59 bytes

Structure:

<0xA0,0xA1>< PL><A8>< message body><CS><0x0D,0x0A>

Example:

```
A0 A1 00 3B A8 02 08 06 04 02 32 18 18 0E C5 E1 99 48 20 78 ED 00 00 2E 3B 00 00 26 93 00 93 00 93
    1  2 3  4 5  6  7 8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
00 93 00 93 00 93 EE 35 4D 30 1D 99 AA 37 0F D7 0B 74 00 00 00 00 00 00 00 00 00 00 00 00 F5 0D 0A
30 31.32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59
```

| Field | Name | Example(hex) | Description | Type | Unit |
|-------|-------------------------|--------------|--|--------|---------------|
| 1 | Message ID | A8 | | UINT8 | |
| 2 | Fix Mode | 02 | Quality of fix 0: no fix 1: 2D 2: 3D 3: 3D+DGNSS | UINT8 | |
| 3 | Number of SV in fix | 08 | Number of SV in fix 0-12 | UINT8 | |
| 4-5 | GNSS Week | 0604 | GNSS week number | UINT16 | |
| 6-9 | TOW | 02321818 | GNSS time of week Scaling 0.01 | UINT32 | 1/100 sec |
| 10-13 | Latitude | 0EC5E199 | > 0: North Hemisphere < 0: South Hemisphere Scaling 1e-7 | SINT32 | 1/1e-7 degree |
| 14-17 | Longitude | 482078ED | > 0: East Hemisphere < 0: West Hemisphere | SINT32 | 1/1e-7 degree |
| 18-21 | ellipsoid altitude, | 00002E3B | height above ellipsoid Scaling 0.01 | SINT32 | 1/100 meter |
| 22-25 | mean sea level altitude | 00002693 | height above mean sea level Scaling 0.01 | SINT32 | 1/100 meter |
| 26-27 | GDOP | 0093 | Geometric dilution of precision Scaling 0.01 | UINT16 | 1/100 |
| 28-29 | PDOP | 0093 | Position dilution of precision Scaling 0.01 | UINT16 | 1/100 |
| 30-31 | HDOP | 0093 | Horizontal dilution of precision | UINT16 | 1/100 |

| | | | | | |
|---------------------------|---------|----------|--|--------|----------------|
| | | | Scaling 0.01 | | |
| 32-33 | VDOP | 0093 | Vertical dilution of precision Scaling 0.01 | UINT16 | 1/100 |
| 34-35 | TDOP | 0093 | Time dilution of precision Scaling 0.01 | UINT16 | 1/100 |
| 36-39 | ECEF-X | EE354D30 | ECEF X coordinate Scaling 0.01 | SINT32 | 1/100 meter |
| 40-43 | ECEF-Y | 1D99AA37 | ECEF Y coordinate Scaling 0.01 | SINT32 | 1/100 meter |
| 44-47 | ECEF-Z | 0FD70B74 | ECEF Z coordinate Scaling 0.01 | SINT32 | 1/100 meter |
| 48-51 | ECEF-VX | 00000000 | ECEF X Veolcity Scaling 0.01 | SINT32 | 1/100 m/s |
| 52-55 | ECEF-VY | 00000000 | ECEF Y Veolcity Scaling 0.01 | SINT32 | 1/100 m/s |
| 56-59 | ECEF-VZ | 00000000 | ECEF Z Veolcity Scaling 0.01 | SINT32 | 1/100 m/s |
| Payload Length : 59 bytes | | | | | |

GNSS DATUM – Datum used by the GNSS receiver (0xAE)

This is a response message to “**QUERY DATUM, ID: 0x2D**” which provides the datum information of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 3 bytes.

Structure:

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

Example:

A0 A1 00 03 AE 00 13 BD 0D 0A
 1 2 3

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-------------|--------------|--|--------|------|
| 1 | Message ID | AE | | UINT8 | |
| 2-3 | Datum Index | 0013 | Datum index Refer to Appendix A & B | UINT16 | |
| Payload Length : 3 bytes | | | | | |

GNSS DOP MASK – DOP Mask used by the GNSS receiver (0xAF)

This is a response message to “**QUERY DOP MASK, ID: 0x2E**” which provides the information of DOP masks of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 8 bytes.

Structure:

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

Example:

A0 A1 00 08 AF 01 00 32 00 32 00 32 9C 0D 0A
 1 2 3 4 5 6 7 8

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-----------------|--------------|---|--------|------|
| 1 | Message ID | AF | | UINT8 | |
| 2 | DOP Mode Select | 01 | 00 : Disable 01 : Auto mode, PDOP when 3-D fix and HDOP when 2-D fix 02 : GDOP only 03 : PDOP only 04 : HDOP only | UINT8 | |
| 3-4 | PDOP Value | 0032 | Valid values between 0.5~30 Valid output value 5 ~ 300 | UINT16 | 1/10 |
| 5-6 | HDOP Value | 0032 | Valid values between 0.5~30 Valid output value 5 ~ 300 | UINT16 | 1/10 |
| 7-8 | GDOP Value | 0032 | Valid values between 0.5~30 Valid output value 5 ~ 300 | UINT16 | 1/10 |
| Payload Length : 8 bytes | | | | | |

GNSS ELEVATION AND CNR MASK – Elevation and CNR mask used by the GNSS receiver (0xB0)

This is a response message to “**QUERY ELEVATION AND CNR MASK, ID: 0x2F**” which provides the information of elevation and CNR masks of the GNSS receiver. When enabled, satellite with elevation angle above the elevation mask value and tracked signal with CNR above the CNR mask value will be used for position fix. This message is sent from the GNSS receiver to host. The payload length is 4 bytes.

Structure:

<0xA0,0xA1>< PL><B0>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 04 B0 01 05 00 B4 0D 0A

1 2 3 4

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-------------------------------|--------------|---|-------|--------|
| 1 | Message ID | B0 | | UINT8 | |
| 2 | Elevation and CNR Mask Select | 01 | 00 : Disable 01 : Elevation and CNR both 02 : Elevation only 03 : CNR only | UINT8 | |
| 3 | Elevation Mask | 05 | Value of elevation mask | UINT8 | Degree |
| 4 | CNR Mask | 00 | Value of CNR mask | UINT8 | dB |
| Payload Length : 4 bytes | | | | | |

GPS EPHEMERIS DATA – GPS ephemeris data of the GNSS receiver (0xB1)

This is a response message to “GET GPS EPHEMERIS, ID: 0x30” which provides the GPS Ephemeris Data of the GNSS receiver to Host. The Host will save the ephemeris data as an ephemeris file. This message is sent from the GNSS 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 00 00 DB DF 59 A6 00 00 1E
    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

0A 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
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

77 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
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 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

GNSS POSITON PINNING STATUS – Position pinning status of the GNSS receiver (0xB4)

This is a response message to “**QUERY POSITION PINNING, ID 0x3A**” which provides the position pinning status and position pinning parameters of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 12 bytes.

Structure:

<0xA0,0xA1>< PL><B4>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 0C B4 02 00 02 00 0A 00 08 00 2D 01 F4 67 0D 0A
 1 2 3 4 5 6 7 8 9 10 11 12

| Field | Name | Example(hex) | Description | Type | Unit |
|---------------------------|--------------------|--------------|---------------------------------------|--------|--------|
| 1 | Message ID | B4 | | UINT8 | |
| 2 | status | 02 | 0: default 1: enable 2: disable | UINT8 | |
| 3-4 | Pinning speed | 0002 | Be effective when status is enable | UINT16 | Km/Hr |
| 5-6 | Pinning cnt | 000A | Be effective when status is enable | UINT16 | Second |
| 7-8 | Unpinning speed | 0008 | Be effective when status is enable | UINT16 | Km/Hr |
| 9-10 | Unpinning cnt | 002D | Be effective when status is enable | UINT16 | Second |
| 11-12 | Unpinning distance | 01F4 | Be effective when status is enable | UINT16 | Meter |
| Payload Length : 12 bytes | | | | | |

GNSS POWER MODE STATUS – Power mode status of the GNSS receiver (0xB9)

This is a response message to “**QUERY POWER MODE, ID: 0x15**” which provides the power mode status of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 2 bytes.

Structure:

<0xA0,0xA1>< PL><B9>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 02 B9 00 B9 0D 0A

1 2

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|------------|--------------|---|-------|------|
| 1 | Message ID | B9 | | UINT8 | |
| 2 | Mode | 00 | 00 = Normal (disable power save) 01 = Power Save (enable power save) | UINT8 | |
| Payload Length : 2 bytes | | | | | |

GNSS 1PPS CABLE DELAY – 1PPS cable delay of the GNSS receiver (0xBB)

This is a response message to “**QUERY 1PPS CABLE DELAY, ID: 0x46**” which provides the 1PPS cable delay of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 5 bytes.

Structure:

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

Example:

A0 A1 00 05 BB 00 00 00 00 BB 0D 0A
 1 2 3 4 5

| Field | Name | Example(hex) | Description | Type | Unit |
|--------------------------|-------------|--------------|---|--------|----------|
| 1 | Message ID | BB | | UINT8 | - |
| 2-5 | Cable Delay | 00000000 | Cable delay of 1PPS timing mode Return value is in unit of 1/100 ns. Ex. If 100 is the cable delay, it's of value 1ns. | SINT32 | 1/100 ns |
| Payload Length : 5 bytes | | | | | |

GPS ALMANAC DATA – GPS almanac data of the GNSS receiver (0xBE)

This is a response message to “GET GPS ALMANAC, ID: 0x50” which provides the GPS almanac Data of the GNSS receiver to Host. The Host will save the almanac data as an almanac file. This message is sent from the GNSS receiver to host. The payload length is 52 bytes.

Structure:

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

Example:

A0 A1 00 34 BE 30 00 01 4B CA A2 AE 3F 89 EE C1 3E E3 CF 59 BE A1 20 22 3B 74 38 00 3F 76 1C 04
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

B2 05 52 43 B7 40 00 00 00 00 00 00 07 B0 00 00 01 03 1E 00 04 00 00 15 0D 0A
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52

| Field | Name | Example(hex) | Description | Type | Unit |
|---------------------------|--------------|--------------|---------------------------------|--------|------|
| 1 | Message ID | BE | | UINT8 | |
| 2 | Almanac Size | 30 | 48 bytes of each SV | | |
| 3-4 | SV ID | 0x0001 | Satellite id | UINT16 | |
| 5-52 | Almanac Data | | Almanac data of satellite SV ID | UINT8 | |
| Payload Length : 52 bytes | | | | | |

GNSS 1PPS TIMING – 1PPS timing information of the GNSS receiver (0xC2)*1

This is a response message to “**QUERY 1PPS TIMING, ID: 0x44**” which provides the information of 1PPS timing of the GNSS receiver. This message is sent from the GNSS receiver to host. The payload length is 35 bytes.

Structure:

<0xA0,0xA1>< PL><C2>< message body><CS><0x0D,0x0A>

Example:

A0 A1 00 23 C2 00 00 00 07 D0 00 00 00 1E 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

00 00 00 01 00 00 07 D0 DC 0D 0A
 28 29 30 31 32 33 34 35

| Field | Name | Example(hex) | Description | Type | Unit |
|--------|----------------------|------------------|--|--------|------|
| 1 | Message ID | C2 | | UINT8 | - |
| 2 | Saved Timing Mode | 00 | 00 = Timing PVT Mode 01 = Timing Survey Mode 02 = Timing Static Mode Value saved in SRAM/Flash by request command, QUERY 1PPS TIMING, id 0x44 with attribute 1 or 2 | UINT8 | |
| 3-6 | Saved Survey Length | 000007D0 | Survey length used when in “Saved Timing Survey Mode”. Value saved in SRAM/Flash by request command, QUERY 1PPS TIMING, id 0x44 with attribute 1 or 2 | UINT32 | |
| 7-10 | Standard deviation | 0000001E | Standard Deviation when in Timing Survey Mode not used when in other mode. Valid values between 3~100 | UINT32 | |
| 11-18 | Saved Latitude | 0000000000000000 | Latitude in double in Timing Static Mode | DPFP | |
| 19-26- | Saved Longitude | 0000000000000000 | Longitude in double in Timing Static Mode | DPFP | |
| 27-30 | Saved Altitude | 00000000 | Altitude in float in Timing Static Mode | SPFP | |
| 31 | Run-time Timing Mode | 00 | 00 = Timing Normal Mode 01 = Timing Survey Mode 02 = Timing Static Mode Value currently used and not saved in | UINT8 | |

| | | | | | |
|---------------------------|---------------------------|----------|---|--------|--|
| | | | SRAM/Flash by QUERY 1PPS TIMING, id 0x44 with attribute 0 | | |
| 32-35 | Run-time Survey Length | 000007D0 | Survey length used when in "Run-time Timing Survey Mode". Value currently used and not saved in SRAM/Flash by QUERY 1PPS TIMING, id 0x44 with attribute 0 | UINT32 | |
| Payload Length : 35 bytes | | | | | |

*1: supported only in Venus838LPx-T, S1216F8-T timing mode receivers.

A. Ellipsoid List

| Ellipsoid Index | Ellipsoid | Semi-major axis (a) | Inversed Flattening (1/f) |
|-----------------|-------------------------|---------------------|-----------------------------|
| 1 | Airy 1830 | 6377563.396 | 299.3249646 |
| 2 | Modified Airy | 6377340.189 | 299.3249646 |
| 3 | Australian National | 6378160 | 298.25 |
| 4 | Bessel 1841 (Namibia) | 6377483.865 | 299.1528128 |
| 5 | Bessel 1841 | 6377397.155 | 299.1528128 |
| 6 | Clarke 1866 | 6378206.4 | 294.9786982 |
| 7 | Clarke 1880 | 6378249.145 | 293.465 |
| 8 | Everest (India 1830) | 6377276.345 | 300.8017 |
| 9 | Everest (Sabah Sarawak) | 6377298.556 | 300.8017 |
| 10 | Everest (India 1956) | 6377301.243 | 300.8017 |
| 11 | Everest (Malaysia 1969) | 6377295.664 | 300.8017 |
| 12 | Everest (Malay. & Sing) | 6377304.063 | 300.8017 |
| 13 | Everest (Pakistan) | 6377309.613 | 300.8017 |
| 14 | Modified Fischer 1960 | 6378155 | 298.3 |
| 15 | Helmert 1906 | 6378200 | 298.3 |
| 16 | Hough 1960 | 6378270 | 297 |
| 17 | Indonesian 1974 | 6378160 | 298.247 |
| 18 | International 1924 | 6378388 | 297 |
| 19 | Krassovsky 1940 | 6378245 | 298.3 |
| 20 | GRS 80 | 6378137 | 298.257222101 |
| 21 | South American 1969 | 6378160 | 298.25 |
| 22 | WGS 72 | 6378135 | 298.26 |
| 23 | WGS 84 | 6378137 | 298.257223563 |
| 24 | PZ-90 | 6378136 | 298.257839303 ^{*1} |

*1 supported only in Configure GNSS Datum ((ID: 0x64, SID: 0x27).

B. Datum Reference List

| Datum index | Datum Name | Delta X | Delta Y | Delta Z | Ellipsoid | Ellipsoid Index | Region of Use |
|-------------|-------------------------------|---------|---------|---------|---------------------|-----------------|---|
| 0 | WGS-84 | 0 | 0 | 0 | WGS 84 | 23 | Global |
| 1 | Adindan | -118 | -14 | 218 | Clarke 1880 | 7 | Burkina Faso |
| 2 | Adindan | -134 | -2 | 210 | Clarke 1880 | 7 | Cameroon |
| 3 | Adindan | -165 | -11 | 206 | Clarke 1880 | 7 | Ethiopia |
| 4 | Adindan | -123 | -20 | 220 | Clarke 1880 | 7 | Mali |
| 5 | Adindan | -166 | -15 | 204 | Clarke 1880 | 7 | MEAN FOR Ethiopia; Sudan |
| 6 | Adindan | -128 | -18 | 224 | Clarke 1880 | 7 | Senegal |
| 7 | Adindan | -161 | -14 | 205 | Clarke 1880 | 7 | Sudan |
| 8 | Afgooye | -43 | -163 | 45 | Krassovsky 1940 | 19 | Somalia |
| 9 | Ain el Abd 1970 | -150 | -250 | -1 | International 1924 | 18 | Bahrain |
| 10 | Ain el Abd 1970 | -143 | -236 | 7 | International 1924 | 18 | Saudi Arabia |
| 11 | American Samoa 1962 | -115 | 118 | 426 | Clarke 1866 | 6 | American Samoa Islands |
| 12 | Anna 1 Astro 1965 | -491 | -22 | 435 | Australian National | 3 | Cocos Islands |
| 13 | Antigua Island Astro 1943 | -270 | 13 | 62 | Clarke 1880 | 7 | Antigua (Leeward Islands) |
| 14 | Arc 1950 | -138 | -105 | -289 | Clarke 1880 | 7 | Botswana |
| 15 | Arc 1950 | -153 | -5 | -292 | Clarke 1880 | 7 | Burundi |
| 16 | Arc 1950 | -125 | -108 | -295 | Clarke 1880 | 7 | Lesotho |
| 17 | Arc 1950 | -161 | -73 | -317 | Clarke 1880 | 7 | Malawi |
| 18 | Arc 1950 | -143 | -90 | -294 | Clarke 1880 | 7 | MEAN FOR Botswana; Lesotho; Malawi; Swaziland; Zaire; Zambia; Zimbabwe |
| 19 | Arc 1950 | -134 | -105 | -295 | Clarke 1880 | 7 | Swaziland |
| 20 | Arc 1950 | -169 | -19 | -278 | Clarke 1880 | 7 | Zaire |
| 21 | Arc 1950 | -147 | -74 | -283 | Clarke 1880 | 7 | Zambia |
| 22 | Arc 1950 | -142 | -96 | -293 | Clarke 1880 | 7 | Zimbabwe |
| 23 | Arc 1960 | -160 | -6 | -302 | Clarke 1880 | 7 | MEAN FOR Kenya; Tanzania |
| 24 | Arc 1960 | -157 | -2 | -299 | Clarke 1880 | 7 | Kenya |
| 25 | Arc 1960 | -175 | -23 | -303 | Clarke 1880 | 7 | Taanзания |
| 26 | Ascension Island 1958 | -205 | 107 | 53 | International 1924 | 18 | Ascension Island |
| 27 | Astro Beacon E 1945 | 145 | 75 | -272 | International 1924 | 18 | Iwo Jima |
| 28 | Astro DOS 71/4 | -320 | 550 | -494 | International 1924 | 18 | St Helena Island |
| 29 | Astro Tern Island (FRIG) 1961 | 114 | -116 | -333 | International 1924 | 18 | Tern Island |
| 30 | Astronomical Station 1952 | 124 | -234 | -25 | International 1924 | 18 | Marcus Island |
| 31 | Australian Geodetic 1966 | -133 | -48 | 148 | Australian National | 3 | Australia; Tasmania |
| 32 | Australian Geodetic 1984 | -134 | -48 | 149 | Australian National | 3 | Australia; Tasmania |
| 33 | Ayabelle Lighthouse | -79 | -129 | 145 | Clarke 1880 | 7 | Djibouti |
| 34 | Bellevue (IGN) | -127 | -769 | 472 | International 1924 | 18 | Efate & Erromango Islands |
| 35 | Bermuda 1957 | -73 | 213 | 296 | Clarke 1866 | 6 | Bermuda |
| 36 | Bissau | -173 | 253 | 27 | International 1924 | 18 | Guinea-Bissau |
| 37 | Bogota Observatory | 307 | 304 | -318 | International 1924 | 18 | Colombia |
| 38 | Bukit Rimpah | -384 | 664 | -48 | Bessel 1841 | 5 | Indonesia (Bangka & Belitung Ids) |
| 39 | Camp Area Astro | -104 | -129 | 239 | International 1924 | 18 | Antarctica (McMurdo Camp Area) |
| 40 | Campo Inchauspe | -148 | 136 | 90 | International 1924 | 18 | Argentina |
| 41 | Canton Astro 1966 | 298 | -304 | -375 | International 1924 | 18 | Phoenix Islands |
| 42 | Cape | -136 | -108 | -292 | Clarke 1880 | 7 | South Africa |
| 43 | Cape Canaveral | -2 | 151 | 181 | Clarke 1866 | 6 | Bahamas; Florida |
| 44 | Carthage | -263 | 6 | 431 | Clarke 1880 | 7 | Tunisia |
| 45 | Chatham Island Astro 1971 | 175 | -38 | 113 | International 1924 | 18 | New Zealand (Chatham Island) |
| 46 | Chua Astro | -134 | 229 | -29 | International 1924 | 18 | Paraguay |
| 47 | Corrego Alegre | -206 | 172 | -6 | International 1924 | 18 | Brazil |
| 48 | Dabola | -83 | 37 | 124 | Clarke 1880 | 7 | Guinea |
| 49 | Deception Island | 260 | 12 | -147 | Clarke 1880 | 7 | Deception Island; Antarctica |

| | | | | | | | |
|----|---------------------------------|------|------|------|-----------------------|----|---|
| 50 | Djakarta (Batavia) | -377 | 681 | -50 | Bessel 1841 | 5 | Indonesia (Sumatra) |
| 51 | DOS 1968 | 230 | -199 | -752 | International 1924 | 18 | New Georgia Islands (Gizo Island) |
| 52 | Easter Island 1967 | 211 | 147 | 111 | International 1924 | 18 | Easter Island |
| 53 | Estonia; Coordinate System 1937 | 374 | 150 | 588 | Bessel 1841 | 5 | Estonia |
| 54 | European 1950 | -104 | -101 | -140 | International 1924 | 18 | Cyprus |
| 55 | European 1950 | -130 | -117 | -151 | International 1924 | 18 | Egypt |
| 56 | European 1950 | -86 | -96 | -120 | International 1924 | 18 | England; Channel Islands; Scotland; Shetland Islands |
| 57 | European 1950 | -86 | -96 | -120 | International 1924 | 18 | England; Ireland; Scotland; Shetland Islands |
| 58 | European 1950 | -87 | -95 | -120 | International 1924 | 18 | Finland; Norway |
| 59 | European 1950 | -84 | -95 | -130 | International 1924 | 18 | Greece |
| 60 | European 1950 | -117 | -132 | -164 | International 1924 | 18 | Iran |
| 61 | European 1950 | -97 | -103 | -120 | International 1924 | 18 | Italy (Sardinia) |
| 62 | European 1950 | -97 | -88 | -135 | International 1924 | 18 | Italy (Sicily) |
| 63 | European 1950 | -107 | -88 | -149 | International 1924 | 18 | Malta |
| 64 | European 1950 | -87 | -98 | -121 | International 1924 | 18 | MEAN FOR Austria; Belgium; Denmark; Finland; France; W Germany; Gibraltar; Greece; Italy; Luxembourg; Netherlands; Norway; Portugal; Spain; Sweden; Switzerland |
| 65 | European 1950 | -87 | -96 | -120 | International 1924 | 18 | MEAN FOR Austria; Denmark; France; W Germany; Netherlands; Switzerland |
| 66 | European 1950 | -103 | -106 | -141 | International 1924 | 18 | MEAN FOR Iraq; Israel; Jordan; Lebanon; Kuwait; Saudi Arabia; Syria |
| 67 | European 1950 | -84 | -107 | -120 | International 1924 | 18 | Portugal; Spain |
| 68 | European 1950 | -112 | -77 | -145 | International 1924 | 18 | Tunisia |
| 69 | European 1979 | -86 | -98 | -119 | International 1924 | 18 | MEAN FOR Austria; Finland; Netherlands; Norway; Spain; Sweden; Switzerland |
| 70 | Fort Thomas 1955 | -7 | 215 | 225 | Clarke 1880 | 7 | Nevis; St. Kitts (Leeward Islands) |
| 71 | Gan 1970 | -133 | -321 | 50 | International 1924 | 18 | Republic of Maldives |
| 72 | Geodetic Datum 1949 | 84 | -22 | 209 | International 1924 | 18 | New Zealand |
| 73 | Graciosa Base SW 1948 | -104 | 167 | -38 | International 1924 | 18 | Azores (Faial; Graciosa; Pico; Sao Jorge; Terceira) |
| 74 | Guam 1963 | -100 | -248 | 259 | Clarke 1866 | 6 | Guam |
| 75 | Gunung Segara | -403 | 684 | 41 | Bessel 1841 | 5 | Indonesia (Kalimantan) |
| 76 | GUX 1 Astro | 252 | -209 | -751 | International 1924 | 18 | Guadalcanal Island |
| 77 | Herat North | -333 | -222 | 114 | International 1924 | 18 | Afghanistan |
| 78 | Hermannskogel Datum | 653 | -212 | 449 | Bessel 1841 (Namibia) | 4 | Croatia -Serbia, Bosnia-Herzegovina |
| 79 | Hjorsey 1955 | -73 | 46 | -86 | International 1924 | 18 | Iceland |

| | | | | | | | |
|-----|------------------------------|------|------|-------|-------------------------|----|-------------------------------------|
| 80 | Hong Kong 1963 | -156 | -271 | -189 | International 1924 | 18 | Hong Kong |
| 81 | Hu-Tzu-Shan | -637 | -549 | -203 | International 1924 | 18 | Taiwan |
| 82 | Indian | 282 | 726 | 254 | Everest (India 1830) | 8 | Bangladesh |
| 83 | Indian | 295 | 736 | 257 | Everest (India 1956) | 10 | India; Nepal |
| 84 | Indian | 283 | 682 | 231 | Everest (Pakistan) | 13 | Pakistan |
| 85 | Indian 1954 | 217 | 823 | 299 | Everest (India 1830) | 8 | Thailand |
| 86 | Indian 1960 | 182 | 915 | 344 | Everest (India 1830) | 8 | Vietnam (Con Son Island) |
| 87 | Indian 1960 | 198 | 881 | 317 | Everest (India 1830) | 8 | Vietnam (Near 16øN)) |
| 88 | Indian 1975 | 210 | 814 | 289 | Everest (India 1830) | 8 | Thailand |
| 89 | Indonesian 1974 | -24 | -15 | 5 | Indonesian 1974 | 17 | Indonesia |
| 90 | Ireland 1965 | 506 | -122 | 611 | Modified Airy | 2 | Ireland |
| 91 | ISTS 061 Astro 1968 | -794 | 119 | -298 | International 1924 | 18 | South Georgia Islands |
| 92 | ISTS 073 Astro 1969 | 208 | -435 | -229 | International 1924 | 18 | Diego Garcia |
| 93 | Johnston Island 1961 | 189 | -79 | -202 | International 1924 | 18 | Johnston Island |
| 94 | Kandawala | -97 | 787 | 86 | Everest (India 1830) | 8 | Sri Lanka |
| 95 | Kerguelen Island 1949 | 145 | -187 | 103 | International 1924 | 18 | Kerguelen Island |
| 96 | Kertau 1948 | -11 | 851 | 5 | Everest (Malay. & Sing) | 12 | West Malaysia & Singapore |
| 97 | Kusaie Astro 1951 | 647 | 1777 | -1124 | International 1924 | 18 | Caroline Islands |
| 98 | Korean Geodetic System | 0 | 0 | 0 | GRS 80 | 20 | South Korea |
| 99 | L. C. 5 Astro 1961 | 42 | 124 | 147 | Clarke 1866 | 6 | Cayman Brac Island |
| 100 | Leigon | -130 | 29 | 364 | Clarke 1880 | 7 | Ghana |
| 101 | Liberia 1964 | -90 | 40 | 88 | Clarke 1880 | 7 | Liberia |
| 102 | Luzon | -133 | -77 | -51 | Clarke 1866 | 6 | Philippines (Excluding Mindanao) |
| 103 | Luzon | -133 | -79 | -72 | Clarke 1866 | 6 | Philippines (Mindanao) |
| 104 | M'Poraloko | -74 | -130 | 42 | Clarke 1880 | 7 | Gabon |
| 105 | Mahe 1971 | 41 | -220 | -134 | Clarke 1880 | 7 | Mahe Island |
| 106 | Massawa | 639 | 405 | 60 | Bessel 1841 | 5 | Ethiopia (Eritrea) |
| 107 | Merchich | 31 | 146 | 47 | Clarke 1880 | 7 | Morocco |
| 108 | Midway Astro 1961 | 912 | -58 | 1227 | International 1924 | 18 | Midway Islands |
| 109 | Minna | -81 | -84 | 115 | Clarke 1880 | 7 | Cameroon |
| 110 | Minna | -92 | -93 | 122 | Clarke 1880 | 7 | Nigeria |
| 111 | Montserrat Island Astro 1958 | 174 | 359 | 365 | Clarke 1880 | 7 | Montserrat (Leeward Islands) |
| 112 | Nahrwan | -247 | -148 | 369 | Clarke 1880 | 7 | Oman (Masirah Island) |
| 113 | Nahrwan | -243 | -192 | 477 | Clarke 1880 | 7 | Saudi Arabia |
| 114 | Nahrwan | -249 | -156 | 381 | Clarke 1880 | 7 | United Arab Emirates |
| 115 | Naparima BWI | -10 | 375 | 165 | International 1924 | 18 | Trinidad & Tobago |
| 116 | North American 1927 | -5 | 135 | 172 | Clarke 1866 | 6 | Alaska (Excluding Aleutian Ids) |
| 117 | North American 1927 | -2 | 152 | 149 | Clarke 1866 | 6 | Alaska (Aleutian Ids East of 180øW) |

| | | | | | | | |
|-----|---------------------------------|------|------|------|--------------------|----|---|
| 118 | North American 1927 | 2 | 204 | 105 | Clarke 1866 | 6 | Alaska (Aleutian Ids West of 180°W) |
| 119 | North American 1927 | -4 | 154 | 178 | Clarke 1866 | 6 | Bahamas (Except San Salvador Id) |
| 120 | North American 1927 | 1 | 140 | 165 | Clarke 1866 | 6 | Bahamas (San Salvador Island) |
| 121 | North American 1927 | -7 | 162 | 188 | Clarke 1866 | 6 | Canada (Alberta; British Columbia) |
| 122 | North American 1927 | -9 | 157 | 184 | Clarke 1866 | 6 | Canada (Manitoba; Ontario) |
| 123 | North American 1927 | -22 | 160 | 190 | Clarke 1866 | 6 | Canada (New Brunswick; Newfoundland; Nova Scotia; Quebec) |
| 124 | North American 1927 | 4 | 159 | 188 | Clarke 1866 | 6 | Canada (Northwest Territories; Saskatchewan) |
| 125 | North American 1927 | -7 | 139 | 181 | Clarke 1866 | 6 | Canada (Yukon) |
| 126 | North American 1927 | 0 | 125 | 201 | Clarke 1866 | 6 | Canal Zone |
| 127 | North American 1927 | -9 | 152 | 178 | Clarke 1866 | 6 | Cuba |
| 128 | North American 1927 | 11 | 114 | 195 | Clarke 1866 | 6 | Greenland (Hayes Peninsula) |
| 129 | North American 1927 | -3 | 142 | 183 | Clarke 1866 | 6 | MEAN FOR Antigua; Barbados; Barbuda; Caicos Islands; Cuba; Dominican Republic; Grand Cayman; Jamaica; Turks Islands |
| 130 | North American 1927 | 0 | 125 | 194 | Clarke 1866 | 6 | MEAN FOR Belize; Costa Rica; El Salvador; Guatemala; Honduras; Nicaragua |
| 131 | North American 1927 | -10 | 158 | 187 | Clarke 1866 | 6 | MEAN FOR Canada |
| 132 | North American 1927 | -8 | 160 | 176 | Clarke 1866 | 6 | MEAN FOR CONUS |
| 133 | North American 1927 | -9 | 161 | 179 | Clarke 1866 | 6 | MEAN FOR CONUS (East of Mississippi; River Including Louisiana; Missouri; Minnesota) |
| 134 | North American 1927 | -8 | 159 | 175 | Clarke 1866 | 6 | MEAN FOR CONUS (West of Mississippi; River Excluding Louisiana; Minnesota; Missouri) |
| 135 | North American 1927 | -12 | 130 | 190 | Clarke 1866 | 6 | Mexico |
| 136 | North American 1983 | 0 | 0 | 0 | GRS 80 | 20 | Alaska (Excluding Aleutian Ids) |
| 137 | North American 1983 | -2 | 0 | 4 | GRS 80 | 20 | Aleutian Ids |
| 138 | North American 1983 | 0 | 0 | 0 | GRS 80 | 20 | Canada |
| 139 | North American 1983 | 0 | 0 | 0 | GRS 80 | 20 | CONUS |
| 140 | North American 1983 | 1 | 1 | -1 | GRS 80 | 20 | Hawaii |
| 141 | North American 1983 | 0 | 0 | 0 | GRS 80 | 20 | Mexico; Central America |
| 142 | North Sahara 1959 | -186 | -93 | 310 | Clarke 1880 | 7 | Algeria |
| 143 | Observatorio Meteorologico 1939 | -425 | -169 | 81 | International 1924 | 18 | Azores (Corvo & Flores Islands) |
| 144 | Old Egyptian 1907 | -130 | 110 | -13 | Helmert 1906 | 15 | Egypt |
| 145 | Old Hawaiian | 89 | -279 | -183 | Clarke 1866 | 6 | Hawaii |
| 146 | Old Hawaiian | 45 | -290 | -172 | Clarke 1866 | 6 | Kauai |
| 147 | Old Hawaiian | 65 | -290 | -190 | Clarke 1866 | 6 | Maui |

| | | | | | | | |
|-----|------------------------------------|------|------|-------|--------------------|----|---|
| 148 | Old Hawaiian | 61 | -285 | -181 | Clarke 1866 | 6 | MEAN FOR Hawaii; Kauai; Maui; Oahu |
| 149 | Old Hawaiian | 58 | -283 | -182 | Clarke 1866 | 6 | Oahu |
| 150 | Oman | -346 | -1 | 224 | Clarke 1880 | 7 | Oman |
| 151 | Ordnance Survey Great Britain 1936 | 371 | -112 | 434 | Airy 1830 | 1 | England |
| 152 | Ordnance Survey Great Britain 1936 | 371 | -111 | 434 | Airy 1830 | 1 | England; Isle of Man; Wales |
| 153 | Ordnance Survey Great Britain 1936 | 375 | -111 | 431 | Airy 1830 | 1 | MEAN FOR England; Isle of Man; Scotland; Shetland Islands; Wales |
| 154 | Ordnance Survey Great Britain 1936 | 384 | -111 | 425 | Airy 1830 | 1 | Scotland; Shetland Islands |
| 155 | Ordnance Survey Great Britain 1936 | 370 | -108 | 434 | Airy 1830 | 1 | Wales |
| 156 | Pico de las Nieves | -307 | -92 | 127 | International 1924 | 18 | Canary Islands |
| 157 | Pitcairn Astro 1967 | 185 | 165 | 42 | International 1924 | 18 | Pitcairn Island |
| 158 | Point 58 | -106 | -129 | 165 | Clarke 1880 | 7 | MEAN FOR Burkina Faso & Niger |
| 159 | Pointe Noire 1948 | -148 | 51 | -291 | Clarke 1880 | 7 | Congo |
| 160 | Porto Santo 1936 | -499 | -249 | 314 | International 1924 | 18 | Porto Santo; Madeira Islands |
| 161 | Provisional South American 1956 | -270 | 188 | -388 | International 1924 | 18 | Bolivia |
| 162 | Provisional South American 1956 | -270 | 183 | -390 | International 1924 | 18 | Chile (Northern; Near 19 øS) |
| 163 | Provisional South American 1956 | -305 | 243 | -442 | International 1924 | 18 | Chile (Southern; Near 43 øS) |
| 164 | Provisional South American 1956 | -282 | 169 | -371 | International 1924 | 18 | Colombia |
| 165 | Provisional South American 1956 | -278 | 171 | -367 | International 1924 | 18 | Ecuador |
| 166 | Provisional South American 1956 | -298 | 159 | -369 | International 1924 | 18 | Guyana |
| 167 | Provisional South American 1956 | -288 | 175 | -376 | International 1924 | 18 | MEAN FOR Bolivia; Chile; Colombia; Ecuador; Guyana; Peru; Venezuela |
| 168 | Provisional South American 1956 | -279 | 175 | -379 | International 1924 | 18 | Peru |
| 169 | Provisional South American 1956 | -295 | 173 | -371 | International 1924 | 18 | Venezuela |
| 170 | Provisional South Chilean 1963 | 16 | 196 | 93 | International 1924 | 18 | Chile (Near 53 øS) (Hito XVIII) |
| 171 | Puerto Rico | 11 | 72 | -101 | Clarke 1866 | 6 | Puerto Rico; Virgin Islands |
| 172 | Pulkovo 1942 | 28 | -130 | -95 | Krassovsky 1940 | 19 | Russia |
| 173 | Qatar National | -128 | -283 | 22 | International 1924 | 18 | Qatar |
| 174 | Qornoq | 164 | 138 | -189 | International 1924 | 18 | Greenland (South) |
| 175 | Reunion | 94 | -948 | -1262 | International 1924 | 18 | Mascarene Islands |
| 176 | Rome 1940 | -225 | -65 | 9 | International 1924 | 18 | Italy (Sardinia) |
| 177 | S-42 (Pulkovo 1942) | 28 | -121 | -77 | Krassovsky 1940 | 19 | Hungary |
| 178 | S-42 (Pulkovo 1942) | 23 | -124 | -82 | Krassovsky 1940 | 19 | Poland |
| 179 | S-42 (Pulkovo 1942) | 26 | -121 | -78 | Krassovsky 1940 | 19 | Czechoslovakia |
| 180 | S-42 (Pulkovo 1942) | 24 | -124 | -82 | Krassovsky 1940 | 19 | Latvia |
| 181 | S-42 (Pulkovo 1942) | 15 | -130 | -84 | Krassovsky 1940 | 19 | Kazakhstan |
| 182 | S-42 (Pulkovo 1942) | 24 | -130 | -92 | Krassovsky 1940 | 19 | Albania |

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|-----|-----------------------------|------|------|------|-------------------------|----|---|
| 183 | S-42 (Pulkovo 1942) | 28 | -121 | -77 | Krassovsky 1940 | 19 | Romania |
| 184 | S-JTSK | 589 | 76 | 480 | Bessel 1841 | 5 | Czechoslovakia (Prior 1 JAN 1993) |
| 185 | Santo (DOS) 1965 | 170 | 42 | 84 | International 1924 | 18 | Espirito Santo Island |
| 186 | Sao Braz | -203 | 141 | 53 | International 1924 | 18 | Azores (Sao Miguel; Santa Maria Ids) |
| 187 | Sapper Hill 1943 | -355 | 21 | 72 | International 1924 | 18 | East Falkland Island |
| 188 | Schwarzeck | 616 | 97 | -251 | Bessel 1841 (Namibia) | 4 | Namibia |
| 189 | Selvagem Grande 1938 | -289 | -124 | 60 | International 1924 | 18 | Salvage Islands |
| 190 | Sierra Leone 1960 | -88 | 4 | 101 | Clarke 1880 | 7 | Sierra Leone |
| 191 | South American 1969 | -62 | -1 | -37 | South American 1969 | 21 | Argentina |
| 192 | South American 1969, | -61 | 2 | -48 | South American 1969 | 21 | Bolivia |
| 193 | South American 1969, | -60 | -2 | -41 | South American 1969 | 21 | Brazil |
| 194 | South American 1969, | -75 | -1 | -44 | South American 1969 | 21 | Chile |
| 195 | South American 1969, | -44 | 6 | -36 | South American 1969 | 21 | Colombia |
| 196 | South American 1969, | -48 | 3 | -44 | South American 1969 | 21 | Ecuador |
| 197 | South American 1969, | -47 | 26 | -42 | South American 1969 | 21 | Ecuador (Baltra; Galapagos) |
| 198 | South American 1969, | -53 | 3 | -47 | South American 1969 | 21 | Guyana |
| 199 | South American 1969, | -57 | 1 | -41 | South American 1969 | 21 | MEAN FOR Argentina; Bolivia; Brazil; Chile; Colombia; Ecuador; Guyana; Paraguay; Peru; Trinidad & Tobago; Venezuela |
| 200 | South American 1969, | -61 | 2 | -33 | South American 1969 | 21 | Paraguay |
| 201 | South American 1969, | -58 | 0 | -44 | South American 1969 | 21 | Peru |
| 202 | South American 1969, | -45 | 12 | -33 | South American 1969 | 21 | Trinidad & Tobago |
| 203 | South American 1969, | -45 | 8 | -33 | South American 1969 | 21 | Venezuela |
| 204 | South Asia | 7 | -10 | -26 | Modified Fischer 1960 | 14 | Singapore |
| 205 | Tananarive Observatory 1925 | -189 | -242 | -91 | International 1924 | 18 | Madagascar |
| 206 | Timbalai 1948 | -679 | 669 | -48 | Everest (Sabah Sarawak) | 9 | Brunei; E. Malaysia (Sabah Sarawak) |
| 207 | Tokyo | -148 | 507 | 685 | Bessel 1841 | 5 | Japan |
| 208 | Tokyo | -148 | 507 | 685 | Bessel 1841 | 5 | MEAN FOR Japan; South Korea; Okinawa |
| 209 | Tokyo | -158 | 507 | 676 | Bessel 1841 | 5 | Okinawa |
| 210 | Tokyo | -147 | 506 | 687 | Bessel 1841 | 5 | South Korea |
| 211 | Tristan Astro 1968 | -632 | 438 | -609 | International 1924 | 18 | Tristan da Cunha |
| 212 | Viti Levu 1916 | 51 | 391 | -36 | Clarke 1880 | 7 | Fiji (Viti Levu Island) |
| 213 | Voirol 1960 | -123 | -206 | 219 | Clarke 1880 | 7 | Algeria |
| 214 | Wake Island Astro 1952 | 276 | -57 | 149 | International 1924 | 18 | Wake Atoll |
| 215 | Wake-Eniwetok 1960 | 102 | 52 | -38 | Hough 1960 | 16 | Marshall Islands |
| 216 | WGS 1972 | 0 | 0 | 0 | WGS 72 | 22 | Global Definition |
| 217 | Yacare | -155 | 171 | 37 | International 1924 | 18 | Uruguay |

| | | | | | | | |
|-----|----------|------|-----|------|--------------------|----|----------|
| 218 | Zanderij | -265 | 120 | -358 | International 1924 | 18 | Suriname |
|-----|----------|------|-----|------|--------------------|----|----------|

| Datum index | Datum Name | Delta X | Delta Y | Delta Z | Rotation X | Rotation Y | Rotation Z | Scale Factor | Ellipsoid | Ellipsoid Index | Region of Use |
|-------------------|--------------|---------|---------|---------|------------|------------|------------|--------------|-----------------|-----------------|---------------|
| 219 ^{*1} | Pulkovo 1995 | 24.82 | -131.21 | -82.66 | 0.000 | 0.000 | -0.160 | -82.66 | Krassovsky 1940 | 19 | Russia |
| 220 ^{*1} | PZ-90 | 0.00 | 0.00 | 1.50 | 0.000 | 0.000 | -0.076 | 0 | PZ-90 | 24 | Global |

*1 supported only in Configure GNSS Datum ((ID: 0x64, SID: 0x27).

Change Log

Ver 1.4.40 Oct. 13 2016

1. Update "Navigation Data Message, ID: 0xA8", the type of ellipsoid altitude and mean sea level altitude are SINT32.

Ver 1.4.39 Feb. 05 2016

1. Add "Get Glonass Ephemeris, ID: 0x5B", "Set Glonass Ephemeris, ID: 0x5C", "Get Glonass Almanac, ID: 0x5D", "Set Glonass Almanac, ID: 0x5E", "Get Glonass Time Correction, ID: 0x5E", "Set Glonass Time Correction, ID: 0x5F", "Glonass Ephemeris Data, ID: 0x90", "Glonass Almanac Data, ID: 0x91" and "Glonass Time Correction Parameters, ID: 0x92" 9 messages
2. Add "Set Beidou Ephemeris Data, ID: 0x67, SID: 0x1", "Get Beidou Ephemeris Data, ID: 0x67, SID: 0x2", "Set Beidou Almanac Data, ID: 0x67, SID: 0x3", "Get Beidou Almanac Data, ID: 0x67, SID: 0x4", "Beidou Ephemeris Data, ID: 0x67, SID: 0x80" and "Beidou Almanac Data, ID: 0x67, SID: 0x81" 6 messages

Ver 1.4.38 Dec 16 2015

1. Add "CONFIGURE RTK MODE, ID: 0x6A, SID: 0x1", "QUERY RTK MODE, ID: 0x6A, SID: 0x2", "RTK MODE, ID: 0x6A, SID: 0x80" 3 messages.

Ver 1.4.37 Sep 17 2015

1. Add "CONFIGURE GNSS GEO-FENCING DATA, ID: 0x64, SID: 0x2E", "QUERY GNSS GEO-FENCING DATA, ID: 0x64, SID: 0x2F", "GNSS GEO-FENCING DATA, ID: 0x64, SID: 0x96" 3 messages.
2. Add "QUERY GNSS GEO-FENCING RESULT, ID: 0x64, SID: 0x30", "GNSS GEO-FENCING RESULT, ID: 0x64, SID: 0x97" 2 messages.

Ver 1.4.36 July 16 2014

1. Modify SBAS commands ID: 0x62, SID: 0x01 and ID: 0x62, SID: 0x80 with Subsystem mask adding Bit3: GAGAN subsystem mask.

Ver 1.4.35 June 17 2015

1. Add "CONFIGURE POSITION FIX NAVIGATION MASK, ID: 0x64, SID: 0x11", "QUERY POSITION FIX NAVIGATION MASK, ID: 0x64, SID: 0x12", "POSITION FIX NAVIGATION MASK, ID: 0x64, SID: 0x88" 3 messages.

Ver 1.4.34 February 10 2015

1. Add "CONFIGURE UTC REFERENCE TIME SYNC TO GPS TIME, ID: 0x64, SID: 0x15", "QUERY GPS UTC REFERENCE TIME SYNC TO GPS TIME, ID: 0x64, SID: 0x16", "GPS UTC REFERENCE TIME, ID: 0x64, SID: 0x8A" 3 messages.

Ver 1.4.33 Dec 11 2014

1. Add "GET GPS ALMANAC, ID: 0x50", "SET GPS ALMANAC, ID: 0x51", "GPS ALMANAC DATA, ID: 0xBE" 3 messages.

Ver 1.4.32 Nov 4 2014

1. Added description for 0x4B NMEA Talker ID

Ver 1.4.31 May 15 2014

1. Add "CONFIGURE GNSS DATUM INDEX, ID: 0x64, SID: 0x27", "QUERY GNSS DATUM INDEX, ID: 0x64, SID: 0x28", "GNSS DATUM INDEX, ID: 0x64, SID: 0x92" 3 messages.
2. Modify Appendix A and Appendix B to include Pulkovo 1995 and PZ-90 datum.

Ver 1.4.30 April 24 2014

1. Add "CONFIGURE 1PPS FREQUENCY OUTPUT, ID: 0x65, SID: 0x3", "QUERY 1PPS FREQUENCY OUTPUT, ID: 0x65, SID: 0x4", "1PPS FREQUENCY OUTPUT, ID: 0x65, SID: 0x82" 3 messages.

Ver 1.4.29 April 23 2014

2. Modify SBAS commands ID: 0x62, SID: 0x01 and ID: 0x62, SID: 0x80 with Subsystem mask adding Bit7: All SBAS PRN 120~138
3. Add 1PPS timing commands, "CONFIGURE GNSS 1PPS Timing, ID: 0x54", "QUERY GNSS 1PPS Timing, ID: 0x44", "GNSS 1PPS Timing, ID: 0xC2" 3 messages.

Ver 1.4.28 April 16 2014

1. Add "CONFIGURE GPS PARAMETER SEARCH ENGINE NUMBER, ID: 0x64, SID: 0xA", "QUERY GPS PARAMETER SEARCH ENGINE NUMBER, ID: 0x64, SID: 0xB", "GPS PARAMETER SEARCH ENGINE NUMBER, ID: 0x64, SID: 0x85" 3 messages.

Ver 1.4.27 March 14 2014

1. Update "CONFIGURE SBAS, ID: 0x62, SID: 0x1" message field 4, Ranging by adding auto mode.
2. Update "SBAS STATUS, ID: 0x62, SID: 0x80" message field 4, Ranging by adding auto mode.
3. Add "CONFIGURE GPS/UTC LEAP SECONDS, ID: 0x64, SID: 0x1F", "QUERY GPS TIME, ID: 0x64, SID: 0x20", "GPS TIME, ID: 0x64, SID:0x8E" 3 messages.

Ver 1.4.26, Sep. 17, 2013

1. Update 0x63/0x1, 0x63/0x2, 0x63/0x80 to use name "SAEE" instead of "SAGPS".
2. Add NMEA talker ID related commands, ID: 0x4B, 0x4F, 0x93.

Ver 1.4.25, July 10, 2013

1. Initial release based on AN0003 1.4.24.

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