# GeoS® Binary Data Protocol v3.0

R&D “GeoStar navigation” Ltd.

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# Revision History

| # | Updates | Notes |
|---|---|---|
| **Release from 09/06/2012** | | |
| 1 | Original release | |
| **Release from 28/06/2013** | | |
| 1 | Message 0x13: PDOP components changed | |
| 2 | Message 0x16 added | |
| **Release from 06/08/2015** | | |
| 1 | • Carrier phase measurements description added to message 0x10<br>• Message 0x10 rate changed to as per output data rate<br>• Bit 26 added to Receiver Status Word (messages 0x20, 0x21) | |
| 2 | Messages 0x4A, 0x43, 0x45 changed | |
| 3 | Messages 0x18, 0x19, 0x1A, 0x1B, 0x1C, 0x1D, 0x1E, 0x9C, 0x9D, 0x9E added | |
| 4 | Editorial corrections | |
| **Release from 16/09/2015** | | |
| 1 | Message 0x42 changed | |
| 2 | Receiver Configuration Register changed (messages 0x21, 0xC8) | |
| 3 | Editorial corrections | |
| **Release from 09/12/2015** | | |
| 1 | Message 0x10: Word formula corrected | |
| 2 | Message 0x14: ordering and length of words corrected | |
| 3 | Message 0x21, word #11: bits 15:8 and 7:0 swapped | |

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# Scope

The document is description of GeoS® Binary Data Protocol v3.0 supported by GeoS-3, GeoS-3M, GeoS-3R, GeoS-3MR, and GeoS-3E GNSS modules.

The document contains four chapters as follows:

- Chapter 1: list of abbreviations
- Chapter 2: data formats
- Chapter 3: output messages
- Chapter 4: input messages.
-

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# 1. Abbreviations

| | |
|---|---|
| **ADR**: | Accumulated Delta Ranges (Integrated Doppler) |
| **AGC**: | Auto Gain Control |
| **DGNSS**: | Differential GNSS |
| **DLL**: | Delay Locked Loop |
| **DOP**: | Dilution Of Precision |
| **DR**: | Dead Reckoning |
| **FW**: | Firmware |
| **GDOP**: | Geometric Dilution Of Precision |
| **GNSS**: | Global Navigation Satellite System |
| **HDOP**: | Horizontal Dilution Of Precision |
| **ID**: | Identifier |
| **LSB**: | Least Significant Bit |
| **MSB**: | Most Significant Bit |
| **SRAM**: | Static Random Acess Memory |
| **PDOP**: | Positional Dilution Of Precision |
| **PLL**: | Phase Locked Loop |
| **RF**: | Radio Frequency |
| **RMS**: | Root Mean Square |
| **RTC**: | Real Time Clock |
| **S/N**: | Serial Number |
| **SNR**: | Signal-to-Noise Ratio |
| **SV**: | Space Vehicle |
| **TDOP**: | Time Dilution Of Precision |
| **VDOP**: | Vertical Dilution Of Precision |
| **UTC**: | Universal Time Coordinated |
| **2D**: | Two-dimensional |
| **3D**: | Three-dimensional |

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# 2. Data Formats

Input and output messages have the same data format.

Endianness: little-endian for both input and output messages.

**<preamble: 64><ndat & ncmd: 32> <dat1: 32, …, datN: 32> <cs: 32>**

- **<preamble: 64>:** preamble “GEOSr3PS” (length: 64 bits, 534F4547 53503372)
- **<ndat>**: number of 32-bit words in data fields (length: 16 bits)
- **<ncmd>**: message ID (length: 16 bits)
- **<dat1, dat2, …, datN**>: data (length: 32 bits) fields; N=<ndat>
- **<cs>**: check sum (length: 32 bits); calculated as bit-by-bit “exclusive OR” of all data fields.

*Example:*

534F4547 53503372: preamble

00060021: message I – 0x21, length (words: here and hereinafter) – 6

8001C0FF 003E4130 0000001A 079F6E51 00000000 15171016: data

92AE8986: check sum

*Check sum calculation example:*

534F4547 ^ 53503372 ^ 00060021 ^ 8001C0FF ^ 003E4130 ^ 0000001A ^ 079F6E51 ^ 00000000 ^ 15171016 = 92AE8986

Table 1: Data types

| Type | Description | Length (32-bit words) |
|---|---|---|
| byte | Unsigned integer, 8 bit | 1/4 |
| short | Signed integer, 16 bit | 1/2 |
| u_short | Unsigned integer, 16 bit | 1/2 |
| int | Signed integer, 32 bit | 1 |
| u_int | Unsigned integer, 32 bit | 1 |
| float | Signed real, 32 bit | 1 |
| double | Signed real, 64 bit | 2 |

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# 3. Output Messages

The output binary messages are divided into following groups:

1. 0x00…0x3F: automatically generated
2. 0x40…0x7F: responses to settings
3. 0x80…0xBF: responses to queries
4. 0xC0…0xFF: responses to commands.

The messages 0x00…0x08 are debug data and unavailable to the user. Messages 0x00…0x1F are masked i.e. can be disabled by using appropriate mask (message 0x4F). On default, all automatically generated masked messages are disabled (no output). Messages 0x20…0x3F are unmasked i.e. can't be disabled. Output messages are summarized in Table 2.

Table 2: Output binary messages

| Message ID | Message |
|---|---|
| **Automatically generated messages** | |
| 0x0…0x8 | Debug data |
| 0x9…0xF | Reserved |
| 0x10 | Raw Measurements |
| 0x11 | GPS Sub-frame Data |
| 0x12 | GLONASS Sub-frame Data |
| 0x13 | Navigation Solution State Vector |
| 0x14 | Timing Parameters |
| 0x15 | Geographic Coordinates: Extended Data Set |
| 0x16 | SBAS Message |
| 0x17 | Reserved |
| 0x18 | GPS Almanac |
| 0x19 | GPLONASS Almanac |
| 0x1A | GPS Ephemeris |
| 0x1B | GLONASS Ephemeris |
| 0x1C | GPS Ionospheric Parameters |
| 0x1D | GPS UTC Parameters |
| 0x1E | GLONASS UTC Parameters |
| 0x1F | Reserved |
| 0x20 | Geographic Coordinates: Basic Data Set |
| 0x21 | Current Receiver Telemetry |
| 0x22 | SVs in View |

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| | |
|---|---|
| 0x23…0x3D | Reserved |
| 0x3E | Receiver Power-up Message |
| 0x3F | Negative Acknowledge |
| **Responses to settings** | |
| 0x40 | Response to Set Initial Parameters |
| 0x41 | Response to Set Serial Ports Parameters |
| 0x42 | Response to Set Receiver Operation Mode |
| 0x43 | Response to Set Navigation Solution Parameters |
| 0x44 | Response to Set Output Data Rate |
| 0x45 | Response to DGNSS Control |
| 0x46 | Response to SBAS Control |
| 0x47 | Response to Power-save Modes Control |
| 0x48 | Response to Set GPS Almanac |
| 0x49 | Response to Set GLONASS Almanac |
| 0x4A | Response to Set GPS Ephemeris |
| 0x4B | Response to Set GLONASS Ephemeris |
| 0x4C | Response to Set PPS Parameters |
| 0x4D | Response to Enable/Disable SV in Position Fix |
| 0x4E | Response to Enable/Disable NMEA Messages |
| 0x4F | Response to Enable/Disable Binary Messages |
| 0x50 | Response to Set Data Protocol Assignment to Serial Port |
| 0x51…0x7F | Reserved |
| **Responses to queries** | |
| 0x80 | Response to Query Initial Parameters |
| 0x81 | Response to Query to Serial Ports Parameters |
| 0x82 | Response to Query Receiver Operation Mode |
| 0x83 | Response to Query Navigation Solution Parameters |
| 0x84 | Response to Query Output Data Rate |
| 0x85 | Response to Query DGNSS Parameters |
| 0x86 | Response to Query SBAS Parameters |
| 0x87 | Response to Query Parameters of Power-save Modes |
| 0x88 | Response to Query GPS Almanac |
| 0x89 | Response to Query GLONASS Almanac |
| 0x8A | Response to Query GPS Ephemeris |
| 0x8B | Response to Query GLONASS Ephemeris |
| 0x8C | Response to Query PPS Parameters |
| 0x8D | Response to Query Enable/disable Status of the SV in Position Fix |
| 0x8E | Response to Query Enabled NMEA Messages |
| 0x8F | Response to Query Enabled Binary Messages |

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| | |
|---|---|
| 0x90 | Response to Query Data Protocol Assignment to Serial Port |
| 0x91…0x9B | Reserved |
| 0x9C | Response to Query GPS Ionospheric Parameters |
| 0x9D | Response to Query GPS UTC Parameters |
| 09E | Response to Query GLONASS UTC Parameters |
| 0x9F…0xBF | Reserved |
| **Responses to commands** | |
| 0xC0 | Reserved for internal use |
| 0xC1 | Response to Request FW Version |
| 0xC2 | Reserved |
| 0xC3 | Response to Store Almanacs to Flash |
| 0xC4 | Response to Enter/Quit Power-save Mode |
| 0xC5 | Reserved |
| 0xC6 | Response to Request Serial Port Number |
| 0xC7 | Response to Enable/Disable Antenna Power |
| 0xC8 | Response to Request Receiver Configuration |
| 0xC9…0xCF | Reserved |
| 0xD0 | Reserved for internal use |
| 0xD1 | Reserved for internal use |
| 0xD2 | Reserved for internal use |
| 0xD3…0xFF | Reserved |

## 3.1. 0x10: Raw Measurements

Message length (words: here and hereinafter): 4 + 14*NSat.
Rate: as per output data rate.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1, 2 | double | s | Time of measurements (UTC) (1). Zero value corresponds to Jan 1st 2008 |
| 3 | int | | Number of 16.369MHz cycles in current measurement interval (2) |
| 4 | int | | Number of SVs for which the measurements are transmitted (NSat) |
| 5…16 | structure | | Measurements data for the 1st SV |
| 17…28 | structure | | Measurements data for the 2nd SV |
| ... | | | ... |
| -9+14*NSat …4+14*NSat | structure | | Measurements data for the NSatth SV |

*Notes:*

1. Incremented by 100ms, 200ms, 500ms or 1s according to the output data rate 10, 5, 2 or 1Hz, respectively.

   Relationship between Time of measurements and GPS Time:
   GPS Time=Time of measurements – Clock shift relative to GPS time scale (message 0x13).

2. Measurement interval is 100ms, 200ms, 500ms or 1s according to the output data rate 10, 5, 2 or 1Hz, respectively.

Measurements data (structure):

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | byte | | Bits 31:24: Channel number (0…31) |
| | byte | | Bits 23:16: SV number:<br>GPS: 1…32<br>GLONASS: 65…96<br>SBAS: 33…64 |
| | byte | | Bits 15:8: Carrier frequency number of RF signal transmitted by $n^A$ SV $H_n^A$ (two's complemented code). Value range: from minus 7 to +12<br>Transmits 0 for GPS and SBAS |
| | byte | | Bits 7:6: Carrier phase measurements valid flag:<br>0: valid<br>1: likely cycle slip happened in current measurement interval<br>2: likely cycle slip happened in previous measurement interval<br>3: likely cycle slip happened in both current and previous measurement interval<br>Bits 5:4: Reserved |

| | | | |
|---|---|---|---|
| | | | Bits 3:0: SV enabled/disabled flag:<br>0: SV used in fix<br>2: SV disabled by 0x4D<br>4: SV disabled by choosing satellite system<br>7: SV disabled by signal level mask<br>8: SV disabled by elevation mask |
| 2 | float | dBHz | SNR |
| 3, 4 | double | m | Pseudorange (1) |
| 5, 6 | double | m/s | Pseudorange rate |
| 7, 8 | double | m | ADR |
| 9, 10 | double | cycles | Carrier phase (2)(3) |
| 11 | float | m | Pseudorange error estimate, RMS |
| 12 | float | m/s | Pseudorange rate error estimate, RMS |
| 13 | float | m | Pseudorange residuals |
| 14 | float | m/s | Pseudorange rate residuals |

*Notes:*

1. To align pseudorange measurements to GPS Time, use following formula:

   $PR_{GPS}^{(i)}=PR_{rcv}^{(i)} - \Delta t_{offs_rcv_GPS}$, where:

   $PR_{GPS}$: pseudorange at GPS Time
   $PR_{rcv}^{(i)}$: pseudorange at the Time of measurements
   $\Delta t_{off_rcv_GPS}$: Clock shift relative to GPS time scale (message 0x13).

2. To align carrier phase measurements to GPS Time, use following formula:

   For GLONASS measurements:
   $Ph_{GPS}^{(i)}=Ph_{rcv}^{(i)} - ((F_{n_GLN} + H_n^A \bullet \Delta F_n) \bullet Doppler_{rcv}^{(i)} \bullet \Delta t_{offs_rcv_GPS}/c + H_n^A \bullet \Delta F_n \bullet \Delta t_{offs_rcv_GPS})$

   For GPS measurements:
   $Ph_{GPS}^{(i)}=Ph_{rcv}^{(i)} - (F_{n_GPS} \bullet Doppler_{rcv}^{(i)} \bullet \Delta t_{offs_rcv_GPS}/c)$, where:

   $Ph_{GPS}$: carrier phase at GPS Time
   $Ph_{rcv}$: carrier phase at the Time of measurements
   $F_{n_GPS}$: 1575420000Hz (GPS carrier frequency)
   $F_{n_GLN}$: 1602000000Hz (carrier frequency of GLONASS $0^{th}$ frequency number)
   $\Delta F_n$: 562500Hz (GLONASS frequency step)
   $H_n^A$: GLONASS carrier frequency number
   $Doppler_{rcv}$: pseudorange rate
   c: 299792458m/s (speed of light)

3. Carrier phase measurements available in GeoS-3R/3MR modules only.

*Example:*

534F4547 53503372: preamble

01540010: message ID – 0x10, length – 340

C399999A 419FBA83 0018FA26 00000018 000910FF 41F6CF68 2FB9E0B1 417695C8
9CD69907 C06A3CD2 3CA16748 C03507E2 7F01EA8E C06A2C3D 408EEE20 3EC1ABBB
C18A627F BE2831DC 014B00FF 4210EC32 AAE825D4 41750DCD CE0F9795 407BD892
EFED5286 404646F0 8811DC96 407BD9F6 40ACC882 3DB39A20 C0F4EA29 3E142C88
020B00FF 41F3A4C8 26C9538A 4173D0B7 8A789EFD 406FFA70 507A2800 40398C03
F1E7286D 4070065F 407E8850 3EAFA250 BEA6B4D4 3DBBCC15 031600FF 42331668
BF5184F2 4174CA9F 69EA30A9 C076C38C 888AB1F6 C0423C36 8449732D C076BC75
4082E991 3EA2239F C099953D 3B210475 041390FF 41D88A13 E38A9638 41757252
B2624A4C C07BA23D EEA8DEAF C04620C7 43EF2B15 C07B9A2B 408501BA 3EB68B2B
40316F66 BE88636E 055100FF 41EE0D56 4FDD010B 4173787A 580FF230 C07C3115
DA736853 C0469174 2E4E1006 C07C2C5C 40A0FE70 3E660394 412011DD 3D481B66
064200FF 41F27920 4210B1A9 41726021 3C368C03 405723AF 758E7E96 40228FBB
2602B9FA 405717CA 40C8F558 3E1544FC C096AC01 3DD525D1 075200FF 4201C09A
FAB9D4EB 41735F53 74C72175 4075F292 DD5720C9 404190F9 72C4CA3C 4075F04D
40DC7A1D 3E128020 C1054CB7 BC129FE1 0806D19D 4153B751 6C7FCE03 417883A5
437C0610 405752D8 B2FD10E4 402290DE DE2792D4 4057708D 3FFD0EB7 3E097A09
4AC23510 C2B76CCE 094100FF 42092D04 4BA53C70 4174A2A8 63FEAAC5 C0811252
5560EDAA C04B51A1 4FF256B5 C081115A 40AE7FE5 3DC02332 4204654F 3D47447A
0A58C1FC 41369C95 8A730E4C 41772F79 8F12DBBC 4085FD45 40CC24F2 4051965C
7EB4F04A 4085FEA3 40FB964E 3DDB4F6E 46D16B04 44BAC64D 0B0110FF 41F9923E
C2987DF3 4174AF81 EDB48166 4081C8E4 C0045838 404C6E7E 27D01EDA 4081CC7E
407E65CE 3EAD8CDB 40D01371 BD951804 0C4380F7 41D8D75B 77BDA10E 417470E4
9BBF4D14 408565E4 BC611C9E 40511C01 B13E9E1A 408568C9 40FDC0B7 3EA57EEB
41445C79 BC315B61 0D53D19C 412B1158 9E886880 4176BF65 EB941DDB C0831146
8907EBC0 C04E8520 AEA11FE5 C0830F7E 402D7397 3EBA3AF7 4BA6F55C 44FCA70C
0E0E00FF 420A4111 14DE4025 4173E70F C960B0C3 40628F37 5340FC30 402D9797
533E3C7A 40629C7A 40809106 3EBBAEB6 C1AC4609 3DA985D1 0F1200FF 4205CD82
DD064549 41781E66 6F763FCF C080A489 FB98A120 C04AA6C3 2A0D6F11 C080A0D3
408E0A47 3EA669AE C0D737D1 BD8251D7 101CC0FD 418C3DA0 70D1C7B2 4177C484
71B3C74A C0821049 35B21082 C04CEAE0 CE5D54AE C0820B64 40872848 3CDB9582
C66A4E66 C3E7D871 1120C0FD 41443FC5 497539D6 41755617 04B0F81D 3FB1724A
C2964166 BFA474E1 AE38A274 3FE0D43F 4081B221 3D3E380F 46A11932 C4181DB0
1311D19D 418848D1 FC783E94 41786443 E48ACDEE 4087B731 BA62EEAD 4052F5FC
D8C9120F 4087BAEA 3FEC8F3D 3D0E1326 7FC00000 7FC00000 144AC1E4 4140BC0C
930BFBD6 4175B322 D275CAB3 C06A10C5 84C239EC C034CD50 28181392 C06A1B06
40A028FF 3EBF207B 452E125E 4229665C 1503D19D 419DDF08 42EFE087 41782C8F
4CA868EB C0834E03 C968E9BB C04EE919 CAAF9C74 C0834A48 451ECE33 3EC14E46
4AC234AC C2B780DE 1614C19D 41283525 328BE93E 4177A351 AEBBBF18 C0834711
20A462BD C04EDE04 4134C813 C083435B 40971498 3ECE2513 4B9D81D9 C349C69E

171FC19F 41C196A8 A4D5FFF3 417846DE 88D74126 4088A3F9 8E4F8903 4053B363
61B0D2FA 4088A7AB 3F67B92A 3EAAD33E 4AC23519 C2B783FD 194CD184 412391CD
919E9C83 41773026 00F6E861 408D3670 1699273E 40575DA9 03E7995F 408D34B2
7FC00000 3EACF1D9 7FC00000 7FC00000: data

7850B423: check sum

## 3.2. 0x11: GPS Sub-frame Data

Message length: 12.
Rate: once per 6 seconds; transmitted by the channel that tracks GPS SV.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | | | Channel Identifier (see below) |
| 2 | u_int | s | GPS sub-frame arrival time (time of week that corresponds to arrival of the first word of sub-frame data) |
| 3 | u_int | | Word #1 (30 LSBs).<br>If Hamming code is OK then relevant bits are 0 |
| 4 | u_int | | Word #2 |
| … | | | … |
| 12 | u_int | | Word #10 |

Channel Identifier (here and hereinafter):

| Bit field | Type | Description |
|---|---|---|
| 31:24 | byte | Channel number (0…31) |
| 23:16 | byte | SV number:<br>GPS: 1…32<br>GLONASS: 65…96<br>SBAS: 33…64 |
| 15:0 | u_short | 16 MSBs of the Channel Status Word (see below) |

Channel Status Word (here and hereinafter):

| Bit field | Description |
|---|---|
| 31:30 | Carrier phase measurements valid flag:<br>0: valid<br>1: likely cycle slip in current measurement interval<br>2: likely cycle slip in previous measurement interval<br>3: reserved |
| 29 | Using SV in fix:<br>0: not used<br>1: used |

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| | |
|---|---|
| 28 | Multipath detection flag [1]:<br>0: no<br>1: yes |
| 27:24 | SV enabled/disabled flag:<br>0: SV used in fix<br>2: SV disabled by 0x4D<br>4: SV disabled by choosing satellite system<br>7: SV disabled by signal level mask<br>8: SV disabled by elevation mask |
| 23 | Signal measurements ready flag:<br>0: not ready<br>1: ready |
| 22 | Navigation data frame valid flag:<br>0: not valid<br>1: valid |
| 21 | Ephemerides extracted from navigation data:<br>0: not available<br>1: available |
| 20 | Time extracted from navigation data:<br>0: not available<br>1: available |
| 19 | Frame sync flag:<br>0: no sync<br>1: sync achieved |
| 18 | Bit sync flag:<br>0: no sync<br>1:sync achieved |
| 17 | PLL and DLL lock detect:<br>0: unlocked<br>1: locked |
| 16 | Signal power detect:<br>0: no signal<br>1: signal detected |
| 15:0 | Debug data |

*Notes:*

1. For signal level >30dBHz

*Example:*

534F4547 53503372: preamble

000C0011: message ID – 0x11, length – 12

020760FF 00030834 E2C28700 902BEC80 DFAE6D80 ABD368C0 3C0C8900 557C8780 BBA02240 9C3100C0 BEBAB280 6AAAAA00: data

9E7244AF: check sum

## 3.3. 0x12: GLONASS Sub-frame Data

Message length: 8.

Rate: once per 2 seconds; transmitted by the channel that tracks GLONASS SV.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | | | Channel Identifier (3.2) |
| 2 | u_int | s | GLONASS sub-frame arrival time (time of day that corresponds to arrival of the first word of sub-frame data) |
| 3 | u_int | | Data bits (Bits 85:54) |
| 4 | u_int | | Data bits (Bits 53:22) |
| 5 | u_int | | Data bits (Bits 21:1); 11 LSB are filled with 0 |
| 6 | u_int | | Hamming code check results:<br>0: no errors |
| 7 | u_int | | String number (1…75) |
| 8 | u_int | | 30-bit time mark decode results:<br>0 or 0x3FFFFFFF: OK<br>otherwise: failed |

*Example:*

534F4547 53503372: preamble

00080012: message ID – 0x12, length – 8

0B1820FF 0000A932 6A89D842 5AB4C00C 2A356000 00000000 0000003A 3FFFFFFF: data

2EF87861: check sum

## 3.4. 0x13: Navigation Solution State Vector

Message length: 32.
Rate: as per output data rate.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1, 2 | double | m | User X coordinate (WGS-84) |
| 3, 4 | double | m | User Y coordinate (WGS-84) |
| 5, 6 | double | m | User Z coordinate (WGS-84) |
| 7, 8 | double | m | Clock shift relative to GPS time scale |
| 9, 10 | double | m/s | User velocity on X axis ($V_X$) |
| 11, 12 | double | m/s | User velocity on Y axis ($V_Y$) |
| 13, 14 | double | m/s | User velocity on Z axis ($V_Z$) |
| 15, 16 | double | m/s | Clock drift |

| | | | |
|---|---|---|---|
| 17, 18 | double | | North PDOP |
| 19, 20 | double | | East PDOP |
| 21, 22 | double | | Vertical PDOP |
| 23, 24 | double | | Reserved |
| 25, 26 | double | m | Clock shift relative to GLONASS time scale |
| 27, 28 | double | m | Position accuracy estimate (3D) |
| 29, 30 | double | m/s | Velocity accuracy estimate (3D) |
| 31, 32 | double | ns | 1PPS accuracy estimate |

*Example:*

534F4547 53503372: preamble

00200013: message ID – 0x13, length – 2

2766C06F 4145B6B3 37926D97 4140CCC0 6A579FA4 415405A6 0868891F C033B0FA F7D54A6F BF744C6B 1A1486F6 BF2B114A 407477BD BF69EB8E D4C1A51D C043C110 E28B856F 3FCF1296 B025483F 3FD097D8 20D4809F 3FECF54B 7069A941 3FD85E1C F063AC1A C060552F F9078EB0 402306B4 6066E521 3F781C83 D334B312 4010E42A: data

B2B27EF0: check sum

## 3.5. 0x14: Timing Parameters

Message length: 12.
Rate: once per second.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1, 2 | double | s | Current time (UTC). Zero value corresponds to Jan 1st 2008 |
| 3, 4 | double | s | Local time and date |
| 5, 6 | double | ns | 1PPS accuracy estimate |
| 7 | u_int | s | GPS time of week |
| 8 | u_int | s | GLONASS time of day |
| 9 | u_short | | Bits 31:16: GPS week rollover |
| | u_short | weeks | Bits 15:0: GPS Week Number WN |
| 10 | u_short | | Bits 31:16: GLONASS number of four-year period $N_4$ |

| | | | |
|---|---|---|---|
| | u_short | days | Bits 15:0: GLONASS calendar day number within the four-year period $N_T$ |
| 11 | byte | s | Bits 31:24: Current leap second count $\Delta t_{LS}$ |
| | byte | s | Bits 23:16: Future leap second count $\Delta t_{LSF}$ |
| | byte | | Bits 15:8: Leap second correction notification KP:<br>0: no correction is scheduled<br>1: “+1 s” leap second correction is scheduled<br>2: decision has not been made yet<br>3: “-1 s” leap second correction is scheduled |
| | byte | | Bits 7:0: Reserved |
| 12 | u_int | | Reserved |

*Example:*

534F4547 53503372: preamble

000C0014: message ID – 0x14, length – 12

A4000000 419FBB52 A4000000 419FBB52 D2C21714 403CBDEE 000331B8 0000B8D9 00010290 00050050 0F100000 00000000: data

9DFA577A: check sum

## 3.6. 0x15: Geographic Coordinates: Extended Data Set

Message length: 18.
Rate: as per output data rate.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1, 2 | double | m | Horizontal position accuracy estimate |
| 3, 4 | double | m | Vertical position accuracy estimate |
| 5, 6 | double | m/s | Vertical velocity |
| 7, 8 | double | rad | Pitch |
| 9, 10 | double | m/s | Horizontal velocity accuracy estimate |
| 11, 12 | double | m/s | Vertical velocity accuracy estimate |
| 13, 14 | double | $m/s^2$ | Acceleration |
| 15 | float | s | Age of GPS diff corrections (RTCM, SBAS).<br>Transmits 9999 if no corrections are received |
| 16 | float | s | Age of GLONASS diff corrections (RTCM, SBAS).<br>Transmits 9999 if no corrections are received |

| | | | |
|---|---|---|---|
| 17 | int | | Number of GPS reference station (RTCM).<br>Transmits 0xFFFFFFFF if no corrections are received |
| 18 | int | | Number of GLONASS reference station (RTCM).<br>Transmits 0xFFFFFFFF if no corrections are received |

*Example:*

534F4547 53503372: preamble

00120015: message ID – 0x15, length – 12

5A4C0867 402D28DC 9D86BF0C 4038A51D 00000000 00000000 00000000 00000000 E7E11C22 3F6B0A1D E542C771 3F76DA66 5E0EDD5F 3F658D8E 461C3C00 461C3C00 FFFFFFFF FFFFFFFF: data

A4071773: check sum

## 3.7. 0x16: SBAS Message

Message length: 11.
Rate: once per second.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | byte | | Bits 31:24: Channel number (0…31) |
| | byte | | Bits 23:16: SBAS SV number (PRN 120…141) |
| | u_short | | 16 MSBs of the Channel Status Word (3.2) |
| 2 | u_int | s | SBAS message arrival time (UTC). Zero value corresponds to Jan 1st 2008 |
| 3 | u_int | | Data bits (Bits 1:32). The first received bit is MSB |
| 4 | u_int | | Data bits (Bits 33:64) |
| 5 | u_int | | Data bits (Bits 65:96) |
| 6 | u_int | | Data bits (Bits 97:128) |
| 7 | u_int | | Data bits (Bits 129:160) |
| 8 | u_int | | Data bits (Bits 161:192) |
| 9 | u_int | | Data bits (Bits 193:224) |
| 10 | u_int | | Data bits (Bits 225:250); 6 LSBs are filled with 0 |
| 11 | u_int | | CRC check results:<br>0: no errors |

*Example:*

534F4547 53503372: preamble

000B0016: message ID – 0x16, length – 11

107F0587 0A538CE4 C6283609 84C80130 644DC538 00CD24B0 00400000 00000000 00000000 2C128C40 00000000: data

100AA5B1: check sum

## 3.8. 0x18: GPS Almanac

Message length: 20.
Data content is identical to that of output message 0x48.
Rate: immediately after extraction of almanac data from the received GPS signal.

*Example:*

534F4547 53503372: preamble

00140018: message ID – 0x18, length – 20

DD4D13F1 4005F8A8 00000000 00000000 60000000 40B421B3 7C2BFF98 3FC690B0 CD9DBC52 3F91DFBA 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 3FC09000 00000006: data

33D62001: check sum

## 3.9. 0x19: GLONASS Almanac

Message length: 18.
Data content is identical to that of output message 0x49.
Rate: immediately after extraction of almanac data from the received GLONASS signal.

*Example:*

534F4547 53503372: preamble

00120019: message ID – 0x19, length – 18

00000000 00000000 00000000 00000000 00000000 00000000 00000000 C0A54F34 00000000 40CF3DF8 00000000 BFB49920 00000000 3F847B00 00000000 00000000 035B000C 00018001: data

030D66CD: check sum

## 3.10. 0x1A: GPS Ephemeris

Message length: 32.
Data content is identical to that of output message 0x4A.
Rate: immediately after extraction of ephemerides data from the received GPS signal.

*Example:*

534F4547 53503372: preamble

0020001A: message ID – 0x1A, length – 32

0BF20D7E 30CC3C00 CB400000 BFEF6EAF A7FFFFFF 3F7CC304 C2A00000 40B42198 4B000000 BFCADB16 21000000 3FD3C6B5 90800000 BFD8F105 FFFFFFFF BE2708BF 00000000 00000000 2E5E0000 B4B90000 36696000 43A0D800 C0E40000 B3A80000 31C00000 B2600000 00000000 00000000 00062700 00062700 000302FF 031F0000: data

CD7E9584: check sum

## 3.11. 0x1B: GLONASS Ephemeris

Message length: 30.
Data content is identical to that of output message 0x4B.
Rate: immediately after extraction of ephemerides data from the received GLONASS signal.

*Example:*

534F4547 53503372: preamble

001E001B: message ID – 0x4B, length – 30

0BF20DDD 035B1FE3 2B000000 C1463BC9 B4C00000 C1644EEB 7A600000 4175E5DE CF000000 40A5DBD0 80000000 C096AAFA 80000000 C073DBBD 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 10300000 0B010045: data

382E5E3E: check sum

## 3.12. 0x1C: GPS Ionospheric Parameters

Message length: 8.
Rate: immediately after extraction of ionospheric model data from the received GPS signal.

| Слово | Тип | Ед. измер. | Параметр |
|---|---|---|---|
| 1 | float | s | Coefficient $\alpha_0$ |
| 2 | float | s/semi-circle | Coefficient $\alpha_1$ |
| 3 | float | s/semi-circle$^2$ | Coefficient $\alpha_2$ |
| 4 | float | s/semi-circle$^3$ | Coefficient $\alpha_3$ |
| 5 | float | s | Coefficient $\beta_0$ |
| 6 | float | s/semi-circle | Coefficient $\beta_1$ |

| | | | |
|---|---|---|---|
| 7 | float | s/semi-circle$^2$ | Coefficient $\beta_2$ |
| 8 | float | s/semi-circle$^3$ | Coefficient $\beta_3$ |

*Example:*

534F4547 53503372: preamble

0008001C: message ID – 0x18, length – 20

00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000: data

00177629: check sum

## 3.13. 0x1D: GPS UTC Parameters

Message length: 8.
Rate: immediately after extraction of UTC parameters data from the received GPS signal.

| Слово | Тип | Ед. измер. | Параметр |
|---|---|---|---|
| 1, 2 | double | s | Coefficient $A_0$ (bias) |
| 3, 4 | double | s/s | Coefficient $A_1$ (drift) |
| 5 | u_int | s | Time data reference Time of Week $t_{ot}$ |
| 6 | u_short | weeks | Bits 31:16: Time data reference Week Number $WN_{ot}$ |
| | u_short | s | Bits 15:0: Current leap second count $\Delta t_{LS}$ |
| 7 | u_short | days | Bits 31:16: Leap second reference Day Number DN |
| | u_short | weeks | Bits 15:0: Leap second reference Week Number $WN_{LSF}$ |
| 8 | u_short | weeks | Bits 31:16: GPS Week Number WN |
| | u_short | s | Bits 15:0: Future leap second count $\Delta t_{LSF}$ |

*Example:*

534F4547 53503372: preamble

0008001D: message ID – 0x1D, length – 20

00000000 00000000 00000000 00000000 00009000 00000010 000200FD 02FF0010: data

02EAE6D5: check sum

## 3.14. 0x1E: GLONASS UTC Parameters

Message length: 10.
Rate: immediately after extraction of UTC parameters data from the received GLONASS signal.

| Слово | Тип | Ед. измер. | Параметр |
|---|---|---|---|
| 1, 2 | double | s | GLONASS time scale correction to UTC(SU) time $\tau_c$ |
| 3, 4 | double | s | Correction of GPS time relative to GLONASS time $\tau_{GPS}$ |
| 5, 6 | double | s | Time shift between UT1 and UTC(SU): polinomial coefficient B1 (bias) |
| 7, 8 | double | s/day | Time shift between UT1 and UTC(SU): polinomial coefficient B2 (drift) |
| 9 | u_short | days | Bits 31:16: GLONASS calendar day number within the four-year period $N_T$ |
| | u_short | | Bits 15:0: GLONASS number of four-year period $N_4$ |
| 10 | u_short | days | Bits 31:16: GLONASS calendar day number within the four-year period related to almanac data $N^A$ |
| | u_short | | Bits 15:0: Leap second correction notification KP:<br>0: no correction is scheduled<br>1: “+1 s” leap second correction is scheduled<br>2: decision has not been made yet<br>3: “-1 s” leap second correction is scheduled |

*Example:*

534F4547 53503372: preamble

000A001E: message ID – 0x1E, length – 10

00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 035B0005 035B0003: data

0015762D: check sum

## 3.15. 0x20: Geographic Coordinates: Basic Data Set

Message length: 28.
Rate: as per output data rate.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1, 2 | double | s | Position fix time (UTC). Zero value corresponds to Jan 1st 2008 |

| | | | |
|---|---|---|---|
| 3, 4 | double | rad | Latitude |
| 5, 6 | double | rad | Longitude |
| 7, 8 | double | m | Height above ellipsoid |
| 9, 10 | double | m | Geoidal separation |
| 11 | u_int | | Number of SVs in fix |
| 12 | u_int | | Receiver Status Word (see below) |
| 13, 14 | double | | GDOP |
| 15, 16 | double | | PDOP |
| 17, 18 | double | | TDOP |
| 19, 20 | double | | HDOP |
| 21, 22 | double | | VDOP |
| 23 | u_int | | Position fix valid indicator:<br>0: fix valid<br>otherwise: fix not valid |
| 24 | u_int | | Number of continuous fixes |
| 25, 26 | double | m/s | Speed over ground |
| 27, 28 | double | rad | Course |

Receiver Status Word:

| Bit field | Description |
|---|---|
| 31 | Reserved |
| 30 | RF PLL status:<br>0: failed<br>1: OK |
| 29:28 | Receiver operation mode:<br>0: normal<br>1: test<br>2: FW update<br>3: saving data to Flash |
| 27 | Reserved |
| 26 | Carrier phase measurements (message 0x10) availability indicator:<br>0: carrier phase measurements unavailable<br>1: carrier phase measurements available |
| 25 | Reserved |
| 24 | DR mode indicator:<br>0: fix calculated<br>1: fix extrapolated |

| | |
|---|---|
| 23 | Reserved |
| 22 | Assisted mode indicator:<br>0: autonomous<br>1: assisted |
| 21 | “ACTIVE”/”SLEEP” state indicator:<br>0: “SLEEP”<br>1: “ACTIVE” |
| 20 | Differential mode indicator:<br>0: autonomous mode<br>1: differential mode |
| 19 | Actual RTCM corrections availability indicator:<br>0: not available<br>1: available |
| 18 | Actual SBAS corrections availability indicator:<br>0: not available<br>1: available |
| 17 | SBAS SV tracking indicator:<br>0: no SBAS SV in tracking<br>1: at least one SBAS SV in tracking |
| 16 | Ionospheric model/UTC data decoded from GPS message availability indicator:<br>0: not available<br>1: available |
| 15 | Position fix indicator:<br>0: fix not available<br>1: fix available |
| 14 | Indicator that at least one position fix has been available after receiver start:<br>0: not available<br>1: available |
| 13 | Reserved |
| 12 | 2D fix indicator:<br>0: 3D fix<br>1: 2D fix |
| 11, 10 | Antenna status:<br>0: not measured<br>1: overload<br>2: open<br>3: OK |
| 9 | GLONASS AGC:<br>0: failed<br>1: OK |
| 8 | GPS AGC:<br>0: failed<br>1: OK |
| 7 | Reserved |
| 6 | Reserved |
| 5 | Date decoded from navigation message availability indicator:<br>0: not available<br>1: available |
| 4 | Time decoded from navigation message availability indicator:<br>0: not available<br>1: available |
| 3 | GLONASS almanac availability indicator:<br>0: not available<br>1: available |

| | |
|---|---|
| 2 | GPS almanac availability indicator:<br>0: not available<br>1: available |
| 1 | RTC test results:<br>0: failed<br>1: OK |
| 0 | Backup SRAM test results:<br>0: failed<br>1: OK |

*Example:*

534F4547 53503372: preamble

001C0020: message ID – 0x20, length – 28

9C000000 419EB972 3AD3F983 3FEF224A 290E77B8 3FE51264 A9223ED0 4066AA61 00000000 402C5500 00000014 C001CBFF 53AD7DAB 3FF1CFF3 86A6C275 3FF04159 270410EF 3FDD21F4 815C268F 3FE2EB1D 7BFF0202 3FEA706C 00000000 00000406 7672085E 3F65C805 777CE306 3FF1C379: data

91C12099: check sum

## 3.16. 0x21: Current Receiver Telemetry

Message length: 6.
Rate: once per second.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Receiver Status Word (3.15) |
| 2 | u_int | | Receiver Configuration Word (see below) |
| 3 | u_int | s | Time elapsed since last restart |
| 4 | u_int | s | Current time (UTC). Zero value corresponds to Jan 1st 2008 |
| 5(1) | u_int | | Reserved |
| 6(1) | byte | | Bits 31:24: Number of SVs in view |
| | byte | | Bits 23:16: Number of the receiver busy channels |
| | byte | | Bits 15:8: Number of SVs in fix |
| | byte | | Bits 7:0: Number of SVs being tracked |

*Notes:*

1. Words #5, #6 are filled with “0” in “SLEEP” state

Receiver Configuration Register (here and hereinafter):

| Bit # | Description |
|---|---|
| 31:30 | Diff corrections source:<br>0: auto select<br>1: RTCM<br>2: SBAS |
| 29 | PRN SBAS:<br>0: user defined<br>1: auto select |
| 28 | Differential mode:<br>0: disabled<br>1: enabled |
| 27 | Using SVs in position fix in diff mode:<br>0: only those SVs for which diff corrections are available<br>1: all available SVs |
| 26 | Pseudorange measurements in message 0x10:<br>0: unsmoothed<br>1: smoothed |
| 25 | Power-save mode:<br>0: RELAXED FIX®<br>1: FIX-BY-REQUEST® |
| 24 | Power-save mode:<br>0: disabled<br>1: enabled |
| 23:21 | User dynamics profile:<br>0: auto select<br>1:pedestrian-car<br>2: marine<br>3: airborne |
| 20:19 | Output data rate, Hz:<br>0: 10<br>1: 5<br>2: 2<br>3: 1 |
| 18 | Dynamic filtering:<br>0: disabled<br>1: enabled |
| 17 | Pseudorange smoothing:<br>0: disabled<br>1: enabled |
| 16 | 2D for the first fix:<br>0: enabled<br>1: disabled |
| 15 | 2D mode:<br>0: disabled<br>1: enabled |
| 14 | Coordinates hold mode:<br>0: disabled<br>1: enabled |
| 13 | Reserved |
| 12 | Datum:<br>0: WGS-84<br>1: PZ-90.11 |
| 11:10 | 1PPS synchronization time scale:<br>0: GPS<br>1: UTC<br>2: GLONASS |

| | |
|---|---|
| | 3: UTC(SU) |
| 9 | 1PPS polarity:<br>0: positive<br>1: negative |
| 8 | 1PPS output:<br>0: disabled<br>1: enabled |
| 7 | Antenna power:<br>0: disabled<br>1: enabled |
| 6 | Reserved |
| 5 | Reserved |
| 4 | Reserved |
| 3 | Reserved |
| 2 | Reserved |
| 1 | GPS system:<br>0: disabled<br>1: enabled |
| 0 | GLONASS system:<br>0: disabled<br>1: enabled |

*Example:*

534F4547 53503372: preamble

00060021: message ID – 0x21, length – 6

8001C0FF 003E4130 0000001A 079F6E51 00000000 15171016: data

92AE8986: check sum

## 3.17. 0x22: SVs in View

Message length: 1 + 5*NSat.
Rate: once per second.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Number of SVs for which the data is transmitted (NSat) |
| 2…6 | structure | | Data for the 1st SV in view |
| … | | | … |

| | | | |
|---|---|---|---|
| -3+5*NSat …1+5*NSat | structure | | Data for the NSat$^{th}$ SV in view |

Data for SV in view (structure):

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | byte | | Bits 31:24: Number of receiver channel (0…31) that tracks given SV<br>Transmits 0xFF if SV is not in track |
| | byte | | Bits 23:16: SV number<br>GPS: 1…32<br>GLONASS: 65…96<br>SBAS: 33…64 |
| | short | | Bits 15:0: Carrier frequency number of RF signal transmitted by $n^A$ SV $H_n^A$<br>Transmits 0 for GPS and SBAS |
| 2 | u_int | | Channel Status Word (3.2)<br>Transmits 0 if SV is not in track |
| 3 | float | dBHz | SNR<br>Transmits 0 if SV is not in track |
| 4 | float | rad | Elevation angle |
| 5 | float | rad | Azimuth |

*Example:*

534F4547 53503372: preamble

006A0022: message ID – 0x22, length – 106

00000015 0142FFFC 20FFD02B 424C3B8A 3F303AAF 3FAF2B3E 0E430005 20FFC02B 42607411 3FABBB16 40BAD99F 0F440006 20FFC02B 424F2514 3EF5BFF9 409A932C 084B0000 20FFC02B 4243BBDF 3E95261F 3E8B8AA8 074CFFFF 20FFD02B 425B2E4F 3F362F62 3FA44FF7 054DFFFE 20FFC02B 4249EDE7 3ED09FA4 401605CF 0252FFFD 20FFC02B 423C219B 3F082BEA 40816F6C 0C530003 20FFC02B 425A13CD 3F38C7AC 40A66D3B 0B540002 20FFC02B 42314499 3E421BC1 40C26B34 00010000 20FFC128 4258DCC4 3F911948 4078A1E3 030B0000 01FB4128 424BBA9A 3F3EACB0 405FC7C1 040C0000 20FFC128 422BC84F 3E205306 3ED2887B 060E0000 20FFC128 424509D6 3F2314CF 3F83CC9C 09110000 20FFC128 42442E65 3EDF282A 40AA6F90 0A140000 20FFD128 42502009 3F64DB8F 4099A9AA FF160000 00000000 00000000 3D9898FB 3FDC66A9 0D170000 20FFC128 423278D2 3E7783C9 407B36D7 13180000 09FF4128 41F43A89 3F9572F7 407DB743 14190000 20FFC128 421F9D27 3DC74077 3F7BD83C 111F0000 20FFC128 424C9FD7 3F2B1158 4004675D 10200000 20FFC128 4257CB63 3FB5B444 40932BC0: data

F3ACAC6E: check sum

## 3.18. 0x3E: Receiver Power-up Message

Message length: 3.
Rate: once per second during first 5 seconds after receiver power-up.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Backup SRAM integrity test results. Transmits 0 if SRAM is OK |
| 2 | u_int | | UTC reading taken from backup SRAM. Transmits 0 if the data is failed |
| 3 | u_int | | UTC reading taken from RTC |

*Example:*

534F4547 53503372: preamble

0003003E: message ID – 0x3E, length – 3

000000B4 07AFA1D0 07AFA231: data

001C755E: check sum

## 3.19. 0x3F: Negative Acknowledge

Message length: 2.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Message ID which caused error |
| 2 | u_int | | Error cause:<br>0: data synchronization failed (no preamble found); in this case Word #1 transmits 0xFFFF<br>1: incorrect check sum<br>2: incorrect number of data<br>3: incorrect message ID<br>4: incorrect value |

*Example:*

534F4547 53503372: preamble

0002003F: message ID – 0x3F, length – 3

00000011 00000003: data

001D7618: check sum

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## 3.20. 0x40: Response to Set Initial Parameters

Message length: 10.
Response to the input message 0x40.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | s | UTC. Zero value corresponds to Jan 1st 2008 |
| 2 | int | s | Local time shift relative to UTC |
| 3, 4 | double | m | User X coordinate (WGS-84) |
| 5, 6 | double | m | User Y coordinate (WGS-84) |
| 7, 8 | double | m | User Z coordinate (WGS-84) |
| 9 | float | m/s | Clock drift |
| 10 | float | m | GLONASS-GPS time shift |

*Example:*

534F4547 53503372: preamble

000A0040: message ID – 0x40, length – 10

07B0E938 00003840 4E76C8B4 4145B6B7 A0C49BA6 4140CCBE E8D4FDF4 415405A9 3F99999A C3020000: data

BC09EFD1: check sum

## 3.21. 0x41: Response to Set Serial Ports Parameters

Message length: 4.
Response to the input message 0x41.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Port number:<br>0: Port #0<br>1: Port #1 |
| 2 | u_int | bit/s | Baud rate:<br>0: 4800<br>1: 9600<br>2: 19200 |

| | | | |
|---|---|---|---|
| | | | 3: 38400<br>4: 57600<br>5: 115200<br>6: 230400<br>7: 460800<br>8: 921600 |
| 3 | u_int | | Stop bits:<br>0: 1 stop bit<br>1: 2 stop bits |
| 4 | u_int | | Parity:<br>0: no parity<br>1: even<br>2: odd<br>3: space<br>4: mark |

*Example:*

534F4547 53503372: preamble

00040041: message ID – 0x41, length – 4

00000001 00000005 00000001 00000000: data

001B7671: check sum

## 3.22. 0x42: Response to Set Receiver Operation Mode

Message length: 2.
Response to the input message 0x42.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_short | | Bits 31:16: Datum:<br>0: WGS-84<br>1: PZ-90.11 |
| | u_short | | Bits 15:0: Satellite system:<br>1: GLONASS only<br>2: GPS only<br>3: GPS+GLONASS |
| 2 | u_int | | Coordinates hold mode:<br>0: disabled<br>1: enabled |

*Example:*

534F4547 53503372: preamble

00020042: message ID – 0x42, length – 2

00000003 00000000: data

001D7674: check sum

## 3.23. 0x43: Response to Set Navigation Solution Parameters

Message length: 8.
Response to the input message 0x43.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | User dynamics profile:<br>0: auto select<br>1: pedestrian-car<br>2: marine<br>3: airborne |
| 2 | float | | GDOP mask |
| 3 | float | rad | Elevation angle mask |
| 4 | float | dBHz | Signal level mask |
| 5 | u_int | | 2D mode control:<br>0: 2D not allowed<br>1: 2D allowed except the first fix<br>2: 2D allowed |
| 6 | u_int | s | DR duration.<br>Value range: 0…10s. If set to 0, DR is disabled |
| 7 | u_int | | Bits 1:0: Position fix filtering<br>0: no filtering<br>1: pseudorange smoothing on<br>2: dynamic filtering on<br>3: both on<br>Bit 2: Pseudorange measurements in message 0x10<br>0: unsmoothed<br>1: smoothed |
| 8 | float | m/s | Static navigation threshold.<br>If set to 0, static navigation is disabled |

*Example:*

534F4547 53503372: preamble

00080043: message ID – 0x43, length – 8

00000001 42200000 3D8EFA35 41700000 00000001 0000000A 00000003 40000000: data

7EC98C4A: check sum

## 3.24. 0x44: Response to Set Output Data Rate

Message length: 1.
Response to the input message 0x44.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | Hz | Output data rate:<br>0: 10<br>1: 5<br>2: 2<br>3: 1 |

*Example:*

534F4547 53503372: preamble

00010043: message ID – 0x44, length – 8

00000003: data

001E7672: check sum

## 3.25. 0x45: DGNSS Control

Message length: 1.
Response to the input message 0x45.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Bit 0: Differential mode:<br>0: disabled<br>1: enabled<br>Bit 1: Using SVs in position fix in diff mode:<br>0: only those SVs for which diff corrections are available<br>1: all available SVs |
| 2 | u_int | | Diff corrections source:<br>0: auto select<br>1: RTCM<br>2: SBAS |

*Example:*

534F4547 53503372: preamble

00020045: message ID – 0x45, length – 2

00000001 00000001: data

001D7670: check sum

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## 3.26. 0x46: SBAS Control

Message length: 3.
Response to the input message 0x46.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | SBAS PRN:<br>0: user defined<br>1: auto select |
| 2 | u_int | | PRN number for the first receiver SBAS channel:<br>120 … 141<br>otherwise: SBAS disabled for given channel |
| 3 | u_int | | PRN number for the second receiver SBAS channel:<br>120 … 141<br>otherwise: SBAS disabled for given channel |

*Example:*

534F4547 53503372: preamble

00030046: message ID – 0x46, length – 3

00000001 0000007D 00000089: data

001C7686: check sum

## 3.27. 0x47: Response to Power-save Modes Control

Message length: 5.
Response to the input message 0x47.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Power-save mode:<br>0: RELAXED FIX®<br>1: FIX-BY-REQUEST® |
| 2 | u_int | s | Minimum “ACTIVE” time duration ($T_{ACT\ MIN}$).<br>Minimum value: 2 |
| 3 | u_int | s | Maximum “ACTIVE” time duration ($T_{ACT\ MAX}$).<br>Cannot be less than $T_{ACT\ MIN}$. |
| 4 | u_int | s | Time interval between “ACTIVE” states for RELAXED FIX® ($T_{AC-ACT}$).<br>Cannot be less than $T_{ACT\ MAX}$ and ($T_{ACT\ MIN}$ + $T_{ACT\ FIX}$).<br>Value range: 10…120 |
| 5 | u_int | s | ACTIVE” time after the first fix ($T_{ACT\ FIX}$).<br>Minimum value: 0 |

*Example:*

534F4547 53503372: preamble

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00050047: message ID – 0x47, length – 5

00000001 00000002 00000005 0000003C 00000000: data

001A7648: check sum

## 3.28. 0x48: Response to Set GPS Almanac

Message length: 20.
Response to the input message 0x48.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1, 2 | double | semi-circles | Mean Anomaly at Reference Time M0 |
| 3, 4 | double | | Eccentricity e |
| 5, 6 | double | $m^{1/2}$ | Square Root of the Semi-Major Axis $\sqrt{A}$ |
| 7, 8 | double | semi-circles | Longitude of Ascending Node of Orbit Plane at Weekly Epoch OMEGA0 |
| 9, 10 | double | semi-circles | Inclination Angle at Reference Time i0 |
| 11, 12 | double | semi-circles | Argument of Perigee ω |
| 13, 14 | double | semi-circles/s | Rate of Right Ascension OMEGADOT |
| 15, 16 | double | s | Polinomial coefficient $a_{f0}$ |
| 17, 18 | double | s/s | Polinomial coefficient $a_{f1}$ |
| 19 | int | s | Bits 21:0: Reference Time Almana $t_{oa}$ |
| | | | Bits 31:22: Number of Week $WN_a$ to which the $t_{oa}$ is referenced |
| 20 | u_short | | Bits 31:16: SV health |
| | u_short | | Bits 15:0: PRN Number (PRN No.) |

*Example:*

534F4547 53503372: preamble

00140048: message ID – 0x48, length – 20

05B7A31C 40069F94 00000000 3F7D3D00 60000000 40B42194 0CEEBD0C BFCEAD9D C4FE8679 3F94BEDC D95A552F C002C782 4B19CDF5 BE414114 00000000 3F23A000 00000000 BD900000 22890000 00000011: data

5E03C008: check sum

## 3.29. 0x49: Response to Set GLONASS Almanac

Message length: 18.
Response to the input message 0x49.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1, 2 | double | | Eccentricity $\varepsilon_n^A$ |
| 3, 4 | double | s/orbital period$^2$ | Rate of change of Draconian period of $n^A$ SV $\dot{T}_{n^A}$ |
| 5, 6 | double | semi-circles | Argument of perigee of $n^A$ SV ($\omega_{n^A}$) |
| 7, 8 | double | s/orbital period | Correction to the mean value of Draconian period of the $n^A$ SV $\Delta T_{n^A}$ |
| 9, 10 | double | s | Time of the first ascending node passage of $n^A$ SV within $N^A$ day $t_{\lambda,n^A}$ |
| 11, 12 | double | semi-circles | Longitude of the first ascending node of $n^A$ SV orbit in PZ-90 within $N^A$ day $\lambda_{n^A}$ |
| 13, 14 | double | semi-circles | Correction to the mean value of inclination of $n^A$ SV $\Delta i_{n^A}$ |
| 15, 16 | double | s | Coarse value of $n^A$ SV time correction to GLONASS time $\tau_{n^A}$ |
| 17 | u_short | day | Bits 31:16: GLONASS calendar day number within the four-year period related to almanac data $N^A$ |
| | u_short | | Bits 15:0: SV system number $n^A$ |
| 18 | short | | Bits 31:16: Carrier frequency number of RF signal transmitted by $n^A$ SV $H_{n^A}$ |
| | u_short | | Bits 15:0: Unhealthy flag $C_{n^A}$ (bit 15), type of GLONASS SV $M_{n^A}$ (bits 0 and 1) |

*Example:*

534F4547 53503372: preamble

00120049: message ID – 0x49, length – 18

00000000 3F621600 00000000 BF3C0000 00000000 3FB31200 00000000 C0A4BFC5 00000000 40DBBFC2 00000000 3FEC52E4 00000000 3F874280 00000000 3F020000 00280009 FFFE8001: data

FF20E217: check sum

## 3.30. 0x4A: Response to Set GPS Ephemeris

Message length: 32.
Response to the input message 0x4A.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | int | s | Current time (UTC) at the moment of ephemerides reception. Zero value corresponds to Jan 1st 2008 |
| 2 | float | semi-circles/s | Mean Motion Difference From Computed Value Δn |
| 3, 4 | float | semi-circles | Mean Anomaly M0 |
| 5, 6 | double | | Eccentricity e |
| 7, 8 | double | $m^{1/2}$ | Square Root of the Semi-Major Axis $\sqrt{A}$ |
| 9, 10 | double | semi-circles | Longitude of Ascending Node of Orbit Plane at Weekly Epoch $OMEGA_0$ |
| 11, 12 | double | semi-circles | Inclination Angle at Reference Time i0 |
| 13, 14 | double | semi-circles | Argument of Perigee ω |
| 15, 16 | double | semi-circles/s | Rate of Right Ascension OMEGADOT |
| 17, 18 | double | s | Polinomial coefficient $a_{f0}$ |
| 19 | float | semi-circles/s | Rate of Inclination Angle IDOT |
| 20 | float | rad | Amplitude of the Cosine Harmonic Correction Term to the Argument of Latitude $C_{uc}$ |
| 21 | float | rad | Amplitude of the Sine Harmonic Correction Term to the Argument of Latitude $C_{us}$ |
| 22 | float | m | Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius $C_{rc}$ |
| 23 | float | m | Amplitude of the Sine Harmonic Correction Term to the Orbit Radius $C_{rs}$ |
| 24 | float | rad | Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination $C_{ic}$ |
| 25 | float | rad | Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination $C_{is}$ |
| 26 | float | | $T_{GD}$ |
| 27 | float | $s/s^2$ | Polinomial coefficient $a_{f2}$ |
| 28 | float | s/s | Polinomial coefficient $a_{f1}$ |
| 29 | int | s | Reference Time Ephemerides $t_{oe}$ |
| 30 | int | s | Clock data reference time $t_{oc}$ |
| 31 | short | | Bits 31:16: IODC |
| | short | | Bits 15:0: GPS Week Number WN |
| 32 | byte | | Bits 31:24: IODE |
| | byte | | Bits 23:16: PRN number (PRN No.) |
| | byte | | Bits 15:8: SV health |

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| | | | |
|---|---|---|---|
| | byte | | Bits 7:0: SV accuracy |

*Example:*

534F4547 53503372: preamble

0020004A: message ID – 0x4A, length – 32

07BB16EC 30E25000 A7C00000 3FE839E7 0FFFFFFF 3F6633FD B0800000 40B42198 04000000 3FE289F4 9E000000 3FD361A9 54000000 3FB7B534 FFFFFFFE BE27613F 00000000 BF326A4A 2EA1C000 36276000 36835000 43963000 4240A000 B3400000 32A00000 B2300000 00000000 ACA00000 0006EBE0 0006EBE0 0050028A BF050000: data

6F792F86: check sum

## 3.31. 0x4B: Response to Set GLONASS Ephemeris

Message length: 30.
Response to the input message 0x4B.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | int | | Current time (UTC) at the moment of ephemerides reception. Zero value corresponds to Jan 1st 2008 |
| 2 | u_short | | Bits 31:16: Calendar day number within the four-year period beginning since the leap year $N^A$ |
| | u_short | | Bits 15:0: Sum of four-year period and day number within the four-year period expressed in days $1461*N_4 + (N_T - 1)$ |
| 3, 4 | double | m | SV X coordinate in PZ-90 at the instant $t_b$ ($x_n$ ($t_b$)) |
| 5, 6 | double | m | SV Y coordinate in PZ-90 at the instant $t_b$ ($y_n$ ($t_b$)) |
| 7, 8 | double | m | SV Z coordinate in PZ-90 at the instant $t_b$ ($z_n$ ($t_b$)) |
| 9, 10 | double | m/s | SV velocity on X axis in PZ-90 at the instant $t_b$ $(\dot{x}_n(t_b))$ |
| 11, 12 | double | m/s | SV velocity on Y axis in PZ-90 at the instant $t_b$ $(\dot{y}_n(t_b))$ |
| 13, 14 | double | m/s | SV velocity on Z axis in PZ-90 at the instant $t_b$ $(\dot{z}_n(t_b))$ |
| 15, 16 | double | m/s$^2$ | SV acceleration on X axis in PZ-90 at the instant $t_b$ $(\ddot{x}_n(t_b))$ |
| 17, 18 | double | m/s$^2$ | SV acceleration on Y axis in PZ-90 at the instant $t_b$ $(\ddot{y}_n(t_b))$ |
| 19, 20 | double | m/s$^2$ | SV acceleration on Z axis in PZ-90 at the instant $t_b$ $(\ddot{z}_n(t_b))$ |
| 21, 22 | double | | Relative deviation of predicted carrier frequency value of SV from nominal value $\gamma_n$ ($t_b$) |

| | | | |
|---|---|---|---|
| 23, 24 | double | s | Correction to SV time relative to GLONASS time $\tau_n(t_b)$ |
| 25, 26 | double | s | GLONASS time scale correction to UTC(SU) time $\tau_c$ |
| 27, 28 | double | s | Correction of GPS time relative to GLONASS time $\tau_{GPS}$ |
| 29 | u_short | | Flags:<br>// Bits 17:16: flag P1<br>// Bits 19:18: flag Bn<br>// Bit 20: flag P2<br>// Bit 21: flag P3<br>// Bits 23:22: flag P<br>// Bit 24: flag P4<br>// Bits 27:25: reserved<br>// Bits 29:28: flag M |
| | u_short | | SV health flag:<br>// bit 0: $l_n$ from string 2 of ephemerides<br>// bit 1: $l_n$ from string 3 of ephemerides<br>// bit 2: $l_n$ from string 5 of ephemerides<br>// bit 4: $l_n$ from string 7 of almanac<br>// bit 5: $l_n$ from string 9 of almanac<br>// bit 6: $l_n$ from string 11 of almanac<br>// bit 7: $l_n$ from string 13 of almanac<br>// bit 8: $l_n$ from string 15 of almanac<br>// bit 9: inverse $C_n^A$ of almanac |
| 30 | byte | | Bits 31:24: SV system number $n^A$ |
| | byte | | Bits 23:16: Parameter of predicted SV user range accuracy $F_T$ |
| | byte | day | Bits 15:8: Age of ephemerides $E_n^{\vartheta}$ |
| | byte | | Bits 7:0: Index of a 15-minute time interval within current day according to UTC(SU) + 03 hours 00 min $t_b$ |

*Example:*

534F4547 53503372: preamble

001E004B: message – 0x4B, length – 30

07BB8ABB 00281CB1 02000000 414105BF 7E200000 416D97A7 15900000 4173343B 94000000 C09C3C18 E8000000 C0A05895 EC000000 409C30F8 00000000 3EBF4000 00000000 00000000 00000000 BEBF4000 00000000 3D880000 00000000 BF197FE0 00000000 BE855000 00000000 BE997000 10F00000 0E05003D: data

E3A54DFF: check sum

## 3.32. 0x4C: Response to Set PPS Parameters

Message length: 6.
Response to the input message 0x4C.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | 1PPS output:<br>0: disabled<br>1: enabled |
| 2 | u_int | | 1PPS polarity:<br>0: positive<br>1: negative |
| 3 | u_int | | 1PPS synchronization:<br>0: GPS<br>1: UTC<br>2: GLONASS<br>3: UTC(SU) |
| 4 | float | us | 1PPS duration.<br>Value range: 10…2000 |
| 5, 6 | double | ns | 1PPS shift.<br>Value range: ±500 000 000 |

*Example:*

534F4547 53503372: preamble

0006004C: message ID – 0x4C, length – 6

00000001 00000000 00000000 447A0000 00000000 00000000: data

44637678: check sum

## 3.33. 0x4D: Response to Enable/Disable SV in Position Fix

Message length: 2.
Response to the input message 0x4D.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | SV number<br>GPS: 1…32<br>GLONASS: 65…96 |
| 2 | u_int | | SV status:<br>0: disabled<br>1: enabled |

*Example:*

534F4547 53503372: preamble

0002004D: message ID – 0x4D, length – 2

00000041 00000001: data

001D7638: check sum

## 3.34. 0x4E: Response to Enable/Disable NMEA Messages

Message length: 2.
Response to the input message 0x4E.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Port number:<br>0: Port #0<br>1: Port #1 |
| 2 | u_int | | Bits 6:0: Enable/disable mask of NMEA messages<br>(0: disabled; 1: enabled):<br>Bit 0: GGA/GNS mask<br>Bit 1: GSA mask<br>Bit 2: GSV mask<br>Bit 3: RMC mask<br>Bit 4: VTG mask<br>Bit 5: GLL mask<br>Bit 6: ZDA mask<br><br>Bit 12: NMEA 0183 version standard<br>0: v2.x<br>1: v3.x<br><br>Bit 13: GGA or GNS select (for NMEA 0183 v3.x only)<br>0: GGA<br>1: GNS |

*Example:*

534F4547 53503372: preamble

0002004E: message ID – 0x4E, length – 2

00000000 0000000F: data

001D7674: check sum

## 3.35. 0x4F: Response to Enable/Disable Binary Messages

Message length: 2.
Response to the input message 0x4F.

| Word # | Type | Units | Parameter |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | u_int | | Enable/disable mask of binary messages<br>(0: disabled; 1: enabled):<br>Bit 0: 0x00 mask<br>Bit 1: 0x01 mask<br>Bit 2: 0x02 mask<br>…<br>Bit 31: 0x1F mask |

*Example:*

534F4547 53503372: preamble

0001004F: message ID – 0x4F, length – 1

12345000: data

122A267A: check sum

## 3.36. 0x50: Response to Set Data Protocol Assignment to Serial Port

Message length: 1.
Response to the input message 0x50.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Data protocol to serial port assignment:<br>0: Port #0: binary; Port #1: NMEA<br>1: Port #0: NMEA, Port #1: binary<br>2: Port #0: NMEA, Port #1: NMEA<br>3: Port #0: binary; Port #1: RTCM<br>4: Port #0: NMEA; Port #1: RTCM |

*Example:*

534F4547 53503372: preamble

00010050: message ID – 0x50, length – 1

00000001: data

001E7664: check sum

## 3.37. 0x80: Response to Query Initial Parameters

Message length: 10.
Response to the input message 0x80. Data content is identical to that of output message 0x40. Word #1 is a receiver current time.

*Example:*

534F4547 53503372: preamble

000A0080: message ID – 0x80, length – 10

07B0F1E1 00003840 4E76C8B4 4145B6B7 A0C49BA6 4140CCBE E8D4FDF4 415405A9 C20EA965 C2E72E34: data

407BE903: check sum

## 3.38. 0x81: Response to Query Serial Ports Parameters

Message length: 4.
Response to the input message 0x81. Data content is identical to that of output message 0x41.

*Example:*

534F4547 53503372: preamble

00040081: message ID – 0x81, length – 4

00000000 00000005 00000001 00000000: data

001B76B0: check sum

## 3.39. 0x82: Response to Query Receiver Operation Mode

Message length: 2.
Response to the input message 0x82. Data content is identical to that of output message 0x42.

*Example:*

534F4547 53503372: preamble

00020082: message ID – 0x82, length – 2

00000003 00000000: data

001D76B4: check sum

## 3.40. 0x83: Response to Query Navigation Solution Parameters

Message length: 8.

Response to the input message 0x83. Data content is identical to that of output message 0x43.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00080083: | message ID – 0x83, length – 8 |
| 00000001 42200000 3D8EFA35 41700000 00000001 0000000A 00000003 40000000: | data |
| 7EC98C8A: | check sum |

## 3.41. 0x84: Response to Query Output Data Rate

Message length: 1.
Response to the input message 0x84. Data content is identical to that of output message 0x44.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00010084: | message ID – 0x84, length – 1 |
| 00000003: | data |
| 001E76B2: | check sum |

## 3.42. 0x85: Response to Query DGNSS Parameters

Message length: 2.
Response to the input message 0x85. Data content is identical to that of output message 0x45.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00020085: | message ID – 0x85, length – 2 |
| 00000001 00000000: | data |
| 001D76B1: | check sum |

## 3.43. 0x86: Response to Query SBAS Parameters

Message length: 3.

Response to the input message 0x86. Data content is identical to that of output message 0x46.

*Example:*

534F4547 53503372: preamble

00030086: message ID – 0x86, length – 3

00000001 0000007D 00000089: data

001C7646: check sum

## 3.44. 0x87: Response to Query Parameters of Power-save Modes

Message length: 5.
Response to the input message 0x87. Data content is identical to that of output message 0x47.

*Example:*

534F4547 53503372: preamble

00050087: message ID – 0x87, length – 5

00000001 00000002 00000005 0000003C 00000000: data

001A7688: check sum

## 3.45. 0x88: Response to Query GPS Almanac

Message length: 20.
Response to the input message 0x88. Data content is identical to that of output message 0x48.

*Example:*

534F4547 53503372: preamble

00140088: message ID – 0x88, length – 20

62091268 3FC2A5E8 00000000 3F8A1D40 80000000 40B4219C 73BC6699 3FE0298F 1A3DA232 BFABB293 3A715BE0 3FF06C8C 9FE54496 BE42298E 00000000 BF2E6000 00000000 BD900000 22890000 0000000B: data

4F259829: check sum

## 3.46. 0x89: Response to Query GLONASS Almanac

Message length: 18.
Response to the input message 0x89. Data content is identical to that of output message 0x49.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00120089: | message ID – 0x89, length – 18 |
| 00000000 3EEE0000 00000000 3F4A0000 00000000 BFEA6C40 00000000 C0A4C007 00000000 40E1F9C1 00000000 BFE4937E 00000000 3F85FD80 00000000 3F288000 00280013 00038001: | data |
| 81644DD6: | check sum |

## 3.47. 0x8A: Response to Query GPS Ephemeris

Message length: 32.

Response to the input message 0x8A. Data content is identical to that of output message 0x4A.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 0020008A: | message ID – 0x8A, length – 32 |
| 00000000 3EEE0000 00000000 3F4A0000 00000000 BFEA6C40 00000000 C0A4C007 00000000 40E1F9C1 00000000 BFE4937E 00000000 3F85FD80 00000000 3F288000 00280013 00038001: | data |
| 81644DD6: | check sum |

## 3.48. 0x8B: Response to Query GLONASS Ephemeris

Message length: 30.
Response to the input message 0x8B. Data content is identical to that of output message 0x4B.

*Example:*

534F4547 53503372: preamble

001E008B: message ID – 0x8B, length – 30

07BB16EC 30E25000 A7C00000 3FE839E7 0FFFFFFF 3F6633FD B0800000 40B42198 04000000 3FE289F4 9E000000 3FD361A9 54000000 3FB7B534 FFFFFFFE BE27613F 00000000 BF326A4A 07BB7657 00281CB1 9A400000 C169FE76 FA400000 C1540597 B3A00000 4173E116 24000000 C09597CF F9000000 C0A3A179 EA000000 C098351D 00000000 BEC77000 00000000 BEBF4000 00000000 BEBF4000 00000000 00000000 00000000 3F2177B8 00000000 BE855000 00000000 BE997000 10F00000 0C040039: data

FFDC2285: check sum

## 3.49. 0x8C: Response to Query PPS Parameters

Message length: 6.
Response to the input message 0x8C. Data content is identical to that of output message 0x4C.

*Example:*

534F4547 53503372: preamble

0006008C: message ID – 0x8C, length – 6

00000001 00000000 00000000 447A0000 00000000 00000000: data

446376B8: check sum

## 3.50. 0x8D: Response to Query Enable/Disable Status of the SV in Position Fix

Message length: 2.
Response to the input message 0x8D. Data content is identical to that of output message 0x4D.

*Example:*

534F4547 53503372: preamble

0002008D: message ID – 0x8D, length – 2

00000019 00000001: data

001D76A0: check sum

## 3.51. 0x8E: Response to Query Enabled NMEA Messages

Message length: 2.
Response to the input message 0x8E. Data content is identical to that of output message 0x4E.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 0002008E: | message ID – 0x8E, length – 2 |
| 00000001 0000300F: | data |
| 001D46B5: | check sum |

## 3.52. 0x8F: Response to Query Enabled Binary Messages

Message length: 1.
Response to the input message 0x8F. Data content is identical to that of output message 0x4F.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 0001008F: | message ID – 0x8F, length – 1 |
| 12345000: | data |
| 122A26BA: | check sum |

## 3.53. 0x90: Response to Query Data Protocol Assignment to Serial Port

Message length: 1.
Response to the input message 0x90. Data content is identical to that of output message 0x50.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00010090: | message ID – 0x90, length – 1 |
| 00000000: | data |

001E76A5: check sum

## 3.54. 0x9C: Response to Query GPS Ionospheric Parameters

Message length: 8.
Response to the input message 0x9C.
Data content is identical to that of output message 0x1C.

*Example:*

534F4547 53503372: preamble

0008009C: message ID – 0x9C, length – 8

32B00000 B2000000 B3800000 34400000 48060000 C8300000 47800000 47800000: data

875176A9: check sum

## 3.55. 0x9D: Response to Query GPS UTC Parameters

Message length: 8.
Response to the input message 0x9D.
Data content is identical to that of output message 0x1D.

*Example:*

534F4547 53503372: preamble

0008009D: message ID – 0x9D, length – 8

00000000 00000000 FFFFFFFE BCF7FFFF 0004E000 001E0010 0007009E 031E0010: data

401C9637: check sum

## 3.56. 0x9E: Response to Query GLONASS UTC Parameters

Message length: 10.
Response to the input message 0x9E.
Data content is identical to that of output message 0x1E.

*Example:*

534F4547 53503372: preamble

000A009E: message ID – 0x9E, length – 10

00000000 BE650000 00000000 BE6B8000 00000000 BFDBA000 00000000 BF4E8000 04320005 04310000: data

008DD6AE: check sum

## 3.57. 0xC1: Response to Request FW Version

Message length: 4.
Response to the input message 0xC1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_short | | Bits 31:16: FW version, high half-word |
| | u_short | | Bits 15:0: FW version, low half-word |
| 2 | u_int | | FW date:<br>Bits 23:9: year<br>Bits 8:5: month<br>Bits 4:0: day |
| 3 | u_int | | Receiver serial number:<br>high byte: alphabetical code<br>three low bytes: numerical code |
| 4 | u_int | | FW check sum |

*Example:*

534F4547 53503372: preamble

000400C1: message ID – 0xC1, length – 4

000300C8 000FB881 FFFFFFFF 7274126A: data

8D9C2328: check sum

## 3.58. 0xC3: Response to Store Almanacs to Flash

Message length: 1.
Transmitted upon completion of saving data to Flash.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Saving data to Flash report:<br>0: saving data cannot be completed<br>1: saving almanacs by command 0xC3 successfully done<br>2: saving almanacs automatically successfully done |

| | | | |
|---|---|---|---|
| | | | 3: saving configuration/FW settings successfully done |

*Example:*

534F4547 53503372: preamble

000100C3: message ID – 0xC3, length – 1

00000003: data

001E76F5: check sum

## 3.59. 0xC4: Response to Enter/Quit Power-save Mode

Message length: 1.
Response to the input message 0xC4.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Power-save mode status:<br>0: power-save mode has been quitted<br>1: power-save mode has been entered |

*Example:*

534F4547 53503372: preamble

000100C4: message ID – 0xC4, length – 1

00000001: data

001E76F0: check sum

## 3.60. 0xC6: Response to Request Serial Port Number

Message length: 1.
Response to the input message 0xC6.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Serial port number:<br>0:Port #0<br>1 :Port #1 |

*Example:*

534F4547 53503372: preamble

000100C6: message ID – 0xC6, length – 1

00000000: data

001E76F3: check sum

## 3.61. 0xC7: Response to Enable/Disable Antenna Power

Message length: 1.
Response to the input message 0xC7.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Antenna power status:<br>0: antenna power disabled<br>1: antenna power enabled |

*Example:*

534F4547 53503372: preamble

000100C7: message ID – 0xC7, length – 1

00000000: data

001E76F2: check sum

## 3.62. 0xC8: Response to Request Receiver Configuration

Message length: 28.
Response to the input message 0xC8.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Reserved |
| 2 | u_int | | Receiver Configuration Register (3.16) |
| 3, 4 | double | m | User X coordinate (WGS-84) |
| 5, 6 | double | m | User Y coordinate (WGS-84) |
| 7, 8 | double | m | User Z coordinate (WGS-84) |

| | | | |
|---|---|---|---|
| 9 | u_short | | Port #0 parameters:<br>Bit 16: Stop bits<br>0: 1 stop bit<br>1: 2 stop bits<br>Bits 19:17: Parity<br>0 or 2 or 4 or 6: no parity<br>1: even<br>3: odd<br>5: space<br>7: mark<br>Bits 23:20: Baud rate, bit/s<br>0: 4800<br>1: 9600<br>2: 19200<br>3: 38400<br>4:57600<br>5: 115200<br>6: 230400<br>7: 460800<br>8: 921600<br>Bits 25:24 Type of data protocol<br>1: binary<br>2: NMEA<br>3: RTCM |
| | u_short | | Port #1 parameters:<br>Bit 0: Stop bits<br>0: 1 stop bit<br>1: 2 stop bits<br>Bits 3:1: Parity<br>0 or 2 or 4 or 6: no parity<br>1: even<br>3: odd<br>5: space<br>7: mark<br>Bits 7:4: Baud rate, bit/s<br>0: 4800<br>1: 9600<br>2: 19200<br>3: 38400<br>4:57600<br>5: 115200<br>6: 230400<br>7: 460800<br>8: 921600<br>Bits 9:8: Type of data protocol<br>1: binary<br>2: NMEA<br>3: RTCM |
| 10 | int | s | Local time shift relative to UTC |
| 11 | float | rad | Elevation angle mask |

| | | | |
|---|---|---|---|
| 12 | float | | GDOP mask |
| 13 | float | dBHz | Signal level mask |
| 14 | float | m/s | Static navigation threshold |
| 15 | u_short | s | Bits 31:16: DR duration |
| | byte | | Bits 15:8: PRN number for the first receiver SBAS channel<br>120 … 141<br>otherwise: SBAS disabled for given channel |
| | byte | | Bits 7:0: PRN number for the second receiver SBAS channel<br>120 … 141<br>otherwise: SBAS disabled for given channel |
| 16 | float | us | 1PPS duration |
| 17, 18 | double | ns | 1PPS shift |
| 19 | u_int | | Enable/disable mask of binary messages<br>(0: disabled; 1: enabled):<br>Bit 0: 0x00 mask<br>Bit 1: 0x01 mask<br>Bit 2: 0x02 mask<br>…<br>Bit 31: 0x1F mask |
| 20 | | | Port #0:<br>Bits 22…16: Enable/disable mask of NMEA messages<br>(0: disabled; 1: enabled):<br>Bit 16: GGA/GNS mask<br>Bit 17: GSA mask<br>Bit 18: GSV mask<br>Bit 19: RMC mask<br>Bit 20: VTG mask<br>Bit 21: GLL mask<br>Bit 22: ZDA mask<br><br>Bit 28: NMEA 0183 standard version<br>0: v2.x<br>1: v3.x<br><br>Bit 29: GGA or GNS select (for NMEA 0183 v3.x only)<br>0: GGA<br>1: GNS |
| | | | Port #1:<br>Bits 6…0: Enable/disable mask of NMEA messages<br>(0: disabled; 1: enabled):<br>Bit 0: GGA/GNS mask<br>Bit 1: GSA mask<br>Bit 2: GSV mask<br>Bit 3: RMC mask<br>Bit 4: VTG mask<br>Bit 5: GLL mask<br>Bit 6: ZDA mask |

| | | | |
|---|---|---|---|
| | | | Bit 12: NMEA 0183 standard version<br>0: v2.x<br>1: v3.x<br><br>Bit 13: GGA or GNS (for NMEA 0183 v3.x only)<br>0: GGA<br>1: GNS |
| 21 | byte | s | Bits 31:24: Time interval between “ACTIVE” states (RELAXED FIX®) |
| | byte | s | Bits 25:16: Minimum “ACTIVE” time duration |
| | byte | s | Bits 15:8: Maximum “ACTIVE” time duration |
| | byte | s | Bits 7:0: “ACTIVE” time after the first fix |
| 22…28 | | | Reserved |

*Example:*

534F4547 53503372: preamble

001C00C8: message ID – 0xC8, length – 28

07B62ABB 301C8183 00000000 00000000 00000000 00000000 00000000 00000000 02511151 00000000 3DB2B8C2 41F00000 41880000 3F800000 00000032 447A0000 00000000 00000000 FFFEFFFF 000F000F 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000: data

8C398B94: check sum

# 4. Input Messages

Input messages are summarized in Table 3.

1. Messages 0x00…0x3F: reserved
2. Messages 0x40…0x7F: settings
3. Messages 0x80…0xBF: queries
4. Messages 0xC0…0xFF: commands

Table 3: Input binary messages

| Message ID | Message |
|---|---|
| | **Settings** |
| 0x40 | Set Initial Parameters |
| 0x41 | Set Serial Port Parameters |
| 0x42 | Set Receiver Operation Mode |
| 0x43 | Set Navigation Solution Parameters |
| 0x44 | Set Output Data Rate |
| 0x45 | DGNSS Control |
| 0x46 | SBAS Control |
| 0x47 | Power-save Modes Control |
| 0x48 | Set GPS Almanac |
| 0x49 | Set GLONASS Almanac |
| 0x4A | Set GPS Ephemeris |
| 0x4B | Set GLONASS Ephemeris |
| 0x4C | Set PPS Parameters |
| 0x4D | Enable/Disable SV in Position Fix |
| 0x4E | Enable/Disable NMEA Messages |
| 0x4F | Enable/Disable Binary Messages |
| 0x50 | Set Data Protocol Assignment to Serial Port |
| 0x51…0x7F | Reserved |
| | **Queries** |
| 0x80 | Query Initial Parameters |
| 0x81 | Query Serial Ports Parameters |
| 0x82 | Query Receiver Operation Mode |
| 0x83 | Query Navigation Solution Parameters |
| 0x84 | Query Output Data Rate |
| 0x85 | Query DGNSS Parameters |
| 0x86 | Query SBAS Parameters |
| 0x87 | Query Parameters of Power-save Modes |
| 0x88 | Query GPS Almanac |

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| | |
|---|---|
| 0x89 | Query GLONASS Almanac |
| 0x8A | Query GPS Ephemeris |
| 0x8B | Query GLONASS Ephemeris |
| 0x8C | Query PPS Parameters |
| 0x8D | Query Enable/Disable Status of the SV in Position Fix |
| 0x8E | Query Enabled NMEA Messages |
| 0x8F | Query Enabled Binary Messages |
| 0x90 | Query Data Protocol Assignment to Serial Port |
| 0x91…0x9B | Reserved |
| 0x9C | Query GPS Ionospheric Parameters |
| 0x9D | Query GPS UTC Parameters |
| 0x9E | Query GLONASS UTC Parameters |
| 0x9F…0xBF | Reserved |
| **Commands** | |
| 0xC0 | Reserved for internal use |
| 0xC1 | Request FW Version |
| 0xC2 | Restart Receiver |
| 0xC3 | Store Almanacs to Flash |
| 0xC4 | Enter/Quit Power-save Mode |
| 0xC5 | Switch to NMEA |
| 0xC6 | Request Serial Port Number |
| 0xC7 | Enable/Disable Antenna Power |
| 0xC8 | Request Receiver Configuration |
| 0xC9…0xCF | Reserved |
| 0xD0 | Reserved for internal use |
| 0xD1 | Reserved for internal use |
| 0xD2 | Reserved for internal use |
| 0xD3…0xFF | Reserved |

## 4.1. 0x40: Set Initial Parameters

Message length: 10.
Data content is identical to that of output message 0x40.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 000A0040: | message ID – 0x40, length – 10 |
| 07B0E938 00003840 4E76C8B4 4145B6B7 A0C49BA6 4140CCBE E8D4FDF4 415405A9 3F99999A C3020000: | data |
| BC09EFD1: | check sum |

## 4.2. 0x41: Set Serial Port Parameters

Message length: 4.
Data content is identical to that of output message 0x41.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00040041: | message ID – 0x41, length – 4 |
| 00000001 00000005 00000001 00000000: | data |
| 001B7671: | check sum |

## 4.3. 0x42: Set Receiver Operation Mode

Message length: 2.
Data content is identical to that of output message 0x42.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00020042: | message ID – 0x42, length – 2 |
| 00000003 00000000: | data |
| 001D7674: | check sum |

## 4.4. 0x43: Set Navigation Solution Parameters

Message length: 8.
Data content is identical to that of output message 0x43.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00080043: | message ID – 0x43, length – 8 |
| 00000001 42200000 3D8EFA35 41700000 00000001 0000000A 00000003 40000000: | data |
| 7EC98C4A: | check sum |

## 4.5. 0x44: Set Output Data Rate

Message length: 1.
Data content is identical to that of output message 0x44.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00010044: | message ID – 0x44, length – 1 |
| 00000003: | data |
| 001E7672: | check sum |

## 4.6. 0x45: DGNSS Control

Message length: 2.
Data content is identical to that of output message 0x45.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00020045: | message ID – 0x45, length – 2 |
| 00000001 00000001: | data |
| 001D7670: | check sum |

## 4.7. 0x46: SBAS Control

Message length: 3.
Data content is identical to that of output message 0x46.

*Example:*

534F4547 53503372: preamble

00030046: message ID – 0x46, length – 3

00000001 0000007D 00000089: data

001C7686: check sum

## 4.8. 0x47: Power-save Modes Control

Message length: 5.
Data content is identical to that of output message 0x47.

*Example:*

534F4547 53503372: preamble

00050047: message ID – 0x47, length – 5

00000001 00000002 00000005 0000003C 00000000: data

001A7648: check sum

## 4.9. 0x48: Set GPS Almanac

Message length: 20.
Data content is identical to that of output message 0x48.

*Example:*

534F4547 53503372: preamble

00140048: message ID – 0x48, length – 20

05B7A31C 40069F94 00000000 3F7D3D00 60000000 40B42194 0CEEBD0C BFCEAD9D C4FE8679 3F94BEDC D95A552F C002C782 4B19CDF5 BE414114 00000000 3F23A000 00000000 BD900000 22890000 00000011: data

5E03C008: check sum

## 4.10. 0x49: Set GLONASS Almanac

Message length: 18.
Data content is identical to that of output message 0x49.

*Example:*

534F4547 53503372: preamble

00120049: message ID – 0x49, length – 18

00000000 3F621600 00000000 BF3C0000 00000000 3FB31200 00000000 C0A4BFC5 00000000 40DBBFC2 00000000 3FEC52E4 00000000 3F874280 00000000 3F020000 00280009 FFFE8001: data

FF20E217: check sum

## 4.11. 0x4A: Set GPS Ephemeris

Message length: 32.
Data content is identical to that of output message 0x4A.

*Example:*

534F4547 53503372: preamble

0020004A: message ID – 0x4A, length – 32

07BB16EC 30E25000 A7C00000 3FE839E7 0FFFFFFF 3F6633FD B0800000 40B42198 04000000 3FE289F4 9E000000 3FD361A9 54000000 3FB7B534 FFFFFFFE BE27613F 00000000 BF326A4A 2EA1C000 36276000 36835000 43963000 4240A000 B3400000 32A00000 B2300000 00000000 ACA00000 0006EBE0 0006EBE0 0050028A BF050000: data

6F792F86: check sum

## 4.12. 0x4B: Set GLONASS Ephemeris

Message length: 30.
Data content is identical to that of output message 0x4B.

*Example:*

534F4547 53503372: preamble

001E004B: message ID – 0x4B, length – 30

07BB8ABB 00281CB1 02000000 414105BF 7E200000 416D97A7 15900000 4173343B 94000000 C09C3C18 E8000000 C0A05895 EC000000 409C30F8 00000000 3EBF4000 00000000 00000000 00000000 BEBF4000 00000000 3D880000 00000000 BF197FE0 00000000 BE855000 00000000 BE997000 10F00000 0E05003D: data

E3A54DFF: check sum

## 4.13. 0x4C: Set PPS Parameters

Message length: 6.
Data content is identical to that of output message 0x4C.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 0006004C: | message ID – 0x4C, length – 6 |
| 00000001 00000000 00000000 447A0000 00000000 00000000: | data |
| 44637678: | check sum |

## 4.14. 0x4D: Enable/Disable SV in Position Fix

Message length: 2.
Data content is identical to that of output message 0x4D.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 0002004D: | message ID – 0x4D, length – 2 |
| 00000041 00000001: | data |
| 001D7638: | check sum |

## 4.15. 0x4E: Enable/Disable NMEA Messages

Message length: 2.
Data content is identical to that of output message 0x4E.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 0002004E: | message ID – 0x4E, length – 2 |
| 00000000 0000000F: | data |
| 001D7674: | check sum |

## 4.16. 0x4F: Enable/Disable Binary Messages

Message length: 1.
Data content is identical to that of output message 0x4F.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 0001004F: | message ID – 0x4F, length – 1 |
| 12345000: | data |
| 122A267A: | check sum |

## 4.17. 0x50: Set Data Protocol Assignment to Serial Port

Message length: 1.
Data content is identical to that of output message 0x50.

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00010050: | message ID – 0x50, length – 1 |
| 00000001: | data |
| 001E7664: | check sum |

## 4.18. 0x80: Query Initial Parameters

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

| | |
|---|---|
| 534F4547 53503372: | preamble |
| 00010080: | message ID – 0x80, length – 1 |
| 00000000: | data |
| 001E76B5: | check sum |

## 4.19. 0x81: Query Serial Ports Parameters

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Port number which parameters are requested:<br>0: Port #0<br>1: Port #1 |

*Example:*

534F4547 53503372: preamble

00010081: message ID – 0x81, length – 1

00000000: data

001E76B4: check sum

## 4.20. 0x82: Query Receiver Operation Mode

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

00010082: message ID – 0x82, length – 1

00000000: data

001E76B7: check sum

## 4.21. 0x83: Query Navigation Solution Parameters

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

00010083: message ID – 0x83, length – 1

00000000: data

001E76B6: check sum

## 4.22. 0x84: Query Output Data Rate

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

00010084: message ID – 0x84, length – 1

00000000: data

001E76B1: check sum

## 4.23. 0x85: Query DGNSS Parameters

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

00010085: message ID – 0x85, length – 1

00000000: data

001E76B0: check sum

## 4.24. 0x86: Query SBAS Parameters

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

00010086: message ID – 0x86, length – 1

00000000: data

001E76B3: check sum

## 4.25. 0x87: Query Parameters of Power-save Modes

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

00010087: message ID – 0x87, length – 1

00000000: data

001E76B2: check sum

## 4.26. 0x88: Query GPS Almanac

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | GPS SV system number (1…32) |

*Example:*

534F4547 53503372: preamble

00010088: message ID – 0x88, length – 1

0000000B: data

001E76B6: check sum

## 4.27. 0x89: Query GLONASS Almanac

Message length: 1.

| Слово | Тип | Ед. измер. | Параметр |
|---|---|---|---|
| 1 | u_int | | GLONASS SV system number (1…24) |

*Example:*

534F4547 53503372: preamble

00010089: message ID – 0x89, length – 1

00000013: data

001E76AF: check sum

## 4.28. 0x8A: Query GPS Ephemeris

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | GPS SV system number (1…32) |

*Example:*

534F4547 53503372: preamble

0001008A: message ID – 0x8A, length – 1

00000005: data

001E76BA: check sum

## 4.29. 0x8B: Query GLONASS Ephemeris

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | GLONASS SV system number (1…24) |

*Example:*

534F4547 53503372: preamble

0001008B: message ID – 0x8B, length – 1

0000000C: data

001E76B2: check sum

## 4.30. 0x8C: Query PPS Parameters

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

0001008C: message ID – 0x8C, length – 1

00000000: data

001E76B9: check sum

## 4.31. 0x8D: Query Enable/Disable Status of the SV in Position Fix

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | SV number:<br>GPS: 1…32<br>GLONASS: 65…96 |

*Example:*

534F4547 53503372: preamble

0001008D: message ID – 0x8D, length – 1

00000019: data

001E76A1: check sum

## 4.32. 0x8E: Query Enabled NMEA Messages

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Port number:<br>0: Port #0<br>1: Port #1 |

*Example:*

534F4547 53503372: preamble

0001008E: message ID – 0x8E, length – 1

00000001: data

001E76BA: check sum

## 4.33. 0x8F: Query Enabled Binary Messages

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

0001008F: message ID – 0x8F, length – 1

00000000: data

001E76BA: check sum

## 4.34. 0x90: Query Data Protocol Assignment to Serial Port

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

00010090: message ID – 0x90, length – 1

00000000: data

001E76A5: check sum

## 4.35. 0x9C: Query GPS Ionospheric Parameters

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

0001009C: message ID – 0x9C, length – 1

00000000: data

001E76A9: check sum

## 4.36. 0x9D: Query GPS UTC Parameters

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

0001009C: message ID – 0x9D, length – 1

00000000: data

001E76A8: check sum

## 4.37. 0x9E: Query GLONASS UTC Parameters

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

0001009E: message ID – 0x9E, length – 1

00000000: data

001E76AB: check sum

## 4.38. 0xC1: Request FW version

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

000100C1: message ID – 0xC1, length – 1

00000000: data

001E76F4: check sum

## 4.39. 0xC2: Restart Receiver

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Restart receiver and restore default settings command:<br><br>Bit 2: restore default FW settings<br>0: has no effect (receiver is operating with current FW settings)<br>1: restore default settings<br><br>Bit 1: clear almanacs<br>0: has no effect<br>1: clear almanacs<br><br>Bit 0: clear ephemeris<br>0: has no effect<br>1: clear ephemeris.<br><br>0: hot start<br>1: warm start<br>3: cold start |

*Example:*

534F4547 53503372: preamble

000100C2: message ID – 0xC2, length – 1

00000000: data

001E76F7: check sum

## 4.40. 0xC3: Store Almanacs to Flash

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

000100C3: message ID – 0xC3, length – 1

00000000: data

001E76F6: check sum

## 4.41. 0xC4: Enter/Quit Power-save Mode

Message length: 1.
Data content is identical to that of output message 0xC4.

*Example:*

534F4547 53503372: preamble

000100C4: message ID – 0xC4, length – 1

00000000: data

001E76F1: check sum

## 4.42. 0xC5: Switch to NMEA

Message length: 4.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Bits 6:0: Enable/disable mask of NMEA messages<br>(0: disabled; 1: enabled):<br>Bit 0: GGA/GNS mask<br>Bit 1: GSA mask |

| | | | |
|---|---|---|---|
| | | | Bit 2: GSV mask<br>Bit 3: RMC mask<br>Bit 4: VTG mask<br>Bit 5: GLL mask<br>Bit 6: ZDA mask<br><br>Bit 12: NMEA 0183 standard version<br>0: v2.x<br>1: v3.x<br><br>Bit 13: GGA or GNS select (for NMEA 0183 v3.x only)<br>0: GGA<br>1: GNS |
| 2 | u_int | bit/s | Baud rate:<br>0: 4800<br>1: 9600<br>2: 19200<br>3: 38400<br>4: 57600<br>5: 115200<br>6: 230400<br>7: 460800<br>8: 921600 |
| 3 | u_int | | Stop bits:<br>0: 1 stop bit<br>1: 2 stop bits |
| 4 | u_int | | Parity:<br>0: no parity<br>1: even<br>2: odd<br>3: space<br>4: mark |

*Example:*

534F4547 53503372: preamble

000400C5: message ID – 0xC5, length – 4

0000307F 00000005 00000000 00000000: data

001B468A: check sum

## 4.43. 0xC6: Request Serial Port Number

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

000100C6: message ID – 0xC6, length – 1

00000000: data

001E76F3: check sum

## 4.44. 0xC7: Enable/Disable Antenna Power

Message length: 1.
Data content is identical to that of output message 0xC7.

*Example:*

534F4547 53503372: preamble

000100C7: message ID – 0xC7, length – 1

00000000: data

001E76F2: check sum

## 4.45. 0xC8: Request Receiver Configuration

Message length: 1.

| Word # | Type | Units | Parameter |
|---|---|---|---|
| 1 | u_int | | Any value |

*Example:*

534F4547 53503372: preamble

000100C8: message ID – 0xC8, length – 1

00000000: data

001E76FD: check sum