

GSOF (General Serial Output Format) Output

In this appendix:

- 40h, GENOUT (General output record reports)
- GSOF record types

This chapter documents the GSOF output records that are output in Report Packet 40h.

40h, GENOUT (General output record reports)

When scheduled, Report Packet 40h is continuously output at the FREQUENCY specified by the current application file. The GENOUT report contains multiple sub-records as scheduled by the application file (subtype = 10, GSOF).

For information about controlling the record types included in Report Packet 40h, see [Command 64h, APPFILE \(Application file record\)](#), page 117.

Packet Flow	
Receiver	Connected computer
(02h) STX	→
(??h) STATUS	→
(40h) TYPE	→
(??h) LENGTH	→
1 (byte) TRANSMISSION NUMBER	→
1 (byte) PAGE INDEX	→
1 (byte) MAX PAGE INDEX	→
Various record types	
1 (byte) OUTPUT RECORD TYPE	→
1 (byte) RECORD LENGTH	→
Various fields dependant on RECORD TYPE.	→
<i>There can be multiple records in one GENOUT packet. There could be multiple GENOUT packets per epoch. Records may be split over two consecutive packets.</i>	
(??h) CHECKSUM	→
(03h) ETX	→

Where:

- TRANSMISSION NUMBER is a unique number assigned to a chapter of pages indicating that the pages are from the same group.
- PAGE INDEX is the page number of this page in a sequence (chapter) of pages and is zero based.
- MAX PAGE INDEX is the index of the last page in the chapter.
- RECORD LENGTH is the length of data in the record (excluding type and size).

Page Numbering – The Page Index and Max Page Index fields are 0-based, so for example the first transmission of a 2-page set will be 0/1 (PAGE/MAX PAGE) and the 2nd (last) page will be 1/1. The total number of pages is MAX PAGE INDEX + 1.

GSOF record types

Table B.1 GSOF record types

Record number	Description	See page...
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GSOF 1: GSOF 1 (01h) POSITION TIME

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 1	→
1 (byte) RECORD LENGTH	→
4 (long) GPS TIME (ms)	→
2 (int) GPS WEEK NUMBER	→
1 (byte) NUMBER OF SVS USED	→
1 (byte) POSITION FLAGS 1	→
1 (byte) POSITION FLAGS 2	→
1 (byte) INITIALIZATION NUMBER	→

Where:

- OUTPUT RECORD TYPE = 1.

- RECORD LENGTH is the length of this sub-record.
- GPS TIME is in milliseconds of the GPS week.
- GPS WEEK NUMBER is the week count since January 1980.
- NUMBER OF SVS USED is the number of satellites used to determine the position.
- POSITION FLAGS 1 reports position attributes and is defined as follows:
 - bit 0 SET: New Position
 - bit 1 SET: Clock fix calculated this position
 - bit 2 SET: Horizontal coordinates calculated this position
 - bit 3 SET: Height calculated this position
 - bit 4 reserved: Always SET (was "Weighted position")
 - bit 5 SET: Least squares position
 - bit 6 reserved: Always CLEAR (was "Ionó-free position")
 - bit 7 SET: Position uses Filtered L1 pseudoranges
- POSITION FLAGS 2 reports position attributes and is defined as follows:
 - bit 0 SET: Position is a differential solution. RESET: Position is autonomous or WAAS solution.
 - bit 1 SET: Differential position is phase including RTK (float, fixed or location), HP or XP Omnistar (VBS is not derived from phase). RESET: Differential position is code.
 - bit 2 SET: Differential position is fixed integer phase position (RTK-fixed). Uncorrected position is WAAS (if bit 0 is 0). RESET: Differential position is RTK-float, RTK-location or code phase (DGPS), Uncorrected position is Autonomous (if bit 0 is 0).
 - bit 3 SET: OmniSTAR differential solution (including HP, XP, and VBS.) RESET: Not OmniSTAR solution.
 - bit 4 SET: Position determined with STATIC as a constraint.
 - bit 5 SET: Position is Network RTK solution.
 - bit 6 SET: RTK-Location.
 - bit 7 SET: Beacon DGPS.
- INITIALIZATION NUMBER is a rollover counter to indicate when re-initializations have taken place.

GSOF 2: GSOF 2 (02h) LAT, LONG, HEIGHT

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 2	→
1 (byte) RECORD LENGTH	→
8 (double) LATITUDE	→
8 (double) LONGITUDE	→
8 (double) HEIGHT	→

Where:

- OUTPUT RECORD TYPE = 2.
- RECORD LENGTH is the length of this sub-record.
- LATITUDE is the WGS-84 latitude in radians.
- LONGITUDE is the WGS-84 longitude in radians.
- HEIGHT is the WGS-84 height in meters.

GSOF 3: GSOF 3 (03h) ECEF POSITION

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 3	→
1 (byte) RECORD LENGTH	→
8 (double) X	→
8 (double) Y	→
8 (double) Z	→

Where:

- OUTPUT RECORD TYPE = 3.
- RECORD LENGTH is the length of this sub-record.
- X is the earth-centered earth-fixed X axis WGS-84 coordinate of the position in meters.
- Y is the earth-centered earth-fixed Y axis WGS-84 coordinate of the position in meters.
- Z is the earth-centered earth-fixed Z axis WGS-84 coordinate of the position in meters.

GSOF 4: GSOF 4 (04h) LOCAL DATUM POSITION

Back to: 40h GENOUT

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 4 →	
1 (byte) RECORD LENGTH →	
8 (char) LOCAL DATUM ID →	
8 (double) LOCAL DATUM ECEF LATITUDE	
8 (double) LOCAL DATUM LONGITUDE	
8 (double) LOCAL DATUM HEIGHT →	
1 (byte) OUTPUT RECORD TYPE = 4 →	

Where:

- OUTPUT RECORD TYPE = 4.
- RECORD LENGTH is the length of this sub-record.
- LOCAL DATUM IDENTIFIER is an ASCII string that identifies the coordinate datum.
- LOCAL DATUM LATITUDE is the latitude in the local datum (radians).
- LOCAL DATUM LONGITUDE is the longitude in the local datum (radians).
- LOCAL DATUM HEIGHT is the height in the local datum (meters).

GSOF 5: GSOF 5 (05h) LOCAL ZONE POSITION

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 5 →	
1 (byte) RECORD LENGTH →	
8 (char) LOCAL DATUM ID →	
8 (char) LOCAL ZONE ID →	
8 (double) LOCAL ZONE NORTH →	
8 (double) LOCAL ZONE EAST →	
8 (double) LOCAL DATUM HEIGHT →	

Where:

- OUTPUT RECORD TYPE = 5.
- RECORD LENGTH is the length of this sub-record.
- LOCAL DATUM IDENTIFIER is an ASCII string that identifies the coordinate datum.

- LOCAL ZONE IDENTIFIER is an ASCII string that identifies the coordinate zone.
- LOCAL ZONE NORTH is the local zone north coordinate (meters).
- LOCAL ZONE EAST is the local zone east coordinate (meters).
- LOCAL DATUM HEIGHT is the height in the local datum (meters).

GSOF 6: GSOF 6 (06h) ECEF DELTA

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 6	→
1 (byte) RECORD LENGTH	→
8 (double) DELTA X	→
8 (double) DELTA Y	→
8 (double) DELTA Z	→

Where:

- OUTPUT RECORD TYPE = 6.
- RECORD LENGTH is the length of this sub-record.
- DELTA X is the ECEF X axis delta between the rover and base positions (rover - base) in meters.
- DELTA Y is the ECEF Y axis delta between the rover and base positions (rover - base) in meters.
- DELTA Z is the ECEF Z axis delta between the rover and base positions (rover - base) in meters.

GSOF 7: GSOF 7 (07h) TANGENT PLANE DELTA

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 7	→
1 (byte) RECORD LENGTH	→
8 (double) DELTA EAST	→
8 (double) DELTA NORTH	→
8 (double) DELTA UP	→

Where:

- OUTPUT RECORD TYPE = 7.
- RECORD LENGTH is the length of this sub-record.

- DELTA EAST is the east component of a vector from the base to the rover projected onto a plane tangent to the WGS-84 ellipsoid at the base. Units: meters.
- DELTA NORTH is the north component of the tangent plane vector.
- DELTA UP is the difference between the ellipsoidal height of the tangent plane at the base and a plane parallel to this passing through the rover point.

GSOF 8: GSOF 8 (08h) VELOCITY DATA

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 8	→
1 (byte) RECORD LENGTH	→
1 (byte) VELOCITY FLAGS	→
4 (float) VELOCITY	→
4 (float) HEADING	→
4 (float) VERTICAL VELOCITY	→

Where:

- OUTPUT RECORD TYPE = 8.
- RECORD LENGTH is the length of this sub-record.
- VELOCITY FLAGS indicate attributes of the velocity information. Defined values are:
 - bit 0 SET: Velocity data valid. RESET: Velocity data not valid
 - bit 1 SET: Velocity computed from consecutive measurements. RESET: Velocity computed from Doppler
 - bits 2-7: RESERVED
- VELOCITY is the horizontal velocity in meters per second.
- HEADING is the WGS-84 referenced true north heading in radians.
- VERTICAL VELOCITY is the velocity in the vertical direction in meters per second.

GSOF 9: GSOF 9 (09h) PDOP INFO

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 9	→
1 (byte) RECORD LENGTH	→
4 (float) PDOP	→
4 (float) HDOP	→
4 (float) VDOP	→
4 (float) TDOP	→

Where:

- OUTPUT RECORD TYPE = 9.
- RECORD LENGTH is the length of this sub-record.
- PDOP is the positional dilution of precision.
- HDOP is the horizontal dilution of precision.
- VDOP is the vertical dilution of precision.
- TDOP is the time dilution of precision.

Note – When an RTK system is placed in the Static (measuring) mode, these values become Relative DOP values, and as such tend to diminish with elapsed time spend static.

GSOF 10: GSOF 10 (0Ah) CLOCK INFO

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 10	→
1 (byte) RECORD LENGTH	→
1 (byte) CLOCK FLAGS	→
8 (double) CLOCK OFFSET	→
8 (double) FREQUENCY OFFSET	→

Where:

- OUTPUT RECORD TYPE = 10.
- RECORD LENGTH is the length of this sub-record.
- CLOCK FLAGS indicates information relation of the clock fix process. Defined values are:
 - bit 0 SET: Clock offset is valid
 - bit 1 SET: Frequency offset is valid

- bit 2 SET: Receiver is in anywhere fix mode
- bit 3-7: RESERVED
- CLOCK OFFSET is the current clock offset in milliseconds.
- FREQUENCY OFFSET is the offset of the local oscillator from the nominal GPS L1 frequency in parts per million.

GSOF 11: GSOF 11 (0Bh) POSITION VCV INFO

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 11	→
1 (byte) RECORD LENGTH	→
4 (float) POSITION RMS	→
4 (float) VCV xx	→
4 (float) VCV xy	→
4 (float) VCV xz	→
4 (float) VCV yy	→
4 (float) VCV yz	→
4 (float) VCV zz	→
4 (float) UNIT VARIANCE	→
2 (short) NUMBER OF EPOCHS	→

Where:

- OUTPUT RECORD TYPE = 11.
- RECORD LENGTH is the length of this sub-record.
- RANGE RESIDUAL RMS is the square root of (the sum of the squares of the range residuals divided by the number of degrees of freedom in the solution).
- VCVxx .. VCVzz is the variance-covariance matrix. This contains the positional components of the inverted normal matrix of the position solution in a ECEF WGS-84 reference.
- UNIT VARIANCE is the unit variance of the position solution.
- NUMBER OF EPOCHS indicates the number of measurements used to compute the position. It may be greater than 1 for positions subjected to a STATIC constraint.

GSOF 12: GSOF 12 (0Ch) POSITION SIGMA INFO

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 12	→
1 (byte) RECORD LENGTH	→
4 (float) POSITION RMS	→
4 (float) SIGMA EAST	→
4 (float) SIGMA NORTH	→
4 (float) COVAR. EAST-NORTH	→
4 (float) SIGMA UP	→
4 (float) SEMI MAJOR AXIS	→
4 (float) SEMI-MINOR AXIS	→
4 (float) ORIENTATION	→
4 (float) UNIT VARIANCE	→
2 (short) NUMBER EPOCHS	→

Where:

- OUTPUT RECORD TYPE = 12.
- RECORD LENGTH is the length of this sub-record.
- RANGE RESIDUAL RMS is the square root of (the sum of the squares of the range residuals divided by the number of degrees of freedom in the solution).
- SIGMA EAST, NORTH, UP are in meters.
- COVARIANCE EAST-NORTH is dimensionless.
- SEMI-MAJOR/MINOR AXES of the error ellipse is in meters.
- ORIENTATION of the semi-major axis is in degrees from clockwise from True North.
- UNIT VARIANCE is valid only for over determined solutions. It should tend towards 1.0. A value less than 1.0 indicates that the apriori variances were too pessimistic.
- NUMBER OF EPOCHS indicates the number of measurements used to compute the position. It may be greater than 1 for positions subjected to a STATIC constraint.

GSOF 13: GSOF 13 (0Dh) SV BRIEF INFO

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 13	→
1 (byte) RECORD LENGTH	→
1 (byte) NUMBER OF SVS	→
repeated for number of sv	
1 (byte) PRN	→
1 (byte) SV FLAGS1	→
1 (byte) SV FLAGS2	→

Where:

- OUTPUT RECORD TYPE = 13.
- RECORD LENGTH is the length of this sub-record.
- NUMBER OF SVS is the number of tracked satellites reported in this record.
- PRN is the PRN number of the satellite which the following flags refer to.
- SV FLAGS1 indicate conditions relating to satellites. Defined values are:
 - bit 0 SET: Above horizon
 - bit 1 SET: Currently assigned to a channel (trying to track)
 - bit 2 SET: Currently tracked on L1 frequency
 - bit 3 SET: Currently tracked on L2 frequency
 - bit 4 SET: Reported at Base on L1 frequency
 - bit 5 SET: Reported at Base on L2 frequency
 - bit 6 SET: Used in Position
 - bit 7 SET: Used in current RTK process (search, propagate, fix solution)
- SV FLAGS2 indicate conditions relating to satellites. Defined values are:
 - bit 0 SET: Tracking P Code on L1
 - bit 1 SET: Tracking P Code on L2
 - bit 2 SET: Tracking CS on L2
 - bits 3-7: RESERVED

GSOF 14: GSOF 14 (0Eh) SV DETAILED INFO

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 14	→
1 (byte) RECORD LENGTH	→
1 (byte) NUMBER OF SVS	→
repeated for number of sv	
1 (byte) PRN	→
1 (byte) SV FLAGS1	→
1 (byte) SV FLAGS2	→
1 (signed byte) ELEVATION	→
2 (short) AZIMUTH	→
1 (byte) SNR L1*4	→
1 (byte) SNR L2*4	→

Where:

- OUTPUT RECORD TYPE = 14.
- RECORD LENGTH is the length of this sub-record.
- NUMBER OF SVS is the number of tracked satellites reported in this record.
- PRN is the PRN number of the satellite which the following information refers to.
- SV FLAGS1 indicate conditions relating to satellites. Defined values are:
 - bit 0 SET: Above horizon
 - bit 1 SET: Currently assigned to a channel (trying to track)
 - bit 2 SET: Currently tracked on L1 frequency
 - bit 3 SET: Currently tracked on L2 frequency
 - bit 4 SET: Reported at Base on L1 frequency
 - bit 5 SET: Reported at Base on L2 frequency
 - bit 6 SET: Used in Position
 - bit 7 SET: Used in current RTK process (search, propagate, fix solution)
- SV FLAGS2 indicate conditions relating to satellites. Defined values are:
 - bit 0 SET: Tracking P Code on L1
 - bit 1 SET: Tracking P Code on L2
 - bit 2 SET: Tracking CS on L2
 - bits 3-7: RESERVED
- ELEVATION is the angle of the satellite above the horizon in degrees.

- AZIMUTH is the azimuth of the satellite from true north in degrees.
- SNR L1 is the signal-to-noise ratio of the L1 signal (multiplied by 4). 0 for SVs not tracked on this frequency.
- SNR L2 is the signal-to-noise ratio of the L2 signal (multiplied by 4). 0 for SVs not tracked on this frequency.

GSOF 15: GSOF 15 (0fh) RECEIVER SERIAL NUMBER

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 15	→
1 (byte) RECORD LENGTH	→
4 (long) SERIAL NUMBER	→

Where:

- OUTPUT RECORD TYPE = 15.
- RECORD LENGTH is the length of this sub-record.
- RECEIVER SERIAL NUMBER is the full serial number of the receiver.

GSOF 16: GSOF 16 (10h) CURRENT TIME

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 16	→
1 (byte) RECORD LENGTH	→
4 (long) GPS MILLISEC OF WEEK	→
2 (short) GPS WEEK NUMBER	
2 (short) UTC OFFSET	
1 (byte) FLAGS	

Where:

- OUTPUT RECORD TYPE = 16.
- RECORD LENGTH is the length of this sub-record.
- GPS MILLISECONDS OF WEEK is the time that the message was sent from the receiver.
- GPS WEEK NUMBER is the full week number since start of GPS time.
- UTC OFFSET is the current GPS to UTC time offset in integer seconds.

- FLAGS indicate the validity of the time and UTC offset parameters. Defined values are:
 - bit 0 SET: Time information (week and milliseconds of week) valid
 - bit 1 SET: UTC Offset is valid

GSOF 26: GSOF 26 (1Ah) POSITION TIME UTC

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 26	→
1 (byte) RECORD LENGTH	→
4 (long) MILLISECONDS OF WEEK	→
2 (short) GPS WEEK NUMBER	→
1 (byte) NUMBER OF SVS USED	→
1 (byte) POSITION FLAGS 1	→
1 (byte) POSITION FLAGS 2	→
1 (byte) INITIALIZATION NUMBER	→

Where:

- OUTPUT RECORD TYPE = 26.
- RECORD LENGTH is the length of this sub-record.
- MILLISECONDS OF WEEK is the GPS time since the start of the GPS week.
- GPS WEEK NUMBER is the week count since January 1980.
- NUMBER OF SVS USED is the number of satellites used to determine the position.
- POSITION FLAGS 1 reports position attributes and is defined as follows:
 - bit 0 SET: New Position
 - bit 1 SET: Clock fix calculated this position
 - bit 2 SET: Horizontal coordinates calculated this position
 - bit 3 SET: Height calculated this position
 - bit 4 reserved: Always SET (was "Weighted position")
 - bit 5 SET: Least squares position
 - bit 6 reserved: Always CLEAR (was "Iono-free position")
 - bit 7 SET: Position uses Filtered L1 pseudoranges
- POSITION FLAGS 2 reports position attributes and is defined as follows:
 - bit 0 SET: Position is a differential solution. RESET: Position is autonomous or WAAS solution.

- bit 1 SET: Differential position is phase (RTK, or HP Omnistar). RESET: Differential position is code.
- bit 2 SET: Differential position is fixed integer phase position (RTK). Uncorrected position is WAAS (if bit 0 is 0). RESET: Differential position is RTK-float or code phase (DGPS). Uncorrected position is Autonomous (if bit 0 is 0).
- bit 3 SET: HP / Omnistar differential solution. RESET: HP / Omnistar not active.
- bit 4 SET: Position determined with STATIC as a constraint
- bit 5 SET: Position is Network RTK solution
- bits 6-7: RESERVED
- INITIALIZATION NUMBER is a rollover counter to indicate when re-initializations have taken place.

DRAFT

GSOF 27: GSOF 27 (1Bh) ATTITUDE INFO

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 27	→
1 (byte) RECORD LENGTH	→
4 (unsigned long) GPS TIME	→
1 (byte) FLAGS	→
1 (byte) NUMBER OF SVS	→
1 (byte) CALCULATION MODE	→
1 (byte) RESERVED	→
8 (double) PITCH	→
8 (double) YAW	→
8 (double) ROLL	→
8 (double) MASTER-SLAVE RANGE	→
2 (word) PDOP	→
Record length = 42, up to and including PDOP (does not include type and length bytes)	
4 (float) PITCH VARIANCE	→
4 (float) YAW VARIANCE	→
4 (float) ROLL VARIANCE	→
4 (float) MASTER-SLAVE RANGE VARIANCE	→
Record length = 70 up to and including Master Slave Range Variance	

Where:

- OUTPUT RECORD TYPE = 27.
- RECORD LENGTH is the length of this sub-record.
- GPS TIME is time of position in milliseconds of GPS week.
- FLAGS indicate the following:
 - bit 0: Calibrated
 - bit 1: Pitch Valid
 - bit 2: Yaw Valid
 - bit 3: Roll Valid
 - bit 4: Scalar Valid
 - bit 5 - Bit 7: Reserved
 - bit 5: Diagnostic Valid

- bit 6: Slave Static
 - bit 7: Error Stats valid
- NUMBER OF SVS.
- CALCULATION MODE is one of the following values:
 - 0: None
 - 1: Autonomous
 - 2: RTK/Float
 - 3: RTK/Fix
 - 4: DGPS
- RESERVED is currently unused.
- PITCH is the forward dive/climb angle (radians).
- YAW is the horizontal turn (left or right) (radians).
- ROLL is the side-to-side roll angle (radians).
- MASTER-SLAVE RANGE is the distance between master and slave antennas, in meters.
- PDOP is the current position PDOP in tenths.

Subsequent elements are not implemented in firmware versions prior to GNSS version 4.20. The error stats valid flag is also set when these elements are implemented.

- PITCH VARIANCE is the expected variance of error of the pitch estimate (radians²).
- YAW VARIANCE is the expected variance of error of the yaw estimate (radians²).
- ROLL VARIANCE is the expected variance of error of the roll estimate (radians²).
- PITCH-YAW COVARIANCE is the expected covariance of errors of the pitch and yaw estimates (radians²).
- PITCH-ROLL COVARIANCE is the expected covariance of errors of the pitch and roll estimates (radians²).
- YAW-ROLL COVARIANCE is the expected covariance of errors of the yaw and roll estimates (radians²).
- MASTER-SLAVE RANGE VARIANCE is the expected variance of error of the master-slave range estimate, in meters².

GSOF 33: GSOF 33 (21h) ALL SV BRIEF INFO

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 33	→
1 (byte) RECORD LENGTH	→
1 (byte) NUMBER OF SVs	→
Repeated for number of SVs	
1 (byte) PRN	→
1 (byte) SV System	→
1 (byte) SV FLAGS1	→
1 (byte) SV FLAGS2	→

Where:

- OUTPUT RECORD TYPE = 33.
- RECORD LENGTH is the length of this sub-record.
- NUMBER OF SVs is the number of tracked satellites reported in this record.
- PRN is the PRN number of the satellite which the following flags refer to. This will be the ACTUAL PRN number given by the SV (not ranged due to SV system) due to the next field:
- SV System is the system that the SV belongs to.
 - 0 = GPS
 - 1 = SBAS
 - 2 = GLONASS
 - 3 = GALILEO
 - 4 - 255: RESERVED
- SV FLAGS1 indicate conditions relating to satellites.
 - bit 0 set: Above horizon
 - bit 1 set: Currently assigned to a channel (trying to track)
 - bit 2 set: Currently tracked on L1/G1 frequency
 - bit 3-7: RESERVED
- SV FLAGS2 indicate conditions relating to satellites.
 - bits 0-7: RESERVED

GSOF 34: GSOF 34 (22h) ALL SV DETAILED INFO

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 34	→
1 (byte) RECORD LENGTH	→
1 (byte) NUMBER OF SVS	→
Repeated for number of SVs	
1 (byte) PRN	→
1 (byte) SV SYSTEM	→
1 (byte) SV FLAGS1	→
1 (byte) SV FLAGS2	→
1 (signed byte) ELEVATION	→
2 (short) AZIMUTH	→
1 (byte) SNR L1*4	→
1 (byte) SNR L2*4	→
1 (byte) SNR L5*4 OR G1P SNR OR Galileo SNR	→

Where:

- OUTPUT RECORD TYPE = 34.
- RECORD LENGTH is the length of this sub-record.
- NUMBER OF SVS is the number of tracked satellites reported in this record.
- PRN is the PRN number of the satellite which the following flags refer to. This will be the ACTUAL PRN number given by the SV (not ranged due to SV system) due to the next field.
- SV SYSTEM is the system that the SV belongs to.
 - 0: GPS
 - 1: SBAS
 - 2: GLONASS
 - 3 - 9: RESERVED
 - 10: OMNISTAR
 - 11 - 255: RESERVED
- SV FLAGS1 is a bitmap field having the following values:
 - bit 0 Set: Above horizon
 - bit 1 Set: Currently assigned to a channel (trying to track)
 - bit 2 Set: Currently tracked on L1/G1 frequency
 - bit 3 Set: Currently tracked on L2/G2 frequency

- bit 4 Set: Reported at base on L1/G1 frequency
- bit 5 Set: Reported at base on L2/G2 frequency
- bit 6 Set: Used in current position
- bit 7 Set: Used in the current RTK solution.
- SV FLAGS2 is a bitmap variable having the following values:
 - bit 0 Set: Tracking P-Code on L1/G1
 - bit 1 Set: Tracking P-Code on L2
- IF GPS SV:
 - bit 2 Set: Tracking CS on L2
 - bit 3 Set: Tracking L5 Signal
 - Bits 4-7 are reserved
- If GLONASS SV:
 - bit 2 Set: Glonass SV is “M” SV
 - bit 3 Set: Glonass SV is “K” SV
 - Bits 4-7 are reserved
- ELSE
 - Bits 2-7 are reserved
- ELEVATION is the angle of the satellite above the horizon in degrees.
- AZIMUTH is the azimuth of the satellite from true north in degrees.
- SNR L1 is the signal-to-noise ratio of the L1 signal (multiplied by 4). 0 for SVs not tracked on this frequency.
- SNR L2 is the signal-to-noise ratio of the L2 signal (multiplied by 4). 0 for SVs not tracked on this frequency.
- IF GPS SNR L5 is the signal-to-noise ratio of the L5 signal (multiplied by 4). 0 for SVs not tracked on this frequency.
- IF GLONASS G1P SNR is the signal-to-noise ratio of the G1P signal (multiplied by 4). 0 for SVs not tracked on this frequency.
- IF Galileo, E1 SNR or E5A SNR or E5B SNR or E5AltBOC SNR
- ELSE This last byte is RESERVED.

GSOF 35: GSOF 35 (23h) RECEIVED BASE INFO

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 35	→
1 (byte) RECORD LENGTH	→
1 (Byte) FLAGS and VERSION OF MESSAGE	→
8 (chars) BASE NAME	→
2 (bytes) BASE ID	→
8 (double) BASE LATITUDE	→
8 (double) BASE LONGITUDE	→
8 (double) BASE HEIGHT	→

Where:

- OUTPUT RECORD TYPE = 35.
- RECORD LENGTH is the length of this sub-record.
- FLAGS specifies a few attributes about the BASE (and ONLY the base, since there are status flags about RTK in other messages). Defined values:
 - Bits 0 - 2 specify a “version number” for this message.
 - Bit 3 if SET specifies that the base info given is valid.
 - Bits 4 - 7 are currently RESERVED.
- BASE NAME is the short base name received from the base. In the case of the base being RTCM (with no base name), the field is set to all 0s.
- BASE ID is the ID# of the base being used. This field is big-endian, so the first byte will always be set to 0 if the base is a CMR base.
- BASE LATITUDE is the WGS-84 latitude of the base in radians.
- BASE LONGITUDE is the WGS-84 longitude of the base in radians.
- BASE HEIGHT is the WGS-84 height of the base in meters.

GSOF 41: GSOF 41 (29h) BASE POSITION AND QUALITY INDICATOR

Packet Flow	
Receiver	Connected computer
1 (byte) OUTPUT RECORD TYPE = 41	→
1 (byte) RECORD LENGTH	→
4 (long) GPS TIME (ms)	→
2 (int) GPS WEEK NUMBER	→
8 (double) LATITUDE	→
8 (double) LONGITUDE	→
8 (double) HEIGHT	→
1 (byte) QUALITY INDICATOR	→

Where:

- OUTPUT RECORD TYPE = 41.
- RECORD LENGTH is the length of this sub-record.
- GPS TIME is in milliseconds of the GPS week.
- GPS WEEK NUMBER is the week count since January 1980.
- LATITUDE is the base WGS-84 latitude in radians.
- LONGITUDE is the base WGS-84 longitude in radians.
- HEIGHT is the base WGS-84 height in meters.
- QUALITY INDICATOR shows the quality of the base position:
 - 0 - Fix not available or invalid
 - 1 - Autonomous
 - 2 - Differential, SBAS or OmniSTAR VBS
 - 4 - RTK Fixed
 - 5 - OmniSTAR XP, OmniSTAR HP, RTK Float, or RTK Location

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