HIGH PRECISION

COMMANDS AND LOGS

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High Precision Products

Revision History

Version	Revision History	Date
R1.0	First release	Oct. 2022
R1.1	- Added new commands, including CONFIG MMP, CONFIG SIGNALGROUP, CONFIG IONMODE, CONFIG RTCMPHASERATE, GPHPR2, GPTRA2, GPROT2 - IRNSS L5 was supported in the following messages: MASK, UNMASK, and NMEA messages - CONFIG JAMMING was replaced by CONFIG ANTIJAM - Chapter 5.2: Added MASK RTCMCN0/CN0 configuration - Chapter 3.6: Added more details in the rover station mode - Chapter 4.10: Added SBAS timeout configuration - Modified the description of CONFIG PPS ENABLE & ENABLE2 - Chapter 3.4: Updated the default value of the horizontal and vertical error tolerance - Modified the description of CONFIG HEADING TRACTOR - Added Chapter 7.3 Unicore Data Output Commands	May 2023
R1.2	- Expanded SIGNALGROUP and SBAS configurations - Added some configurations, including CONFIG EVENT2, CONFIG RTCMCLOCKOFFSET, CONFIG PVTALG and CONFIG PSRPOSBIAS - Added QZSSEPH and GPHPD - RTKSTATUS: updated the description of field 17 - BD3EPH: updated the description of IODC and IODE - Table 7-55: updated the ID number of IRNSS - Updated the optional parameters of the MASK command - Table 3-8: changed the name of UAV “FORMATION” mode to UAV “HIGHDYN” mode	Nov. 2023
R1.3	- Added the following configurations: 4.31 Network IP Address Configuration 4.32 Network Serial Port Configuration 4.33 LOGSEQ – LOG Output Sequence Configuration 4.34 Ntripserver Configuration 4.35 Ntripclient Configuration 4.36 RTCMDECAUTO – RTCM Decoding Configuration 4.37 ALLEPHRTCM – Ephemeris Output Configuration - Added the CONFIG PPP ENABLE AUTO configuration - Updated 4.23 Signal Group Configuration - Updated Table 7-78 GLONASS Ephemeris Flags Coding - Added the following log outputs: 7.3.22 IRNSSEPH – IRNSS Ephemeris 7.3.72 E6MASKBLOCK – Mask Block	Apr. 2024

Version	Revision History	Date
	7.3.73 E6ORBITBLOCK – Orbit Corrections Block 7.3.74 E6CLOCKFULLBLOCK – Clock Full-Set Corrections Block 7.3.75 E6CLOCKSUBBLOCK – Clock Subset Corrections Block 7.3.76 E6CBIASBLOCK – Code Biases Block 7.3.77 E6PBIASBLOCK – Phase Biases Block 7.3.78 BSLNENUHD2 – Heading2 Baseline in ENU Coordinate System 7.3.79 BSLNXYZHD2 – Heading2 Baseline in XYZ Coordinate System 7.3.80 DOPHD2 – DOP of Heading2 7.3.50 HEADINGSTATUS – Heading Status	
R1.4	- Added notes in Heading2 related logs (GPHPR2, GPTRA2, GPROT2): only ONCHANGED trigger is supported - Deleted Galileo E6 in SIGNALGROUP 9 configuration - Added QZSS L6D and L6E in Table 7-56 Channel Tracking Status - Added CONFIG VELSTDTHD and CONFIG RTKASITPPP - Added command format with checksum (see the description in Chapter 1 and CONFIG CMDFORMAT in Chapter 4) - Added notes in the EPH logs in Section 7.3: recommended to use the ONCHANGED trigger when output with 50 Hz observation data - Revised the "Version" and "Reserved" fields in the binary header (Table 7-50) and ASCII header (Table 7-51) - Added 4.17 RTCM L2C L2P Configuration - Added requirement for the range of the port number in Section 4.32 Network Serial Port Configuration - Added the description of valid decimal places in Section 7.1 & 7.2 NMEA messages - UM982 was supported in TROPINFO, BD3ION, BD3UTC and BD3EPH.	Jun. 2024
R1.5	Updated Chapter 3.2: If the 3D position error between the coordinates computed by the receiver and that set by the user is more than 300 meters, no RTCM data will be output.	Sept. 2024
R1.6	- Updated the output example in GPHPR2 - Parity check and stop bits were supported in section 4.2 Serial Port Configuration - Added information about base station ID in PPPNAV - Added support of QZSS L6, including CONFIG SIGNALGROUP 10, L6MDCTYPE 1/2/3/4/5/7 logs, CONFIG PPP ENABLE L6MDCPPP - Added the QZQSM message - Added SLAS in CONFIG SBAS ENABLE - Deleted the CONFIG RTCMSWITCHL2CL2P configuration - Added QZSS L1C/B and L1S in Table 7-56 Channel Tracking	Oct. 2024

Version	Revision History	Date
	Status - Specified the range of parameters in CONFIG VELSTDTHD - Added the RTKSTATUS2 message - The default configuration of CONFIG VELSTDTHD was changed to DISABLE - Revised the description of the parameters in CONFIG IONMODE - Added TIMEOUT configuration in CONFIG STANDALONE - Added the ENVINFO message - Added KASS in Table 7-36 Satellite ID Numbers in NMEA Messages - 50 Hz PVT output was supported for UM980 SIGNALGROUP 8 configuration	
R1.7	- Added Appendix 3: BINEX Data Stream - Added an optional parameter <ONLY> - QZSS L6MDCTYPE message is supported on UM982 - Updated the 13rd field of ENVINFO from RSV to the total number of available satellites. - Added QZSS L6E to SATSINFO - Added the following configuration command and logs: CONFIG SELFANTENNAPCO: Receiver Antenna Phase Center Offset Configuration CONFIG REMOTEANTENNAPCO CONFIG POSREF REMOTEANTENNAPCOA - Added E6 to SIGNALGROUP 10	Jan. 2025
R1.8	- Added the following commands, parameters or services: PPPDOP2: DOP of PPPNAV CONFIG SMOOTH HEADING <PITCH> CONFIG RTCMCLOCKDRIFT - B2b-PPP is supported in UM982 SG 7 mode - MADOCA-PPP and E6-HAS are supported in SG 3 6 mode MASK L6 - Updated the value range for HEADING <LENGTH> in CONFIG HEADING: HEADING Configuration - Removed CONFIG PPP ENABLE SSR-RX	Mar. 2025
R1.9	- Added CONFIG RXTYPE: Data Type for Serial Port - ENVINFO: Environment Information is supported on UB9A0 - Added the version ID for UM980C in VERSION: Version and Authorization - Updated the default values of the parameters in CONFIG RTK: RTK Configuration - SG 8 supports QZSS L1C/A, L2C, L5 and UB9A0 supports SG 10 in CONFIG SIGNALGROUP: Supported Signal Combination	May 2025

Version	Revision History	Date
	Configuration - Changed the field SysID to SingalID in GPGSV: GNSS Satellites in View and GPGSV: GNSS Satellites in View V4.11 - Updated the differential age description to "accurate to 1 decimal place" in GPGGA: Global Positioning System Fix Data and GPGGA: Global Positioning System Fix Data V4.11	
R1.10	- Updated the 9th field of ENVINFO: Environment Information to <Pos Type> and the 11th to <Com Sat Num> - Added UM981, UM981C and UM980C to the support list for CONFIG SIGNALGROUP: Supported Signal Combination Configuration - Added UM981 to the support list of some N4 commands - Updated description of CONFIG RXTYPE: Data Type for Serial Port - Updated the ASCII value range for <UserDelay> supported on UM980 in CONFIG PPS: Pulse Per Second Configuration - Removed G1 and G2 in SG 6 mode in TableDefault Signal Group and Table Satellite Systems and Frequencies - Added ANT1GROUP : Query Supported Systems and Frequencies, ANT2GROUP : Query Supported Systems and Frequencies, CONFIG IONLEVEL: Ionospheric Activity Level Configuration, and CONFIG BASEBIAS: Base Station Coordinate Bias Configuration	Jun. 2025
R1.11	- UM980C, UM981C, and UM982C supports the following commands or message: GPGGA: Global Positioning System Fix Data BESTNAV: Best Position and Velocity CONFIG PPP: Precise Point Positioning Configuration PPPNAV: Position and Velocity of PPP - Introduced the signalgroup supported on UM980C, UM981C and UM982C and their default configuration. - Added the following commands: CONFIG LBAND: L-Band Satellite Information Configuration CONFIG PPPRTK: PPPRTK Configuration APPPNAV: PPPAR Position, Accuracy, and Status Information LBANDAUTH: Authorization Information LBANDBEAM: Available L-Band Beam Information LBANDTRACKSTATUS: Status of Tracked L-Band Satellite LBANDUSERDATA: L-Band User Data - UM982C supports GPGGAH: Global Positioning System Fix Data (Slave Antenna) and PPPNAVH: Position and Velocity of PPP - Added RPPPDOP: DOP of RPPPNAV - Updated CONFIG PPPRTK TIMEOUT/ CONVERGE in CONFIG PPPRTK: PPPRTK Configuration - Updated the field value of <datumid> to 9991 in APPPNAV: PPPAR	Aug. 2025

Version	Revision History	Date
	Position, Accuracy, and Status Information - Changed PPKNAV to RPPPNAV: Position, Accuracy, and Status Information - Changed PPKDOP to RPPPDOP: DOP of RPPPNAV - Updated the <StnID> field in GPGGA: Global Positioning System Fix Data - Updatde the binary offset in BD3ION: BDS3 Ionosphere Parameters - Removed AUTHCODE - Added CONFIG LBAND TIMEOUT - UB9A0 supports CONFIG PVTALG: PVT Algorithm Configuration	
R1.12	- Added UMD981, UM981S, UM980C and UMD981S in the **Applicable Products** list for some of the N4 protocol. - Added Type numbers for several product models in VERSION: Version and Authorization Information. - Updated Field 6 in LBANDAUTH: Authorization Information from "Reserved" to "L-bandSat," and updated the example. - Removed the footnote in CONFIG STANDALONE: Standalone Configuration, as UM981S now supports the CONFIG STANDALONE TIMEOUT command. - Deleted the CONFIG SBAS ENABLE SLAS command in CONFIG SBAS: SBAS Configuration. - Added UM980C in the **Applicable Products** for some commands.	Jan. 2025
R1.13	- Updated the description of Heading field in Table HPD Message Structure, Table HPR Message Structure, Table HPR2 Message Structure, Table THS Message Structure, and Table THS Message Structure-V4.11, Table THS2 Message Structure. - Updated the default configuration to Enable of CONFIG ALLEPHRTCM: Ephemeris Output Configuration. - Updated the default configuration of L-band function to Enable in CONFIG LBAND: L-Band Satellite Information Configuration and added command CONFIG LBAND RELIABILITY. - Updated the field value of <stn ID> to 999X in Table APPPNAV Data Structure. - Updated CONFIG SIGNALGROUP : Supported Signal Combination Configuration to clarify that, when SG 3 6 is used with L-band firmware on UM982C, BDS B1C and QZSS L6 are not supported. - Removed PPPB2BINFO6: Information Type 6 and PPPB2BINFO7: Information Type 7. - Updated the field <stn ID> value range to 0000~4095 in Table GGA Message Structure (V410) and Table GGA Message Structure (V411). - Added Table L6 MADOCA-PPP Type1 Message Mask Data	Dec. 2025

Version	Revision History	Date
	Structure, Table L6 MADOCA-PPP Type2 Message Orbit Correction Data Structure, Table L6 MADOCA-PPP Type4 Message Satellite Code Bias Data Structure, Table L6 MADOCA-PPP Type5 Phase Bias Data Structure. - Added Table PPPB2BINFO2 Orbit Correction Data Structure, Table PPPB2BINFO3 Code Bias Data Structure, Table PPPB2BINFO3 Code Bias Correction Data Structure, Table PPPB2BINFO4 Clock Bias Correction Data Structure, Table PPPB2BINFO5 User Range Accuracy Index.	

Foreword

This manual provides information on the commands and logs of Unicore's high precision GNSS boards and receivers, the default configuration of the receivers and operating instructions.

This manual is a generic version. Please refer to the appropriate part according to the configuration of the product you purchased and different needs concerning RTK, heading, DGPS, etc.

Target Readers

This manual is written for technicians who have knowledge of GNSS receivers, but not to general readers.

1 Frequently Used Commands

Unicore high precision products support the input of commands in ASCII format (with XOR checksum) and abbreviated ASCII format (without XOR checksum). For example:

- Input a command without checksum: `RESET`
- Input a command with checksum: `$RESET*55`

The abbreviated ASCII format without checksum is convenient to use, while the ACSII format with checksum can prevent the module from making errors when recognizing commands. By default, the module can only recognize commands without checksum.

If you want to use commands with checksum, you need to set the parameter of `CONFIG CMDFORMAT` to 1, and then input commands with checksum. For more information about `CONFIG CMDFORMAT`, see CONFIG CMDFORMAT.

All commands are composed of a header and configuration parameters (which could be null, then there will be only one header left). The header field contains the command name, or message header.

Table 1-1 Frequently Used Commands

Command Name	Description
freset	Clear the saved configurations, satellite ephemerides, position information, and reset the baud rate to 115200 bps.
version	Query version information
config	Query status of the serial port
mask BDS	Disable BDS. BDS/GPS/GLO/GAL can be disabled respectively.
unmask BDS	Enable BDS. BDS/GPS/GLO/GAL can be enabled respectively. The receiver tracks all GNSS by default.
config com1 115200	Configure COM1 port to operate at 115200 baud rate. The usable COM ports are: COM1, COM2, COM3. The baud rate could be: 9600, 19200, 38400, 57600, 115200, 230400,

Command Name	Description
	460800, 921600.
unlog	Disable all outputs from the port in use
saveconfig	Save configurations
mode base time 60	After 60 seconds of automatic positioning, set the average value of horizontal and vertical positioning results as the base station coordinates. Restarting the receiver triggers a new calculation and repositioning of the datum coordinates.
mode base lat Lon height	Set datum coordinates manually: lat, lon, height (The coordinates do not change when restarting the receiver). For example, lat=40.07898324818, lon=116.23660197714, height=60.4265 Note: Longitude and latitude can be obtained by BESTNAV command. Southern Hemisphere corresponds to a negative latitude value; Western Hemisphere corresponds to a negative longitude value.
mode base	Set the base station mode
mode rover	Set the default rover station mode (This command transfers the receiver from base station mode to rover station mode.)
rtcm1033 comx 10 rtcm1006 comx 10 rtcm1074 comx 1 rtcm1124 comx 1 rtcm1084 comx 1 rtcm1094 comx 1	Set the base station and rover station to transmit RTCM messages via COMX. COMX could be COM1, COM2 or COM3.
NMEA0183 Output Messages	
gpgga comx 1	Set the output rate of GGA message to 1 Hz. Users can set both of the message type and update rate. The update rate can be set to 1, 0.5, 0.2, 0.1, 0.05 and 0.02[1], which corresponds to 1 Hz, 2 Hz, 5 Hz, 10 Hz, 20 Hz and 50 Hz[1:1] respectively. Message types include GGA, RMC, ZDA, VTG, etc.
gpths comx 1	Output the heading message THS of the current moment.

1.1 Base Station Configuration

In base station (fixed base station) mode, the receiver's antenna is placed at a fixed location with no changes during the whole use. Meanwhile, the precise coordinates of the base station and received satellite information are sent to the rover station (yet to be positioned) directly or after being processed (such as the RTCM correction data). The rover station receives both satellite observations and information from the base station to perform RTK solution to realize high precision positioning at centimeter level or millimeter level.

Applicable Products: UM960, UMD960, UM960L, UM982, UMD982, UM980, UMD980, UB9A0, UBD9A0

When the precise coordinates are known, input the commands in Table Fixed Base Station Configuration to configure the receiver.

Table 1-2 Fixed Base Station Configuration

No.	Command	Description
1	mode base 40.078983248 116.236601977 60.42	Set the precise coordinates of base station: latitude, longitude, height
2	rtcm1006 com2 10	Antenna reference point coordinates of RTK base station (antenna height included)
3	rtcm1033 com2 10	Receiver and antenna description
4	rtcm1074 com2 1	GPS correction data
5	rtcm1124 com2 1	BDS correction data
6	rtcm1084 com2 1	GLONASS correction data
7	rtcm1094 com2 1	Galileo correction data
8	saveconfig	Save configuration

When the coordinates of base station are unknown, users can set the receiver to automatically positioning for a period of time and get the average value as the coordinates of the base station. Relevant commands are shown in Table Self-optimizing Base Station Configuration.

For more information about configuring the rover station, see Configure the Rover Mode.

Table 1-3 Self-optimizing Base Station Configuration

No.	Command	Description
1	mode base time 60	After 60 seconds of automatic positioning, set the average value of horizontal and vertical positioning results as the base station coordinates. Restarting the receiver triggers a new calculation and repositioning of the datum coordinates.
2	rtcm1006 com2 10	Antenna reference point coordinates of RTK base station (antenna height included)
3	rtcm1033 com2 10	Receiver and antenna description
4	rtcm1074 com2 1	GPS correction data
5	rtcm1124 com2 1	BDS correction data
6	rtcm1084 com2 1	GLONASS correction data
7	rtcm1094 com2 1	Galileo correction data
8	saveconfig	Save configuration

1.2 Rover Station Configuration

RTK rover station receives real-time correction data from the base station. Meanwhile, it receives satellite signals to perform RTK solution to realize high precision positioning.

Frequently used commands:

- `MODE ROVER`
- `SAVECONFIG`

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982

For more information about configuring the rover station, see Mode Rover: Rover Mode Configuration.

1.3 HEADING Configuration

This command applies to single-board/module dual-antenna receivers. The heading result is the angle from True North to the baseline of the master antenna (ANT1) to the slave antenna (ANT2) in a clockwise direction. The heading function is enabled by default for dual-antenna receivers. See Figure Heading Schematic for the details.

Frequently used commands:

- `GPTHS 1`
- `SAVECONFIG`

Applicable Products: UM982, UMD982

1.4 HEADING2 Configuration

Heading2 refers to the angle from True North to the baseline of the base to rover in a clockwise direction.
For dual-antenna receivers with heading function, heading2 is the angle from True North to the baseline of the base to the rover's master antenna (ANT1) in a clockwise direction. See Figure Heading Schematic for the details.

Frequently used commands:

`MODE HEADING2`

`GPTHS2 ONCHANGED`

`SAVECONFIG`

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982

2 Unicore Receiver Command Types

Unicore commands for high precision GNSS receivers include the following types: MODE, CONFIG, MASK, AGNSS, data output commands, save configuration, factory reset, etc.

Table 2-1 Receiver Command Types

No.	Command	Description	Receiver Type
1	MODE	Set the receiver's operating mode, such as base/rover	UM960/UMD960/UM960L/ UM980/UMD980/UM982/ UMD982/UB9A0/UBD9A0
		Query the receiver's operating mode	UM960/UMD960/UM960L/ UM980/UMD980/UM982/ UMD982/UB9A0/UBD9A0
2	CONFIG	Configure the receiver's functions/interfaces	UM960/UMD960/UM960L/ UM980/UMD980/UM982/ UMD982/UB9A0/UBD9A0
		Query the receiver's configuration	UM960/UMD960/UM960L/ UM980/UMD980/UM982/ UMD982/UB9A0/UBD9A0
3	MASK	Set satellite system, frequency, and elevation angle tracked by the receiver	UM960/UMD960/UM960L/ UM980/UMD980/UM982/ UMD982/UB9A0/UBD9A0
		Query satellite system, frequency, and elevation angle tracked by the receiver	UM960/UMD960/UM960L/ UM980/UMD980/UM982/ UMD982/UB9A0/UBD9A0
4	AGNSS	Input assisted position and assisted time information	UM982/UMD982/UM980/ UMD980/UB9A0/UBD9A0
5	Data output commands	Request the output of positioning information, heading, etc.	UM960/UMD960/UM960L/ UM980/UMD980/UM982/ UMD982/UB9A0/UBD9A0
6	Other commands	Save configuration, reset to factory settings, etc.	UM960/UMD960/UM960L/ UM980/UMD980/UM982/ UMD982/UB9A0/UBD9A0

3 MODE Command

3.1 MODE Command Description

MODE command can be used to set the operating mode of the receiver. The receiver's operating modes include base mode, rover mode, heading mode, and high precision timing mode.

Re-entering a new command will make the receiver perform solution according to the latest input. For example, when the receiver is working in base mode, re-entering RTK rover mode will make it switch to rover mode and start RTK initialization.

The receiver supports all the operating modes above, but in actual use, the available functions are dependent on the authorization that the user bought.

The default setting is rover mode. The receiver can automatically identify RTCM format, so users do not need to specify the type of RTCM.

Syntax

```
MODE <mode> <parameters>
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM980C

Table 3-1 Receiver Operating Modes List

Parameter	Description
BASE	Set the receiver to work in base station mode
ROVER	Set the receiver to work in rover station mode
HEADING2	Set the receiver to work in heading mode

Example

```
MODE BASE 40.45628476579 116.2859754968 58.0984

MODE ROVER
```

3.2 MODE: Query the Receiver's Operating Mode

High precision receivers support using `MODE` command to query the operating mode.

Syntax

```
MODE
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 3-2 Query the Receiver's Operating Modes

Command	Description
MODE	Query the receiver's operating mode, such as base/rover

Table 3-3 MODE Message Structure

ID	Field	Data Description
1	Header	Log header, see Table ASCII Header Structure (N4)
2	MODE	Operating mode, as shown below: MODE ROVER UAV MODE ROVER AUTOMOTIVE MODE ROVER SURVEY MODE BASE MODE BASE TIME MODE HEADING2

3	HEADINGMODE	HEADING2 mode, as shown below:
		`HEADINGMODE FIXLENGTH`
		`HEADINGMODE VARIABLELENGTH`
		`HEADINGMODE LOWDYNAMIC`
		`HEADINGMODE STATIC`
		`HEADINGMODE TRACTOR`
		If HEADING2 is disabled, this field is null.

4	*xx	Checksum, a hexadecimal number obtained by calculating an XOR of all characters from # to * (including # and excluding *)
5	[CR][LF]	Sentence terminator (ASCII only)

Example

```
MODE
```

Output

```
#MODE,81,GPS,FINE,2230,547967000,0,0,18,518;MODE ROVER SURVEY,*1B
```

3.3 MODE BASE: Fixed Base Station Mode with Precise Coordinates

`MODE BASE` command is used to set the coordinates of the base station to make the receiver work in base station mode. The receiver supports Geodetic Coordinate System and Earth-Centered Earth-Fixed (ECEF) Coordinate System. After the coordinates are set, the GPGGA message will always display the coordinates when outputting the positioning information.

If the 3D position error between the coordinates computed by the receiver (which can be output using the BASEPOS command) and the coordinates set by the user is more than 300 meters, no RTCM data will be output.

In open environment, it is recommended to configure the PVT engine to `MULTI`, that is, using the `CONFIG PVTALG MULTI` command, to improve the positioning accuracy.

Syntax

> MODE BASE <ID> <paramter1> <paramter2> <paramter3>

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982 , UM980C

Table 3-4 Base Mode Parameter Description

Parameter	Description
ID	Base station ID, 0 ≤ ID ≤ 4095 (integer, can be omitted) Set the receiver to work in base station mode and set its ID. Only applicable to RTCM 3.2
Paramter1	Latitude coordinate in Geodetic Coordinate System, in degrees, -90 ≤ value ≤ 90, (11 significant digits) The X-axis coordinate in ECEF Coordinate System, in meters, value < -90 or value > 90 (4 significant digits)
Paramter2	Longitude coordinate in Geodetic Coordinate System, in degrees, -180 ≤ value ≤ 180 (11 significant digits)

Parameter	Description
	The Y-axis coordinate in ECEF Coordinate System, in meters, value < -180 or value > 180 (4 significant digits)
Paramter3	Altitude, in meters, -30000 ≤ value ≤ 30000 (6 significant digits) The Z-axis coordinate in ECEF Coordinate System, in meters, Param3 < -30000 or Param3 > 30000 (4 significant digits)

Example

```
MODE BASE 40.45628476579 116.2859754968 58.0984

MODE BASE -2160489.0276 4383620.1006 4084738.1110
```

3.3.1 MODE BASE TIME: Self-Optimizing Base Station Mode

This command is used to set the receiver to work in base station mode with self-optimization.

In open environment, it is recommended to configure the PVT engine to `MULTI` using the `CONFIG PVTALG MULTI` command, to improve the positioning accuracy.

Syntax

> MODE BASE <ID> TIME <paramter1> <paramter2>

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982 , UM980C

Table 3-5 Base Station Mode with Self-Optimizing Coordinates

Parameter	Description
ID	Integer between 0~4095 (can be omitted)
Time	—
Paramter1	Maximum time to calculate the average position, in seconds, cannot be a negative value, no more than 3600 s. The convergence time is counted from the position fix with good quality rather than from the first position fix.
Paramter2	Distance, in meters. The receiver starts in self-optimizing base station mode and saves the optimized position in Flash.

Parameter	Description
	When the receiver restarts, it optimizes the position again. If the distance between the optimized coordinates and that saved in Flash is less than the value of Distance, the receiver will set the coordinates saved in Flash as the base station coordinates. The value range of <Distance> is 0 ≤ Distance ≤ 10. If Distance = 0, the receiver will start in self-optimizing base station mode and set the optimized result as the coordinates of the base station.

Example

```
MODE BASE TIME 60

MODE BASE TIME 60 5

MODE BASE 1 TIME 60
```

3.3.2 MODE BASE: Base Station Mode without Parameters

`MODE BASE` is the command to set the base station mode. If it is not followed by any parameter, the receiver will start the default base station configuration, setting the average value of the positioning results in 60 seconds as the coordinates of the base station. The average value in 60 seconds meets the following requirements: the optimizing time lasts for 60 seconds, or the horizontal error tolerance reaches the default value of 2.5 m and the vertical error tolerance reaches 3.5 m.

In open environment, it is recommended to configure the PVT engine to `MULTI` using the `CONFIG PVTALG MULTI` command, to improve the positioning accuracy.

Syntax

```
MODE BASE
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UMD981, UM981S, UMD981S, UM980C

Table 3-6 Base Station Mode with Default Parameters

Command	Mode	Parameter	Description
MODE	BASE	-	Set as default base station mode

Example

```
MODE BASE
```

3.3.3 MODE BASE: Base Station ID

Set the base station ID, an integer between 0 ~ 4095 (0 ≤ ID < 4096).

Syntax

```
MODE BASE <ID>
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981 , UM980C

Table 3-7 Base Station ID Parameter

Command	Mode	ID	Description
MODE	BASE	0 ≤ ID < 4096 (integer)	Set the receiver to work in base station mode and set its ID.

Example

```
MODE BASE 1
```

3.4 Mode Rover : Rover Mode Configuration

RTK rover station receives real-time correction data from the base station. Meanwhile, it receives satellite signals to perform RTK solution to realize high precision positioning.

Syntax

```
MODE ROVER <paramter1> <paramter2(optional)>
```

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S , UM980C

> **Note:**
> Applicable to UM980 Build7923 and later versions.
> Applicable to UM982 Build7650 and later versions.

Table 3-8 Rover Station Mode Parameter Description

Parameter 1	Parameter 2 (Optional)	Description
UAV	DEFAULT	UAV dynamic mode (default)
	HIGHDYN	UAV high dynamic mode
SURVEY	DEFAULT	Precision surveying mode (default)
	MOW	Lawn mower mode
AUTOMOTIVE	DEFAULT	Automotive dynamic mode (default)

> **Note:** When <paramter2> is null, MODE ROVER SURVEY is the default configuration.

`UAV`- UAV dynamic mode: This mode is suitable for most UAV applications, such as agricultural UAVs, surveying UAVs, aerial photography UAVs, inspection UAVs, etc., with large vertical acceleration, and horizontal speed approximate to automobiles. The maximum horizontal speed is 50 m/s, the maximum vertical speed is 30 m/s, the maximum altitude is 18000 m, and the rate of change in position is large.

`UAV HIGHDYN`- UAV high dynamic mode: This mode is suitable for high dynamic applications such as drone light show and FPV drones.

`AUTOMOTIVE`- Automotive dynamic mode: This mode is suitable for passenger vehicles and logistics intelligent driving, with low vertical acceleration and diverse scene changes. The maximum horizontal speed is 100 m/s, the maximum vertical speed is 15 m/s, and the rate of change in position is moderate.

`SURVEY`- Precision surveying mode: This mode is suitable for high-precision application scenarios which require higher positioning accuracy but with lower dynamic features, such as surveying and mapping, precision agriculture, etc.

`DEFAULT`- Default mode: The system will automatically choose different modes according to the product models. Users can query the default mode using corresponding command.

Table 3-9 Default Configuration of Rover Station Mode

Product Model	Default Mode	Description
UM980/UMD980/UMD960/UB9A0/UBD9A0	SURVEY	Precision surveying mode
UM982/UMD982	UAV	UAV dynamic mode
UM960	SURVEY	Lawn mower mode

Product Model	Default Mode	Description
	MOW	

Example

```
MODE ROVER SURVEY

MODE ROVER SURVEY MOW
```

3.5 Heading2 Mode

This command is used to set the heading function between two receivers. Heading2 refers to the angle from True North to the baseline of the base to rover in a clockwise direction.

For dual-antenna receivers, Heading2 is the angle from True North to the baseline of the base to the rover's master antenna (ANT1) in a clockwise direction. The schematic diagram is shown in Figure Heading Schematic.

Heading Schematic

Figure 3-1 Heading Schematic

Syntax

> MODE HEADING2 <parameter>

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 3-10 HEADING2 Mode Parameter

Parameter	Description
FIXLENGTH	Enable Heading2 mode. The distance between the antenna of the moving base station and that of the heading receiver is fixed. The two antennas can move synchronously or in relative static state. (The default mode is `FIXLENGTH` if the parameter of mode heading2 is empty.)
STATIC	Enable Heading2 mode. Both antennas of the moving base station and the heading

Parameter	Description
	receiver are in static state.
VARIABLELENGTH	Enable Heading2 mode. The relative position and distance between the antenna of the moving base station and that of the heading receiver are in dynamic changes.
LOWDYNAMIC	Enable Heading2 mode, low dynamic, suitable for low-speed moving carriers such as pile drivers. The distance between the antenna of the moving base station and that of the heading receiver is fixed.
TRACTOR	For agricultural machinery, operating mode. The distance between the antenna of the moving base station and that of the heading receiver is fixed.

Example

```
MODE HEADING2

MODE HEADING2 FIXLENGTH

MODE HEADING2 VARIABLELENGTH

MODE HEADING2 STATIC

MODE HEADING2 LOWDYNAMIC
```

4 CONFIG Commands

`CONFIG` is the header of the commands to set the following configurations:

1. ANTIJAM
2. DGPS MMP
3. EVENT
4. Heading
5. Heading2
6. PPS
7. PVT
8. RTK
9. SBAS
10. PSRPOS
11. Serial port
12. SIGNALGROUP
13. UNDULATION

The acceptable characters that can appear in the command include numbers, upper case and lower case letters, and specified characters including:

- double quotation marks (" ")
- hyphen (-)
- colon (:)
- underscore (_)
- dollar sign ($)
- comma (,)
- slash (/)
- backslashes (\)

Other characters appeared in the command cannot be decoded.

Syntax

```
CONFIG <device/function> <parameter>
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981 , UM980C

Table 4-1 Configuration List

No.	Configuration Item	Description
1	COM1	Serial port configuration related to COM1, such as baud rate and parity bit
2	COM2	Serial port configuration related to COM2, such as baud rate and parity bit
3	COM3	Serial port configuration related to COM3, such as baud rate and parity bit
4	ANTIJAM	Setting the anti-jamming mode for receivers
5	DGPS	DGPS configuration, such as setting the maximum age of DGPS data
6	MMP	Configuring the pseudorange multipath suppression function for the receiver's output of raw observations
7	PPS	PPS configuration: set the output period, pulse width, rising edge and falling edge
8	RTK	RTK configuration, such as setting the mode and the maximum age of RTK data
9	PVTALG	Setting the calculation mode of the PVT algorithm.
10	PSRPOSBIAS	Enabling/disabling the function of position bias compensation
11	SIGNALGROUP	Setting the combination of signals tracked by the receiver antenna.
12	RTCMB1CB2a	External event configuration
13	UNDULATION	Geoid undulation configuration: input a specific undulation value or use the built-in geoid grid

Example

```
CONFIG COM1 115200 8 n 1
```

```
CONFIG PPS ENABLE BDS POSITIVE 100000 1000 0 0

CONFIG UNDULATION 9.7

CONFIG RTK TIMEOUT 60

CONFIG DGPS TIMEOUT 100
```

4.1 CONFIG: Query Receiver's Configuration

High precision receivers support the use of `CONFIG` command to query the receiver's configuration.

Syntax

```
CONFIG
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM980C

Output

```
$CONFIG,COM1,CONFIG COM1 460800*65

$CONFIG,COM2,CONFIG COM2 115200*23

$CONFIG,COM3,CONFIG COM3 115200*23

$CONFIG,PPS,CONFIG PPS ENABLE GPS POSITIVE 500000 1000 0 0*6E
```

Table 4-2 Query the Receiver's Configuration

Command	Description
CONFIG	Query the current function and configuration of the receiver, including the default configuration

Example

```
CONFIG
```

4.2 CONFIG: Serial Port Configuration

Serial ports are interfaces used to input and output data. The command to control the serial port configuration starts with CONFIG as the header, followed by the port name and properties of the serial port, such as configuring the baud rate, data bits, parity, stop bit properties, etc.

Unicore high precision receivers support the configuration of three serial ports — COM1, COM2, and COM3, which have the same functions but work independently according to their respective configuration. The three ports can be configured mutually. For example, COM2 can be configured through COM1, vice versa. It is recommended to reserve COM1 for upgrade when integrating GNSS boards or modules.

Syntax

```
CONFIG <serial port number> <serial port property parameter>
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-3 Serial Port Configuration

Header	Serial Port	No.	Parameter	Description
CONFIG	COM1 COM2 COM3	1	Baud rate	Set the baud rate of the serial port. See Table Supported Baud Rate for the supported baud rate.
		2	Data bits	Set the data bits of the serial port. Please make sure that the preceding baud rate is not empty before setting this field. Note: Seven or eight data bits are supported in data transmission. The current products only support eight bits.
		3	Parity check	Set the parity check of the serial port. Please make sure that the preceding parameters are not empty before setting this field. Note: Three settings are supported for parity check in data transmission: N, E, O. The default setting is N.
		4	Stop bits	Set the stop bits of the serial port. Please make sure that the preceding

Header	Serial Port	No.	Parameter	Description
				parameters are not empty before setting this field. Note: One or two stop bits are supported in data transmission. The default setting is one bit.

Table 4-4 Supported Baud Rate

Serial Port	Baud Rate
COM1	9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600
COM2	9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600
COM3	9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600

Example

```
CONFIG COM1 115200

CONFIG COM1 115200 8 n 1
```

4.3 CONFIG RXTYPE: Data Type for Serial Port

This command is used to configure the data types received by COM2/COM3.

> **Note** This command can only be issued via **COM1**.

Syntax

> CONFIG RXTYPE <parameter1> <parameter2>

Applicable Products: UM980, UM980C

Table 4-5 RXTYPE Parameter Description

Parameter 1	Parameter 2	Description
Serial Port Number Values: COM2 or	AUTO	Automatic identification, this is the default state.

Parameter 1	Parameter 2	Description
COM3.	NONE	Block all inputs, only use as output serial port.
	RTCM	Only receive differential corrections and auxiliary information; Does not respond to commands.

Example

```
CONFIG RXTYPE COM2 NONE
```

4.4 CONFIG AGNSS: AGNSS Configuration

This command is used to enable/disable the AGNSS function. AGNSS can reduce the Time to First Fix (TTFF) after receiving the assisted GNSS information, such as satellite ephemeris and time. After AGNSS is enabled, the TTFF will be reduced to less than 5 s.

Syntax

```
CONFIG AGNSS <parameter>
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

> **Note:**
> Applicable to UM980 Build7923 and later versions.
> Applicable to UM982 Build7650 and later versions.

Table 4-6 AGNSS Configuration

Parameter	Description
ENABLE	Enable AGNSS
DISABLE	Disable AGNSS (default)

Example

```
CONFIG AGNSS ENABLE
```

4.5 CONFIG ALGRESET: Algorithm Reset Configuration

This command is used to reset the algorithms.

Syntax :

```
CONFIG ALGRESET <parameter>
```

Input :

```
CONFIG ALGRESET HEADING
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-7 Algorithm Reset Configuration

parameter	Description
RTK1	Reset the master antenna's RTK algorithm
RTK2	Reset the slave antenna's RTK algorithm; only applicable to UM982/ UMD982
HEADING	Reset the HEADING algorithm, only applicable to UM982/UMD982
PPP	Reset the master antenna's PPP algorithm, only applicable to UM982/ UMD982/UM980/UMD980/UB9A0/UBD9A0
ADR	Reset the ADR algorithm for the master antenna and slave antenna

4.6 CONFIG ALLEPHRTCM: Ephemeris Output Configuration

This command is used to configure the number of ephemeris output each time. After it is enabled, the receiver will output the ephemeris of all satellites simultaneously.

Syntax

```
CONFIG ALLEPHRTCM <parameter>
```

Applicable Products: UM980, UMD980, UM982, UMD982, UB9A0, UBD9A0, UM981, UMD981, UMD981S, UM980C

Table 4-8 Ephemeris Output Configuration

Parameter	Description
ENABLE	Output the ephemeris of all satellites simultaneously (by default)
DISABLE	Output the ephemeris of only one satellite each time

Example

```
CONFIG ALLEPHRTCM ENABLE
```

4.7 CONFIG ANTENNADELTAHEN: Antenna Height Configuration

This command is used to set the antenna height (height of the antenna relative to the marking point on the ground) and the plane offset when the receiver works as a base station, which will affect the description of the antenna in the RTCM 1006 differential message.

Syntax

```
CONFIG ANTENNADELTAHEN <Height> <East> <North>
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-9 Antenna Height Configuration

Parameter	Value	Description
Height	0.0000~6.5535	Antenna height, the vertical distance from the center of the marking point on the ground to the antenna reference point (ARP), in meters, 0.0000 by default
East	0.0000~100.0000	East offset from the center of the marking point on the ground to the antenna reference point (ARP), in meters, 0.0000 by default
North	0.0000~100.0000	North offset from the center of the marking point on the ground to the antenna reference point (ARP), in

Parameter	Value	Description
		meters, 0.0000 by default

Example

```
CONFIG ANTENNADELTAHEN 1.521 0.0 0.0
```

4.8 CONFIG ANTIJAM: Anti-Jamming Configuration

`ANTIJAM` command is used to set the mode of the anti-jamming function.

> Tip: The ANTIJAM command replaces the previous JAMMING command.

Syntax

```
CONFIG ANTIJAM <mode>
```

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-10 Anti-Jamming Command Description

Parameter	Description
Disable	Disable the anti-jamming function
AUTO	Autonomous (default)
FORCE	Force the anti-jamming mode. When this mode is enabled, power consumption increases.

Example

```
CONFIG ANTIJAM DISABLE

CONFIG ANTIJAM AUTO

CONFIG ANTIJAM FORCE
```

4.9 CONFIG BASEANTENNAMODEL: Base Station Antenna Configuration

This command is used to set the antenna ID, name, type, and phase center offset (only field 1-5 are supported currently) when the receiver works as a base station. It will affect the antenna description in differential message RTCM 1005, RTCM 1006, RTCM 1007, and RTCM 1033.

The antenna phase center offset and the value that changes with the elevation angle conforms to the definition offered by NGS.

The antenna name in RTCM v3.2 complies with the IGS standard, which allows spaces to appear in it. In view of this problem, double quotation marks (" ") are needed to enclose the antenna name. For example, the HX-CGX601A Antenna is specified by IGS as HXCCGX601A HXCS, therefore, `HXCCGX601A HXCS` should be entered when inputting the command.

Syntax

```
CONFIG BASEANTENNAMODEL <name> <SN> <setupID> <type>
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-11 Base Station Antenna Configuration

Parameter	ASCII Value	Description
name	String	Antenna name, up to 31 ASCII characters, default = ADVNULLANTENNA
SN	String	Antenna serial number, up to 31 ASCII characters, default = a0001
setupID	0~255	Antenna ID, integer from 0 to 255, default = 0
type	NO or USER	Antenna type, default = NO

Example

```
CONFIG BASEANTENNAMODEL "HXCCGX601A HXCS" 62815 1 USER
```

4.10 CONFIG BASEBIAS: Base Station Coordinate Bias Configuration

This command is used in base station mode to configure the offset between the reported base station coordinates and the true physical location of the base station.

Syntax

```
CONFIG BASEBIAS <parameter>
```

Applicable Products: UM980, UM980C

Table 4-12 Base Station Tolerable Bias Parameter Description

Parameter	Description
`<Tolerable Bias>`	Unit: meter (m) Value range: 50~800. Default value: 300.

Example

```
CONFIG BASEBIAS 500
```

4.11 CONFIG CMDFORMAT: Command Format Configuration

This command is used to configure the input command format. When the parameter is set to 1, the input command shall be followed by a checksum.

The checksum mode can prevent the module from making errors when recognizing commands. If you use commands with a checksum, you need to first configure the parameter of CMDFORMAT to 1, and then enter commands with an XOR checksum, for example: `$RESET*55`.

Syntax

```
CONFIG CMDFORMAT <parameter>
```

Applicable Products: UM982, UMD982, UB9A0, UM981, UMD981, UMD981S

Table 4-13 Command Format Configuration

Parameter	Description
0	Disable the command checking mode (by default); input commands without checksum
1	Enable the command checking mode; input commands with XOR checksum

Example

```
CONFIG CMDFORMAT 1
```

4.12 CONFIG DGPS

This command sets the maximum age of the differential data received from the base station. The differential data older than the specified age is ignored. The command can also disable DGPS positioning calculation.

Syntax

```
CONFIG DGPS TIMEOUT <parameter>
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-14 DGPS Parameter Description

Parameter	Description
0	Disable DGPS positioning
1~1800	Maximum age of differential data. 300s by default. Integers only. Unit: second. See Table Default Configuration of DGPS TIMEOUT for the default configuration for specific products.

Table 4-15 Default Configuration of DGPS TIMEOUT

Product Model	Defualt Timeout Value
UM982/UMD982	600 s

Product Model	Defualt Timeout Value
UM980/UMD980	300 s
UM960/UMD960/UM960L	300 s
UB9A0/UBD9A0	300 s

Example

```
CONFIG DGPS TIMEOUT 100
```

4.13 CONFIG ETH1: Network IP Address Configuration

The network device ETH1 is the network interface of the receiver. CONFIG is the header of the network configuration command, followed by the network device and network device properties, which are used for setting the IPv4 address. High precision GNSS receiver supports one network device: `ETH1`.

Syntax

> CONFIG ETH1 <parameter>

Applicable Products: UB9A0, UBD9A0

Table 4-16 Network IP Address Configuration

Parameter	Description
DHCP	Obtain configuration using DHCP mode
IPv4 list	IP GateWay NetMask DNS_Server. Use ASCII “SPACE” as segmented symbol. Local IP, IP gateway, IP Netmask, DNS server

Example

```
CONFIG ETH1 DHCP

CONFIG ETH1 192.168.0.100 192.168.0.1 255.255.255.0 192.168.0.1
```

4.14 Network Serial Port Configuration

The network serial port is an interface of receiver to input and output data. CONFIG is the header of the serial port configuration command, followed by the network serial port device and network serial port properties, which are used for setting the port number of network serial ports, IP and port number of the server, etc.

High precision GNSS receiver supports three network serial ports: icom1, icom2, and icom3. The three serial ports of the receiver have the same function, but the data input and output of each network serial port is configured to work independently.

Syntax

```
CONFIG <port> <parameter>
```

Applicable Products: UB9A0, UBD9A0

Table 4-17 Network Serial Port Configuration

Port	Parameter	Description
ICOM1 ICOM2 ICOM3	Disable	Disable the server connection function of the TCP/IP client
	Protocol	TCP/UDP. (TCP protocol by default)
	IP	Set up the IPv4 address for the server end of network ports; the network port is in SERVER mode by default.
	Port*	Set up port number. Range: 1 ~ 65534. Use the local port number (local) for SERVER mode; otherwise, use a server port number

*: The port number 40000 cannot be configured as it is allocated to the internal system programming. It is recommended to use 30001/30002/30003, and try to avoid using ports above 32768.

Example

```
CONFIG ICOM1 TCP 30001

CONFIG ICOM1 TCP 192.168.0.2 30001
```

4.15 CONFIG EVENT: Event Configuration

This command is used to set the EVENT function and related parameters. EVENT is disabled by default.

Syntax

```
CONFIG EVENT <parameter 1> <parameter 2> <parameter 3>
```

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-18 EVENT Configuration

Parameter 1	Parameter 2	Parameter 3
DISABLE. Disable EVENT (default)		
ENABLE (Enable EVENT)	POSITIVE (Rising edge triggering)	TGUARD. The minimum time between two valid pulses, unit: ms. If the time is less than TGUARD, the second Event will be ignored. Default = 4, minimum = 2, maximum = 3,599,999
	NEGATIVE (Falling edge triggering)	

Example

```
CONFIG EVENT ENABLE POSITIVE 10
```

4.16 CONFIG EVENT2: Event2 Configuration

This command is used to set the EVENT2 function and related parameters. EVENT2 is disabled by default.

Syntax

```
CONFIG EVENT2 <parameter 1> <parameter 2> <parameter 3>
```

Example

```
CONFIG EVENT2 ENABLE POSITIVE 10
```

Applicable Products: UM982, UMD982

Table 4-19 EVENT2 Configuration

Parameter 1	Parameter 2	Parameter 3
DISABLE. Disable EVENT2 (default)		
ENABLE (Enable EVENT2)	POSITIVE. (Rising edge triggering)	TGUARD. The minimum time between two valid pulses, unit: ms. If the time is less than TGUARD, the second Event will be ignored. Default = 4, minimum = 2, maximum = 3,599,999
	NEGATIVE (Falling edge triggering)	

4.17 CONFIG HEADING: HEADING Configuration

This command is used to set single-board/module dual-antenna heading receivers. It sets the fixed baseline length, change of baseline length and low dynamic mode of heading. The single board/module dual-antenna receiver starts up with heading function enabled by default. Refer to Figure Heading Schematic for the details.

Syntax (1)

```
CONFIG HEADING <parameter>
```

Table 4-20 Heading Configuration Parameter Description (1)

Parameter	Description
FIXLENGTH	The distance between the master antenna (ANT1) and the slave antenna (ANT2) is fixed. ANT1 and ANT2 move synchronously or in relatively static state (default mode).
VARIABLELENGTH	The relative position and distance between the master antenna (ANT1) and the slave antenna (ANT2) change dynamically in real time.
STATIC	Both of the master antenna (ANT1) and slave antenna (ANT2) are in static state.

Parameter	Description
LOWDYNAMIC	Low dynamic, which can be used for low speed moving carriers such as pile drivers.
TRACTOR	The distance between the master antenna (ANT1) and the slave antenna (ANT2) is changing slowly, which is similar to the velocity of a tractor.
LENGTH	This parameter is used to set the baseline length between the two antennas in order to regulate the heading calculation. It is fit for dual-antenna applications with fixed baseline. For the detailed configuration, see Table Heading LENGHTH Configuration Parameter Description (2) below.
RELIABILITY	Heading reliability threshold: 1: Low reliability 2: Normal reliability 3: Relatively high reliability (default) 4: High reliability

Syntax (2)

> CONFIG HEADING LENGTH <parameter1(optional)> <parameter2(optional)>

Applicable Products: UM982, UMD982

Table 4-21 Heading LENGHTH Configuration Parameter Description (2)

Parameter 1	Parameter 2
Fixed baseline length (cm) Valid range: ≥ 0. Example: `20` for a 20 cm baseline. Setting this value to `0` restores the default behavior.	Tolerable error margin (cm) Valid range: > 0. Example: `3` for a 3 cm error margin.

> **Note** If **parameter 1** and **parameter 2** are not configured, the system will automatically use the default configuration.

Example

```
CONFIG HEADING FIXLENGTH
```

```
CONFIG HEADING VARIABLELENGTH

CONFIG HEADING STATIC

CONFIG HEADING LOWDYNAMIC
```

4.18 CONFIG HEADING OFFSET: Heading Offset and Pitch Offset Configuration

This command is used to set the offset value in order to correct the heading angle and pitch angle output in HEADING, GPTHS and HEADING2 messages.

Syntax

```
CONFIG HEADING OFFSET <Headingoffset> <Pitchoffset>
```

Applicable Products: UM982, UMD982, UM980, UMD980, UB9A0, UBD9A0, UM981, UM980C

Table 4-22 Heading Offset and Pitch Offset Configuration

Parameter	Description
Headingoffset	Heading offset correction, degree, range: -180.0 ~ 180.0
Pitchoffset	Pitch offset correction, degree, range: -90.0 ~ 90.0

Example

```
CONFIG HEADING OFFSET 90 45
```

4.19 CONFIG IONLEVEL: Ionospheric Activity Level Configuration

This command configures the ionospheric activity level.

Syntax

```
CONFIG IONLEVEL <parameter>
```

Applicable Products: UM982, UMD982, UB9A0, UM980, UM980C

Table 4-23 Ionospheric Intensity Level Parameter Description

Parameter	Description
<Ionospheric Level>	Valid range: 0.5 ~ 3.0, with one decimal place.
AUTO	Automatic mode; estimates the real-time ionospheric activity level.

Example

```
CONFIG IONLEVEL 0.5
```

4.20 CONFIG IONMODE: Ionospheric Model Configuration

This command is used to set the ionospheric model used by the receiver.

Syntax

```
CONFIG IONMODE <type>
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S

> **Note:**
> Applicable to UM982 Build 9669 and later verisons.
> Applicable to UM980 Build 10110 and later versions.

Table 4-24 Ionospheric Model Configuration

Parameter	Description
GPSK8	GPS ionospheric model (default)
BD2K8	BDS-2 ionospheric model
BD3GIM	BDS-3 ionospheric model (not supported currently)
GALNTCM	Galileo ionospheric model (not supported currently)

Example

```
CONFIG IONMODE GPSK8
```

4.21 CONFIG LBAND: L-Band Satellite Information Configuration

The `CONFIG LBAND` command configures L-band satellite information. The L-band function is enabled by default.

Syntax (1)

```
CONFIG LBAND <parameter1> <parameter2> <parameter3(optional)>
```

Applicable Products: UM980C, UM981C, UM982C

Table 4-25 L-Band Command Parameter Description

Parameter 1	Parameter 2	Parameter 3	Description
DISABLE			Disables the L-band reception.
ENABLE	AUTO		Automatically switches tracking beams and channels based on the strategy module.
	BeamID	ID	The ID specifies an L-band satellite, which is prioritized for PPPAR positioning. If the beam ID is not configured, this command is invalid. Value range: Decimal integer 1~7.
RELIABILITY	Reliability threshold value	Reserved	Configure the PPPAR convergence time and post-convergence accuracy based on L-band. See Table L-Band Reliability Parameter Description
DATUM	WGS84		Refer to coordinate system: WGS84 (Default).
	LBANDORIGINAL		Consistent with the coordinate system used by the service.
BEAM	Parameter set		The parameter set must include all parameters specified in Table L-band Beam Parameter Set Description. Separate each parameter with a single space.

Parameter 1	Parameter 2	Parameter 3	Description
TIMEOUT			The maximum age for switching L-band satellites. Value range: 90 ~ 600 seconds. Default value: 120 seconds.

Table 4-26 L-Band Beam Parameter Set Description

No.	Configuration Item	Description
1	BeamID	Beam ID. Valid range: decimal integers 1~7.
2	BeamName	Beam name, a string of up to 7 characters (e.g., abcdefg).
3	Frequency	Center frequency of the beam. Range: 1525~1560 MHz.
4	USE_DESCRAMBLER	Enable descrambling. Value: 1 (yes) or 0 (no).
5	USE_SERVICE_ID	Enable Service ID verification. Value: 1 (yes) or 0 (no).
6	USE_PRESCRAMBLING	Enable de-prescrambling. Value: 1 (yes) or 0 (no).
7	SEARCH_WINDOW	Frequency search window. Range: 0~2200 Hz.
8	DATA_RATE	Data rate. Valid values: 600, 1200, 2400, or 4800 bps.
9	DESCRAMBLER_INIT	Initial phase of the descrambler (hexadecimal).
10	SERVICE_ID	Service ID (hexadecimal).
11	UNIQUE_WORD1	First unique word (hexadecimal).
12	UNIQUE_WORD2	Second unique word (hexadecimal).
13	Longitude	Longitude of the L-band satellite, in degrees.

Example

```
CONFIG LBAND ENABLE AUTO
```

Syntax (2)

```
CONFIG LBAND RELIABILITY <parameter2> <parameter3(reserved)>
```

Example

```
CONFIG LBAND RELIABILITY 3
```

Table 4-27 L-Band Reliability Parameter Description

Parameter2	Parameter3	Description
Reliability threshold value	Reserved	Configure convergence time and post-convergence accuracy for L-band-based PPP-AR. Value descriptions are as follows: 1. Basic reliability requirement; compared with the default configuration, shorter convergence time and lower accuracy 2: Moderate reliability requirement; this is the default setting. 3: Strict reliability requirement; compared with the default configuration, longer convergence time and higher accuracy

4.22 LOGSEQ: LOG Output Sequence Configuration

This command is used to configure the log output sequence.

Syntax

```
CONFIG LOGSEQ <parameter>
```

Applicable Products: UB9A0, UBD9A0, UM981, UMD981, UM981S, UMD981S

Table 4-28 Log Output Sequence

Parameter	Description
1	The output sequence is: Position, RTCM, OBSVM, EPHEM
2	The output sequence is: RTCM, OBSVM, EPHEM, Position **(by default)**

4.23 CONFIG MMP : Multi-Path Mitigation Configuration

This command enables/disables the multi-path mitigation function for the pseudorange measurement in the raw observation message. The function is disabled by default.

Syntax

```
CONFIG MMP <parameter>
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-29 MMP Parameter Description

Parameter	Description
ENABLE	Enable multi-path mitigation for the pseudorange measurement in the raw observation message
DISABLE	Disable multi-path mitigation for the pseudorange measurement in the raw observation message (default)

Example

```
CONFIG MMP ENABLE
```

4.24 CONFIG NMEA: NMEA Version Configuration

This command is used to set the NMEA version. The default version is V410.

Syntax

```
CONFIG NMEA0183 <parameter>
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-30 NMEA 0183 Version Configuration

Parameter	Description
V410	Set NMEA version to be V410[2] (extended to support BDS)
V411	Set NMEA version to be V411 (Refer to the official document of NMEA V411 for more information.)

Example

```
CONFIG NMEA0183 V410
```

4.25 Ntripclient Configuration

Ntrip client is the specific device for receiver downloading data from Ntrip caster, now only supporting Ntrip protocol V1.

High precision GNSS receivers only support one Ntrip client: NCOM20.

Syntax

```
CONFIG <Ntrip client device number> <parameter>
```

Applicable Products: UB9A0, UBD9A0

Table 4-31 Ntrip Client Parameter List

Ntrip Client Device Number	Parameter	Description
NCOM20	Disable	Disabled Ntrip client
	Caster IP	Ntrip caster IPv4 address or domain name
	port	Ntrip caster TCP port number
	mountport	Ntrip caster mount point
	uname	Ntrip caster user name for downloading data
	cli_password	Ntrip caster password for downloading data

Example

```
CONFIG NCOM20 10.0.100.2 9000 UB9A0_RTCM32 UNAME CLI_PASSWORD
```

4.26 Ntripserver Configuration

Ntrip server is the specific device for receiver uploading data to Ntrip caster, now only supporting Ntrip protocol V1.

High precision GNSS receivers support three Ntrip servers (NCOM1, NCOM2, NCOM3).

Syntax

```
CONFIG <Ntrip server device number> <parameter>
```

Table 4-32 Ntrip Client Parameter List

Port	Parameter	Description
NCOM1 NCOM2 NCOM3	Disable	Disable Ntrip server
	Caster IP	Ntrip caster TCP IPv4 address
	port	Ntrip caster TCP port number
	mountport	Ntrip caster mount point
	password	Ntrip caster password for uploading data

Applicable Products: UB9A0, UBD9A0

Example

```
CONFIG NCOM1 10.0.100.2 9000 UB9A0_RTCM32 SERV_PASSWORD
```

4.27 CONFIG POSREF : Positioning Reference Point Configuration

This command is used to configure the reference point for positioning results, which can be set to either the antenna phase center or the ARP (Antenna Reference Point). See Figure Schematic Diagram of the Antenna Phase Center and Antenna Reference Point.

Syntax

```
CONFIG POSREF <parameter>
```

Applicable Products: UM980, UM981, UMD981, UMD981S, UM980C

Table 4-33 Positioning Result Reference Point Parameter Description

Parameter 1	Description
PC/ARP	Positioning result reference point, configurable as: PC - Phase Center ARP - Antenna Reference Point

Use the command:

- **Base Station Mode:** After configuring CONFIG POSREF ARP, the module uses the parameters set in SELFANTENNAPCO to convert the coordinates in base station–related output logs (such as BASEPOS) and the ECEF-X/ECEF-Y/ECEF-Z coordinates in RTCM 1005/1006 to be referenced to the ARP.
- **Rover Mode:** After configuring CONFIG POSREF ARP, the module converts all positioning results to coordinates referenced to the ARP, based on the parameters set in SELFANTENNAPCO and REMOTEANTENNAPCO.

Example

```
CONFIG POSREF ARP
```

4.28 CONFIG PPP : Precise Point Positioning Configuration

This command is used to set the receiver's PPP function. It is supported by specific firmware.

Syntax

```
CONFIG PPP <parameter1> <parameter2>
```

```
CONFIG PPP ENABLE <parameter2>
```

```
CONFIG PPP DATUM <parameter2>
```

```
CONFIG PPP CONVERGENCE <parameter2> <parameter3>
```

```
CONFIG PPP ENABLE <parameter2> ONLY(optional)
```

Applicable Products: UM980, UM980C, UMD980, UB9A0, UBD9A0, UM982, UM982C, UMD982, UM981, UM981C, UMD981, UM981S[3]

> **Note:**
> Applicable to UM980 Build7923 and later versions.
> Applicable to UM982 Build7650 and later versions.

Syntax (1)

```
CONFIG PPP ENABLE <parameter2>
```

Table 4-34 PPP Parameter Description (1)

Parameter2	Description
B2b-PPP*	B2b-PPP
E6-HAS*	E6 HAS
AUTO	Automatically choose the appropriate PPP service according to the application scenario
L6MDCPPP*	QZSS L6E (MADOCA) PPP

Syntax (2)

```
CONFIG PPP ENABLE <parameter2> ONLY(optional)
```

Table 4-35 PPP Parameter Description (2)

Parameter2	Parameter3	Description
B2b-PPP*		Only enable B2b-PPP
E6-HAS*	ONLY	Only enable E6 HAS
L6MDCPPP*		Only enable QZSS L6E MADOCA-PPP

Syntax (3)

```
CONFIG PPP DATUM <parameter2>
```

Table 4-36 PPP Parameter Description (3)

Parameter2	Description
WGS84	Refer to the WGS84 standard
PPPORIGINAL	Use the coordinate system of the PPP service (default)

Syntax (4)

```
CONFIG PPP <parameter1>
```

Table 4-37 PPP Parameter Description (4)

Parameter2	Description
TIMEOUT	Range: 90 ~ 180 s Default = 120 s If `TIMEOUT` is set to 0, PPP is disabled.
CONVERGE	PPP convergence threshold, see Table PPP CONVERGENCE Parameter Description
DISABLE	Disable PPP (default)

> **Note:**
> * : The B2b-PPP service is supported only on UM980 Build7923 and later, and only when operating in SIGNALGROUP 2 mode.
> * : E6-HAS is supported on UM980 Build11833 and later versions, and UM982 Build11826 and later versions.
> * : L6MDCPPP is supported on UM980 Build16606 and later versions.

Syntax (5)

```
CONFIG PPP CONVERGENCE <parameter2> <parameter3>
```

Table 4-38 PPP CONVERGENCE Parameter Description (5)

Parameter2	Parameter3
HorSTD Horizontal standard deviation threshold[4],	VerSTD Vertical standard deviation threshold[4:1] ,

Parameter2	Parameter3
in centimeters	in centimeters

Example

```
CONFIG PPP ENABLE B2b-PPP

CONFIG PPP DISABLE

CONFIG PPP CONVERGE 10 20
```

4.29 CONFIG PPPRTK: PPPRTK Configuration

This command configures PPPRTK positioning-related functions of the receiver, including CLAS feature, which is supported on specific firmware versions.

Syntax (1)

```
CONFIG PPPRTK <parameter1> <parameter2(optional)>
```

Table 4-39 PPPRTK Command Parameters (1)

Parameter 1	Parameter 2	Parameter Description
DISABLE		Disable PPPRTK function. Default state.
ENABLE	L6CLAS	Enable CLAS function.
TIMEOUT		Maximum age of data. Unit: second. Value range: 90~180s, (120s by default) When set to 0, the PPPRTK function is disabled.

Syntax (2)

```
CONFIG PPPRTK CONVERGE <parameter1> <parameter2>
```

Table 4-40 PPPRTK Command Parameters (2)

Parameter 1	Parameter 2
Horizontal deviation threshold. Unit: centimiter	Vertical deviation threshold. Unit: centimiter

Parameter 1	Parameter 2
Default value is 10.	Default value is 15.

Applicable Products: UM980C, UM981C6, UM982C

> **Note:**
> Configuring UM980C and UM981C to SIGNALGROUP 10 is required.
> Configuring UM982C to SIGNALGROUP 3 6 is required.

Example

```
CONFIG PPPRTK ENABLE L6CLAS

CONFIG PPPRTK TIMEOUT 100

CONFIG PPPRTK CONVERGE 50 80
```

4.30 CONFIG PPS: Pulse Per Second Configuration

This command is used to set the pulse signal parameters such as the PPS period and pulse width, meanwhile compensating for the delay of PPS.

Syntax (1)

```
CONFIG PPS <parameter1>
```

Table 4-41 PPS Parameter Description

Parameter1	Description
DISABLE	Disable PPS output.
ENABLE (default)	Enable PPS output. The receiver outputs PPS after the position is fixed and the PPS convergence is finished. If there is loss of lock on satellite signals and the receiver stops positioning, the PPS output would maintain for about 30 seconds.
ENABLE2	Enable PPS output and keep the output state. After the position is fixed and the PPS convergence is finished, the receiver will output the same PPS as that in the ENABLE configuration.

Parameter1	Description
ENABLE3	Enable PPS output after the receiver starts up.

Syntax (2)

```
CONFIG PPS ENABLE/ENABLE2/ENABLE3 <parameter2>
```

Table 4-42 PPS Parameter Description

Parameter2	ASCII Value	Description
Timeref	GPS/BDS/GAL/GLO	Time reference. BDST, GPST, GLOST and GALST are supported currently.
polarity	POSITIVE NEGATIVE	Pulse polarity, active high triggered by the rising edge Pulse polarity, active low triggered by the falling edge
Width	Pulse width, smaller than the period	Pulse width of the PPS signal (microseconds)
Period	PPS output period	Valid values: 50, 100, 200, ..., 20000 (milliseconds)
RfDelay	Integer from -32768 to 32767	RF delay (nanoseconds)
UserDelay	Integer from -32768 to 32767	User-set delay **Note:** UM980 value range: integers within -100000000~100000000 (nanoseconds)

Applicable Products: UM960, UMD960, UM960L[5], UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UM980C

Example

```
CONFIG PPS ENABLE GPS POSITIVE 500000 1000 0 0
```

4.31 CONFIG PSRPOSBIAS: Position Bias Compensation Configuration

This command is used to enable/disable the function of position bias compensation. When it is enabled, it compensates for the inherent bias of pseudorange positioning and RTK positioning.

Syntax

```
CONFIG PSRPOSBIAS <parameter1>
```

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-43 PROSBIAS Parameter Description

Parameter 1	Description
ENABLE	Enable position bias compensation
DISABLE (default)	Disable position bias compensation

Example

```
CONFIG PSRPOSBIAS ENABLE
```

4.32 CONFIG PSRVELDRPOS: Doppler Position Prediction Configuration

This command is used to enable/disable the prediction of position using Doppler calculation. The Doppler position prediction is enabled by default. After it is enabled, the receiver will use the real-time Doppler velocity to predict the next position when the pseudorange measurement quality is poor while the Doppler calculation is successful and with good quality. In this condition, the positioning quality indicator in GGA message is output as 1, but the number of satellites in use is output as 0.

Syntax

```
CONFIG PSRVELDRPOS <parameter>
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-44 Doppler Position Prediction Configuration

Parameter	Description
ENABLE	Enable the function (default state).
DISABLE	Disable the function.

Example

```
CONFIG PSRVELDRPOS ENABLE

CONFIG PSRVELDRPOS DISABLE
```

4.33 CONFIG PVTALG: PVT Algorithm Configuration

This command is used to set the calculation mode of the PVT algorithm.

Syntax

```
CONFIG PVTALG <parameter1>
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-45 PVTALG Algorithmn Parameter Description

Parameter 1	Description
SINGLE	Single-frequency solution **Note:** Default mode for UM982/ UMD982
AUTO	Single-frequency solution with ionospheric error estimation **Note:** Default mode for UM980/UMD980/UB9A0/UBD9A0
MULTI	Dual-frequency solution

Example

```
CONFIG PVTALG MULTI
```

4.34 CONFIG PVT RELIABILITY: PVT RELIABILITY Threshold Configuration

This command is used to configure the reliability thresholds for the PVT (Position, Velocity, Time) engine.

Syntax

```
CONFIG PVT RELIABILITY <parameter1> <parameter2> <parameter3>
```

Applicable Products: UM982, UB9A0

> **Note:** Applicable to UM982 Build 17746 and later versions.

Table 4-46 PVT RELIABILITY Parameter Description

Header	Function	Parameter 1	Parameter 2	Parameter 3
CONFIG	PVT RELIABILITY	Horizontal reliability threshold for single point positioning: 1 – Normal (default) 2 – Strict 3 – Very strict	Vertical reliability threshold for single point positioning: 1 – Normal (default) 2 – Strict 3 – Very strict	Doppler-based velocity reliability threshold: 1 – Normal (default) 2 – Strict 3 – Very strict

Example

```
CONFIG PVT RELIABILITY 2 2 2
```

4.35 CONFIG REMOTEANTENNAPCO

This command is used to configure the offset value between the antenna phase center and the antenna reference point of the remote base station used by the receiver when operating as a rover. See Figure Schematic Diagram of the Antenna Phase Center and Antenna Reference Point.

Since the base station used by the receiver may vary each time, this command does not support saving; the receiver will revert to default configuration after restart. Use the `REMOTEANTENNAPCOA` command to query the current configuration.

antenna phase center and antenna reference point

Figure 4-1 Schematic Diagram of the Antenna Phase Center and Antenna Reference Point

Syntax

```
CONFIG REMOTEANTENNAPCO <NorthOffset> <EastOffset> <UpOffset>
```

Applicable Products: UM980, UM981, UMD981, UM981S, UMD981S, UM980C

Parameter	Description
NorthOffset	Northward offset from the antenna reference point to the antenna phase center, unit: mm. Configured as a DOUBLE type, range: –1,000,000 ~ 1,000,000. Default value is 0.
EastOffset	East offset from antenna reference point to antenna phase center, unit: mm. Configured as a DOUBLE type, range: -1,000,000~1,000,000. Default value is 0.
UpOffset	Up offset from antenna reference point to antenna phase center, unit: mm. Configured as a DOUBLE type, range: -1,000,000~1,000,000. Default value is 0.

Example

```
CONFIG REMOTEANTENNAPCO 100 100 100
```

4.36 RTCMB1CB2a Configuration

This command is used to set whether to encode BDS B1C & B2a signals in RTCM protocol. The configuration is enabled by default.

Syntax

```
CONFIG RTCMB1CB2a <parameter>
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-47 RTCMB1CB2a Parameter Description

Parameter	Description
ENABLE	Encode B1C & B2a signals in RTCM (default)
DISABLE	Do not encode B1C & B2a signals in RTCM

Example

```
CONFIG RTCMB1CB2a ENABLE
```

4.37 RTCMCLOCKDRIFT : RTCM Clock Drift Compensation Configuration

This command configures whether Doppler-based clock drift compensation is applied to the raw RTCM data output by the receiver. By default, this feature is enabled.

Syntax

```
CONFIG RTCMCLOCKDRIFT <parameter>
```

Applicable Products: UM982, UM981, UMD981, UM981S, UMD981S

Table 4-48 RTCMCLOCKDRIFT Configuration

Parameter	Description
ENABLE	Enable the function (default state).
DISABLE	Disable the function.

Examples

```
CONFIG RTCMCLOCKDRIFT ENABLE

CONFIG RTCMCLOCKDRIFT DISABLE
```

4.38 CONFIG RTCMPHASERATE: RTCM Phaserange Rate Configuration

This command is used to set the positive and negative sign for the phaserange rate in RTCM MSM5 & MSM7 format messages.

Syntax

```
CONFIG RTCMPHASERATE <parameter>
```

Input Example

```
CONFIG RTCMPHASERATE POSITIVE
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM980C

> **Note:** Applicable to UM982 Build9669 and later versions.

Table 4-49 RTCM Phaserange Rate Configuration

Parameter	Description
POSITIVE	The same value as the Phaserange Rate in RTCM MSM5 & MSM7 format messages (default)
NEGATIVE	The opposite value of the Phaserange Rate in RTCM MSM5 & MSM7 format messages

4.39 CONFIG RTCMCLOCKOFFSET: RTCM CLOCK Bias Compensation Configurarion

This command is used to configure whether the receiver applies clock bias compensation to the raw RTCM data before output. By default, this command is set to ENABLE, meaning clock bias compensation is applied prior to output.

Syntax

```
CONFIG RTCMCLOCKOFFSET <parameter>
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM980C

Table 4-50 RTCMCLOCKOFFSET Parameter Description

Parameter	Description
ENABLE	Enable the RTCMCLOCKOFFSET function (Default).
DISABLE	Disable the RTCMCLOCKOFFSET function.

Example

```
CONFIG RTCMCLOCKOFFSET DISABLE
```

4.40 CONFIG RTCMDECAUTO : RTCM Decoding Configuration

When the base station sends RTCM 3.0 data and RTCM 3.2 data simultaneously, this command can be used to configure the receiver to decode the RTCM 3.2 data and filter out RTCM 3.0 data.

Syntax

```
CONFIG RTCMDECAUTO <parameter>
```

Applicable Products: UM980, UMD980, UM982, UMD982, UB9A0, UBD9A0, UM981, UMD981, UMD981S, UM980C

Table 4-51 RTCM Decoding Configuration

Parameter	Description
ENABLE	Enable RTCM data filtering.
DISABLE	Disable RTCM data filtering (default).

Example

```
CONFIG RTCMDECAUTO ENABLE
```

4.41 CONFIG RTK: RTK Configuration

This command is used to set the RTK computing engine, RTK operating mode, and to clean RTK parameters.

Syntax (1)

```
CONFIG RTK TIMEOUT <parameter1>
```

Table 4-52 CONFIG RTK TIMEOUT Parameter Description

Parameter	Description
0	Disable RTK function
1~1800	Maximum age of RTK data*, in seconds. Versions without standalone authorization support 600 s at most.

> **Note:**
> CONFIG RTK TIMEOUT <parameter1> is applicable to UM960 Build13457 and later versions.

Syntax (2)

```
CONFIG RTK RELIABILITY <parameter1> <parameter2>
```

Table 4-53 CONFIG RTK RELIABILITY Parameter Description

Parameter1	Parameter2
RTK reliability threshhold. 1: Low reliability 2: Normal reliability 3: Relatively high reliability (default) 4: High reliability	ADR reliability threshhold. 1: Low reliability 2: Normal reliability 3: Relatively high reliability (default) 4: High reliability

Syntax (3)

```
CONFIG RTK CN0THD <parameter1>
```

Table 4-54 CONFIG RTK Parameter Description

Parameter	Description
CN0THD	CN0 level 0=normal CN0 requirement, by default 1=stringent CN0 requirement
MMPL	Multi-path mitigation threshhold. 0=normal MMPL requirement, by default 1=stringent MMPL requirement
RESET	Reset RTK solution
USER_DEFAULTS	Enable the RTK positioning function, by default
DISABLE	Disable RTK solutoin, including float solution and fixed solution

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UMD981, UM981S, UMD981S, UM980C

Example

```
CONFIG RTK TIMEOUT 45 50

CONFIG RTK RELIABILITY 3 1

CONFIG RTK RELIABILITY 3

CONFIG RTK CN0THD 1

CONFIG RTK MMPL 1
```

```
CONFIG RTK MPOS 1 66
```

4.42 CONFIG RTKASITPPP : RTK Assisting PPP Configuration

This command is used to enable or disable the use of RTK positioning results to assist in PPP convergence and positioning.

Syntax

```
CONFIG RTKASITPPP <parameter>
```

Applicable Products: UM982, UMD982, UB9A0, UM981, UMD981, UM981S, UMD981S

Table 4-55 RTK Assisting PPP Configuration

Parameter	Description
ENABLE	Enable RTK result-assisted PPP convergence and positioning function (default)
DISABLE	Disable RTK result-assisted PPP convergence and positioning function

Example

```
CONFIG RTKASITPPP ENABLE
```

4.43 CONFIG SELFANTENNAPCO: Receiver Antenna Phase Center Offset Configuration

This command is used to configure the offset between the receiver's antenna phase center and the antenna reference point. See Figure Schematic diagram of the antenna phase center and antenna reference point.

Syntax

```
CONFIG SELFANTENNAPCO <NorthOffset> <EastOffset> <UpOffset>
```

Applicable Products: UM980, UM981, UMD981, UMD981S, UM980C

Table 4-56 Receiver's Antenna Phase Center Parameter Description

Parameter	Description
NorthOffset	Northward offset from the antenna reference point to the antenna phase center, unit: mm. Configured as a DOUBLE type, range: –1,000,000 ~ 1,000,000. Default value is 0.
EastOffset	East offset from antenna reference point to antenna phase center, unit: mm. Configured as a DOUBLE type, range: -1,000,000~1,000,000. Default value is 0.
UpOffset	Up offset from antenna reference point to antenna phase center, unit: mm. Configured as a DOUBLE type, range: -1,000,000~1,000,000. Default value is 0.

Example

```
CONFIG SELFANTENNAPCO 100 100 100
```

4.44 CONFIG SBAS: SBAS Configuration

This command is used to enable or disable SBAS. The choice of SBAS can be made automatically by the receiver (AUTO mode) or specified by the user. If the user knows the SBAS operational status in their region, it is recommended to specify it explicitly.

Syntax

```
CONFIG SBAS <parameter1> <parameter2>
```

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-57 SBAS Configuration

Parameter 1	Parameter 2	Description
ENABLE	Auto	Automatic mode
	WAAS	Enable WAAS only
	GAGAN	Enable GAGAN only

Parameter 1	Parameter 2	Description
	MSAS	Enable MSAS only
	EGNOS	Enable EGNOS only
	SDCM	Enable SDCM only
	ASECNA	Enable ASECNA only
	KASS	Enable KASS only
	SPAN	Enable SPAN only
	BDS	Enable BDS SBAS only
DISABLE	-	Disable SBAS (Default)
TIMEOUT*	t	SBAS timeout, range: 120~1800s, default=1200s; if the value is set to 0, SBAS is disabled.

> **Note:** The TIMEOUT configuration is applicable to UM982 Build9669 and later versions.

4.45 CONFIG SIGNALGROUP: Supported Signal Combination Configuration

This command is used to set the combination of signals tracked by the master antenna and slave antenna of the receiver. `<parameter1>` is the signals tracked by the master antenna and `<parameter2>` is the signals tracked by the slave antenna.

The master antenna supports receiving SBAS L1C/A by default. The slave antenna does not support SBAS.

Single-antenna products only support the configuration of `<parameter 1>`. If `<parameter2>` is configured, a system error will be returned and a prompt will appear to indicate that `<parameter 2>` is not supported.

Dual-antenna products support the configuration of `<parameter1>` and `<Parameter2>`. When `<parameter2>` is not configured, it will be set to 0 by default.

The method to configure `<parameter1>` and `<parameter2>` is shown in the table below.

After the module is configured, if the new configuration is different from the old one, the module will reset automatically and adopt the new configuration. The configuration of SIGNALGROUP will be saved automatically. It is unnecessary to use `Saveconfig` to save the configuration.

Therefore, if you configure the module with more than one configuration including the SIGNALGROUP, you should save other configurations first in order to avoid the module rebooting due to the configuration of SIGNALGROUP.

Syntax

```
CONFIG SIGNALGROUP <parameter1> <parameter2>
```

Applicable Products: UM980, UM980C, UM981C, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S

Table 4-58 Signalgroup Configuration Command

Header	Configuration Item	Parameter 1	Parameter 2	Description
CONFIG	SIGNALGROUP	TypeNum	TypeNum	See Table Frequency Combination

Table 4-59 Frequency Combination

TypeNum	Signal Group
0	Disable the slave antenna
1	GPS：L1C/A, L2C, L2P(Y), L5 BDS：B1I, B2I, B3I, B1C, B2a, B2b GLO：G1, G2 GAL：E1, E5a, E5b QZSS：L1C/A, L2C, L5
2	GPS：L1C/A, L1C, L2C, L2P（Y）, L5 BDS：B1I, B2I, B3I, B1C, B2a, B2b GLO：G1, G2, G3 GAL：E1, E5a, E5b, E6 QZSS：L1C/A, L1C, L2C, L5 NavIC：L5
3	GPS：L1C/A, L2C/L2P, L5 BDS：B1I, B3I, B1C, B2b-PPP GLO：G1, G2 GAL：E1, E5a, E5b, E6

TypeNum	Signal Group
	QZSS：L1C/A, L2C, L5, L6E, L6D[6]
4	GPS：L1C/A, L2C/L2P, L5 BDS：B1I, B2I, B3I GLO：G1, G2 GAL：E1, E5a, E5b QZSS：L1C/A, L2C, L5
5	GPS：L1C/A, L2C/L2P BDS：B1I, B2I, B3I GLO：G1, G2 GAL：E1, E5b QZSS：L1C/A, L2C
6	GPS：L1C/A, L2C/L2P BDS：B1I, B3I GAL：E1, E5b QZSS：L1C/A, L2C
7	GPS：L1C/A, L2C/L2P, L5 BDS：B1I, B2I, B3I, B1C, B2a, B2b GLO：G1, G2 GAL：E1, E5a, E5b QZSS：L1C/A, L2C, L5
8	GPS：L1C/A, L2C/L2P, L5 BDS：B1I, B3I, B1C, B2a GAL：E1, E5a, E5b QZSS：L1C/A, L2C, L5
9	GPS: L1C/A, L2P(Y)/L2C, L5 BDS: B1I, B2I, B3I, B1C, B2a, B2b GLO: L1C/A, L2C/A GAL: E1C, E5A, E5B QZSS: L1C/A, L2C, L5
10	GPS：L1C/A, L2C/L2P, L5 BDS：B1I, B2I, B3I, B1C, B2a, B2b GLO：G1, G2 GAL：E1, E5a, E5b, E6 QZSS：L1C/A, L2C, L5, L6E, L6D[6:1]

Table 4-60 Default Signal Group

Products	Default TypeNum		Supported TypeNum		Description
	Master Antenna	Slave Antenna	Master Antenna	Slave Antenna	
UM982	4	5	4	5	/
			3	6	Supports B2b-PPP, L6 MADOCA-PPP and E6 HAS
			5	0	Low power consumption
			7	0	For base station mode only; Supports B2b-PPP
UM982C	3	6	3	6	Firmware with CLAS support is required to support L6D. When using the L-band firmware version, BDS B1C and QZSS L6 are not supported.
UM980 UM981	1		1		/
			2		/
			8		Supports up to 50 Hz. UM980 supports up to 50 Hz positioning and velocity output, and 50 Hz raw data (in RTCM format) output when operating in SIGNALGROUP 8 mode.
			10		/
UM980C UM981C	10		10		Firmware with CLAS support is required to support L6D. When using the L-band firmware version, BDS B1C and QZSS L6 are not supported.

Products	Default TypeNum		Supported TypeNum		Description
	Master Antenna	Slave Antenna	Master Antenna	Slave Antenna	
UB9A0	2		2		/
			9		Supports up to 50 Hz
			10		/

Note:

- BDS-only products (UMD982, UMD980, UBD9A0) support tracking all BDS frequencies: B1I, B2I, B3I, B1C, B2a, and B2b.
- SIGNALGROUP 10 mode is supported on UM980 Build 17548 and later version, as well as on UB9A0 Build 18455 and laterversion.
- In SIGNALGROUP 3 6 mode, UM982 Build 10979 and later version supports 20 Hz positioning data output under specific log requests.

Example

```
CONFIG SIGNALGROUP 1
CONFIG SIGNALGROUP 4 5
```

4.46 CONFIG SMOOTH: SMOOTH Function Configuration

This command is used to set the SMOOTH function when calculating RTK results, heading results, and Doppler velocity in SPPNAV. The SMOOTH function is disabled by default.

Syntax

CONFIG SMOOTH <parameter1> <parameter2> <parameter3(optional)>

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-61 Smooth Parameter Description

Parameter 1	Parameter 2	Parameter 3
RTKHEIGHT	Time length Unit: epoch Value range: 0~100	
HEADING Only for dual-antenna products	[LEVEL] Unit: epoch Value range: 0~100. When the value is 0, it returns to the default state and the SMOOTH function is turned off, simultaneously turning off PITCH SMOOTH	[PITCH] (Optional parameter) Unit: epoch Value range: 0~100
PSRVEL	ENABLE Enable Doppler velocity smoothing in SPPNAV	
DISABLE	DISABLE Disable Doppler velocity smoothing in SPPNAV	

> **Note:** CONFIG SMOOTH HEADING is only applicable to dual-antenna products.

Example

```
CONFIG SMOOTH RTKHEIGHT 10

CONFIG SMOOTH PSRVEL ENABLE

CONFIG SMOOTH HEADING 10

CONFIG SMOOTH HEADING 10 10
```

4.47 CONFIG STANDALONE: STANDALONE Function Configuration

This command configures the STANDALONE function of the receiver. In `STANDALONE` mode, the receiver can maintain centimeter-level positioning accuracy for a period of time even when differential correction data is unavailable.

This mode is recommended for use in open-sky environments. For optimal performance, it is recommended to set the PVT engine to `MULTI` mode using the command `CONFIG PVTALG MULTI`

In certain scenarios, masking low-elevation satellites (via elevation mask settings) can help reduce multipath effects and further improve positioning accuracy.

Syntax

```
CONFIG STANDALONE <parameter1> <parameter2> <parameter3> <parameter4>
```

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 4-62 STANDALONE Parameter Description

Parameter 1	Parameter 2	Parameter 3	Parameter 4
ENABLE	Param1 is the input coordinate: -90 ≤ param1 ≤ 90, latitude in Geodetic Coordinate System, in degrees (11 significant digits)	Param2 is the input coordinate: -180 ≤ param2 ≤ 180, longitude in Geodetic Coordinate System, in degrees (11 significant digits)	Param3 is the input coordinate: -30000 ≤ param3 ≤ 18000, altitude, in meters (6 significant digits)
	Time parameter, which configures the waiting time to automatically enter standalone mode. 3 ≤ param1 ≤ 100, in seconds, default = 100 s.		
	If the parameters are empty, the receiver enters the default mode, using automatically calculated position as the initial value, and it enters the STANDALONE mode after 100 seconds by default.		
TIMEOUT	The duration time of the STANDALONE mode, 1800 ≤ param1 ≤ 86400, in seconds, the default is 86400 s. **Note:** TIMEOUT configuration is not applicable to BDS-only products		
DISABLE	The default configuration		

Examples

```
CONFIG STANDALONE ENABLE 40.113452 114.212234 57.23
CONFIG STANDALONE DISABLE
```

4.48 CONFIG TPIONUSE: TruePoint Quality Factor Service Configuration

This command is used to enable or disable the TruePoint quality factor service on the receiver.

Syntax

```
CONFIG TPIONUSE <type>
```

Applicable Products: UM982

> **Note:** Applicable to UM982 Build 17823 and later versions.

Table 4-63 TPIONUSE Parameter Description

Parameter	Description
ENABLE	Enable the TruePoint Quality Factor service.
DISABLE	Disable the TruePoint Quality Factor service. This is the default value.

Example

```
CONFIG TPIONUSE ENABLE
```

4.49 CONFIG UNDUALTION: UNDUALTION Configuration

This command allows users to enter a specific geoid undulation or use the built-in grid of geoid undulation.

> **Tip:** When setting the receiver to work in base station mode, you should configure the UNDULATION first.

Syntax

```
CONFIG UNDULATION <parameter>
```

Table 4-64 Undulation Parameter

Parameter	Description
Auto	Use the built-in grid of geoid undulation (default)
Separation	Use the user-specified geoid undulation, Unit: meter (m) Range: -1000.0000 m~ +1000.0000 , four digits after the decimal point

Example

```
CONFIG UNDULATION 9.7
```

4.50 CONFIG VELSTDTHD: Velocity STD Threshold Configuration

This command is used to configure the threshold of velocity standard deviation (STD). When the velocity STD exceeds the configured value, the velocity will be marked as invalid.

Syntax

```
CONFIG VELSTDTHD <parameter1> <parameter2> <parameter3>
```

Applicable Products: UM982, UMD982, UB9A0, UM981, UMD981, UMD981S

Table 4-65 Velocity STD Threshold Configuration

Parameter 1	Parameter 2	Parameter 3
ENABLE Enable the velocity STD threshold configuration	<HORSTD> Velocity STD value in the horizontal direction, cm/s, an integer between 10 and 1000, default = 50	<VERSTD> Velocity STD value in the vertical direction, cm/s, an integer between 10 and 1000, default = 50
DISABLE (default) Disable the velocity STD threshold configuration	-	-

Example

```
CONFIG VELSTDTHD ENABLE 120 120
```

5 MASK Command

5.1 MASK: Query the MASK Configuration

High precision receivers support the use of `MASK` command to query the current configuration.

Syntax

```
MASK
```

Application Products UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UM980C

Table 5-1 Query the MASK Configuration

Command	Description
MASK	Query the current MASK configuration

Output

```
$CONFIG,MASK,MASK 5.000000*15
$CONFIG,MASK,MASK GPS*4A
$CONFIG,MASK,MASK 10.000000*21
$CONFIG,MASK,GPSMaskPrn:12,*13
$CONFIG,MASK,QZSSMaskPrn:194,*63
```

Example

```
MASK
```

5.2 MASK: MASK Configuration

`Mask` command is used to disable the receiver tracking specific satellite system and frequency, and to set the elevation mask angle.

Taking the elevation mask angle as an example, the receiver will automatically track satellites above the angle and ignore those below the angle unless the configuration is reset. The default elevation mask angle is 5 degrees.

> **Note:** MASK/UNMASK satellite system and MASK/UNMASK satellite ID cannot be mixed with each other. For example, if you MASK a **<satellite system>**, you cannot UNMASK a specific **<satellite ID>** ; the **UNMASK satellite ID** would not work.

Syntax

```
MASK <frequency/satellite system>
```

```
MASK <elevation angle>
```

```
MASK <satellite system> PRN <satellite ID>
```

```
MASK CN0 <CN0 Value> <frequency (optional)>
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 5-2 MASK Command Parameters (1)

Command	Parameter 1
MASK	<Frequency/satellite system>. See Table Satellite Systems and Frequencies.

Table 5-3 MASK Command Parameters (2)

Command	Parameter 1
MASK	<Elevation angle> (ranging from -90° to 90°; default = 5°)

Table 5-4 MASK Command Parameters (3)

Command	Parameter 1	Fixed Value	Parameter 2
MASK	<Satellite system>	PRN	Satellite ID. See Table Satellite PRN Number in Unicore-Defined Messages.

Table 5-5 MASK RTCMCN0/CN0 Parameters

Command	Configuration Item	Parameter 1	Parameter 2 (Optional)
MASK	RTCMCN0	C/N0, limits the RTCM observation data output	<Frequency>. See Table Satellite Systems and Frequencies. If parameter 2 is null, all frequencies will be configured.
MASK	CN0	C/N0, limits the observation data output of OBSV messages	<Frequency>. See Table Satellite Systems and Frequencies. If parameter 2 is null, all frequencies will be configured.

Note:
Mask RTCMCN0 and MASK CN0 are applicable to UM982 Build9669 and later versions.

Example

```
MASK GPS
Disable the receiver tracking GPS

MASK BDS
Disable the receiver tracking BDS

MASK GLO
Disable the receiver tracking GLONASS

MASK GAL
Disable the receiver tracking Galileo

MASK QZSS
Disable the receiver tracking QZSS

MASK 10
Set the elevation mask angle as 10 degrees

MASK 0
Set the elevation mask angle as 0 degree
```

```
MASK B1
Disable the receiver tracking BDS B1 signal

MASK E5a
Disable the receiver tracking Galileo E5a signal

MASK GPS PRN 10
Disable the receiver tracking GPS No.10 satellite

MASK AZIMUTH 1 20 90 15 45
Disable the receiver tracking satellites with the e levation angle range 20° to 90° and the azimuth angl
e range 15° to 45°
```

5.3 UNMASK: UNMASK Configuration

`UNMASK` command is used to enable the receiver to track specific satellite system and frequency.

Syntax

> UNMASK <frequency/satellite system>

> UNMASK <satellite system> PRN <satellite ID>

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UM980C

Table 5-6 UNMASK Command Parameter (1)

Command	Parameter
UNMASK	`<Frequency/satellite system>` (see Table Satellite Systems and Frequencies.

Table 5-7 UNMASK Command Parameter (2)

Command	Parameter 1	Fixed Value	Parameter 2
UNMASK	`<Satellite system>`	PRN	`<Satellite ID>`. See Table Satellite PRN Number in Unicore-defined Messages.

Example

```
UNMASK GPS
Enable the receiver to track GPS

UNMASK BDS
Enable the receiver to track BDS

UNMASK GLO
Enable the receiver to track GLONASS

UNMASK GAL
Enable the receiver to track Galileo

UNMASK B1
Enable the receiver to track BDS B1 signal

UNMASK E5a
Enable the receiver to track Galileo E5a signal
```

6 Assisted Position and Time

6.1 $AIDPOS: Assisted Position

This command is used to input assisted position (The difference between the assisted position and the actual position should not exceed 10000 m).

Syntax

```
$AIDPOS,Latitude,LatDir,Longitude,LonDir,Altitude
```

Applicable Products: UM982, UMD982, UM980, UMD980, UB9A0, UBD9A0, UM981, UMD981, UM981S, UMD981S, UM980C

Table 6-1 Assisted Position Parameters

ID	Parameter	Type	Description
1	Latitude	DOUBLE	Latitude, the format is ddmm.mmmmmm dd – degrees mm.mmmmmm – minutes
2	LatDir	Str	North or South latitude indicator N – North latitude S – South latitude
3	Longitude	DOUBLE	Longitude, the format is dddmm.mmmmmm ddd – degrees mm.mmmmmm – minutes
4	LonDir	Str	East or West longitude indicator E – East longitude W – West longitude
5	Altitude	DOUBLE	Ellipsoidal height, meters

Example

```
$AIDPOS,4002.229934,N,11618.096855,E,37.254
```

6.2 $AIDTIME: Assisted Time

This command is used to input assisted time (UTC time +/- 3 s).

Syntax

```
$AIDTIME,Year,Month,Day,Hour,Minute,Second,Millisecond,Leapsec
```

Applicable Products: UM982, UMD982, UM980, UMD980, UB9A0, UBD9A0, UM981, UMD981, UM981S, UMD981S, UM980C

Table 6-2 Assisted Time Parameters

ID	Parameter	Type	Description
1	Year	UINT	Year
2	Month	UINT	Month
3	Day	UINT	Day
4	Hour	UINT	Hour
5	Minute	UINT	Minute
6	Second	UINT	Second
7	Millisecond	UINT	Millisecond
8	Leapsec	UINT	Leap second

Example

```
$AIDTIME,2021,12,3,15,2,36,400,18
```

7 Data Output Commands

Data output commands are used to output positioning and heading information, including:

- NMEA standard commands,
- Unicore-extended NMEA format commands,
- Unicore-defined commands,

Syntax

```
Command <Port(optional)> <Output frequency/ ONCHANGED(optional)>
```

- `<Port>` and `<Output frequency>` are optional parameters. When `<Port>` is not specified, messages will be output through the current port by default
- When `<Output frequency>` is not specified, messages will be output only once.
- The `ONCHANGED` output frequency is non-fixed. After the initial message output, subsequent outputs only occur when the message content changes. This request mode is only applicable to specific Unicore-format messages. Refer to individual message sections for details.
- Currently supported output frequencies include:
    - 1 Hz (parameter: 1)
    - 2 Hz (parameter: 0.5)
    - 5 Hz (parameter: 0.2)
    - 10 Hz (parameter: 0.1)
    - 20 Hz (parameter: 0.05)
    - 50 Hz[7] (parameter: 0.02)

Example

```
GPGGA 1

GPGGA COM2 1

GPSIONA ONCHANGED

OBSVBASEA COM1 ONCHANGED
```

```
VERSIONA
```

7.1 NMEA Message Output Commands

When requesting NMEA messages, users should add **GP** before each command name, such as GPGSV, GPGGA, etc. Do not use other characters such as **GB**, **GL**, **GA** or **GN** to request messages.

In the message output, GP represents GPS, GB represents BDS … GN represents GNSS multi-system joint positioning (**but the input command is still GP**).

Table Satellite Systems and Abbreviations shows the symbols corresponding to each satellite system.

Table 7-1 Satellite Systems and Abbreviations (4.10)

Satellite System	Input Command	Output Message
GPS	GP--	GP----
BDS	GP--	GB---
GLONASS	GP--	GL---
Galileo	GP--	GA---
QZSS	GP--	GQ---
Multi-system joint positioning	GP--	GN---

7.2 NMEA V4.10 (Default)

7.2.1 GPDTM: Datum Reference

This message contains local geodetic datum information, including latitude, longitude, offset, etc.

ASCII Syntax

Output 1 Hz GPDTM message at the current port

```
GPDTM 1
```

Output 1 Hz GPDTM message at COM2

```
GPDTM COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UM980C

Output

```
$GNDTM,W84,,0.0,N,0.0,E,0.0,W84*71
```

Table 7-2 DTM Message Structure

ID	Field	Description	Symbol
1	$--DTM	Log header	
2	Datum code	Local datum code: W84 = WGS84 W72 = WGS72 S85 = SGS85 P90 = PE90 999 = User defined IHO datum code **Note:** If the datum is not in the above list, use the IHO datum code. If the datum is unknown, this field is null.	ccc
3	Sub code	One character subdivision datum code when available or user defined reference character for user defined datums, null field otherwise.	a
4	Lat offset	Latitude offset, minutes, N/S, accurate to 1 decimal place	x.x
5	Lat dir	Latitude offset direction (N, S)	a
6	Lon offset	Longitude offset, minutes, E/W, accurate to 1 decimal place	x.x
7	Lon dir	Longitude offset direction (E, W)	a
8	Alt offset	Altitude offset, meters, accurate to 1 decimal place	x.x
9	Rf datum code	Reference datum code: W84 = WGS84 W72 = WGS72 S85 = SGS85 P90 = PE90	ccc
10	*xx	Checksum	

ID	Field	Description	Symbol
11	[CR][LF]	Sentence terminator	

7.2.2 GPGBS: GNSS Satellite Fault Detection

This message is used to support RAIM (Receiver Autonomous Integrity Monitoring). It contains information of the failed satellites.

ASCII Syntax

Output 1 Hz GPGBS message at the current port

```
GPGBS 1
```

Output 1 Hz GPGBS message at COM2

```
GPGBS COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGBS,023509.00,0.5,0.4,1.3,39,0.0,2.1,10.6,5,6*42
```

Table 7-3 GBS Message Structure

Field	Name	Description	Format
1	$--GBS	Log header	
2	Utc	UTC time of the position fix (hhmmss.ss)	hhmmss.ss
3	Lat exp	Expected error in latitude, meters accurate to 1 decimal place	x.x
4	Lon exp	Expected error in longitude, meters accurate to 1 decimal place	x.x
5	Alt exp	Expected error in altitude, meters accurate to 1 decimal place	x.x
6	SatID	ID number of failed satellite GPS: 1~32	x.x

Field	Name	Description	Format
		GLONASS: 65~99 Galileo: 1~36, 37~64 SBAS: 33~64	
7	Pro	Probability of missed detection for failed satellite	x.x
8	est	Estimate of bias on failed satellite, meters accurate to 1 decimal place	x.x
9	Dev std	Standard deviation of bias estimate	x.x
10	SysID	GNSS system ID. See Table GNSS ID	h
11	SigID	GNSS signal ID. See Table GNSS ID	h
12	*xx	Checksum	
13	[CR][LF]	Sentence terminator	

7.2.3 GPGGA: Global Positioning System Fix Data

This command is used to output time, position, and fix related data.

ASCII Syntax

Output 1 Hz GPGGA message at the current port

```
GPGGA 1
```

Output 1 Hz GPGGA message at COM2

```
GPGGA COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UM980C, UMD980, UB9A0, UBD9A0, UM982, UM982C, UMD982, UM981, UM981C, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGGA,023634.00,4004.73871635,N,11614.19729418,E,1,28,0.7,61.0988,M,-8.4923,M,,*58
```

Table 7-4 GGA Message Structure

ID	Field	Description	Symbol
1	$--GGA	Log header	
2	utc	UTC of the position, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	llll.ll
4	lat dir	Latitude direction (N = North, S = South)	a
5	lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
6	lon dir	Longitude direction (E = East, W = West)	a
7	qual	GPS quality indicator 0 = Fix not available or invalid 1 = Single point positioning 2 = Differential positioning 3 = GPS PPS mode 4 = RTK Int 5 = RTK Float 6 = Dead reckoning mode 7 = Manual input mode 8 = Simulator mode	x
8	# sats	Number of satellites in use, may be different from the number in view.	xx
9	hdop	Horizontal dilution of precision, accurate to 1 decimal place	x.x
10	alt	Altitude above/below MSL (geoid), accurate to 4 decimal places	x.x
11	a-units	Unit of altitude (M = m)	M
12	undulation	Geoidal separation, the difference between the Earth ellipsoid surface and mean-sea-level (geoid) surface.	x.x

ID	Field	Description	Symbol
		If the geoid is above the ellipsoid, the value is positive; otherwise, it is negative. Accurate to 4 decimal places.	
13	u-units	Unit of geoidal separation (M = m)	M
14	diff_age	Age of differential data, in seconds (Time since last SC104 Type 1 or 9 update), accurate to 1 decimal places. Null field when differential positioning is not used.	x.x
15	stn ID	Differential station ID, 0000~4095 Satellite-Based Differential Station ID range: 9001~9999 If positioning type is B2b, Station ID is one of: 9901, 9902, 9903, 9904, 9905, 9959, 9960, 9961. If positioning type is E6 HAS, Station ID is fixed to: 9964. If positioning type is QZSS L6 MDC, Station ID is one of: 9934, 9935, 9936, 9939. If positioning type is QZSS L6CLAS, Station ID is one of: 9974, 9975, 9976, 9979. If positioning type is L-band, Station ID follows the format: 999X (where X is a digit).	xxxx
16	*xx	Checksum	*hh
17	[CR][LF]	Sentence terminator	

7.2.4 GPGLL: Geographic Position

This command is used to output geographic longitude/latitude information.

ASCII Syntax

Output 1 Hz GPGLL message at the current port

```
GPGLL 1
```

Output 1 Hz GPGLL message at COM2

```
GPGLL COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UM980C

Output

```
$GNGLL,4004.73885655,N,11614.19746477,E,023842.00,A,A*75
```

Table 7-5 GLL Message Structure

ID	Field	Description	Symbol
1	$--GLL	Log header	
2	lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	llll.ll
3	lat dir	Latitude direction (N = North, S = South)	a
4	lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
5	lon dir	Longitude direction (E = East, W = West)	a
6	Utc	UTC, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
7	status	Status: V = Data not valid A = Adaptive D = Differential	A
8	mode ind	Mode indicator: N = Data not valid A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode M = Manual input mode S = Simulator mode	a
9	*xx	Checksum	*hh
10	[CR][LF]	Sentence terminator	

7.2.5 GPGNS: GNSS Fix Data

This command is used to output GNSS fix data.

ASCII Syntax

Output 1 Hz GPGNS message at the current port

```
GPGNS 1
```

Output 1 Hz GPGNS message at COM2

```
GPGNS COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGNS,024034.00,4004.73854216,N,11614.19720023,E,ANAAA,28,0.8,61.6865,-8.4923,,,S*4E
```

Table 7-6 GNS Message Structure

ID	Field	Description	Symbol
1	$--GNS	Log header	
2	utc	UTC, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	Lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	llll.ll
4	Lat dir	Latitude direction (N = North, S = South)	a
5	Lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
6	Lon dir	Longitude direction (E = East, W = West)	a

ID	Field	Description	Symbol
7	mode	Mode indicator. The length of this field is variable, with the first 3 characters indicating GPS, GLONASS, and Galileo. Each satellite system takes one of the following values: A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode F = RTK Float M = Manual input mode N = No fix P = High precision mode R = RTK Int S = Simulator mode	c--c
8	Use sat	Number of satellites in use, 00-99.	xx
9	Hdop	Horizontal dilution of precision (HDOP), accurate to 1 decimal place	x.x
10	Ant alt	Antenna altitude, meters, re: mean-sea-level (geoid), accurate to 4 decimal places	x.x
11	Geo sep	Geoidal separation, the difference between the Earth ellipsoid surface and mean-sea-level (geoid) surface, meters. If the geoid is above the ellipsoid, the value is positive; otherwise, it is negative. Accurate to 4 decimal places.	x.x
12	Diff_Age[8]	Age of differential data, seconds, accurate to 1 decimal places. Null field when differential positioning is not used.	x.x
13	Station id[8:1]	2Differential reference station ID. Null field when differential positioning is not used.	x.x
14	status	Navigational status indicator S = Safe C = Caution U = Unsafe V = Navigational status not valid	a
15	*xx	Checksum	*hh
16	[CR][LF]	Sentence terminator	

> **Note:** If the log header is $GNGNS and more than one satellite systems are used in differential mode, the age of differential data (field 12) and differential reference station ID (field 13) are null.

7.2.6 GPGRS: GNSS Range Residuals

This command is used to output the range residuals for satellites used in the navigation solution. It supports RAIM (Receiver Autonomous Integrity Monitoring).

ASCII Syntax

Output 1 Hz GPGRS message at the current port

```
GPGRS 1
```

Output 1 Hz GPGRS message at COM2

```
GPGRS COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGRS,024356.00,0,0.1,0.2,0.1,0.2,0.4,,,,,,,,1,1*7D
$GNGRS,024356.00,0,0.1,0.1,0.3,0.1,0.2,,,,,,,,1,4*7C
$GNGRS,024356.00,0,0.1,,0.1,0.0,0.1,,,,,,,,1,8*5F
$GNGRS,024356.00,0,0.7,0.2,0.4,0.1,,,,,,,,,3,7*53
$GNGRS,024356.00,0,0.1,0.1,0.1,0.1,,,,,,,,,3,1*55
$GNGRS,024356.00,0,0.1,0.1,0.1,0.1,,,,,,,,,3,2*56
$GNGRS,024356.00,0,0.2,1.4,0.7,0.2,0.7,0.5,0.2,0.2,0.3,0.3,0.6,1.0,4,1*55
$GNGRS,024356.00,0,1.8,0.3,0.3,0.6,1.2,,,,,,,,4,1*70
$GNGRS,024356.00,0,0.2,0.3,0.2,0.1,0.3,0.2,0.2,0.1,0.1,0.1,0.2,0.1,4,8*58
$GNGRS,024356.00,0,0.3,0.1,0.1,0.1,0.2,,,,,,,,4,8*75
$GNGRS,024356.00,0,0.2,0.4,0.2,0.2,0.2,0.2,0.6,0.2,,,,,4,11*61
$GNGRS,024356.00,0,0.2,0.7,,,,,,,,,,,5,1*56
$GNGRS,024356.00,0,0.1,0.2,,,,,,,,,,,5,6*57
$GNGRS,024356.00,0,0.1,0.1,,,,,,,,,,,5,8*5A
```

Table 7-7 GRS Message Structure

ID	Field	Description	Symbol
1	$--GRS	Log header	
2	Utc	UTC time of GGA/GNS fix associated with this sentence, in the format of hhmmss.ss hh - Hour mm - Minute ss.ss - Second	hhmmss.ss
3	Mode	Mode: 0 = residuals were used to calculate the position given in the matching GGA/GNS sentence 1 = residuals were recomputed after the GGA/GNS position was computed	x
4	Res	Range residuals for satellites used in the navigation solution, in meters. Range: ± 999, accurate to 1 decimal place. If the range residual exceeds ± 99.9, then the decimal part is dropped, resulting in an integer (for example, -103.7 becomes -103)	x.x
5			x.x
6			x.x
7			x.x
8			x.x
9			x.x
10			x.x
11			x.x
12			x.x
13			x.x
14			x.x
15			x.x
16	Sys id	GNSS system ID, see Table GNSS ID	h
17	Signal id	GNSS signal ID, see Table GNSS ID	h
18	*xx	Checksum	*hh
19	[CR][LF]	Sentence terminator	

7.2.7 GPGSA: GNSS DOP and Active Satellites

This command is used to output the receiver operating mode, satellites used in the navigation solution, DOP (Dilution of Precision), etc.

ASCII Syntax

Output 1 Hz GPGSA message at the current port

```
GPGSA 1
```

Output 1 Hz GPGSA message at COM2

```
GPGSA COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGSA,M,3,10,12,23,25,32,,,,,,,,1.7,0.7,1.5,1*3D
$GNGSA,M,3,05,09,24,31,,,,,,,,,1.7,0.7,1.5,3*32
$GNGSA,M,3,01,02,03,06,08,09,13,16,19,20,36,37,1.7,0.7,1.5,4*34
$GNGSA,M,3,38,39,46,59,60,,,,,,,,1.7,0.7,1.5,4*34
$GNGSA,M,3,02,07,,,,,,,,,,,1.7,0.7,1.5,5*39
```

Table 7-8 GSA Message Structure

ID	Field	Description	Symbol
1	$--GSA	Log header	
2	mode MA	Satellite operating mode: M = Manual, forced to operate in 2D or 3D mode A = Automatic, allowed to automatically switch 2D/3D	a
3	mode 123	Positioning mode: 1 = Fix not available 2 = 2D 3 = 3D	x
4	prn	ID numbers of satellites used in solution, see Table Satellite ID Numbers in NMEA Messages	xx
5			xx
6			xx

ID	Field	Description	Symbol
7			xx
8			xx
9			xx
10			xx
11			xx
12			xx
13			xx
14			xx
15			xx
16	pdop	PDOP, accurate to 1 decimal place	x.x
17	hdop	HDOP, accurate to 1 decimal place	x.x
18	vdop	VDOP, accurate to 1 decimal place	x.x
19	SysID	GNSS system ID, see Table GNSS ID	h
20	*xx	Checksum	*hh
21	[CR][LF]	Sentence terminator	

7.2.8 GPGST: GNSS Pseudorange Error Statistics

This command is used to output pseudorange measurement error statistics.

ASCII Syntax

Output 1 Hz GPGST message at the current port

```
GPGST 1
```

Output 1 Hz GPGST message at COM2

```
GPGST COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGST,054013.00,0.67,1.67,1.37,115.3800,1.432,1.620,3.399*41
```

Table 7-9 GST Message Structure

ID	Field	Description	Symbol
1	$--GST	Log header	
2	utc	UTC time of the GGA/GNS fix associated with this sentence, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	rms	Standard deviation of pseudoranges and DGNSS corrections (RMS value), accurate to 2 decimal places	x.x
4	smjr std	Standard deviation of semi-major axis of error ellipse (m), accurate to 2 decimal places	x.x
5	smnr std	Standard deviation of semi-minor axis of error ellipse (m), accurate to 2 decimal places	x.x
6	orient	Orientation of semi-major axis of error ellipse (degrees from true north), accurate to 4 decimal places	x.x
7	lat std	Standard deviation of latitude error (m), accurate to 3 decimal places	x.x
8	lon std	Standard deviation of longitude error (m), accurate to 3 decimal places	x.x
9	alt std	Standard deviation of altitude error (m), accurate to 3 decimal places	x.x
10	*xx	Checksum	*hh
11	[CR][LF]	Sentence terminator	

7.2.9 GPGSV: GNSS Satellites in View

This command is used to output the number of satellites in view, satellite ID numbers, etc.

ASCII Syntax

Output 1 Hz GPGSV message at the current port

```
GPGSV 1
```

Output 1 Hz GPGSV message at COM2

```
GPGSV COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GPGSV,2,1,06,32,48,134,47,31,70,011,46,25,24,046,32,29,27,081,39,1*61
$GPGSV,2,2,06,26,60,213,46,16,20,213,30,1*64
$GPGSV,2,1,05,32,48,134,43,31,70,011,43,25,24,046,34,29,27,081,37,4*6E
$GPGSV,2,2,05,26,60,213,44,4*56
$GPGSV,1,1,03,32,48,134,49,25,24,046,41,26,60,213,50,8*59
$GLGSV,2,1,06,82,04,015,32,71,34,167,43,65,36,322,37,73,27,042,37,1*72
$GLGSV,2,2,06,74,66,350,47,72,76,245,48,1*73
$GLGSV,2,1,05,82,04,015,28,71,34,167,43,65,36,322,32,73,27,042,39,3*73
$GLGSV,2,2,05,72,76,245,45,3*49
$GBGSV,6,1,21,36,72,016,49,19,24,172,36,39,75,082,50,30,13,111,38,1*7B
$GBGSV,6,2,21,10,30,201,35,27,10,062,32,01,34,140,40,07,40,195,39,1*74
$GBGSV,6,3,21,16,78,051,49,22,59,233,48,09,69,327,45,59,38,144,43,1*73
$GBGSV,6,4,21,03,42,188,39,04,25,124,36,40,48,180,45,45,41,261,40,1*7D
$GBGSV,6,5,21,60,28,227,36,02,33,224,32,46,25,059,35,21,32,308,35,1*7F
$GBGSV,6,6,21,06,79,008,47,1*46
$GBGSV,4,1,15,36,72,016,33,19,24,172,29,39,75,082,34,30,13,111,25,8*7A
$GBGSV,4,2,15,10,30,201,23,27,10,062,22,07,40,195,27,16,78,051,29,8*71
$GBGSV,4,3,15,22,59,233,32,09,69,327,28,40,48,180,31,45,41,261,27,8*7E
$GBGSV,4,4,15,46,25,059,24,21,32,308,22,06,79,008,30,8*4E
$GBGSV,3,1,10,10,30,201,40,01,34,140,45,07,40,195,44,16,78,051,49,B*0E
$GBGSV,3,2,10,09,69,327,48,03,42,188,45,04,25,124,42,02,33,224,41,B*0D
$GBGSV,3,3,10,05,16,248,37,06,79,008,48,B*00
$GAGSV,2,1,07,05,71,159,50,09,20,141,41,03,49,308,44,31,11,046,32,1*74
$GAGSV,2,2,07,02,10,226,38,24,59,047,47,25,60,226,48,1*4D
$GAGSV,2,1,07,05,71,159,52,09,20,141,42,03,49,308,47,31,11,046,34,2*73
$GAGSV,2,2,07,02,10,226,41,24,59,047,50,25,60,226,51,2*4E
$GAGSV,2,1,07,05,71,159,48,09,20,141,35,03,49,308,39,31,11,046,29,7*78
$GAGSV,2,2,07,02,10,226,27,24,59,047,45,25,60,226,45,7*4A
$GQGSV,1,1,02,02,70,095,46,07,42,163,35,1*6F
```

```
$GQGSV,1,1,02,02,70,095,46,07,42,163,40,6*6A
$GQGSV,1,1,02,02,70,095,50,07,42,163,47,8*64
```

Table 7-10 GSV Message Structure

ID	Field	Description	Symbol
1	$--GSV	Log header	
2	# msgs	Total number of GSV messages, 1~9	x
3	msg #	GSV message number, 1~9	x
4	# sats	Total number of satellites in view	xx
5	Sat id	Satellite ID number, see Table Satellite ID Numbers in NMEA Messages	xx
6	Elevation	Elevation, an integer in degrees, maximum value 90°	xx
7	Azi	Azimuth, degrees True, an integer within 000~359	xxx
8	CN0	Carrier to noise ratio (C/N0), an integer within 0 ~ 99 dB-Hz, null when not tracking	xx
9	Next sat	The 2nd ~ 3rd SV, a variable number of "Satellite ID-Elevation-Azimuth-SNR" sets are allowed up to a maximum of four sets per sentence. Null fields are not required for unused sets when less than four sets are transmitted.	xx
10			xx
11			xx
12			xx
13		The 4th SV, a variable number of "Satellite ID-Elevation-Azimuth-SNR" sets are allowed up to a maximum of four sets per sentence. Null fields are not required for unused sets when less than four sets are transmitted.	xx
14			xx
15			xxx
16			xx
17	SignalID	GNSS signal ID, see GNSS ID	h
18	*xx	Checksum	*hh
19	[CR][LF]	Sentence terminator	

7.2.10 GPTHS: True Heading and Status

This command is used to output true heading and status.

As defined by the NMEA Protocol, the THS message replaces the HDT message.

ASCII Syntax

Output 1 Hz GPTHS message at the current port

```
GPTHS 1
```

Output 1 Hz GPTHS message at COM2

```
GPTHS COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GNTHS,341.3344,A*1F
```

Table 7-11 THS Message Structure

Field	Name	Description	Format
1	$--THS	Log header	
2	Heading	Heading, 0.00~360.00 Unit: degrees, accurate to 4 decimal places. Baseline solution from dual-antenna configuration (direction from master to slave antenna)	x.x
3	Mode	Mode indicator: A = Autonomous E = Estimated (dead reckoning) M = Manual input S = Simulator V = Data not valid	a
4	*xx	Checksum	*hh
5	[CR][LF]	Sentence terminator	

7.2.11 GPRMC: Recommended Minimum Specific GNSS Data

This command is used to output time, date, position, velocity, etc.

ASCII Syntax

Output 1 Hz GPRMC message at the current port

```
GPRMC 1
```

Output 1 Hz GPRMC message at COM2

```
GPRMC COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNRMC,054733.00,A,4004.73893635,N,11614.19823325,E,0.002,155.1,301221,6.9,W,A,V*4B
```

Table 7-12 RMC Message Structure

ID	Field	Description	Symbol
1	$--RMC	Log header	
2	utc	UTC of position fix, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	pos status	Status: A = Data valid V = Navigation receiver warning	A
4	lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	llll.ll
5	lat dir	Latitude direction (N = North, S = South)	a
6	lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
7	lon dir	Longitude direction (E = East, W = West)	a
8	speed Kn	Speed over ground, knots, accurate to 3 decimal places	x.x

ID	Field	Description	Symbol
9	track true	Course over ground, degrees True, measured clockwise from the North, accurate to 1 decimal place	x.x
10	date	Date: ddmmyy	xxxxxx
11	mag var	Magnetic variation, degrees, accurate to 1 decimal place	x.x
12	var dir	Magnetic variation direction	a
13	mode ind	Mode indicator: A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode F = RTK Float M = Manual input mode N = No fix P = High precision mode R = RTK int S = Simulator mode V = Mode invalid (except for A and D)	a
14	mode status	Navigational status: S = Safe C = Caution U = Unsafe V = Navigational status not valid	a
15	*xx	Checksum	*hh
16	[CR][LF]	Sentence terminator	

7.2.12 GPROT: Rate of Turn

This command is used to output the rate of turn and direction of turn.

ASCII Syntax

Output 1 Hz GPROT message at the current port

```
GPROT 1
```

Output 1 Hz GPROT message at COM2

```
GPROT COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GNROT,0.0,V*38
```

Table 7-13 ROT Message Structure

Field	Name	Description	Format
1	$--ROT	Log header	
2	Rate	Rate of turn, degrees per minute	x.x
3	Status	Status: A = Data valid V = Data not valid	A
4	*xx	Checksum	*hh
5	[CR][LF]	Sentence terminator	

7.2.13 GPVTG: Course over Ground and Ground Speed

This command is used to output the actual course and speed relative to the ground.

ASCII Syntax

Output 1 Hz GPVTG message at the current port

```
GPVTG 1
```

Output 1 Hz GPVTG message at COM2

```
GPVTG COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNVTG,335.750,T,342.678,M,0.00437,N,0.00810,K,A*3F
```

Table 7-14 VTG Message Structure

ID	Field	Description	Symbol
1	$--VTG	Log header	
2	Course true	Course over ground, degrees True, accurate to 3 decimal places	x.x
3	Course ind	Course indicator, a fixed character of T	T
4	Course mag	Course over ground, degrees Magnetic, accurate to 3 decimal places	x.x
5	Course ind	Course indicator, a fixed character of M	M
6	speed Kn	Speed over ground, knots, accurate to 5 decimal places	x.x
7	N	Unit of speed, a fixed character of N	N
8	speed Km	Speed over ground, km/h, accurate to 5 decimal places	x.x
9	K	Unit of speed, a fixed character of K	K
10	Mode ind	Mode indicator: A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode M = Manual input mode N = Data not valid P = High precision mode S = Simulator mode	xxxxxx
11	*xx	Checksum	*hh
12	[CR][LF]	Sentence terminator	

7.2.14 GPZDA: Time and Date

This command is used to output UTC, day, month, year, etc.

ASCII Syntax

Output 1 Hz GPZDA message at the current port

```
GPZDA 1
```

Output 1 Hz GPZDA message at COM2

```
GPZDA COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNZDA,054931.00,30,12,2021,,*73
```

Table 7-15 ZDA Message Structure

ID	Field	Description	Symbol
1	$--ZDA	Log header	
2	Utc	UTC, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	Day	Day, 01~31	xx
4	Month	Month, 01~12	xx
5	Year	Year	xxxx
6	Local zone hour	Local zone hours, 00~±13	xx
7	Local zone minute	Local zone minutes, 00~±59	xx
8	*xx	Checksum	*hh
9	[CR][LF]	Sentence terminator	

7.3 NMEA V4.11

7.3.1 GPDTM: Datum Reference

This message contains local geodetic datum information, including latitude, longitude, offset, etc.

ASCII Syntax

Output 1 Hz GPDTM message at the current port

```
GPDTM 1
```

Output 1 Hz GPDTM message at COM2

```
GPDTM COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNDTM,W84,,0.0,N,0.0,E,0.0,W84*71
```

Table 7-16 DTM Message Structure

ID	Field	Description	Symbol
1	$--DTM	Log header	
2	Datum code	Local datum code: W84 = WGS84 W72 = WGS72 S85 = SGS85 P90 = PE90 999 = User defined IHO datum code **Note:** If the datum is not in the above list, use the IHO datum code. If the datum is unknown, this field is null.	ccc
3	Sub code	One character subdivision datum code when available or user defined reference character for user defined datums, null field otherwise.	a
4	Lat offset	Latitude offset, minutes, N/S, accurate to 1 decimal place	x.x
5	Lat dir	Latitude offset direction (N, S)	a
6	Lon offset	Longitude offset, minutes, E/W, accurate to 1 decimal place	x.x
7	Lon dir	Longitude offset direction (E, W)	a
8	Alt offset	Altitude offset, meters, accurate to 1 decimal place	x.x

ID	Field	Description	Symbol
9	Rf datum code	Reference datum code: W84 = WGS84 W72 = WGS72 S85 = SGS85 P90 = PE90	ccc
10	*xx	Checksum	
11	[CR][LF]	Sentence terminator	

7.3.2 GPGBS: GNSS Satellite Fault Detection

This message is used to support RAIM (Receiver Autonomous Integrity Monitoring). It contains information of the failed satellites.

ASCII Syntax

Output 1 Hz GPGBS message at the current port

```
GPGBS 1
```

Output 1 Hz GPGBS message at COM2

```
GPGBS COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGBS,055214.00,0.3,0.3,0.8,45,0.0,-1.2,8.4,4,1*58
```

Table 7-17 GBS Data Structure

ID	Field	Description	Symbol
1	$--GBS	Log header	
2	Utc	UTC time of the position fix, in the format of hhmmss.ss hh – Hour mm – Minute	hhmmss.ss

ID	Field	Description	Symbol
		ss.ss – Second	
3	Lat exp	Expected error in latitude, meters, accurate to 1 decimal place	x.x
4	Lon exp	Expected error in longitude, meters, accurate to 1 decimal place	x.x
5	Alt exp	Expected error in altitude, meters, accurate to 1 decimal place	x.x
6	ID	ID number of failed satellite GPS:1~32 BDS:1~64 GLONASS:65~96 Galileo:1~36, 37~64 SBAS:33~64	x.x
7	pro	Probability of missed detection for failed satellite, accurate to 1 decimal place	x.x
8	est	Estimate of bias on failed satellite, in meters, accurate to 1 decimal place	x.x
9	Dev std	Standard deviation of bias estimate, accurate to 1 decimal place	x.x
10	Sys id	GNSS system ID, see Table GNSS ID	h
11	Signal id	GNSS signal ID, see Table GNSS ID	h
12	*xx	Checksum	
13	[CR][LF]	Sentence terminator	

7.3.3 GPGGA: Global Positioning System Fix Data V4.11

This command is used to output time, position, and fix related data.

ASCII Syntax

Output 1 Hz GPGGA message at the current port

```
GPGGA 1
```

Output 1 Hz GPGGA message at COM2

```
GPGGA COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UM980C, UMD980, UB9A0, UBD9A0, UM982, UM982C, UMD982, UM981, UM981C, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGGA,055234.00,4004.73879510,N,11614.19821957,E,1,28,0.7,61.8089,M,-8.4923,M,,*50
```

Table 7-18 GGA Message Structure

ID	Field	Description	Symbol
1	$--GGA	Log header	
2	utc	UTC of the position, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	llll.ll
4	lat dir	Latitude direction (N = North, S = South)	a
5	lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
6	lon dir	Longitude direction (E = East, W = West)	a
7	qual	GPS quality indicator 0 = Fix not available or invalid 1 = Single point positioning 2 = Differential positioning 3 = GPS PPS mode 4 = RTK Int 5 = RTK Float 7 = Manual input mode 8 = Simulator mode	x
8	# sats	Number of satellites in use, may be different from	xx

ID	Field	Description	Symbol
		the number in view.	
9	hdop	Horizontal dilution of precision, accurate to 1 decimal place	x.x
10	alt	Altitude above/below MSL (geoid), accurate to 4 decimal places	x.x
11	a-units	Unit of altitude (M = m)	M
12	undulation	Geoidal separation, the difference between the Earth ellipsoid surface and mean-sea-level (geoid) surface. If the geoid is above the ellipsoid, the value is positive; otherwise, it is negative. Accurate to 4 decimal places.	x.x
13	u-units	Unit of geoidal separation (M = m)	M
14	diff_age	Age of differential data, in seconds (Time since last SC104 Type 1 or 9 update), accurate to 1 decimal places. Null field when differential positioning is not used.	x.x
15	stn ID	Differential station ID, 0000~4095 Satellite-Based Differential Station ID range: 9001~9999 If positioning type is B2b, Station ID is one of: 9901, 9902, 9903, 9904, 9905, 9959, 9960, 9961. If positioning type is E6 HAS, Station ID is fixed to: 9964. If positioning type is QZSS L6 MDC, Station ID is one of: 9934, 9935, 9936, 9939. If positioning type is QZSS L6CLAS, Station ID is one of: 9974, 9975, 9976, 9979. If positioning type is L-band, Station ID follows the format: 999X (where X is a digit).	xxxx
16	*xx	Checksum	*hh
17	[CR][LF]	Sentence terminator	

7.3.4 GPGLL: Geographic Position

This command is used to output geographic longitude/latitude information.

ASCII Syntax

Output 1 Hz GPGLL message at the current port

```
GPGLL 1
```

Output 1 Hz GPGLL message at COM2

```
GPGLL COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGLL,4004.73879998,N,11614.19807677,E,055322.00,A,A*7C
```

Table 7-19 GLL Message Structure

ID	Field	Description	Symbol
1	$--GLL	Log header	
2	lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	llll.ll
3	lat dir	Latitude direction (N = North, S = South)	a
4	lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
5	lon dir	Longitude direction (E = East, W = West)	a
6	Utc	UTC, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
7	status	Status: A = Data valid V = Data not valid D = Differential	A
8	mode ind	Mode indicator:	a

ID	Field	Description	Symbol
		N = Data not valid A = Autonomous mode D = Differential mode M = Manual input mode S = Simulator mode	
9	*xx	Checksum	*hh
10	[CR][LF]	Sentence terminator	

7.3.5 GPGNS: GNSS Fix Data

This command is used to output GNSS fix data.

ASCII Syntax

Output 1 Hz GPGNS message at the current port

```
GPGNS 1
```

Output 1 Hz GPGNS message at COM2

```
GPGNS COM2 1
```

Output

```
$GNGNS,060920.00,4004.73891567,N,11614.19148292,E,AAAAA,28,0.7,62.5759,-8.4925,,,S*4C
```

Table 7-20 GNS Message Structure

ID	Field	Description	Symbol
1	$--GNS	Log header	
2	Utc	UTC, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	Lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree	llll.ll

ID	Field	Description	Symbol
		mm.mmmmmmmm – Minute	
4	Lat dir	Latitude direction (N = North, S = South)	a
5	Lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
6	Lon dir	Longitude direction (E = East, W = West)	a
7	Mode	Mode indicator. The length of this field is variable, with the first 6 characters indicating GPS, GLONASS, Galileo, BDS, QZSS, and NavIC (IRNSS). Each satellite system takes one of the following values: A = Autonomous mode D = Differential mode F = RTK Float M = Manual input mode N = No fix P = High precision mode R = RTK Int S = Simulator mode	c--c
8	Use sat	Number of satellites in use, 00-99	xx
9	Hdop	Horizontal dilution of precision (HDOP), accurate to 1 decimal place	x.x
10	Ant alt	Antenna altitude, meters, re: mean-sea-level (geoid), accurate to 4 decimal places	x.x
11	Geo sep	Geoidal separation, the difference between the Earth ellipsoid surface and mean-sea-level (geoid) surface, meters. If the geoid is above the ellipsoid, the value is positive; otherwise, it is negative. Accurate to 4 decimal places.	x.x
12	Diff_Age[8:2]	Age of differential data, seconds, accurate to 1 decimal places. Null field when differential positioning is not used.	x.x
13	Station id[8:3]	Differential reference station ID. Null field when differential positioning is not used.	x.x

ID	Field	Description	Symbol
14	status	Navigational status indicator S = Safe C = Caution U = Unsafe V = Navigational status not valid	a
15	*xx	Checksum	*hh
16	[CR][LF]	Sentence terminator	

> **Note:** If the log header is $GNGNS and more than one satellite systems are used in differential mode, the age of differential data (field 12) and differential reference station ID (field 13) are null.

7.3.6 GPGRS: GNSS Range Residuals

This command is used to output the range residuals for satellites used in the navigation solution. It supports RAIM (Receiver Autonomous Integrity Monitoring).

ASCII Syntax

Output 1 Hz GPGRS message at the current port

```
GPGRS 1
```

Output 1 Hz GPGRS message at COM2

```
GPGRS COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGRS,055557.00,0,1.5,0.0,0.4,0.1,0.1,,,,,,,,1,1*78
$GNGRS,055557.00,0,,0.2,0.5,0.1,0.2,,,,,,,,1,4*57
$GNGRS,055557.00,0,,0.0,,,0.1,,,,,,,,1,8*5E
$GNGRS,055557.00,0,0.3,0.1,0.2,0.1,,,,,,,,,3,7*53
$GNGRS,055557.00,0,0.1,0.0,0.1,0.1,,,,,,,,,3,1*55
$GNGRS,055557.00,0,0.0,0.0,0.0,0.0,,,,,,,,,3,2*57
```

```
$GNGRS,055557.00,0,0.2,0.5,0.5,0.1,0.4,0.3,0.5,0.2,0.4,0.2,0.2,0.2,4,1*56
$GNGRS,055557.00,0,0.4,0.8,1.6,0.6,1.4,,,,,,,,4,1*75
$GNGRS,055557.00,0,,,,2.4,,1.5,1.7,1.1,1.7,0.7,1.0,0.6,4,8*58
$GNGRS,055557.00,0,1.3,1.2,1.8,,,,,,,,,,4,8*7C
$GNGRS,055557.00,0,0.1,0.2,0.2,0.1,0.2,0.0,0.4,0.1,,,,,4,11*65
$GNGRS,055557.00,0,0.1,0.6,,,,,,,,,,,5,1*55
$GNGRS,055557.00,0,0.1,0.4,,,,,,,,,,,5,6*50
$GNGRS,055557.00,0,0.1,0.0,,,,,,,,,,,5,8*5A
```

Table 7-21 GRS Message Structure

ID	Field	Description	Symbol
1	$--GRS	Log header	
2	Utc	UTC time of GGA/GNS fix associated with this sentence, in the format of hhmmss.ss hh - Hour mm - Minute ss.ss - Second	hhmmss.ss
3	Mode	Mode: 0 = residuals were used to calculate the position given in the matching GGA/GNS sentence 1 = residuals were recomputed after the GGA/GNS position was computed	x
4	Res	Range residuals for satellites used in the navigation solution, in meters. Range: ± 999, accurate to 1 decimal place. If the range residual exceeds ± 99.9, then the decimal part is dropped, resulting in an integer (for example, -103.7 becomes -103)	x.x
5			x.x
6			x.x
7			x.x
8			x.x
9			x.x
10			x.x
11			x.x
12			x.x
13			x.x
14			x.x
15			x.x
16	Sys id	GNSS system ID, see Table GNSS ID	h

ID	Field	Description	Symbol
17	Signal id	GNSS signal ID, see Table GNSS ID	h
18	*xx	Checksum	*hh
19	[CR][LF]	Sentence terminator	

7.3.7 GPGSA: GNSS DOP and Active Satellites

This command is used to output the receiver operating mode, satellites used in the navigation solution, and DOP (dilution of precision), etc.

ASCII Syntax

Output 1 Hz GPGSA message at the current port

```
GPGSA 1
```

Output 1 Hz GPGSA message at COM2

```
GPGSA COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGSA,M,3,03,16,26,29,31,32,,,,,,,1.4,0.7,1.2,1*34
$GNGSA,M,3,03,05,24,25,,,,,,,,,1.4,0.7,1.2,3*39
$GNGSA,M,3,01,03,04,06,07,09,10,16,21,22,36,39,1.4,0.7,1.2,4*3D
$GNGSA,M,3,40,45,59,60,,,,,,,,,1.4,0.7,1.2,4*36
$GNGSA,M,3,02,07,,,,,,,,,,,1.4,0.7,1.2,5*3D
```

Table 7-22 GSA Message Structure

ID	Field	Description	Symbol
1	$--GSA	Log header	
2	mode MA	Satellite operating mode: M = Manual, forced to operate in 2D or 3D mode A = Automatic, allowed to automatically switch 2D/3D	a

ID	Field	Description	Symbol
3	mode 123	Positioning mode: 1 = Fix not available 2 = 2D 3 = 3D	x
4	prn	ID numbers of satellites used in solution, see Table Satellite ID Numbers in NMEA Messages	xx
5			xx
6			xx
7			xx
8			xx
9			xx
10			xx
11			xx
12			xx
13			xx
14			xx
15			xx
16	pdop	PDOP, accurate to 1 decimal place	x.x
17	hdop	HDOP, accurate to 1 decimal place	x.x
18	vdop	VDOP, accurate to 1 decimal place	x.x
19	SysID	GNSS system ID, see Table GNSS ID	h
20	*xx	Checksum	*hh
21	[CR][LF]	Sentence terminator	

7.3.8 GPGST: GNSS Pseudorange Error Statistics

This command is used to output pseudorange measurement error statistics.

ASCII Syntax

Output 1 Hz GPGST message at the current port

```
GPGST 1
```

Output 1 Hz GPGST message at COM2

```
GPGST COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNGST,060458.00,0.71,1.62,1.44,9.1113,1.618,1.441,3.761*42
```

Table 7-23 GST Message Structure

ID	Field	Description	Symbol
1	$--GST	Log header	
2	utc	UTC time of the GGA/GNS fix associated with this sentence, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	rms	Standard deviation of pseudoranges and DGNSS corrections (RMS value), accurate to 2 decimal places	x.x
4	smjr std	Standard deviation of semi-major axis of error ellipse (m), accurate to 2 decimal places	x.x
5	smnr std	Standard deviation of semi-minor axis of error ellipse (m), accurate to 2 decimal places	x.x
6	orient	Orientation of semi-major axis of error ellipse (degrees from true north), accurate to 4 decimal places	x.x
7	lat std	Standard deviation of latitude error (m), accurate to 3 decimal places	x.x
8	lon std	Standard deviation of longitude error (m), accurate to 3 decimal places	x.x
9	alt std	Standard deviation of altitude error (m), accurate to 3 decimal places	x.x
10	*xx	Checksum	*hh

ID	Field	Description	Symbol
11	[CR][LF]	Sentence terminator	

7.3.9 GPGSV: GNSS Satellites in View V4.11

This command is used to output the number of satellites in view, satellite ID numbers, etc.

ASCII Syntax

Output 1 Hz GPGSV message at the current port

```
GPGSV 1
```

Output 1 Hz GPGSV message at COM2

```
GPGSV COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GPGSV,2,1,08,03,29,287,33,04,14,313,23,32,37,141,44,31,65,039,46,1*63
$GPGSV,2,2,08,25,14,047,30,29,28,068,39,26,72,222,48,16,31,218,36,1*6F
$GPGSV,2,1,08,03,29,287,34,04,14,313,29,32,37,141,40,31,65,039,43,4*6A
$GPGSV,2,2,08,25,14,047,30,29,28,068,33,26,72,222,44,16,31,218,29,4*62
$GPGSV,2,1,05,03,29,287,41,04,14,313,31,32,37,141,46,25,14,047,37,8*6F
$GPGSV,2,2,05,26,72,222,51,8*5F
$GLGSV,2,1,05,71,21,169,38,65,47,313,38,73,17,049,36,74,57,013,45,1*7C
$GLGSV,2,2,05,72,65,211,47,1*4A
$GLGSV,1,1,04,71,21,169,40,65,47,313,35,73,17,049,37,72,65,211,45,3*78
$GBGSV,6,1,22,36,65,034,48,19,14,172,33,39,74,101,49,29,04,152,31,1*7A
$GBGSV,6,2,22,30,19,103,38,10,34,206,36,27,11,053,31,01,34,140,39,1*7F
$GBGSV,6,3,22,07,44,200,39,16,79,073,48,22,51,219,46,09,73,329,44,1*74
$GBGSV,6,4,22,59,38,145,43,03,41,188,39,04,25,124,35,40,53,185,45,1*74
$GBGSV,6,5,22,45,48,272,43,60,28,227,34,02,32,224,32,46,18,064,32,1*7A
$GBGSV,6,6,22,21,38,299,37,06,82,023,46,1*77
$GBGSV,5,1,19,36,65,034,34,19,14,172,26,39,74,101,35,29,04,152,26,8*7A
$GBGSV,5,2,19,30,19,103,26,10,34,206,26,01,34,140,27,07,44,200,29,8*73
$GBGSV,5,3,19,16,79,073,30,22,51,219,32,09,73,329,28,59,38,145,32,8*79
$GBGSV,5,4,19,04,25,124,21,40,53,185,33,45,48,272,30,60,28,227,27,8*78
$GBGSV,5,5,19,46,18,064,23,21,38,299,25,06,82,023,31,8*4D
$GBGSV,3,1,10,10,34,206,41,01,34,140,45,07,44,200,44,16,79,073,50,B*0E
```

```
$GBGSV,3,2,10,09,73,329,48,03,41,188,44,04,25,124,42,02,32,224,41,B*0B
$GBGSV,3,3,10,05,16,247,38,06,82,023,49,B*0C
$GAGSV,2,1,08,05,61,163,49,09,12,145,31,03,57,301,44,08,07,318,30,1*78
$GAGSV,2,2,08,31,04,049,30,02,17,232,39,24,51,046,45,25,68,240,48,1*7A
$GAGSV,2,1,08,05,61,163,51,09,12,145,33,03,57,301,48,08,07,318,34,2*78
$GAGSV,2,2,08,31,04,049,32,02,17,232,40,24,51,046,48,25,68,240,50,2*71
$GAGSV,2,1,07,05,61,163,48,09,12,145,27,03,57,301,42,31,04,049,26,7*78
$GAGSV,2,2,07,02,17,232,31,24,51,046,43,25,68,240,46,7*4B
$GQGSV,1,1,03,02,71,088,46,07,42,163,36,03,14,145,30,1*55
$GQGSV,1,1,03,02,71,088,45,07,42,163,40,03,14,145,28,6*59
$GQGSV,1,1,03,02,71,088,50,07,42,163,47,03,14,145,33,8*5E
```

Table 7-24 GSV Message Structure

ID	Field	Description	Symbol
1	$--GSV	Log header	
2	# msgs	Total number of GSV messages, 1~9	x
3	msg #	GSV message number, 1~9	x
4	# sats	Total number of satellites in view	xx
5	Sat id	Satellite ID number, see Table Satellite ID Numbers in NMEA Messages	xx
6	Elevation	Elevation, an integer in degrees, maximum value 90°	xx
7	Azi	Azimuth, degrees True, an integer within 000~359	xxx
8	CN0	Carrier to noise ratio (C/N0), an integer within 0 ~ 99 dB-Hz, null when not tracking	xx
9	Next sat	The 2^{nd} ~ 3^{rd} SV, a variable number of "Satellite ID-Elevation-Azimuth-SNR" sets are allowed up to a maximum of four sets per sentence. Null fields are not required for unused sets when less than four sets are transmitted.	xx
10			xx
11			xx
12			xx
13		The 4^{th} SV, a variable number of "Satellite ID-Elevation-Azimuth-SNR" sets are allowed up to a maximum of four sets per sentence. Null fields are not required for unused sets when less than four sets are transmitted.	xx
14			xx
15			xxx
16			xx
17	SignalID	GNSS signal ID, see GNSS ID	h
18	*xx	Checksum	*hh

ID	Field	Description	Symbol
19	[CR][LF]	Sentence terminator	

7.3.10 GPTHS: True Heading and Status

This command is used to output true heading and status.

As defined by the NMEA Protocol, the THS message replaces the HDT message.

ASCII Syntax

Output 1 Hz GPTHS message at the current port

```
GPTHS 1
```

Output 1 Hz GPTHS message at COM2

```
GPTHS COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GNTHS,341.3065,A*1F
```

Table 7-25 THS Message Structure

Field	Name	Description	Format
1	$--THS	Log header	
2	Heading	Heading, 0.00~360.00 Unit: degrees, accurate to 4 decimal places. Baseline solution from dual-antenna configuration (direction from master to slave antenna)	x.x
3	Mode	Mode indicator: A = Autonomous M = Manual input S = Simulator V = Data not valid	a
4	*xx	Checksum	*hh

Field	Name	Description	Format
5	[CR][LF]	Sentence terminator	

7.3.11 GPRMC: Recommended Minimum Specific GNSS Data

This command is used to output time, date, position, velocity, etc.

ASCII Syntax

Output 1 Hz GPRMC message at the current port

```
GPRMC 1
```

Output 1 Hz GPRMC message at COM2

```
GPRMC COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNRMC,061402.00,A,4004.73846648,N,11614.19829285,E,0.003,12.5,301221,6.9,W,A,V*78
```

Table 7-26 RMC Message Structure

ID	Field	Description	Symbol
1	$--RMC	Log header	
2	utc	UTC of position fix, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	pos status	Status: A = Data valid V = Navigation receiver warning	A
4	lat	Latitude, in the format of	llll.ll

ID	Field	Description	Symbol
		ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	
5	lat dir	Latitude direction (N = North, S = South)	a
6	lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
7	lon dir	Longitude direction (E = East, W = West)	a
8	speed Kn	Speed over ground, knots, accurate to 3 decimal places	x.x
9	track true	Course over ground, degrees True, measured clockwise from the North, accurate to 1 decimal place	x.x
10	date	Date: ddmmyy	xxxxxx
11	mag var	Magnetic variation, degrees, accurate to 1 decimal place	x.x
12	var dir	Magnetic variation direction	a
13	mode ind	Mode indicator: A = Autonomous mode D = Differential mode F = RTK Float M = Manual input mode N = No fix P = High precision mode R = RTK Int S = Simulator mode V = Mode invalid (except for A and D)	a
14	mode status	Navigational status: S = Safe C = Caution U = Unsafe V = Navigational status not valid	a
15	*xx	Checksum	*hh
16	[CR][LF]	Sentence terminator	

7.3.12 GPROT: Rate of Turn

This command is used to output the rate of turn and direction of turn.

ASCII Syntax

Output 1 Hz GPROT message at the current port

```
GPROT 1
```

Output 1 Hz GPROT message at COM2

```
GPROT COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GNROT,0.0,V*38
```

Table 7-27 ROT Message Structure

Field	Name	Description	Format
1	$--ROT	Log header	
2	rate	Rate of turn, degrees/minute, accurate to 1 decimal place	x.x
3	status	Status: A = Data valid V = Data invalid	A
4	*xx	Checksum	*hh
5	[CR][LF]	Sentence terminator	

7.3.13 GPVTG: Course Over Ground and Ground Speed

This command is used to output the actual course and speed relative to the ground.

ASCII Syntax

Output 1 Hz GPVTG message at the current port

```
GPVTG 1
```

Output 1 Hz GPVTG message at COM2

```
GPVTG COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNVTG,123.119,T,130.046,M,0.00444,N,0.00822,K,A*38
```

Table 7-28 VTG Message Structure

ID	Field	Description	Symbol
1	$--VTG	Log header	
2	Course true	Course over ground, degrees True, accurate to 3 decimal places	x.x
3	Course ind	Course indicator, a fixed character of T	T
4	Course mag	Course over ground, degrees Magnetic, accurate to 3 decimal places	x.x
5	Course ind	Course indicator, a fixed character of M	M
6	speed Kn	Speed over ground, knots, accurate to 5 decimal places	x.x
7	N	Unit of speed, a fixed character of N	N
8	speed Km	Speed over ground, km/h, accurate to 5 decimal places	x.x
9	K	Unit of speed, a fixed character of K	K
10	Mode ind	Mode indicator: A = Autonomous mode D = Differential mode M = Manual input mode V = Data not valid P = High precision mode	xxxxxx

ID	Field	Description	Symbol
		S = Simulator mode	
11	*xx	Checksum	*hh
12	[CR][LF]	Sentence terminator	

7.3.14 GPZDA: Time and Date

This command is used to output UTC, day, month, year, etc.

ASCII Syntax

Output 1 Hz GPZDA message at the current port

```
GPZDA 1
```

Output 1 Hz GPZDA message at COM2

```
GPZDA COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$GNZDA,061555.00,30,12,2021,,*7B
```

Table 7-29 ZDA Message Structure

ID	Field	Description	Symbol
1	$--ZDA	Log header	
2	Utc	UTC, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	Day	Day, 01~31	xx
4	Month	Month, 01~12	xx
5	Year	Year	xxxx

ID	Field	Description	Symbol
6	Local zone hour	Local zone hours, 00~±13	xx
7	Local zone minute	Local zone minutes, 00~±59	xx
8	*xx	Checksum	*hh
9	[CR][LF]	Sentence terminator	

7.4 Unicore Extended NMEA Message Commands

7.4.1 GPGGAH: Global Positioning System Fix Data (Slave Antenna)

This command is used to output time, position, and fix related data which is calculated with the slave antenna.

ASCII Syntax

Output 1 Hz GPGGAH message at the current port

```
GPGGAH 1
```

Output 1 Hz GPGGAH message at COM2

```
GPGGAH COM2 1
```

Applicable Products: UM982, UM982C, UMD982

Output

```
$GNGGAH,073346.00,4004.73874301,N,11614.19077585,E,1,28,0.6,64.2831,M,-8.4925,M,,*18
```

Table 7-30 GGAH Data Structure

ID	Field	Description	Symbol
1	$--GGAH	Log header	
2	utc	UTC of position, in the format of hhmmss.ss hh – Hour	hhmmss.ss

ID	Field	Description	Symbol
		mm – Minute ss.ss – Second	
3	lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	llll.ll
4	lat dir	Latitude direction (N = North, S = South)	a
5	lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
6	lon dir	Longitude direction (E = East, W = West)	a
7	qual	GPS quality indicator 0 = Fix not available or invalid 1 = Single point positioning 2 = Differential positioning 3 = GPS PPS mode 4 = RTK Int 5 = RTK Float 6 = Dead reckoning mode 7 = Manual input mode 8 = Simulator mode	x
8	# sats	Number of satellites in use, may be different from the number in view.	xx
9	hdop	Horizontal dilution of precision, accurate to 1 decimal place	x.x
10	alt	Altitude above/below MSL (geoid), accurate to 4 decimal places	x.x
11	a-units	Unit of altitude (M = m)	M
12	undulation	Undulation, the difference between the Earth ellipsoid surface and geoid surface. If the geoid is above the ellipsoid, the value is positive; otherwise, it is negative. Accurate to 4 decimal places.	x.x
13	u-units	Unit of undulation (M =m)	M
14	diff_age	Age of differential data, in seconds, accurate to 2 decimal places. This value is the average age of the most recent differential corrections in use. Null	x.x

ID	Field	Description	Symbol
		field when differential GNSS is not used.	
15	stn ID	Differential base station ID, Range: 0000~1023 Satellite-based differential station ID, Range: 9001~9999	xxxx
16	*xx	Checksum	*hh
17	[CR][LF]	Sentence terminator	

7.4.2 GPGLLH: Geographic Position (Slave Antenna)

This command is used to output geographic longitude/latitude information which is calculated with the slave antenna.

ASCII Syntax:

Output 1 Hz GPGLLH message at the current port

```
GPGLLH 1
```

Output 1 Hz GPGLLH message at COM2

```
GPGLLH COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UM980C

Output

```
$GNGLLH,4004.73814597,N,11614.19908275,E,054501.00,A,D*37
```

Table 7-31 GLLH Data Structure

ID	Field	Description	Symbol
1	$--GLLH	Log header	
2	lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	llll.ll

ID	Field	Description	Symbol
3	lat dir	Latitude direction (N = North, S = South)	a
4	lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
5	lon dir	Longitude direction (E = East, W = West)	a
6	Utc	UTC of position, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
7	status	Status: V = Data not valid A = Autonomous D = Differential	A
8	mode ind	Positioning system mode indicator: N = No fix A = Autonomous positioning D = Differential positioning E = Estimated (dead reckoning) mode M = Manual input S = Simulator	a
9	*xx	Checksum	*hh
10	[CR][LF]	Sentence terminator	

7.4.3 GPGNSH: GNSS Fix Data (Slave Antenna)

This command is used to output GNSS fix data which is calculated with the slave antenna.

ASCII Syntax

Output 1 Hz GPGNSH message at the current port

```
GPGNSH 1
```

Output 1 Hz GPGNSH message at COM2

```
GPGNSH COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GNGNSH,074444.00,4004.73864213,N,11614.19082153,E,ANAAA,28,0.7,64.6536,-8.4925,,,S*08
```

Table 7-32 GNSH Data Structure

ID	Field	Description	Symbol
1	$--GNSH	Log header	
2	utc	UTC of position, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	Lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	llll.ll
4	Lat dir	Latitude direction (N = North, S = South)	a
5	Lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
6	Lon dir	Longitude direction (E = East, W = West)	a
7	mode	Mode indicator. The length of this field is variable, with the first 3 characters indicating GPS, GLONASS, and Galileo. Each satellite system takes one of the following modes: A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode F = RTK Float M = Manual input mode N = No fix	c--c

ID	Field	Description	Symbol
		P = High precision mode R = RTK Int S = Simulator mode	
8	Use sat	Number of satellites in use, 00-99.	xx
9	Hdop	Horizontal dilution of precision (HDOP), accurate to 1 decimal place	x.x
10	Ant alt	Antenna altitude, meters, above MSL (geoid), accurate to 4 decimal places	x.x
11	Geo sep	Geoidal separation: the difference between the earth ellipsoid surface and the geoid surface, meters. If the geoid is above the ellipsoid, the value is positive; otherwise, it is negative. Accurate to 4 decimal places.	x.x
12	Age[8:4]	Age of differential data, seconds, accurate to 2 decimal places. Null if the mode is not differential positioning.	x.x
13	Station id[8:5]	2 Differential base station ID. Null if the mode is not differential positioning.	x.x
14	status	Navigational status indicator S = Safe C = Caution U = Unsafe V = Navigational status not valid	a
15	*xx	Checksum	*hh
16	[CR][LF]	Sentence terminator	

7.4.4 GPGRSH: GNSS Range Residuals (Slave Antenna)

This command is used to output the residuals for satellites involved in the navigation solution using the slave antenna. It supports RAIM (Receiver Autonomous Integrity Monitoring).

ASCII Syntax

Output 1 Hz GPGRSH message at the current port

```
GPGRSH 1
```

Output 1 Hz GPGRSH message at COM2

```
GPGRSH COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GNGRSH,055209.00,0,0.0,0.8,0.1,,0.1,2.2,0.2,,,,,,1,1*18
$GNGRSH,055209.00,0,0.1,0.4,0.1,,0.1,1.5,0.2,,,,,,1,4*14
$GNGRSH,055209.00,0,0.0,0.2,,,0.0,0.1,,,,,,,1,8*18
$GNGRSH,055209.00,0,0.1,0.4,0.1,0.1,,,,,,,,,2,1*14
$GNGRSH,055209.00,0,0.1,0.1,0.1,0.3,,,,,,,,,2,3*11
$GNGRSH,055209.00,0,0.6,0.7,0.3,0.8,0.1,0.1,,,,,,,3,7*1C
$GNGRSH,055209.00,0,0.2,0.2,0.1,0.2,0.0,0.0,,,,,,3,1*13
$GNGRSH,055209.00,0,0.1,0.1,0.1,0.1,0.0,0.0,,,,,,3,2*13
$GNGRSH,055209.00,0,0.3,0.2,0.6,0.1,0.4,0.8,1.2,0.9,0.4,0.4,1.0,2.0,4,1*14
$GNGRSH,055209.00,0,0.9,0.6,0.6,0.4,0.3,0.2,0.8,1.3,0.2,,,,4,1*3D`
$GNGRSH,055209.00,0,0.2,0.1,0.1,0.1,0.1,0.2,0.2,0.2,0.1,0.1,0.2,0.2,4,8*1E
$GNGRSH,055209.00,0,0.2,0.2,0.2,0.1,0.1,0.1,0.2,0.2,0.1,,,,4,8*32
$GNGRSH,055209.00,0,,,0.1,0.0,,0.2,,,,,,,4,11*0B
$GNGRSH,055209.00,0,0.2,0.1,0.1,,,0.1,0.2,,0.1,,,,4,11*26
$GNGRSH,055209.00,0,0.3,0.2,0.1,,,,,,,,,,5,1*38
$GNGRSH,055209.00,0,1.2,0.4,0.1,,,,,,,,,,5,6*39
$GNGRSH,055209.00,0,0.2,0.0,0.1,,,,,,,,,,5,8*32
```

Table 7-33 GRSH Data Structure

ID	Field	Description	Symbol
1	$--GRSH	Log header	
2	Utc	UTC time of GGA/GNS, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	Mode	Mode: 0 = residuals were used to calculate the position given in the GGA/GNS message 1 = residuals were recomputed after the position in GGA/GNS message was computed	x
4-15	Res	Range residuals for satellites used in the navigation solution, in meters.	x.x

ID	Field	Description	Symbol
		Range: ± 999, accurate to 1 decimal place. If the range residual exceeds ± 99.9, drop the decimal part and take the integer (for example, -103.7 becomes -103)	
16	Sys id	GNSS system ID. See Table GNSS ID	h
17	Signal id	Signal ID. See Table GNSS ID	h
18	*xx	Checksum	*hh
19	[CR][LF]	Sentence terminator	

7.4.5 GPGSAH: GNSS DOP and Active Satellites (Slave Antenna)

This command is used to output the receiver's operating mode, satellites used in the navigation solution, DOP (Dilution of Precision), etc. which are calculated with the slave antenna.

ASCII Syntax

Output 1 Hz GPGSAH message at the current port

```
GPGSAH 1
```

Output 1 Hz GPGSAH message at COM2

```
GPGSAH COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GNGSAH,M,3,26,29,31,32,,,,,,,,,1.1,0.6,0.9,1*76
$GNGSAH,M,3,01,04,09,19,21,31,,,,,,,1.1,0.6,0.9,3*7D
$GNGSAH,M,3,01,03,04,06,07,09,16,19,20,22,28,36,1.1,0.6,0.9,4*73
$GNGSAH,M,3,37,39,40,46,59,60,,,,,,,1.1,0.6,0.9,4*7D
```

Table 7-34 GSAH Data Structure

ID	Field	Description	Symbol
1	$-- GSAH	Log header	
2	mode MA	Operation mode: M = Manual, forced to operate in 2D or 3D mode A = Automatic, allowed to automatically switch 2D/3D	a
3	mode 123	Positioning mode: 1 = Fix not available 2 = 2D 3 = 3D	x
4-15	prn	ID numbers of satellites used in solution, see Table Satellite ID Numbers in NMEA Messages	xx
16	pdop	PDOP, accurate to 1 decimal place	x.x
17	hdop	HDOP, accurate to 1 decimal place	x.x
18	vdop	VDOP, accurate to 1 decimal place	x.x
19	SysID	GNSS system ID, see Table GNSS ID	h
20	*xx	Checksum	*hh
21	[CR][LF]	Sentence terminator	

7.4.6 GPGSTH: GNSS Pseudorange Error Statistics (Slave Antenna)

This command is used to output pseudorange measurement error statistics calculated with the slave antenna.

ASCII Syntax

Output 1 Hz GPGSTH message at the current port

```
GPGSTH 1
```

Output 1 Hz GPGSTH message at COM2

```
GPGSTH COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GNGSTH,055543.00,0.45,0.01,0.01,127.6430,0.010,0.010,0.019*0F
```

Table 7-35 GSTH Data Structure

ID	Field	Description	Symbol
1	$--GSTH	Log header	
2	utc	UTC time of GGA/GNS, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	rms	Standard deviation of pseudoranges and DGNSS corrections (RMS value), accurate to 2 decimal places	x.x
4	smjr std	Standard deviation of semi-major axis of error ellipse (m), accurate to 2 decimal places	x.x
5	smnr std	Standard deviation of semi-minor axis of error ellipse (m), accurate to 2 decimal places	x.x
6	orient	Orientation of semi-major axis of error ellipse (degrees from true north), accurate to 4 decimal places	x.x
7	lat std	Standard deviation of latitude error (m), accurate to 3 decimal places	x.x
8	lon std	Standard deviation of longitude error (m), accurate to 3 decimal places	x.x
9	alt std	Standard deviation of altitude error (m), accurate to 3 decimal places	x.x
10	*xx	Checksum	*hh
11	[CR][LF]	Sentence terminator	

7.4.7 GPGSVH: GNSS Satellites in View (Slave Antenna)

This command is used to output the number of satellites in view, satellite ID numbers, and other information which is calculated with the slave antenna.

ASCII Syntax

Output 1 Hz GPGSVH message at the current port

```
GPGSVH 1
```

Output 1 Hz GPGSVH message at COM2

```
GPGSVH COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GPGSVH,2,1,08,16,28,217,38,32,39,140,45,03,29,290,32,31,66,033,50,1*2F
$GPGSVH,2,2,08,04,12,313,34,26,69,220,46,25,16,046,34,29,28,071,37,1*2A
$GPGSVH,2,1,07,32,39,140,41,03,29,290,37,31,66,033,46,04,12,313,35,4*21
$GPGSVH,2,2,07,26,69,220,46,25,16,046,35,29,28,071,41,4*11
$GLGSVH,2,1,05,74,15,049,37,66,38,321,45,76,41,264,42,72,21,168,35,1*3F
$GLGSVH,2,2,05,65,63,206,44,1*07
$GLGSVH,1,1,04,66,38,321,42,76,41,264,43,72,21,168,36,65,63,206,43,3*31
$GBGSVH,6,1,21,27,15,113,36,46,73,006,50,06,81,019,49,07,43,199,36,1*36
$GBGSVH,6,2,21,16,79,068,51,19,55,235,42,10,33,205,34,28,13,062,34,1*3A
$GBGSVH,6,3,21,36,40,265,35,59,38,145,43,40,52,184,43,20,24,178,35,1*3B
$GBGSVH,6,4,21,22,31,308,40,04,25,124,36,03,42,188,35,01,34,140,41,1*37
$GBGSVH,6,5,21,60,28,227,38,39,74,097,51,09,72,329,46,02,32,224,35,1*3A
$GBGSVH,6,6,21,37,24,062,35,1*0D
$GBGSVH,6,1,21,27,15,113,39,46,73,006,52,06,81,019,49,07,43,199,41,8*32
$GBGSVH,6,2,21,16,79,068,48,19,55,235,47,10,33,205,36,28,13,062,39,8*31
$GBGSVH,6,3,21,36,40,265,45,59,38,145,43,40,52,184,46,20,24,178,37,8*32
$GBGSVH,6,4,21,22,31,308,41,04,25,124,37,03,42,188,38,01,34,140,39,8*3C
$GBGSVH,6,5,21,60,28,227,40,39,74,097,53,09,72,329,47,02,32,224,35,8*3F
$GBGSVH,6,6,21,37,24,062,44,8*02
$GBGSVH,3,1,09,06,81,019,50,07,43,199,43,16,79,068,50,10,33,205,40,B*42
$GBGSVH,3,2,09,04,25,124,40,03,42,188,42,01,34,140,40,09,72,329,49,B*49
$GBGSVH,3,3,09,02,32,224,39,B*79
$GAGSVH,2,1,06,19,27,146,38,04,79,220,51,09,34,312,39,31,44,232,43,2*32
$GAGSVH,2,2,06,21,25,048,44,01,76,038,52,2*3C
$GAGSVH,2,1,06,19,27,146,34,04,79,220,48,09,34,312,40,31,44,232,38,7*31
$GAGSVH,2,2,06,21,25,048,36,01,76,038,50,7*3E
$GQGSVH,1,1,03,03,13,146,35,02,71,090,49,07,42,163,35,1*19
$GQGSVH,1,1,03,03,13,146,32,02,71,090,49,07,42,163,42,6*19
```

Table 7-36 GSVH Data Structure

ID	Field	Description	Symbol
1	$--GSVH	Log header	
2	# msgs	Total number of GSV messages, 1~9	x
3	msg #	GSV message number, 1~9	x
4	# sats	Number of satellites in view	xx
5-16	Satellite Data Blocks	Four sets of satellite data blocks, each containing: Sat id - Satellite ID number, see Table Satellite ID Numbers in NMEA Messages Elevation - Elevation, an integer in degrees, max: 90 Azi - Azimuth, degrees True, an integer within 000~359 CN0 - Carrier to noise ratio (C/N0), an integer within 0 ~ 99 dB-Hz, null when not tracking	xx xx xxx xx
17	SignalID/ SystemID	Signal ID for NMEA 0183 Version 4.10; system ID for NMEA 0183 Version 4.11. Refer to Table GNSS ID.	h
18	*xx	Checksum	*hh
19	[CR][LF]	Sentence terminator	

7.4.8 GPHPD: Positioning and Heading Information

This command is used to output time, orientation, position, speed information, etc.

ASCII Syntax

Output 1 Hz GPHPD message at the current port

```
GPHPD 1
```

Output 1 Hz GPHPD message at COM2

```
GPHPD COM2 1
```

Applicable Products: UM982, UMD982

> **Note:** This command will be supported in future versions.

Output

```
$GPHPD,2319,462170.00,251.77,-48.16,178.48,40.0789783,116.2365145,63.03,-0.001,0.000,-0.00
3,-0.001,-0.002,-0.001,0.000,48,48*5ac824c3
```

Table 7-37 HPD Message Structure

ID	Field	Description	Symbol
1	$GPHPD	Log header, constantly outputs GPHPD	
2	GPSWeek	Number of weeks from Jan. 6th 1980 to the present (receiver time)	xxxx
3	GPSTime	Milliseconds of the week (receiver time), accurate to 2 decimal places	xxxxxx.xx
4	Heading	Heading, 0.00~360.00 Unit: degrees, accurate to 2 decimal places. Baseline solution from dual-antenna configuration (direction from master to slave antenna)	xx.xx
5	Pitch	Pitch, -90 ~ 90, degrees, accurate to 2 decimal places	x.xxx
6	Track	Course over ground, degrees True, 0~359.99, accurate to 2 decimal places	xx.xx
7	Latitude	Latitude (WGS84), degrees, accurate to 7 decimal places	xx.xxxxxxx
8	Longitude	Longitude (WGS84), degrees, accurate to 7 decimal places	xxx.xxxxxxx
9	Altitude	Altitude (WGS84), meters, accurate to 2 decimal places	xxx.xx
10	Ve	Velocity in the easterly direction, m/s, accurate to 3 decimal places	x.xxx
11	Vn	Velocity in the northerly direction, m/s, accurate to 3 decimal places	x.xxx
12	Vu	Velocity in the up direction, m/s, accurate to 3 decimal places	x.xxx
13	Ae	East velocity difference between two	x.xxx

ID	Field	Description	Symbol
		measurements, m/s, accurate to 3 decimal places	
14	An	North velocity difference between two measurements, m/s, accurate to 3 decimal places	x.xxx
15	Au	Up velocity difference between two measurements, m/s, accurate to 3 decimal places	x.xxx
16	Baseline	Baseline length, meters, accurate to 3 decimal places	x.xxx
17	NSV1	Number of visible satellites for the master antenna	xx
18	NSV2	Number of visible satellites for the slave antenna	xx
19	*xx	Checksum	*hh
20	[CR][LF]	Sentence terminator	

7.4.9 GPHPR: Attitude Parameters

This log contains the heading, pitch, and roll angles for dual-antenna carriers.

ASCII Syntax

```
GPHPR 1
```

Applicable Products: UM982, UMD982

Output

```
$GNHPR,074615.00,320.9610,-66.1712,000.0000,4,47,0.00,0999*45
```

Table 7-38 HPR Message Structure

ID	Field	Description	Symbol
1	$--HPR	Log header	
2	utc	UTC, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	heading	Heading, 0.00~360.00 Unit: degrees, accurate to 4 decimal places.	hhh.hhhh

ID	Field	Description	Symbol
		Baseline solution from dual-antenna configuration (direction from master to slave antenna)	
4	pitch	Pitch, -90~90°, accurate to 4 decimal places	ppp.pppp
5	roll	Roll, -90~90°, accurate to 4 decimal places	rrr.rrrr
6	QF	Solution quality indicator: 0 = Fix invalid 1 = Single point positioning 2 = Differential GPS 4 = RTK fix 5 = RTK float 6 = Dead reckoning mode 7 = Manual input mode (fixed value) 8 = Extra wide-lane 9 = SBAS	q
7	sat No.	Satellite number	n
8	diff_age	Age of differential data, in seconds, accurate to 2 decimal places	dd.dd
9	stn ID	Base station ID	xxxx
10	*xx	Checksum	*hh
11	[CR][LF]	Sentence terminator	

7.4.10 GPHPR2: Attitude Parameters

This log contains the heading, pitch, and roll angles in HEADING2 mode. It only supports `ONCHANGED` trigger.

ASCII Syntax

```
GPHPR2 ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM980C

> **Note:** Applicable to UM982 Build9669 and later versions.

Output

```
$GNHPR2,013025.00,006.2031,000.6226,000.0000,4,38,0.00,3223*63
```

Table 7-39 HPR2 Message Structure

ID	Field	Description	Symbol
1	$--HPR2	Log header	
2	utc	UTC, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	heading	Azimuth of the baseline from base station to rover (base station → rover), 0–360°, Unit: degrees (°), rounded to 4 decimal places	hhh.hhhh
4	pitch	Pitch, -90~90°, accurate to 4 decimal places	ppp.pppp
5	roll	Roll, -90~90°, accurate to 4 decimal places	rrr.rrrr
6	QF	Solution quality indicator: 0 = Fix invalid 1 = Single point positioning 2 = Differential GPS 4 = RTK fix 5 = RTK float 6 = Dead reckoning mode 7 = Manual input mode (fixed value) 8 = Extra wide-lane 9 = SBAS	q
7	sat No.	Satellite number	n
8	age	Age of differential data, in seconds, accurate to 2 decimal places	dd.dd
9	stn ID	Base station ID	xxxx
10	*xx	Checksum	*hh
11	[CR][LF]	Sentence terminator	

7.4.11 GPRMCH: Recommended Minimum Specific GNSS Data (Slave Antenna)

This command is used to output time, date, position, velocity, etc. which is calculated with the slave antenna.

ASCII Syntax

Output 1 Hz GPRMCH message at the current port

```
GPRMCH 1
```

Output 1 Hz GPRMCH message at COM2

```
GPRMCH COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GNRMCH,055808.00,A,4004.73817916,N,11614.19891207,E,0.004,99.7,311221,6.9,W,D,V*3A
```

Table 7-40 RMCH Data Structure

ID	Field	Description	Symbol
1	$--RMCH	Log header	
2	utc	UTC of position fix, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	pos status	Status: A = Data valid V = Navigation receiver warning	A
4	lat	Latitude, in the format of ddmm.mmmmmmmm dd – Degree mm.mmmmmmmm – Minute	llll.ll
5	lat dir	Latitude direction (N = North, S = South)	a
6	lon	Longitude, in the format of dddmm.mmmmmmmm ddd – Degree mm.mmmmmmmm – Minute	yyyyy.yy
7	lon dir	Longitude direction (E = East, W = West)	a

ID	Field	Description	Symbol
8	speed Kn	Speed over ground, knots, accurate to 3 decimal places	x.x
9	track true	Course over ground, degrees True, measured clockwise from the North, accurate to 1 decimal place	x.x
10	date	Date: ddmmyy	xxxxxx
11	mag var	Magnetic variation, degrees, accurate to 1 decimal place	x.x
12	var dir	Magnetic variation direction	a
13	mode ind	Mode indicator: A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode F = RTK Float M = Manual input mode N = No fix P = High precision mode R = RTK int S = Simulator mode V = Invalid mode (except for A and D)	a
14	mode status	Navigational status: S = Safe C = Caution U = Unsafe V = Navigational status not valid	a
15	*xx	Checksum	*hh
16	[CR][LF]	Sentence terminator	

7.4.12 GPROT2: Rate of Turn

This log contains the rate of turn and direction of turn in HEADING2 mode. It only supports `ONCHANGED` trigger.

ASCII Syntax

Output 1 Hz GPROT2 message at the current port

```
GPROT2 ONCHANGED
```

Output 1 Hz GPROT2 message at COM2

```
GPROT2 COM2 ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM980C

> **Note:** Applicable to UM982 Build9669 and later versions.

Output

```
$GNROT2,-0.0,A*30
```

Table 7-41 ROT2 Message Structure

ID	Field	Description	Symbol
1	$--ROT2	Log header	
2	rate	Rate of turn, degrees/minute, accurate to 1 decimal place, "-" = bow turns to port	x.x
3	status	Status: A = Data valid V = Data invalid	A
4	*xx	Checksum	*hh
5	[CR][LF]	Sentence terminator	

7.4.13 GPTHS2: True Heading and Status

This message contains the heading information of the baseline (from the base station to the rover station) measured in degrees relative to the true north. To output this message, the receiver needs to be able to work in HEADING2 mode. This log only supports `ONCHANGED` trigger.

ASCII Syntax

Output GPTHS2 message at the current port

```
GPTHS2 ONCHANGED
```

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM980C

Output

```
$GNTHS2,88.3640,T*0F
```

Table 7-42 THS2 Data Structure

ID	Field	Description	Symbol
1	$--THS2	Log header	
2	Heading	Azimuth of the baseline from base station to rover (base station → rover), 0–360°, Unit: degrees (°), rounded to 4 decimal places	x.x
3	Mode	Mode indicator, a fixed value of T	a
4	*xx	Checksum	*hh
5	[CR][LF]	Sentence terminator	

7.4.14 GPTRA2: Heading, Pitch & Roll Information

This log contains the heading, pitch, and roll angles in HEADING2 mode. It only supports `ONCHANGED` trigger.

ASCII Syntax

Output 1 Hz GPTRA2 message at the current port

> GPTRA2 ONCHANGED

Output 1 Hz GPTRA2 message at COM2

> GPTRA2 COM2 ONCHANGED

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM980C

> **Note:** Applicable to UM982 Build9669 and later versions.

Output

```
$GNTRA2,090415.00,88.36,-0.09,0.00,4,30,0.00,0000*7D
```

Table 7-43 TRA2 Message Structure

ID	Field	Description	Symbol
1	$--TRA2	Log header	
2	utc	UTC, in the format of hhmmss.ss hh – Hour mm – Minute ss.ss – Second	hhmmss.ss
3	heading	Heading, 0~360 degrees, accurate to 2 decimal places	hhh.hh
4	pitch	Pitch: -90~90 degrees, accurate to 2 decimal places	ppp.pp
5	roll	Roll: -90~90 degrees, accurate to 2 decimal places	rrr.rr
6	Sol status	GPS quality indicator: 0 = Fix not available or invalid 1 = Single point positioning 2 = Differential GPS or SBAS 4 = RTK fix 5 = RTK float 6 = Estimated (dead reckoning) mode	q
7	Sat num	Satellite number	n
8	Age	Age of differential data, in seconds, accurate to 2 decimal places	dd.dd
9	Station ID	Base station ID	xxxx
10	*xx	Checksum	*hh
11	[CR][LF]	Sentence terminator	

7.4.15 GPVTGH: Course over Ground and Ground Speed (Slave Antenna)

This command is used to output the course over ground and ground speed calculated with the slave antenna.

ASCII Syntax

Output 1 Hz GPVTGH message at the current port

```
GPVTGH 1
```

Output 1 Hz GPVTGH message at COM2

```
GPVTGH COM2 1
```

Applicable Products: UM982, UMD982

Output

```
$GNVTGH,113.125,T,120.041,M,0.01474,N,0.02730,K,D*73
```

Table 7-44 VTGH Data Structure

ID	Field	Description	Symbol
1	$--VTGH	Log header	
2	Course true	Course over ground, degrees True, accurate to 3 decimal places	x.x
3	Course ind	Course indicator, a fixed character of T	T
4	Course mag	Course over ground, degrees Magnetic, accurate to 3 decimal places	x.x
5	Course ind	Course indicator, a fixed character of M	M
6	speed Kn	Speed over ground, knots, accurate to 5 decimal places	x.x
7	N	Unit of speed, a fixed character of N	N
8	speed Km	Speed over ground, km/h, accurate to 5 decimal places	x.x
9	K	Unit of speed, a fixed character of K	K
10	Mode ind	Mode indicator: A = Autonomous mode D = Differential mode E = Estimated (dead reckoning) mode	xxxxxx

ID	Field	Description	Symbol
		M = Manual input mode V = Data not valid P = High precision mode S = Simulator mode	
11	*xx	Checksum	*hh
12	[CR][LF]	Sentence terminator	

7.4.16 QZQSM: Disaster and Crisis Report

QZSS provides the service of DC Report (disaster and crisis report) based on the L1 SAIF signal. When disasters such as earthquake and tsunami happen, QZSS will broadcast the warning information.

This log outputs the L1S DCR information, which is in accordance with the IS-QZSS-DCR ICD. It only supports ASCII format. Use the QZQSM [output rate] command to enable the DCR information output.

ASCII Syntax

```
QZQSM 1
```

Applicable Products: UM980, UM982, UB9A0, UM981, UMD981, UMD981S, UM980C

Output

```
$QZQSM,56,53AD54A4FB0001AF2FD80000000000000000000000000000000000013ECA2C98*0F
```

Table 7-45 QZQSM Message Structure

ID	Field	Description	Symbol
1	$QZQSM	Log header	
2	PRN	56, 57, 61 (PRN 184, 185, 189) 55 (PRN 183) 58 (PRN 186)	XX
3	DC Message	Hexadecimal	HEX
4	*xx	Checksum	
5	[CR][LF]	Sentence terminator (ASCII only)	-

7.5 Unicore Defined Data Output Commands

7.5.1 Header Introduction

Each Unicore message data packet consists of three parts: Header + Data + CRC (checksum).

Basic Format:

`Header` 3 Sync bytes, 24 bytes in total. Please always check the header length.

`Data` Variable

`CRC` 4 bytes

A single message may have two output formats:

- XXXA Indicates ASCII format data output.
  ASCII-formatted data begins with a `#` character. The `#` symbol in ASCII data format is excluded from CRC checksum calculations.
- XXXB Indicates BINARY format data output.
  Binary data is a strictly-defined machine-readable format ideal for high-volume data transmission applications. Due to its inherent compact format, binary messages are significantly smaller than ASCII equivalents, enabling the receiver's communication port to handle higher data throughput.

Table 7-46 Unicore ASCII and Binary Message Structure

ID	Structure	Description
1	Header	All Unicore messages have a header. Binary format header has 3 syn bytes and 24 bytes in total. See Table Binary Header Structure (N4) for more information. Please always check the header length before decoding binary messages. ASCII format header is described in Table ASCII Header Structure (N4).
2	Data	Data field, the length is variable according to different message types. Please refer to specific messages for more information.
3	CRC	Unicore messages end with 32-bit CRC. Binary format messages contain a 32-bit CRC calculating all data including the header. ASCII format CRC calculates all data except `#`.

Table 7-47 Three Sync Bytes of the Binary Header (N4)

Byte	Hex	Decimal
First	0xAA	170
Second	0x44	68
Third	0xB5	181

Table 7-48 Binary Header Structure (N4)

ID	Field	Type	Description	Binary Bytes	Binary Offset
1	Sync	UCHAR	Hexadecimal 0xAA.	1	0
2	Sync	UCHAR	Hexadecimal 0x44.	1	1
3	Sync	UCHAR	Hexadecimal 0xB5.	1	2
4	CPUIDle	UCHAR	CPU idle 0-100	1	3
5	Message ID	USHORT	Message ID	2	4
6	MessageLength	USHORT	Message length	2	6
7	TimeRef	UCHAR	Reference time (GPST or BDST)	1	8
8	TimeStatus	UCHAR	Time status	1	9
9	Wn	USHORT	Week number	2	10
10	Ms	ULONG	Seconds of week (ms)	4	12
11	Version	ULONG	Release version	4	16
12	Reserved	UCHAR	Reserved	1	20
13	Leap sec	UCHAR	Leap second	1	21
14	DelayMs	USHORT	Output delay	2	22

Table 7-49 ASCII Header Structure (N4)

ID	Field	Type	Description
1	Sync	CHAR	Sync character. The ASCII message always starts with a #.
2	Message	CHAR	The ASCII name of the log or command in this

ID	Field	Type	Description
			manual.
3	CPUIDle	UCHAR	The minimum percentage of time that the processor is idle, calculated once per second.
4	TimeRef	UCHAR	Reference time (GPST or BDST)
5	TimeStatus	UCHAR	GPS time quality indicator. The value is Unknown or Fine, and the former indicates that the receiver has not yet calculated the precise GPS time.
6	Wn	USHORT	GPS week number
7	Ms	ULONG	GPS seconds of week (ms)
8	Version	ULONG	Unicore format version number
9	Reserved	UCHAR	Reserved
10	Leap sec	UCHAR	Leap second
11	Output Delay	USHORT	Output delay (Difference between the data output time and GNSS signal receiving time), ms

7.5.2 VERSION: Version and Authorization

The Version message contains the product name, authorization, PN and SN, hardware version and firmware version information. The authorization date format is year/month/day.

Message ID : 37

ASCII Syntax

```
VERSIONA
```

Binary Syntax

```
VERSIONB
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C, UM981C, UM982C

Output

```
#VERSIONA,79,GPS,FINE,2326,378237000,15434,0,18,889;"UM982","R4.10Build15434","HRPT00-S10
C-P","2310415000012-LR23A2225208904","ff2740966a10124c","2024/08/08"*769fd54f
```

Table 7-50 VERSION Message Structure

Field	Field	Data Description	Format	Binary Bytes	Binary Offset
1	VERSION header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Type	Product Type 0 = UNKNOWN 17 = UM982 18 = UM980 19 = UM960 24 = UM960L 26 = UM981 40 = UMD982 52 = UB9A0 53 = UBD9A0 62 = UMD960 63 = UMD980 64 = UM980C 43 = UM981C 65 = UM982C 31 = UM981S 41 = UMD981 42 = UMD981S	Enum	4	H+0
3	sw version	Firmware software version	Char[33]	33	H+4
4	Auth	Authorization type. Displays i nvalid when the authrization code expires.	Char[129]	129	H+37
5	Psn	Product PN number and serial number	Char[66]	66	H+166
6	efuse ID	Board ID	Char[33]	33	H+232
7	comp time	Firmware compile time YYYY/ MM/DD	Char[43]	43	H+265
8	xxxx	32-bit CRC (ASCII and Binary	Hex	4	H+308

Field	Field	Data Description	Format	Binary Bytes	Binary Offset
		only)			
9	[CR][LF]	Sentence terminator (ASCII only)	-		

7.5.3 ADRDOP : DOP of ADRNAV

The `ADRDOP` log contains DOP (Dilution of Precision) for all satellites used in the ADRNAV solution.

Message ID : 953

ASCII Syntax

```
ADRDOPA 1
```

Binary Syntax

```
ADRDOPB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#ADRDOPA,59,GPS,FINE,2298,280152000,0,0,18,7;280152000,0.8093,0.7129,0.3831,0.6045,0.377
9,0.2902,0.2421,5.0,0.0,50,4,7,8,9,16,18,26,31,34,35,36,39,51,60,61,58,59,49,50,161,163,219,220,162,16
4,165,166,167,169,170,176,182,189,190,196,199,200,205,206,187,181,76,77,79,84,82,98,99,86,85*0eea
644e
```

Table 7-51 ADRDOP Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	ADRDOP Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Ulong	4	H

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
3	gdop	Geometric DOP	Float	4	H+4
4	Pdop	Position DOP	Float	4	H+8
5	Tdop	Time DOP	Float	4	H+12
6	Vdop	Vertical DOP	Float	4	H+16
7	Hdop	Horizontal DOP	Float	4	H+20
8	Ndop	North DOP	Float	4	H+24
9	Edop	East DOP	Float	4	H+28
10	Cutoff	Elevation cutoff angle	Float	4	H+32
11	Reserved	Reserved	Float	4	H+36
12	#PRN	Number of tracked satellites	UShort	2	H+40
13	PRN	PRN of tracked satellites, see Table Satellite PRN Number (with Offset) in Unicore-defined Messages, null field until the position solution is available.	UShort	2	H+42
14	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+42+2*#PRN
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.4 ADRDOPH: DOP of ADRNAV (Slave Antenna)

This log contains DOP (Dilution of Precision) for all satellites used in the ADRNAVH solution.

Message ID : 2121

ASCII Syntax

```
ADRDOPHA 1
```

Binary Syntax

```
ADRDOPHB 1
```

Applicable Products: UM982, UMD982

Output

```
#ADRDOPHA,46,GPS,FINE,2298,280151000,0,0,18,19;280151000,0.8182,0.7199,0.3888,0.6079,0.385
6,0.2972,0.2456,5.0,0.0,49,16,9,8,4,26,18,7,31,34,36,35,39,58,60,59,50,49,51,61,161,163,220,219,162,16
4,165,169,167,166,176,170,182,190,189,196,181,206,205,200,199,79,77,76,99,98,84,82,86,85*1e0ad99
9
```

Table 7-52 ADRDOPH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	ADRDOPH Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Ulong	4	H
3	gdop	Geometric DOP	Float	4	H+4
4	Pdop	Position DOP	Float	4	H+8
5	Tdop	Time DOP	Float	4	H+12
6	Vdop	Vertical DOP	Float	4	H+16
7	Hdop	Horizontal DOP	Float	4	H+20
8	Ndop	North DOP	Float	4	H+24
9	Edop	East DOP	Float	4	H+28
10	Cutoff	Elevation cutoff angle	Float	4	H+32
11	Reserved	Reserved	Float	4	H+36
12	#PRN	Number of tracked satellites	UShort	2	H+40
13	PRN	PRN of tracked satellites, see Table Satellite PRN Number (with Offset) in Unicore-defined Messages, null field until	UShort	2	H+42

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		the position solution is available.			
14	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+42+2*#PRN
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.5 ADRNAV : RTK Position and Velocity

This log contains the position, accuracy, status, and velocity of the carrier phase RTK positioning.

Message ID : 142

ASCII Syntax

```
ADRNAVA 1
```

Binary Syntax

```
ADRNAVB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#ADRNAVA,97,GPS,FINE,2190,364787000,0,0,18,1;INSUFFICIENT_OBS,NONE,0.00000000000,0.00000000000,-17.0000,17.0000,WGS84,0.0000,0.0000,0.0000,"0",0.000,0.000,46,0,0,0,0,00,00,00,INSUFFICIENT_OBS,NONE,0.000,0.000,0.0000,0.000000,0.0000,00000000*f4ac8d54
```

Table 7-53 ADRNAV Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	ADRNAV header	Log header, See Table Binary Header Structure (N4) and Table ASCII Header Structure		H	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		(N4)			
2	sol status	Solution status. Refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID, only WGS84 is supported for now. ASCII = WGS84, binary = 61.	Enum	4	H+36
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID	Char[4]	4	H+52
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17	Reserved	Reserved	Uchar	1	H+66
18	Reserved	Reserved	Uchar	1	H+67
19	Reserved	Reserved	Uchar	1	H+68

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
20	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, see Table Galileo & BDS-3 Signal Mask	Hex	1	H+70
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask, refer to Table GPS/GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	sol status	Solution status, refer to Table Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table Position or Velocity Type	Enum	4	H+76
25	latency	A measure of latency in the velocity time tag, in seconds. Subtracting latency from epoch time gives accurate velocity.	Float	4	H+80
26	diff_age	Differential age, s	Float	4	H+84
27	hor spd	Horizontal speed over ground, m/s	Double	8	H+88
28	trk gnd	Actual direction of motion over ground (track over ground) with respect to True North, in degrees	Double	8	H+96
29	vert spd	Vertical speed, m/s, positive indicates increasing altitude (up) and negative indicates decreasing altitude (down)	Double	8	H+104
30	Verspd std	Vertical speed standard deviation, m/s	Float	4	H+112
31	Horspd std	Horizontal speed standard deviation, m/s	Float	4	H+116
32	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+120

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
33	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.6 ADRNAVH: RTK Position and Velocity (Slave Antenna)

This log contains the position, accuracy, status, and velocity of the carrier phase RTK positioning solution which is calculated with the slave antenna.

Message ID : 2117

ASCII Syntax

```
ADRNAVHA 1
```

Binary Syntax

```
ADRNAVHB 1
```

Applicable Products: UM982, UMD982

Output

```
#ADRNAVHA,97,GPS,FINE,2190,364822000,0,0,18,9;INSUFFICIENT_OBS,NONE,0.00000000000,0.00000000000,-17.0000,17.0000,WGS84,0.0000,0.0000,0.0000,"0",0.000,0.000,0,0,0,0,0,00,00,00,INSUFFICIENT_OBS,NONE,0.000,0.000,0.0000,0.000000,0.0000,00000000*da9317a3
```

Table 7-54 ADRNAVH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	ADRNAVH header	Log header, See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to Table Position or Velocity	Enum	4	H+4

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Type			
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID, only WGS84 is supported for now. ASCII = WGS84, binary = 61.	Enum	4	H+36
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID	Char[4]	4	H+52
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17-19	Reserved	Reserved	Uchar	3	H+66
20	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, see Table Galileo & BDS-3 Signal Mask	Hex	1	H+70

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask, refer to Table GPS/GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	sol status	Solution status, refer to Table Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table Position or Velocity Type	Enum	4	H+76
25	latency	A measure of latency in the velocity time tag, in seconds. Subtracting latency from epoch time gives accurate velocity.	Float	4	H+80
26	diff_age	Differential age, s	Float	4	H+84
27	hor spd	Horizontal speed over ground, m/s	Double	8	H+88
28	trk gnd	Actual direction of motion over ground (track over ground) with respect to True North, in degrees	Double	8	H+96
29	vert spd	Vertical speed, m/s. Positive indicates increasing altitude (up) and negative indicates decreasing altitude (down).	Double	8	H+104
30	Verspd std	Vertical speed standard deviation, m/s	Float	4	H+112
31	Horspd std	Horizontal speed standard deviation, m/s	Float	4	H+116
32	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+120
33	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.7 AGC: Automatic Gain Control

This log records the AGC (Automatic Gain Control) values for three RF channels each of the primary and secondary antennas.

- When an open circuit occurs in the antenna link (abnormal condition), the AGC will increase its gain (e.g., AGC value may reach 110).
- When signal interference raises the noise floor, the AGC will decrease its gain (e.g., AGC value may drop to 10).
- During normal antenna link operation, the AGC typically maintains intermediate values (e.g., around 60).
  General AGC Principles:
- Inverse relationship between link gain and AGC values (lower gain → higher AGC numbers)
- Direct relationship between interference level and AGC values (higher interference → lower AGC numbers)

> **Note:** Due to differences between module hardware configurations, actual AGC values may vary across different modules while following the same general pattern.

Message ID : 220

ASCII Syntax

```
AGCA 1
```

Binary Syntax

```
AGCB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#AGCA,65,GPS,FINE,2190,375570000,0,0,18,37;44,46,63,-1,-1,41,1,0,-1,-1*634f1e4b
```

Table 7-55 AGC Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	AGC header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	ANT1L1	Value of L1 signal received by the master antenna. AGC register supports values in the range of 0 to 119. If the value is -1, it indicates that the channel is invalid.	Short	2	H
3	ANT1L2	Value of L2 signal received by the master antenna. AGC register supports values in the range of 0 to 119. If the value is -1, it indicates that the channel is invalid.	Short	2	H+2
4	ANT1L5	Value of L5 signal received by the master antenna. AGC register supports values in the range of 0 to 119. If the value is -1, it indicates that the channel is invalid.	Short	2	H+4
5	Reserved	Reserved	Short	2	H+6
6	Reserved	Reserved	Short	2	H+8
7	ANT2L1	Value of L1 signal received by the slave antenna. AGC register supports values in the range of 0 to 119. If the value is -1, it indicates that the channel is invalid.	Short	2	H+10
8	ANT2L2	Value of L2 signal received by the slave antenna. AGC register supports values in the range of 0 to 119. If the value is -1, it indicates that the channel is invalid.	Short	2	H+12
9	ANT2L5	Value of L5 signal received by the slave antenna. AGC register	Short	2	H+14

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		supports values in the range of 0 to 119. If the value is -1, it indicates that the channel is invalid.			
10	Reserved	Reserved	Short	2	H+16
11	Reserved	Reserved	Short	2	H+18
12	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	H+20
13	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

> **Note:** the "L1", "L2" and "L5" indicates RF channels, instead of specific frequencies.

7.5.8 AGNSSSTATUS: AGNSS Status

This command is used to query the AGNSS status.

Message ID : 512

ASCII Syntax

```
AGNSSSTATUSA 1
```

Binary Syntax

```
AGNSSSTATUSB 1
```

Applicable Products: UM982, UMD982, UM980, UMD980, UB9A0, UBD9A0, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#AGNSSSTATUSA,77,GPS,FINE,2216,457483000,0,0,18,9;0000004EF7FFFFFF,0C003FFFBFFCBFFF,00
00000000DF7FFF,0000000B67945FDF,0,F,01,07,2022,0,070418.26,18,0,0,4004.73963848,11614.1967
8280,57.9901*67b51741
```

Table 7-56 AGNSSSTATUS Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	AGNSSSTATUS Header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2-5	Source	GPS: 64 bits, 1 bit represents 1 satellite BDS: 64 bits, 1 bit represents 1 satellite GLO: 64 bits, 1 bit represents 1 satellite GAL: 64 bits, 1 bit represents 1 satellite Source data decoding status. Set the corresponding bit to 1 after receiving the correction data for 1 satellite, in hexadecimal format.	UINT[2]	8	H
6	Reserved	Reserved	UINT	4	H+32
7	Calculate status	Bit 0: assisted data input 0 – no assisted data input 1 – assisted data input Bit 1: available satellites 0 – insufficient 1 – sufficient Bit 2: validity of the assisted time 0 – invalid 1 — valid Bit 3: validity of the assisted position 0 — invalid 1 — valid	UINT	4	H+36

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
8	Aid day	Assisted UTC day, double digits, 01 ~ 31	UINT	4	H+40
9	Aid mon	Assisted UTC month, double digits, 01 ~ 12	UINT	4	H+44
10	Aid year	Assisted UTC year, four digits	UINT	4	H+48
11	Reserved	Reserved	UINT	4	H+52
12	Aid Time	Assisted time, hour-minute-second, hhmmss.sss	Double	8	H+56
13	Aid LeapSecond	Assisted leap second	UShort	2	H+64
14	Reserved	Reserved	UShort	2	H+66
15	Reserved	Reserved	UINT	4	H+68
16	Aid Lat	Assisted latitude, ddmm.mmmmmmmm	Double	8	H+72
17	Aid Lon	Assisted longitude, dddmm.mmmmmmmm	Double	8	H+80
18	Aid Height	Assisted height, 4 digits after the decimal point, meters	Double	8	H+88
19	xxxx	32-bit CRC	Hex	4	H+96
20	[CR][LF]	Sentence terminator			

7.5.9 AGRIC

AGRIC message contains the receiver's position, velocity, serial number, heading, and baseline information.

Message ID : 11276

ASCII Syntax

```
AGRICA 1
```

```
AGRICA COM2 1
```

Binary Syntax

```
AGRICB 1
```

```
AGRICB COM2 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#AGRICA,97,GPS,FINE,2190,363942000,0,0,18,12;GNSS,232,21,12,30,5,5,24,1,0,5,15,1,0.0000,0.000
0,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,0.005,-0.003,0.001,0.004,0.042,0.050,0.044,40.0
7898274722,116.23663152683,60.0036,-2160488.6213,4383615.6655,4084732.9679,1.8493,1.890
2,4.4654,0.0000,0.0000,0.0000,0.00000000000,0.00000000000,0.0000,-0.00000000000,0.000000000
00,0.0000,363942000,0.000,15.213205,-8.492279,0.000000,0.000000,5,0,0,0*0b2e294a
```

Table 7-57 AGRIC Message Structure

ID	Field	Description	Format	Binary Bytes	Binary Offset
1	AGRIC header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	GNSS		Char	4	H
3	length	Command length, from GNSS to CRC, 232 bytes in total, a fixed value of 0XE8	uchar	1	H+4
4	Year	UTC-year, for example: 2016: 16; 2116: 116	uchar	1	H+5
5	Month	UTC-month	uchar	1	H+6
6	Day	UTC-day	uchar	1	H+7

ID	Field	Description	Format	Binary Bytes	Binary Offset
7	Hour	UTC-hour	uchar	1	H+8
8	Minute	UTC-minute	uchar	1	H+9
9	Second	UTC-second	uchar	1	H+10
10	Postype	Rover position status: 0: Invalid solution; 1: Single point solution; 2: Pseudorange differential solution; 4: Fixed solution; 5: Float solution 7: Input a fixed position (only supported by specific versions)	uchar	1	H+11
11	Heading Status	Heading solution status of master and slave antennas 0: Invalid solution; 4: Fixed solution; 5: Float solution	uchar	1	H+12
12	Num GPS Sta	Number of GPS satellites used in the solution	uchar	1	H+13
13	Num BDS Sta	Number of BDS satellites used in the solution	uchar	1	H+14
14	Num GLO Sta	Number of GLONASS satellites used in the solution	uchar	1	H+15
15	Baseline_N	Baseline vector from the base station to the rover station, northern component	float	4	H+16
16	Baseline_E	Baseline vector from the base station to the rover station, eastern component	float	4	H+20

ID	Field	Description	Format	Binary Bytes	Binary Offset
17	Baseline_U	Baseline vector from the base station to the rover station, vertical component	float	4	H+24
18	Baseline_NStd	Baseline vector from the base station to the rover station, northern component standard deviation	float	4	H+28
19	Baseline_EStd	Baseline vector from the base station to the rover station, eastern component standard deviation	float	4	H+32
20	Baseline_UStd	Baseline vector from the base station to the rover station, vertical component standard deviation	float	4	H+36
21	Heading	Heading	float	4	H+40
22	Pitch	Pitch	float	4	H+44
23	Roll	Roll	float	4	H+48
24	Speed	Speed, scalar	float	4	H+52
25	Velocity of North	North velocity	float	4	H+56
26	Velocity of East	East velocity	float	4	H+60
27	Velocity of Up	Up velocity	float	4	H+64
28	Xigema_Vx	North velocity standard deviation	float	4	H+68
29	Xigema_Vy	East velocity standard deviation	float	4	H+72
30	Xigema_Vz	Up velocity standard deviation	float	4	H+76
31	lat	Latitude of the rover station: -90~90 degrees,	double	8	H+80

ID	Field	Description	Format	Binary Bytes	Binary Offset
		positive for the North and negative for the South			
32	lon	Longitude of the rover station: -180~180 degrees, positive for the East and negative for the West	double	8	H+88
33	alt	Height of the rover station	double	8	H+96
34	ECEF_X	X axis of the ECEF coordinate system	double	8	H+104
35	ECEF_Y	Y axis of the ECEF coordinate system	double	8	H+112
36	ECEF_Z	Z axis of the ECEF coordinate system	double	8	H+120
37	Xigema_lat	Latitude standard deviation	float	4	H+128
38	Xigema_lon	Longitude standard deviation	float	4	H+132
39	Xigema_alt	Height standard deviation	float	4	H+136
40	Xigema_ECEF_X	ECEF_X standard deviation	float	4	H+140
41	Xigema_ECEF_Y	ECEF_Y standard deviation	float	4	H+144
42	Xigema_ECEF_Z	ECEF_Z standard deviation	float	4	H+148
43	BASE_lat	Latitude of the base station: -90~90 degrees	double	8	H+152
44	BASE_lon	Longitude of the base station: -180~180 degrees	double	8	H+160

ID	Field	Description	Format	Binary Bytes	Binary Offset
45	BASE_alt	Height of the base station	double	8	H+168
46	SEC_lat	Latitude of the slave antenna: -90~90 degrees	double	8	H+176
47	SEC_lon	Longitude of the slave antenna: -180~180 degrees	double	8	H+184
48	SEC_alt	Height of the slave antenna	double	8	H+192
49	GPS_WEEK_SECOND	Milliseconds of GPS week	int	4	H+200
50	Diffage	Differential age	float	4	H+204
51	Speed_Heading	Direction of velocity	float	4	H+208
52	Undulation	Undulation	float	4	H+212
53	Remain_float_3	Reserved	float	4	H+216
54	Remain_float_4	Reserved	float	4	H+220
55	Num GAL Sta	Number of Galileo satellites	uchar	1	H+224
56	Speed_Type	0: speed solution status valid 1: speed solution status invalid	uchar	1	H+225
57	Remain_char_3	Reserved	uchar	1	H+226
58	Remain_char_4	Reserved	uchar	1	H+227
59	xxxx	32-bit CRC	HEX	4	H+228
60	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.10 ANT1GROUP : Query Supported GNSS Systems and Frequencies

The `ANT1GROUP` command queries the GNSS systems and frequencies supported by the current `SIGNALGROUP`. This command is applicable to single-antenna products. For the corresponding command for dual-antenna products, see ANT2GROUP : Query Supported Systems and Frequencies.

Message ID : 523

ASCII Syntax

```
ANT1GROUPA 1
```

Binary Syntax

```
ANT1GROUPB 1
```

Applicable Products: UM980, UM982[9], UM980C

Output

```
#ANT1GROUPA,97,GPS,FINE,2369,369811000,19540,0,18,17;2,6,GP,0x1F,GL,0x07,GA,0x0F,GB,0x3F,G
Q,0x17,GI,0x01*a4828b45
```

Table 7-58 ANT1GROUP Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	signalgroup header	Log header, see Table Binary Header Structure (N4) and Table Table ASCII Header Structure (N4)		H	0
2	MainAntenna signalgroup	Antenna channel configuration. See Table Satellite Systems and Frequencies	UShort	2	H
3	System Num	Number of supported systems	UShort	2	H+2

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
4	System ID	Refer to Table Satellite Systems and Frequencies for system ID. The system abbreviation is displayed in ASCII, while the corresponding numerical value is represented in binary.	UShort	2	H+4
5	Frequeny ID	Refer to Table Satellite Systems and Frequencies for system ID.	UShort	2	H+6
6...		Next System = H + 4 + (#sys × 4) Each system and its status word occupy 4 bytes, cycling from the 4th to the 5th byte			
Variable	xxxx	32-bit CRC	Hex	4	H+4+(#sys x 4)
Variable	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.11 ANT2GROUP : Query Supported GNSS Systems and Frequencies (Dual-Antenna)

The `ANT2GROUP` command queries the GNSS systems and frequencies supported by the current `SIGNALGROUP`. This command is applicable to dual-antenna products. For the corresponding command for single-antenna products, see ANT1GROUP : Query Supported Systems and Frequencies.

Message ID : 524

ASCII Syntax

```
ANT2GROUPA 1
```

Binary Syntax

```
ANT2GROUPB 1
```

Applicable Products: UM982[10]

Table 7-59 ANT2GROUP Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	signalgroup header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	MainAntenna signalgroup	Antenna channel configuration. See Table Satellite Systems and Frequencies	UShort	2	H
3	System Num	Number of supported systems	UShort	2	H+2
4	System ID	Refer to Table Satellite Systems and Frequencies for system ID. The system abbreviation is displayed in ASCII, while the corresponding numerical value is represented in binary.	UShort	2	H+4
5	Frequeny ID	Refer to Table Satellite Systems and Frequencies for system ID.	UShort	2	H+6
6...		Next System = H + 4 + (#sys × 4) Each system and its status word occupy 4 bytes, cycling from the 4th to the 5th byte			
Variable	xxxx	32-bit CRC	Hex	4	H+4+ (#sys x 4)

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
Variable	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.12 APPPNAV: PPPAR Position, Accuracy, and Status Information

This message contains the receiver's PPP-AR (Precise Point Positioning with Ambiguity Resolution) position, positioning accuracy, and status information. It supports data output up to 20 Hz.

Message ID : 1457

ASCII Syntax

```
APPPNAVA 1
```

Binary Syntax

```
APPPNAVB 1
```

Applicable Products: UM980C, UM981C, UM982C

Output

```
#APPPNAVA,65,GPS,FINE,2372,183965000,19794,0,18,17;SOL_COMPUTED,PPP_AR,40.0789948466
3,116.23661087645,57.9828,0.0000,WGS84,0.0115,0.0096,0.0234,"818",10.000,72.000,58,50,50,49,1,0
0,cf,ff*935ed016
```

Table 7-60 APPPNAV Data Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	APPPNAV header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	PPPIAR	Position type, refer to Table	Enum	4	H+4

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
	pos type	Position or Velocity Type			
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID	Enum	4	H+36
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID, value=999X	Char[4]	4	H+52
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17	Reserved	Reserved	Uchar	1	H+66
18	Reserved	Reserved	Uchar	1	H+67
19	Reserved	Reserved	Float	4	H+68
20	Reserved	Reserved	Float	4	H+72
21	xxxx	32-bit CRC (ASCII and Binary)	Hex	4	H+76
22	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.13 BASEINFO: Base Station Information

This log contains the position, ID, and health status of the base station. The log supports `ONCHANGED` trigger.

Message ID : 176

ASCII Syntax

```
BASEINFOA 1
```

```
BASEINFOA ONCHANGED
```

Binary Syntax

```
BASEINFOB 1
```

```
BASEINFOB ONCHANGED
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#BASEINFOA,56,GPS,FINE,2190,376748000,0,0,18,153;00000000,-2160493.199,4383620.763,408473
4.120,"0000",0*2edbd87a
```

Table 7-61 BASEINFO Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BASEINFO Header	Log header, see Table Binary Header Structure (N4) and Table Table ASCII Header Structure (N4)		H	0
2	Status	Status of the base station: 0 = valid 1 = Invalid	Ulong	4	H
3	X	ECEF X-coordinate	Double	8	H+4
4	Y	ECEF Y-coordinate	Double	8	H+12
5	Z	ECEF Z-coordinate	Double	8	H+20
6	Station id	Base station ID	Char[5]	8	H+28
7	reserved	Reserved	Ulong	4	H+36

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
8	xxxx	32-bit CRC	Hex	4	H+40
9	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.14 BASEPOS: Position of the Base Station

This message outputs the real-time position of the base station when the module works in fixed base station mode in order to monitor the position of the base station and provide information to judge whether the base station is moved by external objects.

> **Note:** This command does not work in moving base station mode.

Message ID : 49

ASCII Syntax

```
BASEPOSA 1
```

Binary Syntax

```
BASEPOSB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#BASEPOSA,96,GPS,FINE,2207,289028000,0,0,18,20;SOL_COMPUTED,SINGLE,40.07899984715,116.23661761328,64.8315,8.4923,WGS84,2.8968,2.0472,6.2202,"0",0.000,0.000,55,28,28,0,16,12,01,51,SOL_COMPUTED,DOPPLER_VELOCITY,0.000,0.000,0.0044,52.887930,0.0082,0.0205,0.0116*80a5f451
```

Table 7-62 BASEPOS Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BASEPOS header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure		H	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		(N4)			
2	p-sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID, only WGS84 (binary = 61) is supported for now	Enum	4	H+36
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID, default = 0	Char[4]	4	H+52
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17	Reserved	Reserved	Uchar	1	H+66
18	Reserved	Reserved	Uchar	1	H+67
19	Reserved	Reserved	Uchar	1	H+68
20	ext sol stat	Extended solution status, refer to Table Extended	Hex	1	H+69

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Solution Status			
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS3 Signal Mask	Hex	1	H+70
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table GPS/ GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	V-sol status	Solution status, refer to Table Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table Position or Velocity Type	Enum	4	H+76
25	latency	A measure of latency in the velocity time tag, in seconds. Subtracting latency from epoch time gives accurate velocity.	Float	4	H+80
26	diff_age	Differential age, s	Float	4	H+84
27	hor spd	Horizontal speed over ground, m/s	Double	8	H+88
28	trk gnd	Actual direction of motion over ground (track over ground) with respect to True North, in degrees	Double	8	H+96
29	vert spd	Vertical speed, m/s, positive indicates increasing altitude (up) and negative indicates decreasing altitude (down)	Double	8	H+104
30	Verspd std	Standard deviation of vertical speed, m/s	Float	4	H+112
31	Horspd std	Standard deviation of horizontal speed, m/s	Float	4	H+116
32	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+120
33	[CR][LF]	Sentence terminator (ASCII	-	-	-

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		only)			

7.5.15 BD3EPH: BDS3 Ephemeris

This log contains BDS3 ephemeris information. It supports `ONCHANGED` trigger.

If you use `ONTIME` trigger (i.e. the output frequency is fixed), the recommended time interval is more than 60 seconds because of the large amount of ephemeris data.

It is not recommended to output this log at 1 Hz. When it is output together with 50 Hz observation data, it is recommended to use the `ONCHANGED` trigger.

Message ID : 2999

ASCII Syntax

```
BD3EPHA COM1 60
```

```
BD3EPHA COM1 ONCHANGED
```

Binary Syntax

```
BD3EPHB COM1 60
```

```
BD3EPHB COM1 ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM960, UMD960, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output


```
#BD3EPHA,77,GPS,FINE,2211,180091000,0,0,18,4;44,0,3,15,21,21,2211,2211,176400.0,176400.0,-1.42
3828125e+01,1.108884811e-02,3.726583799e-09,-1.069685670e-13,1.309681137e+00,8.01902380
8e-04,6.109550176e-01,2.244487405e-07,8.259899914e-06,1.940156250e+02,6.187500000e+0
0,1.210719347e-08,7.450580597e-09,9.593903595e-01,-4.500187451e-11,1.952617584e+00,-6.803
497679e-09,176400.0,-2.153683454e-09,-1.199077815e-08,0.000000000e+00,0.000000000e+0
0,0.000000000e+00,-2.910383046e-10,6.693656906e-04,1.219113699e-11,0.000000000e+00,58
8,0,27,0,7,0,0,1*b90d9566
```

Table 7-63 BD3EPH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BD3EPH header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	PRN	Satellite PRN number (BDS: 1 to 63)	UChar	1	H
3	Health	Satellite health status: 0=healthy, 1=unhealthy	UChar	1	H+1
4	SatType	Satellite type (GEO/MEO/IGSO) 1 = GEO 2 = IGSO 3 = MEO	UChar	1	H+2
5	SISMAI	Signal-in-space monitoring accuracy	UChar	1	H+3
6	IODE	When outputting B1C and B2a ephemeris, this field is the issue of ephemeris data; when outputting B2b ephemeris, this field is reserved.	UShort	2	H+4
7	IODC	When outputting B1C and B2a ephemeris, this field is the issue of clock data; when outputting B2b ephemeris, this field is reserved.	UShort	2	H+6
8	Week	GPS reference week number (GPS week)	UShort	2	H+8
9	Zweek	Z count week number based on GPS week. This is the week number from subframe 1 of the ephemeris (TOE week)	UShort	2	H+10
10	Tow	Time stamp of subframe 1, seconds	Double	8	H+12
11	Toe	Reference time of ephemeris, seconds	Double	8	H+20

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
12	DeltaA	Deviation of the semi-major axis at the reference time relative to the reference value, meters	Double	8	H+28
13	dDeltaA	Rate of change of the semi-major axis, meters/second	Double	8	H+36
14	ΔN	Difference between the satellite mean angular velocity and the calculated value at the reference time, radians/second	Double	8	H+44
15	dΔN	Rate of change of the difference between the satellite mean angular velocity and the calculated value at the reference time, radians/second^2	Double	8	H+52
16	M0	Mean anomaly at reference time, radians	Double	8	H+60
17	Ecc	Eccentricity	Double	8	H+68
18	ω	Argument of perigee, radians	Double	8	H+76
19	Cuc	Argument of latitude (amplitude of cosine, radians)	Double	8	H+84
20	Cus	Argument of latitude (amplitude of sine, radians)	Double	8	H+92
21	crc	Orbit radius (amplitude of cosine, meters)	Double	8	H+100
22	crs	Orbit radius (amplitude of sine, meters)	Double	8	H+108
23	cic	Orbit inclination (amplitude of cosine, radians)	Double	8	H+116
24	cis	Orbit inclination (amplitude of sine, radians)	Double	8	H+124
25	I0	Inclination angle at reference time, radians	Double	8	H+132

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
26	IDOT	Rate of change of inclination angle, radians/second	Double	8	H+140
27	Ω0	Right ascension of ascending node, radians	Double	8	H+148
28	Ω dot	Rate of change of the right ascension of ascending node, radians/second	Double	8	H+156
29	toc	Reference time for satellite clock corrections, seconds	Double	8	H+164
30	Tgdb1cp	Group delay differential for B1C pilot, seconds	Double	8	H+172
31	Tgdb2ap	Group delay differential for B2a pilot, seconds	Double	8	H+180
32	Tgdb2bI	Group delay differential for B2b I-component, seconds	Double	8	H+188
33	Tgdb2bQ[11]	Group delay differential for B2b Q-component, seconds	Double	8	H+196
34	ISCb2ad	Inter-signal correction of B2a data relative to B2a pilot, seconds	Double	8	H+204
35	ISCb1cd	Inter-signal correction of B1C data relative to B1C pilot, seconds	Double	8	H+212
36	af0	Satellite clock bias parameter, seconds	Double	8	H+220
37	af1	Satellite clock drift parameter, s/s	Double	8	H+228
38	af2	Rate of change of the satellite clock drift parameter, s/s^2	Double	8	H+236
39	iTop	Time of week of data prediction	INT	4	H+244
40	SISAIoe	Tangential and normal precision index of satellite orbit	UChar	1	H+248
41	SISAIocb	Accuracy index of satellite orbit radial and satellite clock fixed	UChar	1	H+249

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		bias			
42	SISAIoc1	Accuracy index of satellite clock frequency offset	UChar	1	H+250
43	SISAIoc2	Accuracy index of satellite clock frequency drift	UChar	1	H+251
44	Reserved	Reserved	INT	4	H+252
45	Reserved	Reserved	INT	4	H+256
46	FreqType	If this field is 0, the message output is B1C ephemeris. If this field is 1, the message output is B2a ephemeris. If this field is 2, the message output is B2b ephemeris.	UINT	4	H+260
47	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	H+264
48	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.16 BD3ION: BDS3 Ionosphere Parameters

This log provides the ionospheric model parameters broadcast by BeiDou-3. The log supports `ONCHANGED` trigger.

Message ID : 21

ASCII Syntax

```
BD3IONA 1
```

```
BD3IONA ONCHANGED
```

Binary Syntax

```
BD3IONB 1
```

```
BD3IONB ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM960, UMD960, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#BD3IONA,89,GPS,FINE,2190,371265000,0,0,18,22;0.000000000000000e+00,0.000000000000000e+00,0.000000000000000e+00,0.000000000000000e+00,0.000000000000000e+00,0.000000000000000e+00,0.000000000000000e+00,0.000000000000000e+00,0.000000000000000e+00,0*cd77c4ca
```

Table 7-64 BD3ION Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BD3ION header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	A1	Ionospheric delay correction model parameter 1	FLOAT	4	H
3	A2	Ionospheric delay correction model parameter 2	FLOAT	4	H+4
4	A3	Ionospheric delay correction model parameter 3	FLOAT	4	H+8
5	A4	Ionospheric delay correction model parameter 4	FLOAT	4	H+12
6	A5	Ionospheric delay correction model parameter 5	FLOAT	4	H+16
7	A6	Ionospheric delay correction model parameter 6	FLOAT	4	H+20
8	A7	Ionospheric delay correction model parameter 7	FLOAT	4	H+24
9	A8	Ionospheric delay correction model parameter 8	FLOAT	4	H+28
10	A9	Ionospheric delay correction model parameter 9	FLOAT	4	H+32
11	reserved	Reserved	ULONG	4	H+36

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
12	xxxx	32-bit CRC checksum	Hex	4	H+40
13	[CR][LF]	Sentence terminator (ASCII only)	–	–	–

7.5.17 BD3UTC: Conversion between BDS-3 Time and UTC

This log contains time conversion parameters between BDST and UTC. The log supports `ONCHANGED` trigger.

Message ID : 22

ASCII Syntax

```
BD3UTCA 1
```

```
BD3UTCA ONCHANGED
```

Binary Syntax

```
BD3UTCB 1
```

```
BD3UTCB ONCHANGED
```

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#BD3UTCA,97,GPS,FINE,2190,362396000,0,0,18,14;0,0,0.000000000000000e+00,0.000000000e+0
0,0.000000000000000e+00,0,0,0,0,0,0*4bd9130e
```

Table 7-65 BD3UTC Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BD3UTC	Log header. See Table Binary		H	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Header Structure (N4) and Table ASCII Header Structure (N4)			
2	utc wn	UTC reference week number	Ulong	4	H
3	tot	Reference time of UTC parameters	Ulong	4	H+4
4	A0	Clock bias of BDST relative to UTC	Double	8	H+8
5	A1	Clock drift of BDST relative to UTC	Double	8	H+16
6	A2	Clock drift rate of BDST relative to UTC	Double	8	H+24
7	wn lsf	Future week number when a new leap second is added (based on BDST)	Ulong	4	H+32
8	dn	Future day number in the week when a new leap second is added (the range is 0 to 6 where Sunday = 0 and Saturday = 6)	Ulong	4	H+36
9	deltat ls	Existing leap seconds of BDST relative to UTC before the next leap second is added.	Long	4	H+40
10	deltat lsf	Future leap seconds of BDST relative to UTC after the new leap second is added.	Long	4	H+44
11	reserved	Reserved	Ulong	4	H+48
12	reserved	Reserved	Ulong	8	H+52
13	xxxx	32-bit CRC	Hex	4	H+56
14	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.18 BDSEPH: BDS Ephemeris

This log contains BDS ephemeris information. It supports `ONCHANGED` trigger. If you use `ONTIME` trigger (i.e. the output frequency is fixed), the recommended time interval is more than 60 seconds because of the large amount of ephemeris data.

It is not recommended to output this log at 1 Hz. When it is output together with 50 Hz observation data, it is recommended to use the `ONCHANGED` trigger.

Message ID : 108

ASCII Syntax

```
BDSEPHA COM1 60
```

```
BDSEPHA COM1 ONCHANGED
```

Binary Syntax

```
BDSEPHB COM1 60
```

```
BDSEPHB COM1 ONCHANGED
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#BDSEPHA,97,GPS,FINE,2190,362675000,0,0,18,5;60,360000.0,0,1,1,2190,2190,360000.0,4.21644103
6e+07,-4.103028050e-09,2.042808580e+00,3.8967351429e-05,2.4660025037e+00,-1.457566395
e-05,-2.235500142e-05,6.85031250e+02,-4.52843750e+02,1.438893378e-07,-1.206062734e-07,1.2
597663760e-01,1.132190017e-10,-1.993009969e+00,5.03270963e-09,1,360000.0,4.980000000e-0
8,4.980000000e-08,-1.45519e-07,8.26006e-14,0.00000e+00,TRUE,7.291643104e-05,4.00000000e+0
0*493bb7fb
```

Table 7-66 BDSEPH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BDSEPH header	Log header. See Table Binary Header Structure (N4) and Table Table ASCII Header Structure (N4)		H	0
2	PRN	Satellite PRN number (BDS: 1 to 63)	Ulong	4	H
3	Tow	Time stamp of subframe 1 (based on GPS time), seconds	Double	8	H+4
4	Health	Health status, a 1-bit health code defined in the BDS ICD	Ulong	4	H+12

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
5	AODE	Age of data, ephemeris	Ulong	4	H+16
6	AODE	Age of data, ephemeris (same as field 5)	Ulong	4	H+20
7	Week	GPS reference week number (GPS week)	Ulong	4	H+24
8	Z Week	Z count week number based on GPS week. This is the week number from subframe 1 of the ephemeris. The "TOE week" (field 7) is derived from this to account for rollover.	Ulong	4	H+28
9	Toe	Reference time of ephemeris, seconds	Double	8	H+32
10	A	Semi-major axis of the satellite orbit, meters	Double	8	H+40
11	ΔN	Mean motion difference, radians/ second	Double	8	H+48
12	M0	Mean anomaly at reference time, radians	Double	8	H+56
13	Ecc	Eccentricity	Double	8	H+64
14	ω	Argument of perigee, radians	Double	8	H+72
15	Cuc	Argument of latitude (amplitude of cosine, radians)	Double	8	H+80
16	Cus	Argument of latitude (amplitude of sine, radians)	Double	8	H+88
17	crc	Orbit radius (amplitude of cosine, meters)	Double	8	H+96
18	crs	Orbit radius (amplitude of sine, meters)	Double	8	H+104
19	cic	Inclination (amplitude of cosine, radians)	Double	8	H+112
20	cis	Inclination (amplitude of sine, radians)	Double	8	H+120

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
21	I0	Inclination angle at reference time, radians	Double	8	H+128
22	IDOT	Rate of change of inclination angle, radians/second	Double	8	H+136
23	Ω0	Right ascension of ascending node, radians	Double	8	H+144
24	Ω dot	Rate of change of the right ascension of ascending node, radians/second	Double	8	H+152
25	AODC	Age of data, clock	Ulong	4	H+160
26	toc	Reference time for satellite clock corrections (based on GPS time), seconds	Double	8	H+164
27	tgd1	Group delay differential for B1 signal (Equipment time delay differential for B1 signal), seconds	Double	8	H+172
28	tgd2	Group delay differential for B2 signal (Equipment time delay differential for B2 signal), seconds	Double	8	H+180
29	af0	Satellite clock bias parameter, seconds	Double	8	H+188
30	af1	Satellite clock rate parameter, s/s	Double	8	H+196
31	af2	Satellite clock drift parameter, s/s/s	Double	8	H+204
32	AS	Anti-spoofing: 0 = FALSE 1 = TRUE	Enum	4	H+212
33	N	Corrected mean motion, radians/second	Double	8	H+216
34	URA	User range accuracy, m^2. The ICD specifies an algorithm to convert the URA index transmitted in the ephemeris to a nominal standard deviation value. Here outputs the square (variance) of the nominal value.	Double	8	H+224

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
35	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+232
36	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.19 BDSION: BDS Ionosphere Parameters

This log provides the ionosphere model parameters broadcast by BDS. The log supports `ONCHANGED` trigger.

Message ID : 4

ASCII Syntax

```
BDSIONA 1
```

```
BDSIONA ONCHANGED
```

Binary Syntax

```
BDSIONB 1
```

```
BDSIONB ONCHANGED
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#BDSIONA,97,GPS,FINE,2190,362233000,0,0,18,15;1.396983861923218e-08,4.470348358154297e-08,-5.364418029785156e-07,8.940696716308594e-07,1.433600000000000e+05,-3.768320000000000e+05,4.587520000000000e+05,5.242880000000000e+05,36,0,0,0*94da1274
```

Table 7-67 BDSION Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BDSION	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	a0	Constant term of alpha parameter	Double	8	H
3	a1	1st order term of alpha parameter	Double	8	H+8
4	a2	2nd order term of alpha parameter	Double	8	H+16
5	a3	3rd order term of alpha parameter	Double	8	H+24
6	b0	Constant term of beta parameter	Double	8	H+32
7	b1	1st order term of beta parameter	Double	8	H+40
8	b2	2nd order term of beta parameter	Double	8	H+48
9	b3	3rd order term of beta parameter	Double	8	H+56
10	usSVID	ID numbers of satellites used to calculate ionosphere parameters	Ushort	2	H+64
11	usWeek	GPS week when calculating the ionosphere parameters	Ushort	2	H+66
12	ulSec	GPS second when calculating the ionosphere parameters, milliseconds	ULong	4	H+68
13	reserved	Reserved	Ulong	4	H+72
14	xxxx	32-bit CRC	Hex	4	H+76
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.20 BDSUTC: Conversion Between BDS Time and UTC

This log contains time conversion parameters between BDST and UTC. The log supports `ONCHANGED` trigger.

Message ID : 2012

ASCII Syntax

```
BDSUTCA 1
```

```
BDSUTCA ONCHANGED
```

Binary Syntax

```
BDSUTCB 1
```

```
BDSUTCB ONCHANGED
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#BDSUTCA,97,GPS,FINE,2190,362435000,0,0,18,14;0,0,0.000000000000000e+00,-2.042810365e-14,829,6,4,4,0,0*c81b21f3
```

Table 7-68 BDSUTC Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BDSUTC	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Ulong	4	H
3	Reserved	Reserved	Ulong	4	H+4
4	A0	Clock bias of BDT relative to UTC	Double	8	H+8
5	A1	Clock rate of BDT relative to UTC	Double	8	H+16
6	wn lsf	Future week number when a new leap second is added (based on BDS time)	Ulong	4	H+24
7	dn	Future day number in the week when a new leap second is added (the range is 0 to 6 where Sunday	Ulong	4	H+28

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		= 0 and Saturday = 6)			
8	deltat ls	Existing leap seconds of BDT relative to UTC before the next leap second is added.	Long	4	H+32
9	deltat lsf	Future leap seconds of BDT relative to UTC after the new leap second is added.	Long	4	H+36
10	Reserved	Reserved	Ulong	4	H+40
11	reserved	Reserved	Ulong	4	H+44
12	xxxx	32-bit CRC	Hex	4	H+48
13	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.21 BESTNAVH: Best Position and Velocity (Slave Antenna)

This log contains the best GNSS and INS (if available) position and velocity computed by the receiver using the slave antenna. It also contains several status indicators, including the differential age, which can be used to predict the abnormal operation caused by the interruption of the transmission of differential correction data. If the differential age is 0, it indicates that no differential correction is used.

Message ID : 2119

ASCII Syntax

```
BESTNAVHA 1
```

Binary Syntax

```
BESTNAVHB 1
```

Applicable Products: UM982, UM982C, UMD982

Output

```
#BESTNAVHA,97,GPS,FINE,2190,364700000,0,0,18,13;INSUFFICIENT_OBS,NONE,40.07898868399,11
```

```
6.23660520125,59.8754,-8.4923,WGS84,2.9766,2.8787,10.0570,"0",0.000,11374.000,0,0,0,0,33,02,0
0,00,INSUFFICIENT_OBS,NONE,0.000,0.000,0.0301,33.043127,-0.0892,0004000c*7b4767e9
```

Table 7-69 BESTNAVH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BESTNAVH header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	p-sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID, only WGS84 (binary = 61) is supported for now	Enum	4	H+36
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID, default = 0	Char[4]	4	H+52
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17-19	Reserved	Reserved	Uchar	3	H+66
20	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS3 Signal Mask	Hex	1	H+70
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table GPS/GLONASS/BDS-2 Signal Mask)	Hex	1	H+71
23	V-sol status	Solution status, refer to Table Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table Position or Velocity Type	Enum	4	H+76
25	latency	A measure of latency in the velocity time tag, in seconds. Subtracting latency from epoch time gives accurate velocity.	Float	4	H+80
26	age	Differential age, s	Float	4	H+84
27	hor spd	Horizontal speed over ground, m/s	Double	8	H+88
28	trk gnd	Actual direction of motion over ground (track over ground) with respect to True North, in degrees	Double	8	H+96
29	vert spd	Vertical speed, m/s, positive indicates increasing altitude (up)	Double	8	H+104

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		and negative indicates decreasing altitude (down)			
30	Verspd std	Vertical speed standard deviation, m/s	Float	4	H+112
31	Horspd std	Horizontal speed standard deviation, m/s	Float	4	H+116
32	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+120
33	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.22 BESTNAV : Best Position and Velocity

This log contains the best GNSS and INS (if available) position and velocity computed by the receiver using the master antenna. It also contains several status indicators, including the differential age, which can be used to predict the abnormal operation caused by the interruption of the transmission of differential correction data. If the differential age is 0, it indicates that no differential correction is used.

Message ID: 2118

ASCII Syntax

```
BESTNAVA 1
```

Binary Syntax

```
BESTNAVB 1
```

Applicable Products: UM980, UM980C, UMD980, UB9A0, UBD9A0, UM982, UM982C, UMD982, UM960, UMD960, UM981, UM981C, UMD981, UM981S, UMD981S

Output

```
#BESTNAVA,97,GPS,FINE,2294,472312000,0,0,18,16;SOL_COMPUTED,SINGLE,40.07895888272,116.2
3651029820,65.8312,-8.4925,WGS84,1.2221,1.1053,2.1970,"0",0.000,0.000,50,28,28,0,1,12,12,41,SO
L_COMPUTED,DOPPLER_VELOCITY,0.000,0.000,0.0046,335.592288,0.0045,0.0194,0.0123*c1b4f7fe
```

Table 7-70 BESTNAV Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BESTNAV header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	p-sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID, only WGS84 (binary = 61) is supported for now.	Enum	4	H+36
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID, default = 0	Char[4]	4	H+52
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17	Reserved	Reserved	Uchar	1	H+66
18	Reserved	Reserved	Uchar	1	H+67

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
19	Reserved	Reserved	Uchar	1	H+68
20	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS3 Signal Mask	Hex	1	H+70
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask. See Table GPS/ GLONASS/BDS2 Signal Mask	Hex	1	H+71
23	V-sol status	Solution status, refer to Table Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table Position or Velocity Type	Enum	4	H+76
25	latency	A measure of latency in the velocity time tag, in seconds. Subtracting latency from epoch time gives accurate velocity.	Float	4	H+80
26	diff_age	Differential age, s	Float	4	H+84
27	hor spd	Horizontal speed over ground, m/s	Double	8	H+88
28	trk gnd	Actual direction of motion over ground (track over ground) with respect to True North, in degrees	Double	8	H+96
29	vert spd	Vertical speed, m/s, positive indicates increasing altitude (up) and negative indicates decreasing altitude (down)	Double	8	H+104
30	Verspd std	Vertical speed standard deviation, m/s	Float	4	H+112
31	Horspd std	Horizontal speed standard deviation, m/s	Float	4	H+116

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
32	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	H+120
33	[CR] [LF]	Sentence terminator (ASCII only)	-	-	-

7.5.23 BESTNAVXYZH: Best Position and Velocity in ECEF Coordinate System (Slave Antenna)

This log contains the best position and velocity computed by the receiver using the slave antenna in ECEF coordinate system. The `status` fields of position and velocity indicate the validity of the corresponding data.

Message ID : 242

ASCII Syntax

```
BESTNAVXYZHA 1
```

Binary Syntax

```
BESTNAVXYZHB 1
```

Applicable Products: UM982, UMD982, UM981

Output

```
#BESTNAVXYZHA,97,GPS,FINE,2190,364732000,0,0,18,13;INSUFFICIENT_OBS,NONE,-2160485.548
4,4383615.5669,4084733.8716,0.0000,0.0000,0.0000,INSUFFICIENT_OBS,NONE,0.0227,-0.0831,-0.03
82,0.5312,0.8483,0.5947,"",0.000,0.000,11406.000,0,0,0,0,0,02,0,00*58985f99
```

Table 7-71 BESTNAVXYZH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BESTNAVXYZH header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
2	P-sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	P-X	X-coordinate of position, m	Double	8	H+8
5	P-Y	Y-coordinate of position, m	Double	8	H+16
6	P-Z	Z-coordinate of position, m	Double	8	H+24
7	P-X σ	Standard deviation of P-X, m	Float	4	H+32
8	P-Y σ	Standard deviation of P-Y, m	Float	4	H+36
9	P-Z σ	Standard deviation of P-Z, m	Float	4	H+40
10	V-sol status	Solution status, refer to Table Solution Status	Enum	4	H+44
11	vel type	Velocity type, refer to Table Position or Velocity Type	Enum	4	H+48
12	V-X	Velocity along X-axis, m/s	Double	8	H+52
13	V-Y	Velocity along Y-axis, m/s	Double	8	H+60
14	V-Z	Velocity along Z-axis, m/s	Double	8	H+68
15	V-X σ	Standard deviation of V-X, m/s	Float	4	H+76
16	V-Y σ	Standard deviation of V-Y, m/s	Float	4	H+80
17	V-Z σ	Standard deviation of V-Z, m/s	Float	4	H+84
18	stn ID	Base station ID, default = 0	Char[4]	4	H+88
19	V-latency	A measure of latency in the velocity time tag, in seconds. Subtracting latency from epoch time gives accurate velocity.	Float	4	H+92
20	diff_age	Differential age, s	Float	4	H+96
21	sol_age	Solution age, s	Float	4	H+100

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
22	#SVs	Number of satellites tracked	Uchar	1	H+104
23	#solnSVs	Number of satellites used in solution	Uchar	1	H+105
24	#ggL1	Number of satellites with L1/G1/B1 signals used in solution	Uchar	1	H+106
25	#solnMultiSVs	Number of satellites with L1/G1/B1/E1 signals used in solution	Uchar	1	H+107
26	Reserved	Reserved	Char	1	H+108
27	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+109
28	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS3 Signal Mask	Hex	1	H+110
29	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table GPS/ GLONASS/BDS-2 Signal Mask	Hex	1	H+111
30	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+112
31	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.24 BESTNAVXYZ: Best Position and Velocity in ECEF Coordinate System

This log contains the best position and velocity computed by the receiver in ECEF coordinate system. The "status" fields of position and velocity indicate the validity of the corresponding data.

Message ID : 240

ASCII Syntax

```
BESTNAVXYZA 1
```

Binary Syntax

```
BESTNAVXYZB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#BESTNAVXYZA,97,GPS,FINE,2190,364674000,0,0,18,9;SOL_COMPUTED,SINGLE,-2160488.6043,438
3615.8972,4084733.1053,0.0000,0.0000,0.0000,SOL_COMPUTED,DOPPLER_VELOCITY,-0.0023,0.000
3,0.0020,0.0377,0.0503,0.0411,"",0.000,0.000,0.000,47,28,28,0,0,12,0,09*299636fe
```

Table 7-72 BESTNAVXYZ Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BESTNAVXYZ header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	P-sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	P-X	X-coordinate of position, m	Double	8	H+8
5	P-Y	Y-coordinate of position, m	Double	8	H+16
6	P-Z	Z-coordinate of position, m	Double	8	H+24
7	P-X σ	Standard deviation of P-X, m	Float	4	H+32
8	P-Y σ	Standard deviation of P-Y, m	Float	4	H+36
9	P-Z σ	Standard deviation of P-Z, m	Float	4	H+40
10	V-sol status	Solution status, refer to Table Solution Status	Enum	4	H+44
11	vel type	Velocity type, refer to Table	Enum	4	H+48

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Position or Velocity Type			
12	V-X	Velocity along X-axis, m/s	Double	8	H+52
13	V-Y	Velocity along Y-axis, m/s	Double	8	H+60
14	V-Z	Velocity along Z-axis, m/s	Double	8	H+68
15	V-X σ	Standard deviation of V-X, m/s	Float	4	H+76
16	V-Y σ	Standard deviation of V-Y, m/s	Float	4	H+80
17	V-Z σ	Standard deviation of V-Z, m/s	Float	4	H+84
18	stn ID	Base station ID, default = 0	Char[4]	4	H+88
19	V-latency	A measure of latency in the velocity time tag, in seconds. Subtracting latency from epoch time gives accurate velocity.	Float	4	H+92
20	diff_age	Differential age, s	Float	4	H+96
21	sol_age	Solution age, s	Float	4	H+100
22	#SVs	Number of satellites tracked	Uchar	1	H+104
23	#solnSVs	Number of satellites used in solution	Uchar	1	H+105
24	#ggL1	Number of satellites with L1/G1/B1 signals used in solution	Uchar	1	H+106
25	#solnMultiSVs	Number of satellites with L1/G1/B1/E1 signals used in solution	Uchar	1	H+107
26	Reserved	Reserved	Char	1	H+108
27	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+109
28	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo &	Hex	1	H+110

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		BDS3 Signal Mask			
29	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table GPS/ GLONASS/BDS-2 Signal Mask)	Hex	1	H+111
30	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+112
31	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.25 BESTSAT : Satellites Used in Position Solution

This log contains information of satellites used in the position solution.

Message ID : 1041

ASCII Syntax

```
BESTSATA 1
```

Binary Syntax

```
BESTSATB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#BESTSATA,79,GPS,FINE,2203,226245800,0,0,18,22;43,GPS,2,GOOD,00000013,GPS,5,GOOD,0000001
3,GPS,7,GOOD,00000003,GPS,13,GOOD,00000013,GPS,15,GOOD,00000013,GPS,18,GOOD,00000007,G
PS,20,GOOD,00000013,GPS,29,GOOD,00000013,GPS,30,GOOD,00000007,QZSS,195,GOOD,00000017,Q
ZSS,196,GOOD,00000017,QZSS,199,GOOD,00000017,GLONASS,42+8,GOOD,00000003,GLONASS,4
3+3,GOOD,00000001,GLONASS,44+12,GOOD,00000003,GLONASS,57+9,GOOD,00000003,GLONASS,5
8+11,GOOD,00000003,GALILEO,4,GOOD,00000017,GALILEO,11,GOOD,00000017,GALILEO,12,GOOD,000
00017,GALILEO,19,GOOD,00000017,GALILEO,33,GOOD,00000017,BEIDOU,1,GOOD,00000017,BEIDO
U,2,GOOD,00000017,BEIDOU,3,GOOD,00000017,BEIDOU,4,GOOD,00000017,BEIDOU,6,GOOD,0000001
7,BEIDOU,7,GOOD,00000007,BEIDOU,8,GOOD,00000017,BEIDOU,10,GOOD,00000007,BEIDOU,13,GOO
D,00000017,BEIDOU,16,GOOD,0000017,BEIDOU,19,GOOD,00000005,BEIDOU,20,GOOD,0000015,BEI
```

```
DOU,27,GOOD,00000005,BEIDOU,29,GOOD,00000015,BEIDOU,30,GOOD,00000015,BEIDOU,32,GOOD,00
000015,BEIDOU,35,GOOD,00000005,BEIDOU,38,GOOD,00000015,BEIDOU,39,GOOD,00000015,BEIDO
U,59,GOOD,00000015,BEIDOU,60,GOOD,00000015*34479d6a
```

Table 7-73 BESTSAT Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BESTSAT Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	#entries	Number of satellites tracked	Ulong	4	H+0
3	Satellite system	GNSS satellite system list, see Table Satellite System	Enum	4	H+4
4	Satellite ID	Satellite PRN number (see Table Satellite PRN Number in Unicore-defined Messages. In binary messages, satellite ID is composed of two parts of Ushort characters. The 2 lowest order bytes are system identifiers (such as the PRN for GPS and channel for GLONASS) and they are Ushort characters. The 2 highest order bytes are frequency channel for GLONASS and zero for other systems. In ASCII messages, satellite ID field is the system identifier. If the system is GLONASS and the frequency channel is not zero, the frequency channel is appended to the system identifier. For example, the system ID is 13, and the frequency channel is -2, then the output is 13-2.	Ulong	4	H+8
5	Status	In binary messages, the value is "0"; in ASCII messages, the value is "GOOD".	Enum	4	H+12
6	Signal	Table BESTSAT GPS Signal	Hex	4	H+16

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
	mask	Mask Table BESTSAT GLONASS Signal Mask Table BESTSAT BDS Signal Mask Table BESTSAT Galileo Signal Mask			
7		Next satellite offset = H + 4 + (#entries x 16)			
8	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	H+4+ (#entries x 16)
9	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 7-74 BESTSAT GPS Signal Mask

Bit	MASK	Description
0	0x01	GPS L1 used in Solution
1	0x02	GPS L2 used in Solution
2	0x00 or 0x01	GPS L5 used in Solution
3	Reserved	Reserved
4	0x00 or 0x01	If the satellite is a common-view satellite shared with the base station, this bit is set to 0x01, otherwise it is set to 0x00.

Table 7-75 BESTSAT GLONASS Signal Mask

Bit	MASK	Description
0	0x01	GLONASS L1 used in Solution
1	0x02	GLONASS L2 used in Solution
2	0x04	GLONASS L3 used in Solution
3	Reserved	Reserved
4	0x00 or 0x01	If the satellite is a common-view satellite shared with the base station, and the satellite is used in ambiguity resolution, this bit is set to 0x01, otherwise it is set to 0x00.

Table 7-76 BESTSAT BDS Signal Mask

Bit	MASK	Description
0	0x01	BeiDou B1 used in Solution
1	0x02	BeiDou B2 used in Solution
2	0x04	BeiDou B3 used in Solution
3	Reserved	Reserved
4	0x00 or 0x01	If the satellite is a common-view satellite shared with the base station, this bit is set to 0x01, otherwise it is set to 0x00.

Table 7-77 BESTSAT Galileo Signal Mask

Bit	MASK	Description
0	0x01	Galileo E1 used in Solution
1	0x02	Galileo E5A used in Solution
2	0x04	Galileo E5B used in Solution
3	0x08	Galileo ALTBOC used in Solution
4	0x00 or 0x01	If the satellite is a common-view satellite shared with the base station, this bit is set to 0x01, otherwise it is set to 0x00.

7.5.26 BSLNENUHD2: Heading2 Baseline in ENU Coordinate System

This log contains the baseline information when using Heading2 in ENU Coordinate System. For the definition of Heading2, see HEADING2 Configuration.

This log can be output only when Heading2 is enabled (use the command `MODE HEADING2`).

Message ID : 1316

ASCII Syntax

```
BSLNENUHD2A ONCHANGED
```

Binary Syntax

BSLNENUHD2B ONCHANGED

Applicable Products: UM980, UMD980, UM982, UMD982, UB9A0, UBD9A0, UM981, UMD981, UMD981S, UM980C

Output

```
#BSLNENUHD2A,78,GPS,FINE,2298,444774000,0,0,18,466;SOL_COMPUTED,NARROW_INT,10722.741
8,306.2500,-16.3518,0.0134,0.0190,0.0354,"","201",51,29,29,29,3,01,03,cb*c42490b3
```

Table 7-78 BSLNENUHD2 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BSLNENUHD2 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	sol status	Solution status, see Table Solution Status	Enum	4	H
3	pos type	Position type, see Table Position or Velocity Type	Enum	4	H+4
4	East	East component of the baseline (relative to the base position), in meters	Double	8	H+8
5	North	North component of the baseline (relative to the base position), in meters	Double	8	H+16
6	Up	Up component of the baseline (relative to the base position), in meters	Double	8	H+24
7	East STD	Standard deviation of the east component of the baseline, in meters	Float	4	H+32
8	North STD	Standard deviation of the north component of the baseline, in meters	Float	4	H+36
9	Up STD	Standard deviation of the	Float	4	H+40

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		up component of the baseline, in meters			
10	Rover ID	Rover receiver ID	Char[4]	4	H+44
11	Master ID	Base receiver ID	Char[4]	4	H+48
12	#SVs	Number of satellites tracked	Uchar	1	H+52
13	#solnSVs	Number of satellites used in solution	Uchar	1	H+53
14-15	Reserved	Reserved	Uchar	2	H+54
16	Reserved	Reserved	Hex	1	H+56
17	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+57
18	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS3 Signal Mask	Hex	1	H+58
19	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table GPS/GLONASS/ BDS-2 Signal Mask	Hex	1	H+59
20	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+60
21	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.27 BSLNXYZHD2: Heading2 Baseline in XYZ Coordinate System

This log contains the baseline information when using Heading2 in XYZ Coordinate System. For the definition of Heading2, see HEADING2 Configuration.

This log can be output only when Heading2 is enabled (use the command MODE HEADING2).

Message ID : 1317

ASCII Syntax

```
BSLNXYZHD2A ONCHANGED
```

Binary Syntax

```
BSLNXYZHD2B ONCHANGED
```

Applicable Products: UM980, UMD980, UM982, UMD982, UB9A0, UBD9A0, UM981, UMD981, UMD981S, UM980C

Output

```
#BSLNXYZHD2A,78,GPS,FINE,2298,444774000,0,0,18,465;SOL_COMPUTED,NARROW_INT,-9536.148
1,-4907.4470,223.8114,0.0212,0.0332,0.0154,"","201",51,29,29,29,3,01,03,cb*2427e31b
```

Table 7-79 BSLNXYZHD2 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	BSLNXYZHD2 header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	sol status	Solution status, see Table Solution Status	Enum	4	H
3	pos type	Position type, see Table Position or Velocity Type	Enum	4	H+4
4	dX	X component of the baseline (relative to the base position), in meters	Double	8	H+8
5	dY	Y component of the baseline (relative to the base position), in meters	Double	8	H+16
6	dZ	Z component of the baseline (relative to the base position), in meters	Double	8	H+24
7	dX STD	Standard deviation of the X component of the	Float	4	H+32

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		baseline, in meters			
8	dY STD	Standard deviation of the Y component of the baseline, in meters	Float	4	H+36
9	dZ STD	Standard deviation of the Z component of the baseline, in meters	Float	4	H+40
10	Rover ID	Rover receiver ID	Char[4]	4	H+44
11	Master ID	Base receiver ID	Char[4]	4	H+48
12	#SVs	Number of satellites tracked	Uchar	1	H+52
13	#solnSVs	Number of satellites used in solution	Uchar	1	H+53
14-15	Reserved	Reserved	Uchar	2	H+54
16	Reserved	Reserved	Hex	1	H+56
17	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+57
18	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS-3 Signal Mask	Hex	1	H+58
19	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table GPS/GLONASS/BDS-2 Signal Mask)	Hex	1	H+59
20	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+60
21	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.28 DOPHD2: DOP of Heading2

This log contains the DOP (Dilution of Precision) for satellites used in heading2 solution. For the definition of Heading2, see HEADING2 Configuration. This log can be output only when Heading2 is enabled (use the command `MODE HEADING2`).

Message ID : 1333

ASCII Syntax

```
DOPHD2A ONCHANGED
```

Binary Syntax

```
DOPHD2B ONCHANGED
```

Applicable Products: UM980, UMD980, UM982, UMD982, UB9A0, UBD9A0, UM981, UMD981, UMD981S, UM980C

Output

```
#DOPHD2A,78,GPS,FINE,2298,444774000,0,0,18,466;1.7488,1.4302,0.7034,1.2278,1.0063,2.0,29,4,1
6,28,31,34,39,81,82,101,161,162,163,167,169,170,171,176,183,185,192,197,199,200,203,219,220,26,10
4,166*50cc4364
```

Table 7-80 DOPHD2 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	DOPHD2 header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	GDOP	Geometric DOP	Float	4	H
3	PDOP	Position DOP	Float	4	H+4
4	HDOP	Horizontal DOP	Float	4	H+8
5	HTDOP	Horizontal and time DOP	Float	4	H+12
6	TDOP	Time DOP	Float	4	H+16
7	Elev mask	Elevation mask angle	Float	4	H+20

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
8	#sats	Number of satellites tracked	Ulong	4	H+24
9	Sats list	List of the satellites tracked, see Table Satellite PRN Number (with Offset) in Unicore-defined Messages. This field is null before the position solution is available.	Ulong	4	H+28
10	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+32
11	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.29 E6CBIASBLOCK: Code Biases Block

This log contains the code biases block information broadcast by E6 HAS and decoded by the receiver. It only supports the `ONCHANGED` trigger.

Message ID : 2323

ASCII Syntax

```
E6CBIASBLOCKA ONCHANGED
```

Binary Syntax

```
E6CBIASBLOCKB ONCHANGED
```

Applicable Products: UM980, UM982, UB9A0, UM981, UM980C

Output

```
#E6CBIASBLOCKA,62,GPS,FINE,2287,384303800,0,0,18,27;2700,50,19,25,0,14,0,-304,-327,791,799,22
2,-17,-289,-129,-488,488,976,815,590,-202,-368,584,-768,975,734,-2,-121,-833,959,663,-841,959,64
0,248,680,400,720,-648,-856,680,-928,136,504,216,392,864,640,744,-832,544,-840,904,256,640,42
4,-359,728,744,-816,848,-648,304,728,511,999,543,319,959,335,255,558,-74,-408,432,936,712,560,-9
76,935,-1017,599,368,864,-456,-625,-929,671,504,80,144,207,-273,-361,-657,-649,-368,424,760,75
2,375,-609,951,967,-568,424,768,784,615,-121,-217,-217,-256,8,15,-49,-528,-415,881,841,664,-775,2
25,113,247,-617,943,983,-497,-729,735,767,-888,448,800,760,511,-273,-497,-473,-824,456,816,840,3
43,-449,-809,-801,-288,512,920,936,207,-249,-449,-441,-809,-241,-433,-401,-153,-537,-961,-953,-1
52,432,776,776,199,-457,-825,-873,-737,-641,895,887,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
```

```
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0*3cebdc0a
```

Table 7-81 E6CBIASBLOCK Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	E6CBIASBLOCK header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	TOH	Time Of Hour of the message information, related to GST. For the absolute message applicability time can be calculated, refer to **Galileo HAS SIS ICD (Issue 1.0)**.	ULONG	4	H
3	Block Flag	Block Flag 6-Bit Bit5: Mask Flag Bit4: Orbit Correction Flag Bit3: Clock Full-Set Flag Bit2: Clock Subset Flag Bit1: Code Bias Flag Bit0: Phase Bias Flag Each flag indicates if the content block is present ("1") or not ("0").	UCHAR	1	H+4
4	Reserved	Reserved	UCHAR	1	H+5
5	MASK ID	ID of the Mask	UCHAR	1	H+6
6	IOD Set ID	ID of reference set of IODs	UCHAR	1	H+7
7	VI	Validity Interval, see Table Validity Interval Index	SHORT	2	H+8
8	Reserved	Reserved	SHORT	2	H+10

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
9	Code Biases	Code bias for the m-th signal of the n-th SV, as indicated in Table Signal Index (or in Cell Mask if available). Value "10000000000" indicates data not available. Unit: m; scale: 0.0025; values range: ±10.2375	SHORT[256]	512	H+12
10	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+524
11	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 7-82 Validity Interval Index

Validity Interval Index	Validity Interval
0	5 s
1	10 s
2	15 s
3	20 s
4	30 s
5	60 s
6	90 s
7	120 s
8	180 s
9	240 s
10	300 s
11	600 s
12	900 s
13	1800 s

Validity Interval Index	Validity Interval
14	3600 s
15	Reserved

7.5.30 E6CLOCKFULLBLOCK: Clock Full-Set Corrections Block

This log contains the clock full-set corrections block information broadcast by E6 HAS and decoded by the receiver. It only supports the `ONCHANGED` trigger.

Message ID : 2321

ASCII Syntax

```
E6CLOCKFULLBLOCKA ONCHANGED
```

Binary Syntax

```
E6CLOCKFULLBLOCKB ONCHANGED
```

Applicable Products: UM980, UM982, UB9A0, UM981, UM980C

Output

```
#E6CLOCKFULLBLOCKA,63,GPS,FINE,2287,384268800,0,0,18,27;2667,8,15,24,15,5,0,0,0,0,0,-639,40,-3
11,118,365,-322,-166,60,-717,-159,-142,-4096,-190,333,-254,-619,-97,-783,-504,-705,-107,285,-27
9,-142,-4096,-21,-72,-424,189,241,260,12,61,-111,27,-25,-62,181,71,-104,-88,101,-36,154,11,-73,-7
6,74,-19,3,-64,-88,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0*3f50e3fc
```

Table 7-83 E6CLOCKFULLBLOCK Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	E6CLOCKFULLBLOCK header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	TOH	Time Of Hour of	ULONG	4	H

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		the message information, related to GST. For the absolute message applicability time can be calculated, refer to **Galileo HAS SIS ICD (Issue 1.0)**.			
3	Block Flag	Block Flag 6-Bit Bit5: Mask Flag Bit4: Orbit Correction Flag Bit3: Clock Full-Set Flag Bit2: Clock Subset Flag Bit1: Code Bias Flag Bit0: Phase Bias Flag Each flag indicates if the content block is present ("1") or not ("0").	UCHAR	1	H+4
4	Reserved	Reserved	UCHAR	1	H+5
5	MASK ID	ID of the Mask	UCHAR	1	H+6
6	IOD Set ID	ID of reference set of IODs	UCHAR	1	H+7
7	VI	Validity Interval, see Table Validity Interval Index	SHORT	2	H+8
8	Reserved	Reserved	SHORT	2	H+10
9	DCM	Delta Clock Multipliers The 2-bit DCM for each system is defined in Table	UCHAR[4]	4	H+12

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Delta Clock Multiplier Parameter Definition.			
10	DCC	Delta Clock Corrections Value "1000000000000" indicates data not available. Value "0111111111111" indicates the satellite shall not be used. Unit: m; scale: 0.0025; values range: ±10.2375	SHORT[68]	136	H+16
11	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+152
12	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 7-84 Delta Clock Multiplier Parameter Definition

DCM Value	Multiplier
"00"	1
"01"	2
"10"	3
"11"	4

7.5.31 E6CLOCKSUBBLOCK: Clock Subset Corrections Block

This log contains the clock subset corrections block information broadcast by E6 HAS and decoded by the receiver. It only supports the `ONCHANGED` trigger.

Message ID : 2322

ASCII Syntax

```
E6CLOCKSUBBLOCKA ONCHANGED
```

Binary Syntax

```
E6CLOCKSUBBLOCKB ONCHANGED
```

Applicable Products: UM980, UM982, UB9A0, UM981, UM980C

Table 7-85 E6CLOCKSUBBLOCK Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	E6CLOCKSUBBLOCK header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	TOH	Time Of Hour of the message information, related to GST. For the absolute message applicability time can be calculated, refer to **Galileo HAS SIS ICD (Issue 1.0)**.	ULONG	4	H
3	Block Flag	Block Flag 6-Bit Bit5: Mask Flag Bit4: Orbit Correction Flag Bit3: Clock Full-Set Flag Bit2: Clock Subset Flag Bit1: Code Bias Flag Bit0: Phase Bias Flag Each flag indicates if the content block	UCHAR	1	H+4

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		is present ("1") or not ("0").			
4	Reserved	Reserved	UCHAR	1	H+5
5	MASK ID	ID of the Mask	UCHAR	1	H+6
6	IOD Set ID	ID of reference set of IODs	UCHAR	1	H+7
7	VI	Validity Interval, see Table Validity Interval Index	SHORT	2	H+8
8	Nsys	Indicates the number of GNSS for which corrections are provided	SHORT	2	H+10
		Output the following contents Nsys times. The current number of Nsys is 2.			
9	GNSS ID	GNSS ID 0: GPS 1: Reserved 2: Galileo 3-15: Reserved	USHORT	2	H+12
10	DCM	Delta Clock Multipliers The 2-bit DCM for each system is defined in Table Delta Clock Multiplier Parameter Definition.	USHORT	2	H+14
11	Sat Mask	Satellite Mask is a 40-bit field that specifies the satellites of the GNSS identified by GNSS ID which are	Hex	5	H+16

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		corrected ("1") and those which are not ("0"). The list of satellite indexes is provided in Table Satellite Index. The MSB of the field corresponds to Satellite Index = 0.			
12	Reserved	Reserved	UCHAR[3]	3	H+21
13	DCC	Delta Clock Corrections Value "1000000000000" indicates data not available. Value "0111111111111" indicates the satellite shall not be used. Unit: m; scale: 0.0025; values range: ±10.2375	SHORT[36]	72	H+24
14	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+96
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.32 E6MASKBLOCK：Mask Block

This log contains the mask block information broadcast by E6 HAS and decoded by the receiver. It only supports the `ONCHANGED` trigger.

Message ID : 2319

ASCII Syntax

```
E6MASKBLOCKA ONCHANGED
```

Binary Syntax

```
E6MASKBLOCKB ONCHANGED
```

Applicable Products: UM980, UM982, UB9A0, UM981, UM980C

Output

```
#E6MASKBLOCKA,62,GPS,FINE,2287,384303800,0,0,18,26;2700,50,19,25,0,2,0,0,7FFFFBDF00,8140,1,B
FFFFFFFDFEFF6DFFFFFFE000000000000000000000000000000000000000000000000000000000
0,0,0,0,0,2,73FA29E6D0,4904,0,00000000000000000000000000000000000000000000000000000000
000000000000000000000000,0,0,0,0*d0234a2b
```

Table 7-86 E6MASKBLOCK Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	E6MASKBLOCK header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	TOH	Time Of Hour of the message information, related to GST. For the absolute message applicability time can be calculated, refer to **Galileo HAS SIS ICD (Issue 1.0)**.	ULONG	4	H
3	Block Flag	Block Flag 6-Bit Bit5: Mask Flag Bit4: Orbit Correction Flag Bit3: Clock Full-Set Flag Bit2: Clock Subset Flag Bit1: Code Bias Flag Bit0: Phase Bias Flag Each flag indicates if the content block is	UCHAR	1	H+4

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		present ("1") or not ("0").			
4	Reserved	Reserved	UCHAR	1	H+5
5	MASK ID	ID of the Mask	UCHAR	1	H+6
6	IOD Set ID	ID of reference set of IODs	UCHAR	1	H+7
7	Nsys	Indicates the number of GNSS for which corrections are provided	USHORT	2	H+8
8	Reserved	Reserved	USHORT	2	H+10
		Output the following contents Nsys times. The current number of Nsys is 2.			
9	GNSS ID	GNSS ID 0: GPS 1: Reserved 2: Galileo 3-15: Reserved	USHORT	2	H+12
10	Sat Mask	Satellite Mask is a 40-bit field that specifies the satellites of the GNSS identified by GNSS ID which are corrected ("1") and those which are not ("0"). The list of satellite indexes is provided in Table Satellite Index. The MSB of the field corresponds to Satellite Index = 0.	Hex	5	H+14
11	Signal Mask	Signal Mask is a 16-bit field that indicates the signals	Hex	2	H+19

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		of the GNSS identified by GNSS ID for which biases are provided in the Code Bias and Phase Bias content blocks. The list of signals is provided in Table Signal Index. For each signal, "1" indicates that biases are provided and "0" indicates that they are not. The MSB of the field corresponds to Signal Index = 0.			
12	CMAF	Cell Mask Availability Flag which indicates if the Cell Mask is provided ("1") or not ("0")	UCHAR	1	H+21
13	CM	Cell Mask. The Cell Mask field indicates with one bit whether biases are provided ("1") or not ("0") for each satellite of the satellite mask (i.e. each "1" of the Satellite Index Table) and for each signal of the signal mask (i.e. each "1" of the Signal Index Table).	Hex	40	H+22
14	NM	Navigation Message index, see Table Navigation Message Index.	UCHAR	1	H+62
15	Reserved	Reserved	UCHAR[3]	3	H+63
16	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+12+2*54

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
17	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.33 E6ORBITBLOCK: Orbit Corrections Block

This log contains the orbit corrections block information broadcast by E6 HAS and decoded by the receiver. It only supports the `ONCHANGED` trigger.

Message ID : 2320

ASCII Syntax

```
E6ORBITBLOCKA ONCHANGED
```

Binary Syntax

```
E6ORBITBLOCKB ONCHANGED
```

Applicable Products: UM980, UM982, UB9A0, UM981, UM980C

Output

```
#E6ORBITBLOCKA,62,GPS,FINE,2287,384303800,0,0,18,26;2700,50,19,25,0,10,0,13,-16,-150,-25,17,7
1,-34,-48,113,-352,-54,-84,48,-28,-33,23,30,42,167,119,60,-21,83,-19,13,91,18,10,32,84,-171,-113,14
5,-74,-82,110,20,-345,-4,46,102,-59,-178,-74,103,-8,-23,14,169,-331,160,-66,1,-49,106,-22,54,37,-7
2,-15,65,-10,74,-163,233,-422,-54,-50,74,40,-296,-78,62,-66,224,-13,54,45,-259,19,32,-374,29,-20,5
1,69,-98,-32,51,-58,22,17,34,-125,-71,-58,45,-406,-66,-63,44,-88,96,67,44,85,75,20,40,-58,79,-24,84,2
6,-118,128,127,131,-7,-5,127,20,12,23,127,31,-33,-21,127,-59,36,5,236,70,61,49,127,-7,9,-15,126,8,-1
2,19,127,-22,12,-12,127,42,-6,14,127,-69,15,32,127,-38,0,44,127,51,-30,-33,127,-35,-4,17,126,35,12,3
2,127,36,13,12,127,-117,-7,31,127,-110,13,54,127,56,-4,18,127,21,-32,17,127,-107,34,21,127,54,7,17,1
21,32,-15,-19,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0*35090b59
```

Table 7-87 E6ORBITBLOCK Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	E6ORBITBLOCK	Log header, see Table		H	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
	header	Binary Header Structure (N4) and Table ASCII Header Structure (N4)			
2	TOH	Time Of Hour of the message information, related to GST. For the absolute message applicability time can be calculated, refer to **Galileo HAS SIS ICD (Issue 1.0)**.	ULONG	4	H
3	Block Flag	Block Flag 6-Bit Bit5: Mask Flag Bit4: Orbit Correction Flag Bit3: Clock Full-Set Flag Bit2: Clock Subset Flag Bit1: Code Bias Flag Bit0: Phase Bias Flag Each flag indicates if the content block is present ("1") or not ("0").	UCHAR	1	H+4
4	Reserved	Reserved	UCHAR	1	H+5
5	MASK ID	ID of the Mask	UCHAR	1	H+6
6	IOD Set ID	ID of reference set of IODs	UCHAR	1	H+7
7	VI	Validity Interval, see Table Validity Interval Index	SHORT	2	H+8
8	Reserved	Reserved	SHORT	2	H+10
9	IODref	Reference IOD. Indicates the Orbit and Clock Data corrected.	USHORT	2	H+12

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
10	DR	Delta Radial correction. Value "1000000000000" indicates data not available. Unit: m; scale: 0.0025; values range ±10.2375	SHORT	2	H+14
11	DIT	Delta In-Track correction. Value "100000000000" indicates data not available. Unit: m; scale: 0.008; values range: ±16.376	SHORT	2	H+16
12	DCT	Delta Cross-Track correction. Value "100000000000" indicates data not available. Unit: m; scale: 0.008; values range ±16.376	SHORT	2	H+18
13	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+12+8*68
14	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.34 E6PBIASBLOCK: Phase Biases Block

This log contains the phase biases block information broadcast by E6 HAS and decoded by the receiver. It only supports the `ONCHANGED` trigger.

Message ID : 2324

ASCII Syntax

```
E6PBIASBLOCKA ONCHANGED
```

Binary Syntax

```
E6PBIASBLOCKB ONCHANGED
```

Applicable Products: UM980, UM982, UB9A0, UM981, UM980C

Table 7-88 E6PBIASBLOCK Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	E6PBIASBLOCK header	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	TOH	Time Of Hour of the message information, related to GST. For the absolute message applicability time can be calculated, refer to **Galileo HAS SIS ICD (Issue 1.0)**.	ULONG	4	H
3	Block Flag	Block Flag 6-Bit Bit5: Mask Flag Bit4: Orbit Correction Flag Bit3: Clock Full-Set Flag Bit2: Clock Subset Flag Bit1: Code Bias Flag Bit0: Phase Bias Flag Each flag indicates if the content block is present ("1") or not ("0").	UCHAR	1	H+4
4	Reserved	Reserved	UCHAR	1	H+5
5	MASK ID	ID of the Mask	UCHAR	1	H+6
6	IOD Set ID	ID of reference set of IODs	UCHAR	1	H+7

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
7	VI	Validity Interval, see Table Validity Interval Index	SHORT	2	H+8
8	Reserved	Reserved	SHORT	2	H+10
		Output the following contents 256 times according to the satellite data provided by the current HAS service.			
9	Phase Biases	Phase bias for the m-th signal of the n-th SV, as indicated in Table Signal Index (or in the Cell Mask if available). Value "10000000000" indicates data not available. Unit: m; scale: 0.01; values range: ±10.23	SHORT	2	H+12
10	PDI	Phase Discontinuity Indicator for the m-th signal of the n-th SV, as indicated in Table Signal Index (or in the Cell Mask if available).	USHORT	2	H+14
11	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+12+4*256
12	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.35 ENVINFO: Environment Information

This log outputs the score of the environment where the base station is located so that users can evaluate whether the environment is suitable for building a base station. It can also output whether the base station has been moved or is moving.

The method of scoring the environment is as follows:

1. Set the base station to BASE mode.
2. Use the command ENVINFO to make the base station output information and save the configuration.
3. Place the base station at the position where it is to be set up and keep it there for about 30 seconds.
4. The ENVINFO log can display the score of the current environment.

Message ID : 11779

ASCII Syntax

```
ENVINFOA 1
```

Binary Syntax

```
ENVINFOB 1
```

Applicable Products: UM980, UB9A0, UM960, UM960E, UM981, UMD981, UMD981S, UM980C

Output

```
#ENVINFOA,84,GPS,FINE,2302,466453000,0,0,18,23;88,90.00,89,92,0,0,0.118,NARROW_INT,53,51,0.02
2,46,44,50,56,0,0,0,25751,0.0027,0.432,0.385,0,0,0.000,0.007*803048db
```

Table 7-89 ENVINFO Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	ENVINFO header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Base Score	The score of the environment where the base station is located (applies to BASE mode). For more information about the score and its explanation, see Table Environment Score and	USHORT	2	H

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Judgement Criteria			
3	Confidence level of solution	Confidence level of solution (applies to ROVER mode)	DOUBLE	8	H+2
4	Sat vis	Utilization ratio of visible satellites (applies to ROVER mode)	USHORT	2	H+10
5	Sat Slo	Ratio of satellites used in solution (applies to ROVER mode)	USHORT	2	H+12
6	Moved Flag	Whether the base station has been moved: 0: not moved 1: moved (compared to the position before power off or in the process of power on) 2: N/A (not applicable due to poor environment or large deviation of the position)	CHAR	1	H+14
7	Moving Flag	Whether the base station is moving: 0: static 1: moving	CHAR	1	H+15
8	Pos Diff	The distance between the current position and the fixed coordinates. If the receiver is not working in BASE mode, this field is 0.	DOUBLE	8	H+16
9	Pos Type	Position status type	ENMU	4	H+24
10	Base sat Num	Number of satellites observed by the base station	INT	4	H+28
11	Com sat Num	Number of satellites in common view of both the base station and rover station	INT	4	H+32
12	Reserved	Reserved	DOUBLE	8	H+36
13	SV Num	Number of visible satellites	USHORT	2	H+44

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
14		Reserved, 68 bytes	68	H+46	
15	XXXX	32-bit CRC	Hex	4	H+114
16	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

> **Note:**
>
> - After using **FRESET** and the receiver restarts in BASE mode, the Moved Flag cannot be used for determining whether the base station has been moved.
> - In BASE mode, if the distance between the current position and the position saved by the receiver before the last power off exceeds 20 m, the Moved Flag will be set to 2.

Table 7-90 Environment Score and Judgement Criteria

Environment Score	Judgement Criteria
90~100	Very good
85~90	Good
80~85	Acceptable
1~80	Not suitable for building a base station

7.5.36 FREQJAMSTATUS: Frequency Jamming Status

This command is used to check the jamming information of each frequency, including L1, L2, and L5. It only supports 1 Hz message output.

Message ID : 519

ASCII Syntax

```
FREQJAMSTATUSA 1
```

Binary Syntax

```
FREQJAMSTATUSB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM960, UMD960, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#FREQJAMSTATUSA,97,GPS,FINE,2164,559464000,0,0,18,8;SINGLE,255,2,0,0,0,0,0,0*b0cdc7de
```

Table 7-91 FREQJAMSTATUS Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	FREQJAMSTATUS Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H
3	L1CWRatio	Range: 0~255 The strength of the jamming signal. The higher the strength, the greater the impact on positioning	UCHAR	1	H+4
4	L1CWFlag	0: NO CW JAM 1: CW JAM 2: Strong CW JAM	UCHAR	1	H+5
5	L2CWRatio	Range: 0~255 The strength of the jamming signal. The higher the strength, the greater the impact on positioning	UCHAR	1	H+6
6	L2CWFlag	0: NO CW JAM 1: CW JAM 2: Strong CW JAM	UCHAR	1	H+7
7	L5CWRatio	Range: 0~255 The strength of the	UCHAR	1	H+8

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		jamming signal. The higher the strength, the greater the impact on positioning			
8	L5CWFlag	0: NO CW JAM 1: CW JAM 2: Strong CW JAM	UCHAR	1	H+9
9, 10	Reserved	Reserved	Uchar*2	2	H+10
11	Xxxx	Checksum	Hex	4	H+12
12	[CR][LF]	Sentence terminator			

7.5.37 GALEPH: Galileo Ephemeris

This log contains Galileo ephemeris information. It supports `ONCHANGED` trigger. If you use `ONTIME` trigger (i.e. the output frequency is fixed), the recommended time interval is more than 60 seconds because of the large amount of ephemeris data; it is not recommended to output this log at 1 Hz. When it is output together with 50 Hz observation data, it is recommended to use the `ONCHANGED` trigger.

Message ID : 109

ASCII Syntax

```
GALEPHA COM1 60
```

```
GALEPHA COM1 ONCHANGED
```

Binary Syntax

```
GALEPHB COM1 60
```

```
GALEPHB COM1 ONCHANGED
```

Applicable Products: UM960, UM960L, UM980, UB9A0, UM982, UM981, UM980C

Output

```
#GALEPHA,97,GPS,FINE,2190,363656000,0,0,18,3;36,TRUE,TRUE,0,0,0,0,0,0,107,0,82,356400,5.44061113e+03,2.4787e-09,-1.46715796e+00,2.844742266e-04,-1.325646591e+00,-8.5607e-06,9.0413e-06,1.590e+02,-1.839e+02,9.3132e-09,-3.9116e-08,9.965504471e-01,-2.6823e-10,-1.201660091e+00,-5.44451250e-09,356400,-3.108567325e-04,-5.357492e-12,0.0e+00,356400,-3.108558012e-04,-5.357492e-12,0.0e+00,5.821e-09,6.752e-09*e8487c09
```

Table 7-92 GALEPH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	GALEPH header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	SatId	Satellite ID (Galileo: 1 to 36)	Ulong	4	H
3	FNAVReceived	Indicates FNAV ephemeris data received	Bool	4	H+4
4	INAVReceived	Indicates INAV ephemeris data received	Bool	4	H+8
5	E1BHealth	E1b health status (valid only if INAVReceived is TRUE)	Uchar	1	H+12
6	E5aHealth	E5a health status (valid only if FNAVReceived is TRUE)	Uchar	1	H+13
7	E5bHealth	E5b health status (valid only if INAVReceived is TRUE)	Uchar	1	H+14
8	E1BDVS	E1b data validity status (valid only if INAVReceived is TRUE)	Uchar	1	H+15
9	E5aDVS	E5a data validity status (valid only if FNAVReceived is TRUE)	Uchar	1	H+16
10	E5bDVS	E5b data validity status (valid only if INAVReceived is TRUE)	Uchar	1	H+17
11	SISA	Signal in space accuracy	Uchar	1	H+18
12	Reserved	Reserved	Uchar	1	H+19

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
13	IODNav	Issue of data, ephemeris	Ulong	4	H+20
14	T0e	Reference time of ephemeris, seconds	Ulong	4	H+24
15	RootA	Square root of semi-major axis, meter1/2	Double	8	H+28
16	DeltaN	Mean motion difference, radians/second	Double	8	H+36
17	M0	Mean anomaly at reference time, radians	Double	8	H+44
18	Ecc	Eccentricity of the satellite orbit	Double	8	H+52
19	Omega	Argument of perigee, radians	Double	8	H+60
20	Cuc	Argument of latitude (amplitude of cosine, radians)	Double	8	H+68
21	Cus	Argument of latitude (amplitude of sine, radians)	Double	8	H+76
22	Crc	Orbit radius (amplitude of cosine, meters)	Double	8	H+84
23	Crs	Orbit radius (amplitude of sine, meters)	Double	8	H+92
24	Cic	Inclination (amplitude of cosine, radians)	Double	8	H+100
25	Cis	Inclination (amplitude of sine, radians)	Double	8	H+108
26	I0	Inclination angle at TOE time, radians	Double	8	H+116
27	IDot	Rate of change of inclination angle, radians/second	Double	8	H+124
28	Omega0	Right ascension of ascending node, radians	Double	8	H+132
29	OmegaDot	Rate of change of the right ascension of ascending	Double	8	H+140

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		node, radians/second			
30	FNAVT0c	Satellite clock bias parameter, seconds (valid only if FNAVReceived is TRUE)	Ulong	4	H+148
31	FNAVAf0	Satellite clock bias parameter, seconds (valid only if FNAVReceived is TRUE)	Double	8	H+152
32	FNAVAf1	Satellite clock rate parameter, s/s (valid only if FNAVReceived is TRUE)	Double	8	H+160
33	FNAVAf2	Satellite clock drift parameter, s/s^2 (valid only if FNAVReceived is TRUE)	Double	8	H+168
34	INAVT0c	Satellite clock bias parameter, seconds (valid only if INAVReceived is TRUE)	Ulong	4	H+176
35	INAVAf0	Satellite clock bias parameter, seconds (valid only if INAVReceived is TRUE)	Double	8	H+180
36	INAVAf1	Satellite clock rate parameter, s/s (valid only if INAVReceived is TRUE)	Double	8	H+188
37	INAVAf2	Satellite clock drift parameter, s/s^2 (valid only if INAVReceived is TRUE.)	Double	8	H+196
38	E1E5aBGD	E1, E5a broadcast group delay	Double	8	H+204
39	E1E5bBGD	E1, E5b broadcast group delay (valid only if INAVReceived is TRUE)	Double	8	H+212
40	xxxx	32-bit CRC	Hex	4	H+220
41	[CR][LF]	Sentence terminator (ASCII	-		-

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		only)			

7.5.38 GALION: Galileo Ionosphere Parameters

This log provides the ionosphere model parameters broadcast by Galileo. The log supports `ONCHANGED` trigger.

Message ID : 9

ASCII Syntax

```
GALIONA 1
```

```
GALIONA ONCHANGED
```

Binary Syntax

```
GALIONB 1
```

```
GALIONB ONCHANGED
```

Applicable Products: UM960, UM960L, UM980, UB9A0, UM982, UM981, UM980C

Output

```
#GALIONA,96,GPS,FINE,2218,465990000,0,0,18,21;1.240000000000000e+02,4.921875000000000e-01,1.293945312500000e-02,0,0,0,0,0,0*9e349a84
```

Table 7-93 GALION Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	GALION	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
2	a0	1st order term of alpha parameter	Double	8	H
3	a1	2nd order term of alpha parameter	Double	8	H+8
4	a2	3rd order term of alpha parameter	Double	8	H+16
5	SF1	Ionospheric disturbance flag for Region 1	UCHAR	1	H+24
6	SF2	Ionospheric disturbance flag for Region 2	UCHAR	1	H+25
7	SF3	Ionospheric disturbance flag for Region 3	UCHAR	1	H+26
8	SF4	Ionospheric disturbance flag for Region 4	UCHAR	1	H+27
9	SF5	Ionospheric disturbance flag for Region 5	UCHAR	1	H+28
10	reserved	Reserved	Ulong	4	H+29
11	xxxx	32-bit CRC	Hex	4	H+33
12	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.39 GALUTC: Conversion Between Galileo Time and UTC

This log contains time conversion parameters between Galileo time and UTC. The log supports `ONCHANGED` trigger.

Message ID : 20

ASCII Syntax

```
GALUTCA 1
```

```
GALUTCA ONCHANGED
```

Binary Syntax

```
GALUTCB 1
```

```
GALUTCB ONCHANGED
```

Applicable Products: UM960, UM960L, UM980, UB9A0, UM982, UM981, UM980C

Output

```
#GALUTCA,97,GPS,FINE,2190,362475000,0,0,18,14;2.793967723846436e-09,-1.776356839400250
e-15,18,96,1166,1161,7,18,6.984919309616089e-10,-1.865174681370263e-14,345600,14*d266704b
```

Table 7-94 GALUTC Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	GALUTC	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	A0	Clock bias of Galileo time relative to UTC	Double	8	H+0
3	A1	Clock rate of Galileo time relative to UTC	Double	8	H+8
4	deltat ls	Existing leap seconds of Galileo time relative to UTC before the next leap second is added.	long	4	H+16
5	tot	Reference time of UTC parameters	Ulong	4	H+20
6	utc wn	UTC reference week number	Ulong	4	H+24
7	ulWNlsf	Future week number when a new leap second is added (based on Galileo time)	Ulong	4	H+28
8	dn	Future day number in the week when a new leap second is added (the range is 1 to 7 where Sunday = 1 and Saturday = 7)	Ulong	4	H+32
9	deltat lsf	Future leap seconds of Galileo time relative to UTC after the new leap second is added.	Long	4	H+36

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
10	dA0g	The constant term of the conversion parameter between Galileo time and GPS time.	Long	8	H+40
11	dA1g	The first order term of the conversion parameter between Galileo time and GPS time.	Ulong	8	H+48
12	ulT0g	The reference second of week used to convert between Galileo time and GPS time.	Ulong	4	H+56
13	ulWN0g	The reference week number used to convert between Galileo time and GPS time.	Ulong	4	H+60
14	xxxx	32-bit CRC	Hex	4	H+64
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.40 GLOEPH: GLONASS Ephemeris

This log contains GLONASS ephemeris information. GLONASS ephemerides use PZ90.02 geodetic datum. The log supports `ONCHANGED` trigger. If you use `ONTIME` trigger (i.e. the output frequency is fixed), the recommended time interval is more than 60 seconds because of the large amount of ephemeris data; it is not recommended to output this log at 1 Hz. When it is output together with 50 Hz observation data, it is recommended to use the `ONCHANGED` trigger.

Message ID : 107

ASCII Syntax

```
GLOEPHA COM1 60
```

```
GLOEPHA COM1 ONCHANGED
```

Binary Syntax

```
GLOEPHB COM1 60
```

```
GLOEPHB COM1 ONCHANGED
```

Applicable Products: UM960, UM960L, UM980, UB9A0, UM982, UM981, UM980C

Output

```
#GLOEPHA,88,GPS,FINE,2305,116282000,0,0,18,30;40,12,1,0,2305,114318000,10782,71,0,0,43,0,1.890321777343750e+06,-1.100072509765625e+07,2.298513378906250e+07,3.121249198913574e+03,-2.802515029907227e+02,-3.969745635986328e+02,-0.000000931322575,-2.793967723846436e-06,-2.793967723846436e-06,-9.616464376449585e-05,-2.793967724e-09,9.094947017729282e-13,38040,2,3,0,12*2f2935b8
```

Table 7-95 GLOEPH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	GLOEPH header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Sloto	Slot information - PRN identification (Slot + 37).	Ushort	2	H
3	freqo	Frequency channel, in the range of 0 to 20	Ushort	2	H+2
4	sat type	Satellite type 0 = GLO_SAT 1 = GLO_SAT_M (M type) 2 = GLO_SAT_K (K type)	Uchar	1	H+4
5	Reserved	Reserved		1	H+5
6	e week	Reference week of ephemeris (GPS week)	Ushort	2	H+6
7	e time	Reference time of ephemeris (GPS reference time), ms	Ulong	4	H+8
8	t offset	Integer seconds between GPS time and GLONASS time. A positive value implies that GLONASS is ahead of GPS time.	Ulong	4	H+12
9	Nt	Number of days past from the Jan 1st of a leap year	Ushort	2	H+16

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
10	Reserved	Reserved		1	H+18
11	Reserved	Reserved		1	H+19
12	issue	Number of 15-minute intervals relative to the reference time of ephemeris	Ulong	4	H+20
13	health	Ephemeris health, where 0 = healthy 1 = unhealthy	Ulong	4	H+24
14	pos x	X coordinate for satellite at reference time (PZ-90.02), meters	Double	8	H+28
15	pos y	Y coordinate for satellite at reference time (PZ-90.02), meters	Double	8	H+36
16	pos z	Z coordinate for satellite at reference time (PZ-90.02), meters	Double	8	H+44
17	vel x	X coordinate for satellite velocity at reference time (PZ-90.02), m/s	Double	8	H+52
18	vel y	Y coordinate for satellite velocity at reference time (PZ-90.02), m/s	Double	8	H+60
19	vel z	Z coordinate for satellite velocity at reference time (PZ-90.02), m/s	Double	8	H+68
20	LS acc x	X coordinate for lunisolar acceleration at reference time (PZ-90.02), m/s^2	Double	8	H+76
21	LS acc y	Y coordinate for lunisolar acceleration at reference time (PZ-90.02), m/s^2	Double	8	H+84
22	LS acc z	Z coordinate for lunisolar acceleration at reference time (PZ-90.02), m/s^2	Double	8	H+92
23	tau_n	Correction to the nth satellite	Double	8	H+100

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		time t_n relative to GLONASS time t_c, in seconds			
24	delta_tau_n	Time difference between the RF signal transmitted in L2 sub-band and that transmitted in L1 sub-band by the nth satellite, seconds	Double	8	H+108
25	gamma	Frequency correction, s/s	Double	8	H+116
26	Tk	Time of frame start (since start of GLONASS day), seconds	Ulong	4	H+124
27	P	Technological parameter	Ulong	4	H+128
28	Ft	Prediction of user range accuracy	Ulong	4	H+132
29	age	Age of data, day	Ulong	4	H+136
30	Flags	Information flags, see Table GLONASS Ephemeris Flags Coding	Ulong	4	H+140
31	xxxx	32-bit CRC	Hex	4	H+144
32	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 7-96 GLONASS Ephemeris Flags Coding

Bit	Description	Value	Mask
0	P1 flag: time interval between two adjacent tb values	See Table P1 Flag Range Values	00000001
1			00000002
2	P2 flag: Oddness or Evenness of tb value	0=even, 1=odd	00000004
3	P3 flag: number of satellites contained in the almanac of the current subframe	0=4, 1=5	00000008
4	Reserved		
...			
31			

Table 7-97 P1 Flag Range Values

State	Description
00	0 minutes
01	30 minutes
10	45 minutes
11	60 minutes

7.5.41 GPSEPH: GPS Ephemeris

This log contains GPS ephemeris information. It supports `ONCHANGED` trigger. If you use `ONTIME` trigger (i.e. the output frequency is fixed), the recommended time interval is more than 60 seconds because of the large amount of ephemeris data; it is not recommended to output this log at 1 Hz. When it is output together with 50 Hz observation data, it is recommended to use the `ONCHANGED` trigger.

Message ID : 106

ASCII Syntax

```
GPSEPHA COM1 60
```

```
GPSEPHA COM1 ONCHANGED
```

Binary Syntax

```
GPSEPHB COM1 60
```

```
GPSEPHB COM1 ONCHANGED
```

Applicable Products: UM960, UM960L, UM980, UB9A0, UM982, UM981, UM980C

Output

```
#GPSEPHA,97,GPS,FINE,2190,362528000,0,0,18,1;10,360210.0,0,30,30,2190,2190,367200.0,2.656037
435e+07,4.374825086e-09,4.615227840e-01,7.3941934388e-03,-2.5487093877e+00,0.000000000
e+00,9.177252650e-06,2.07281250e+02,-1.78125000e+00,-2.048909664e-08,1.136213541e-07,9.72
```

```
16383679e-01,4.053740283e-10,-2.969634463e-03,-7.97997526e-09,30,367200.0,2.328306437e-0
9,-2.8089155e-04,-9.3223207e-12,0.0000000e+00,TRUE,1.458581356e-04,4.00000000e+00*ef6608f
f
```

Table 7-98 GPSEPH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	GPSEPH header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	PRN	Satellite PRN number: GPS: 1 to 32 QZSS: 33 to 42	Ulong	4	H
3	Tow	Time stamp of subframe 0, seconds	Double	8	H+4
4	health	Health status, a 6-bit health code as defined in ICD-GPS-200a	Ulong	4	H+12
5	IODE1	Issue of data, ephemeris 1	Ulong	4	H+16
6	IODE2	Issue of data, ephemeris 2 = GPS IODE1	Ulong	4	H+20
7	Week	GPS reference week number (GPS week)	Ulong	4	H+24
8	Z Week	Z count week number. This is the week number from subframe 1 of the ephemeris. The "TOW week" (field #7) is derived from this to account for rollover.	Ulong	4	H+28
9	Toe	Reference time of ephemeris, seconds	Double	8	H+32
10	A	Semi-major axis of the satellite orbit, meters	Double	8	H+40
11	ΔN	Mean motion difference, radians/ second	Double	8	H+48
12	M0	Mean anomaly at reference time, radians	Double	8	H+56
13	Ecc	Eccentricity of the satellite orbit	Double	8	H+64
14	ω	Argument of perigee, radians	Double	8	H+72

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
15	cuc	Argument of latitude (amplitude of cosine, radians)	Double	8	H+80
16	cus	Argument of latitude (amplitude of sine, radians)	Double	8	H+88
17	crc	Orbit radius (amplitude of cosine, meters)	Double	8	H+96
18	crs	Orbit radius (amplitude of sine, meters)	Double	8	H+104
19	cic	Inclination (amplitude of cosine, radians)	Double	8	H+112
20	cis	Inclination (amplitude of sine, radians)	Double	8	H+120
21	I0	Inclination angle at reference time, radians	Double	8	H+128
22	IDOT	Rate of change of inclination angle, radians/second	Double	8	H+136
23	Ω0	Right ascension of ascending node, radians	Double	8	H+144
24	Ω dot	Rate of change of the right ascension of ascending node, radians/second	Double	8	H+152
25	iodc	Issue of data, clock	Ulong	4	H+160
26	toc	Reference time for satellite clock corrections, seconds	Double	8	H+164
27	tgd	Group delay, seconds	Double	8	H+172
28	af0	Satellite clock bias parameter, seconds	Double	8	H+180
29	af1	Satellite clock rate parameter, s/s	Double	8	H+188
30	af2	Satellite clock drift parameter, s/s/s	Double	8	H+196
31	AS	Anti-spoofing: 0 = FALSE 1 = TRUE	Enum	4	H+204
32	N	Corrected mean motion, radians/second	Double	8	H+208

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
33	URA	User range accuracy, m^2. The ICD specifies an algorithm to convert the URA index transmitted in the ephemeris to a nominal standard deviation value. Here outputs the square (variance) of the nominal value.	Double	8	H+216
34	xxxx	32-bit CRC	Hex	4	H+224
35	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.42 GPSION: GPS Ionosphere Parameters

This log provides the ionosphere model parameters broadcast by GPS. The log supports `ONCHANGED` trigger.

Message ID : 8

ASCII Syntax

```
GPSIONA 1
```

```
GPSIONA ONCHANGED
```

Binary Syntax

```
GPSIONB 1
```

```
GPSIONB ONCHANGED
```

Applicable Products: UM960, UM960L, UM980, UB9A0, UM982, UM981, UM980C

Output

```
#GPSIONA,90,GPS,FINE,2190,371250000,0,0,18,21;1.490116119384766e-08,-7.450580596923828e-09,-5.960464477539062e-08,1.192092895507812e-07,1.290240000000000e+05,-1.966080000000000e+05,6.553600000000000e+04,3.276800000000000e+05,0,0,0,0*c5974f70
```

Table 7-99 GPSION Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	GPSION	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	a0	Constant term of alpha parameter	Double	8	H
3	a1	1st order term of alpha parameter	Double	8	H+8
4	a2	2nd order term of alpha parameter	Double	8	H+16
5	a3	3rd order term of alpha parameter	Double	8	H+24
6	b0	Constant term of beta parameter	Double	8	H+32
7	b1	1st order term of beta parameter	Double	8	H+40
8	b2	2nd order term of beta parameter	Double	8	H+48
9	b3	3rd order term of beta parameter	Double	8	H+56
10	usSVID	ID numbers of satellites used to calculate ionosphere parameters	Ushort	2	H+64
11	usWeek	GPS week when calculating the ionosphere parameters	Ushort	2	H+66
12	ulSec	GPS second when calculating the ionosphere parameters, milliseconds	ULong	4	H+68
13	reserved	Reserved	Ulong	4	H+72
14	xxxx	32-bit CRC	Hex	4	H+76
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.43 GPSUTC: Conversion between GPS Time and UTC

This log contains time conversion parameters between GPST and UTC. The log supports `ONCHANGED` trigger.

Message ID : 19

ASCII Syntax

```
GPSUTCA 1
```

```
GPSUTCA ONCHANGED
```

Binary Syntax

```
GPSUTCB 1
```

```
GPSUTCB ONCHANGED
```

Applicable Products: UM960, UM960L, UM980, UB9A0, UM982, UM981, UM980C

Output

```
#GPSUTCA,97,GPS,FINE,2190,362356000,0,0,18,15;2190,589824,-1.862645149230957e-09,-5.32907
0518e-15,2185,7,18,18,0,0*4a84abce
```

Table 7-100 GPSUTC Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	GPSUTC	Log header, see Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	utc wn	UTC reference week number	Ulong	4	H
3	tot	Reference time of UTC parameters	Ulong	4	H+4
4	A0	Clock bias of GPST relative to UTC	Double	8	H+8
5	A1	Clock rate of GPST relative to UTC	Double	8	H+16
6	wn lsf	Future week number when a new leap second is added (based on GPST)	Ulong	4	H+24
7	dn	Future day number in the week when a new leap second is added (the range is 1 to 7 where Sunday = 1 and Saturday = 7)	Ulong	4	H+28

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
8	deltat ls	Existing leap seconds of GPST relative to UTC before the next leap second is added.	Long	4	H+32
9	deltat lsf	Future leap seconds of GPST relative to UTC after the new leap second is added.	Long	4	H+36
10	deltat utc	Time offset of GPST relative to UTC	Ulong	4	H+40
11	reserved	Reserved	Ulong	4	H+44
12	xxxx	32-bit CRC	Hex	4	H+48
13	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.44 HEADINGSTATUS: Heading Status

This log outputs information used in Heading solution.

Message ID : 521

ASCII Syntax

```
HEADINGSTATUSA 1
```

Binary Syntax

```
HEADINGSTATUSB 1
```

Applicable Products: UM982, UMD982

Output

```
#HEADINGSTATUSA,40,GPS,FINE,2255,117816000,0,0,18,15;233.0000,123.0000,0.0,0.0,0.0,0.0,0,0*5d
660f9c
```

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	HEADINGSTATUS	Log header, see Table		H	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
	Header	Binary Header Structure (N4) and Table ASCII Header Structure (N4)			
2	CfgLength	Baseline length configuration in the CONFIG HEADING LENGTH	Float	4	H
3	Cfgtol	Error tolerance configuration in the CONFIG HEADING LENGTH	Float	4	H+4
4	Reserved	Reserved	Float	4	H+8
5	Reserved	Reserved	Float	4	H+12
6	Reserved	Reserved	Float	4	H+16
7	Reserved	Reserved	Float	4	H+20
8	Reserved	Reserved	UINT	4	H+24
9	Reserved	Reserved	UINT	4	H+28
10	Xxxx	32-bit CRC	Hex	4	H+32
11	[CR][LF]	Sentence terminator (ASCII only)			

7.5.45 HWSTATUS: Hardware Status

This message contains the hardware status. It only supports 1 Hz output.

Message ID : 218

ASCII Syntax

```
HWSTATUSA 1
```

Binary Syntax

```
HWSTATUSB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#HWSTATUSA,97,GPS,FINE,2221,111183000,0,0,18,15;66807,0.920,1.020,0.908,1,-0.693,0.0,0x00,0,0x0377,0,0*9d7ce51d
```

Table 7-101 HWSTATUS Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	HWSTATUS Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Int	4	H
3	DC09	The normal voltage range of DC09 is 0.85~1.0V; 3 digits after the decimal point are valid	Float	4	H+4
4	DC10	The normal voltage range of DC 10 is 0.95~1.1V; 3 digits after the decimal point are valid	Float	4	H+8
5	DC18	The normal voltage range of DC18 is 1.7~1.9V; 3 digits after the decimal point are valid	Float	4	H+12
6	Clockflag	Validity flag of ClockDrift 0 = Invalid 1 = Valid	UINT	4	H+16
7	ClockDrift	Equivalent velocity of clock drift, m/s	Float	4	H+20
8	Reserved	Reserved	Float	4	H+24
9	hwFlag	Hardware information, see Table HWFLAG Bit Description for the description of each bit.	UCHAR	1	H+28
10	Reserved	Reserved	UCHAR	1	H+29
11	PLL_LOCK	PLL status	USHORT	2	H+30

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
12	Reserved	Reserved	UINT	4	H+32
13	Reserved	Reserved	UINT	4	H+36
14	Xxxx	Checksum	Hex	4	H+40
15	[CR][LF]	Sentence terminator			

Table 7-102 HWFLAG Bit Description

Bit	Description
Bit0	0 = oscillator, 1 = crystal
Bit1	0 = VCXO, 1 = TCXO
Bit2	0 = 26 MHz oscillator, 1 = 20 MHz oscillator
Bit3	0 = only supports oscillator, 1 = supports oscillator and crystal
Bit4	0 = internal clock, 1 = external clock
Bit5	
Bit6	
Bit7	Check status: 0 = unknown, 1 = valid

7.5.46 INFOPART1

Read user-defined information stored in the space of PART1.

Message ID : 1019

ASCII Syntax

```
INFOPART1A
```

Binary Syntax

```
INFOPART1B
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#INFOPART1A,69,GPS,FINE,2190,376054000,0,0,18,953;0*723399e1
```

Table 7-103 INFOPART1 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	INFOPART1 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Count	Number of messages	Uchar	1	H
3	Info id	0~7	Uchar	1	H+1
4	Length	Data length	Ushort	2	H+2
5	Data	Content of information, 128 bytes at most. Output the actual data length when less than 128 bytes.	Uchar[128]	128	H+4
6		Output message in a continuous loop of #Count times			
7	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+X
8	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.47 INFOPART2

Read user-defined information stored in the space of PART2.

Message ID : 1020

ASCII Syntax

```
INFOPART2A
```

Binary Syntax

INFOPART2B

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#INFOPART2A,67,GPS,FINE,2190,376094000,0,0,18,753;0*c5702fa1
```

Table 7-104 INFOPART2 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	INFOPART2 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Count	Number of messages	Uchar	1	H
3	Info id	0~23	Uchar	1	H+1
4	Length	Data length	Ushort	2	H+2
5	Data	Content of information, 128 bytes at most. Output the actual data length when less than 128 bytes.	Uchar[128]	128	H+4
6		Output message in a continuous loop of #Count times			
7	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+X
8	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.48 IRNSSEPH: IRNSS Ephemeris

This log contains IRNSS ephemeris information. It supports `ONCHANGED` trigger. If you use ONTIME trigger (i.e. the output frequency is fixed), the recommended time interval is more than 60 seconds because of the large amount of ephemeris data; it is not recommended to output this log at 1 Hz. When it is output together with 50 Hz observation data, it is recommended to use the `ONCHANGED` trigger.

Message ID : 112

ASCII Syntax

```
IRNSSEPHA COM1 60
```

```
IRNSSEPHA COM1 ONCHANGED
```

Binary Syntax

```
IRNSSEPHB COM1 60
```

```
IRNSSEPHB COM1 ONCHANGED
```

Applicable Products: UM980, UB9A0, UM981, UM980C

Output

```
#IRNSSEPHA,87,GPS,FINE,2305,116273000,0,0,18,31;2,9685.0,0,193,0,2305,0,115536.0,4.216456644
e+07,4.968778398e-09,-1.455813652e+00,2.0113651408e-03,3.0523021218e+00,2.138316631e-0
5,-2.254918218e-05,7.77500000e+02,6.59937500e+02,-2.346932888e-07,-2.123415470e-07,5.0866
932453e-01,4.564475843e-10,1.506952289e+00,-4.93877715e-09,0,115536.0,-1.862645149e-0
9,6.0655642e-05,2.3760549e-11,0.0000000e+00,0,7.292510329e-05,4.0*298210c8
```

Table 7-105 IRNSSEPH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	IRNSSEPH header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	PRN	Satellite PRN number IRNSS: 1 to 15	Ulong	4	H
3	TOWC	Time stamp of subframe 1, TOWC*12 is the start time of the next subframe, seconds	Double	8	H+4
4	L5 health	Health status of navigation data	Ulong	4	H+12

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		on L5 SPS signal 0=healthy; 1=unhealthy			
5	IODEC	Issue of data ephemeris and clock	Ulong	4	H+16
6	S health	Health status of navigation data on S SPS signal 0=healthy; 1=unhealthy	Ulong	4	H+20
7	Week	GPS week number (GPS Week)	Ulong	4	H+24
8	Reserved	Reserved	Ulong	4	H+28
9	Toe	Time of ephemeris, seconds	Double	8	H+32
10	A	Semi-major axis of satellite orbit, meters	Double	8	H+40
11	ΔN	Mean motion difference, radians/ second	Double	8	H+48
12	M0	Mean anomaly at reference time, radians	Double	8	H+56
13	Ecc	Eccentricity of satellite orbit	Double	8	H+64
14	ω	Argument of perigee, radians	Double	8	H+72
15	cuc	Argument of latitude (amplitude of cosine, radians)	Double	8	H+80
16	cus	Argument of latitude (amplitude of sine, radians)	Double	8	H+88
17	crc	Orbit radius (amplitude of cosine, meters)	Double	8	H+96
18	crs	Orbit radius (amplitude of sine, meters)	Double	8	H+104
19	cic	Inclination (amplitude of cosine, radians)	Double	8	H+112
20	cis	Inclination (amplitude of sine, radians)	Double	8	H+120
21	I0	Inclination angle at reference time, radians	Double	8	H+128

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
22	IDOT	Rate of change of inclination angle, radians/second	Double	8	H+136
23	Ω0	Right ascension of ascending node, radians	Double	8	H+144
24	Ω dot	Rate of change of the right ascension of ascending node, radians/second	Double	8	H+152
25	Reserved	Reserved	Ulong	4	H+160
26	toc	Reference time for satellite clock corrections, seconds	Double	8	H+164
27	tgd	Total group delay for IRNSS S signal, seconds	Double	8	H+172
28	af0	Satellite clock bias parameter, seconds	Double	8	H+180
29	af1	Satellite clock rate parameter, s/s	Double	8	H+188
30	af2	Satellite clock drift parameter, s/s^2	Double	8	H+196
31	Flag	Bit0: Alert Flag, 1 = Alert (The utilization of navigation data shall be at the users' own risk.) Bit1: AutoNav mode, 1 = AutoNav (Satellite broadcasts primary navigation parameters from AutoNav data sets with no uplink from ground for maximum of seven days.)	Enum	4	H+204
32	N	Corrected mean motion, radians/ second	Double	8	H+208
33	URA	User range accuracy, m^2. The ICD specifies an algorithm to convert the URA index transmitted in the ephemeris to a nominal standard deviation value. Here outputs the square (variance) of the nominal value.	Double	8	H+216
34	xxxx	32-bit CRC	Hex	4	H+224

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
35	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.49 JAMSTATUS: Jamming Detection

This command is used to check the information of jamming detection. It only supports 1 Hz output.

Message ID : 511

ASCII Syntax

```
JAMSTATUSA 1
```

Binary Syntax

```
JAMSTATUSB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM960L, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#JAMSTATUSA,97,GPS,FINE,2190,365412000,0,0,18,14;SINGLE,0,0,0,0*e31418ea
```

Table 7-106 JAMSTATUS Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	JAMSTATUS Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H
3	CWRatio	In the range of 0 to 255. Indicates the strength of the jamming signal. The higher the value is, the greater the impact	Uchar	1	H+4

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		it has on positioning.			
4	CWFlag	0: NO CW JAM 1: CW JAM 2: Strong CW JAM	Uchar	1	H+5
5, 6	Reserved	Reserved	Uchar*2	2	H+6
7	Xxxx	Checksum	Hex	4	H+8
8	[CR][LF]	Sentence terminator			

7.5.50 KSXT: Positioning and Heading Data Output

This message contains the time, positioning and heading information of the GNSS receiver. It only supports ASCII format.

ASCII Syntax

Output 1 Hz KSXT message at the current port

```
KSXT 1
```

Output 1 Hz KSXT message at COM2

```
KSXT COM2 1
```

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
$KSXT,20190909084745.00,116.23662400,40.07897925,68.3830,299.22,-67.03,190.28,0.022,,1,3,46,28,,,,-0.004,-0.021,-0.020,,*27
```

Table 7-107 KSXT Message Structure

ID	Field	Data Description	Symbol
1	$KSXT	Log header, see Table ASCII Header Structure (N4).	

ID	Field	Data Description	Symbol
2	Utc	UTC time	yyyymmddhhmmss.ss
3	Lon	Longitude, degrees (Output 8 digits after the decimal point)	DDD.DDDDDDDD
4	Lat	Latitude, degrees (Output 8 digits after the decimal point)	DD.DDDDDDDD
5	Height	Height above mean sea level, meters (Output 4 digits after the decimal point)	xxxxx.xxxx
6	Heading	Azimuth (Output 2 digits after the decimal point)	xxx.xx
7	Pitch	Pitch angle (Output 2 digits after the decimal point)	xxx.xx
8	Track true	Course over ground (Output 2 digits after the decimal point)	xxx.xx
9	Vel	Horizontal velocity, km/h (Output 3 digits after the decimal point)	xxx.xxx
10	Roll	Roll (Output 2 digits after the decimal point)	xxx.xx
11	Pos qual	Position quality indicator: 0 = Fix not available or invalid 1 = Single point positioning 2 = RTK float solution 3 = RTK fixed solution	X
12	Heading qual	Heading quality indicator: 0 = Fix not available or invalid 1 = Single point positioning 2 = RTK float solution 3 = RTK fixed solution	X
13	#hsolnSVs	Number of satellites used by the slave antenna to perform solution	xx
14	#msolnSVs	Number of satellites used by the master antenna to perform solution	xx
15	East	East coordinate, in Geographic Coordinate System with the base station as the origin, in meters, 3 digits after the decimal point.	xxx.xxx

ID	Field	Data Description	Symbol
16	North	North coordinate, in Geographic Coordinate System with the base station as the origin, in meters, 3 digits after the decimal point.	xxx.xxx
17	Up	Up coordinate, in Geographic Coordinate System with the base station as the origin, in meters, 3 digits after the decimal point.	xxx.xxx
18	EastVel	East velocity, in Geographic Coordinate System with the base station as the origin, 3 digits after the decimal point, km/h (null if no value)	xxx.xxx
19	northVel	North velocity, in Geographic Coordinate System with the base station as the origin, 3 digits after the decimal point, km/h (null if no value)	xxx.xxx
20	upVel	Up velocity, in Geographic Coordinate System with the base station as the origin, 3 digits after the decimal point, km/h (null if no value)	xxx.xxx
21	Reserved	Reserved	
22	Reserved	Reserved	
23	*xx	Checksum, a hexadecimal number obtained by calculating an XOR of all characters from $ to * (excluding $ and *)	*FF
24	[CR][LF]	Sentence terminator	[CR][LF]

7.5.51 LBANDAUTH: L-Band Authorization Information

This message outputs L-band related authorization information.

Message ID : 1468

ASCII Syntax

```
LBANDAUTHA 1
```

Binary Syntax

```
LBANDAUTHB 1
```

Applicable Products: UM980C, UM981C, UM982C

Output

```
#LBANDAUTHA,56,GPS,FINE,2384,119469000,21315,0,18,17;3000099,ACTIVATED,2025/10/31,GLOBA
L,OCSAT,*5a14e0ab
```

Table 7-108 LBANDAUTH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	LBANDAUTH Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)	–	H	0
2	LSN	License Serial Number (LSN).	CHAR[16]	16	H
3	LbandAuth	L-band authorization status: `UNAUTHORIZED`, `TRIAL`, `ACTIVATED`, or `INCOMPATIBLE`.	CHAR[16]	16	H+16
4	ServiceEndDate	Service expiration date in `YYYY/MM/DD` format.	CHAR[16]	16	H+32
5	Region	Service region: `GLOBAL`, `CHINA`, `OFFSHORE`, or `UNAUTHORIZED`.	CHAR[16]	16	H+48
6	L-bandSat	Optimal L-band satellite.	CHAR[8]	8	H+64
7	Reserved	Reserved.	CHAR[8]	8	H+72
8	xxxx	32-bit CRC.	Hex	4	H+80
9	[CR][LF]	Sentence terminator	–	–	–

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		(ASCII only).			

7.5.52 LBANDBEAM: Available L-Band Beam Information

This message outputs information on all currently available L-band beams. It is recommended to output this message at 1 Hz.

Message ID : 1466

ASCII Syntax

```
LBANDBEAM COM1 1
```

> **Note:** The output is in the form of table.

```
LBANDBEAMA COM1 1
```

Binary Syntax

```
LBANDBEAMB COM1 1
```

Applicable Products: UM980C, UM981C, UM982C

Output

```
#LBANDBEAM,86,GPS,FINE,2372,200184000,19794,0,18,16;
<     7
<     1,ARSAT,1545245000,2400,0,-45.4644,46.6997,-98.0000,1,1,1,0,0,0,2200,0X5C08,0XC685,0XE15AE893,0XE15AE893
<     2,SASAT,1545815000,1200,0,-54.2067,344.9805,-54.0000,1,1,1,0,0,0,2200,0X5C08,0XC685,0XE15AE893,0XE15AE893
<     3,ERSAT,1545950000,2400,0,-9.5340,270.7931,25.0000,1,1,1,0,0,0,2200,0X5C08,0XC685,0XE15AE893,0XE15AE893
<     4,EASAT,1546230000,1200,0,-9.5340,270.7931,25.0000,1,1,1,0,0,0,2200,0X5C08,0XC685,0XE15AE893,0XE15AE893
<     5,IRSAT,1546240000,1200,0,32.8944,225.0706,83.5000,1,1,1,0,0,0,2200,0X5C08,0XC685,0XE15AE893,0XE15AE893
```

```
<      6,OCSAT,1545875000,1200,0,35.9665,141.2161,143.5000,1,1,1,0,0,0,2200,0X3041,0X2873,0XE15
AE893,0XE15AE893
<      0,,0,0,0,-27.5414,287.5403,0.0000,0,0,0,0,0,0,0,0X0,0X0,0X0,0X0
#LBANDBEAMA,86,GPS,FINE,2372,200188200,19794,0,18,15;7,1,ARSAT,1545245000,2400,0,-45.464
4,46.6997,-98.0000,1,1,1,0,0,0,2200,0X5C08,0XC685,0XE15AE893,0XE15AE893,2,SASAT,154581500
0,1200,0,-54.2067,344.9805,-54.0000,1,1,1,0,0,0,2200,0X5C08,0XC685,0XE15AE893,0XE15AE893,3,ER
SAT,1545950000,2400,0,-9.5340,270.7931,25.0000,1,1,1,0,0,0,2200,0X5C08,0XC685,0XE15AE893,0XE
15AE893,4,EASAT,1546230000,1200,0,-9.5340,270.7931,25.0000,1,1,1,0,0,0,2200,0X5C08,0XC685,0XE
15AE893,0XE15AE893,5,IRSAT,1546240000,1200,0,32.8944,225.0706,83.5000,1,1,1,0,0,0,2200,0X5C0
8,0XC685,0XE15AE893,0XE15AE893,6,OCSAT,1545875000,1200,0,35.9665,141.2161,143.500
0,1,1,1,0,0,0,2200,0X3041,0X2873,0XE15AE893,0XE15AE893,0,,0,0,0,-27.5414,287.5403,0.000
0,0,0,0,0,0,0,0,0X0,0X0,0X0,0X0*12b7b515
```

Table 7-109 LBANDBEAM Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	LBANDBEAM	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	#Beam	Number of beams.	Uint	4	H
3	BeamID	Beam ID (as configured).	Uint	4	H+4
4	BeamName	Beam name (as configured).	Char[8]	8	H+8
5	Freq	Center frequency of the beam, in Hz.	Uint	4	H+16
6	DataRate	Data transmission rate of the beam, in bps.	USHORT	2	H+20
7	Reserved	Reserved.	UCHAR	2	H+22
8	Elevation	Elevation angle relative to current position, in	Float	4	H+24

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		degrees.			
9	Azimuth	Azimuth angle relative to current position, in degrees.	Float	4	H+28
10	Longitude	Satellite longitude, in degrees.	Float	4	H+32
11	USE_DESCRAMBLER	Descrambling enabled: 1 = yes, 0 = no.	UCHAR	1	H+36
12	USE_SERVICE_ID	Service ID verification enabled: 1 = yes, 0 = no.	UCHAR	1	H+37
13	USE_PRESCRAMBLING	De-prescrambling enabled: 1 = yes, 0 = no.	UCHAR	1	H+38
14	Reserved[3]	Reserved.	UCHAR	3	H+39
15	SEARCH_WINDOW	Configured frequency search window, in Hz.	HEX	2	H+42
16	DESCRAMBLER_INIT	Initial phase of descrambler (hexadecimal).	USHORT	2	H+44
17	SERVICE_ID	Service ID (hexadecimal).	USHORT	2	H+46
18	UNIQUE_WORD1	First unique word (hexadecimal).	Uint	4	H+48
19	UNIQUE_WORD2	Second unique word (hexadecimal).	Uint	4	H+52
20		Next beam = H + 4 + (#Beam × 52). Each beam occupies 52 bytes			

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		(fields 3~19 repeat per beam).			
21	xxxx	32-bit CRC	Hex	4	H + 4 + (#Beam × 52)
22	[CR][LF]	Sentence terminator (ASCII only).	–	–	–

7.5.53 LBANDTRACKSTATUS: Status of Tracked L-Band Satellite

This message outputs the status information of the currently tracked L-band satellite(s). It is recommended to output this message at 1 Hz.

Message ID : 1467

ASCII Syntax

> LBANDTRACKSTATUS COM1 1
> **Note:** The output is in the form of table.

> LBANDTRACKSTATUSA COM1 1

Binary Syntax

> LBANDTRACKSTATUSB COM1 1

Applicable Products: UM980C, UM981C, UM982C

Output

```
#LBANDTRACKSTATUS,72,GPS,FINE,2372,206546800,19794,0,18,15;
<      2
<      5,IRSAT,1546240000,1200,0XC685,25673176,-22.4763,46.3300,0.1000,0,5,7758176,0.0008,93,0
<      6,OCSAT,1545875000,1200,0X2873,18800,-24.6819,40.7400,0.1000,0,0,0,0.0000,80,0
#LBANDTRACKSTATUSA,72,GPS,FINE,2372,206539000,19794,0,18,16;2,5,IRSAT,1546240000,1200,0X
```

```
C685,25666176,-23.9124,47.7900,0.1000,0,5,7756144,0.0008,94,0,6,OCSAT,1545875000,1200,0X287
3,11800,-23.5923,41.6900,0.1000,0,0,0,0.0000,80,0*63a34574
```

Table 7-110 LBANDTRACKSTATUS Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	LBANDTRACKSTATUS	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)	–	H	0
2	#Beam	Number of tracked beams.	Uint	4	H
3	BeamID	Beam ID (as configured).	Uint	4	H+4
4	BeamName	Beam name.	Char[8]	8	H+8
5	Frequency	Center frequency of the beam, in Hz.	Uint	4	H+16
6	DataRate	Data transmission rate of the beam, in bps.	USHORT	2	H+20
7	ServiceID	Actual service ID resolved by the receiver.	HEX	2	H+22
8	Locktime	Duration since Unique Word and Service ID synchronization was achieved.	Uint	4	H+24
9	Doppler	Doppler shift, in Hz.	Float	4	H+28
10	CN0	Carrier-to-noise ratio, in dB-Hz.	Float	4	H+32
11	Phase std dev	Phase standard deviation, in cycles.	Float	4	H+36

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
12	BadUniqueWordBit	Number of erroneous bits in the current frame's unique word.	UShort	2	H+40
13	CorrectedViterbi	Number of Viterbi-corrected symbols in the current frame.	UShort	2	H+42
14	ReceivedMessage Number	Total amount of received data, in bytes.	Uint	4	H+44
15	BitErrorRate	Estimated Viterbi bit error rate.	Float	4	H+48
16	Reserved1	Reserved.	Uint	4	H+52
17	Reserved2	Reserved.	Uint	4	H+56
18		Next beam = H + 4 + (#Beam × 56). Each beam occupies 56 bytes (fields 3–17 repeat per tracked beam). If only one satellite is tracked, this section is not repeated.	–	–	–
19	xxxx	32-bit CRC	Hex	4	H + 4 + (#Beam × 56)
20	[CR][LF]	Sentence terminator (ASCII only).	–	–	–

7.5.54 LBANDUSERDATA: L-Band User Data

This message outputs the raw data stream received from the tracked L-band satellite. For information about configuration of the tracked L-band satellite, refer to LBAND: L-Band Satellite Information Configuration. This message supports `ONCHANGED` output only.

Message ID : 1469

ASCII Syntax

```
LBANDUSERDATAA COM1 ONCHANGED
```

Binary Syntax

```
LBANDUSERDATAB COM1 ONCHANGED
```

Applicable Products: UM980C, UM981C, UM982C

Output

```
#LBANDUSERDATAA,85,GPS,FINE,2372,264384600,19794,0,18,15;5,501,CE,3D,08,1C,BE,95,EE,68,F9,9
4,FE,D0,18,CB,70,88,C5,00,8C,FF,E7,F0,C1,F7,1C,C0,67,D8,F2,27,44,F8,C7,E0,FB,A0,98,C8,10,C7,8F,8C,4
3,31,1F,F3,F3,00,E3,F3,01,9B,BD,C2,6B,D7,DE,0B,EB,C5,A3,33,C0,5B,34,41,7E,8F,99,CF,FD,0C,2F,82,7C,4
C,B4,01,8C,55,04,0C,2D,76,8C,2F,77,EC,0B,73,4F,27,16,8F,7F,6C,6F,D5,1A,4C,96,7C,40,7E,C6,3E,CC,08,3
3,41,FA,07,30,50,16,BF,3C,1B,B0,15,F5,BF,EC,25,BC,E9,DC,3E,B0,05,BF,A5,CB,B3,2D,F0,E8,F9,10,CD,B0,1
8,C1,C7,C4,C2,F7,98,FE,10,5C,F0,37,06,FA,07,B6,FA,07,FA,07,97,1A,CA,20,1E,03,E6,4B,18,5F,D3,35,41,D
3,17,9F,93,F2,DE,6B,01,00,F3,06,9C,CB,CD,5F,03,E2,01,0B,F5,02,3E,0F,99,0C,C4,7F,0C,42,7F,AC,21,75,6C,2
9,79,8C,02,7C,4F,37,7F,AF,A6,7F,EF,D1,11,3A,36,7B,30,2C,08,3F,48,09,3F,39,DC,B2,54,0D,B1,04,4A,BE,D0,0
2,3F,E0,03,BF,C8,26,3D,FD,F0,BF,10,E1,32,7C,13,17,23,10,C9,97,F6,FD,82,B8,F8,27,AE,EB,A7,C6,C7,C1,1
0,C7,87,DC,FE,C0,4A,47,40,1D,6B,CD,61,53,FA,FB,FA,A5,03,40,8B,D8,0A,3F,FD,7F,F9,7F,C0,C7,A2,82,CC,8
7,D4,92,D1,B8,B1,C5,EE,A8,B5,6C,0B,1C,D0,78,5F,34,98,5D,C4,A5,EE,68,2F,BA,2E,F2,FF,2F,E3,DF,81,ED,6
8,80,01,2C,05,7F,D0,1C,A8,A4,5C,F6,DA,E7,5F,D0,00,BC,AF,91,79,B2,A3,E9,08,0C,7E,2A,FA,FB,FA,A3,20,4
5,EE,0B,00,00,5F,F0,30,B3,21,F5,24,B4,6E,2C,71,7B,AA,2D,5B,02,C7,34,1E,17,6B,54,A0,C6,E4,FA,FB,FA,A
5,12,A1,EB,1A,63,01,11,00,10,01,00,11,0D,00,01,00,00,00,11,01,E1,BD,B9,33,FA,FB,FA,A2,20,45,EE,0B,3
B,EA,6F,FF,30,9C,74,4B,9B,46,EF,E8,E8,07,70,3B,23,F7,FF,03,DF,FF,38,4B,D8,7C,47,B8,5F,C1,78,6C,F7,3B,F
A,FB,FA,D8,2F,67,00,01,7F,DB,BC,48,2A,96,22,57,A1,1A,F9,84,40,04,72,4C,20,F0,25*ff1d6dd7
```

Table 7-111 LBANDUSERDATA Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	LBANDUSERDATA	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)	–	H	0
2	BeamID	Satellite ID.	USHORT	2	H
3	NumberOfBytes	Length of the `Content` field.	USHORT	2	H+2

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
4	Content	Raw L-band frame data.	UCHAR[X]	X	H+4
5	xxxx	32-bit CRC.	Hex	4	H+
6	[CR][LF]	Sentence terminator (ASCII only).	–	–	–

7.5.55 L6MDCTYPE1: Compact SSR Mask

This log outputs the QZSS MADOCA-PPP sub type 1 message, which contains the satellite mask information. It only supports the `ONCHANGED` trigger.

Message ID : 2325

ASCII Syntax

```
L6MDCTYPE1A ONCHANGED
```

Binary Syntax

```
L6MDCTYPE1B ONCHANGED
```

Applicable Products: UM981, UB9A0, UM980, UM982, UM980C

Output

```
#L6MDCTYPE1A,89,GPS,FINE,2331,121686000,16071,0,18,28;36,4073,1,121685,5,0,11,4,0,0,0,7,0,7F7
B7BFF00,A4A4,1,0,0,0,CB7FF6DF6DF7FF6CB6CBFCB2CBFDF7DF7FF6DF6DC000000000000000000
0000000000000000000,1,F3B7FD0000,F000,0,0,0,0,000000000000000000000000000000000000
0000000000000000000000000000000000000000,2,7AFA29C2D0,2400,0,0,0,0,000000000000000
000000000000000000000000000000000000000000000000000000000,4,6000000000,924
0,0,0,0,0,000000000000000000000000000000000000000000000000000000000000000000000
0000000*79a68e3a
```

Table 7-112 L6MDCTYPE1 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	L6MDCTYPE1	Log header.		H1	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
	header	See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4).			
2	L6Corrheader	Header of the L6 correction messages, see Table Header of the L6 Correction Messages.		H2	H1
3	MASK	Mask information, See Table L6 MADOCA-PPP Type1 Message Mask Data Structure for details.	L6PPPMsg SysMask [NumGNSS]	52*NumGNSS	H(H1+H2)
4	Xxxx	32-bit CRC	HEX	4	H+ 52*NumGNSS
5	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 7-113 L6 MADOCA-PPP Type1 Message Mask Data Structure

ID	Field	Format	Description	Binary Bytes	Binary Offset
1	GnssID	UCHAR	GNSS ID. See Figure GNSS ID.	1	0

ID	Field	Format	Description	Binary Bytes	Binary Offset
2	SatelliteMask	UCHAR	SatelliteMask. See Figure Compact SSR Satellite Mask.	5	1
3	SignalMask	UCHAR	SignalMask. See Figure Compact SSR Signal Mask.	2	6
4	Cell-MaskAvailabilityFlag	UCHAR	Validity flage：0=invalid, 1=valid	1	8
5	Reserved	UCHAR[3]	Reserved	3	9
6	Cell Mask	UCHAR		40	12

Table 7-114 Header of the L6 Correction Messages

ID	Field	Format	Description	Binary Bytes	Binary Offset
1	PRN	ULONG	PRN number	4	0
2	MsgNum	USHORT	Message number	2	4
3	SubID	USHORT	Message sub type ID	2	6
4	EpochTime	ULONG	GPS epoch time 1s	4	8
5	Interval	USHORT	SSR update interval	2	12
6	Indicator	UCHAR	Multiple message indicator	1	14
7	SSRIOD	UCHAR	IOD SSR	1	15
8	NumGNSS	UCHAR	Number of augmented GNSS	1	16
9	Reserved	UCHAR	Reserved	1	17
10	HourlyTime	USHORT	GNSS hourly epoch time 1s	2	18
11	CorNum	USHORT	Number of corrections	2	20
12	MsgValid	USHORT	Nominal validity period	2	22

Table 4.2.2-7 GNSS ID

GNSS ID	GNSS
0	GPS
1	GLONASS
2	Galileo
3	BDS
4	QZSS
5,6	Reserved
7	BDS3
8-15	Reserved

Figure 7-1 GNSS ID

Table 4.2.2-8 Compact SSR satellite mask

Compact SSR Satellite Mask	0 (MSB)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
GPS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
GLONASS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Galileo	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
BDS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
QZSS*	193	194	195	196 203	197 204	198	199	200 205	201 206	202	Reserved				
BDS3	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Compact SSR Satellite Mask	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
GPS	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
GLONASS	16	17	18	19	20	21	22	23	24	Reserved					
Galileo	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
BDS	16	17	18	Reserved											
QZSS	Reserved														
BDS3	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48

Compact SSR Satellite Mask	30	31	32	33	34	35	36	37	38	39 (LSB)
GPS	31	32	33	34	35	36	37	38	39	40
GLONASS	Reserved									
Galileo	31	32	33	34	35	36	37	Reserved		
BDS	Reserved									
QZSS	Reserved									
BDS3	49	50	51	52	53	54	55	56	57	58

* PRN number for QZSS is used to express which QZSS is augmented for convenience. PRN 203-206 is described alongside because some satellites transmit L1C/B with PRN 203-206 while they transmit L1C, L2C, and L5 with PRN 193-202.

Figure 7-2 Compact SSR Satellite Mask

Table 4.2.2-9 Compact SSR signal mask

Compact SSR Signal mask	GPS	GLONASS	Galileo	BDS	QZSS	BDS3
0	L1 C/A	G1 C/A	E1 B I/NAV OS/CS/SoL	B1 I	L1 C/A	B1 I
1	L1 P	G1 P	E1 C no data	B1 Q	L1 L1C(D)	B1 Q
2	L1 Z-tracking	G2 C/A	E1 B+C	B1 I+Q	L1 L1C(P)	B1 I+Q
3	L1 L1C(D)	G2 P	E5a I F/NAV OS	B3 I	L1 L1C(D+P)	B3 I
4	L1 L1C(P)	G1a(D)	E5a Q no data	B3 Q	L2 L2C(M)	B3 Q
5	L1 L1C(D+P)	G1a(P)	E5a I+Q	B3 I+Q	L2 L2C(L)	B3 I+Q
6	L2 L2C(M)	G1a(D+P)	E5b I I/NAV OS/CS/SoL	B2 I	L2 L2C(M+L)	B2b I
7	L2 L2C(L)	G2a(D)	E5b Q no data	B2 Q	L5 I	B2b Q
8	L2 L2C(M+L)	G2a(P)	E5b I+Q	B2 I+Q	L5 Q	B2b I+Q
9	L2 P	G2a(D+P)	E5 I		L5 I+Q	B1C(D)
10	L2 Z-tracking	G3 I	E5 Q		L6D	B1C(P)
11	L5 I	G3 Q	E5 I+Q		L6P	B1C(D+P)
12	L5 Q	G3 I+Q	E6 B		L6E	B2a(D)
13	L5 I+Q		E6 C		L1 C/B	B2a(P)
14						B2a(D+P)
15						

Figure 7-3 Compact SSR Signal Mask

7.5.56 L6MDCTYPE2：Compact SSR GNSS Orbit Correction

This log outputs the QZSS MADOCA-PPP sub type 2 message, which contains the GNSS orbit correction information. It only supports the `ONCHANGED` trigger.

Message ID : 2326

ASCII Syntax

```
L6MDCTYPE2A ONCHANGED
```

Binary Syntax

```
L6MDCTYPE2B ONCHANGED
```

Applicable Products: UM981, UB9A0, UM980, UM982, UM980C

Output

```
#L6MDCTYPE2A,89,GPS,FINE,2331,121686000,16071,0,18,29;36,4073,2,0,5,0,11,0,0,2885,68,7,172,-43
2,610,316,53,-132,131,-130,215,-193,235,21,62,159,-119,-105,50,-123,-266,150,46,-7,-142,13,41,-20
1,532,100,57,53,-67,-6,136,-4,-27,-58,26,118,-156,82,71,38,-36,-5,25,58,14,-166,34,11,-27,-64,94,-3
1,200,-60,103,-39,-132,-104,62,117,-452,151,18,-249,215,99,109,26,-321,-54,42,191,-110,-70,15,17,2
81,-16,104,91,-153,153,17,-15,124,-12,147,-188,586,-4,22,124,-89,-94,54,-43,-60,-103,59,-95,219,-3
7,32,-13,-147,77,51,117,52,103,51,217,199,98,51,292,2,158,51,156,-124,59,51,556,-534,64,51,1,-14,-1
1,51,444,12,24,51,196,-115,66,51,231,-72,87,51,224,-13,-45,51,293,255,-125,51,308,307,-96,51,118,-1
80,-213,51,157,-209,-131,51,322,-676,-445,51,57,-255,-11,51,81,266,-23,51,568,695,-244,51,284,-56
```

```
9,-50,74,160,-86,-8,73,-8,21,23,74,156,5,17,74,112,85,17,74,79,12,37,74,108,20,40,74,101,3,-14,74,55,4
4,-2,71,65,27,-45,74,206,-76,48,72,225,-67,14,74,111,90,76,74,276,-17,-39,73,115,-19,-10,72,154,-5
7,6,74,242,-11,15,74,92,-47,-63,74,196,-10,19,74,91,-77,-5,70,42,-57,-8,133,403,59,22,133,220,17,36*7
d02c73e
```

Table 7-115 L6MDCTYPE2 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	L6MDCTYPE2 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4).		H1	0
2	L6Corrheader	Header of the L6 correction messages, see Table Header of the L6 Correction Messages.		H2	H1
3	OrbitCorr	Orbit correction. See Table L6 MADOCA-PPP Type2 Message Orbit Correction Data Structure.	L6PPP MsgSatOrbit [CorNum]	8*CorNum	H(H1+H2)
4	Xxxx	32-bit CRC	HEX	4	H+ 8*CorNum
5	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 7-116 L6 MADOCA-PPP Type2 Message Orbit Correction Data Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	GNSS IODE	USHORT	IODE (Ephemeris Issue of Data) for ephemeris and clock correction data, used to match the original broadcast ephemeris.	2	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
2	Radial	SHORT	Radial correction, Unit: 0.0016 m	2	2
3	Along-Track	SHORT	Along-track correction, Unit: 0.0064 m	2	4
4	Cross-Track	SHORT	Cross-track correction, Unit: 0.0064 m	2	6

7.5.57 L6MDCTYPE3: Compact SSR GNSS Clock Correction

This log outputs the QZSS MADOCA-PPP sub type 3 message, which contains the GNSS clock correction information. It only supports the `ONCHANGED` trigger.

Message ID : 2327

ASCII Syntax

```
L6MDCTYPE3A ONCHANGED
```

Binary Syntax

```
L6MDCTYPE3B ONCHANGED
```

Applicable Products: UM981, UB9A0, UM980, UM982, UM980C

Output

```
#L6MDCTYPE3A,89,GPS,FINE,2331,121671000,16071,0,18,29;36,4073,3,0,2,0,11,0,0,2870,68,4,-859,68
4,184,-18,206,86,-349,-175,568,146,-242,349,-457,476,-1106,-895,-934,567,389,-190,-85,-66,387,-5
3,-143,219,228,2666,1212,-689,-1579,492,-1751,-73,897,2194,2403,328,1680,-813,1665,874,-88,-119
3,1680,738,146,-22,-51,-199,-164,-77,-87,327,56,-176,-292,-97,-283,180,-60,-105,-25,26,-208,-68,12
8,248*5413e1d3
```

Table 7-117 L6MDCTYPE3 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	L6MDCTYPE3 header	Log header. See Table Binary		H1	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Header Structure (N4) and Table ASCII Header Structure (N4).			
2	L6Corrheader	Header of the L6 correction messages, see Header of the L6 Correction Messages.		H2	H1
3	Clk	Clock correction	asClk[CorNum]	2*CorNum	H(H1+H2)
4	Xxxx	32-bit CRC	HEX	4	H+2*CorNum
5	[CR][LF]	Sentence terminator (ASCII only)			

7.5.58 L6MDCTYPE4: Compact SSR GNSS Satellite Code Bias

This log outputs the QZSS MADOCA-PPP sub type 4 message, which contains the GNSS satellite code bias information. It only supports the `ONCHANGED` trigger.

Message ID : 2328

ASCII Syntax

```
L6MDCTYPE4A ONCHANGED
```

Binary Syntax

```
L6MDCTYPE4B ONCHANGED
```

Applicable Products: UM981, UB9A0, UM980, UM982, UM980C

Output

```
#L6MDCTYPE4A,89,GPS,FINE,2331,121696000,16071,0,18,30;36,4073,4,0,5,0,11,0,0,2895,68,12,204,2
32,336,0,0,0,0,-143,-163,-246,-235,-157,0,0,0,-13,3,10,-1,-63,0,49,38,77,80,0,0,0,-168,-183,-293,-27
8,-188,0,0,63,62,111,103,0,0,0,-161,-157,-286,-265,-112,0,0,-138,-140,-204,-227,-25,0,0,62,47,60,10
9,101,19,0,76,74,120,125,0,0,0,72,69,118,0,0,0,0,39,26,71,64,0,0,0,88,107,146,0,0,0,0,50,35,48,86,8
1,-5,0,197,236,323,0,0,0,0,83,115,137,0,0,0,0,101,133,167,0,0,0,0,54,40,52,96,89,1,0,-155,-166,-256,-25
5,-165,0,0,-159,-143,-282,-262,-189,0,0,-197,-197,-313,-324,-162,0,0,-125,-122,-203,-206,-69,0,0,6
7,53,68,116,110,3,0,43,41,69,70,0,0,0,-142,-132,-241,-234,-137,0,0,85,75,135,140,0,0,0,-116,-125,-19
9,-190,-34,0,0,-100,-88,-140,-164,0,0,0,-21,-19,-35,-34,0,0,0,34,29,52,57,0,0,0,44,32,72,7
3,0,0,0,6,1,2,9,0,0,0,64,48,105,107,0,0,0,51,43,86,86,0,0,0,82,79,135,137,0,0,0,-63,-68,-89,-105,0,0,0,-5
7,-56,-100,-94,0,0,0,-19,-26,-26,-32,0,0,0,-30,-34,-44,-50,0,0,0,13,14,22,22,0,0,0,-41,-45,-61,-68,0,0,0,4
1,56,44,67,0,0,0,-120,-117,-233,-198,0,0,0,4,4,14,6,0,0,0,68,63,122,112,0,0,0,3,4,5,4,0,0,0,17,3
4,0,0,0,0,0,-39,-76,0,0,0,0,0,53,102,0,0,0,0,0,-47,-83,0,0,0,0,0,-76,-138,0,0,0,0,0,-15,-2
8,0,0,0,0,0,3,9,0,0,0,0,0,198,362,0,0,0,0,0,161,292,0,0,0,0,0,-75,-137,0,0,0,0,0,-90,-163,0,0,0,0,0,51,9
4,0,0,0,0,0,-26,-47,0,0,0,0,0,58,105,0,0,0,0,0,-52,-98,0,0,0,0,0,69,120,0,0,0,0,0,-57,-108,0,0,0,0,0,56,10
5,0,0,0,0,0,-60,-108,0,0,0,0,0,-83,-149,0,0,0,0,0,-78,-79,-128,-112,0,0,0,-62,-66,-99,-111,0,0,0*54a25c1
7
```

Table 7-118 L6MDCTYPE4 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	L6MDCTYPE4 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4).		H1	0
2	L6Corrheader	Header of the L6 correction messages, see Header of the L6 Correction Messages.		H2	H1
3	CodeBias	Code bias	L6PPPSat	14*CorNum	H(H1+H2)

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		information. See L6 MADOCA-PPP Type4 Message Satellite Code Bias Data Structure.	CodeBias[CorNum]		
4	Xxxx	32-bit CRC	HEX	4	H+14*CorNum
5	[CR][LF]	Sentence terminator (ASCII only)			

Table 7-119 L6 MADOCA-PPP Type4 Message Satellite Code Bias Data Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	CodeBias	SHORT[7]	Code Bias, Unit: 0.02 m	14	0

7.5.59 L6MDCTYPE5: Compact SSR GNSS Satellite Phase Bias

This log outputs the QZSS MADOCA-PPP sub type 5 message, which contains the GNSS satellite phase bias information. It only supports the `ONCHANGED` trigger.

Message ID : 2329

ASCII Syntax

```
L6MDCTYPE5A ONCHANGED
```

Binary Syntax

```
L6MDCTYPE5B ONCHANGED
```

Applicable Products: UM981, UB9A0, UM980, UM982, UM980C

Output

```
#L6MDCTYPE5A,89,GPS,FINE,2331,121676000,16071,0,18,29;36,4073,5,0,5,0,11,0,0,2875,68,20,183
8,459,-16185,0,0,0,0,2,3,0,0,0,0,0,-343,8106,10223,-15877,-3969,0,0,0,3,2,3,0,0,0,1593,398,8291,-1430
3,-1528,16002,0,0,3,1,0,0,0,0,114,28,-14343,-1538,0,0,0,1,3,3,0,0,0,0,-692,8019,1987,12784,-499
7,0,0,1,2,2,3,0,0,0,-1026,7935,-14422,6634,0,0,0,2,0,3,0,0,0,0,-2114,7663,-14523,4561,933
2,0,0,0,0,2,3,0,0,0,-1045,7930,-6233,10729,-5511,0,0,3,3,3,1,0,0,0,-77,8172,-6149,6650,-4994,-944
1,0,3,1,1,2,3,0,0,553,138,8235,2058,0,0,0,3,0,1,0,0,0,0,-285,8120,-6190,0,0,0,0,1,3,0,0,0,0,0,383,95,-818
8,-12287,0,0,0,0,2,2,0,0,0,0,1235,308,-8080,0,0,0,0,1,2,0,0,0,0,0,-8,8190,2047,-15879,-1410,1603
1,0,3,0,0,2,1,0,0,1266,316,-16274,0,0,0,0,2,3,0,0,0,0,0,-884,7971,1968,0,0,0,0,3,3,0,0,0,0,0,1099,274,-803
9,0,0,0,0,1,1,0,0,0,0,0,-143,8156,10231,2552,-14722,4511,0,2,0,3,0,2,0,0,-228,8135,1996,14835,370
8,0,0,1,1,1,1,0,0,0,290,72,-16361,-16379,-3969,0,0,3,1,1,2,0,0,0,743,185,-8131,10255,1075
5,0,0,2,1,0,1,0,0,0,-477,8072,-6181,6646,-6531,0,0,3,2,3,0,0,0,0,483,120,-8162,6157,-3581,1548
9,0,0,3,0,2,3,0,0,-670,8024,-14383,14836,0,0,0,1,1,3,0,0,0,0,-2250,7629,-14520,-1582,779
6,0,0,3,3,2,0,0,0,0,-498,8067,-14384,12788,0,0,0,0,1,2,0,0,0,0,-256,8128,2022,4601,-1523
4,0,0,0,0,1,2,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1238,366,0,0,0,0,0,0,0,0,0,0,0,0,2179,62
0,0,0,0,0,0,0,0,0,0,0,0,0,1079,526,0,0,0,0,0,3,0,0,0,0,0,0,338,219,0,0,0,0,0,1,0,0,0,0,0,0,708,8
7,0,0,0,0,0,1,0,0,0,0,0,0,982,429,0,0,0,0,0,0,0,0,0,0,0,0,-1561,7588,0,0,0,0,0,3,0,0,0,0,0,0,-4978,604
8,0,0,0,0,0,2,0,0,0,0,0,0,-459,7680,0,0,0,0,0,2,0,0,0,0,0,0,-55,14,0,0,0,0,0,2,0,0,0,0,0,0,1422,52
8,0,0,0,0,0,2,0,0,0,0,0,0,-2492,7672,0,0,0,0,0,2,0,0,0,0,0,0,335,91,0,0,0,0,0,0,0,0,0,0,0,0,-283,806
2,0,0,0,0,0,3,0,0,0,0,0,0,48,6,0,0,0,0,0,2,0,0,0,0,0,0,-153,483,0,0,0,0,0,2,0,0,0,0,0,0,-2045,727
9,0,0,0,0,0,3,0,0,0,0,0,0,-1053,7954,0,0,0,0,0,0,0,0,0,0,0,0,1391,664,0,0,0,0,0,1,0,0,0,0,0,0,569,14
3,0,0,0,0,0,0,0,0,0,0,0,0,103,25,-6188,510,0,0,0,2,3,0,0,0,0,0,-103,8166,8236,1,0,0,0,1,1,0,0,0,0,0*dce0428
6
```

Table 7-120 L6MDCTYPE5 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	L6MDCTYPE5 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4).		H1	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
2	L6Corrheader	Header of the L6 correction messages, see Table Header of the L6 Correction Messages.		H2	H1
3	PhaseBias	Phase bias information. See Table L6 MADOCA-PPP Type5 Phase Bias Data Structure.	L6PPP SatPhaseBias [CorNum]	H+ 28*CorNum	H(H1+H2)
4	Xxxx	32-bit CRC	HEX	4	H+ 28*CorNum
5	[CR][LF]	Sentence terminator (ASCII only)			

Table 7-121 L6 MADOCA-PPP Type5 Phase Bias Data Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	Phase Bias	SHORT[7]	Signal phase bias, unit: 0.001 m	2	0
2	Indicator	USHORT[7]	Signal phase bias indicator	2	14

7.5.60 L6MDCTYPE7: Compact SSR GNSS URA

This log outputs the QZSS MADOCA-PPP sub type 7 message, which contains the GNSS user range accuracy (URA) information. It only supports the `ONCHANGED` trigger.

Message ID : 2330

ASCII Syntax

```
L6MDCTYPE7A ONCHANGED
```

Binary Syntax

```
L6MDCTYPE7B ONCHANGED
```

Applicable Products: UM981, UB9A0, UM980, UM982, UM980C

Output

```
#L6MDCTYPE7A,89,GPS,FINE,2331,121691000,16071,0,18,30;36,4073,7,0,5,0,11,0,0,2890,0,68,21,22,2
2,24,21,21,23,22,23,22,24,24,23,21,21,24,22,22,21,22,23,23,22,22,22,22,22,26,26,25,26,27,27,26,26,26,2
6,27,27,27,26,26,26,26,27,26,25,24,24,24,25,24,24,24,24,24,23,24,25,24,25,24,24,24,24,24,33,3
2,0,0,0,0,0,0,0,0,0,0,0,0*98499c0d
```

Table 7-122 L6MDCTYPE7 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	L6MDCTYPE7 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4).		H1	0
2	L6Corrheader	Header of the L6 correction messages, see Header of the L6 Correction Messages.		H2	H1
3	URA	User range accuracy	URA[80]	160	H(H1+H2)
4	Xxxx	32-bit CRC	HEX	4	H+160
5	[CR][LF]	Sentence terminator (ASCII only)			

7.5.61 MSPOS: Best Position of Dual Antennas

This message contains the best position calculated with the master antenna and slave antenna.

Message ID : 520

ASCII Syntax

```
MSPOSA 1
```

Binary Syntax

```
MSPOSB 1
```

Applicable Products: UM982, UMD982

> **Note:** Applicable to UM982 Build9669 and later versions.

Output

```
#MSPOSA,86,GPS,FINE,2247,471141000,0,0,18,25;SOL_COMPUTED,SINGLE,40.07896381103,116.236
51058490,64.4448,1.3441,1.2328,2.9707,46,28,,SOL_COMPUTED,SINGLE,40.07896511614,116.23651
086865,64.5809,1.3723,1.1967,2.9210,45,28,,"0",0.000*a71a580e
```

Table 7-123 MSPOS Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	MSPOS header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Master_p-sol status	Solution status calculated with the master antenna, refer to Table Solution Status	Enum	4	H
3	Master_pos type	Position type calculated with the master antenna, refer to Table Position or Velocity Type	Enum	4	H+4
4	Master_lat	Latitude calculated with the master antenna, degrees	Double	8	H+8
5	Master_lon	Longitude calculated with the master antenna, degrees	Double	8	H+16
6	Master_Hgt	Height above mean sea level calculated with the master	Double	8	H+24

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		antenna, meters			
7	Master_lat σ	Latitude standard deviation calculated with the master antenna, meters	Float	4	H+32
8	Master_lon σ	Longitude standard deviation calculated with the master antenna, meters	Float	4	H+36
9	Master_hgt σ	Height standard deviation calculated with the master antenna, meters	Float	4	H+40
10	MasterObs	Number of satellites observed by the master antenna	UCHAR	1	H+44
11	MasterSatUse	Number of satellites used in solution by the master antenna	UCHAR	1	H+45
12	Reserved	Reserved	Short	2	H+46
13	Slave_p-sol status	Solution status calculated with the slave antenna, refer to Table Solution Status	Enum	4	H+48
14	Slave_pos type	Position type calculated with the slave antenna, refer to Table Position or Velocity Type	Enum	4	H+52
15	Slave_lat	Latitude calculated with the slave antenna, degrees	Double	8	H+56
16	Slave_lon	Longitude calculated with the slave antenna, degrees	Double	8	H+64
17	Slave_Hgt	Height above mean sea level calculated with the slave antenna, meters	Double	8	H+72
18	Slave_lat σ	Latitude standard deviation calculated with the slave antenna, meters	Float	4	H+80
19	Slave_lon σ	Longitude standard deviation	Float	4	H+84

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		calculated with the slave antenna, meters			
20	Slave_hgt σ	Height standard deviation calculated with the slave antenna, meters	Float	4	H+88
21	SlaveObs	Number of satellites observed by the slave antenna	UCHAR	1	H+92
22	SlaveSatUse	Number of satellites used in solution by the slave antenna	UCHAR	1	H+93
23	Reserved	Reserved	Short	2	H+94
24	stn id	Base station ID, default = 0	Char[4]	4	H+96
25	age	Age of differential data, s	Float	4	H+100
26	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+104
27	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.62 OBSVBASE: Observation of the Base Station

OBSVBASE contains the observation of the base station. The log only supports `ONCHANGED` trigger.

Message ID : 284

ASCII Syntax

```
OBSVBASEA COM1 ONCHANGED
```

Binary Syntax

```
OBSVBASEB COM1 ONCHANGED
```

Applicable Products: UM982, UMD982, UM980, UMD980, UB9A0, UBD9A0, UM960L, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#OBSVBASEA,92,GPS,FINE,2249,205089000,0,0,18,74;24,0,1,19949528.980,-104835482.17096
0,0,0,0.000,4500,0,0.001,00001c00,0,1,19949532.536,-81689986.637729,0,0,0.000,4900,0,0.001,0220
1c00,0,1,19949531.929,-78286236.510802,0,0,0.000,5300,0,0.001,01c01c00,0,3,24393288.815,-1281
87597.395405,0,0,0.000,3100,0,0.001,00001c00,0,3,24393312.277,-99886437.505261,0,0,0.000,290
0,0,0.001,02201c00,0,3,24393311.741,-95724503.606254,0,0,0.000,3200,0,0.001,01c01c00,0,7,22345
353.436,-117425624.537871,0,0,0.000,4200,0,0.001,00001c00,0,7,22345357.939,-91500486.47453
3,0,0,0.000,4100,0,0.001,02201c00,0,8,23355052.211,-122731627.217417,0,0,0.000,3500,0,0.001,000
01c00,0,8,23355058.822,-95635036.671759,0,0,0.000,4100,0,0.001,02201c00,0,8,23355058.125,-916
50242.898597,0,0,0.000,4500,0,0.001,01c01c00,0,14,21044513.242,-110589663.518782,0,0,0.000,43
00,0,0.001,00001c00,0,14,21044514.689,-86173762.987424,0,0,0.000,4700,0,0.001,02201c00,0,14,21
044519.746,-82583190.254938,0,0,0.000,5200,0,0.001,01c01c00,0,14,21044513.135,-110589662.770
497,0,0,0.000,4400,0,0.001,00601c00,0,17,22264289.041,-116999629.117075,0,0,0.000,4100,0,0.00
1,00001c00,0,17,22264290.650,-91168542.230887,0,0,0.000,4200,0,0.001,02201c00,0,19,25085746.6
02,-131826487.397418,0,0,0.000,3600,0,0.001,00001c00,0,19,25085754.035,-102721938.51300
4,0,0,0.000,3100,0,0.001,01201c00,0,21,21374822.792,-112325452.257686,0,0,0.000,4500,0,0.001,00
001c00,0,21,21374822.721,-87526326.180750,0,0,0.000,4200,0,0.001,01201c00,0,30,21595580.72
3,-113485542.603204,0,0,0.000,4400,0,0.001,00001c00,0,30,21595585.190,-88430293.12048
9,0,0,0.000,4500,0,0.001,02201c00,0,30,21595584.940,-84745697.365627,0,0,0.000,4900,0,0.001,01c
01c00*e25781b8
```

Table 7-124 OBSVBASE Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	OBSVBASE header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4). Note: The time in Header refers to the observation time of the base station.		H	0
2	obs Number	Number of observation messages	Ulong	4	H
3	System Freq	GLONASS frequency number (GLONASS frequency + 7). It is not applicable for GPS, BDS and Galileo, which outputs 0.	UShort	2	H+4
4	PRN/ slot	Satellite PRN number,	UShort	2	H+6

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		see Table Satellite PRN Number in Unicore-defined Messages.			
5	psr	Pseudorange measurement, meters	Double	8	H+8
6	adr	Carrier phase (accumulated Doppler range), cycles	Double	8	H+16
7	psr std	Pseudorange measurement standard deviation * 100	UShort	2	H+24
8	adr std	Carrier phase standard deviation * 10000	UShort	2	H+26
9	dopp	Instantaneous carrier Doppler frequency (Hz)	Float	4	H+28
10	C/N0	Carrier to noise ratio C/N0 = 10[log10(S/N0)] (dB-Hz). Carrier to noise ratio * 100	UShort	2	H+32
11	reserved	Reserved	UShort	2	H+34
12	locktime	Continuous tracking time (no cycle slip), seconds	Float	4	H+36
13	ch-tr-status	Tracking status, refer to Table Channel Tracking Status		4	H+40
14		Next OBS offset = H+4+ (#obs x 40) An epoch contains the observations of all frequencies and all satellites. Each frequency observation			

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		accounts for 40 bytes and loops from the 3rd to the 13th field.			
Variable	xxxx	32-bit CRC	Hex	4	H+4+(#obs x 40)
Variable	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.63 OBSVH: Observation of the Slave Antenna

OBSVH contains the channel measurements for the satellites tracked by the slave antenna.

Message ID : 13

ASCII Syntax

```
OBSVHA COM1 1
```

Binary Syntax

```
OBSVHB COM1 1
```

Applicable Products: UM982, UMD982

Output

```
#OBSVHA,97,GPS,FINE,2190,359897000,0,0,18,14;0*9d38304c
```

Table 7-125 OBSVH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	OBSVHheader	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	obs Number	Number of observation	Ulong	4	H

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		messages			
3	System Freq	GLONASS frequency number (GLONASS frequency + 7). It is not applicable for GPS, BDS and Galileo, which outputs 0.	UShort	2	H+4
4	PRN/ slot	Satellite PRN number, see Table Satellite PRN Number in Unicore-defined Messages	UShort	2	H+6
5	psr	Pseudorange measurement, meters	Double	8	H+8
6	adr	Carrier phase (accumulated Doppler range), cycles	Double	8	H+16
7	psr std	Pseudorange measurement standard deviation * 100	UShort	2	H+24
8	adr std	Carrier phase standard deviation * 10000	UShort	2	H+26
9	dopp	Instantaneous carrier Doppler frequency (Hz)	Float	4	H+28
10	C/N0	Carrier to noise ratio C/N0 = 10[log10(S/N0)] (dB-Hz). Carrier to noise ratio * 100	UShort	2	H+32
11	Reserved	Reserved	UShort	2	H+34
12	locktime	Continuous tracking time (no cycle slip), seconds	Float	4	H+36
13	ch-tr-status	Tracking status, refer to Table Channel Tracking Status		4	H+40
14		Next OBS offset = H+4+ (#obs x 40) An epoch			

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		contains the observations of all frequencies and all satellites. Each frequency observation accounts for 40 bytes and loops from the 3rd to the 13th field.			
variable	xxxx	32-bit CRC	Hex	4	H+4+ (#obs x 40)
variable	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.64 OBSVM: Observation of the Master Antenna

OBSVM contains the channel measurements for the satellites currently tracked by the receiver. For dual-antenna receivers, OBSVM outputs the master antenna's raw observation data.

Message ID : 12

ASCII Syntax

```
OBSVMA COM1 1
```

Binary Syntax

```
OBSVMB COM1 1
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#OBSVMA,94,GPS,FINE,2190,117395000,0,0,18,17;18,0,26,21720097.812,-114139892.254585,52,18
1,-2263.222,4270,0,6262.010,00181c23,0,4,21162081.928,-111207490.841520,349,1600,-225.810,20
10,0,0.000,0018104b,0,31,23853967.973,-125353430.240712,16,89,-2865.568,4666,0,6267.010,0018
1c63,0,27,20924379.679,-109958370.210834,547,1390,2341.516,2953,0,4.010,00181c83,0,16,203221
```

```
04.147,-106793385.550616,59,216,-518.194,3848,0,970.010,00181ca3,0,18,24441329.785,-1284400
30.962618,15,106,850.996,4281,0,3268.010,00181cc3,0,34,39461753.070,-207372954.189817,294,67
9,60.342,3964,0,6267.010,00181da3,0,35,37928367.004,-199314917.709832,436,1004,77.257,349
1,0,5037.010,00181dc3,7,52,23348014.480,-124764670.630508,74,237,-2702.620,4022,0,254.010,00
191c23,11,54,22454359.660,-120157814.237355,165,1600,-2435.304,2260,0,0.000,0019104b,10,56,2
2207432.072,-118794787.240679,108,1600,3984.848,2660,0,0.000,001910ab,4,55,20768970.641,-11
0866113.369865,12,87,1123.037,4537,0,1748.010,00191ce3,0,18,20791545.038,-109260348.04001
7,22,113,717.752,4422,0,6267.010,005b1c23,0,24,25006179.764,-131408344.422726,34,160,-1447.6
80,3982,0,6268.010,005b1c43,0,31,28623544.586,-150417707.949574,15,121,-2204.498,3966,0,34
6.010,005b1c63,0,33,28224656.356,-148321530.956877,529,1240,-1071.997,3280,0,91.010,005b1ca
3,0,12,25003241.058,-131392963.047669,71,246,1277.601,3765,0,4137.010,005b1cc3,0,11,2586700
3.553,-135931981.151064,86,301,2863.429,3516,0,89.010,005b1d03*db2fc208
```

Table 7-126 OBSVM Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	OBSVM header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	obs Number	Number of observation messages	Ulong	4	H
3	System Freq	GLONASS frequency number (GLONASS frequency + 7). It is not applicable for GPS, BDS and Galileo, which outputs 0.	UShort	2	H+4
4	PRN/ slot	Satellite PRN number, see Table Satellite PRN Number in Unicore-Defined Messages	UShort	2	H+6
5	psr	Pseudorange measurement, meters	Double	8	H+8
6	adr	Carrier phase (accumulated Doppler range), cycles	Double	8	H+16
7	psr std	Pseudorange measurement standard deviation * 100	UShort	2	H+24
8	adr std	Carrier phase standard deviation * 10000	UShort	2	H+26
9	dopp	Instantaneous carrier Doppler frequency (Hz)	Float	4	H+28

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
10	C/N0	Carrier to noise ratio C/N0 = 10[log10(S/N0)] (dB-Hz). Carrier to noise ratio * 100	UShort	2	H+32
11	Reserved	Reserved	UShort	2	H+34
12	locktime	Continuous tracking time (no cycle slip), seconds	Float	4	H+36
13	ch-tr-status	Tracking status, refer to Table Channel Tracking Status		4	H+40
14...		Next OBS offset = H+4+ (#obs x 40) An epoch contains the observations of all frequencies and all satellites. Each frequency observation accounts for 40 bytes and loops from the 3rd to the 13th field.			
variable	xxxx	32-bit CRC	Hex	4	H+4+ (#obs x 40)
variable	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.65 OBSVHCMP : Compressed Observation of the Slave Antenna

OBSVHCMP contains the compressed OBSVH data.

Message ID : 139

ASCII Syntax

```
OBSVHCMPA COM1 1
```

Binary Syntax

```
OBSVHCMPB COM1 1
```

Applicable Products: UM982, UMD982

> **Note:** Applicable to UM982 Build9669 and later versions.

Output


```
#OBSVHCMPA,97,GPS,FINE,2244,271111000,0,0,18,14;8,231c3805d95bf4cfc78e9b0be8f5fe8ed90a2
01640020000,431c3805b86906904ad9340b8f6b91c395034016a0020000,631c3805b86ffbbfee0eff0
93daf22e22020c01660030000,831c3805c09e00d06d09b2097e358f89541f601660030000,a31c3805
c06c06205c085e0be7d77caee71d401660020000,c31c380514420910c84f5e0a333561b1311a60162
0030000,e31c38057430f78f6af6820ae5ab9e9e53192016c0020000,231d380560daf4ff561bd40b33ec
0cf27a0c2016c0010000*24135d12
```


Table 7-127 OBSVHCMP Message Structure (Slave Antenna)

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	OBSVHCMP header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4). The time in the Header refers to the observation time of the base station.		H	0
2	obs Number	Number of observation messages	Ulong	4	H
3	Cmp record	Compressed format of OBSVH, see Table OBSVHCMP Compressed Format	Hex	24	H+4
4		Next Cmp offset = H+4+ (#obs x 24)			
variable	xxxx	32-bit CRC	Hex	4	H+4+(#obs x 24)
variable	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 7-128 OBSVHCMP Compressed Format

Data	Bit (from low to high)	Length (Bits)	Scale Factor	Unit
Channel Tracking Status	0-31	32	Refer to Table Channel Tracking Status	-
Doppler	32-59	28	1/256	Hz
PSR (Pseudorange)	60-95	36	1/128	m
ADR (Carrier phase/ accumulated Doppler range)	96-127	32	1/256	Cycles
Psr Std	128-131	4	See Table Psrstd Index	m
Adr Std	132-135	4	(n+1)/512	Cycles
PRN	136-143	8	1	-
Lock time	144-164	21	1/32	S
C/N0	165-169	5	20+n	dB-Hz
GLONASS frequency number	170-175	N+7	1	-
Reserved	176-191	16		

7.5.66 OBSVMCMP : Compressed Observation of the Master Antenna

OBSVMCMP contains the compressed OBSVM data.

Message ID : 138

ASCII Syntax

```
OBSVMCMPA COM1 1
```

Binary Syntax

```
OBSVMCMPB COM1 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM960, UMD960, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

> **Note:** Applicable to UM982 Build9669 and later versions

Output


```
#OBSVMCMPA,97,GPS,FINE,2244,271100000,0,0,18,14;15,231c38056534f76f3f39820a747fff9e7519c
015e0020000,231cd0012392f75f2639820a8f905fd82019c01560030000,431c380562a20030e916b2
0965478889431fc01560030000,631c3805c35cf43fad949a0b0e037f8f850ac01560020000,631cd001
bad8f42f9e949a0bbfcbd9ce420ac015e0020000,831c380598dcf4cf102cd30b9e9687f2190cc015e00
10000,a31c300109070260ace7bb093919828463162015c0020000,e31c3805f873fb6f0dadfe0926ca5
4e23220c01580030000,e31cd0018aa4fbcfe2acfe09f5ace6982020c015c0030000,071d300129740cd
017ca160c7457ebcf7a10200040010000,231d3805014609f0e7165f0aba44fbb0651ac01520030000,2
31dd001fce208b0c0165f0a5d8c9be9201ac015a0030000,431d3805df6f06d090925e0bac1a36ae621
dc01560020000,631d3805026f06305463350bb9bd4ac3e703c015a0020000,631dd001562a06d03a6
3350bd5057d803003c01540030000*d04eae82
```


Table 7-129 OBSVCMP Message Structure (Master Antenna)

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	OBSVCMP header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4). The time in the Header refers to the observation time of the base station.		H	0
2	obs Number	Number of observation messages	Ulong	4	H
3	Cmp record	Compressed format of OBSVH, see Table OBSVCMP Compressed Format	Hex	24	H+4
4		Next Cmp offset =			

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		H+4+ (#obs x 24)			
variable	xxxx	32-bit CRC	Hex	4	H+4+(#obs x 24)
variable	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 7-130 OBSVMCMP Compressed Format (Master Antenna)

Data	Bit (from low to high)	Length (Bits)	Scale Factor	Unit
Channel Tracking Status	0-31	32	Refer to Table Channel Tracking Status.	-
Doppler	32-59	28	1/256	Hz
PSR (Pseudorange)	60-95	36	1/128	m
ADR (Carrier phase/ accumulated Doppler range)	96-127	32	1/256	Cycles
Psr Std	128-131	4	See Table Psrstd Index.	m
Adr Std	132-135	4	(n+1)/512	Cycles
PRN	136-143	8	1	-
Lock time	144-164	21	1/32	s
C/N0	165-169	5	20+n	dB-Hz
GLONASS frequency number	170-175	N+7	1	-
Reserved	176-191	16		

7.5.67 PPPB2BINFO1: Information Type 1

This command is used to output PPP-B2b information type 1 - satellite mask information. For more details, please refer to PPP-B2b ICD. PPP is supported by specific versions only. This log **only** supports `ONCHANGED` trigger.

Message ID : 2302

ASCII Syntax

```
PPPB2BINFO1A ONCHANGED
```

Binary Syntax

```
PPPB2BINFO1B ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#PPPB2BINFO1A,80,GPS,FINE,2203,366209000,0,0,18,1;219,1,2,20590,00003FFDFFFC0001FFFFFFFE
0000000000000000000000000000000000000000*f7e11cb5
```

Table 7-131 PPPB2BINFO1 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO1 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4).		H	0
2	Prn	PRN (161 based)	Short	2	H
3	Iodssr	Issue of Data, State Space Representation	Uchar	1	H+2
4	Iodp	Issue of Data, PRN mask	Uchar	1	H+3
5	Sow	Epoch time, second of day	UINT	4	H+4
6	Mask	PRN bit mask	Uchar[32]	32	H+8
7	Xxxx	32-bit CRC	HEX	4	H+40
8	[CR][LF]	Sentence terminator (ASCII only)			

7.5.68 PPPB2BINFO2: Information Type 2

This command is used to output PPP-B2b information type 2, including satellite orbit corrections and User Range Accuracy Index. For more details, please refer to PPP-B2b ICD. PPP is supported by specific versions only. This log **only** supports `ONCHANGED` trigger.

Message ID : 2304

ASCII Syntax

```
PPPB2BINFO2A ONCHANGED
```

Binary Syntax

```
PPPB2BINFO2B ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#PPPB2BINFO2A,86,GPS,FINE,2203,366269000,0,0,18,1;219,1,0,20631,72,86,-84,25,-24,0,27,84,50,3
9,71,18,4,27,90,57,-3,129,-1,0,27,93,86,-182,90,163,4,27,0,0,0,0,0,0,00,0,0,0,0,0,0,00*16d92a8c
```

Table 7-132 PPPB2BINFO2 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO2 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4).		H	0
2	Prn	PRN (161 based)	Ushort	2	H
3	Iodssr	Issue of Data-SSR	Uchar	1	H+2
4	Reserved	Reserved	Uchar	1	H+3
5	SOW	Epoch time, second of day	UINT	4	H+4
6	OrbitCorr	Orbit corrections. See Table PPPB2BINFO2 Orbit Correction Data	OrbitCorr[6]	72	H+8

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Structure.			
7	XXXX	32-bit CRC	HEX	4	H+80
8	[CR][LF]	Sentence terminator (ASCII only)			

Table 7-133 PPPB2BINFO2 Orbit Correction Data Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	Prn	Satellite PRN Number. See Table Satellite PRN Number (with Offset) in Unicore-defined Messages.	USHORT	2	0
2	Iodn	IODE (Ephemeris Issue of Data) for navigation message, used to match the original ephemeris.	USHORT	2	2
3	Radial	Radial correction, Unit: 0.0016 m	SHORT	2	4
4	Along-Track	Along-Track correction, Unit: 0.0064 m	SHORT	2	6
5	Cross-Track	Cross-Track correction, Unit: 0.0064 m	SHORT	2	8
6	IODCorr	SSR correction IOD	UCHAR	1	10
7	URAI	User Range Accuracy Index	UCHAR	1	11

7.5.69 PPPB2BINFO3: Information Type 3

This command is used to output PPP-B2b information type 3, including differential code bias corrections. For more details, please refer to PPP-B2b ICD. PPP is supported by specific versions only. This log only supports `ONCHANGED` trigger.

Message ID : 2306

ASCII Syntax

```
PPPB2BINFO3A ONCHANGED
```

Binary Syntax

```
PPPB2BINFO3B ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#PPPB2BINFO3A,78,GPS,FINE,2203,366263000,0,0,18,1;219,1,3,20631,40,8,0,15,1,43,2,50,4,-305,5,-25
9,7,-227,8,-199,12,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,44,8,0,-35,1,-43,2,-37,4,-255,5,-210,7,-212,8,-182,1
2,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,45,8,0,-490,1,-355,2,-350,4,-327,5,-284,7,-270,8,-243,1
2,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0*943febbe
```

Table 7-134 PPPB2BINFO3 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO3 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4).		H	0
2	Prn	PRN (161 based)	Ushort	2	H
3	Iodssr	Issue of Data-SSR	Uchar	1	H+2
4	SatNum	Satellite number	Uchar	1	H+3
5	Sow	Epoch time, second of day	UINT	4	H+4
6	CodeBias	Differential code bias. See Table PPPB2BINFO3 Code Bias Data Structure.	CodeBias [SatNum]	64*SatNum	H+8
7	xxxx	32-bit CRC	HEX	4	H+8+ 64*SatNum
8	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 7-135 PPPB2BINFO3 Code Bias Data Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	SatSlot	Satellite mask slot	USHORT	2	0
2	BiasNum	Number of valid code biases for the satellite	USHORT	2	2
3~17	CodeBias	Code bias arry. See Table PPPB2BINFO3 Code Bias Correction Data Structure.	CodeBias[15]	60	4

Table 7-136 PPPB2BINFO3 Code Bias Correction Data Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	Mode	Signal channel and processing mode for code bias correction	USHORT	2	0
2	CodeCorr	Code bias correction	SHORT	2	2

7.5.70 PPPB2BINFO4: Information Type 4

This command is used to output PPP-B2b information type 4, including satellite clock bias corrections. For more details, please refer to PPP-B2b ICD. PPP is supported by specific versions only. This log only supports `ONCHANGED` trigger.

Message ID : 2308

ASCII Syntax

```
PPPB2BINFO4A ONCHANGED
```

Binary Syntax

```
PPPB2BINFO4B ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#PPPB2BINFO4A,85,GPS,FINE,2203,366294000,0,0,18,1;219,1,2,20674,0,0,0,0,0,-16383,0,-16383,0,-16383,0,-16383,0,-16383,7,71,0,-16383,5,119,0,-16383,0,-16383,3,79,0,-16383,0,-16383,0,-16383,0,-16383,1,-52,0,-16383,0,-16383,3,773,4,1225,3,775,0,-16383,0,-16383*3a7fd61c
```

Table 7-137 PPPB2BINFO4 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO4 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4).		H	0
2	Prn	PRN (161 based)	Ushort	2	H
3	Iodssr	Issue of Data-SSR	Uchar	1	H+2
4	Iodp	Issue of Data, PRN mask	Uchar	1	H+3
5	Sow	Epoch time, second of day	UINT	4	H+4
6	SubType	Subtype identifier	Uchar	1	H+8
7	Reserved	Reserved	Uchar[3]	3	H+9
8	ClkCorr	Clock bias corrections. See Table PPPB2BINFO4 Clock Bias Correction Data Structure.	ClkCorr[23]	92	H+12
9	xxxx	32-bit CRC	HEX	4	H+104
10	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 7-138 PPPB2BINFO4 Clock Bias Correction Data Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	IOD SSR	IOD SSR (Issue of Data-SSR) for this clock bias correction	USHORT	2	0
2	C0	First-order clock bias correction (constant term). Unit: 0.0016 m	SHORT	2	2

7.5.71 PPPB2BINFO5: Information Type 5

This command is used to output PPP-B2b information type 5, including User Range Accuracy Index. For more details, please refer to PPP-B2b ICD. PPP is supported by specific versions only. This log only supports `ONCHANGED` trigger.

Message ID : 2310

ASCII Syntax

```
PPPB2BINFO5A ONCHANGED
```

Binary Syntax

```
PPPB2BINFO5B ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#PPPB2BINFO5A,85,GPS,FINE,2203,366294000,0,0,18,1;219,1,2,20674,0,0,0,0,0,-16383,0,-16383,0,-16383,0,-16383,0,-16383,7,71,0,-16383,5,119,0,-16383,0,-16383,3,79,0,-16383,0,-16383,0,-16383,0,-16383,1,-52,0,-16383,0,-16383,3,773,4,1225,3,775,0,-16383,0,-16383,0,-16383,0,-16383,0,-16383,0,-16383,0,-16383,7,71,0,-16383,5,119,0,-16383,0,-16383,3,79,0,-16383,0,-16383,0,-16383,0,-16383,1,-52,0,-16383,0,-16383,3,773,4,1225,3,775,0,-16383,0,-16383,0,-16383,0,-16383,0,-16383,0,-16383,0,-16383,7,71,0,-16383,5,119,0,-16383,0,-16383,3,79,0,-16383,0,-16383,0,-16383,0,-16383,1,-52,0,-16383,0,-16383,3,773,4,1225,3,775,0,-16383,0,-16383,0,-16383*3a7fd61c
```

Table 7-139 PPPB2BINFO5 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO5 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4).		H	0
2	Prn	PRN (161 based)	Ushort	2	H
3	Iodssr	Issue of Data-SSR	Uchar	1	H+2
4	IODP	Issue of Data, PRN mask	Uchar	1	H+3

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
5	Subtype	Subtype identifier	Uchar	1	H+4
6	Reserved	Reserved	Uchar	1	H+5
7	Reserved	Reserved	Uchar	1	H+6
8	Reserved	Reserved	Uchar	1	H+7
9	SOW	Epoch time, second of day	UINT	4	H+8
10	URAI	User range accuracy index. See Table PPPB2BINFO5 User Range Accuracy Index.	URAI[70]	140	H+12
11	XXXX	32-bit CRC	HEX	4	H+152
12	[CR][LF]	Sentence terminator (ASCII only)			

Table 7-140 PPPB2BINFO5 User Range Accuracy Index

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	URA_CLASS	UCHAR	URA class identifier	1	0
2	URA_VALUE	UCHAR	URA value identifier, mapping to user range accuracy	1	1

7.5.72 PPPDOP : DOP of PPPNAV

This log contains DOP (Dilution of Precision) for all satellites used in the PPPNAV solution. PPP is supported by specific versions only.

Message ID : 1025

ASCII Syntax

```
PPPDOPA 1
```

Binary Syntax

```
PPPDOPB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#PPPDOPA,60,GPS,FINE,2298,280475000,0,0,18,18;280475000,0.7632,0.6743,0.3574,0.5637,0.370
0,0.0000,0.0000,5.0,0.0,51,4,7,8,9,16,18,26,21,34,35,36,39,51,60,61,58,59,49,50,62,161,163,219,220,16
2,164,165,166,167,169,170,176,182,189,190,196,199,200,205,206,187,181,76,77,79,84,82,98,99,86,8
5*bb86e61e
```

Table 7-141 PPPDOP Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	PPPDOP Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Ulong	4	H
3	gdop	Geometric DOP	Float	4	H+4
4	Pdop	Position DOP	Float	4	H+8
5	Tdop	Time DOP	Float	4	H+12
6	Vdop	Vertical DOP	Float	4	H+16
7	Hdop	Horizontal DOP	Float	4	H+20
8	Ndop	North DOP	Float	4	H+24
9	Edop	East DOP	Float	4	H+28
10	Cutoff	Elevation cutoff angle	Float	4	H+32
11	Reserved	Reserved	Float	4	H+36
12	#PRN	Number of tracked satellites	UShort	2	H+40
13	PRN	PRN of tracked satellites, see Table Satellite PRN Number (with Offset) in Unicore-defined Messages, null field until the position solution is available.	UShort	2	H+42

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
14	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+42+2*#PRN
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.73 PPPDOP2: DOP of PPPNAV

This log contains DOP (Dilution of Precision) for all satellites used in the PPPNAV solution. PPP is supported by specific versions only.

Message ID : 5995

ASCII Syntax

```
PPPDOP2A
```

Binary Syntax

```
PPPDOP2B
```

Applicable Products: UM982

Output

```
#PPPDOP2A,62,GPS,FINE,2356,387470000,18403,0,18,15;387469000,0.9314,0.8102,0.4596,0.672
7,0.4515,0.3284,0.3098,5.0,0.0,41,20,19,12,11,9,6,5,29,13,25,39,34,36,161,220,219,163,164,165,198,17
0,168,167,204,200,195,189,173,179,182,180,110,99,93,90,86,85,84,80,78,76*64d33c8b
```

Table 7-142 PPPDOP2 Data Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	PPPDOP Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Ulong	4	H
3	gdop	Geometric DOP	Float	4	H+4

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
4	Pdop	Position DOP	Float	4	H+8
5	Tdop	Time DOP	Float	4	H+12
6	Vdop	Vertical DOP	Float	4	H+16
7	Hdop	Horizontal DOP	Float	4	H+20
8	Ndop	North DOP	Float	4	H+24
9	Edop	East DOP	Float	4	H+28
10	Cutoff	Elevation cutoff angle	Float	4	H+32
11	Reserved	Reserved	Float	4	H+36
12	#PRN	Number of tracked satellites	UShort	2	H+40
13	PRN	PRN of tracked satellites, see Table Satellite PRN Number (with Offset) in Unicore-defined Messages, null field until the position solution is available.	UShort	2	H+42
14	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+42+2*#PRN
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.74 RPPPDOP: DOP of RPPPNAV

This message provides the DOP (Dilution of Precision) values computed from all satellites used in the RPPPNAV solution. Supported only in specific PPP-capable firmware versions.

Message ID : 1028

ASCII Syntax

```
RPPPDOPA 1
```

Binary Syntax

```
RPPPDOPB 1
```

Applicable Products: UM980C, UM981C, UM982C

Output

```
#RPPPDOPA,81,GPS,FINE,2374,396466200,20180,0,18,17;396466200,0.7968,0.7033,0.3744,0.591
7,0.3803,0.2699,0.2678,5.0,0.0,49,16,25,26,28,29,31,32,3,34,36,39,35,56,64,55,57,66,65,45,46,47,161,16
3,164,219,220,162,166,167,169,184,186,193,195,198,199,202,204,168,173,176,200,172,76,81,82,101,1
03,104*ba98cf0d
```

Table 7-143 RPPPDOP Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	RPPPDOP Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Ulong	4	H
3	gdop	Geometric DOP	Float	4	H+4
4	Pdop	Position DOP	Float	4	H+8
5	Tdop	Time DOP	Float	4	H+12
6	Vdop	Vertical DOP	Float	4	H+16
7	Hdop	Horizontal DOP	Float	4	H+20
8	Ndop	North DOP	Float	4	H+24
9	Edop	East DOP	Float	4	H+28
10	Cutoff	Elevation cutoff angle	Float	4	H+32
11	Reserved	Reserved	Float	4	H+36
12	#PRN	Number of tracked satellites	UShort	2	H+40
13	PRN	PRN of tracked satellites, see Table Satellite PRN Number (with Offset) in Unicore-defined Messages, null field until	UShort	2	H+42

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		the position solution is available.			
14	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+42+2*#PRN
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.75 PPPNAV: Position and Velocity of PPP

This log contains the position, accuracy, and status of the precise point positioning (PPP). PPP is only supported by specific version.

Message ID : 1026

ASCII Syntax

```
PPPNAVA 1
```

Binary Syntax

```
PPPNAVB 1
```

Applicable Products: UM980, UM980C, UMD980, UB9A0, UBD9A0, UM982, UM982C, UMD982, UM981, UM981C, UMD981, UM981S, UMD981S

Output

```
#PPPNAVA,64,GPS,FINE,2207,464961000,0,0,18,13;SOL_COMPUTED,PPP_CONVERGING,40.07899442
145,116.23661087189,65.8944,-8.4923,WGS84,1.8755,1.4254,2.4821,"0",1.000,0.000,53,48,48,46,0,0
0,03,ff*2d9412be
```

Table 7-144 PPPNAV Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	PPPNAV header	Log header. See Table Binary Header Structure (N4) and Table ASCII		H	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Header Structure (N4)			
2	sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID, output WGS84 currently. ASCII = WGS84, binary = 61. The actual output coordinate system can be set by CONFIG PPP DATUM. Currently, PPP supports WGS84 and the original coordinate system of B2b-PPP.	Enum	4	H+36
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID (99 & satellite ID): If the positioning type is B2b PPP, the base station ID is one of 9959, 9960 or 9961. If the positioning type is	Char[4]	4	H+52

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		E6 HAS, the station ID is 9901. If the positioning type is QZSS L6 MDC PPP, the station ID is one of 9934, 9935, 9936 or 9939.			
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17-19	Reserved	Reserved	Uchar	3	H+66
20	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS-3 Signal Mask	Hex	1	H+70
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask, refer to Table GPS/GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+72
24	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.76 PPPNAVH: Position and Velocity of PPP

This log contains the position, accuracy, and status of the PPP (Precise Point Positioning). PPP is only supported by specific version.

Message ID : 5996

ASCII Syntax

```
PPPNAVHA 1
```

Binary Syntax

```
PPPNAVHB 1
```

Applicable Products: UM982, UM982C

> **Note:** Applicable to UM982 Build 17698 and later versions.

Output

```
#PPPNAVHA,83,GPS,FINE,2347,111142000,17643,0,18,25;SOL_COMPUTED,PPP,40.07898891173,11
6.23660132069,66.4436,-8.4923,WGS84,0.0432,0.0561,0.0817,"9934",1.000,0.000,46,44,44,40,1,00,0
3,4b*10c0b5fc
```

Table 7-145 PPPNAVH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	PPPNAVH header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID, output WGS84	Enum	4	H+36

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		currently. ASCII = WGS84, binary = 61. The actual output coordinate system can be set by CONFIG PPP DATUM. Currently, PPP supports WGS84 and the original coordinate system of B2b-PPP.			
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID (99 & satellite ID): If the positioning type is B2b PPP, the base station ID is one of 9959, 9960 or 9961. If the positioning type is E6 HAS, the station ID is 9901. If the positioning type is QZSS L6 MDC PPP, the station ID is one of 9934, 9935, 9936 or 9939.	Char[4]	4	H+52
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17	Reserved	Reserved	Uchar	1	H+66
18	Reserved	Reserved	Uchar	1	H+67
19	Reserved	Reserved	Uchar	1	H+68
20	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo &	Hex	1	H+70

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		BDS-3 Signal Mask			
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask, refer to Table GPS/GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+72
24	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.77 RPPPNAV Position, Accuracy, and Status Information

This message contains the receiver's RPPPNAV position, positioning accuracy, and status information. Supported only in specific firmware versions.

Message ID : 1027

ASCII Syntax

```
RPPPNAVA 1
```

Binary Syntax

```
RPPPNAVB 1
```

Applicable Products: UM980C, UM981C, UM982C

Output

```
#RPPPNAVA,81,GPS,FINE,2374,396466200,20180,0,18,17;SOL_COMPUTED,PPPRTK,35.7484212039
0,139.66688275341,37.3411,39.4547,WGS84,0.0238,0.0180,0.0337,"9974",6.200,0.000,51,49,49,47,0,0
0,cf,ff*6063e88b
```

Table 7-146 RPPPNAV Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	RPPPNAV header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID, only WGS84 (binary = 61) is supported for now. The actual coordinate system reference can be configured using the command CONFIG PPP DATUM Currently, PPP supports output in either WGS84 or the original coordinate system of the B2b-PPP service.	Enum	4	H+36
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID follows the format 99* concatenated with the satellite number. When the positioning type is QZSS L6CLAS, the Station ID is one of: 9974, 9975, 9976, or 9979.	Char[4]	4	H+52

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17	Reserved	Reserved	Uchar	1	H+66
18	Reserved	Reserved	Uchar	1	H+67
19	Reserved	Reserved	Uchar	1	H+68
20	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS3 Signal Mask	Hex	1	H+70
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask. See Table GPS/ GLONASS/BDS2 Signal Mask	Hex	1	H+71
23	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	H+72
24	[CR] [LF]	Sentence terminator (ASCII only)	-	-	-

7.5.78 PVTSLN: Position and Heading Information

This log contains the best position, best velocity, and heading information. It integrates multiple messages into one package, which facilitates the terminal device to process data.

Message ID : 1021

ASCII Syntax

```
PVTSLNA 1
```

Binary Syntax

```
PVTSLNB 1
```

Applicable Products:

Output

```
#PVTSLNA,97,GPS,FINE,2190,364536000,0,0,18,13;SINGLE,60.5060,40.07898130522,116.23663134427,4.3353,1.8063,1.8796,0.000,SINGLE,60.5060,40.07898130522,116.23663134427,-8.4923,46,28,46,28,0.0009,-0.0031,-0.0032,NONE,0.0000,0.0000,0.0000,0,0,0,0,2.1753,1.3480,0.6840,1.8392,1.7072,5.0,28,25,26,29,31,32,34,39,77,79,83,98,99,161,162,163,166,167,169,176,179,182,196,199,200,205,206,219,220*1e33c8cb
```

Table 7-147 PVTSLN Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	PVTSLN header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)	H	H	0
2	bestpos_type	Position type, refer to Table Position or Velocity Type	Enum	4	H
3	bestpos_hgt	Height above mean sea level, meters	FLOAT	4	H+4
4	bestpos_lat	Latitude, degrees (Output 11 digits after the decimal point)	DOUBLE	8	H+8
5	bestpos_lon	Longitude, degrees (Output 11 digits after the decimal point)	DOUBLE	8	H+16
6	bestpos_hgtstd	Height standard deviation	FLOAT	4	H+24
7	bestpos_latstd	Latitude standard deviation	FLOAT	4	H+28
8	bestpos_lonstd	Longitude standard deviation	FLOAT	4	H+32

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
9	bestpos_diffage	Differential age of BESTNAV when the position is fixed	FLOAT	4	H+36
10	psrpos_type	Position type, refer to Table Position or Velocity Type	Enum	4	H+40
11	psrpos_hgt	Height above mean sea level	FLOAT	4	H+44
12	psrpos_lat	Latitude	DOUBLE	8	H+48
13	psrpos_lon	Longitude	DOUBLE	8	H+56
14	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	FLOAT	4	H+64
15	bestpos_svs	Number of tracked satellites	UCHAR	1	H+68
16	bestpos_solnsvs	Number of satellites used in solution	UCHAR	1	H+69
17	psrpos_svs	Number of tracked satellites	UCHAR	1	H+70
18	psrpos_solnsvs	Number of satellites used in solution	UCHAR	1	H+71
19	psrvel_north	North velocity, m/s	DOUBLE	8	H+72
20	psrvel_east	East velocity, m/s	DOUBLE	8	H+80
21	psrvel_ground	Horizontal speed over ground, m/s	DOUBLE	8	H+88
22	heading_type	Heading type, refer to Table Solution Status	Enum	4	H+96
23	heading_length	Baseline length (0 to 3000 meters)	FLOAT	4	H+100
24	heading_degree	Heading (0 to 360.0 degrees)	FLOAT	4	H+104
25	heading_pitch	Pitch (± 90 degrees)	FLOAT	4	H+108

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
26	heading_trackedsvs	Number of satellites tracked by the master antenna	UCHAR	1	H+112
27	heading_solnsvs	Number of satellites used in heading solution	UCHAR	1	H+113
28	heading_ggl1	Number of satellites with L1 frequency used in heading solution	UCHAR	1	H+114
29	heading_ggl1l2	Number of satellites with L1 L2 frequencies used in heading solution	UCHAR	1	H+115
30	gdop	Geometric dilution of precision	FLOAT	4	H+116
31	pdop	Position dilution of precision	FLOAT	4	H+120
32	hdop	Horizontal dilution of precision	FLOAT	4	H+124
33	htdop	Horizontal and time dilution of precision	FLOAT	4	H+128
34	tdop	Time dilution of precision	FLOAT	4	H+132
35	cutoff	Elevation cutoff angle	FLOAT	4	H+136
36	PRN No	PRN number of tracked satellites	USHORT	2	H+140
37	PRN_list[41]	PRN of tracked satellites, null field until the position solution is available	USHORT	41*2	H+142
38	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+224
39	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.79 QZSSEPH: QZSS Ephemeris

This log contains QZSS ephemeris information. It supports `ONCHANGED` trigger. If you use ONTIME trigger (i.e. the output frequency is fixed), the recommended time interval is more than 60 seconds because of the large amount of ephemeris data; it is not recommended to output this log at 1 Hz. When it is output together with 50 Hz observation data, it is recommended to use the `ONCHANGED` trigger.

Message ID : 110

ASCII Syntax

```
QZSSEPHA COM1 60
```

```
QZSSEPHA COM1 ONCHANGED
```

Binary Syntax

```
QZSSEPHB COM1 60
```

```
QZSSEPHB COM1 ONCHANGED
```

Applicable Products: UM960, UM960L, UM980, UB9A0, UM982, UM981, UM980C

Output

```
#QZSSEPHA,78,GPS,FINE,2262,368756700,0,0,18,16;4,368730.0,0,185,185,2262,2262,370800.0,4.216
498367e+07,2.569749898e-09,1.905190738e+00,7.5245622196e-02,-1.5526664328e+00,1.5147030
35e-05,3.799796104e-06,-3.61250000e+01,4.70875000e+02,3.501772881e-07,2.438202500e-06,6.1
294064513e-01,4.364467512e-10,-2.354107999e+00,-1.81507561e-09,953,370800.0,-3.725290298
e-09,9.4612129e-05,2.2737368e-13,0.0000000e+00,FALSE,7.292162191e-05,7.84000000e+00*7c79
248b
```

Table 7-148 QZSSEPH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	QZSSEPH header	Log header. See Table Binary Header Structure (N4) and Table		H	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		ASCII Header Structure (N4)			
2	PRN	Satellite PRN number QZSS: 1 to 10	Ulong	4	H
3	Tow	Time stamp of subframe 0, seconds	Double	8	H+4
4	health	Health status, a 6-bit health code as defined in ICD-GPS-200a	Ulong	4	H+12
5	IODE1	Issue of data, ephemeris 1	Ulong	4	H+16
6	IODE2	Issue of data, ephemeris 2 = GPS IODE1	Ulong	4	H+20
7	Week	GPS reference week number (GPS Week)	Ulong	4	H+24
8	Z Week	Z count week number. This is the week number from subframe 1 of the ephemeris. The "TOW week" (field#7) is derived from this to account for rollover.	Ulong	4	H+28
9	Toe	Reference time of ephemeris, seconds	Double	8	H+32
10	A	Semi-major axis of the satellite orbit, meters	Double	8	H+40
11	ΔN	Mean motion difference, radians/ second	Double	8	H+48
12	M0	Mean anomaly at reference time, radians	Double	8	H+56
13	Ecc	Eccentricity of the satellite orbit	Double	8	H+64
14	ω	Argument of perigee, radians	Double	8	H+72
15	cuc	Argument of latitude (amplitude of cosine, radians)	Double	8	H+80
16	cus	Argument of latitude (amplitude of sine, radians)	Double	8	H+88
17	crc	Orbit radius (amplitude of cosine, meters)	Double	8	H+96

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
18	crs	Orbit radius (amplitude of sine, meters)	Double	8	H+104
19	cic	Inclination (amplitude of cosine, radians)	Double	8	H+112
20	cis	Inclination (amplitude of sine, radians)	Double	8	H+120
21	I0	Inclination angle at reference time, radians	Double	8	H+128
22	IDOT	Rate of change of inclination angle, radians/second	Double	8	H+136
23	Ω0	Right ascension of ascending node, radians	Double	8	H+144
24	Ω dot	Rate of change of the right ascension of ascending node, radians/second	Double	8	H+152
25	iodc	Issue of data, clock	Ulong	4	H+160
26	toc	Reference time for satellite clock corrections, seconds	Double	8	H+164
27	tgd	Group delay, seconds	Double	8	H+172
28	af0	Satellite clock bias parameter, seconds	Double	8	H+180
29	af1	Satellite clock rate parameter, s/s	Double	8	H+188
30	af2	Satellite clock drift parameter, s/s/s	Double	8	H+196
31	AS	Anti-spoofing: 0 = FALSE 1 = TRUE	Enum	4	H+204
32	N	Corrected mean motion, radians/second	Double	8	H+208
33	URA	User range accuracy, m^2. The ICD specifies an algorithm to convert the URA index transmitted in the ephemeris to a nominal standard deviation value. Here outputs the square (variance) of the nominal	Double	8	H+216

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		value.			
34	xxxx	32-bit CRC	Hex	4	H+224
35	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.80 RECTIME: Time Information

This log provides time related information, including receiver clock offset, UTC time offset, etc.

Message ID : 102

ASCII Syntax

```
RECTIMEA 1
```

Binary Syntax

```
RECTIMEB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UM980C

Output

```
#RECTIMEA,97,GPS,FINE,2190,365121000,0,0,18,12;VALID,3.580410506e-04,0.000000000e+00,-18.0
0000000000,2021,12,30,5,25,3000,VALID*7e364e74
```

Table 7-149 RECTIME Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	RECTIME header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	clock status	Clock model status. 0 = VALID; 3 = INVALID. The enum of 0 or 3 is displayed when the binary	Enum	4	H

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		information is output.			
3	offset	Receiver clock offset relative to GPS time, s. Positive indicates that the receiver clock is ahead of GPS time. To calculate the GPS time, use the formula below: GPS time = receiver time - clock offset	Double	8	H+4
4	Offset std	Standard deviation of the receiver clock offset, s	Double	8	H+12
5	utc offset	GPS time offset relative to UTC time, computed using almanac parameters, s. UTC time = GPS time + UTC offset + receiver clock offset	Double	8	H+20
6	utc year	UTC year	Ulong	4	H+28
7	utc month	UTC month (0-12)[12]	Uchar	1	H+32
8	utc day	UTC day (0-31)[12:1]	Uchar	1	H+33
9	utc hour	UTC hour (0-23)	Uchar	1	H+34
10	utc min	UTC minute (0-59)	Uchar	1	H+35
11	utc ms	UTC millisecond (0-60999)[13]	Ulong	4	H+36
12	utc status	UTC status: 0 = INVALID; 1 = VALID; 2 = WARNING[14] The enum of 0, 1, or 2 is displayed when the binary information is output.	Enum	4	H+40
13	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	H+44
14	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.81 REMOTEANTENNAPCOA: Base Station Antenna Phase Center Offset

This message outputs the offset value between the base station antenna phase center and the antenna reference point, corresponding to the `CONFIG REMOTEANTENNAPCO` configuration. This message only supports ASCII format output.

ASCII Syntax

```
REMOTEANTENNAPCOA
```

Applicable Products: UM980, UM981, UMD981, UMD981S, UM980C

Output

```
#REMOTEANTENNAPCOA,95,GPS,FINE,2344,437319000,17361,0,18,724;0.00,0.00,0.00*3083056f
```

Table 7-150 REMOTEANTENNAPCOA Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	header	See Table ASCII Header Structure (N4)		H	0
2	NorthOffset	Northward offset from the antenna reference point to the antenna phase center, unit: mm, accurate to 2 decimal places	DOUBLE	8	H
3	EastOffset	East offset from antenna reference point to antenna phase center, unit: mm, accurate to 2 decimal places	DOUBLE	8	H+8
4	UpOffset	Up offset from antenna reference point to antenna phase center, unit: mm, accurate to 2 decimal places	DOUBLE	8	H+16
5	xxxx	32-bit CRC	Hex	4	H+24
6	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.82 RTCMSTATUS: RTCM Data Status

This command is used to check the RTCM data status. It only supports `ONCHANGED` trigger.

Message ID : 2125

ASCII Syntax

```
RTCMSTATUSA ONCHANGED
```

Binary Syntax

```
RTCMSTATUSB ONCHANGED
```

Applicable Products: UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#RTCMSTATUSA,76,GPS,FINE,2219,392572000,0,0,18,187;1124,21186,0,21,0,6,11,0,0,21*601a7581
```

Table 7-151 RTCMSTATUS Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	RTCMSTATUS Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Msg ID	MSM1~MSM7 ID (including RTCM1006/RTCM1033)	UINT	4	H
3	Msg Num	Number of messages	UINT	4	H+4
4	Base ID	Base station ID	UINT	4	H+8
5	Sats Num	Number of satellites in the current message	UINT	4	H+12
6	L1 num	Number of L1 observables, see Table Satellite Signals Corresponding to L1~L6	UCHAR	1	H+16
7	L2 num	Number of L2 observables, see Table Satellite Signals Corresponding to L1~L6	UCHAR	1	H+17
8	L3 num	Number of L3 observables, see Table Satellite Signals Corresponding to L1~L6	UCHAR	1	H+18
9	L4 num	Number of L4 observables,	UCHAR	1	H+19

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		see Table Satellite Signals Corresponding to L1~L6			
10	L5 num	Number of L5 observables, see Table Satellite Signals Corresponding to L1~L6	UCHAR	1	H+20
11	L6 num	Number of L6 observables, see Table Satellite Signals Corresponding to L1~L6	UCHAR	1	H+21
12	Xxxx	Checksum	Hex	4	H+22
13	[CR][LF]	Sentence terminator			

7.5.83 RTCSTATUS: RTC Initialization Status

This command is used to check the initialization status of the RTC register. The message only supports 1 Hz output.

Message ID : 510

ASCII Syntax

```
RTCSTATUSA 1
```

Binary Syntax

```
RTCSTATUSB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S , UM980C

Output

```
#RTCSTATUSA,97,GPS,FINE,2190,365386000,0,0,18,14;1,0,0,0,2190,365386,1495,0,0*ac0f615a
```

Table 7-152 RTCSTATUS Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	RTCSTATUS Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Type	Display the status of RTC counter 0: invalid 1: valid	Uchar	1	H
3-5	Reserved*3	Reserved	Uchar*3	3	H+1
6	Week	Week number. When the number is invalid, the value is -1.	INT	4	H+4
7	Second	Seconds of week	UINT	4	H+8
8	Subsecond	Sub-second, μs	UINT	4	H+12
9	Reserved	Reserved	UINT	4	H+16
10	Reserved	Reserved	UINT	4	H+20
11	Xxxx	Checksum	Hex	4	H+24
12	[CR][LF]	Sentence terminator			

7.5.84 RTKSTATUS: RTK Solution Status

This log outputs RTK solution information, such as the current solution status, differential data status, etc.

Message ID : 509

ASCII Syntax

```
RTKSTATUSA 1
```

Binary Syntax

```
RTKSTATUSB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#RTKSTATUSA,97,GPS,FINE,2190,365354000,0,0,18,1;0,0,0,0,0,0,0,0,0,0,0,0,NONE,0,0,0,0,0*f06a8a06
```

Table 7-153 RTKSTATUS Message Structure

ID	Field	Description	Format	Binary Bytes	Binary Offset
1	RTKSTATUS Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	gpsSource	Displays GPS satellites 1-32, showing raw data parsing status where a bit is set to 1 when corrections are received for the corresponding satellite, presented in hexadecimal format.	UINT	4	H
3	Reserved	Reserved	UINT	4	H+4
4	bdsSource1	Displays BDS satellites 1-32, showing raw data parsing status where a bit is set to 1 when corrections are received for the corresponding satellite, presented in hexadecimal format.	UINT	4	H+8
5	bdsSource2	Displays BDS satellites 33-63, showing raw data parsing status where a bit is set to 1 when corrections are received for the corresponding satellite, presented in hexadecimal format.	UINT	4	H+12
6	Reserved	Reserved	UINT	4	H+16
7	gloSource	Displays GLONASS satellites 1-23, showing raw data parsing status where a bit is set to 1 when corrections are received	UINT	4	H+8

ID	Field	Description	Format	Binary Bytes	Binary Offset
		for the corresponding satellite, presented in hexadecimal format.			
8	Reserved	Reserved	UINT	4	H+24
9	galSource1	Displays Galileo satellites 1-32, showing raw data parsing status where a bit is set to 1 when corrections are received for the corresponding satellite, presented in hexadecimal format.	UINT	4	H+28
10	galSource2	Displays Galileo satellites 33-36, showing raw data parsing status where a bit is set to 1 when corrections are received for the corresponding satellite, presented in hexadecimal format.	UINT	4	H+32
11	QzssSource	Displays QZSS satellites 193-202, showing raw data parsing status where a bit is set to 1 when corrections are received for the corresponding satellite, presented in hexadecimal format.	UINT	4	H+36
12	Reserved	Reserved	UINT	4	H+40
13	Pos type	Position type. See Table Position or Velocity Type	Enum	4	H+44
14	Calculate status	0: No differential source data input 1: Insufficient observations from differential source 2: High latency in differential source 3: High ionospheric activity (valid for base station mode) 4: Insufficient observations at ROVER side 5: RTK solution available	Enum	4	H+48

ID	Field	Description	Format	Binary Bytes	Binary Offset
		(Status codes for RTK/RTD module solution)			
15	Ion detected	Impact of ionospheric scintillation on RTK positioning results 0: No impact on RTK solution 1-255: Negative impact on RTK solution (higher values indicate stronger impact)	uchar	1	H+52
16	Dual rtk flag*	0xFF: Dual-antenna baseline length not configured 0: Baseline length not resolved (dual antennas not in fixed solution) 1: Within tolerance limits 2: Exceeds tolerance limits (applies only to dual-antenna products)	Uchar	1	H+53
17	ADR Number	Total count of valid carrier-phase observations	Uchar	1	H+54
18	Reserved	Reserved	Uchar	1	H+55
19	Xxxx	32-bit CRC	Hex	4	H+56
20	[CR][LF]	Sentence terminator			

*: Field 16 (Dual RTK flag) is supported in UM982 Build 9669 and later versions.

7.5.85 RTKSTATUS2: RTK Solution Status (Slave Antenna)

This log outputs RTK solution information, such as the current solution status, differential data status, etc. computed using the slave antenna.

Message ID : 691

ASCII Syntax

```
RTKSTATUS2A 1
```

Binary Syntax

```
RTKSTATUS2B 1
```

Applicable Products: UM982

> **Note:** Applicable to UM982 Build 17110 and later versions.

Output

```
#RTKSTATUS2A,39,GPS,FINE,2331,283227000,16117,0,18,54;89D24A00,0,81C0B1BF,3C000161,0,638
0E,0,1805096,2,4E,0,NARROW_INT,5,0,FF,110,0*8b15c636
```

Table 7-154 RTKSTATUS2 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	RTKSTATUS2 Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	gpsSource	Source data decoding status for GPS satellite 1 to 32. Set the corresponding bit to 1 after receiving the correction data for 1 satellite, in hexadecimal format.	UINT	4	H
3	Reserved	Reserved	UINT	4	H+4
4	bdsSource1	Source data decoding status for BDS satellite 1 to 32. Set the corresponding bit to 1 after receiving the correction data for 1 satellite, in hexadecimal format.	UINT	4	H+8
5	bdsSource2	Source data decoding status for BDS satellite 33 to 63. Set the corresponding bit to 1 after receiving the correction data for 1 satellite, in hexadecimal format.	UINT	4	H+12
6	Reserved	Reserved	UINT	4	H+16

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
7	gloSource	Source data decoding status for GLONASS satellite 1 to 23. Set the corresponding bit to 1 after receiving the correction data for 1 satellite, in hexadecimal format.	UINT	4	H+20
8	Reserved	Reserved	UINT	4	H+24
9	galSource1	Source data decoding status for Galileo satellite 1 to 32. Set the corresponding bit to 1 after receiving the correction data for 1 satellite, in hexadecimal format.	UINT	4	H+28
10	galSource2	Source data decoding status for Galileo satellite 33 to 36. Set the corresponding bit to 1 after receiving the correction data for 1 satellite, in hexadecimal format.	UINT	4	H+32
11	QzssSource	Source data decoding status for QZSS satellite 193 to 202. Set the corresponding bit to 1 after receiving the correction data for 1 satellite, in hexadecimal format.	UINT	4	H+36
12	Reserved	Reserved	UINT	4	H+40
13	Pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+44
14	Calculate status	0: No differential data input 1: Insufficient observation at the differential source 2: High latency of differential data 3: Active ionosphere (valid for base station mode) 4: Insufficient observation at the ROVER 5: RTK solution available Indicates the RTK/RTD	Enum	4	H+48

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		solution status.			
15	Ion detected	Ionospheric scintillation detected 0: No effect on RTK solution 1~255: Negative effect on RTK solution	uchar	1	H+52
16	Dual rtk flag*	0xFF: The baseline length between the two antennas is not configured. 0: The baseline length is not solved (Not both of the antennas have achieved a fixed solution) 1: Within the limit 2: Out of the limit For dual-antenna products only	Uchar	1	H+53
17	ADR Number	Number of valid carrier phase observations using the slave antenna	Uchar	1	H+54
18	Reserved	Reserved	Uchar	1	H+55
19	Xxxx	32-bit CRC	Hex	4	H+56
20	[CR][LF]	Sentence terminator			

*: Field 16 (Dual RTK flag) is supported in UM982 Build 9669 and later versions.

7.5.86 SATECEF: Satellite Coordinates in ECEF Coordinate System

This message contains the decoded satellite information required when computing a position, including satellite coordinates (ECEF WGS84), satellite clock calibration, ionospheric calibration and tropospheric calibration.

Message ID : 2115

ASCII Syntax

```
SATECEFA 1
```

Binary Syntax

```
SATECEFB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#SATECEFA,97,GPS,FINE,2190,365060000,0,0,18,12;28,GPS,25,-15074001.0000,-1321521.1250,2155
4962.0000,78939.508,8.906,4.603,0.0,GPS,26,-5199400.0000,25154968.0000,6019832.0000,50877.9
14,6.491,3.066,0.0,GPS,29,-24350838.0000,1869061.6250,10471350.0000,-138099.781,10.301,5.61
8,0.0,GPS,31,-5542408.0000,14613293.0000,21302554.0000,-47215.703,5.403,2.538,0.0,GPS,32,-183
96664.0000,16438964.0000,9706892.0000,-12763.542,6.180,2.902,0.0,QZSS,194,-26913374.0000,25
085678.0000,25578198.0000,-202.491,5.491,2.560,0.0,QZSS,199,-25393438.0000,33651112.0000,49
94.1079,3.026,7.522,3.566,0.0,GALILEO,3,7417062.5000,15510334.0000,24086542.0000,-153400.01
6,7.043,3.451,1.0,GALILEO,5,-12822431.0000,21697142.0000,15516904.0000,-66745.031,5.324,2.45
6,1.0,GALILEO,24,-14646293.0000,12395834.0000,22518314.0000,-391926.406,5.595,2.636,1.0,GALI
LEO,25,-3816618.5000,28188316.0000,8166408.5000,-167453.578,6.307,2.980,1.0,BEIDOU,1,-34395
868.0000,24403858.0000,-356958.1562,-87413.930,8.793,4.208,2.0,BEIDOU,2,4489574.5000,419319
96.0000,342.9382,227784.938,8.965,4.403,2.0,BEIDOU,3,-14650923.0000,39556356.0000,-831224.12
50,141089.422,7.682,3.588,2.0,BEIDOU,6,-11866700.0000,23972774.0000,32526292.0000,215105.67
2,5.396,2.463,2.0,BEIDOU,7,-12324336.0000,40175348.0000,-4187626.7500,18499.482,8.480,4.03
4,2.0,BEIDOU,9,-3438167.7500,24575944.0000,34374596.0000,-117248.531,5.592,2.592,2.0,BEIDO
U,16,-16779596.0000,22749714.0000,31341410.0000,12072.259,5.408,2.465,2.0,BEIDOU,19,-146366
72.0000,23563198.0000,-3078972.7500,274718.438,9.268,4.502,2.0,BEIDOU,21,12200400.0000,1055
2887.0000,22784140.0000,-286255.938,9.488,5.114,2.0,BEIDOU,22,-1677701.1250,24076402.0000,1
4022415.0000,-288599.844,5.802,2.686,2.0,BEIDOU,36,-7533112.0000,16531093.0000,21199316.00
00,-254393.703,5.393,2.461,2.0,BEIDOU,39,-20703172.0000,22689450.0000,28809826.0000,10351.2
10,5.451,2.486,2.0,BEIDOU,40,-20012358.0000,37200804.0000,70317.0625,69271.031,7.476,3.47
5,2.0,BEIDOU,45,8088047.5000,25093244.0000,9098498.0000,191929.906,8.316,4.061,2.0,BEIDOU,4
6,-18328430.0000,-1177068.3750,21021694.0000,-26218.129,9.093,4.596,2.0,BEIDOU,59,-3233837
8.0000,27044200.0000,513189.9062,6.267,8.236,3.879,2.0,BEIDOU,60,7289870.5000,41498212.000
0,-1629297.3750,-43.630,9.758,4.989,2.0*017f82f3
```

Table 7-155 SATECEF Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	SATECEF header	Log header. See Table Binary Header Structure (N4) and		H	0

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Table ASCII Header Structure (N4)			
2	SatNum	Satellite number	Ulong	4	H
3	GNSS_SYSTEM	GNSS satellite system, see Table Satellite System	Enum	4	H+4
4	Prn	Satellite PRN number, see Table Satellite PRN Number in Unicore-defined Messages In binary messages, satellite ID is composed of two parts of Ushort characters. The 2 lowest order bytes are system identifiers (such as the PRN for GPS and channel for GLONASS); the 2 highest order bytes are frequency channel for GLONASS and zero for other systems. In ASCII messages, satellite ID field is the system identifier. If the system is GLONASS and the frequency channel is not zero, the frequency channel is appended to the system identifier. For example, the system ID is 13, and the frequency channel is -2, then the output is 13-2.	UINT	4	H+8
5	SatCoord_X	X coordinate of satellite (ECEF, m)	Float	4	H+12
6	SatCoord_Y	Y coordinate of satellite (ECEF, m)	Float	4	H+16
7	SatCoord_Z	Z coordinate of satellite (ECEF, m)	Float	4	H+20
8	Satclk	Satellite clock calibration (m)	Float	4	H+24

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
9	IonoDelay	Ionospheric delay, m	Float	4	H+28
10	TropDelay	Tropospheric delay, m	Float	4	H+32
11	dReserved1	Reserved	Double	8	H+36
12		Next satellite offset = H + 4 + (#SatNum x 40)			
13	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	
14	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.87 SATELLITE: Visible Satellites

This message outputs the visible satellites and detailed information.

Message ID : 1042

ASCII Syntax

```
SATELLITEA 1
```

Binary Syntax

```
SATELLITEB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#SATELLITEA,97,GPS,FINE,2190,364984000,0,0,18,13;GPS,TRUE,TRUE,9,3,0,25.2,308.1,0.000,0.000,1
0,0,2.4,175.2,0.000,0.000,12,0,0.2,39.3,0.000,0.000,16,0,12.5,210.8,0.000,0.000,25,0,31.8,47.4,0.00
0,0.000,26,0,51.2,209.4,0.000,0.000,29,0,25.0,90.5,0.000,0.000,31,0,71.2,345.0,0.000,0.000,32,0,56.6,1
27.5,0.000,0.000*a60a9635
```

Table 7-156 SATELLITE Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	SATELLITE header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Satellite system	GNSS satellite system, see Table Satellite System	Enum	4	H
3	sat vis	Satellite visibility, 0 = FALSE, 1 = TRUE	Enum	4	H+4
4	comp alm	Completeness of BDS/GPS/ GLONASS almanac, 0 = FALSE, 1 = TRUE	Enum	4	H+8
5	#sat	Number of satellites with data to follow	Ulong	4	H+12
6	PRN/slot	Satellite PRN number, see Table Satellite PRN Number in Unicore-defined Messages In binary messages, satellite ID is composed of two parts of Ushort characters. The 2 lowest order bytes are system identifiers (such as the PRN for GPS and channel for GLONASS); the 2 highest order bytes are frequency channel for GLONASS and zero for other systems. In ASCII messages, satellite ID field is the system identifier. If the system is GLONASS and the frequency channel is not zero, the frequency channel is appended to the system identifier. For example, the system ID is 13, and the frequency channel is -2, then the output is 13-2.	Ulong	4	H+16

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
7	health	Satellite health status, 0 = healthy, 1 = unhealthy	Ulong	4	H+20
8	elev	Elevation, degrees	Double	8	H+24
9	az	Azimuth, degrees	Double	8	H+32
10	reserved	Reserved	Double	8	H+40
11	reserved	Reserved	Double	8	H+48
12		The next satellite offset is the byte length from field 6 to field 11 multiplied by the number of #sat.			
13	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+12+(#sat x 40)
14	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.88 SATSINFO: Satellite Information

This log contains all the satellite information tracked by the GNSS board/module, including the number of satellites, satellite PRN, elevation, azimuth, signal-to-noise ratio of different frequencies, etc.

Message ID : 2124

ASCII Syntax

```
SATSINFOA 1
```

Binary Syntax

```
SATSINFOB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S , UM980C

Output

```
#SATSINFOA,96,GPS,FINE,2215,367199000,0,0,18,16;50,2,0,0,0,63,2,302,51,0,45,0,2,0,42,9,2,4,48,17,0,3
7,0,3,0,43,14,3,0,39,9,3,5,225,14,0,42,0,2,0,37,9,2,6,35,64,0,47,0,3,0,52,14,3,0,48,9,3,9,80,33,0,42,0,3,0,4
4,14,3,0,40,9,3,11,300,56,0,46,0,3,0,50,14,3,0,46,9,3,12,277,37,0,42,0,2,0,41,9,2,17,134,31,0,44,0,2,0,4
1,9,2,19,130,53,0,46,0,2,0,43,9,2,20,232,47,0,46,0,2,0,42,9,2,25,316,15,0,38,0,3,0,45,14,3,0,40,9,3,2
8,0,0,0,37,0,2,0,31,9,2,194,170,8,5,38,0,3,5,41,14,3,5,37,9,3,195,112,67,5,45,0,3,5,49,14,3,5,47,9,3,196,13
2,61,5,42,0,3,5,48,14,3,5,46,9,3,199,163,43,5,36,0,3,5,46,14,3,5,44,9,3,39,116,64,1,43,0,2,1,49,5,2,55,31
6,30,1,43,0,2,1,46,5,2,52,242,10,1,39,0,2,1,39,5,2,38,35,28,1,40,0,2,1,41,5,2,61,93,29,1,42,0,2,1,45,5,2,54,2
2,62,1,47,0,2,1,50,5,2,40,180,27,1,42,0,2,1,45,5,2,46,342,4,1,34,0,2,1,39,5,2,11,93,61,4,33,0,3,4,52,17,3,4,5
0,21,3,42,114,67,4,34,0,4,4,51,21,4,4,48,8,4,4,49,12,4,2,224,33,4,45,17,2,4,41,21,2,10,214,52,4,29,0,3,4,4
6,17,3,4,45,21,3,28,306,28,4,29,0,4,4,44,21,4,4,41,8,4,4,42,12,4,40,180,42,4,31,0,4,4,44,21,4,4,43,8,4,4,4
3,12,4,8,289,63,4,31,0,3,4,48,17,3,4,46,21,3,43,8,79,4,36,0,4,4,51,21,4,4,47,8,4,4,50,12,4,7,197,46,4,2
8,0,3,4,47,17,3,4,45,21,3,21,47,30,4,31,0,4,4,43,21,4,4,43,8,4,4,43,12,4,23,243,4,4,24,8,2,4,30,12,2,4,123,2
6,4,43,17,2,4,41,21,2,5,248,16,4,38,17,2,4,35,21,2,1,139,36,4,28,0,3,4,46,17,3,4,43,21,3,34,111,40,4,3
2,0,4,4,48,21,4,4,44,8,4,4,41,12,4,38,317,74,4,35,0,4,4,49,21,4,4,47,8,4,4,49,12,4,2,311,18,3,39,2,3,3,45,1
7,3,3,43,12,3,4,136,38,3,43,2,3,3,48,17,3,3,46,12,3,10,0,0,3,47,2,3,3,53,17,3,3,50,12,3,11,325,63,3,4
3,2,3,3,47,17,3,3,45,12,3,12,71,45,3,42,2,3,3,45,17,3,3,42,12,3,19,63,32,3,40,2,3,3,40,17,3,3,38,12,3,24,20
3,15,3,37,2,3,3,43,17,3,3,40,12,3,25,260,32,3,42,2,3,3,46,17,3,3,44,12,3,9,181,7,3,37,2,3,3,41,17,3,3,39,1
2,3,36,286,19,3,34,2,3,3,42,17,3,3,38,12,3*a79d3813
```

Table 7-157 SATSINFO Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	SATSINFO header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Sat number	Number of tracked satellites	Byte	1	H
3	Version number	Version number, default = 2	Byte	1	H+1
4	reserve	Reserved	Byte	1	H+2
5	reserve	Reserved	Byte	1	H+3
6	reserve	Reserved	Byte	1	H+4
7	Frq flag	Frequency flag, see Table Frequency Flag	Byte	1	H+5
8	PRN	Satellite PRN number, see Table Satellite PRN Number in Unicore-defined Messages	Byte	1	H+6

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
9	Azimuth	Azimuth, degrees	Short	2	H+7
10	Elevation	Elevation, degrees	Byte	1	H+9
11	Sys status	System identifier, see Table System Identifier	Byte	1	H+10
12	SNR	Signal-to-noise ratio	Byte	1	H+11
13	Freq status	Frequency identifier, see Table Frequency Identifier	Byte	1	H+12
14	Freq No	Number of frequencies contained in the current PRN	Byte	1	H+13
15	Next Frq info	Next frequency information (if available)		4	H+14
16		Next frequency offset = H+6+sat*(4+freq No*4), "freq No." is updated according to the real time calculation. See Figure Explanation of the Binary Offset of SATSINFO.			
17	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+6+sat*(4+freq No*4)
18	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Explanation of the Binary Offset of SATSINFO

Figure 7-4 Explanation of the Binary Offset of SATSINFO

7.5.89 SPPDOP : DOP of SPPNAV

This log contains DOP (Dilution of Precision) for all satellites used in the SPPNAV solution. The log supports `ONCHANGED` trigger. In order to output SPPDOP message, SPPNAV needs to be output first.

Message ID : 173

ASCII Syntax

```
SPPDOPA 1
```

```
SPPDOPA ONCHANGED
```

Binary Syntax

```
SPPDOPB 1
```

```
SPPDOPB ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#SPPDOPA,46,GPS,FINE,2298,280151000,0,0,18,41;280151000,1.8370,1.5714,0.9515,1.3668,0.775
2,0.6649,0.3985,5.0,0.0,28,4,8,9,16,26,34,35,39,76,77,79,84,98,99,161,163,166,167,169,170,176,189,19
0,196,199,200,219,220*6f7a59fd
```

Table 7-158 SPPDOP Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	SPPDOP Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Ulong	4	H
3	gdop	Geometric DOP	Float	4	H+4
4	Pdop	Position DOP	Float	4	H+8
5	Tdop	Time DOP	Float	4	H+12
6	Vdop	Vertical DOP	Float	4	H+16
7	Hdop	Horizontal DOP	Float	4	H+20

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
8	Ndop	North DOP	Float	4	H+24
9	Edop	East DOP	Float	4	H+28
10	Cutoff	Elevation cutoff angle	Float	4	H+32
11	Reserved	Reserved	Float	4	H+36
12	#PRN	Number of tracked satellites	UShort	2	H+40
13	PRN	PRN of tracked satellites, see Table Satellite PRN Number (with Offset) in Unicore-defined Messages, null field until the position solution is available.	UShort	2	H+42
14	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+42+2*#PRN
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.90 SPPDOPH: DOP of SPPNAVH (Slave Antenna)

This log contains DOP (Dilution of Precision) for all satellites used in the SPPNAVH solution. The log supports `ONCHANGED` trigger.

Message ID : 2120

ASCII Syntax

```
SPPDOPHA 1
```

```
SPPDOPHA ONCHANGED
```

Binary Syntax

```
SPPDOPHB 1
```

SPPDOPHB ONCHANGED

Applicable Products: UM982, UMD982

Output

```
#SPPDOPHA,46,GPS,FINE,2298,280151000,0,0,18,52;280151000,1.8370,1.5714,0.9515,1.3668,0.775
2,0.6649,0.3985,5.0,0.0,28,4,8,9,16,26,34,35,39,76,77,79,84,98,99,161,163,166,167,169,170,176,189,19
0,196,199,200,219,220*3a8ad917
```

Table 7-159 SPPDOPH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	SPPDOPH Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Ulong	4	H
3	gdop	Geometric DOP	Float	4	H+4
4	Pdop	Position DOP	Float	4	H+8
5	Tdop	Time DOP	Float	4	H+12
6	Vdop	Vertical DOP	Float	4	H+16
7	Hdop	Horizontal DOP	Float	4	H+20
8	Ndop	North DOP	Float	4	H+24
9	Edop	East DOP	Float	4	H+28
10	Cutoff	Elevation cutoff angle	Float	4	H+32
11	Reserved	Reserved	Float	4	H+36
12	#PRN	Number of tracked satellites	UShort	2	H+40
13	PRN	PRN of tracked satellites, see Table Satellite PRN Number (with Offset) in Unicore-defined Messages, null field until the position solution is	UShort	2	H+42

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		available.			
14	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+42+2*#PRN
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.91 SPPNAV : Pseudorange Position and Velocity

This log contains the pseudorange position, accuracy, status, and velocity.

Message ID : 46

ASCII Syntax

```
SPPNAVA 1
```

Binary Syntax

```
SPPNAVB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#SPPNAVA,97,GPS,FINE,2294,472312000,0,0,18,14;SOL_COMPUTED,SINGLE,40.07895888272,116.23
651029820,65.8312,-8.4925,WGS84,1.2221,1.1053,2.1970,"0",0.000,0.000,50,28,28,0,1,12,12,41,SO
L_COMPUTED,DOPPLER_VELOCITY,0.000,0.000,0.0046,335.592288,0.0045,0.0194,0.0123*fab56d4e
```

Table 7-160 SPPNAV Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	SPPNAV header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	sol status	Solution status, refer to	Enum	4	H

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Table Solution Status			
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID, only WGS84 is supported for now. ASCII = WGS84, binary = 61.	Enum	4	H+36
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID	Char[4]	4	H+52
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17-19	Reserved	Reserved	Uchar	3	H+66
20	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3	Galileo and BDS-3 signal	Hex	1	H+70

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
	sig mask	mask, refer to Table Galileo & BDS-3 Signal Mask			
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask, refer to Table GPS/GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	sol status	Solution status, refer to Table Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table Position or Velocity Type	Enum	4	H+76
25	latency	A measure of latency in the velocity time tag, in seconds. Subtracting latency from epoch time gives accurate velocity.	Float	4	H+80
26	age	Differential age, s	Float	4	H+84
27	hor spd	Horizontal speed over ground, m/s	Double	8	H+88
28	trk gnd	Actual direction of motion over ground (track over ground) with respect to True North, in degrees	Double	8	H+96
29	vert spd	Vertical speed, m/s. Positive indicates increasing altitude (up) and negative indicates decreasing altitude (down).	Double	8	H+104
30	Verspd std	Standard deviation of vertical speed, m/s	Float	4	H+112
31	Horspd std	Standard deviation of horizontal speed, m/s	Float	4	H+116
32	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+120

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
33	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.92 SPPNAVH: Pseudorange Position and Velocity (Slave Antenna)

This log contains the pseudorange position, accuracy, status, and velocity calculated with the slave antenna.

Message ID : 2116

ASCII Syntax

```
SPPNAVHA 1
```

Binary Syntax

```
SPPNAVHB 1
```

Applicable Products: UM982, UMD982

Output

```
#SPPNAVHA,97,GPS,FINE,2190,364950000,0,0,18,13;INSUFFICIENT_OBS,NONE,40.07898868399,11
6.23660520125,59.8754,-8.4923,WGS84,2.9766,2.8787,10.0570,"0",0.000,11624.000,0,0,0,0,33,02,0
0,00,INSUFFICIENT_OBS,NONE,0.000,0.000,0.0301,33.043127,-0.0892,0004000C*808205f0
```

Table 7-161 SPPNAVH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	SPPNAVH header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	sol status	Solution status, refer to Table Solution Status	Enum	4	H
3	pos type	Position type, refer to	Enum	4	H+4

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Table Position or Velocity Type			
4	lat	Latitude, degrees	Double	8	H+8
5	lon	Longitude, degrees	Double	8	H+16
6	hgt	Height above mean sea level, meters	Double	8	H+24
7	undulation	Geoid undulation, the distance between the geoid and the WGS84 ellipsoid, meters	Float	4	H+32
8	datum id#	Datum ID, only WGS84 is supported for now. ASCII = WGS84, binary = 61.	Enum	4	H+36
9	lat σ	Latitude standard deviation, m	Float	4	H+40
10	lon σ	Longitude standard deviation, m	Float	4	H+44
11	hgt σ	Height standard deviation, m	Float	4	H+48
12	stn id	Base station ID	Char[4]	4	H+52
13	diff_age	Differential age, s	Float	4	H+56
14	sol_age	Solution age, s	Float	4	H+60
15	#SVs	Number of satellites tracked	Uchar	1	H+64
16	#solnSVs	Number of satellites used in solution	Uchar	1	H+65
17-19	Reserved	Reserved	Uchar	3	H+66
20	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS-3 Signal	Hex	1	H+70

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Mask			
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask, refer to Table GPS/GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	sol status	Solution status, refer to Table Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table Position or Velocity Type	Enum	4	H+76
25	latency	A measure of latency in the velocity time tag, in seconds. Subtracting latency from epoch time gives accurate velocity.	Float	4	H+80
26	age	Differential age, s	Float	4	H+84
27	hor spd	Horizontal speed over ground, m/s	Double	8	H+88
28	trk gnd	Actual direction of motion over ground (track over ground) with respect to True North, in degrees	Double	8	H+96
29	vert spd	Vertical speed, m/s. Positive indicates increasing altitude (up) and negative indicates decreasing altitude (down).	Double	8	H+104
30	Verspd std	Standard deviation of vertical speed, m/s	Float	4	H+112
31	Horspd std	Standard deviation of horizontal speed, m/s	Float	4	H+116
32	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+120
33	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.93 STADOP : DOP of BESTNAV

This log contains DOP (Dilution of Precision) for all satellites used in the BESTNAV solution.

Message ID : 954

ASCII Syntax

```
STADOPA 1
```

Binary Syntax

```
STADOPB 1
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#STADOPA,46,GPS,FINE,2298,280151000,0,0,18,12;280151000,0.8094,0.7129,0.3831,0.6046,0.377
9,0.2902,0.2421,5.0,0.0,50,4,7,8,9,16,18,26,31,34,35,36,39,51,60,61,58,59,49,50,161,163,219,220,162,16
4,165,166,167,169,170,176,182,189,190,196,199,200,205,206,187,181,76,77,79,84,82,98,99,86,85*3e6a
cf8a
```

Table 7-162 STADOP Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	STADOP Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Ulong	4	H
3	gdop	Geometric DOP	Float	4	H+4
4	Pdop	Position DOP	Float	4	H+8
5	Tdop	Time DOP	Float	4	H+12
6	Vdop	Vertical DOP	Float	4	H+16
7	Hdop	Horizontal DOP	Float	4	H+20

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
8	Ndop	North DOP	Float	4	H+24
9	Edop	East DOP	Float	4	H+28
10	Cutoff	Elevation cutoff angle	Float	4	H+32
11	Reserved	Reserved	Float	4	H+36
12	#PRN	Number of tracked satellites	UShort	2	H+40
13	PRN	PRN of tracked satellites, see Table Satellite PRN Number (with Offset) in Unicore-defined Messages, null field until the position solution is available.	UShort	2	H+42
14	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+42+2*#PRN
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.94 STADOPH: DOP of BESTNAVH (Slave Antenna)

This log contains DOP (Dilution of Precision) for all satellites used in the BESTNAVH solution.

Message ID : 2122

ASCII Syntax

```
STADOPHA 1
```

Binary Syntax

```
STADOPHB 1
```

Applicable Products: UM982, UMD982

Output

```
#STADOPHA,46,GPS,FINE,2298,280151000,0,0,18,28;280151000,0.8182,0.7199,0.3888,0.6079,0.385
6,0.2972,0.2456,5.0,0.0,49,16,9,8,4,26,18,7,31,34,36,35,39,58,60,59,50,49,51,61,161,163,220,219,162,16
4,165,169,167,166,176,170,182,190,189,196,181,206,205,200,199,79,77,76,99,98,84,82,86,85*fd39dcfc
```

Table 7-163 STADOPH Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	STADOPH Header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Reserved	Reserved	Ulong	4	H
3	gdop	Geometric DOP	Float	4	H+4
4	Pdop	Position DOP	Float	4	H+8
5	Tdop	Time DOP	Float	4	H+12
6	Vdop	Vertical DOP	Float	4	H+16
7	Hdop	Horizontal DOP	Float	4	H+20
8	Ndop	North DOP	Float	4	H+24
9	Edop	East DOP	Float	4	H+28
10	Cutoff	Elevation cutoff angle	Float	4	H+32
11	Reserved	Reserved	Float	4	H+36
12	#PRN	Number of tracked satellites	UShort	2	H+40
13	PRN	PRN of tracked satellites, see Table Satellite PRN Number (with Offset) in Unicore-defined Messages, null field until the position solution is available.	UShort	2	H+42
14	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+42+2*#PRN
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.95 TROPINFO: Zenith Tropospheric Delay

TROPINFO contains the zenith tropospheric delay information. It only supports `ONCE` or `ON CHANGED` trigger. Besides, it is available only if PPP is enabled.

Message ID : 2318

ASCII Syntax

```
TROPINFOA ONCHANGED
```

Binary Syntax

```
TROPINFOB ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#TROPINFOA,85,GPS,FINE,2244,93693000,0,0,18,63;SAASTAMOINEN,2.354103,2.292246,0.06185
7,0.026856,0.000000*89ed6541
```

Table 7-164 TROPINFO Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	TROPINFO header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	Trop module	Tropospheric model in use. Output "SAASTAMOINEN" by default in ASCII format, and output 1 in binary format.	INT	4	H
3	TropZenith	Zenith total delay	Float	4	H+4
4	Dry	Zenith dry delay	Float	4	H+8
5	Wet	Zenith wet delay	Float	4	H+12
6	Std	Standard deviation of zenith total delay	Float	4	H+16

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
7	Reserved	Reserved	Float	4	H+20
8	Xxxx	32-bit CRC	HEX	4	H+24
9	[CR][LF]	Sentence terminator (ASCII only)			

7.5.96 UNIHEADING: Heading Information

This log outputs the heading information of the receiver in motion. Heading refers to the clockwise angle between True North and the baseline vector from the master antenna to the slave antenna.

Message ID : 972

ASCII Syntax

```
UNIHEADINGA 1
```

Binary Syntax

```
UNIHEADINGB 1
```

Applicable Products: UM982, UMD982

Output

```
#UNIHEADINGA,97,GPS,FINE,2190,365174000,0,0,18,12;INSUFFICIENT_OBS,NONE,0.0000,0.0000,0.00
00,0.0000,0.0000,0.0000,"",0,0,0,0,0,00,0,0*ee072604
```

Table 7-165 UNIHEADING Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	UNIHEADING header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	sol stat	Solution status, refer to Table Solution Status	Enum	4	H

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	length	Baseline length	Float	4	H+8
5	heading	Heading (0 to 360.0 degrees)	Float	4	H+12
6	pitch	Pitch (± 90 degrees)	Float	4	H+16
7	Reserved	Reserved	Float	4	H+20
8	hdgstddev	Standard deviation of heading	Float	4	H+24
9	ptchstddev	Standard deviation of pitch	Float	4	H+28
10	stn id	Base station ID	Char[4]	4	H+32
11	#SVs	Number of satellites tracked	Uchar	1	H+36
12	#solnSVs	Number of satellites used in solution	Uchar	1	H+37
13	#obs	Number of satellites above the elevation mask angle	Uchar	1	H+38
14	#multi	Number of satellites with L2 signal above the elevation mask angle	Uchar	1	H+39
15	Reserved	Reserved	Uchar	1	H+40
16	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Uchar	1	H+41
17	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS-3 Signal Mask	Uchar	1	H+42
18	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table GPS/ GLONASS/BDS-2 Signal Mask	Uchar	1	H+43
19	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+44
20	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Note: If INS is enabled, when **<sol stat>** is 0, there is a **<pos type>** named INS. In that case, the receiver outputs heading and pitch angles calculated by INS and converted to the results in GNSS dual-antenna heading mode. Users need to consider the solution status and position type together to judge the validity of the heading information and the source of calculation.

7.5.97 UNIHEADING2: Multi-Rover Heading Information

This log outputs the heading information of the receiver in motion. Heading refers to the clockwise angle between True North and the baseline vector from the moving base station to the heading receiver. This log can be output by the heading receiver. It is similar to the UNIHEADING log, but has an additional rover ID field.

Message ID : 1331

ASCII Syntax

```
UNIHEADING2A ONCHANGED
```

Binary Syntax

```
UNIHEADING2B ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM960, UMD960, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#UNIHEADING2A,50,GPS,FINE,2207,282484000,0,0,18,675;SOL_COMPUTED,NARROW_INT,10736.383
8,88.3470,0.0876,0.0000,0.0001,0.0001,"201",52,29,29,29,3,01,3,c3*898773d6
```

Table 7-166 UNIHEADING2 Message Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	UNIHEADING2 header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4)		H	0
2	sol stat	Solution status, refer to Table	Enum	4	H

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		Solution Status			
3	pos type	Position type, refer to Table Position or Velocity Type	Enum	4	H+4
4	length	Baseline length	Float	4	H+8
5	heading	Heading (0 to 360.0 degrees)	Float	4	H+12
6	pitch	Pitch (± 90 degrees)	Float	4	H+16
7	Reserved	Reserved	Float	4	H+20
8	hdgstddev	Standard deviation of heading	Float	4	H+24
9	ptchstddev	Standard deviation of pitch	Float	4	H+28
10	Master stn ID	Master station ID	Char[4]	4	H+32
11	#SVs	Number of satellites tracked	Uchar	1	H+36
12	#solnSVs	Number of satellites used in solution	Uchar	1	H+37
13	#obs	Number of satellites above the elevation mask angle	Uchar	1	H+38
14	#multi	Number of satellites with L2 signal above the elevation mask angle	Uchar	1	H+39
15	Reserved	Reserved	Uchar	1	H+40
16	ext sol stat	Extended solution status, refer to Table Extended Solution Status	Uchar	1	H+41
17	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table Galileo & BDS-3 Signal Mask	Uchar	1	H+42
18	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table GPS/ GLONASS/BDS-2 Signal Mask	Uchar	1	H+43
19	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+44

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
20	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.5.98 UNILOGLIST : Output Log List

This command is used to output the list of operating logs. Binary format is not supported.

ASCII Syntax

```
UNILOGLIST
```

Applicable Products: UM960, UMD960, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Output

```
#UNILOGLIST,66,GPS,FINE,2203,447089000,0,0,18,33;
<     3
<     PSRPOSA COM1 1
<     GPGGA COM1 1
<     HWSTATUSA COM1 1
```

Table 7-167 UNILOGLIST Message Structure

ID	Field	Data Description	Format
1	UNILOGLIST (ASCII) header	Log header, see Table ASCII Header Structure (N4)	
2	#port	Number of messages, maximum=30	Long
3	LOG	LOG string	
4	port	Output port, refer to Table Port Identifier	Enum
5	message	Message name of the log, no suffix for abbreviated ASCII, suffix A for ASCII and B for binary	Char [ ]
6	trigger	Trigger mode of output messages, ONTIME or O NCE	

ID	Field	Data Description	Format
7	period	Log period for ONTIME trigger, seconds	
8...	next port		
variable	xxxx	32-bit CRC	Hex
variable	[CR][LF]	Sentence terminator	-

7.6 Reference Tables

7.6.1 Position or Velocity Type

Table 7-168 Position or Velocity Type

Decimal	ASCII	Description
0	NONE	No solution
1	FIXEDPOS	Position has been fixed by the **FIX position** command or by position averaging.
2	FIXEDHEIGHT	Not supported for now
8	DOPPLER_VELOCITY	Velocity computed using instantaneous Doppler
16	SINGLE	Single point position
17	PSRDIFF	Pseudorange differential solution
18	SBAS	Solution calculated using corrections from an SBAS
32	L1_FLOAT	Floating L1 ambiguity solution
33	IONOFREE_FLOAT	Floating ionosphere ambiguity solution
34	NARROW_FLOAT	Floating narrow-lane ambiguity solution
48	L1_INT	Integer L1 ambiguity solution
49	WIDE_INT	Integer wide-lane ambiguity solution
50	NARROW_INT	Integer narrow-lane ambiguity solution
52	INS	INS position solution
53	INS_PSRSP	INS pseudorange single point solution – no DGPS corrections
54	INS_PSRDIFF	INS pseudorange differential solution

Decimal	ASCII	Description
55	INS_RTKFLOAT	INS RTK floating point ambiguities solution
56	INS_RTKFIXED	INS RTK fixed ambiguities solution
68	PPP_CONVERGING	PPP in convergence
69	ppp	PPP positioning
70	PPP_AR	PPP fixed solution, PPP_AR status
71	PPP_RTK	PPP fixed solution, PPP_RTK status

7.6.2 Solution Status

Table 7-169 Solution Status

Solution Status	Description	
0	SOL_COMPUTED	Solution computed
1	INSUFFICIENT_OBS	Insufficient observations
2	NO_CONVERGENCE	No convergence
3	SINGULARITY	Singularity at parameters matrix
4	COV_TRACE	Covariance trace exceeds maximum (trace > 1000 m)

7.6.3 Extended Solution Status

Table 7-170 Extended Solution Status

Bit	Description
0	RTK solution verification 0 = unverified 1 = verified
1-3	Pseudo-distance ionospheric correction 0 = unknown 1 = Klobuchar, broadcast ephemeris correction 2 = SBAS, Ionospheric grid correction 3 = multi-frequency correction 4 = pseudo-range differential correction

7.6.4 Satellite System

Table 7-171 Satellite System

Binary Value	Satellite System Name in ASCII Format
0	GPS
1	GLONASS
2	SBAS
5	GALILEO
6	BEIDOU
7	QZSS
9	NAVIC

7.6.5 GPS, GLONASS and BDS Signal-Used Mask

Table 7-172 GPS, GLONASS and BDS Signal-Used Mask

Bit	Mask	Description
0	0x01	GPS L1 used in Solution
1	0x02	GPS L2 used in Solution
2	0x04	GPS L5 used in Solution
3	0x08	BDS B3 used in Solution
4	0x10	GLONASS L1 used in Solution
5	0x20	GLONASS L2 used in Solution
6	0x40	BDS B1 used in Solution
7	0x80	BDS B2 used in Solution

7.6.6 Galileo & BDS-3 Signal Mask

Table 7-173 Galileo & BDS-3 Signal Mask

Bit	Mask	Description
0	0x01	Galileo E1 used in Solution
1	0x02	Galileo E5B used in Solution

Bit	Mask	Description
2	0x04	Galileo E5A used in Solution
3	0x08	Reserved
4	0x10	BDS3 B1I used in Solution
5	0x20	BDS3 B3I used in Solution
6	0x40	BDS3 B2a used in Solution
7	0x80	BDS3 B1C used in Solution

7.6.7 GPS/GLONASS/BDS2 Signal Mask

Table 7-174 GPS/GLONASS/BDS2 Signal Mask

Bit	Mask	Description
0	0x01	GPS L1 used in solution
1	0x02	GPS L2 used in solution
2	0x04	GPS L5 used in solution
3	0x08	BDS B3I used in solution
4	0x10	GLONASS L1 used in solution
5	0x20	GLONASS L2 used in solution
6	0x40	BDS B1I used in solution
7	0x80	BDS2 B2I used in solution

7.6.8 Galileo Signal Mask

Table 7-175 Galileo Signal Mask

Bit	Mask	Description
0	0x01	Galileo E1 used in Solution
1	0x02	Galileo E5B used in Solution
2	0x04	Galileo E5A used in Solution
3	0x08	Reserved
4	0x10	Reserved

Bit	Mask	Description
5	0x20	Reserved
6	0x40	Reserved
7	0x80	Reserved

7.6.9 GLONASS Ephemeris Flags Coding

Table 7-176 GLONASS Ephemeris Flags Coding

Bit	Description	Value	Mask
0	P1 flag: time interval between two adjacent tb values	See Table P1 Flag Range Values	00000001
1			00000002
2	P2 flag: Oddness or Evenness of tb value	0=even, 1=odd	00000004
3	P3 flag: number of satellites contained in the almanac of the current subframe	0=5, 1=4	00000008
4	N1 to N7. Reserved		
...			
31			

7.6.10 P1 Flag Range Values

Table 7-177 P1 Flag Range Values

State	Description
00	0 minutes
01	30 minutes
10	45 minutes
11	60 minutes

7.6.11 Channel Tracking Status

Table 7-178 Channel Tracking Status

Nibble #	Bit #	Mask	Description	Range Value
N0	0	0x00000001	Reserved	
	1	0x00000002		
	2	0x00000004		
	3	0x00000008		
N1	4	0x00000010		
	5	0x00000020	SV channel number	0-n (0 = first, n = last) n depends on the receiver
	6	0x00000040		
	7	0x00000040		
N2	8	0x00000100		
	9	0x00000200		
	10	0x00000400	Carrier phase flag	0 = invalid, 1 = valid
	11	0x00000800	Reserved	
N3	12	0x00001000	Pseudorange flag	0 = invalid, 1 = valid
	13	0x00002000	Reserved	
	14	0x00004000		
	15	0x00008000		
N4	16	0x00010000	Satellite system	0 = GPS 1 = GLONASS 2 = SBAS 3 = GAL 4 = BDS 5 = QZSS 6 = IRNSS 7 = Reserved
	17	0x00020000		
	18	0x00040000		
	19	0x00080000	Reserved	
N5	20	0x00100000	Reserved	

Nibble #	Bit #	Mask	Description	Range Value
	21	0x00200000	Signal type	Depends on the supported satellite system: GPS: 0 = L1 C/A 9 = L2P (Y)* 3 = L1C pilot 11 = L1C data semicodeless 6 = L5 data 14 = L5 pilot 17 = L2C (L) GLONASS: 0 = L1 C/A 5 = L2 C/A 6 = G3I 7 = G3Q QZSS: 0 = L1 C/A 1 = L1C/B 3 = L1C pilot 4 = L1S 6 = L5 data 11 = L1C data 14 = L5 pilot 17 = L2C (L) 21 = L6D 27 = L6E IRNSS: 6 = L5 data 14 = L5 pilot BDS: 0 = B1I 4 = B1Q 8 = B1C (Pilot) 23 = B1C (Data) 5 = B2Q 17 = B2I 12 = B2a (Pilot) 28 = B2a (Data) 6 = B3Q 21 = B3I
	22	0x00400000		
	23	0x00800000		
N6	24	0x01000000		
	25	0x02000000		

Nibble #	Bit #	Mask	Description	Range Value
				13= B2b (I) GAL: 1 = E1B 2 = E1C 12 = E5A pilot 17 = E5B pilot 18 = E6B 22 = E6C SBAS: 0 = L1 C/A 6 = L5 (I)
	26	0x04000000	L2C flag	0: L2P (Y); 1: L2C
	27	0x08000000	Reserved	
N7	28	0x10000000	Reserved	
	29	Reserved	Reserved	
	30	0x40000000	Reserved	
	31	0x80000000	Reserved	

*: When the value of Bit 26 is 1, the L2P (Y) in Bit 25 is actually the L2C signal.

7.6.12 Port Identifier

Table 7-179 Port Identifier

Port Name	Description
COM1	COM port 1
COM2	COM port 2
COM3	COM port 3

Table 7-180 Psrstd Index

Index	Data
0	0.050
1	0.075

Index	Data
2	0.113
3	0.169
4	0.253
5	0.380
6	0.570
7	0.854
8	1.281
9	2.375
10	4.750
11	9.500
12	19.000
13	38.000
14	76.000
15	152.000

7.6.13 Header of the L6 Correction Messages

Table 7-181 Header of the L6 Correction Messages

ID	Field	Format	Description	Binary Bytes	Binary Offset
1	PRN	ULONG	PRN number	4	0
2	MsgNum	USHORT	Message number	2	4
3	SubID	USHORT	Message sub type ID	2	6
4	EpochTime	ULONG	GPS epoch time 1s	4	8
5	Interval	USHORT	SSR update interval	2	12
6	Indicator	UCHAR	Multiple message indicator	1	14
7	SSRIOD	UCHAR	IOD SSR	1	15
8	NumGNSS	UCHAR	Number of augmented	1	16

ID	Field	Format	Description	Binary Bytes	Binary Offset
			GNSS		
9	Reserved	UCHAR	Reserved	1	17
10	HourlyTime	USHORT	GNSS hourly epoch time 1s	2	18
11	CorNum	USHORT	Number of corrections	2	20
12	MsgValid	USHORT	Nominal validity period	2	22

7.6.14 Navigation Message Index

Table 7-182 Navigation Message Index

Navigation Message Index	Galileo	GPS
0	I/NAV	LNAV (L1 C/A)
1-7	Reserved	Reserved

7.6.15 Satellite Systems and Frequencies

Table 7-183 Satellite Systems and Frequencies

No.	GNSS	Frequency	Description
1	GPS	L1, L1CA, L1C, L2, L2C, L2P, L5	Supported frequencies of GPS: L1CA (i.e. L1C/A), L1C, L2C, L2P, L5. When masking L1, it disables L1C/A and L1C. When masking L2, it disables L2C and L2P.
2	BDS	B1, B2, B3, B1I, B2I, B3I, BD3B1C, BD3B2A, BD3B2B	Supported frequencies of BDS-2: B1I, B2I, B3I Supported frequencies of BDS-3: B1I, B3I Supported frequencies of BDS-3: BD3B1C, BD3B2A, BD3B2B When masking B1, it disables B1I and BD3B1C. When masking B2, it disables B2I, B2a and B2b. When masking B3, it disables B3I.

No.	GNSS	Frequency	Description
3	GLO	R1, R2, R3	Supported frequencies of GLONASS: R1, R2, R3
4	GAL	E1, E5a, E5b, E6C	Supported frequencies of Galileo: E1, E5b, E5a, E6C
5	QZSS	Q1, Q2, Q5, Q1CA, Q1C, Q2C	Supported frequencies of QZSS: Q1, Q2, Q5 (i.e. QZSS L5), Q1CA (i.e. QZSS L1C/A), Q1C (i.e. QZSS L1C), Q2C (i.e. QZSS L2C) When masking Q1, it disables QZSS L1C/A and QZSS L1C. When masking Q2, it disables QZSS L2C. When masking Q5, it disables QZSS L5.
6	IRNSS	I5	Supported frequencies of IRNSS: I5 (IRNSS L5) When masking I5, it disables IRNSS L5.

7.6.16 Satellite PRN Numbers in NMEA Messages

Table 7-184 Satellite PRN Numbers in NMEA Messages

GNSS Satellite ID Number	SBAS Satellite ID Number
GPS: 1~32	WAAS 33~64
BDS: 1~64	BDSBAS 65~75
GLONASS: 65~96	SDCM 33~64
Galileo: 1~36	EGNOS 37~64
QZSS: 1~10	QZSS-SAIF 55~63
IRNSS: 1~15	GAGAN 33~64
-	KASS 47

7.6.17 Satellite PRN Number in Unicore-defined Messages

Table 7-185 Satellite PRN Number in Unicore-defined Messages

GNSS	PRN
BDS	1~63
GPS	1~32
GLONASS	38~61
Galileo	1~36
SBAS	120~158
QZSS ...	193~202
IRNSS 31	1~15

7.6.18 Satellite PRN Number (with Offset) in Unicore-defined Messages

Table 7-186 Satellite PRN Number (with Offset) in Unicore-defined Messages

GNSS	PRN
GPS	1~32
QZSS	33~42
GLONASS	43~66
Galileo	75~110
SBAS	120~158
BDS	161~223
IRNSS	67~74, 111~117

7.6.19 Signal Index

Table 7-187 Signal Index

Signal Index	Galileo	GPS
0	E1-B I/NAV OS	L1 C/A
1	E1-C	Reserved

Signal Index	Galileo	GPS
2	E1-B + E1-C	Reserved
3	E5a-I F/NAV OS	L1C(D)
4	E5a-Q	L1C(P)
5	E5a-I+E5a-Q	L1C(D+P)
6	E5b-I I/NAV OS	L2 CM
7	E5b-Q	L2 CL
8	E5b-I+E5b-Q	L2 CM+CL
9	E5-I	L2 P
10	E5-Q	Reserved
11	E5-I + E5-Q	L5 I
12	E6-B C/NAV HAS	L5 Q
13	E6-C	L5 I + L5 Q
14	E6-B + E6-C	Reserved
15	Reserved	Reserved

7.6.20 Satellite Index

Table 7-188 Satellite Index

Satellite Index	Galileo SVID	GPS PRN
0	1	1
1	2	2
…	…	…
39	40	40

7.6.21 Satellite Signals Corresponding to L1~L6

Table 7-189 Satellite Signals Corresponding to L1~L6

GNSS	Signal ID	Signal Channel
GPS	1	L1C/A

GNSS	Signal ID	Signal Channel
	2	L2P
	3	L2C
	4	L5
	5	L1C
	6	Reserved
GLONASS	1	G1C/A
	2	G1P
	3	G2C/A
	4	G2P
	5 ~ 6	Reserved
Galileo	1	E1
	2	E6
	3	E5B
	4	E5A+B
	5	E5A
	6	Reserved
QZSS	1	L1C/A
	2	LEX
	3	L2C
	4	L5
	5	L1C
	6	Reserved
BDS	1	B1
	2	B3
	3	B2
	4	B2A
	5	B2B

GNSS	Signal ID	Signal Channel
	6	B1C

7.6.22 Frequency Flag

Table 7-190 Frequency Flag

Bit	Description	Value
Bit7	Reserved	0
Bit6	Reserved	0
Bit5	BDS B2b, GPS L2P	0: not included; 1: included
Bit4	BDS B2a, GLO G3, GAL E6	0: not included; 1: included
Bit3	BDS B1C, GPS L1C	0: not included; 1: included
Bit2	GPS L5, BDS B3I, GAL E5a, IRNSS L5	0: not included; 1: included
Bit1	GPS L2C, GLO L2, BDS B2I, GAL E5b	0: not included; 1: included
Bit0	GPS L1C/A, GLO L1, BDS B1I, GAL E1	0: not included; 1: included

7.6.23 System Identifier

Table 7-191 System Identifier

Bit	Description
Bit7	0 = GPS 1 = GLONASS 2 = SBAS 3 = GAL 4 = BDS 5 = QZSS 6 = IRNSS
Bit6	
Bit5	
Bit4	
Bit3	
Bit2	
Bit1	
Bit0	

7.6.24 Frequency Identifier

Table 7-192 Frequency Identifier

<table>
<tr><th>Bit</th><th>Description</th></tr>
<tr><td>Bit7</td><td rowspan="8">GPS:
0 = L1 C/A
9 = L2P (Y)
3 = L1C pilot
11 = L1C data
6 = L5 data
14 = L5 pilot
17 = L2C (L)
BDS:
0 = B1I
4 = B1Q
8 = B1C(Pilot)
23 = B1C(Data)
5 = B2Q
17 = B2I
12 = B2a(Pilot)
28 = B2a(Data)
6 = B3Q
21 = B3I
13= B2b(I)
GLONASS:
0 = L1 C/A
5 = L2 C/A
6 = G3I
7 = G3Q
GAL:
1 = E1B
2 = E1C
12 = E5A pilot
17 = E5B pilot
18 = E6B
22 = E6C
QZSS:
0 = L1 C/A
6 = L5 data
14 = L5 pilot
17 = L2C (L)
18 = L61 Data
22 = L61 Pilot
24 = L62 Data1
25 = L62 Data2</td></tr>
<tr><td>Bit6</td></tr>
<tr><td>Bit5</td></tr>
<tr><td>Bit4</td></tr>
<tr><td>Bit3</td></tr>
<tr><td>Bit2</td></tr>
<tr><td>Bit1</td></tr>
<tr><td>Bit0</td></tr>
</table>

Bit	Description
	27 = L6E SBAS: 0 = L1 C/A 6 = L5 (I) IRNSS: 6 = L5 data 14 = L5 pilot

7.6.25 GNSS ID

Table 7-193 GNSS ID

GNSS	GNSS ID	Signal ID	Signal Channel
GPS	0 (GP)	0	All signals
		1	L1 C/A
		2	L1 P(Y)
		3	L1 M
		4	L2 P(Y)
		5	L2C-M
		6	L2C-L
		7	L5-I
		8	L5-Q
		9-F	Reserved
GLONASS	1 (GL)	0	All signals
		1	G1 C/A
		2	G1 P
		3	G2 C/A
		4	GLONASS (M) G2 P
		5-F	Reserved
Galileo	2 (GA)	0	All signals
		1	E5a
		2	E5b

GNSS	GNSS ID	Signal ID	Signal Channel
		3	E5 a+b
		4	E6-A
		5	E6-BC
		6	L1-A
		7	L1-BC
		8-F	Reserved
BDS2	3 (GB)	0	All signals
		1	B1I
		2	B1Q
		3	B1C
		4	B1A
		5	B2-a
		6	B2-b
		7	B2 a+b
		8	B3I
		9	B3Q
		A	B3A
		B	B2I
		C	B2Q
		D-F	Reserved
QZSS	4 (GQ)	0	All signals
		1	L1 C/A
		2	L1C (D)
		3	L1C (P)
		4	LIS
		5	L2C-M
		6	L2C-L

GNSS	GNSS ID	Signal ID	Signal Channel
		7	L5-I
		8	L5-Q
		9	L6D
		A	L6E
		B-F	Reserved
NavIC (IRNSS)	6 (GI)	0	All signals
		1	L5-SPS
		2	S-SPS
		3	L5-RS
		4	S-RS
		5	L1-SPS
		6-F	Reserved
BDS3	7 (BI)	0	All signals
		1	B1I
		2	B1Q
		3	B1C
		4	B1A
		5	B2-a
		6	B2-b
		7	B2 a+b
		8	B3I
		9	B3Q
		A	B3A
		B	B2I
		C	B2Q
		D-F	Reserved
RESERVED	8~15		

GNSS ID	GNSS
0	GPS
1	GLONASS
2	Galileo
3	BDS
4	QZSS
5,6	Reserved
7	BDS3
8-15	Reserved

GNSS	GNSS ID	Signal ID	Signal Channel
GPS	1 (GP)	0	All signals
		1	L1 C/A
		2	L1 P(Y)
		3	L1 M
		4	L2 P(Y)
		5	L2C-M
		6	L2C-L
		7	L5-I
		8	L5-Q
		9-F	Reserved
GLONASS	2 (GL)	0	All signals
		1	G1 C/A
		2	G1 P
		3	G2 C/A
		4	GLONASS (M) G2 P
		5-F	Reserved
Galileo	3 (GA)	0	All signals
		1	E5a

GNSS	GNSS ID	Signal ID	Signal Channel
		2	E5b
		3	E5 a+b
		4	E6-A
		5	E6-BC
		6	L1-A
		7	L1-BC
		8-F	Reserved
BDS	4 (GB)	0	All signals
		1	B1I
		2	B1Q
		3	B1C
		4	B1A
		5	B2-a
		6	B2-b
		7	B2 a+b
		8	B3I
		9	B3Q
		A	B3A
		B	B2I
		C	B2Q
		D-F	Reserved
QZSS	5 (GQ)	0	All signals
		1	L1 C/A
		2	L1C (D)
		3	L1C (P)
		4	LIS
		5	L2C-M

GNSS	GNSS ID	Signal ID	Signal Channel
		6	L2C-L
		7	L5-I
		8	L5-Q
		9	L6D
		A	L6E
		B-F	Reserved
NavIC (IRNSS)	6 (GI)	0	All signals
		1	L5-SPS
		2	S-SPS
		3	L5-RS
		4	S-RS
		5	L1-SPS
		6-F	Reserved
RESERVED	7 to F		

8 Other Commands

8.1 FRESET : Clear NVM Data and Restart the Receiver

This command is used to clear all user-specified configurations, satellite ephemerides, and position information stored in the non-volatile memory (NVM), and reset the baud rate to 115200 bps. This command will force a restart of the receiver.

Syntax

```
FRESET
```

ASCII Syntax

```
FRESET
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 8-1 Parameter of the FRESET Command

Header	Parameter	Description
FRESET	-	Clear the saved configurations, satellite ephemerides, position information, and reset the baud rate to 115200 bps.

8.2 RESET: Restart the Receiver

This command can be used to restart the receiver or reset the receiver and to clear the satellite ephemerides, position information, satellite almanacs, ionosphere parameters and UTC parameters saved in the receiver.

Syntax

```
RESET <parameter>
```

ASCII Syntax

```
RESET
```

```
RESET EPHEM
```

```
RESET EPHEM ALMANAC IONUTC POSITION XOPARAM
```

```
RESET ALL
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S

Table 8-2 Parameters of the RESET Command

Header	Parameter	Description
RESET	-	Restart the receiver
	EPHEM	Restart the receiver and clear the ephemeris
	CONFIG	Restart the receiver and clear the configuration except for serial port, SIGNALGROUP, LOGLIST and STANDBY configuration.
	IONUTC	Restart the receiver and clear the ionosphere and UTC parameters
	ALMANAC	Restart the receiver and clear the almanac
	POSITION	Restart the receiver and clear the position
	XOPARAM or CLOCKDRIFT	Restart the receiver and clear the crystal oscillator information
	ALL	Restart the receiver and clear all the information above, except for XOPARAM or CLOCKDRIFT

Note:

- When the signal is switched from simulator to real application scenario, it is recommended to clear the ephemeris (EPHEM), almanac (ALMANAC), ionosphere and UTC parameters (IONUTC), and the position (POSITION) of the receiver; otherwise, there might be no fix or the fix might be abnormal.
- If the antenna and RF link are normal, but the module cannot fix the position for a long time, you can use the XOPARAM or CLOCKDRIFT command to clear the crystal oscillator information to make the receiver compute solution again.

8.3 SAVECONFIG: Save Configuration into NVM

This command saves the current configuration into non-volatile memory (NVM), including LOG messages (except for those triggered by ONCE), port configuration, etc.

Syntax

```
SAVECONFIG
```

ASCII Syntax

```
SAVECONFIG
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 8-3 Parameter of the SAVECONFIG Command

Header	Parameter	Description
SAVECONFIG	-	Save the current configuration into non-volatile memory (NVM)

8.4 UNLOG: Stop Message Output

This command is used to stop the serial port outputting specific messages. Both `<message>` and `<port>` can be configured. If the `<port>` is not specified, it will stop the current port by default. If the `<message>` is not specified, it will stop all message output.

Syntax

```
UNLOG <port> <message>
```

ASCII Syntax

Stop the current port outputting all messages

```
UNLOG
```

Stop the current port outputting GPGGA message

```
UNLOG GPGGA
```

Stop COM1 outputting all messages

```
UNLOG COM1
```

Stop COM2 outputting GPGGA message

```
UNLOG COM2 GPGGA
```

Applicable Products: UM960, UMD960, UM960L, UM980, UMD980, UB9A0, UBD9A0, UM982, UMD982, UM981, UMD981, UM981S, UMD981S, UM980C

Table 8-4 Parameters of the UNLOG Command

Header	Port	Message
UNLOG	COM1 COM2 COM3	Message to be stopped

9 Appendix

- Appendix 1: 32-bit CRC
- Appendix 2: RTCM V3 Differential Corrections
- Appendix 3: BINEX Data Stream
- Appendix 4: Event Output

Appendix 1: 32-bit CRC

The ASCII and binary format log messages all contain a 32-bit CRC to ensure the validity of data reception and transmission. The following example shows the C programming language that generates CRC:

const ULONG aulCrcTable[256] =

{

0x00000000UL, 0x77073096UL, 0xee0e612cUL, 0x990951baUL, 0x076dc419UL, 0x706af48fUL,

0xe963a535UL, 0x9e6495a3UL, 0x0edb8832UL, 0x79dcb8a4UL, 0xe0d5e91eUL, 0x97d2d988UL,

0x09b64c2bUL, 0x7eb17cbdUL, 0xe7b82d07UL, 0x90bf1d91UL, 0x1db71064UL, 0x6ab020f2UL,

0xf3b97148UL, 0x84be41deUL, 0x1adad47dUL, 0x6ddde4ebUL, 0xf4d4b551UL, 0x83d385c7UL,

0x136c9856UL, 0x646ba8c0UL, 0xfd62f97aUL, 0x8a65c9ecUL, 0x14015c4fUL, 0x63066cd9UL,

0xfa0f3d63UL, 0x8d080df5UL, 0x3b6e20c8UL, 0x4c69105eUL, 0xd56041e4UL, 0xa2677172UL,

0x3c03e4d1UL, 0x4b04d447UL, 0xd20d85fdUL, 0xa50ab56bUL, 0x35b5a8faUL, 0x42b2986cUL,

0xdbbbc9d6UL, 0xacbcf940UL, 0x32d86ce3UL, 0x45df5c75UL, 0xdcd60dcfUL, 0xabd13d59UL,

0x26d930acUL, 0x51de003aUL, 0xc8d75180UL, 0xbfd06116UL, 0x21b4f4b5UL, 0x56b3c423UL,

0xcfba9599UL, 0xb8bda50fUL, 0x2802b89eUL, 0x5f058808UL, 0xc60cd9b2UL, 0xb10be924UL,

0x2f6f7c87UL, 0x58684c11UL, 0xc1611dabUL, 0xb6662d3dUL, 0x76dc4190UL, 0x01db7106UL,

0x98d220bcUL, 0xefd5102aUL, 0x71b18589UL, 0x06b6b51fUL, 0x9fbfe4a5UL, 0xe8b8d433UL,

0x7807c9a2UL, 0x0f00f934UL, 0x9609a88eUL, 0xe10e9818UL, 0x7f6a0dbbUL, 0x086d3d2dUL, 0x91646c97UL, 0xe6635c01UL, 0x6b6b51f4UL, 0x1c6c6162UL, 0x856530d8UL, 0xf262004eUL,

0x6c0695edUL, 0x1b01a57bUL, 0x8208f4c1UL, 0xf50fc457UL, 0x65b0d9c6UL, 0x12b7e950UL,

0x8bbeb8eaUL, 0xfcb9887cUL, 0x62dd1ddfUL, 0x15da2d49UL, 0x8cd37cf3UL, 0xfbd44c65UL,

0x4db26158UL, 0x3ab551ceUL, 0xa3bc0074UL, 0xd4bb30e2UL, 0x4adfa541UL, 0x3dd895d7UL,

0xa4d1c46dUL, 0xd3d6f4fbUL, 0x4369e96aUL, 0x346ed9fcUL, 0xad678846UL, 0xda60b8d0UL,

0x44042d73UL, 0x33031de5UL, 0xaa0a4c5fUL, 0xdd0d7cc9UL, 0x5005713cUL, 0x270241aaUL,

0xbe0b1010UL, 0xc90c2086UL, 0x5768b525UL, 0x206f85b3UL, 0xb966d409UL, 0xce61e49fUL,

0x5edef90eUL, 0x29d9c998UL, 0xb0d09822UL, 0xc7d7a8b4UL, 0x59b33d17UL, 0x2eb40d81UL,

0xb7bd5c3bUL, 0xc0ba6cadUL, 0xedb88320UL, 0x9abfb3b6UL, 0x03b6e20cUL, 0x74b1d29aUL,

0xead54739UL, 0x9dd277afUL, 0x04db2615UL, 0x73dc1683UL, 0xe3630b12UL, 0x94643b84UL,

0x0d6d6a3eUL, 0x7a6a5aa8UL, 0xe40ecf0bUL, 0x9309ff9dUL, 0x0a00ae27UL, 0x7d079eb1UL,

0xf00f9344UL, 0x8708a3d2UL, 0x1e01f268UL, 0x6906c2feUL, 0xf762575dUL, 0x806567cbUL,

0x196c3671UL, 0x6e6b06e7UL, 0xfed41b76UL, 0x89d32be0UL, 0x10da7a5aUL, 0x67dd4accUL,

0xf9b9df6fUL, 0x8ebeeff9UL, 0x17b7be43UL, 0x60b08ed5UL, 0xd6d6a3e8UL, 0xa1d1937eUL,

0x38d8c2c4UL, 0x4fdff252UL, 0xd1bb67f1UL, 0xa6bc5767UL, 0x3fb506ddUL, 0x48b2364bUL,

0xd80d2bdaUL, 0xaf0a1b4cUL, 0x36034af6UL, 0x41047a60UL, 0xdf60efc3UL, 0xa867df55UL,

0x316e8eefUL, 0x4669be79UL, 0xcb61b38cUL, 0xbc66831aUL, 0x256fd2a0UL, 0x5268e236UL, 0xcc0c7795UL, 0xbb0b4703UL, 0x220216b9UL, 0x5505262fUL, 0xc5ba3bbeUL, 0xb2bd0b28UL,

0x2bb45a92UL, 0x5cb36a04UL, 0xc2d7ffa7UL, 0xb5d0cf31UL, 0x2cd99e8bUL, 0x5bdeae1dUL,

0x9b64c2b0UL, 0xec63f226UL, 0x756aa39cUL, 0x026d930aUL, 0x9c0906a9UL, 0xeb0e363fUL,

0x72076785UL, 0x05005713UL, 0x95bf4a82UL, 0xe2b87a14UL, 0x7bb12baeUL, 0x0cb61b38UL,

0x92d28e9bUL, 0xe5d5be0dUL, 0x7cdcefb7UL, 0x0bdbdf21UL, 0x86d3d2d4UL, 0xf1d4e242UL,

0x68ddb3f8UL, 0x1fda836eUL, 0x81be16cdUL, 0xf6b9265bUL, 0x6fb077e1UL, 0x18b74777UL,

0x88085ae6UL, 0xff0f6a70UL, 0x66063bcaUL, 0x11010b5cUL, 0x8f659effUL, 0xf862ae69UL,

0x616bffd3UL, 0x166ccf45UL, 0xa00ae278UL, 0xd70dd2eeUL, 0x4e048354UL, 0x3903b3c2UL,

0xa7672661UL, 0xd06016f7UL, 0x4969474dUL, 0x3e6e77dbUL, 0xaed16a4aUL, 0xd9d65adcUL,

0x40df0b66UL, 0x37d83bf0UL, 0xa9bcae53UL, 0xdebb9ec5UL, 0x47b2cf7fUL, 0x30b5ffe9UL,

0xbdbdf21cUL, 0xcabac28aUL, 0x53b39330UL, 0x24b4a3a6UL, 0xbad03605UL, 0xcdd70693UL,

0x54de5729UL, 0x23d967bfUL, 0xb3667a2eUL, 0xc4614ab8UL, 0x5d681b02UL, 0x2a6f2b94UL,

0xb40bbe37UL, 0xc30c8ea1UL, 0x5a05df1bUL, 0x2d02ef8dUL

};

// Calculate and return the CRC for usA binary buffer

ULONG CalculateCRC32(UCHAR *szBuf, INT iSize)

{

int iIndex;

ULONG ulCRC = 0;

for (iIndex=0; iIndex<iSize; iIndex++)

```
{
ulCRC = aulCrcTable[(ulCRC ^ szBuf[iIndex]) & 0xff] ^ (ulCRC >> 8);
}
return ulCRC;
}
```

Appendix 2: RTCM V3 Differential Corrections

The RTCM recommended standards for differential GNSS (Global Navigation Satellite Systems) services - Version 3. Information in Version 3.0 and 3.2 is partly supported in this protocol. For more details, please refer to http://www.rtcm.org/overview.php.

This chapter complies with RTCM standard format, including 1004, 1006, 1007, 1012, 1019, 1033, and 1104, which are defined as RTCM1004, RTCM1006, RTCM1007, RTCM1012, RTCM1019, RTCM1033, and RTCM1104.

Syntax

```
RTCM <message ID> <output rate>
```

Example

```
RTCM1005 1      // Output RTCM1005 at the rate of 1 Hz
RTCM1033 1      // Output RTCM1033 at the rate of 1 Hz
RTCM1019 60     // Output RTCM1019 every 60 s
RTCM1074 0.2    // Output RTCM1074 at the rate of 5 Hz
```

Supported RTCM V3 messages

Group 1 – Observables

```
RTCM1001 GPS RTK L1 observables
RTCM1002 GPS RTK L1 observables, extended
RTCM1003 GPS RTK L1 and L2 observables
RTCM1004 GPS RTK L1 and L2 observables, extended
RTCM1009 GLONASS RTK L1 observables
RTCM1010 GLONASS RTK L1 observables, extended
RTCM1011 GLONASS RTK L1 and L2 observables
```

RTCM1012 GLONASS RTK L1 and L2 observables, extended

RTCM1074 GPS MSM4 (Full GPS Pseudoranges and PhaseRanges plus CNR)

RTCM1075 GPS MSM5 (Full GPS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR)

RTCM1084 GLONASS MSM4 (Full GLONASS Pseudoranges and PhaseRanges plus CNR)

RTCM1085 GLONASS MSM5 (Full GLONASS Pseudoranges, PhaseRanges, PhaseRangeRate and CNR)

RTCM1123 BDS MSM3 (Compact BeiDou Pseudoranges and PhaseRanges)

RTCM1124 BDS MSM4 (Full BeiDou Pseudoranges and PhaseRanges plus CNR)

RTCM1125 BDS MSM5 (Full BeiDou Pseudoranges, PhaseRanges, PhaseRangeRate and CNR)

RTCM1126 BDS MSM6 (Full BeiDou Pseudoranges and PhaseRanges plus CNR (high resolution))

RTCM1127 BDS MSM7 (Full BeiDou Pseudoranges, PhaseRanges, PhaseRangeRate and CNR (high resolution))

RTCM1104 BDS RTK observables (Defined by the industry in China, which should not be mixed with other definitions such as SBAS)

Group 2 – Base station coordinates

RTCM1005 RTK base station antenna reference point (ARP) coordinates

RTCM1006 RTK base station ARP coordinates with antenna height

Group 3 – Base station antenna description

RTCM1007 Antenna description and installation information (only coding is supported currently)

Group 4 – Auxiliary information

RTCM63 BDS ephemerides (testing message)

RTCM1042 BDS ephemerides

RTCM1019 GPS ephemerides

RTCM1020 GLONASS ephemerides

RTCM1045 GALILEO F/NAV ephemerides

RTCM1046 GALILEO I/NAV ephemerides

RTCM1033 Receiver and antenna descriptors

RTCM1105 Internal heading application: the heading receiver transmits heading information to the rover receiver (Unicore-defined)

Appendix 3: BINEX Data Stream

BINEX is a binary "RINEX"-style format developed under the leadership of UNAVCO, a U.S.-based organization. It is primarily used for real-time transmission of GNSS observation data streams from CORS (Continuously Operating Reference Stations) and GBAS (Ground-Based Augmentation Systems). For detailed format specifications, please refer to the official documentation on the UNAVCO website (http://binex.unavco.org/binex.html).

Certain Unicore GNSS receivers support BINEX output for ephemeris data of GPS, GLONASS, Galileo, BDS, QZSS, and IRNSS, as well as raw observation data. The encoding employs an Enhanced CRC (Cyclic Redundancy Check) method for error detection.

> Note:
> Currently, only the UB9A0 and UBD9A0 models support BINEX data output. Among them, the UBD9A0 is a BDS-only product and supports only BDS ephemeris and raw observation data output.

Syntax

> BINEX <Message ID> <Request Rate>

Example

Output GPS ephemeris data whenever it changes

```
BINEX0101 ONCHANGED
```

Output OBSVM observation data at 1 Hz

```
BINEX7F05 1
```

> Tip:
> Message output rates support two modes—ONTIME and ONCHANGED. For ephemeris-related messages, which typically involve larger data volumes, it is recommended to use the ONCHANGED mode.

Table 9-1 BINEX Output

BINEX Record ID	Subrecord	Description	Log Information
0x01		Ephemeris information	
	0x01	GPS ephemeris	BINEX0101
	0x02	GLONASS ephemeris	BINEX0102
	0x04	Galileo ephemeris	BINEX0104
	0x05	BDS ephemeris	BINEX0105
	0x06	QZSS ephemeris	BINEX0106
	0x07	IRNSS ephemeris	BINEX0107
0x7F		GNSS observations	
	0x05	GNSS pseudorange, carrier phase and other raw observations	BINEX7F05

Appendix 4: Event Output

(1) EVENTFLAG: EVENT Position Information

This log outputs the absolute time and relative time when the EVENT happens, supporting ASCII/ABBASCII/Binary format and the `ONCE`/`ONCHANGED` trigger. It must be used in conjunction with the GGA output.

Message ID : 312

Syntax

```
EVENTFLAG <parameter>
```

ASCII Syntax

```
EVENTFLAGB ONCHANGED
```

```
EVENTFLAGA ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UM982, UMD982

Output

```
#EVENTFLAGA,97,GPS,FINE,2227,210352000,0,0,18,0;2,43,0,0,2227,210351,999532091,0,-1,-1*405dd7fe
```

Table 9-2 EVENTFLAG Data Structure

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
1	EVENTFLAG header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4) **Note:** The time in the header is obtained by rounding the time of the event.		H	0
2	eventID	Event ID (Event 1 or Event	UCHAR	1	H

ID	Field	Data Description	Format	Binary Bytes	Binary Offset
		2)			
3	Status*	Status of the module, see Table STATUS Bit Description	UCHAR	1	H+1
4	Reserved	Reserved	UCHAR	1	H+2
5	Reserved	Reserved	UCHAR	1	H+3
6	week	Week	UINT	4	H+4
7	second	Second	UINT	4	H+8
8	subSecond	Nanosecond	UINT	4	H+12
9	Reserved	Reserved		4	H+16
10	offset_second	Based on the output rate of GGA, this value refers to the offset between the time of EVENT and its closest absolute time output by GGA (second). If this value is invalid, the output is -1.	INT	4	H+20
11	offset_SubSecond	Based on the output rate of GGA, this value refers to the offset between the time of EVENT and its closest absolute time output by GGA (nanosecond). If this value is invalid, the output is -1.	INT	4	H+24
12	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+28
13	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

Table 9-3 STATUS Bit Description

Bit	Description
Bit0	Validity flag of seconds of week: 0=invalid; 1=valid

Bit	Description
Bit1	Validity flag of PPS: 0=invalid; 1=valid
Bit2	Reserved
Bit3	Validity flag of week: 0=invalid; 1=valid
Bit4	Reserved

(2) EVENTSLN: EVENT Position and Time Information

This log outputs the time, position, velocity and solution status when the EVENT happens. The EVENTSLN command must be used in conjunction with the GGA output.

Message ID: 311

Syntax

```
EVENTSLN <parameter>
```

ASCII Syntax

Output EVENTSLN message on changed at the current port

```
EVENTSLNB ONCHANGED
```

Output EVENTSLN message on changed at the current port

```
EVENTSLNA ONCHANGED
```

Applicable Products: UM980, UMD980, UB9A0, UM982, UMD982

Output

```
#EVENTSLNA,97,GPS,FINE,2227,210381000,0,0,18,0;2,43,0,0,2227,210380,999532081,0,-1,-1,SOL_CO
MPUTED,SINGLE,40.07896911523,116.23651480774,67.0271,-8.4925,WGS84,1.7728,1.6873,4.7070,4
8,0.000,0.000,50,28,0,0,-0.009,-0.004,-0.116*8f231ab8
```

Table 9-4 EVENTSLN Data Structure

ID	Field	Description	Format	Binary Bytes	Binary Offset
1	eventsln header	Log header. See Table Binary Header Structure (N4) and Table ASCII Header Structure (N4) **Note**: The time in the header is obtained by rounding the time of the event.		H	0
2	eventID	Event ID (Event 1 or Event 2)—only Event 1 is supported currently	UCHAR	1	H
3	Status*	Status of the module, see Table STATUS Bit Description	UCHAR	1	H+1
4	Reserved	Reserved	UCHAR	1	H+2
5	Reserved	Reserved	UCHAR	1	H+3
6	week	Week	UINT	4	H+4
7	second	Second	UINT	4	H+8
8	subSecond	Nanosecond	UINT	4	H+12
9	reserved2	Reserved		4	H+16
10	offset_second	Based on the output rate of GGA, this value refers to the offset between the time of EVENT and its closest absolute time output by GGA (second). If this value is invalid, the output is -1.	INT	4	H+20
11	offset_subSecond	Based on the output rate of GGA, this value refers to the offset between the time of EVENT and its closest absolute time output by GGA (nanosecond). If this	INT	4	H+24

ID	Field	Description	Format	Binary Bytes	Binary Offset
		value is invalid, the output is -1.			
12	sol status	Solution status, see Table Solution Status	Enum	4	H+28
13	pos type	Position type, see Table Position or Velocity Type	Enum	4	H+32
14	lat	Latitude, deg	Double	8	H+36
15	lon	Longitude, deg	Double	8	H+44
16	hgt	Height above mean sea level, m	Double	8	H+52
17	undulation	Undulation—the distance between the geoid and the WGS84 ellipsoid, m	Float	4	H+60
18	datum id#	Datum ID, only WGS84 is supported currently	Enum	4	H+64
19	lat σ	Latitude standard deviation, m	Float	4	H+68
20	lon σ	Longitude standard deviation, m	Float	4	H+72
21	hgt σ	Height standard deviation, m	Float	4	H+76
22	stn id	Base station ID	Char[4]	4	H+80
23	diff_age	Differential data age, s	Float	4	H+84
24	sol_age	Solution age, s	Float	4	H+88
25	#SVs	Number of satellites tracked	Uchar	1	H+92
26	#solnSVs	Number of satellites used in solution	Uchar	1	H+93
27	reserved	Reserved	Uchar	1	H+94
28	reserved	Reserved	Uchar	1	H+95
29	EastVel	East velocity in Geographic Coordinate	Float	4	H+96

ID	Field	Description	Format	Binary Bytes	Binary Offset
		System, accurate to three decimal places, km/h (null if no value)			
30	northVel	North velocity in Geographic Coordinate System, accurate to three decimal places, km/h (null if no value)	Float	4	H+100
31	upVel	Vertical velocity in Geographic Coordinate System, accurate to three decimal places, km/h (null if no value)	Float	4	H+104
32	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+108
33	[CR][LF]	Sentence terminator (ASCII only)			

1. The 50 Hz output rate is supported by specific product and specific firmware. ↩ ↩
2. The "0" in parameter "V410" cannot be omitted. ↩
3. UM981S currently does not support the command `CONFIG PPP ENABLE AUTO/L6MDCPPP`. ↩
4. The horizontal STD is recommended to be set above 10 cm, and the vertical STD above 15 cm. ↩ ↩
5. UM960L doesn't support `ENABLE2` or `ENABLE3`. ↩
6. Firmware supporting CLAS is required and L6D signal is supported in `SIGNALGROUP 10` mode of UM980C & UM981C, and in `SIGNALGROUP 3` and `SIGNALGROUP 6` modes of UM982. ↩ ↩
7. 50 Hz output frequency is supported on specific firmware. ↩
8. If the log header is `$GNGNS` and more than one satellite systems are used in differential mode, the differential data age (field 12) and differential base station ID (field 13) are null. ↩ ↩ ↩ ↩ ↩ ↩

9. The command will be supported on UM982. ↩

10. `ANT2GROUP` will be supported on UM982 subsequent versions. ↩

11. Not supported on Build7160 and Build7676. ↩

12. 10 If UTC time is unknown, the values of month and day are both 0s. ↩ ↩

13. The maximum value is 60999 when leap second is used. ↩

14. Indicates that leap second is used as default due to the lack of almanac. ↩

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