HIGH PRECISION

COMMANDS AND LOGS

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NebulasIV

High Precision Products

Revision History

Version	Revision History	Date
R1.0	First release	2022-10
R1.1	• Add new commands, including CONFIG MMP, CONFIG SIGNALGROUP, CONFIG IONMODE, CONFIG RTCMPHASERATE, GPHPR2, GPTRA2, GPROT2 • IRNSS L5 is supported in the following messages: MASK, UNMASK, and NMEA messages • CONFIG JAMMING is replaced by CONFIG ANTIJAM • Chapter 5.2: Add MASK RTCMCN0/CN0 configuration • Chapter 3.6: Add more details in the rover station mode • Chapter 4.10: Add SBAS timeout configuration • Optimize the description of CONFIG PPS ENABLE & ENABLE2 • Chapter 3.4: Update the default value of the horizontal and vertical error tolerance of average position • Optimize the description of CONFIG HEADING TRACTOR • Add Chapter 7.3 Unicore Data Output Commands	2023-05

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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.

List of Abbreviations

RTK

GPS

BDS

GLO

Contents

Tables

1 Frequently Used Commands

Unicore high precision products support the input of commands in abbreviated ASCII format. This format has no CRC and is convenient to use.

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.

Frequently used commands are listed below:

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, 460800, 921600.
unlog	Disable all outputs from the port in use
saveconfig	Save configurations

Command Name	Description
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 at 1Hz. Users can set both of the message type and update rate. 1, 0.5, 0.2, 0.1 corresponds to 1Hz, 2Hz, 5Hz, 10Hz respectively. Message types include GGA, RMC, ZDA, and VTG.

Command Name	Description
gpths comx 1	Output the heading message THS at the time.

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 to: UM960, UM960L, UM982, UM980

When the precise coordinates are known, input the following commands 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 the table below.

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 are:

MODE ROVER
SAVECONFIG

Applicable to: UM960, UM960L, UM980, UM982

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 3-1 Heading Schematic for the details.

Frequently used commands are:

GPTHS 1
SAVECONFIG

Applicable to: UM982

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 3-1 Heading Schematic for the details.

Frequently used commands are:

MODE HEADING2
GPTHS2 ONCHANGED
SAVECONFIG

Applicable to: UM960, UM980, UM982

2 Unicore 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/UM960L/UM980 /UM982
		Query the receiver's operating mode	UM960/UM960L/UM980 /UM982
2	CONFIG	Configure the receiver's functions/interfaces	UM960/UM960L/UM980 /UM982
		Query the receiver's configuration	UM960/UM960L/UM980 /UM982
3	MASK	Set satellite system, frequency, and elevation angle tracked by the receiver	UM960/UM960L/UM980 /UM982
		Query satellite system, frequency, and elevation angle tracked by the receiver	UM960/UM960L/UM980 /UM982
4	AGNSS	Input assisted position and assisted time information	UM982/UM980
5	Data output commands	Request the output of positioning information, heading, etc.	UM960/UM960L/UM980 /UM982
6	Other commands	Save configuration, reset to factory settings, etc.	UM960/UM960L/UM980 /UM982

3 MODE Command

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 of the Command:

MODE [mode] [parameters]

Abbreviated ASCII Syntax:

MODE BASE 40.45628476579 116.2859754968 58.0984

MODE ROVER

Applicable to: UM960, UM960L, UM980, UM982

Table 3-1 Receiver Operating Mode List

No.	Mode	Description
1	BASE	Set the receiver to work in base station mode
2	ROVER	Set the receiver to work in rover station mode
3	HEADING2	Set the receiver to work in heading mode

3.1 Query the Receiver's Operating Mode

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

Syntax of the Command:

MODE

Abbreviated ASCII Syntax:

MODE

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 3-2 Query the Receiver's Operating Mode

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

Table 3-3 MODE Message Structure

ID	Field Type	Data Description
1	Header	Log header, see Table 7-49 ASCII Header Structure
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.

ID	Field Type	Data Description
4	xxxx	32-bit CRC
5	[CR][LF]	Sentence terminator (ASCII only)

3.2 Fixed Base Station with Precise Coordinates

This 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.

Syntax of the Command:

MODE BASE [ID] [param1 param2 param3]

Abbreviated ASCII Syntax:

MODE BASE 40.45628476579 116.2859754968 58.0984

MODE BASE -2160489.0276 4383620.1006 4084738.1110

Applicable to: UM960, UM960L, UM980, UM982

Table 3-4 Base Station Mode with Fixed Coordinates

Command	Mode	ID	Parameter	Description
MODE	BASE	Base station ID, integer between 0~4095 (can be omitted)[1]	param1	Latitude coordinate in Geodetic Coordinate System, in degrees, -90 ≤ param1 ≤ 90 (11 significant digits)
				The X-axis coordinate in ECEF Coordinate System, in meters, param1 < -90 or param1 > 90 (4 significant digits)

[1] Restricted to RTCM3.2 only

Command	Mode	ID	Parameter	Description
			param2	Longitude coordinate in Geodetic Coordinate System, in degrees, -180 ≤ param2 ≤ 180 (11 significant digits)
				The Y-axis coordinate in ECEF Coordinate System, in meters, param2 < -180 or param2 > 180 (4 significant digits)
			param3	Altitude, in meters, -30000 ≤ param3 ≤ 30000 (6 significant digits)
				The Z-axis coordinate in ECEF Coordinate System, in meters, Param3 < -30000 or Param3 > 30000 (4 significant digits)

3.3 Self-optimizing Base Station Mode

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

Syntax of the Command:

MODE BASE [ID] TIME [T] [Distance]

Abbreviated ASCII Syntax:

MODE BASE TIME 60

MODE BASE TIME 60 5

MODE BASE 1 TIME 60

Applicable to: UM960, UM960L, UM980, UM982

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

Command	Mode	ID	Name	Parameter	Description
MODE	BASE	Integer between 0~4095 (can be omitted)	Time	T	Maximum time to calculate the average position, in seconds, cannot be a negative value. The convergence time is counted from the position fix with good quality rather than from the first position fix.
				Distance	Distance, in meters. The receiver starts in self-optimizing base station mode and saves the optimized position in Flash. 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 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.

3.4 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.

Syntax of the Command:

MODE BASE

Abbreviated ASCII Syntax:

MODE BASE

Applicable to: UM960, UM960L, UM980, UM982

Table 3-6 Base Station Mode with Default Parameters

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

3.5 Base Station ID

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

Syntax of the Command:

MODE BASE [ID]

Abbreviated ASCII Syntax:

MODE BASE 1

Applicable to: UM960, UM960L, UM980, UM982

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.

3.6 Rover Station Mode

This command is used to set the operating mode of the receiver as a rover station in different application scenarios. When [parameter 2] is null, the mode is default.

Syntax of the Command:

MODE ROVER [parameter 1] [parameter 2 (optional)]

Abbreviated ASCII Syntax:

MODE ROVER UAV

MODE ROVER SURVEY

MODE ROVER SURVEY MOW

Applicable to: UM960, UM980, UM982

☞ Applicable to UM980 Build7923 and later versions.

☞ Applicable to UM982 Build7650 and later versions.

Table 3-8 Rover Station Mode Parameters

Command	Parameter 1	Parameter 2	Description
MODE ROVER	UAV	DEFAULT	UAV default mode
		FORMATION	UAV formation mode
	SURVEY	DEFAULT	Default mode of precision surveying
		MOW	Lawn mower mode
	AUTOMOTIVE	DEFAULT	Default automotive mode

1. UAV dynamic mode (UAV): This mode is suitable for most UAV application scenarios, 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.
2. Automotive dynamic mode (AUTOMOTIVE): 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.

3. Precision surveying mode (SURVEY): 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.
4. 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	SURVEY	Precision surveying mode
UM982	UAV	UAV dynamic mode
UM960	SURVEY MOW	Lawn mower mode

3.7 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 3-1 Heading Schematic.

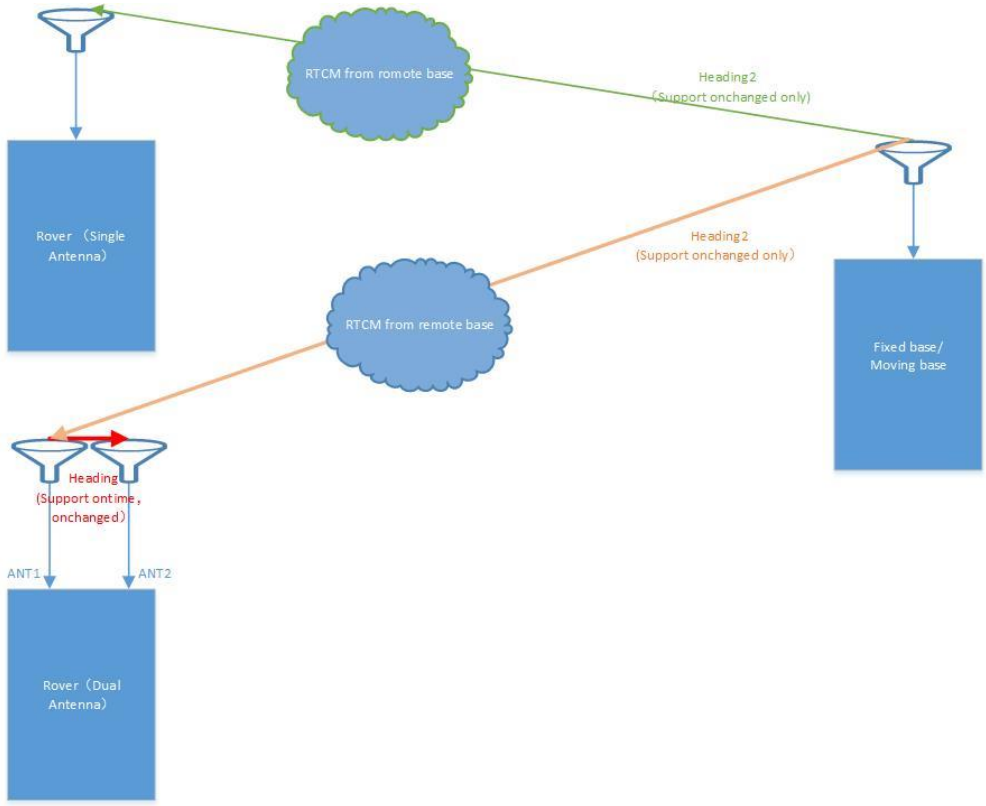

Figure 3-1 Heading Schematic

Syntax of the Command:

MODE HEADING2 [parameter]

Abbreviated ASCII Syntax:

MODE HEADING2

MODE HEADING2 FIXLENGTH

MODE HEADING2 VARIABLELENGTH

MODE HEADING2 STATIC

MODE HEADING2 LOWDYNAMIC

Applicable to: UM960, UM980, UM982

Table 3-10 Heading2 Mode Parameter

Command	Mode	Parameter	Description
MODE	HEADING2	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 stationary state. (The default mode is FIXLENGTH when the parameter of mode heading2 is empty.)
		STATIC	Enable Heading2 mode. Both antennas of the moving base station and the heading 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.
		TRACTOR	For agricultural machinery, operating mode.

4 CONFIG Command

CONFIG is the header of the commands that are used to set the serial port, PPS, geoid undulation, DGNSS, RTK, etc. It supports the following configurations:

1) Serial port
2) PPS
3) Geoid undulation
4) DGPS
5) RTK
6) Heading
7) Heading2
8) SBAS
9) EVENT

...

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 (/), and backslashes (\\). Other characters appeared in the command cannot be decoded.

Syntax:

CONFIG [device/function] [parameter]

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

Applicable to: UM960, UM960L, UM980, UM982

Table 4-1 Configuration List

No.	Configuration Item	Description
1	COM1	Serial port configuration related to COM1, such as baud rate and parity bit

No.	Configuration Item	Description
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	PPS	PPS configuration: set the output period, pulse width, rising edge and falling edge
5	EVENT	Reserved temporarily
6	UNDULATION	Geoid undulation configuration: input a specific undulation value or use the built-in geoid grid
7	RTK	RTK configuration, such as setting the mode and the maximum age of RTK data
8	DGPS	DGPS configuration, such as setting the maximum age of DGPS data

4.1 Query the Receiver's Configuration

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

Syntax of the Command:

CONFIG

Input Example:

CONFIG

Applicable to: UM960, UM960L, UM980, UM982

Message 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

Note: CONFIG can query the current configuration of the receiver, including default configurations.

4.2 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 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 of the Command:

CONFIG [serial port number] [serial port property parameter]

Input Example:

CONFIG COM1 115200

CONFIG COM1 115200 8 n 1

Applicable to: UM960, UM960L, UM980, UM982

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 4-4 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 current products only support N.
		4	Stop bits	Set the stop bits of the serial port. Please make sure that the preceding parameters are not empty before setting this field. Note: One or two stop bits are supported in data transmission. The current products only support 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

4.3 PPS 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 of the Command:

CONFIG PPS [parameter]

Input Example:

CONFIG PPS ENABLE GPS POSITIVE 500000 1000 0 0

Applicable to: UM960, UM960L[2], UM980, UM982

Table 4-5 Enable/Disable PPS

Header	Configuration Item	Enable/ Disable	Description
CONFIG	PPS	DISABLE	Disable PPS output.
		ENABLE (default)	Enable PPS output. The receiver outputs PPS after the position is fixed and the PPS is converged. If there is loss of lock on satellite signals and the receiver stops positioning, the PPS output would maintain for about 1 minute.
		ENABLE2	Enable PPS output. The receiver keeps PPS output after the time is valid, and the PPS accuracy is within ±100 ms. When the PPS is converged, the receiver will align its clock to the GNSS time and the bias of PPS ENABLE2 is the same as that of PPS ENABLE configuration.
		ENABLE3	Enable PPS output after the receiver starts to work.

[2] UM960L does not support ENABLE2 and ENABLE3.

Table 4-6 PPS Configuration

Header	Configuration Item	Enable/ Disable	Parameter	ASCII Value	Description
CONFIG	PPS	DISABLE	-	-	Disable PPS. It is not followed by any parameters.
		ENABLE (default)/ ENABLE2/ ENABLE3	Timeref	GPS/BDS/ GAL/GLO	Time reference. BDST, GPST, GLOST and GALST are supported currently.
			polarity	POSITIVE	Pulse polarity, active high triggered by the rising edge
				NEGATIVE	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 (nanoseconds)

4.4 UNDULATION Configuration

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

☞ When setting the receiver to work in base station mode, you should configure the UNDULATION first.

Syntax of the Command:

CONFIG UNDULATION [parameter]

Input Example:

CONFIG UNDULATION 9.7

Applicable to: UM960, UM960L, UM980, UM982

Table 4-7 Undulation Configuration

Header	Configuration Item	Parameter	Description
CONFIG	UNDULATION	Auto	Use the built-in grid of geoid undulation (default)
		Separation (m)	Use the user-specified geoid undulation, ranging from -1000.0000 m to +1000.0000 m, four digits after the decimal point

4.5 DGPS Configuration

This command is used to set the maximum age of the differential data received from the base station. The differential data older than the specified age will be ignored, which can be used to disable DGPS positioning calculation.

Syntax of the Command:

CONFIG DGPS [parameter]

Input Example:

CONFIG DGPS TIMEOUT 100

Applicable to: UM960, UM960L, UM980, UM982

Table 4-8 DGPS Configuration

Header	Configuration Item	Parameter	Value	Description
CONFIG	DGPS	TIMEOUT	0	Disable DGPS positioning
			1-1800	Maximum age of differential data (default = 300), in seconds, integers only

4.6 RTK Configuration

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

Syntax of the Command:

CONFIG RTK [parameter]

CONFIG RTK RELIABILITY [parameter 1] [parameter 2]

Input Example:

CONFIG RTK TIMEOUT 60

CONFIG RTK RELIABILITY 3 1

Applicable to: UM960, UM960L, UM980, UM982

Table 4-9 RTK Configuration

Header	Configuration Item	Parameter	Description	
CONFIG	RTK	TIMEOUT	0	Disable RTK function
			1-1800	Maximum age of RTK data*, in seconds. Versions without standalone authorization support 600 s at most.
		RELIABILITY	RTK reliability threshold: 1: Low reliability 2: Normal reliability 3: Relatively high reliability (**default**) 4: High reliability	

Header	Configuration Item	Parameter	Description
		USER_DEFAULTS	RTK dynamic mode (**default**)
		RESET	Reset RTK solution
		DISABLE	Stop calculating RTK results, including float solution and fixed solution

* The default RTK TIMEOUT of UM982 is 600s, and that of UM980 is 120s.

Table 4-10 RTK Reliability Configuration

Header	Configuration Item	Parameter	Description
CONFIG	RTK RELIABILITY	Parameter 1: Reliability threshold of the RTK positioning engine	1: Low reliability 2: Normal reliability 3: Relatively high reliability (**default**) 4: High reliability
		Parameter 2: ADR reliability threshold	1: Low reliability (**default**) 2: Reserved 3: Reserved 4: High reliability

4.7 STANDALONE Configuration

This command is used to set the STANDALONE mode for the receiver. In STANDALONE mode, the receiver can perform centimeter-level positioning for a period of time even if it has not received differential correction data.

Syntax of the Command:

CONFIG STANDALONE [Function Parameter] [Param1] [Param2] [Param3]

Input Example:

CONFIG STANDALONE ENABLE 40.113452 114.212234 57.23

CONFIG STANDALONE DISABLE

Applicable to: UM960, UM980, UM982

Table 4-11 STANDALONE Configuration

Header	Configuration Item	Enable/ Disable	Param1	Param2	Param3
CONFIG	STANDALONE	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)
		ENABLE	Time parameter, which configures the waiting time to automatically enter standalone mode. 3 ≤ param1 ≤ 100, in seconds, default = 100 s.		
		ENABLE	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.		
		DISABLE			

4.8 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 3-1 Heading Schematic for the details.

Syntax of the Command:

CONFIG HEADING [parameter]

CONFIG HEADING LENGTH [parameter 1 (optional)] [parameter 2 (optional)]

Input Example:

CONFIG HEADING FIXLENGTH

CONFIG HEADING VARIABLELENGTH

CONFIG HEADING STATIC

CONFIG HEADING LOWDYNAMIC

Applicable to: UM982

Table 4-12 Heading Configuration

Header	Configuration Item	Parameter	Description
CONFIG	HEADING	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.
		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.

Header	Configuration Item	Parameter	Description
		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 the table below.
		RELIABILITY	Heading reliability threshold: 1: Low reliability 2: Normal reliability 3: Relatively high reliability (**default**) 4: High reliability

Table 4-13 Heading LENGTH Configuration

Header	Configuration Item	Parameter 1	Parameter 2
CONFIG	HEADING LENGTH	Fixed length of the baseline, centimeters. If the length is 20 cm, input 20.	Error tolerance, centimeters. If the error tolerance is 3 cm, input 3.

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

4.9 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 of the Command:

CONFIG HEADING OFFSET [Headingoffset Pitchoffset]

Input Example:

CONFIG HEADING OFFSET 90 45

Applicable to: UM982, UM980

Table 4-14 Heading Offset and Pitch Offset Configuration

Header	Configuration Item	Parameter	Description
CONFIG	HEADING OFFSET	Headingoffset	Heading offset correction, degree, range: -180.0 ~ 180.0
		Pitchoffset	Pitch offset correction, degree, range: -90.0 ~ 90.0

4.10 SBAS Configuration

This command is used to enable or disable SBAS.

Syntax of the Command:

CONFIG SBAS [parameter 1] [parameter 2]

Input Example:

CONFIG SBAS ENABLE WAAS

CONFIG SBAS TIMEOUT 600

Applicable to: UM960, UM980, UM982

Table 4-15 SBAS Configuration

Header	Configuration Item	Parameter 1	Parameter 2	Description
CONFIG	SBAS	Enable	Auto	Automatic mode
		Enable	WAAS	Enable WAAS only
			GAGAN	Enable GAGAN only
			MSAS	Enable MSAS only
			EGNOS	Enable EGNOS only
			SDCM	Enable SDCM only
			BDS	Enable BDS SBAS only
		Disable	-	Disable SBAS

Header	Configuration Item	Parameter 1	Parameter 2	Description
		TIMEOUT*	t	SBAS timeout, range: 120~1800s, default=1200s

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

4.11 EVENT Configuration

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

Syntax of the Command:

CONFIG EVENT [parameter 1] [parameter 2] [parameter 3]

Input Example:

CONFIG EVENT ENABLE POSITIVE 10

Applicable to: UM960, UM980, UM982

Table 4-16 EVENT Configuration

Header	Configuration Item	Parameter 1	Parameter 2	Parameter 3
CONFIG	EVENT	Disable (Disable EVENT, **default mode**)		
		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)	

4.12 SMOOTH 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 of the Command:

CONFIG SMOOTH [computing engine] [parameter]

Input Example:

CONFIG SMOOTH RTKHEIGHT 10

CONFIG SMOOTH HEADING 10

CONFIG SMOOTH PSRVEL enable

Applicable to: UM960, UM960L, UM980, UM982

Table 4-17 SMOOTH Configuration

Header	Configuration Item	Computing Engine	Parameter	Description
CONFIG	SMOOTH	RTKHEIGHT	Time length	Unit: epoch, range: 0~100
		HEADING	Time length	Unit: epoch, range: 0~100
		PSRVEL	enable	Enable smoothing of Doppler velocity in SPPNAV.
			disable	Disable smoothing of Doppler velocity in SPPNAV.

4.13 MMP – Multi-path Mitigation Configuration

This command is used to enable/disable the multi-path mitigation function. It is disabled by default.

Syntax of the Command:

CONFIG MMP [parameter]

Input Example:

CONFIG MMP ENABLE

Applicable to: UM980

Table 4-18 Multi-path Mitigation Configuration

Header	Configuration Item	Parameter	Description
CONFIG	MMP	ENABLE	Enable multi-path mitigation
		DISABLE	Disable multi-path mitigation (default)

4.14 NMEA Version Configuration

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

Syntax of the Command:

CONFIG NMEA0183 [parameter]

Input Example:

CONFIG NMEA0183 V410

Applicable to: UM960, UM960L, UM980, UM982

Table 4-19 NMEA 0183 Version Configuration

Header	Configuration Item	Parameter	Description
CONFIG	NMEA0183	V410	Set NMEA version to be V410 (extended to support BDS)
		V411	Set NMEA version to be V411 (Refer to the official document of NMEA V411 for more information.)

4.15 RTCM B1C B2a Configuration

This command is used to set whether to include BDS B1C & B2a signals into RTCM protocol. The configuration is disabled by default.

Syntax of the Command:

CONFIG RTCMB1CB2a [parameter]

Input Example:

CONFIG RTCMB1CB2a Enable

Applicable to: UM980, UM982

Table 4-20 RTCM B1C B2a Configuration

Header	Configuration Item	Parameter	Description
CONFIG	RTCMB1CB2a	Enable	Include B1C & B2a signals into RTCM
		Disable	Do not include B1C & B2a signals into RTCM

4.16 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 of the Command:

CONFIG RTCMPHASERATE [parameter]

Input Example:

CONFIG RTCMPHASERATE POSITIVE

Applicable to: UM980, UM982

☞ Applicable to UM982 Build9669 and later versions.

Table 4-21 RTCM Phaserange Rate Configuration

Header	Configuration Item	Parameter	Description
CONFIG	RTCMPHASERATE	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

4.17 PSRVELDRPOS – Doppler Position Prediction

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 of the Command:

CONFIG PSRVELDRPOS [parameter]

Input Example:

CONFIG PSRVELDRPOS ENABLE

CONFIG PSRVELDRPOS DISABLE

Applicable to: UM980

Table 4-22 Doppler Position Prediction Configuration

Header	Configuration Item	Parameter	Description
CONFIG	PSRVELDRPOS	Enable	Enable Doppler position prediction (default)
		Disable	Disable Doppler position prediction

4.18 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 of the Command:

CONFIG AGNSS [parameter]

Input Example:

CONFIG AGNSS Enable

Applicable to: UM980, UM982, UM960

☞ Applicable to UM980 Build7923 and later versions.

☞ Applicable to UM982 Build7650 and later versions.

Table 4-23 AGNSS Configuration

Header	Configuration Item	Parameter	Description
CONFIG	AGNSS	Enable	Enable AGNSS
		Disable	Disable AGNSS (default)

4.19 PPP Configuration

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

Syntax of the Command:

CONFIG PPP [parameter1] [parameter2]

CONFIG PPP CONVERGE [parameter1] [parameter2]

Input Example:

CONFIG PPP Enable B2b-PPP

CONFIG PPP Disable

CONFIG PPP CONVERGE 10 20

Applicable to: UM980, UM982

☞ Applicable to UM980 Build7923 and later versions.

☞ Applicable to UM982 Build7650 and later versions.

Table 4-24 PPP Configuration

Header	Configuration Item	Parameter 1	Parameter 2	Description
CONFIG	PPP	Enable	B2b-PPP	B2b-PPP (default)
			SSR-RX	RXN PPP SSR service
		DATUM (for UM980 only)	WGS84	Refer to the WGS84 standard
			PPPORIGINAL	Use the coordinate system of the PPP service (default)
		CONVERGE		PPP convergence threshold, see the table below
		Disable		Disable PPP

Table 4-25 PPP CONVERGE Configuration

Header	Configuration Item	Parameter 1	Parameter 2
CONFIG	PPP CONVERGE	HorSTD Horizontal standard deviation threshold, in centimeters	VerSTD Vertical standard deviation threshold, in centimeters

4.20 ANTIJAM – Anti-jamming Configuration

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

☞ If you have used the JAMMING command, please note that it has been replaced by the new command ANTIJAM.

Abbreviated ASCII Syntax:

CONFIG ANTIJAM [mode]

Input Example:

CONFIG ANTIJAM DISABLE

CONFIG ANTIJAM AUTO

CONFIG ANTIJAM FORCE

Applicable to: UM960, UM980

☞ Applicable to UM980 Build7923 and later versions.

Table 4-26 Anti-jamming Configuration

Header	Configuration Item	Parameter	Description
CONFIG	ANTIJAM	Disable	Disable the anti-jamming function
		AUTO	Autonomous (default)
		FORCE	Force the anti-jamming mode. After enabling this mode, the power consumption will increase.

4.21 SIGNALGROUP — Signal Group Configuration

This command is used to set the combination of signals tracked by the master antenna and slave antenna of the receiver. Parameter 1 represents the signals tracked by the master antenna and parameter 2 represents the signals tracked by the slave antenna.

The master antenna supports receiving the SBAS L1 by default.

Single-antenna products only support the configuration of parameter 1. If parameter 2 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 parameter 1 and parameter 2. When parameter 2 is not configured, it will be set to 0 by default.

The method to configure parameter 1 and parameter 2 is shown in the table below.

After the configuration is set, if it is different from the old one, the module will reset automatically and adopt the new configuration. The configuration controlled by this command will be saved automatically; it is unnecessary to use Saveconfig to save the configuration.

Syntax of the Command:

CONFIG SIGNALGROUP [parameter 1] [parameter 2]

Input Example:

CONFIG SIGNALGROUP 1

CONFIG SIGNALGROUP 2 3

Applicable to: UM980, UM982

Table 4-27 Signal Group Configuration

Header	Configuration Item	Parameter 1	Parameter 2	Description
CONFIG	SIGNALGROUP	TypeNum	TypeNum	See Table 4-28 Frequency Combination

Table 4-28 Frequency Combination

TypeNum	Description
0	Disable the slave antenna
1	BDS: B1I, B2I, B3I, B1C, B2a, B2b GPS: L1C/A, L2C, L2P, L5 GLO: G1, G2 GAL: E1, E5a, E5b QZSS: L1, L2, L5 SBAS: L1 (Note: The B2b signal refers to the PPP-B2b signal broadcast by the three GEO satellites.)
2	BDS: B1I, B2I, B3I, B1C, B2a, B2b GPS: L1C/A, L1C, L2C, L2P, L5 GLO: G1, G2, G3 GAL: E1, E5a, E5b, E6 QZSS: L1C/A, L1C, L2C, L5 SBAS: L1 (Note: The B2b signal refers to the PPP-B2b signal broadcast by the three GEO satellites.)

TypeNum	Description
3	BDS: B1I, B2I, B3I, B1C, B2b-PPP* GPS: L1C/A, L2C, L2P, L5 GLO: G1, G2 GAL: E1, E5a, E5b QZSS: L1, L2, L5 (Note: The B2b signal refers to the PPP-B2b signal broadcast by the three GEO satellites.)
4	BDS: B1I, B2I, B3I GPS: L1C/A, L2C, L2P, L5 GLO: G1, G2 GAL: E1, E5a, E5b QZSS: L1, L2, L5 SBAS: L1
5	BDS: B1I, B2I, B3I GPS: L1C/A, L2C, L2P GLO: G1, G2 GAL: E1, E5b QZSS: L1, L2
6	BDS: B1I, B3I GPS: L1C/A, L2C, L2P GLO: G1, G2 GAL: E1, E5b QZSS: L1, L2 SBAS: L1
7	BDS: B1I, B2I, B3I, B1C, B2a, B2b GPS: L1C/A, L2C, L2P, L5 GLO: G1, G2 GAL: E1, E5a, E5b QZSS: L1, L2, L5 SBAS: L1

Table 4-29 Default Configuration and Supported Configuration

Product Model	Default TypeNum Configuration		Supported TypeNum Configuration		Note
	Master antenna	Slave antenna	Master antenna	Slave antenna	
UM982	4	5	4	5	
			3	6	This mode supports 10 Hz at most.
			5	0	
			7	0	
UM980	1		1		
			2		
UM960	1		1		

4.22 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.

Abbreviated ASCII Syntax:

CONFIG ANTENNADELTAHEN [Height] [East] [North]

Input Example:

CONFIG ANTENNADELTAHEN 1.521 0.0 0.0

Applicable to: UM960, UM960L, UM980, UM982

Table 4-30 Antenna Height Configuration

Header	Configuration Item	Parameter	Value	Description
CONFIG	ANTENNADELTAHEN	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 meters, 0.0000 by default

4.23 AUTHCODE — Authorization Code Configuration

This command is used to add authorization code for the receiver. Once the correct code is entered, the receiver will automatically save the authorization information and restart. The saved information cannot be erased by updating firmware or using FRESET command. Entering a wrong code will make the receiver work abnormally.

Abbreviated ASCII Syntax:

Config AUTHCODE [string]

Input Example:

Config AUTHCODE 0x000000bf:080101007502:961101144100099:E9CC4A711D000001:556fb037:696CC7AE564AAC66AA92AA8116D26CE71E15692D581B2CA308C5D90E4FDC2DBE6FBDB48942

BF0DF7CAF1271DBA54D7123D73585EA4E8FA496C847E184D126C5607A2050E696812D9EB05015B4A0630531380CE34A893F49F1192984BD279AC9FB09EB0EAEACA71F0108B56302F9120DC2BBA5394A969B31A5959AB1F25DE0416

Applicable to: UM980, UM982

Table 4-31 Authorization Code Configuration

Header	Configuration Item	Parameter	Description
CONFIG	AUTHCODE	string	String of authorization code

4.24 ALGRESET — Algorithm Reset Configuration

This command is used to reset the algorithms.

Abbreviated ASCII Syntax:

CONFIG ALGRESET [type]

Input Example:

CONFIG ALGRESET HEADING

Applicable to: UM980, UM982, UM960

Table 4-32 Algorithm Reset Configuration

Header	Configuration Item	Computing Engine	Description
CONFIG	ALGRESET	RTK1	Reset the master antenna's RTK algorithm
		RTK2	Reset the slave antenna's RTK algorithm; only applicable to UM982
		HEADING	Reset the HEADING algorithm, only applicable to UM982
		PPP	Reset the master antenna's PPP algorithm, only applicable to UM982 and UM980
		ADR	Reset the ADR algorithm for the master antenna and slave antenna

4.25 IONMODE — Ionospheric Model Configuration

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

Abbreviated ASCII Syntax:

CONFIG IONMODE [type]

Input Example:

CONFIG IONMODE GPSK8

Applicable to: UM980, UM982, UM960

☞ Applicable to UM982 Build9669 and later versions.

Table 4-33 Ionospheric Model Configuration

Header	Configuration Item	Parameter	Description
CONFIG	IONMODE	GPSK8	GPS ionospheric model (default)
		BD2K8*	BDS-2 ionospheric model (not supported currently)
		BD3GIM*	BDS-3 ionospheric model (not supported currently)
		GALNTCM	Galileo ionospheric model

4.26 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.

Abbreviated ASCII Syntax:

CONFIG BASEANTENNAMODEL [name] [sn] [setupid] [type]

Input Example:

CONFIG BASEANTENNAMODEL “HXCCGX601A HXCS” 62815 1 USER

Applicable to: UM960, UM960L, UM980, UM982

Table 4-34 Base Station Antenna Configuration

Header	Configuration Item	Parameter	ASCII Value	Description
CONFIG	BASEANTENNAMODEL	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

5 MASK Command

5.1 Query the MASK Configuration

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

Syntax of the Command:

MASK

Input Example:

MASK

Applicable to: UM960, UM960L, UM980, UM982

Message 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

Table 5-1 Query the MASK Configuration

Command	Description
MASK	Query the current MASK configuration

5.2 MASK Configuration

This command is used to disable the receiver from tracking specific satellite system and frequency, and to set the elevation mask angle. Take 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.

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]; otherwise, the UNMASK [satellite ID] would not work.

Syntax of the Command:

MASK [elevation mask angle (optional)] [frequency/satellite system]

MASK [satellite system] PRN [satellite ID]

MASK RTCMCN0 [CN0] [frequency (optional)]

Abbreviated ASCII Syntax:

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 10 GPS	Set the elevation mask angle as 10 degrees for GPS
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

Applicable to: UM960, UM960L, UM980, UM982

Table 5-2 MASK Command Parameters (1)

Command	Parameter 1	Parameter 2
MASK	Elevation mask angle (optional, ranging from -90° to 90°)	Frequency/satellite system (see Table 5-4 Satellite Systems and Frequencies)

Table 5-3 MASK Command Parameters (2)

Command	Parameter 1	Fixed Value	Parameter 2
MASK	Satellite system	PRN	Satellite ID: (see Table 7-52 Satellite PRN Number in Unicore-defined Messages)

Table 5-4 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.
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.

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 5-4 Satellite Systems and Frequencies). If parameter 2 is null, all frequencies will be configured.
	CN0	C/N0, limits the observation data output of OBSV messages	Frequency (see Table 5-4 Satellite Systems and Frequencies). If parameter 2 is null, all frequencies will be configured.

☞ The MASK RTCMCN0/CN0 command is applicable to UM982 Build9669 and later versions.

5.3 UNMASK Configuration

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

Syntax of the Command:

UNMASK [frequency/satellite system]

UNMASK [satellite system] PRN [satellite ID]

Abbreviated ASCII Syntax:

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

Applicable to: UM960, UM960L, UM980, UM982

Table 5-6 UNMASK Command Parameter (1)

Command	Parameter
UNMASK	Frequency/satellite system (see Table 5-4 Satellite Systems and Frequencies)

Table 5-7 UNMASK Command Parameters (2)

Command	Parameter 1	Fixed Value	Parameter 2
UNMASK	Satellite system	PRN	Satellite ID (see Table 7-52 Satellite PRN Number in Unicore-defined Messages)

6 Assisted Position and Time

6.1 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 of the Command:

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

Input Example:

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

Applicable to: UM982, UM980

Table 6-1 Parameters of Assisted Position

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

6.2 Assisted Time

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

Syntax of the Command:

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

Input Example:

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

Applicable to: UM982, UM980

Table 6-2 Parameters of Assisted Time

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

7 Data Output Commands

Data output commands, including NMEA standard commands, Unicore-extended NMEA format commands, and Unicore defined commands, are used to output positioning and heading information.

Syntax:

[Command name] [serial port (optional)] [output rate/ONCHANGED (optional)]

Example:

GPGGA 1

GPGGA COM2 1

GPSIONA ONCHANGED

OBSVBASEA COM1 ONCHANGED

VERSIONA

☞ [Serial port] and [output rate] are optional parameters. If you do not specify the [serial port], the message will be output at the current port; if you do not specify the [output rate], the message will be output only once.

☞ The ONCHANGED trigger means to output the massage as soon as it is changed. In other words, if a message is output once, it will not be output again until the data is changed. ONCHANGED only applies to particular messages in Unicore format. Refer to each section for the details.

7.1 NMEA Data Output Commands

When requesting NMEA messages, users should add GP before each command name, such as GPGSV, GPGGA, etc. In the message output, GP represents GPS, GB represents BDS (**but the input command is still GP**), and so on. The input example and output description are listed as follows:

Example of the correct input: GPGSV / GPGGA / …

Example of the incorrect input: GBGSV / GLGSV / GAGGA / …

Table 7-1 Satellite Systems and Abbreviations

Satellite System	Abbreviation in the Output Message
GPS	GP
BDS	GB

Satellite System	Abbreviation in the Output Message
GLONASS	GL
Galileo	GA
QZSS	GQ
Multi-system joint positioning	GN

7.1.1 NMEA Version 4.10 (Default)

7.1.1.1 GPDTM — Datum Reference

This command is used to output local geodetic datum information, including latitude, longitude, offset, etc.

Abbreviated ASCII Syntax:

GPDTM 1 Output 1Hz GPDTM message at the current port

GPDTM COM2 1 Output 1Hz GPDTM message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

$GPDTM,W84,,0.000000,0.000000,0.000000,W84*54

Table 7-2 DTM Data Structure

ID	Field	Description	Symbol	Example
1	$--DTM	Log header		
2	Datum code	Local datum code: W84 = WGS84 W72 = WGS72 S85 = SGS85 P90 = PE90 999 = User defined IHO datum code[1]	ccc	

ID	Field	Description	Symbol	Example
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	x.x	
5	Lat dir	Latitude offset direction (N, S)	a	
6	Lon offset	Longitude offset, minutes, E/W	x.x	
7	Lon dir	Longitude offset direction (E, W)	a	
8	Alt offset	Altitude offset, meters	x.x	
9	Rf datum code	Reference datum code: W84 = WGS84 W72 = WGS72 S85 = SGS85 P90 = PE90	ccc	
10	*xx	Checksum		
11	[CR][LF]	Sentence terminator		[CR][LF]

[1] If the datum is not in the above list, use the IHO datum code; if the datum is unknown, this field is null.

7.1.1.2 GPGBS — GNSS Satellite Fault Detection

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

Abbreviated ASCII Syntax:

GPGBS 1 Output 1Hz GPGBS message at the current port

GPGBS COM2 1 Output 1Hz GPGBS message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 7-3 GBS Data Structure

ID	Field	Description	Symbol	Example
1	$--GBS	Log header		
2	Utc	UTC time of the position fix	hhmmss.ss	
3	Lat exp	Expected error in latitude, meters	x.x	
4	Lon exp	Expected error in longitude, meters	x.x	
5	Alt exp	Expected error in altitude, meters	x.x	
6	ID	ID number of failed satellite GPS:1~32 GLONASS:65~99 Galileo:1~36, 37~64 SBAS:33~64	x.x	
7	pro	Probability of missed detection for failed satellite	x.x	
8	est	Estimate of bias on failed satellite, in meters	x.x	
9	Dev std	Standard deviation of bias estimate	x.x	
10	Sys id	GNSS system ID, see Table 7-34 GNSS ID	h	
11	Signal id	GNSS signal ID, see Table 7-34 GNSS ID	h	
12	*xx	Checksum		
13	[CR][LF]	Sentence terminator		[CR][LF]

7.1.1.3 GPGGA — Global Positioning System Fix Data

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

Abbreviated ASCII Syntax:

GPGGA 1 Output 1Hz GPGGA message at the current port

GPGGA COM2 1 Output 1Hz GPGGA message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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 Data Structure

ID	Field	Description	Symbol	Example
1	$--GGA	Log header		
2	utc	UTC of the position	hhmmss.ss	
3	lat	Latitude	llll.ll	
4	lat dir	Latitude direction (N = North, S = South)	a	
5	lon	Longitude	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	x.x	
10	alt	Altitude above/below MSL (geoid)	x.x	
11	a-units	Unit of altitude (M = m)	M	

ID	Field	Description	Symbol	Example
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.	x.x	
13	u-units	Unit of geoidal separation (M = m)	M	
14	age	Age of differential data, in seconds (Time since last SC104 Type 1 or 9 update). Null field when differential positioning is not used.	x.x	
15	stn ID	Differential reference station ID, 0000-1023	xxxx	
16	*xx	Checksum	*hh	
17	[CR][LF]	Sentence terminator		[CR][LF]

7.1.1.4 GPGLL — Geographic Position

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

Abbreviated ASCII Syntax:

GPGLL 1 Output 1Hz GPGLL message at the current port

GPGLL COM2 1 Output 1Hz GPGLL message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 7-5 GLL Data Structure

ID	Field	Description	Symbol	Example
1	$--GLL	Log header		

ID	Field	Description	Symbol	Example
2	lat	Latitude	llll.ll	
3	lat dir	Latitude direction (N = North, S = South)	a	
4	lon	Longitude	yyyyy.yy	
5	lon dir	Longitude direction (E = East, W = West)	a	
6	Utc	UTC	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		[CR][LF]

7.1.1.5 GPGNS — GNSS Fix Data

This command is used to output GNSS fix data.

Abbreviated ASCII Syntax:

GPGNS 1 Output 1Hz GPGNS message at the current port

GPGNS COM2 1 Output 1Hz GPGNS message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 7-6 GNS Data Structure

ID	Field	Description	Symbol	Example
1	$--GNS	Log header		
2	utc	UTC	hhmmss.ss	
3	Lat	Latitude	llll.ll	
4	Lat dir	Latitude direction (N = North, S = South)	a	
5	Lon	Longitude	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 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)	x.x	
10	Ant alt	Antenna altitude, meters, re: mean-sea-level (geoid)	x.x	

ID	Field	Description	Symbol	Example
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.	x.x	
12	Age	[1]Age of differential data, seconds. Null field when differential positioning is not used.	x.x	
13	Station id	[2]Differential 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		[CR][LF]

[1,2] 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.

7.1.1.6 GPGRS — GNSS Range Residuals

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

Abbreviated ASCII Syntax:

GPGRS 1 Output 1Hz GPGRS message at the current port

GPGRS COM2 1 Output 1Hz GPGRS message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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 Data Structure

ID	Field	Description	Symbol	Example
1	$--GRS	Log header		
2	Utc	UTC time of GGA/GNS fix associated with this sentence	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. If the range residual exceeds ±	x.x	
5			x.x	
6			x.x	
7			x.x	

ID	Field	Description	Symbol	Example
8		99.9, then the decimal part is dropped, resulting in an integer (for example, -103.7 becomes -103)	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 7-34 GNSS ID	h	
17	Signal id	GNSS signal ID, see Table 7-34 GNSS ID	h	
18	*xx	Checksum	*hh	
19	[CR][LF]	Sentence terminator		[CR][LF]

7.1.1.7 GPGSA — GNSS DOP and Active Satellites

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

Abbreviated ASCII Syntax:

GPGSA 1 Output 1Hz GPGSA message at the current port

GPGSA COM2 1 Output 1Hz GPGSA message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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 Data Structure

ID	Field	Description	Symbol	Example
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 7-36 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	x.x	
17	hdop	HDOP	x.x	
18	vdop	VDOP	x.x	

ID	Field	Description	Symbol	Example
19	SysID	GNSS system ID, see Table 7-34 GNSS ID	h	
20	*xx	Checksum	*hh	
21	[CR][LF]	Sentence terminator		[CR][LF]

7.1.1.8 GPGST — GNSS Pseudorange Error Statistics

This command is used to output pseudorange measurement error statistics.

Abbreviated ASCII Syntax:

GPGST 1 Output 1Hz GPGST message at the current port

GPGST COM2 1 Output 1Hz GPGST message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 7-9 GST Data Structure

ID	Field	Description	Symbol	Example
1	$--GST	Log header		
2	utc	UTC time of the GGA/GNS fix associated with this message	hhmmss.ss	
3	rms	Standard deviation of pseudoranges and DGNSS corrections (RMS value)	x.x	
4	smjr std	Standard deviation of semi-major axis of error ellipse (m)	x.x	
5	smnr std	Standard deviation of semi-minor axis of error ellipse (m)	x.x	
6	orient	Orientation of semi-major axis of error ellipse (degrees from true north)	x.x	
7	lat std	Standard deviation of latitude error (m)	x.x	
8	lon std	Standard deviation of longitude error (m)	x.x	

ID	Field	Description	Symbol	Example
9	alt std	Standard deviation of altitude error (m)	x.x	
10	*xx	Checksum	*hh	
11	[CR][LF]	Sentence terminator		[CR][LF]

7.1.1.9 GPGSV — GNSS Satellites in View

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

Abbreviated ASCII Syntax:

GPGSV 1 Output 1Hz GPGSV message at the current port

GPGSV COM2 1 Output 1Hz GPGSV message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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 Data Structure

ID	Field	Description	Symbol	Example
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 7-36 Satellite ID Numbers in NMEA Messages	xx	
6	Elevation	Elevation, degrees, 90° maximum	xx	
7	Azi	Azimuth, degrees True, 000~359	xxx	
8	CN0	Carrier to noise ratio (C/N0), 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			xxx	
12			xx	
13		The 4th SV, a variable number of "Satellite ID-Elevation-Azimuth-SNR" sets are allowed up	xx	
14			xx	

ID	Field	Description	Symbol	Example
15		to a maximum of four sets per sentence. Null fields are not required for unused sets when less than four sets are transmitted.	xxx	
16			xx	
17	SignalID	GNSS signal ID, see Table 7-34 GNSS ID	h	
18	*xx	Checksum	*hh	
19	[CR][LF]	Sentence terminator		[CR][LF]

7.1.1.10 GPTHS — True Heading and Status

This command is used to output true heading and status.

Abbreviated ASCII Syntax:

GPTHS 1 Output 1Hz GPTHS message at the current port

GPTHS COM2 1 Output 1Hz GPTHS message at COM2

Applicable to: UM982

Message Output:

$GNTHS,341.3344,A*1F

Table 7-11 THS Data Structure

ID	Field	Description	Symbol	Example
1	$--THS	Log header		
2	Heading	Heading, degrees True	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		[CR][LF]

7.1.1.11 GPRMC — Recommended Minimum Specific GNSS Data

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

Abbreviated ASCII Syntax:

GPRMC 1 Output 1Hz GPRMC message at the current port

GPRMC COM2 1 Output 1Hz GPRMC message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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 Data Structure

ID	Field	Description	Symbol	Example
1	$--RMC	Log header		
2	utc	UTC of position fix	hhmmss.ss	
3	pos status	Status: A = Data valid V = Navigation receiver warning	A	
4	lat	Latitude	llll.ll	
5	lat dir	Latitude direction (N = North, S = South)	a	
6	lon	Longitude	yyyyy.yy	
7	lon dir	Longitude direction (E = East, W = West)	a	
8	speed Kn	Speed over ground, knots	x.x	
9	track true	Course over ground, degrees True, measured clockwise from the North	x.x	
10	date	Date: ddmmyy	xxxxxx	
11	mag var	Magnetic variation, degrees	x.x	
12	var dir	Magnetic variation direction	a	

ID	Field	Description	Symbol	Example
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		[CR][LF]

7.1.1.12 GPROT — Rate of Turn

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

Abbreviated ASCII Syntax:

GPROT 1 Output 1Hz GPROT message at the current port

GPROT COM2 1 Output 1Hz GPROT message at COM2

Applicable to: UM960, UM980, UM982

Message Output:

$GNROT,0.0,V*38

Table 7-13 ROT Data Structure

ID	Field	Description	Symbol	Example
1	$--ROT	Log header		

ID	Field	Description	Symbol	Example
2	rate	Rate of turn, degrees/minute	x.x	
3	Status	Status: A = Data valid V = Data invalid	A	
4	*xx	Checksum	*hh	
5	[CR][LF]	Sentence terminator		[CR][LF]

7.1.1.13 GPVTG — Course over Ground and Ground Speed

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

Abbreviated ASCII Syntax:

GPVTG 1 Output 1Hz GPVTG message at the current port

GPVTG COM2 1 Output 1Hz GPVTG message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 7-14 VTG Data Structure

ID	Field	Description	Symbol	Example
1	$--VTG	Log header		
2	Course true	Course over ground, degrees True	x.x	
3	Course ind	Course indicator, a fixed character of T	T	
4	Course mag	Course over ground, degrees Magnetic	x.x	
5	Course ind	Course indicator, a fixed character of M	M	
6	speed Kn	Speed over ground, knots	x.x	
7	N	Unit of speed, a fixed character of N	N	
8	speed Km	Speed over ground, km/h	x.x	
9	K	Unit of speed, a fixed character of K	K	

ID	Field	Description	Symbol	Example
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		[CR][LF]

7.1.1.14 GPZDA — Time and Date

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

Abbreviated ASCII Syntax:

GPZDA 1 Output 1Hz GPZDA message at the current port

GPZDA COM2 1 Output 1Hz GPZDA message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 7-15 ZDA Data Structure

ID	Field	Description	Symbol	Example
1	$--ZDA	Log header		
2	Utc	UTC	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	

ID	Field	Description	Symbol	Example
8	*xx	Checksum	*hh	
9	[CR][LF]	Sentence terminator		[CR][LF]

7.1.2 NMEA Version 4.11

7.1.2.1 GPDTM — Datum Reference

This command is used to output local geodetic datum information, including latitude, longitude, offset, etc.

Abbreviated ASCII Syntax:

GPDTM 1 Output 1Hz GPDTM message at the current port

GPDTM COM2 1 Output 1Hz GPDTM message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

$GPDTM,W84,,0.000000,0.000000,0.000000,W84*54

Table 7-16 DTM Data Structure

ID	Field	Description	Symbol	Example
1	$--DTM	Log header		
2	Datum code	Local datum code: W84 = WGS84 W72 = WGS72 S85 = SGS85 P90 = PE90 999 = user-defined IHO datum code[1]	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	x.x	
5	Lat dir	Latitude offset direction (N, S)	a	

ID	Field	Description	Symbol	Example
6	Lon offset	Longitude offset, minutes, E/W	x.x	
7	Lon dir	Longitude offset direction (E, W)	a	
8	Alt offset	Altitude offset, meters		
9	Rf datum code	Reference datum code: W84 = WGS84 W72 = WGS72 S85 = SGS85 P90 = PE90	ccc	
10	*xx	Checksum		
11	[CR][LF]	Sentence terminator		[CR][LF]

[1] If the datum is not in the above list, use the IHO datum code; if the datum is unknown, this field is null.

7.1.2.2 GPGBS — GNSS Satellite Fault Detection

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

Abbreviated ASCII Syntax:

GPGBS 1 Output 1Hz GPGBS message at the current port

GPGBS COM2 1 Output 1Hz GPGBS message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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	Example
1	$--GBS	Log header		
2	Utc	UTC time of the position fix	hhmmss.ss	
3	Lat exp	Expected error in latitude, meters	x.x	
4	Lon exp	Expected error in longitude, meters	x.x	

ID	Field	Description	Symbol	Example
5	Alt exp	Expected error in altitude, meters	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	x.x	
8	est	Estimate of bias on failed satellite, in meters	x.x	
9	Dev std	Standard deviation of bias estimate	x.x	
10	Sys id	GNSS system ID, see Table 7-34 GNSS ID	h	
11	Signal id	GNSS signal ID, see Table 7-34 GNSS ID	h	
12	*xx	Checksum		
13	[CR][LF]	Sentence terminator		[CR][LF]

7.1.2.3 GPGGA — Global Positioning System Fix Data

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

Abbreviated ASCII Syntax:

GPGGA 1 Output 1Hz GPGGA message at the current port

GPGGA COM2 1 Output 1Hz GPGGA message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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 Data Structure

ID	Field	Description	Symbol	Example
1	$--GGA	Log header		
2	utc	UTC of the position	hhmmss.ss	
3	lat	Latitude	llll.ll	
4	lat dir	Latitude direction (N = North, S = South)	a	
5	lon	Longitude	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 the number in view.	xx	
9	hdop	Horizontal dilution of precision	x.x	
10	alt	Altitude above/below MSL (geoid)	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.	x.x	
13	u-units	Unit of geoidal separation (M = m)	M	

ID	Field	Description	Symbol	Example
14	age	Age of differential data, in seconds (Time since last SC104 Type 1 or 9 update). Null field when differential positioning is not used.	x.x	
15	stn ID	Differential reference station ID, 0000-1023	xxxx	
16	*xx	Checksum	*hh	
17	[CR][LF]	Sentence terminator		[CR][LF]

7.1.2.4 GPGLL — Geographic Position

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

Abbreviated ASCII Syntax:

GPGLL 1 Output 1Hz GPGLL message at the current port

GPGLL COM2 1 Output 1Hz GPGLL message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 7-19 GLL Data Structure

ID	Field	Description	Symbol	Example
1	$--GLL	Log header		
2	lat	Latitude	llll.ll	
3	lat dir	Latitude direction (N = North, S = South)	a	
4	lon	Longitude	yyyyy.yy	
5	lon dir	Longitude direction (E = East, W = West)	a	
6	Utc	UTC	hhmmss.ss	
7	status	Status: A = Data valid V = Data not valid D = Differential	A	

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

7.1.2.5 GPGNS — GNSS Fix Data

This command is used to output GNSS fix data.

Abbreviated ASCII Syntax:

GPGNS 1 Output 1Hz GPGNS message at the current port

GPGNS COM2 1 Output 1Hz GPGNS message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

$GNGNS,061840.00,4004.73714630,N,11614.19919496,E,RRRRR,47,0.4,65.7900,-8.4923,02,0,S*6D

Table 7-20 GNS Data Structure

ID	Field	Description	Symbol	Example
1	$--GNS	Log header		
2	Utc	UTC	hhmmss.ss	
3	Lat	Latitude	llll.ll	
4	Lat dir	Latitude direction (N = North, S = South)	a	
5	Lon	Longitude	yyyyy.yy	
6	Lon dir	Longitude direction (E = East, W = West)	a	

ID	Field	Description	Symbol	Example
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)	x.x	
10	Ant alt	Antenna altitude, meters, re: mean-sea-level (geoid)	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.	x.x	
12	Age	[1]Age of differential data, seconds. Null field when differential positioning is not used.	x.x	
13	Station id	[2]Differential 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	

ID	Field	Description	Symbol	Example
15	*xx	Checksum	*hh	
16	[CR][LF]	Sentence terminator		[CR][LF]

[1,2] 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.

7.1.2.6 GPGRS — GNSS Range Residuals

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

Abbreviated ASCII Syntax:

GPGRS 1 Output 1Hz GPGRS message at the current port

GPGRS COM2 1 Output 1Hz GPGRS message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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 Data Structure

ID	Field	Description	Symbol	Example
1	$--GRS	Log header		

ID	Field	Description	Symbol	Example
2	Utc	UTC time of GGA/GNS fix associated with this sentence	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. 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 7-34 GNSS ID	h	
17	Signal id	GNSS signal ID, see Table 7-34 GNSS ID	h	
18	*xx	Checksum	*hh	
19	[CR][LF]	Sentence terminator		[CR][LF]

7.1.2.7 GPGSA — GNSS DOP and Active Satellites

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

Abbreviated ASCII Syntax:

GPGSA 1 Output 1Hz GPGSA message at the current port

GPGSA COM2 1 Output 1Hz GPGSA message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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 Data Structure

ID	Field	Description	Symbol	Example
1	$--GSA	Log header		
2	mode MA	Satellite operating mode: M = Manual, forced to operate in 2D/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 7-36 Satellite ID Numbers in NMEA Messages	xx	
5			xx	
6			xx	
7			xx	
8			xx	

ID	Field	Description	Symbol	Example
9			xx	
10			xx	
11			xx	
12			xx	
13			xx	
14			xx	
15			xx	
16	pdop	PDOP	x.x	
17	hdop	HDOP	x.x	
18	vdop	VDOP	x.x	
19	SysID	GNSS system ID, see Table 7-34 GNSS ID	h	
20	*xx	Checksum	*hh	
21	[CR][LF]	Sentence terminator		[CR][LF]

7.1.2.8 GPGST — GNSS Pseudorange Error Statistics

This command is used to output pseudorange measurement error statistics.

Abbreviated ASCII Syntax:

GPGST 1 Output 1Hz GPGST message at the current port

GPGST COM2 1 Output 1Hz GPGST message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 7-23 GST Data Structure

ID	Field	Description	Symbol	Example
1	$--GST	Log header		

ID	Field	Description	Symbol	Example
2	utc	UTC time of the GGA/GNS fix associated with this message	hhmmss.ss	
3	rms	Standard deviation of pseudoranges and DGNSS corrections (RMS value)	x.x	
4	smjr std	Standard deviation of semi-major axis of error ellipse (m)	x.x	
5	smnr std	Standard deviation of semi-minor axis of error ellipse (m)	x.x	
6	orient	Orientation of semi-major axis of error ellipse (degrees from true north)	x.x	
7	lat std	Standard deviation of latitude error (m)	x.x	
8	lon std	Standard deviation of longitude error (m)	x.x	
9	alt std	Standard deviation of altitude error (m)	x.x	
10	*xx	Checksum	*hh	
11	[CR][LF]	Sentence terminator		[CR][LF]

7.1.2.9 GPGSV — GNSS Satellites in View

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

Abbreviated ASCII Syntax:

GPGSV 1 Output 1Hz GPGSV message at the current port

GPGSV COM2 1 Output 1Hz GPGSV message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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 Data Structure

ID	Field	Description	Symbol	Example
1	$--GSV	Log header		
2	# msgs	Total number of GSV messages, minimum value 1	x	
3	msg #	GSV message number, minimum value 1	x	
4	# sats	Total number of satellites in view	xx	

ID	Field	Description	Symbol	Example
5	Sat id	Satellite ID number, see Table 7-36 Satellite ID Numbers in NMEA Messages	xx	
6	Elevation	Elevation, degrees, 90° maximum	xx	
7	Azi	Azimuth, degrees True, 000~359	xxx	
8	CN0	Carrier to noise ratio (C/N0), 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			xxx	
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	SysID	GNSS system ID, see Table 7-34 GNSS ID	h	
18	*xx	Checksum	*hh	
19	[CR][LF]	Sentence terminator		[CR][LF]

7.1.2.10 GPTHS — True Heading and Status

This command is used to output true heading and status.

Abbreviated ASCII Syntax:

GPTHS 1 Output 1Hz GPTHS message at the current port

GPTHS COM2 1 Output 1Hz GPTHS message at COM2

Applicable to: UM982

Message Output:

$GNTHS,341.3065,A*1F

Table 7-25 THS Data Structure

ID	Field	Description	Symbol	Example
1	$--THS	Log header		
2	Heading	Heading, degrees True	x.x	
3	Mode	Mode indicator: A = Autonomous M = Manual input S = Simulator V = Data not valid	a	
4	*xx	Checksum	*hh	
5	[CR][LF]	Sentence terminator		[CR][LF]

7.1.2.11 GPRMC — Recommended Minimum Specific GNSS Data

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

Abbreviated ASCII Syntax:

GPRMC 1 Output 1Hz GPRMC message at the current port

GPRMC COM2 1 Output 1Hz GPRMC message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message 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 Data Structure

ID	Field	Description	Symbol	Example
1	$--RMC	Log header		
2	utc	UTC of position fix	hhmmss.ss	
3	pos status	Status: A = Data valid V = Navigation receiver warning	A	
4	lat	Latitude	llll.ll	
5	lat dir	Latitude direction (N = North, S = South)	a	

ID	Field	Description	Symbol	Example
6	lon	Longitude	yyyyy.yy	
7	lon dir	Longitude direction (E = East, W = West)	a	
8	speed Kn	Speed over ground, knots	x.x	
9	track true	Course over ground, degrees True, measured clockwise from the North	x.x	
10	date	Date: ddmmyy	xxxxxx	
11	mag var	Magnetic variation, degrees	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		[CR][LF]

7.1.2.12 GPROT — Rate of Turn

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

Abbreviated ASCII Syntax:

GPROT 1 Output 1Hz GPROT message at the current port

GPROT COM2 1 Output 1Hz GPROT message at COM2

Applicable to: UM960, UM980, UM982

Message Output:

$GNROT,0.0,V*38

Table 7-27 ROT Data Structure

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

7.1.2.13 GPVTG — Course Over Ground and Ground Speed

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

Abbreviated ASCII Syntax:

GPVTG 1 Output 1Hz GPVTG message at the current port

GPVTG COM2 1 Output 1Hz GPVTG message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 7-28 VTG Data Structure

ID	Field	Description	Symbol	Example
1	$--VTG	Log header		
2	Course true	Course over ground, degrees True	x.x	
3	Course ind	Course indicator, a fixed character of T	T	
4	Course mag	Course over ground, degrees Magnetic	x.x	
5	Course ind	Course indicator, a fixed character of M	M	

ID	Field	Description	Symbol	Example
6	speed Kn	Speed over ground, knots	x.x	
7	N	Unit of speed, a fixed character of N	N	
8	speed Km	Speed over ground, km/h	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 S = Simulator mode	xxxxxx	
11	*xx	Checksum	*hh	
12	[CR][LF]	Sentence terminator		[CR][LF]

7.1.2.14 GPZDA — Time and Date

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

Abbreviated ASCII Syntax:

GPZDA 1 Output 1Hz GPZDA message at the current port

GPZDA COM2 1 Output 1Hz GPZDA message at COM2

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

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

Table 7-29 ZDA Data Structure

ID	Field	Description	Symbol	Example
1	$--ZDA	Log header		
2	Utc	UTC	hhmmss.ss	
3	Day	Day, 01~31	xx	
4	Month	Month, 01~12	xx	

ID	Field	Description	Symbol	Example
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		[CR][LF]

7.2 NMEA Data Output Commands Extended by Unicore

7.2.1 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.

Abbreviated ASCII Syntax:

GPGGAH 1 Output 1Hz GPGGAH message at the current port

GPGGAH COM2 1 Output 1Hz GPGGAH message at COM2

Applicable to: UM982

Message Output:

$GNGGAH,054536.00,4004.73794643,N,11614.19884494,E,4,39,0.5,65.7579,M,-8.4923,M,02,0*2C

Table 7-30 GGAH Data Structure

ID	Field	Description	Symbol	Example
1	$--GGAH	Log header		
2	utc	UTC of position	hhmmss.ss	
3	lat	Latitude	llll.ll	
4	lat dir	Latitude direction (N = North, S = South)	a	
5	lon	Longitude	yyyyy.yy	

ID	Field	Description	Symbol	Example
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	x.x	
10	alt	Altitude above/below MSL (geoid)	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.	x.x	
13	u-units	Unit of undulation (M =m)	M	
14	age	Age of differential data, in seconds. This value is the average age of the most recent differential corrections in use. Null field when differential GNSS is not used.	x.x	

ID	Field	Description	Symbol	Example
15	stn ID	Differential base station ID, 0000-1023	xxxx	
16	*xx	Checksum	*hh	
17	[CR][LF]	Sentence terminator		[CR][LF]

7.2.2 GPGLLH — Geographic Position (Slave Antenna)

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

Abbreviated ASCII Syntax:

GPGLLH 1 Output 1Hz GPGLLH message at the current port

GPGLLH COM2 1 Output 1Hz GPGLLH message at COM2

Applicable to: UM982

Message Output:

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

Table 7-31 GLLH Data Structure

ID	Field	Description	Symbol	Example
1	$--GLLH	Log header		
2	lat	Latitude	llll.ll	
3	lat dir	Latitude direction (N = North, S = South)	a	
4	lon	Longitude	yyyyy.yy	
5	lon dir	Longitude direction (E = East, W = West)	a	
6	Utc	UTC of position	hhmmss.ss	
7	status	Status: V = Data not valid A = Autonomous D = Differential	A	

ID	Field	Description	Symbol	Example
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		[CR][LF]

7.2.3 GPGNSH — GNSS Fix Data (Slave Antenna)

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

Abbreviated ASCII Syntax:

GPGNSH 1 Output 1Hz GPGNSH message at the current port

GPGNSH COM2 1 Output 1Hz GPGNSH message at COM2

Applicable to: UM982

Message Output:

$GNGNSH,055136.00,4004.73822173,N,11614.19906650,E,DNDDN,28,0.6,66.2344,-8.4923,02,0,S*37

Table 7-32 GNSH Data Structure

ID	Field	Description	Symbol	Example
1	$--GNSH	Log header		
2	utc	UTC of position	hhmmss.ss	
3	Lat	Latitude	llll.ll	
4	Lat dir	Latitude direction (N = North, S = South)	a	

ID	Field	Description	Symbol	Example
5	Lon	Longitude	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 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)	x.x	
10	Ant alt	Antenna altitude, meters, above MSL (geoid)	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.	x.x	

ID	Field	Description	Symbol	Example
12	Age	[1]Age of differential data, seconds. Null if the mode is not differential positioning.	x.x	
13	Station id	[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		[CR][LF]

[1,2] 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.

7.2.4 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 Receiver Autonomous Integrity Monitoring (RAIM).

Abbreviated ASCII Syntax:

GPGRSH 1 Output 1Hz GPGRSH message at the current port

GPGRSH COM2 1 Output 1Hz GPGRSH message at COM2

Applicable to: UM982

Message 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	Example
1	$--GRSH	Log header		
2	Utc	UTC time of GGA/GNS	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	Res	Range residuals for satellites used in the navigation solution, in meters. Range: ± 999. If the range residual exceeds ± 99.9, drop the decimal part and take the 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	

ID	Field	Description	Symbol	Example
12			x.x	
13			x.x	
14			x.x	
15			x.x	
16	Sys id	GNSS system ID. See Table 7-34 GNSS ID	h	
17	Signal id	Signal ID. See Table 7-34 GNSS ID	h	
18	*xx	Checksum	*hh	
19	[CR][LF]	Sentence terminator		[CR][LF]

Table 7-34 GNSS ID

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

GNSS	GNSS ID	Signal ID	Signal Channel
		3	G2 C/A
		4	GLONASS (M) G2 P
		5-F	Reserved
Galileo	3 (GA)	0	All signals
		1	E5a
		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

GNSS	GNSS ID	Signal ID	Signal Channel
		D-F	Reserved
QZSS	5 (GQ)	0	All signals
		1	L1 C/A
		2	L1C (D)
		3	L1C (P)
		4	LIS
		5	L2C-M
		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		

7.2.5 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, dilution of precision (DOP), etc. which are calculated with the slave antenna.

Abbreviated ASCII Syntax:

GPGSAH 1 Output 1Hz GPGSAH message at the current port

GPGSAH COM2 1 Output 1Hz GPGSAH message at COM2

Applicable to: UM982

Message 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 7-35 GSAH Data Structure

ID	Field	Description	Symbol	Example
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	prn	ID numbers of satellites used in solution, see Table 7-36 Satellite ID Numbers in NMEA Messages	xx	
5			xx	
6			xx	
7			xx	
8			xx	

ID	Field	Description	Symbol	Example
9			xx	
10			xx	
11			xx	
12			xx	
13			xx	
14			xx	
15			xx	
16	pdop	PDOP	x.x	
17	hdop	HDOP	x.x	
18	vdop	VDOP	x.x	
19	SysID	GNSS system ID, see Table 7-34 GNSS ID	h	
20	*xx	Checksum	*hh	
21	[CR][LF]	Sentence terminator		[CR][LF]

Table 7-36 Satellite ID 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

7.2.6 GPGSTH — GNSS Pseudorange Error Statistics (Slave Antenna)

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

Abbreviated ASCII Syntax:

GPGSTH 1 Output 1Hz GPGSTH message at the current port

GPGSTH COM2 1 Output 1Hz GPGSTH message at COM2

Applicable to: UM982

Message Output:

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

Table 7-37 GSTH Data Structure

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

7.2.7 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.

Abbreviated ASCII Syntax:

GPGSVH 1	Output 1Hz GPGSVH message at the current port
GPGSVH COM2 1	Output 1Hz GPGSVH message at COM2

Applicable to: UM982

Message 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 7-38 GSVH Data Structure

ID	Field	Description	Symbol	Example
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	Sat id	Satellite ID number, see Table 7-36 Satellite ID Numbers in NMEA Messages	xx	
6	Elevation	Elevation, degrees, max: 90	xx	
7	Azi	Azimuth, degrees True, 000~359	xxx	
8	CN0	Carrier to noise ratio (C/N0), 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 message. Null fields are not required for unused sets when less than four sets are transmitted.	xx	
10			xx	
11			xxx	
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 message. Null fields are not required for unused sets when less than four sets are transmitted.	xx	
14			xx	
15			xxx	
16			xx	
17	SignalID/ SystemID	Signal ID for NMEA 0183 Version 4.10; system ID for NMEA 0183 Version 4.11. Refer to Table 7-34 GNSS ID.	h	
18	*xx	Checksum	*hh	
19	[CR][LF]	Sentence terminator		[CR][LF]

7.2.8 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.

Abbreviated ASCII Syntax:

GPRMCH 1 Output 1Hz GPRMCH message at the current port

GPRMCH COM2 1 Output 1Hz GPRMCH message at COM2

Applicable to: UM982

Message Output:

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

Table 7-39 RMCH Data Structure

ID	Field	Description	Symbol	Example
1	$--RMCH	Log header		
2	utc	UTC of position fix	hhmmss.ss	
3	pos status	Status: A = Data valid V = Navigation receiver warning D = Differential	A	
4	lat	Latitude	llll.ll	
5	lat dir	Latitude direction (N = North, S = South)	a	
6	lon	Longitude	yyyyy.yy	
7	lon dir	Longitude direction (E = East, W = West)	a	
8	speed Kn	Speed over ground, knots	x.x	
9	track true	Course over ground, degrees True, measured clockwise from the North	x.x	
10	date	Date: ddmmyy	xxxxxx	
11	mag var	Magnetic variation, degrees	x.x	

ID	Field	Description	Symbol	Example
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		[CR][LF]

7.2.9 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.

Abbreviated ASCII Syntax:

GPVTGH 1 Output 1Hz GPVTGH message at the current port

GPVTGH COM2 1 Output 1Hz GPVTGH message at COM2

Applicable to: UM982

Message Output:

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

Table 7-40 VTGH Data Structure

ID	Field	Description	Symbol	Example
1	$--VTGH	Log header		
2	Course true	Course over ground, degrees True	x.x	
3	Course ind	Course indicator, a fixed character of T	T	
4	Course mag	Course over ground, degrees Magnetic	x.x	
5	Course ind	Course indicator, a fixed character of M	M	
6	speed Kn	Speed over ground, knots	x.x	
7	N	Unit of speed, a fixed character of N	N	
8	speed Km	Speed over ground, km/h	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 V = Data not valid P = High precision mode S = Simulator mode	xxxxxx	
11	*xx	Checksum	*hh	
12	[CR][LF]	Sentence terminator		[CR][LF]

7.2.10 GPTHS2 — True Heading and Status

This message contains the heading 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.

Abbreviated ASCII Syntax:

GPTHS2 ONCHANGED Output GPTHS2 message at the current port

Applicable to: UM960, UM980

Message Output:

$GNTHS2,88.3640,T*0F

Table 7-41 THS Data Structure

ID	Field	Description	Symbol	Example
1	$--THS2	Log header		
2	Heading	Heading, degrees True	x.x	
3	Mode	Mode indicator: a fixed value of T	a	
4	*xx	Checksum	*hh	
5	[CR][LF]	Sentence terminator		[CR][LF]

7.2.11 GPHPR — Attitude Parameters

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

Abbreviated ASCII Syntax:

GPHPR 1

Applicable to: UM982

Message Output:

$GNHPR,081212.00,341.48,-00.64,000.00,4,46,0.00,0999*4F

Table 7-42 HPR Message Structure

ID	Field	Description	Symbol	Example
1	$--HPR	Log header		$GPHPR
2	utc	UTC (hour/minute/second/fractional second)	hmmss.ss	070901.00
3	heading	Heading, 0~360°	hhh.hh	090.10
4	pitch	Pitch, -90~90°	ppp.pp	000.20
5	roll	Roll, -90~90°	rrr.rr	000.00

ID	Field	Description	Symbol	Example
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	4
7	sat No.	Satellite number	n	14
8	age	Age of differential data	dd.dd	1.00
9	stn ID	Base station ID	xxxx	0004
10	*xx	Checksum	*hh	*42
11	[CR][LF]	Sentence terminator		[CR][LF]

7.2.12 GPHPR2 — Attitude Parameters

This log contains the heading, pitch, and roll angles in HEADING2 mode.

Abbreviated ASCII Syntax:

GPHPR2 1

Applicable to: UM980, UM982

☞ Applicable to UM982 Build9669 and later versions

Message Output:

$GNHPR2,090415.00,088.36,-00.09,000.00,4,30,0.00,0201*73

Table 7-43 HPR2 Message Structure

ID	Field	Description	Symbol	Example
1	$--HPR2	Log header		

ID	Field	Description	Symbol	Example
2	utc	UTC (hour/minute/second/fractional second)	hmmss.ss	
3	heading	Heading, 0~360°	hhh.hh	
4	pitch	Pitch, -90~90°	ppp.pp	
5	roll	Roll, -90~90°	rrr.rr	
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	dd.dd	
9	stn ID	Base station ID	xxxx	
10	*xx	Checksum	*hh	
11	[CR][LF]	Sentence terminator		[CR][LF]

7.2.13 GPTRA2 — Heading, Pitch & Roll Information

This log contains the heading, pitch, and roll angles in HEADING2 mode.

Abbreviated ASCII Syntax:

GPTRA2 1 Output 1Hz GPTRA2 message at the current port

GPTRA2 COM2 1 Output 1Hz GPTRA2 message at COM2

Applicable to: UM980, UM982

☞ Applicable to UM982 Build9669 and later versions

Message Output:

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

Table 7-44 TRA2 Message Structure

ID	Field	Description	Symbol	Example
1	$--TRA2	Log header		
2	utc	UTC	hhmmss.ss	
3	heading	Heading, 0~360 degrees	hhh.hh	
4	pitch	Pitch: -90~90 degrees	ppp.pp	
5	roll	Roll: -90~90 degrees	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	dd.dd	
9	Station ID	Base station ID	xxxx	
10	*xx	Checksum	*hh	
11	[CR][LF]	Sentence terminator		[CR][LF]

7.2.14 GPROT2 – Rate of Turn

This log contains the rate of turn and direction of turn in HEADING2 mode.

Abbreviated ASCII Syntax:

GPROT2 1 Output 1Hz GPROT2 message at the current port

GPROT2 COM2 1 Output 1Hz GPROT2 message at COM2

Applicable to: UM980, UM982

☞ Applicable to UM982 Build9669 and later versions

Message Output:

$GNROT2,-0.0,A*30

Table 7-45 ROT2 Message Structure

ID	Field	Description	Symbol	Example
1	$--ROT2	Log header		
2	rate	Rate of turn, degrees/minute, "-" = 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		[CR][LF]

7.3 Unicore Data Output Commands

Unicore data output commands support ASCII and binary formats. Binary format is compact and strictly machine readable, which makes the message size much smaller and allows the receiver to transmit and receive more data. ASCII format starts with "#", which is not calculated in CRC. Unicore data format is defined as follows:

Basic Format:

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

Data Variable

CRC 4 bytes

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 7-48 Binary Header Structure for more information. Please always check the header length before decoding binary messages. ASCII format header is described in Table 7-49 ASCII Header Structure.
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

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

Table 7-48 Binary Header Structure

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

ID	Field	Type	Description	Binary Bytes	Binary Offset
9	Wn	Ushort	Week number	2	10
10	Ms	ULONG	Seconds of week (ms)	4	12
11	Reserved	ULONG	Reserved	4	16
12	Version	uchar	Release version	1	20
13	Leap sec	Uchar	Leap second	1	21
14	DelayMs	Ushort	Output delay	2	22

Table 7-49 ASCII Header Structure

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 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, of which 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	reserved	ulong	Reserved
9	version	uchar	Reserved for the Unicore format version number
10	Leap sec	uchar	Leap second
11	Output Delay	Ushort	Output delay (Difference between the data output time and GNSS signal receiving time), ms

7.3.1 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

Message Output:

#VERSIONA,94,GPS,FINE,2190,117325000,0,0,18,160;"UM982","R4.10Build5251","HRPT00-S10C-P","-","ffff48ffff0fffff","2021/11/26"*e195b254

Applicable to: UM960, UM960L, UM980, UM982

Table 7-50 VERSION Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	VERSIONA header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Type	Product model 0 = UNKNOWN 1 = UB4B0 2 = UM4B0 3 = UM480 4 = UM440 5 = UM482 6 = UM442 7 = UB482 8 = UT4B0 9 = UT900 10 = UB362L 11 = UB4B0M	Enum	4	H

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
		12 = UB4B0J 13 = UM482L 14 = UM4B0L 15 = UT910 16 = CLAP-B 17 = UM982 18 = UM980 19 = UM960 20 = UM980i 21 = UM980A 22 = UM960A 23 = CLAP-C 24 = UM960L			
3	sw version	Firmware version	Char[33]	33	H+4
4	Auth	Authorization type. Invalid when the authorization code expires.	Char[129]	129	H+37
5	Psn	PN and SN. Before “-” are 13 PN numbers, and after “-” are 15 SN numbers.	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 only)	Hex	4	H+308
9	[CR][LF]	Sentence terminator (ASCII only)	-		

7.3.2 OBSVM — Observation of the Master Antenna

OBSVM contains the measurements of the channels 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 to: UM960, UM960L, UM980, UM982

Message Output:

#OBSVMA,94,GPS,FINE,2190,117395000,0,0,18,17;18,0,26,21720097.812,-114139892.254585,52,181,-2263.222,4270,0,6262.010,00181c23,0,4,21162081.928,-111207490.841520,349,1600,-225.810,2010,0,0.000,0018104b,0,31,23853967.973,-125353430.240712,16,89,-2865.568,4666,0,6267.010,00181c63,0,27,20924379.679,-109958370.210834,547,1390,2341.516,2953,0,4.010,00181c83,0,16,20322104.147,-106793385.550616,59,216,-518.194,3848,0,970.010,00181ca3,0,18,24441329.785,-128440030.962618,15,106,850.996,4281,0,3268.010,00181cc3,0,34,39461753.070,-207372954.189817,294,679,60.342,3964,0,6267.010,00181da3,0,35,37928367.004,-199314917.709832,436,1004,77.257,3491,0,5037.010,00181dc3,7,52,23348014.480,-124764670.630508,74,237,-2702.620,4022,0,254.010,00191c23,11,54,22454359.660,-120157814.237355,165,1600,-2435.304,2260,0,0.000,0019104b,10,56,22207432.072,-118794787.240679,108,1600,3984.848,2660,0,0.000,001910ab,4,55,20768970.641,-110866113.369865,12,87,1123.037,4537,0,1748.010,00191ce3,0,18,20791545.038,-109260348.040017,22,113,717.752,4422,0,6267.010,005b1c23,0,24,25006179.764,-131408344.422726,34,160,-1447.680,3982,0,6268.010,005b1c43,0,31,28623544.586,-150417707.949574,15,121,-2204.498,3966,0,346.010,005b1c63,0,33,28224656.356,-148321530.956877,529,1240,-1071.997,3280,0,91.010,005b1ca3,0,12,25003241.058,-131392963.047669,71,246,1277.601,3765,0,4137.010,005b1cc3,0,11,25867003.553,-135931981.151064,86,301,2863.429,3516,0,89.010,005b1d03*db2fc208

Table 7-51 OBSVM Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	OBSVM header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	obs Number	Number of observation messages	Ulong	4	H

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 7-52 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 7-54 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.				

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

Table 7-52 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-SAIF	183~187
QZSS	193~202
IRNSS	1~15

Table 7-53 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	240~254

Table 7-54 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	0x00000080		
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	

Nibble #	Bit #	Mask	Description	Range Value
N5	20	0x00100000	Reserved	
	21	0x00200000	Signal type	Depends on the supported satellite system:
	22	0x00400000		
	23	0x00800000		
N6	24	0x01000000		
	25	0x02000000		GPS: 0 = L1 C/A 9 = L2P (Y)[3] 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 3 = L1C pilot 6 = L5 data 11 = L1C 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) GAL: 1 = E1B 2 = E1C 12 = E5A pilot 17 = E5B pilot 18 = E6B 22 = E6C SBAS: 0 = L1 C/A 6 = L5 (I)

[3] When the value of Bit 26 is 1, the L2P (Y) in Bit 25 is actually the L2C signal.

Nibble #	Bit #	Mask	Description	Range Value
				IRNSS 6 = L5 data 14 = L5 pilot
	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	

7.3.3 OBSVH — Observation of the Slave Antenna

OBSVH contains the measurements of the channels tracked by the slave antenna.

Message ID: 13

ASCII Syntax:

OBSVHA COM1 1

Binary Syntax:

OBSVHB COM1 1

Applicable to: UM982

Message Output:

#OBSVHA,97,GPS,FINE,2190,359897000,0,0,18,14;0*9d38304c

Table 7-55 OBSVH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	OBSVHheader	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	obs Number	Number of observation messages	Ulong	4	H

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 7-52 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 7-54 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.				

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

7.3.4 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 to: UM980, UM960, UM982

☞ Applicable to UM982 Build9669 and later versions

Message Output:

#OBSVMCMPA,97,GPS,FINE,2244,271100000,0,0,18,14;15,231c38056534f76f3f39820a747fff9e7519c015e0020000,231cd0012392f75f2639820a8f905fd82019c01560030000,431c380562a20030e916b20965478889431fc01560030000,631c3805c35cf43fad949a0b0e037f8f850ac01560020000,631cd001bad8f42f9e949a0bbfcbd9ce420ac015e0020000,831c380598dcf4cf102cd30b9e9687f2190cc015e0010000,a31c300109070260ace7bb0939198284631620 15c0020000,e31c3805f873fb6f0dadfe0926ca54e23220c0158003000 0,e31cd0018aa4fbcfe2acfe09f5ace6982020c015c0030000,071d300129740cd017ca160c7457ebcf7a10200040010000,231d3805014609f0e7165f0aba44fbb0651ac015200300 00,231dd001fce208b0c0165f0a5d8c9be9201ac015a0030000,431d3805df6f06d090925e0bac1a36ae621dc01560020000,631d3805026f06305463350bb9bd4ac3e703c015a00 20000,631dd001562a06d03a63350bd5057d803003c01540030000*d04eae82

Table 7-56 OBSVMCMP Compressed Format

Data	Bit (from low to high)	Length (Bits)	Scale Factor	Unit
Channel Tracking Status	0-31	32	Refer to Table 7-54 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 7-57 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		

Table 7-57 Psrstd Index

Index	Data
0	0.050
1	0.075
2	0.113
3	0.169
4	0.253
5	0.380
6	0.570

Index	Data
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

Table 7-58 OBSVMCMP Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	OBSVMCMP header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure. 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 OBSVM, see Table 7-56 OBSVMCMP 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)	-	-	-

7.3.5 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 to: UM982

☞ Applicable to UM982 Build9669 and later versions.

Message Output:

#OBSVHCMPA,97,GPS,FINE,2244,271111000,0,0,18,14;8,231c3805d95bf4cfc78e9b0be8f5fe8ed90a201640020000,431c3805b86906904ad9340b8f6b91c395034016a0020000,631c3805b86ffbbfee0eff093daf22e22020c01660030000,831c3805c09e00d06d09b2097e358f89541f601660030000,a31c3805c06c06205c085e0be7d77caee71d401660020000,c31c380514420910c84f5e0a333561b1311a601620030000,e31c38057430f78f6af6820ae5ab9e9e53192016c0020000,231d380560daf4ff561bd40b33ec0cf27a0c2016c0010000*24135d12

Table 7-59 OBSVHCMP Compressed Format

Data	Bit (from low to high)	Length (Bits)	Scale Factor	Unit
Channel Tracking Status	0-31	32	Refer to Table 7-54 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 7-57 Psrstd Index	m

Data	Bit (from low to high)	Length (Bits)	Scale Factor	Unit
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		

Table 7-60 OBSVHCMP Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	OBSVHCMP header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure. 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 7-59 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)	-	-	-

7.3.6 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 to: UM982, UM980, UM960, UM960L

Message Output:

#OBSVBASEA,92,GPS,FINE,2249,205089000,0,0,18,74;24,0,1,19949528.980,-104835482.170960,0,0,0.000,4500,0,0.001,00001c00,0,1,19949532.536,-81689986.637729,0,0,0.000,4900,0,0.001,02201c00,0,1,19949531.929,-78286236.510802,0,0,0.000,5300,0,0.001,01c01c00,0,3,24393288.815,-128187597.395405,0,0,0.000,3100,0,0.001,00001c00,0,3,24393312.277,-99886437.505261,0,0,0.000,2900,0,0.001,02201c00,0,3,24393311.741,-95724503.606254,0,0,0.000,3200,0,0.001,01c01c00,0,7,22345353.436,-117425624.537871,0,0,0.000,4200,0,0.001,00001c00,0,7,22345357.939,-91500486.474533,0,0,0.000,4100,0,0.001,02201c00,0,8,23355052.211,-122731627.217417,0,0,0.000,3500,0,0.001,00001c00,0,8,23355058.822,-95635036.671759,0,0,0.000,4100,0,0.001,02201c00,0,8,23355058.125,-91650242.898597,0,0,0.000,4500,0,0.001,01c01c00,0,14,21044513.242,-110589663.518782,0,0,0.000,4300,0,0.001,00001c00,0,14,21044514.689,-86173762.987424,0,0,0.000,4700,0,0.001,02201c00,0,14,21044519.746,-82583190.254938,0,0,0.000,5200,0,0.001,01c01c00,0,14,21044513.135,-110589662.770497,0,0,0.000,4400,0,0.001,00601c00,0,17,22264289.041,-116999629.117075,0,0,0.000,4100,0,0.001,00001c00,0,17,22264290.650,-91168542.230887,0,0,0.000,4200,0,0.001,02201c00,0,19,25085746.602,-131826487.397418,0,0,0.000,3600,0,0.001,00001c00,0,19,25085754.035,-102721938.513004,0,0,0.000,3100,0,0.001,01201c00,0,21,21374822.792,-112325452.257686,0,0,0.000,4500,0,0.001,00001c00,0,21,21374822.721,-87526326.180750,0,0,0.000,4200,0,0.001,01201c00,0,30,21595580.723,-113485542.603204,0,0,0.000,4400,0,0.001,00001c00,0,30,21595585.190,-

88430293.120489,0,0,0.000,4500,0,0.001,02201c00,0,30,21595584.940,-84745697.365627,0,0,0.000,4900,0,0.001,01c01c00*e25781b8

Table 7-61 OBSVBASE Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	OBSVBASE header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure. 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, see Table 7-52 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 7-54 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)	-	-	-

7.3.7 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 to: UM960, UM960L, UM980, UM982

Message Output:

#BASEINFOA,56,GPS,FINE,2190,376748000,0,0,18,153;00000000,-2160493.199,4383620.763,4084734.120,"0000",0*2edbd87a

Table 7-62 BASEINFO Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BASEINFO Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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
8	xxxx	32-bit CRC	Hex	4	H+40
9	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.3.8 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 to: UM960, UM960L, UM980, UM982

Message 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 7-63 GPSION Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	GPSION	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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

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

7.3.9 BD3ION — BDS-3 Ionosphere Parameters

This log provides the ionosphere model parameters broadcast by BeiDou3. The log supports ONCHANGED trigger.

Message ID: 21

ASCII Syntax:

BD3IONA 1

BD3IONA ONCHANGED

Binary Syntax:

BD3IONB 1

BD3IONB ONCHANGED

Applicable to: UM960, UM980

Message 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 Type	Data Description	Format	Binary Bytes	Binary Offset
1	BD3ION	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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+40
12	xxxx	32-bit CRC	Hex	4	H+44
13	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.3.10 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 to: UM960, UM960L, UM980, UM982

Message 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 7-65 BDSION Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BDSION	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
13	reserved	Reserved	Ulong	4	H+72
14	xxxx	32-bit CRC	Hex	4	H+76
15	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.3.11 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 to: UM960, UM960L, UM980, UM982

Message 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 7-66 GALION Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	GALION	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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)	-	-	-

7.3.12 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 to: UM960, UM960L, UM980, UM982

Message Output:

#GPSUTCA,97,GPS,FINE,2190,362356000,0,0,18,15;2190,589824,-1.862645149230957e-09,-5.329070518e-15,2185,7,18,18,0,0*4a84abce

Table 7-67 GPSUTC Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	GPSUTC	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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
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)	-	-	-

7.3.13 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 to: UM960, UM980

Message Output:

#BD3UTCA,97,GPS,FINE,2190,362396000,0,0,18,14;0,0,0.000000000000000e+00,0.0000000000e+00,0.000000000000000e+00,0,0,0,0,0,0*4bd9130e

Table 7-68 BD3UTC Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BD3UTC	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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	4	H+52
13	xxxx	32-bit CRC	Hex	4	H+456
14	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.3.14 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 to: UM960, UM960L, UM980, UM982

Message 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 7-69 BDSUTC Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BDSUTC	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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 = 0 and Saturday = 6)	Ulong	4	H+28
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)	-	-	-

7.3.15 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 to: UM960, UM960L, UM980, UM982

Message Output:

#GALUTCA,97,GPS,FINE,2190,362475000,0,0,18,14;2.793967723846436e-09,-1.776356839400250e-15,18,96,1166,1161,7,18,6.984919309616089e-10,-1.865174681370263e-14,345600,14*d266704b

Table 7-70 GALUTC Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	GALUTC	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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
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)	-	-	-

7.3.16 GPSEPH — GPS and QZSS Ephemeris

This log contains GPS and QZSS ephemeris information. 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 message at 1 Hz.

Message ID: 106

ASCII Syntax:

GPSEPHA COM1 60

GPSEPHA COM1 ONCHANGED

Binary Syntax:

GPSEPHB COM1 60

GPSEPHB COM1 ONCHANGED

Applicable to: UM960, UM960L, UM980, UM982

Message Output:

#GPSEPHA,97,GPS,FINE,2190,362528000,0,0,18,1;10,360210.0,0,30,30,2190,2190,367200.0,2.656037435e+07,4.374825086e-09,4.615227840e-01,7.3941934388e-03,-2.5487093877e+00,0.000000000e+00,9.177252650e-06,2.07281250e+02,-1.78125000e+00,-2.048909664e-08,1.136213541e-07,9.7216383679e-01,4.053740283e-10,-2.969634463e-03,-7.97997526e-09,30,367200.0,2.328306437e-09,-2.8089155e-04,-9.3223207e-12,0.0000000e+00,TRUE,1.458581356e-04,4.00000000e+00*ef6608ff

Table 7-71 GPSEPH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	GPSEPH header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
4	health	Health status, the 6-bit health code 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 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.	Ulong	4	H+28
9	Toe	Reference time of the ephemeris, seconds	Double	8	H+32
10	A	Semi-major axis of the satellite orbit, meters	Double	8	H+40
11	ΔN	Correction of the satellite mean angular velocity, radians/second	Double	8	H+48
12	M0	Mean anomaly at TOE 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
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 Type	Data Description	Format	Binary Bytes	Binary Offset
21	I0	Inclination angle at TOE 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 of satellite clock bias, 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 angular velocity, 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
35	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.3.17 BD3EPH — BDS-3 Ephemeris[4]

This log contains BDS-3 ephemeris information. 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 message at 1 Hz.

Message ID: 2999

ASCII Syntax:

BD3EPHA COM1 60

BD3EPHA COM1 ONCHANGED

Binary Syntax:

BD3EPHB COM1 60

BD3EPHB COM1 ONCHANGED

Applicable to: UM960, UM980

Message Output:

#BD3EPHA,77,GPS,FINE,2211,180091000,0,0,18,4;44,0,3,15,21,21,2211,2211,176400.0,176400.0,-1.423828125e+01,1.108884811e-02,3.726583799e-09,-1.069685670e-13,1.309681137e+00,8.019023808e-04,6.109550176e-01,2.244487405e-07,8.259899914e-06,1.940156250e+02,6.187500000e+00,1.210719347e-08,7.450580597e-09,9.593903595e-01,-4.500187451e-11,1.952617584e+00,-6.803497679e-09,176400.0,-2.153683454e-09,-1.199077815e-08,0.000000000e+00,0.000000000e+00,0.000000000e+00,-2.910383046e-10,6.693656906e-04,1.219113699e-11,0.000000000e+00,588,0,27,0,7,0,0,1*b90d9566

Table 7-72 BD3EPH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BD3EPH header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	PRN	Satellite PRN number (BDS: 1 to 63)	UChar	1	H

[4] Not supported currently

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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	Issue of data, ephemeris	UShort	2	H+4
7	IODC	Issue of data, clock	UShort	2	H+6
8	Week	GPS 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 the ephemeris, seconds	Double	8	H+20
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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 the 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 the reference time, radians	Double	8	H+132
26	IDOT	Rate of change of the 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 of satellite clock bias, seconds	Double	8	H+164

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
30	Tgdb1cp	Group delay differential of B1C pilot, seconds	Double	8	H+172
31	Tgdb2ap	Group delay differential of B2A pilot, seconds	Double	8	H+180
32	Tgdb2bI*	Group delay differential of B2b I-component, seconds	Double	8	H+188
33	Tgdb2bQ*	Group delay differential of 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 bias	UChar	1	H+249
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

* Not supported by Build7160 and Build7676.

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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)	-	-	-

7.3.18 BDSEPH — BDS Ephemeris

This log contains BDS ephemeris information. 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 message at 1 Hz.

Message ID: 108

ASCII Syntax:
BDSEPHA COM1 60
BDSEPHA COM1 ONCHANGED

Binary Syntax:
BDSEPHB COM1 60
BDSEPHB COM1 ONCHANGED

Applicable to: UM960, UM960L, UM980, UM982

Message Output:
#BDSEPHA,97,GPS,FINE,2190,362675000,0,0,18,5;60,360000.0,0,1,1,2190,2190,360000.0
,4.216441036e+07,-4.103028050e-09,2.042808580e+00,3.8967351429e-
05,2.4660025037e+00,-1.457566395e-05,-2.235500142e-05,6.85031250e+02,-
4.52843750e+02,1.438893378e-07,-1.206062734e-07,1.2597663760e-
01,1.132190017e-10,-1.993009969e+00,5.03270963e-09,1,360000.0,4.980000000e-
08,4.980000000e-08,-1.45519e-07,8.26006e-14,0.00000e+00,TRUE,7.291643104e-

05,4.00000000e+00*493bb7fb

Table 7-73 BDSEPH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BDSEPH header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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
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 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 the ephemeris, seconds	Double	8	H+32
10	A	Semi-major axis of the satellite orbit, meters	Double	8	H+40
11	ΔN	Correction of the satellite mean angular velocity, radians/second	Double	8	H+48

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
12	M0	Mean anomaly at the 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
21	I0	Inclination angle at the reference time, radians	Double	8	H+128
22	IDOT	Rate of change of the 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 of satellite clock bias (based on GPS time), seconds	Double	8	H+164

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
27	tgd1	Group delay differential of B1 signal (Equipment time delay differential for B1 signal), seconds	Double	8	H+172
28	tgd2	Group delay differential of 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 angular velocity, 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
35	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+232
36	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.3.19 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 message at 1 Hz.

Message ID: 107

ASCII Syntax:
GLOEPHA COM1 60
GLOEPHA COM1 ONCHANGED

Binary Syntax:
GLOEPHB COM1 60
GLOEPHB COM1 ONCHANGED

Applicable to: UM960, UM960L, UM980, UM982

Message Output:
#GLOEPHA,97,GPS,FINE,2190,362727000,0,0,18,2;48,7,1,0,2190,362718000,10782,730,0,0,31,4,7.058993164062500e+06,2.432434033203125e+07,-3.059087402343750e+06,2.596797943115234e+02,3.714027404785156e+02,3.541890144348145e+03,0.000001862645149,4.656612873077393e-06,-2.793967723846436e-06,-4.810560494661331e-05,2.793967724e-09,-9.094947017729282e-13,27900,3,3,0,12*1e30aedf

Table 7-74 GLOEPH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	GLOEPH header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
4	sat type	Satellite type 0 = GLO_SAT 1 = GLO_SAT_M (M 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
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[a]	Ephemeris health 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 n^{th} satellite time t_n relative to GLONASS time t_c, in seconds	Double	8	H+100

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
24	delta_tau_n	Time difference between the RF signal transmitted in L2 sub-band and that transmitted in L1 sub-band by the n^{th} 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[5]	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 7-75 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 7-75 GLONASS Ephemeris Flags Coding

Bit	Description	Value	Mask
0	P1 flag: time interval between two adjacent tb values	see Table 7-76 P1 Flag Range Values	00000001
1			00000002
2	P2 flag: Oddness or Evenness of tb value	0=even, 1=odd	00000004

[5] Bit 0:2 = Bn

Bit 3 = In

Other bits = 0.

Bit	Description	Value	Mask
3	P3 flag: number of satellites contained in the almanac of the current subframe	0=5, 1=4	00000008
4	Reserved		
…			
31			

Table 7-76 P1 Flag Range Values

State	Description
00	0 minutes
01	30 minutes
10	45 minutes
11	60 minutes

7.3.20 GALEPH — Galileo Ephemeris

This log contains Galileo ephemeris information. 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 message at 1 Hz.

Message ID: 109

ASCII Syntax:

GALEPHA COM1 60

GALEPHA COM1 ONCHANGED

Binary Syntax:

GALEPHB COM1 60

GALEPHB COM1 ONCHANGED

Applicable to: UM960, UM960L, UM980, UM982

Message 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 7-77 GALEPH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	GALEPH header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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
13	IODNav	Issue of data, ephemeris	Ulong	4	H+20

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
14	Toe	Reference time of the ephemeris, seconds	Ulong	4	H+24
15	RootA	Square root of semi-major axis, meters	Double	8	H+28
16	DeltaN	Correction of satellite mean angular velocity, radians/second	Double	8	H+36
17	M0	Mean anomaly at TOE 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 the inclination angle, radians/second	Double	8	H+124
28	Omega0	Right ascension of ascending node, radians	Double	8	H+132

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
29	OmegaDot	Rate of change of the right ascension of ascending node, radians/second	Double	8	H+140
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 only)	-		-

7.3.21 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 to: UM960, UM960L, UM980, UM982

Message Output:

#AGRICA,97,GPS,FINE,2190,363942000,0,0,18,12;GNSS,232,21,12,30,5,5,24,1,0,5,15,1,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,0.005,-0.003,0.001,0.004,0.042,0.050,0.044,40.07898274722,116.23663152683,60.0036,-2160488.6213,4383615.6655,4084732.9679,1.8493,1.8902,4.4654,0.0000,0.0000,0.0000,0.00000000000,0.00000000000,0.0000,-0.00000000000,0.00000000000,0.0000,363942000,0.000,15.213205,-8.492279,0.000000,0.000000,5,0,0,0*0b2e294a

Table 7-78 AGRIC Message Structure

ID	Field Type	Description	Format	Binary Bytes	Binary Offset
1	AGRIC header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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

ID	Field Type	Description	Format	Binary Bytes	Binary Offset
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
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

ID	Field Type	Description	Format	Binary Bytes	Binary Offset
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
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

ID	Field Type	Description	Format	Binary Bytes	Binary Offset
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, positive for the North and negative for the South	double	8	H+80
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

ID	Field Type	Description	Format	Binary Bytes	Binary Offset
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
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)	-	-	-

7.3.22 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 to: UM980, UM982, UM960

Message 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 7-79 PVTSLN Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	PVTSLN header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure	H	H	0
2	bestpos_type	Position type, refer to Table 0- 4 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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
9	bestpos_diffage	Differential age of BESTNAV when the position is fixed	FLOAT	4	H+36
10	psrpos_type	Position type, refer to Table 0- 4 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 0- 5 Solution Status	Enum	4	H+96

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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
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

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

7.3.23 UNILOGLIST — Output Log List

This command is used to output the list of operating logs. Binary format is not supported.

ASCII Syntax:

UNILOGLIST

Applicable to: UM960, UM980, UM982

Message Output:

#UNILOGLIST,66,GPS,FINE,2203,447089000,0,0,18,33;

< 3

< PSRPOSA COM1 1

< GPGGA COM1 1

< HWSTATUSA COM1 1

Table 7-80 UNILOGLIST Message Structure

ID	Field Type	Data Description	Format
1	UNILOGLIST (ASCII)header	Log header, see Table 7-49 ASCII Header Structure	
2	#port	Number of messages, maximum=30	Long
3	LOG	LOG string	
4	port	Output port, refer to Table 7-81 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 ONCE	
7	period	Log period for ONTIME trigger, seconds	
8...	Next port		

ID	Field Type	Data Description	Format
Variable	xxxx	32-bit CRC	Hex
Variable	[CR][LF]	Sentence terminator	-

Table 7-81 Port Identifier

Port Name	Description
COM1	COM port 1
COM2	COM port 2
COM3	COM port 3

7.3.24 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 to: UM980, UM982, UM960

Message Output:

#BESTNAVA,97,GPS,FINE,2190,364622000,0,0,18,9;SOL_COMPUTED,SINGLE,40.078983
53385,116.23662959156,60.2103,-
8.4923,WGS84,1.6582,1.8339,3.9820,"0",0.000,0.000,47,28,28,0,16,12,02,09,SOL_COMPU
TED,DOPPLER_VELOCITY,0.000,0.000,0.0014,213.210639,0.0015,00010002*673a8224

Table 7-82 BESTNAV Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BESTNAV header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	p-sol status	Solution status, refer toTable 0- 5 Solution Status	Enum	4	H
3	pos type	Position type, refer to Table 0- 4 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
18	Reserved	Reserved	Uchar	1	H+67
19	Reserved	Reserved	Uchar	1	H+68
20	ext sol stat	Extended solution status, refer to Table 7-85 Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 Galileo & BDS-3 Signal Mask	Hex	1	H+70
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table 7-83 GPS/GLONASS/BDS-2 Signal Mask)	Hex	1	H+71
23	V-sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table 0- 4 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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)	-	-	-

Table 7-83 GPS/GLONASS/BDS-2 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-2 B3I used in solution
4	0x10	GLONASS L1 used in solution
5	0x20	GLONASS L2 used in solution
6	0x40	BDS-2 B1I used in solution
7	0x80	BDS-2 B2I used in solution

Table 7-84 Galileo & BDS-3 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	BDS-3 B1I used in solution
5	0x20	BDS-3 B3I used in solution
6	0x40	BDS-3 B2a used in solution

Bit	Mask	Description
7	0x80	BDS-3 B1C used in solution

Table 7-85 Extended Solution Status

Bit	Description
0	RTK solution verification 0 = unchecked 1 = checked
1-3	Pseudorange ionospheric correction 0 = Unknown 1 = Klobuchar broadcast ephemeris correction 2 = SBAS ionospheric grid correction 3 = Multi-frequency correction 4 = Pseudorange differential correction

7.3.25 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 to: UM980, UM982, UM960

Message Output:

#BESTNAVXYZA,97,GPS,FINE,2190,364674000,0,0,18,9;SOL_COMPUTED,SINGLE,-2160488.6043,4383615.8972,4084733.1053,0.0000,0.0000,0.0000,SOL_COMPUTED,DO

PPLER_VELOCITY,-0.0023,0.0003,0.0020,0.0377,0.0503,0.0411,"",0.000,0.000,0.000,47,28,28,0,0,12,0,09*299636fe

Table 7-86 BESTNAVXYZ Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BESTNAVXYZ header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	P-sol status	Solution status, refer to Table 0-5 Solution Status	Enum	4	H
3	pos type	Position type, refer to Table 0- 4 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 0-5 Solution Status	Enum	4	H+44
11	vel type	Velocity type, refer to Table 0- 4 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 7-85 Extended Solution Status	Hex	1	H+109
28	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 Galileo & BDS-3 Signal Mask	Hex	1	H+110
29	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table 7-83 GPS/GLONASS/BDS-2 Signal Mask)	Hex	1	H+111

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
30	xxxx	32-bit CRC (ASCII and binary only)	Hex	4	H+112
31	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.3.26 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 to: UM982

Message Output:
#BESTNAVHA,97,GPS,FINE,2190,364700000,0,0,18,13;INSUFFICIENT_OBS,NONE,40.078
98868399,116.23660520125,59.8754,-
8.4923,WGS84,2.9766,2.8787,10.0570,"0",0.000,11374.000,0,0,0,0,33,02,00,00,INSUFFICI
ENT_OBS,NONE,0.000,0.000,0.0301,33.043127,-0.0892,0004000c*7b4767e9

Table 7-87 BESTNAVH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BESTNAVH header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	p-sol status	Solution status, refer toTable 0- 5 Solution Status	Enum	4	H

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
3	pos type	Position type, refer to Table 0- 4 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 7-85 Extended Solution Status	Hex	1	H+69

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 Galileo & BDS-3 Signal Mask	Hex	1	H+70
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table 7-83 GPS/GLONASS/BDS-2 Signal Mask)	Hex	1	H+71
23	V-sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table 0- 4 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	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)	-	-	-

7.3.27 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 to: UM982

Message Output:

#BESTNAVXYZHA,97,GPS,FINE,2190,364732000,0,0,18,13;INSUFFICIENT_OBS,NONE,-2160485.5484,4383615.5669,4084733.8716,0.0000,0.0000,0.0000,INSUFFICIENT_OBS,NONE,0.0227,-0.0831,-0.0382,0.5312,0.8483,0.5947,"",0.000,0.000,11406.000,0,0,0,0,0,02,0,00*58985f99

Table 7-88 BESTNAVXYZH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BESTNAVXYZH header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	P-sol status	Solution status, refer to Table 0-5 Solution Status	Enum	4	H
3	pos type	Position type, refer to Table 0- 4 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 0-5 Solution Status	Enum	4	H+44
11	vel type	Velocity type, refer to Table 0- 4 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-X, m/s	Float	4	H+80
17	V-Z σ	Standard deviation of V-X, 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 7-85 Extended Solution Status	Hex	1	H+109
28	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 Galileo & BDS-3 Signal Mask	Hex	1	H+110
29	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table 7-83 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)	-	-	-

7.3.28 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 to: UM980, UM982, UM960

Message Output:

#BESTSATA,79,GPS,FINE,2203,226245800,0,0,18,22;43,GPS,2,GOOD,00000013,GPS,5,GOOD,00000013,GPS,7,GOOD,00000003,GPS,13,GOOD,00000013,GPS,15,GOOD,00000013,

GPS,18,GOOD,00000007,GPS,20,GOOD,00000013,GPS,29,GOOD,00000013,GPS,30,GOOD,00000007,QZSS,195,GOOD,00000017,QZSS,196,GOOD,00000017,QZSS,199,GOOD,00000017,GLONASS,42+8,GOOD,00000003,GLONASS,43+3,GOOD,00000001,GLONASS,44+12,GOOD,00000003,GLONASS,57+9,GOOD,00000003,GLONASS,58+11,GOOD,00000003,GALILEO,4,GOOD,00000017,GALILEO,11,GOOD,00000017,GALILEO,12,GOOD,00000017,GALILEO,19,GOOD,00000017,GALILEO,33,GOOD,00000017,BEIDOU,1,GOOD,00000017,BEIDOU,2,GOOD,00000017,BEIDOU,3,GOOD,00000017,BEIDOU,4,GOOD,00000017,BEIDOU,6,GOOD,00000017,BEIDOU,7,GOOD,00000007,BEIDOU,8,GOOD,00000017,BEIDOU,10,GOOD,00000007,BEIDOU,13,GOOD,00000017,BEIDOU,16,GOOD,00000017,BEIDOU,19,GOOD,00000005,BEIDOU,20,GOOD,00000015,BEIDOU,27,GOOD,00000005,BEIDOU,29,GOOD,00000015,BEIDOU,30,GOOD,00000015,BEIDOU,32,GOOD,00000015,BEIDOU,35,GOOD,00000005,BEIDOU,38,GOOD,00000015,BEIDOU,39,GOOD,00000015,BEIDOU,59,GOOD,00000015,BEIDOU,60,GOOD,00000015*34479d6a

Table 7-89 BESTSAT Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BESTSATS Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	#entries	Number of satellites tracked	Ulong	4	H+0
3	Satellite system	GNSS satellite system list, see Table 7-112 Satellite System	Enum	4	H+4
4	Satellite ID	Satellite PRN number (see Table 7-52 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,	Ulong	4	H+8

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
		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.			
5	Status	In binary messages, the value is "0"; in ASCII messages, the value is "GOOD".	Enum	4	H+12
6	Signal mask	Table 7-90 BESTSAT GPS Signal Mask Table 7-91 BESTSAT GLONASS Signal Mask Table 7-92 BESTSAT BDS Signal Mask Table 7-93 BESTSAT Galileo Signal Mask	Hex	4	H+16
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 7-90 BESTSAT GPS Signal Mask

Bit	MASK	Description
0	0x01	GPS L1 used in Solution
1	0x02	GPS L2 used in Solution

Bit	MASK	Description
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 7-91 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, this bit is set to 0x01, otherwise it is set to 0x00.

Table 7-92 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 7-93 BESTSAT Galileo Signal Mask

Bit	MASK	Description
0	0x01	Galileo E1 used in Solution

Bit	MASK	Description
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.

7.3.29 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 to: UM980, UM982, UM960

Message Output:

#ADRNAVA,97,GPS,FINE,2190,364787000,0,0,18,1;INSUFFICIENT_OBS,NONE,0.0000000000,0.00000000000,-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 7-94 ADRNAV Messsage Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	ADRNAV header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
2	sol status	Solution status, refer toTable 0- 5 Solution Status	Enum	4	H
3	pos type	Position type, refer to Table 0- 4 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 Type	Data Description	Format	Binary Bytes	Binary Offset
20	ext sol stat	Extended solution status, refer to Table 7-85 Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 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 7-83 GPS/GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table 0- 4 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	Vertical speed standard deviation, m/s	Float	4	H+112

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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)	-	-	-

7.3.30 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 to: UM982

Message Output:
#ADRNAVHA,97,GPS,FINE,2190,364822000,0,0,18,9;INSUFFICIENT_OBS,NONE,0.000000000000,0.00000000000,-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 7-95 ADRNAVH Messsage Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	ADRNAVH header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H
3	pos type	Position type, refer to Table 0- 4 Position or Velocity Type	Enum	4	H+4

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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
20	ext sol stat	Extended solution status, refer to Table 7-85 Extended Solution Status	Hex	1	H+69

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 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 7-83 GPS/GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table 0- 4 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	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)	-	-	-

7.3.31 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 to: UM980, UM982

Message Output:

#PPPNAVA,64,GPS,FINE,2207,464961000,0,0,18,13;SOL_COMPUTED,PPP_CONVERGING,40.07899442145,116.23661087189,65.8944,-8.4923,WGS84,1.8755,1.4254,2.4821,"0",1.000,0.000,53,48,48,46,0,00,03,ff*2d9412be

Table 7-96 PPPNAV Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	PPPNAV header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	sol status	Solution status, refer toTable 0- 5 Solution Status	Enum	4	H
3	pos type	Position type, refer to Table 0- 4 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 command. 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	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 7-85 Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 Galileo & BDS-3 Signal Mask	Hex	1	H+70

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask, refer to Table 7-83 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)	-	-	-

7.3.32 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 to: UM980, UM982, UM960

Message Output:

#SPPNAVA,97,GPS,FINE,2190,364880000,0,0,18,12;SOL_COMPUTED,SINGLE,40.07898383787,116.23662885600,60.2401,-8.4923,WGS84,1.6491,1.8392,3.9804,"0",0.000,0.000,46,28,28,0,16,12,02,09,SOL_COMPUTED,DOPPLER_VELOCITY,0.000,0.000,0.0015,267.680610,-0.0019,00010002*fda82d07

Table 7-97 SPPNAV Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	SPPNAV header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
3	pos type	Position type, refer to Table 0- 4 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
20	ext sol stat	Extended solution status, refer to Table 7-85 Extended Solution Status	Hex	1	H+69

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 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 7-83 GPS/GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table 0- 4 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 Type	Data Description	Format	Binary Bytes	Binary Offset
33	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

7.3.33 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 to: UM982

Message Output:

#SPPNAVHA,97,GPS,FINE,2190,364950000,0,0,18,13;INSUFFICIENT_OBS,NONE,40.0789
8868399,116.23660520125,59.8754,-
8.4923,WGS84,2.9766,2.8787,10.0570,"0",0.000,11624.000,0,0,0,0,33,02,00,00,INSUFFICI
ENT_OBS,NONE,0.000,0.000,0.0301,33.043127,-0.0892,0004000C*808205f0

Table 7-98 SPPNAVH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	SPPNAVH header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H
3	pos type	Position type, refer to Table 0- 4 Position or Velocity Type	Enum	4	H+4
4	lat	Latitude, degrees	Double	8	H+8

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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
20	ext sol stat	Extended solution status, refer to Table 7-85 Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 Galileo & BDS-3 Signal Mask	Hex	1	H+70

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask, refer to Table 7-83 GPS/GLONASS/BDS-2 Signal Mask	Hex	1	H+71
23	sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table 0- 4 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)	-	-	-

7.3.34 STADOP — DOP of BESTNAV

This log contains dilution of precision (DOP) for all satellites used in the BESTNAV solution.

Message ID: 954

ASCII Syntax:

STADOPA 1

Binary Syntax:

STADOPB 1

Applicable to: UM980, UM982, UM960

Message Output:

#STADOPA,97,GPS,FINE,2190,364332000,0,0,18,9;0,2.1821,1.3521,1.7127,1.1664,0.6838,0.4951,0.4718,5.0,0.0,28,25,26,29,31,32,34,39,77,79,83,98,99,161,162,163,166,167,169,176,179,182,196,199,200,205,206,219,220*fe183bbd

Table 7-99 STADOP Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	STADOP Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Itow	Seconds of week	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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 7-53 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)	-	-	-

7.3.35 STADOPH — DOP of BESTNAVH (Slave Antenna)

This log contains dilution of precision (DOP) for all satellites used in the BESTNAVH solution.

Message ID: 2122

ASCII Syntax:

STADOPHA 1

Binary Syntax:

STADOPHB 1

Applicable to: UM982

Message Output:

#STADOPHA,97,GPS,FINE,2190,364378000,0,0,18,13;0,9999.0000,9999.0000,9999.0000,9999.0000,9999.0000,9999.0000,9999.0000,5.0,0.0,0*5624c3f9

Table 7-100 STADOPH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	STADOPH Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Itow	Seconds of week	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 7-53 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)	-	-	-

7.3.36 ADRDOP — DOP of ADRNAV

This log contains dilution of precision (DOP) for all satellites used in the ADRNAV solution.

Message ID: 953

ASCII Syntax:

ADRDOPA 1

Binary Syntax:

ADRDOPB 1

Applicable to: UM980, UM982, UM960

Message Output:

#ADRDOPA,97,GPS,FINE,2190,364413000,0,0,18,1;0,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,0.0,0.0,0*585b7ece

Table 7-101 ADRDOP Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	ADRDOP Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Itow	Seconds of week	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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
12	#PRN	Number of tracked satellites	UShort	2	H+40
13	PRN	PRN of tracked satellites, see Table 7-53 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)	-	-	-

7.3.37 ADRDOPH — DOP of ADRNAVH (Slave Antenna)

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

Message ID: 2121

ASCII Syntax:

ADRDOPHA 1

Binary Syntax:

ADRDOPHB 1

Applicable to: UM982

Message Output:

#ADRDOPHA,97,GPS,FINE,2190,364440000,0,0,18,9;0,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,0.0,0.0,0*f68e12af

Table 7-102 ADRDOPH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	ADRDOPH Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
2	Itow	Seconds of week	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 7-53 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)	-	-	-

7.3.38 PPPDOP — DOP of PPPNAV

This log contains dilution of precision (DOP) 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 to: UM980, UM982

Message Output:

#PPPDOPA,77,GPS,FINE,2207,235545100,0,0,18,9;235545100,0.7393,0.6569,0.3394,0.5381,0.3767,0.0000,0.0000,5.0,0.0,49,10,12,32,15,18,24,36,39,34,57,62,61,47,45,56,55,161,182,173,180,204,198,199,164,219,168,220,163,205,162,166,197,206,169,179,195,196,172,104,76,82,100,107,101,86,23,46,81,176*46996fc5

Table 7-103 PPPDOP Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	PPPDOP Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Itow	Seconds of week	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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
13	PRN	PRN of tracked satellites, see Table 7-53 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)	-	-	-

7.3.39 SPPDOP — DOP of SPPNAV

This log contains dilution of precision (DOP) 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 to: UM980, UM982, UM960

Message Output:

#SPPDOPA,64,GPS,FINE,2190,378591000,0,0,18,27;0,2.6060,1.6437,2.0223,1.4873,0.6996,0.5725,0.4020,5.0,0.0,28,4,8,9,16,26,27,76,77,82,85,99,110,161,162,163,166,167,169,170,176,186,189,195,199,200,205,219,220*8481ed9b

Table 7-104 SPPDOP Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	SPPDOP Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Itow	Seconds of week	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 7-53 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)	-	-	-

7.3.40 SPPDOPH — DOP of SPPNAVH (Slave Antenna)

This log contains dilution of precision (DOP) 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 to: UM982

Message Output:

#SPPDOPHA,97,GPS,FINE,2190,364513000,0,0,18,13;0,9999.0000,9999.0000,9999.0000,9999.0000,9999.0000,9999.0000,9999.0000,5.0,0.0,0*93cc9f7e

Table 7-105 SPPDOPH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	SPPDOPH Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Itow	Seconds of week	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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 7-53 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)	-	-	-

7.3.41 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 to: UM980, UM982, UM960

Message Output:

#SATSINFOA,96,GPS,FINE,2215,367199000,0,0,18,16;50,2,0,0,0,63,2,302,51,0,45,0,2,0,42,9,2,4,48,17,0,37,0,3,0,43,14,3,0,39,9,3,5,225,14,0,42,0,2,0,37,9,2,6,35,64,0,47,0,3,0,52,14,3,0,48,9,3,9,80,33,0,42,0,3,0,44,14,3,0,40,9,3,11,300,56,0,46,0,3,0,50,14,3,0,46,9,3,12,277,37,0,42,0,2,0,41,9,2,17,134,31,0,44,0,2,0,41,9,2,19,130,53,0,46,0,2,0,43,9,2,20,232,47,0,46,0,2,0,42

,9,2,25,316,15,0,38,0,3,0,45,14,3,0,40,9,3,28,0,0,0,37,0,2,0,31,9,2,194,170,8,5,38,0,3,5,41,14,3,5,37,9,3,195,112,67,5,45,0,3,5,49,14,3,5,47,9,3,196,132,61,5,42,0,3,5,48,14,3,5,46,9,3,199,163,43,5,36,0,3,5,46,14,3,5,44,9,3,39,116,64,1,43,0,2,1,49,5,2,55,316,30,1,43,0,2,1,46,5,2,52,242,10,1,39,0,2,1,39,5,2,38,35,28,1,40,0,2,1,41,5,2,61,93,29,1,42,0,2,1,45,5,2,54,22,62,1,47,0,2,1,50,5,2,40,180,27,1,42,0,2,1,45,5,2,46,342,4,1,34,0,2,1,39,5,2,11,93,61,4,33,0,3,4,52,17,3,4,50,21,3,42,114,67,4,34,0,4,4,51,21,4,4,48,8,4,4,49,12,4,2,224,33,4,45,17,2,4,41,21,2,10,214,52,4,29,0,3,4,46,17,3,4,45,21,3,28,306,28,4,29,0,4,4,44,21,4,4,41,8,4,4,42,12,4,40,180,42,4,31,0,4,4,44,21,4,4,43,8,4,4,43,12,4,8,289,63,4,31,0,3,4,48,17,3,4,46,21,3,43,8,79,4,36,0,4,4,51,21,4,4,47,8,4,4,50,12,4,7,197,46,4,28,0,3,4,47,17,3,4,45,21,3,21,47,30,4,31,0,4,4,43,21,4,4,43,8,4,4,43,12,4,23,243,4,4,24,8,2,4,30,12,2,4,123,26,4,43,17,2,4,41,21,2,5,248,16,4,38,17,2,4,35,21,2,1,139,36,4,28,0,3,4,46,17,3,4,43,21,3,34,111,40,4,32,0,4,4,48,21,4,4,44,8,4,4,41,12,4,38,317,74,4,35,0,4,4,49,21,4,4,47,8,4,4,49,12,4,2,311,18,3,39,2,3,3,45,17,3,3,43,12,3,4,136,38,3,43,2,3,3,48,17,3,3,46,12,3,10,0,0,3,47,2,3,3,53,17,3,3,50,12,3,11,325,63,3,43,2,3,3,47,17,3,3,45,12,3,12,71,45,3,42,2,3,3,45,17,3,3,42,12,3,19,63,32,3,40,2,3,3,40,17,3,3,38,12,3,24,203,15,3,37,2,3,3,43,17,3,3,40,12,3,25,260,32,3,42,2,3,3,46,17,3,3,44,12,3,9,181,7,3,37,2,3,3,41,17,3,3,39,12,3,36,286,19,3,34,2,3,3,42,17,3,3,38,12,3*a79d3813

Table 7-106 SPPDOPH Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	SATSINFO header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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 7-107 Frequency Flag	Byte	1	H+5
8	PRN	Satellite PRN number, see Table 7-52 Satellite PRN Number in Unicore-defined Messages	Byte	1	H+6

ID	Field Type	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 7-108 System Identifier	Byte	1	H+10
12	SNR	Signal-to-noise ratio	Byte	1	H+11
13	Freq status	Frequency identifier, see Table 7-109 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 7-1 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)	-	-	-

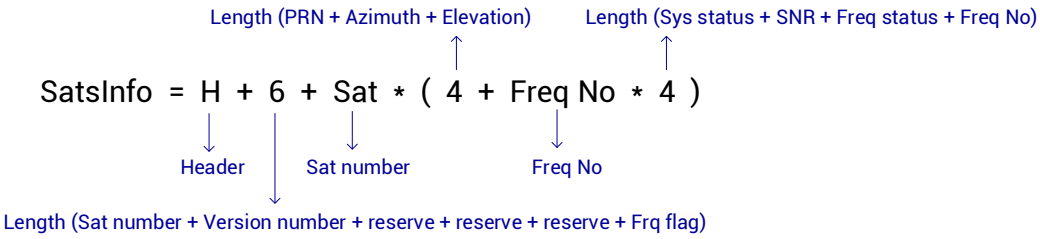

Figure 7-1 Explanation of the Binary Offset of SATSINFO

Table 7-107 Frequency Flag

Bit	Description	Value
Bit7	Reserved	0
Bit6	Reserved	0

Bit	Description	Value
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

Table 7-108 System Identifier

Bit	Description	Note
Bit7	0 = GPS 1 = GLONASS 2 = SBAS 3 = GAL 4 = BDS 5 = QZSS 6 = IRNSS	
Bit6		
Bit5		
Bit4		
Bit3		
Bit2		
Bit1		
Bit0		

Table 7-109 Frequency Identifier

Bit	Description		Note
Bit7	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)	

Bit	Description		Note
	GLONASS: 0 = L1 C/A 5 = L2 C/A 6 = G3I 7 = G3Q 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 IRNSS: 6 = L5 data 14 = L5 pilot	6 = B3Q 21 = B3I 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)	

7.3.42 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 to: UM980, UM982, UM960

Message 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 7-110 BASEPOS Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	BASEPOS header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	p-sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H
3	pos type	Position type, refer to Table 0- 4 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 Type	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	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 7-85 Extended Solution Status	Hex	1	H+69
21	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 Galileo & BDS-3 Signal Mask	Hex	1	H+70
22	GPS, GLONASS and BDS2 sig mask	GPS, GLONASS and BDS-2 signal mask (see Table 7-83 GPS/GLONASS/BDS-2 Signal Mask)	Hex	1	H+71
23	V-sol status	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H+72
24	vel type	Velocity type, refer to Table 0- 4 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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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)	-	-	-

7.3.43 SATELLITE — Visible Satellites

This message outputs the visible satellites and detailed information.

Message ID: 1042

ASCII Syntax:

SATELLITEA 1

Binary Syntax:

SATELLITEB 1

Applicable to: UM980, UM982, UM960

Message Output:

#SATELLITEA,97,GPS,FINE,2190,364984000,0,0,18,13;GPS,TRUE,TRUE,9,3,0,25.2,308.1,0.000,0.000,10,0,2.4,175.2,0.000,0.000,12,0,0.2,39.3,0.000,0.000,16,0,12.5,210.8,0.000,0.000,25,0,31.8,47.4,0.000,0.000,26,0,51.2,209.4,0.000,0.000,29,0,25.0,90.5,0.000,0.000,31,0,71.2,345.0,0.000,0.000,32,0,56.6,127.5,0.000,0.000*a60a9635

Table 7-111 SATELLITE Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	SATELLITE header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Satellite system	GNSS satellite system, see Table 7-112 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 7-52 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 Type	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)	-	-	-

Table 7-112 Satellite System

Binary Value	Satellite System Name in ASCII Format
0	GPS
1	GLONASS
2	SBAS
5	GALILEO
6	BEIDOU
7	QZSS
9	NAVIC

7.3.44 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 to: UM980, UM982, UM960

Message Output:

#SATECEFA,97,GPS,FINE,2190,365060000,0,0,18,12;28,GPS,25,-15074001.0000,-1321521.1250,21554962.0000,78939.508,8.906,4.603,0.0,GPS,26,-5199400.0000,25154968.0000,6019832.0000,50877.914,6.491,3.066,0.0,GPS,29,-24350838.0000,1869061.6250,10471350.0000,-138099.781,10.301,5.618,0.0,GPS,31,-5542408.0000,14613293.0000,21302554.0000,-47215.703,5.403,2.538,0.0,GPS,32,-18396664.0000,16438964.0000,9706892.0000,-12763.542,6.180,2.902,0.0,QZSS,194,-26913374.0000,25085678.0000,25578198.0000,-202.491,5.491,2.560,0.0,QZSS,199,-25393438.0000,33651112.0000,4994.1079,3.026,7.522,3.566,0.0,GALILEO,3,7417062.5000,15510334.0000,24086542.0000,-153400.016,7.043,3.451,1.0,GALILEO,5,-12822431.0000,21697142.0000,15516904.0000,-66745.031,5.324,2.456,1.0,GALILEO,24,-14646293.0000,12395834.0000,22518314.0000,-391926.406,5.595,2.636,1.0,GALILEO,25,-3816618.5000,28188316.0000,8166408.5000,-167453.578,6.307,2.980,1.0,BEIDOU,1,-34395868.0000,24403858.0000,-356958.1562,-87413.930,8.793,4.208,2.0,BEIDOU,2,4489574.5000,41931996.0000,342.9382,227784.938,8.965,4.403,2.0,BEIDOU,3,-14650923.0000,39556356.0000,-831224.1250,141089.422,7.682,3.588,2.0,BEIDOU,6,-11866700.0000,23972774.0000,32526292.0000,215105.672,5.396,2.463,2.0,BEIDOU,7,-12324336.0000,40175348.0000,-4187626.7500,18499.482,8.480,4.034,2.0,BEIDOU,9,-3438167.7500,24575944.0000,34374596.0000,-117248.531,5.592,2.592,2.0,BEIDOU,16,-

16779596.0000,22749714.0000,31341410.0000,12072.259,5.408,2.465,2.0,BEIDOU,19,-14636672.0000,23563198.0000,-3078972.7500,274718.438,9.268,4.502,2.0,BEIDOU,21,12200400.0000,10552887.0000,22784140.0000,-286255.938,9.488,5.114,2.0,BEIDOU,22,-1677701.1250,24076402.0000,14022415.0000,-288599.844,5.802,2.686,2.0,BEIDOU,36,-7533112.0000,16531093.0000,21199316.0000,-254393.703,5.393,2.461,2.0,BEIDOU,39,-20703172.0000,22689450.0000,28809826.0000,10351.210,5.451,2.486,2.0,BEIDOU,40,-20012358.0000,37200804.0000,70317.0625,69271.031,7.476,3.475,2.0,BEIDOU,45,8088047.5000,25093244.0000,9098498.0000,191929.906,8.316,4.061,2.0,BEIDOU,46,-18328430.0000,-1177068.3750,21021694.0000,-26218.129,9.093,4.596,2.0,BEIDOU,59,-32338378.0000,27044200.0000,513189.9062,6.267,8.236,3.879,2.0,BEIDOU,60,7289870.5000,41498212.0000,-1629297.3750,-43.630,9.758,4.989,2.0*017f82f3

Table 7-113 SATECEF Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	SATECEF header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	SatNum	Satellite number	Ulong	4	H
3	GNSS_SYSTEM	GNSS satellite system, see Table 7-112 Satellite System	Enum	4	H+4
4	Prn	Satellite PRN number, see Table 7-52 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	UINT	4	H+8

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
		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.			
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
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)	-	-	-

7.3.45 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 to: UM980, UM982, UM960

Message Output:

#RECTIMEA,97,GPS,FINE,2190,365121000,0,0,18,12;VALID,3.580410506e-04,0.000000000e+00,-18.00000000000,2021,12,30,5,25,3000,VALID*7e364e74

Table 7-114 RECTIME Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	RECTIME header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	clock status	Clock model status. 0 = VALID; 3 = INVALID. The enum of 0 or 3 is displayed when the binary information is output.	Enum	4	H
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)[6]	Uchar	1	H+32
8	utc day	UTC day (0-31)[7]	Uchar	1	H+33

[6, 7] If UTC time is unknown, the values of month and day are both 0s.

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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)[8]	Ulong	4	H+36
12	utc status	UTC status: 0 = INVALID; 1 = VALID; 2 = WARNING[9] 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)	-	-	-

7.3.46 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 to: UM982

Message Output:

#UNIHEADINGA,97,GPS,FINE,2190,365174000,0,0,18,12;INSUFFICIENT_OBS,NONE,0.0000,0.0000,0.0000,0.0000,0.0000,0.0000,"",0,0,0,0,0,00,0,0*ee072604

[8] The maximum value is 60999 when leap second is used.

[9] Indicates that leap second is used as default due to the lack of almanac.

Table 7-115 UNIHEADING Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	UNIHEADING header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	sol stat	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H
3	pos type	Position type, refer to Table 0- 4 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 7-85 Extended Solution Status	Uchar	1	H+41

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
17	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 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 7-83 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.

7.3.47 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 to: UM980, UM982, UM960

Message Output:

#UNIHEADING2A,50,GPS,FINE,2207,282484000,0,0,18,675;SOL_COMPUTED,NARROW_INT,10736.3838,88.3470,0.0876,0.0000,0.0001,0.0001,"201",52,29,29,29,3,01,3,c3*899773d6

Table 7-116 UNIHEADING2 Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	UNIHEADING2 header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	sol stat	Solution status, refer to Table 0- 5 Solution Status	Enum	4	H
3	pos type	Position type, refer to Table 0- 4 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 7-85 Extended Solution Status	Uchar	1	H+41

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
17	Galileo&BDS3 sig mask	Galileo and BDS-3 signal mask, refer to Table 7-84 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 7-83 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)	-	-	

7.3.48 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 to: UM980, UM982, UM960

Message Output:
#RTKSTATUSA,97,GPS,FINE,2190,365354000,0,0,18,1;0,0,0,0,0,0,0,0,0,0,0,NONE,0,0,0,0,0*f06a8a06

Table 7-117 RTKSTATUS Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	RTKSTATUS Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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
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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 0- 4 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 solution status.	Enum	4	H+48
15	Ion detected	Ionospheric scintillation detected 0: No effect on RTK solution 1~255: Negative effect on RTK solution	uchar	1	H+52

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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. 18	Reserved	Reserved	Uchar*2	2	H+54
19	Xxxx	32-bit CRC	Hex	4	H+56
20	[CR][LF]	Sentence terminator			

* Field 16 (Dual rtk flag) is applicable to UM982 Build9669 and later versions.

7.3.49 AGNSSSTATUS — AGNSS Status

This command is used to query the AGNSS status.

Message ID: 512

ASCII Syntax:

AGNSSSTATUSA 1

Binary Syntax:

AGNSSSTATUSB 1

Applicable to: UM982, UM980*

Message Output:

#AGNSSSTATUSA,77,GPS,FINE,2216,457483000,0,0,18,9;0000004EF7FFFFFF,0C003FFFBFFCBFFF,0000000000DF7FFF,0000000B67945FDF,0,F,01,07,2022,0,070418.26,18,0,0,4004.73963848,11614.19678280,57.9901*67b51741

* UM980 does not support the output of AGNSS status currently.

Table 7-118 AGNSSSTATUS Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	AGNSSSTATUS Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2,3,4,5	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	UINT	4	H+36
		Bit 1: available satellites 0 – insufficient 1 – sufficient Note: The ephemeris sent by the AGNSS server may not match the observations.			
		Bit2: validity of the assisted time 0 – invalid 1 — valid			

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
		Bit3: validity of the assisted position 0 — invalid 1 — valid			
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			

7.3.50 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 to: UM980, UM982, UM960

Message Output:

#RTCSTATUSA,97,GPS,FINE,2190,365386000,0,0,18,14;1,0,0,0,2190,365386,1495,0,0*ac0f615a

Table 7-119 RTCSTATUS Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	RTCSTATUS Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Type	0: invalid 1: valid Display the status of RTC counter	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			

7.3.51 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 to: UM980, UM982, UM960, UM960L

Message Output:

#JAMSTATUSA,97,GPS,FINE,2190,365412000,0,0,18,14;SINGLE,0,0,0,0*e31418ea

Table 7-120 JAMSTATUS Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	JAMSTATUS Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Pos type	Position type, refer to Table 0- 4 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 it has on positioning.	Uchar	1	H+4

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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			

7.3.52 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 to: UM980, UM960, UM982

☞ Applicable to UM982 Build9669 and later versions

Message Output:

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

Table 7-121 FREQJAMSTATUS Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	FREQJAMSTATUS Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
2	Pos type	Position type, refer to Table 0- 4 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 jamming signal The higher the strength, the greater the impact on positioning	UCHAR	1	H+8
8	L5CWFlag	0: NO CW JAM 1: CW JAM 2: Strong CW JAM	UCHAR	1	H+9
9	Reserved	Reserved	Uchar[2]	2	H+10
10	Xxxx	Checksum	Hex	4	H+12

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
11	[CR][LF]	Sentence terminator			

7.3.53 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 to: UM960L

Message Output:

#RTCMSTATUSA,76,GPS,FINE,2219,392572000,0,0,18,187;1124,21186,0,21,0,6,11,0,0,21*601a7581

Table 7-122 RTCMSTATUS Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	RTCMSTATUS Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
6	L1 num	Number of L1 observables, see Table 7-123 Satellite Signals Corresponding to L1~L6	UCHAR	1	H+16
7	L2 num	Number of L2 observables, see Table 7-123 Satellite Signals Corresponding to L1~L6	UCHAR	1	H+17
8	L3 num	Number of L3 observables, see Table 7-123 Satellite Signals Corresponding to L1~L6	UCHAR	1	H+18
9	L4 num	Number of L4 observables, see Table 7-123 Satellite Signals Corresponding to L1~L6	UCHAR	1	H+19
10	L5 num	Number of L5 observables, see Table 7-123 Satellite Signals Corresponding to L1~L6	UCHAR	1	H+20
11	L6 num	Number of L6 observables, see Table 7-123 Satellite Signals Corresponding to L1~L6	UCHAR	1	H+21
12	Xxxx	Checksum	Hex	4	H+22
13	[CR][LF]	Sentence terminator			

Table 7-123 Satellite Signals Corresponding to L1~L6

GNSS	Signal ID	Signal Channel
GPS	1	L1C/A
	2	L2P
	3	L2C
	4	L5
	5	L1C
	6	Reserved

GNSS	Signal ID	Signal Channel
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
	6	B1C

7.3.54 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 to: UM980, UM982, UM960

Message 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 7-124 HWSTATUS Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	HWSTATUS Header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Temp1	Temperature, °C * 1000. It refers to the junction temperature of the main chip; different from the ambient temperature.	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

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 the table below 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
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 7-125 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	
Bit5	
Bit6	
Bit7	Check status: 0 = unknown, 1 = valid

7.3.55 AGC — Automatic Gain Control

This log outputs the automatic gain control (AGC) information. If the antenna link is abnormal when an open circuit occurs, the AGC will increase the gain. When signal interference raises the noise floor, the AGC will reduce the gain. This is the general rule of AGC, but due to the difference between the hardware of the modules, the AGC values may be different.

Message ID: 220

ASCII Syntax:

AGCA 1

Binary Syntax:

AGCB 1

Applicable to: UM980, UM982, UM960

Message Output:

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

Table 7-126 AGC Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	AGC header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	ANT1L1	Value of L1 signal received by the master antenna. AGC register supports values in the range of 0 to 255. If the value is -1, it indicates that the channel is invalid.	Short	2	H

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
3	ANT1L2	Value of L2 signal received by the master antenna. AGC register supports values in the range of 0 to 255. 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 255. 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 255. 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 255. If the value is -1, it indicates that the channel is invalid.	Short	2	H+12

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
9	ANT2L5	Value of L5 signal received by the slave antenna. AGC register supports values in the range of 0 to 255. If the value is -1, it indicates that the channel is invalid.	Short	2	H+14
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)	-	-	-

7.3.56 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:

KSXT 1 Output 1Hz KSXT message at the current port

KSXT COM2 1 Output 1Hz KSXT message at COM2

Applicable to: UM980, UM982, UM960

Message 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 7-127 KSXT Message Structure

ID	Field Type	Data Description	Symbol
1	$KSXT	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure	
2	Utc	UTC time	yyyymmddhhmmss.ss

ID	Field Type	Data Description	Symbol
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

ID	Field Type	Data Description	Symbol
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
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	Xor check (hexadecimal string, check from the header)	*FF
24	[CR][LF]	Sentence terminator	[CR][LF]

7.3.57 INFOPART1

Read user-defined information stored in the space of PART1.

Message ID: 1019

ASCII Syntax:

INFOPART1A

Binary Syntax:

INFOPART1B

Applicable to: UM980, UM982

Message Output:

#INFOPART1A,69,GPS,FINE,2190,376054000,0,0,18,953;0*723399e1

Table 7-128 INFOPART1 Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	INFOPART1 header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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)	-	-	-

7.3.58 INFOPART2

Read user-defined information stored in the space of PART2.

Message ID: 1020

ASCII Syntax:

INFOPART2A

Binary Syntax:

INFOPART2B

Applicable to: UM980, UM982

Message Output:

#INFOPART2A,67,GPS,FINE,2190,376094000,0,0,18,753;0*c5702fa1

Table 7-129 INFOPART2 Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	INFOPART2 header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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)	-	-	-

7.3.59 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 to: UM982

☞ Applicable to UM982 Build9669 and later versions

Message Output:

#MSPOSA,86,GPS,FINE,2247,471141000,0,0,18,25;SOL_COMPUTED,SINGLE,40.07896381103,116.23651058490,64.4448,1.3441,1.2328,2.9707,46,28,,SOL_COMPUTED,SINGLE,40.07896511614,116.23651086865,64.5809,1.3723,1.1967,2.9210,45,28,,"0",0.000*a71a580e

Table 7-130 MSPOS Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	MSPOS header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Master_p-sol status	Solution status calculated with the master antenna, refer to Table 0- 5 Solution Status	Enum	4	H
3	Master_pos type	Position type calculated with the master antenna, refer to Table 0- 4 Position or Velocity Type	Enum	4	H+4

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 antenna, meters	Double	8	H+24
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 0- 5 Solution Status	Enum	4	H+48
14	Slave_pos type	Position type calculated with the slave antenna, refer to Table 0- 4 Position or Velocity Type	Enum	4	H+52

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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 calculated with the slave antenna, meters	Float	4	H+84
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)	-	-	-

7.3.60 TROPINFO — Zenith Tropospheric Delay

TROPINTO contains the zenith tropospheric delay information. It only supports ONCE or ONCHANGED trigger. Besides, it is available only if PPP is enabled.

Message ID: 2318

ASCII Syntax:

TROPINFOA ONCHANGED

Binary Syntax:

TROPINFOB ONCHANGED

Applicable to: UM980

Message Output:

#TROPINFOA,85,GPS,FINE,2244,93693000,0,0,18,63;SAASTAMOINEN,2.354103,2.29224
6,0.061857,0.026856,0.000000*89ed6541

Table 7-131 TROPINFO Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	TROPINFO header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		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
7	Reserved	Reserved	Float	4	H+20
8	Xxxx	32-bit CRC	HEX	4	H+24
9	[CR][LF]	Sentence terminator (ASCII only)			

7.3.61 PTOBSINFO — Observation Information for Production Test

This log outputs observation validity information used for production test.

Message ID: 221

ASCII Syntax:

PTOBSINFOA 1

Binary Syntax:

PTOBSINFOB 1

Applicable to: UM980, UM982, UM960

☞ Applicable to UM982 Build9669 and later versions

Message Output:

#PTOBSINFOA,85,GPS,FINE,2244,93711000,0,0,18,34;1,1,195,194,1,0.00,0,0,0,0,1ffff,43.23,44.51,42.98,49.38,41.98,44.16,42.30,47.10,46.21,43.43,44.63,41.66,49.34,42.48,44.92,42.65,47.03,0.00*d9c47abd

Table 7-132 PTOBSINFO Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	PTOBSINFO header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	RTC Flag	RTC validity flag 0: Unknown 1: Valid 2: Invalid	INT	4	H
3	Clock drift Flag	0: Invalid 1: Valid	INT	4	H+4

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
4	PsrValidNum	Number of observations with valid PSR	INT	4	H+8
5	AdrValidNum	Number of observations with valid ADR	INT	4	H+12
6	ADRNumValidFlag	Validity flag 0: Invalid 1: Valid	INT	4	H+16
7	ADRPrecise	Precision of ADR, in millimeters	Float	4	H+20
8	Reserved	Reserved	INT[4]	16	H+24
9	SignalValid	Signal validity flag, see Table 7-133 Index of SignalValid and SignalAvgCN0	UINT	4	H+40
10	SignalAvgCN0	Average CN0 of a specific signal, in dB-Hz, see Table 7-133 Index of SignalValid and SignalAvgCN0	Float[18]	4*18	H+44
11	Xxxx	32-bit CRC	HEX	4	H+116
12	[CR][LF]	Sentence terminator (ASCII only)			

Table 7-133 Index of SignalValid and SignalAvgCN0

Freq.	Index for the Master Antenna	Index for the Slave Antenna
GPS L1C/A	0	9
GPS L2C	1	10
GLO G1	2	11
GLO G2	3	12
BDS B1	4	13
BDS B3	5	14

Freq.	Index for the Master Antenna	Index for the Slave Antenna
GAL E1	6	15
GAL E5B	7	16
GAL E5A	8	17

7.3.62 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 to: UM980, UM982

Message Output:

#PPPB2BINFO1A,80,GPS,FINE,2203,366209000,0,0,18,1;219,1,2,20590,00003FFDFFFC0001FFFFFFFE000000000000000000000000000000000000000*f7e11cb5

Table 7-134 PPPB2BINFO1 Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO1 header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Prn	PRN (161 based)	Short	2	H
3	Iodssr	Issue of Data, State Space Representation	Uchar	1	H+2

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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)			

7.3.63 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 to: UM980, UM982

Message Output:

#PPPB2BINFO2A,86,GPS,FINE,2203,366269000,0,0,18,1;219,1,0,20631,72,86,-84,25,-24,0,27,84,50,39,71,18,4,27,90,57,-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 7-135 PPPB2BINFO2 Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO2 header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
2	Prn	PRN (161 based)	Ushort	2	H
3	Iodssr	Issue of Data, State Space Representation	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	StOrbitCorr[6]	72	H+8
7	XXXX	32-bit CRC	HEX	4	H+80
8	[CR][LF]	Sentence terminator (ASCII only)			

```
typedef struct
{
    USHORT usPrn;   //SatSlot in ICD
    USHORT usIodn;  // Issue of Data, Navigation
    SHORT   sRadial; //radial correction
    SHORT   sInTrack; //tangential correction
    SHORT   sCross; //normal correction
    UCHAR   ucIODCorr; //Issue of Data, Correction
    UCHAR   ucURAI;   //User Range Accuracy Index
}_PACKED_ StOrbitCorr;
```

7.3.64 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 to: UM980, UM982

Message 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,-259,7,-227,8,-199,12,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,44,8,0,-35,1,-43,2,-37,4,-255,5,-210,7,-212,8,-182,12,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,45,8,0,-490,1,-355,2,-350,4,-327,5,-284,7,-270,8,-243,12,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0*943febbe

Table 7-136 PPPB2BINFO3 Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO3 header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Prn	PRN (161 based)	Ushort	2	H
3	Iodssr	Issue of Data, State Space Representation	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	StCodeBias_t [SatNum]	64*SatNum	H+8
7	xxxx	32-bit CRC	HEX	4	H+8+64*SatNum
8	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

```
typedef struct
{
    USHORT usMode;    //signal type and data processing mode
    SHORT   sCodeCorr;  //differential code bias (DCB)
}_PACKED_ StCodeCorr_t;

typedef struct
{
```

```
    USHORT usSatSlot;           //satellite slot
    USHORT usBiasNum;           //number of DCB
    StCodeCorr_t stCodeCorr[15];  //DCB corrections
}_PACKED_ StCodeBias_t;
```

7.3.65 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 to: UM980, UM982

Message 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 Type	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO4 header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Prn	PRN (161 based)	Ushort	2	H
3	Iodssr	Issue of Data, State Space Representation	Uchar	1	H+2

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
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	StClkCorr_t[23]	92	H+12
9	xxxx	32-bit CRC	HEX	4	H+104
10	[CR][LF]	Sentence terminator (ASCII only)	-	-	-

```
typedef struct
{
    USHORT usIodCorr;  //issue of data, correction
    SHORT   sC0;       //clock bias corrections
}_PACKED_ StClkCorr_t;
```

7.3.66 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 to: UM980, UM982

Message 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,-16383,7,71,0,-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 7-138 PPPB2BINFO5 Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO5 header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	Prn	PRN (161 based)	Ushort	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	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	StURAI-t[70]	140	H+12
11	XXXX	32-bit CRC	HEX	4	H+152
12	[CR][LF]	Sentence terminator (ASCII only)			

```
typedef struct
{
```

```
    UCHAR  ucCLASS;
    UCHAR  ucValue;
}_PACKED_ StURAI_t;
```

7.3.67 PPPB2BINFO6 — Information Type 6

This command is used to output PPP-B2b information type 6, including satellite clock bias corrections and orbit 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: 2312

ASCII Syntax:

PPPB2BINFO6A ONCHANGED

Binary Syntax:

PPPB2BINFO6B ONCHANGED

Applicable to: UM980, UM982

Message Output:

#PPPB2BINFO6A,85,GPS,FINE,2203,366294000,0,0,18,1;219,1,2,20674,1,2,0,0,-16383,20674,1,0,0,0,219,1,2,3,4,5,6,220,1,2,3,4,5,6*3a7fd61c

Table 7-139 PPPB2BINFO6 Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO6 header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	PRN	PRN (161 based)	Ushort	2	H
3	NumC	Number of satellites with clock bias corrections	Uchar	1	H+2
4	NumO	Number of satellites with orbit corrections	Uchar	1	H+3
5	RawNumc	Clock bias corrections	StNumC	96	H+4

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
6	RawNumo	Orbit corrections	StNumO	80	H+100
7	XXXX	32-bit CRC	HEX	4	H+180
8	[CR][LF]	Sentence terminator (ASCII only)			

```
typedef struct
{
   USHORT usIODCorr;
   SHORT  sC0;
}_PACKED_ StClkCorr6_t;
typedef struct
{
   UINT   uiSow;
   UCHAR  ucIodssr;
   UCHAR  ucIodp;
   USHORT usSatStartIndex;
   StClkCorr6_t astClkCorr[22];
}_PACKED_ StNumC_t;
typedef   struct
{
   USHORT usPrn;
   USHORT usIodn;
   SHORT  sRadial;
   SHORT  sInTrack;
   SHORT  sCross;
   UCHAR  ucIodCorr;
   UCHAR  ucURAI;
}_PACKED_ StOrbitCorr_t;
typedef struct
{
   UINT   uiSow;
   UCHAR  ucIodssr;
   UCHAR  aucReserved[3];
   StOrbitCorr_t astOrbitCorr[6];
```

}_PACKED_ StNumO_t;

7.3.68 PPPB2BINFO7 — Information Type 7

This message is used to broadcast satellite clock bias corrections and orbit corrections. The difference between this message and Information Type 6 is that satellite clock bias corrections are matched with satellites by SatSlot rather than by mask. For more details, please refer to PPP-B2b ICD. PPP is supported by specific versions only. This log **only** supports ONCHANGED trigger.

Message ID: 2314

ASCII Syntax:

PPPB2BINFO7A ONCHANGED

Binary Syntax:

PPPB2BINFO7B ONCHANGED

Applicable to: UM980, UM982

Message Output:

#PPPB2BINFO7A,85,GPS,FINE,2203,366294000,0,0,18,1;219,1,2,20674,1,2,0,0,219,1,2,20674,1,0,0,0,219,1,2,3,4,5,6,220,1,2,3,4,5,6*3a7fd61d

Table 7-140 PPPB2BINFO7 Message Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	PPPB2BINFO6 header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure		H	0
2	PRN	PRN (161 based)	Ushort	2	H
3	NumC	Number of satellites with clock bias corrections	Uchar	1	H+2
4	NumO	Number of satellites with orbit corrections	Uchar	1	H+3
5	RawNumc	Clock bias corrections	StNumC	128	H+4

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
6	RawNumo	Orbit corrections	StNumO	80	H+132
7	XXXX	32-bit CRC	HEX	4	H+212
8	[CR][LF]	Sentence terminator (ASCII only)			

```
typedef struct
{
   INT    iPrn;
   USHORT usIODCorr;
   SHORT  sC0;
}_PACKED_ StClkCorr7_t;
typedef struct
{
   UINT   uiSow;
   UCHAR  ucIodssr;
   UCHAR  ucIodp;
   UCHAR  aucReserved[2];
   StClkCorr7_t astRawClkCorr[15];
}_PACKED_ StNumC7_t;
typedef    struct
{
   USHORT usPrn;
   USHORT usIodn;
   SHORT  sRadial;
   SHORT  sInTrack;
   SHORT  sCross;
   UCHAR  ucIodCorr;
   UCHAR  ucURAI;
}_PACKED_ StOrbitCorr7_t;
typedef struct
{
   UINT   uiSow;
   UCHAR  ucIodssr;
   UCHAR  aucReserved[3];
   StOrbitCorr7_t    astRawOrbitCorr[6];
}_PACKED_ StNumO7_t;
```

8 Other Commands

8.1 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 of the Command:

UNLOG [port] [message]

Abbreviated ASCII Syntax:

UNLOG	Stop the current port outputting all messages
UNLOG GPGGA	Stop the current port outputting GPGGA message
UNLOG COM1	Stop COM1 outputting all messages
UNLOG COM2 GPGGA	Stop COM2 outputting GPGGA message

Applicable to: UM960, UM960L, UM980, UM982

Table 8-1 Parameters of the UNLOG Command

Header	Port	Message
UNLOG	COM1 COM2 COM3	Message to be stopped

8.2 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 of the Command:

FRESET

Abbreviated ASCII Syntax:

FRESET

Applicable to: UM960, UM960L, UM980, UM982

Table 8-2 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.

8.3 Reset

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 of the Command:

RESET [parameter]

Abbreviated ASCII Syntax:

RESET

RESET EPHEM

RESET EPHEM ALMANAC IONUTC POSITION XOPARAM

RESET ALL

Applicable to: UM960, UM960L, UM980, UM982

Table 8-3 Parameters of the RESET Command

Header	Parameter	Description
RESET	-	Restart the receiver
	EPHEM	Restart the receiver and clear the ephemeris
	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

Header	Parameter	Description
	ALL	Restart the receiver and clear all the information above, except XOPARAM or CLOCKDRIFT

☞ 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.

8.4 SAVECONFIG — Save Configuration into NVM

This command saves the current configuration into non-volatile memory (NVM), including LOG messages (except those triggered by ONCE), port configuration, etc.

Syntax of the Command:

SAVECONFIG

Abbreviated ASCII Syntax:

SAVECONFIG

Applicable to: UM960, UM960L, UM980, UM982

Table 8-4 Parameter of the SAVECONFIG Command

Header	Parameter	Description
SAVECONFIG	-	Save the current configuration into non-volatile memory (NVM)

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 of the Command:

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 (based on RTCM3.03)
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 end transmits heading information to the rover end (UNICORECOMM-defined)

Appendix 3: 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 of the Command:
EVENTFLAG [parameter]

Abbreviated ASCII Syntax:
EVENTFLAGB ONCHANGED
EVENTFLAGA ONCHANGED

Applicable to: UM980, UM982

Message Output:
#EVENTFLAGA,97,GPS,FINE,2227,210352000,0,0,18,0;2,43,0,0,2227,210351,999532091,0,-1,-1*405dd7fe

Table 0- 1 EVENTFLAG Data Structure

ID	Field	Description	Format	Binary Bytes	Binary Offset
1	EVENTFLAG header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure 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)	UCHAR	1	H
3	Status*	Status of the module, see Table 0- 2 STATUS Bit Description	UCHAR	1	H+1
4	Reserved	Reserved	UCHAR	1	H+2

ID	Field	Description	Format	Binary Bytes	Binary Offset
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)	-	-	-

* Field 3 (status) is applicable to UM982 Build9669 and later versions.

Table 0- 2 STATUS Bit Description

Bit	Description
Bit0	Validity flag of seconds of week: 0=invalid; 1=valid
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 of the Command:

EVENTSLN [parameter]

Abbreviated ASCII Syntax:

EVENTSLNB ONCHANGED

EVENTSLNA ONCHANGED

Applicable to: UM980, UM982

Message Output:

#EVENTSLNA,97,GPS,FINE,2227,210381000,0,0,18,0;2,43,0,0,2227,210380,999532081,0,-1,-1,SOL_COMPUTED,SINGLE,40.07896911523,116.23651480774,67.0271,-8.4925,WGS84,1.7728,1.6873,4.7070,48,0.000,0.000,50,28,0,0,-0.009,-0.004,-0.116*8f231ab8

Table 0- 3 EVENTSLN Data Structure

ID	Field	Description	Format	Binary Bytes	Binary Offset
1	eventsln header	Log header, see Table 7-48 Binary Header Structure and Table 7-49 ASCII Header Structure 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 0- 2 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

ID	Field	Description	Format	Binary Bytes	Binary Offset
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	sol status	Solution status, see Table 0- 5 Solution Status	Enum	4	H+28
13	pos type	Position type, see Table 0- 4 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

ID	Field	Description	Format	Binary Bytes	Binary Offset
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 System, accurate to three decimal places, km/h (null if no value)	Float	4	H+96
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)			

* Field 3 (status) is applicable to UM982 Build9669 and later versions.

Table 0- 4 Position or Velocity Type

Decimal	ASCII	Description
0	NONE	No solution
1	FIXEDPOS	Position fixed by the FIX POSITION command
2	FIXEDHEIGHT	Not supported currently

Decimal	ASCII	Description
8	DOPPLER_VELOCITY	Velocity computed using instantaneous Doppler
16	SINGLE	Single point positioning
17	PSRDIFF	Pseudorange differential solution
18	SBAS	SBAS positioning
32	L1_FLOAT	L1 float solution
33	IONOFREE_FLOAT	Ionosphere-free float solution
34	NARROW_FLOAT	Narrow-lane float solution
48	L1_INT	L1 fixed solution
49	WIDE_INT	Wide-lane fixed solution
50	NARROW_INT	Narrow-lane fixed solution
52	INS	Inertial navigation solution
53	INS_PSRSP	Integrated solution of INS and single point positioning
54	INS_PSRDIFF	Integrated solution of INS and pseudorange differential positioning
55	INS_RTKFLOAT	Integrated solution of INS and RTK float
56	INS_RTKFIXED	Integrated solution of INS and RTK fix
68	PPP_CONVERGING	PPP solution converging
69	PPP	Precise Point Positioning

Table 0- 5 Solution Status

Solution Status		Description
0	SOL_COMPUTED	Solution computed
1	INSUFFICIENT_OBS	Insufficient observation
2	NO_CONVERGENCE	No convergence, invalid solution

Solution Status		Description
4	COV_TRACE	Covariance matrix trace exceeds maximum (trace > 1000 m)

和芯星通科技 (北京) 有限公司
Unicore Communications, Inc.

北京市海淀区丰贤东路 7 号北斗星通大厦三层
F3, No.7, Fengxian East Road, Haidian, Beijing, P.R.China, 100094
www.unicorecomm.com

Phone: 86-10-69939800

Fax: 86-10-69939888

info@unicorecomm.com