INERTIAL NAVIGATION SYSTEM

PROTOCOL

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Inertial Navigation System Products

Revision History

Version	Revision History	Date
R1	Initial release revision	2020-03-27
R2	Add CFGCOG	2020-06-30
R2.1	Remove the mode of 2~9 in CFGINS Revise the default configuration of CFGODOFWD to 1	2020-10-19
R2.2	Update the comments from test	2020-12-03
R2.3	Revise typo	2020-12-15
R2.4	Update parameters of NMEA message	2020-12-31
R2.5	Update the description of LSF and default parameters of CFGINS	2021-07-20
R2.6	Update the description of “mapstat” in SNRSTAT; Add explanations for UTC and DIF messages in MAPFB; Add notes about firmware version in CFGCOG message; Revise the message syntax, examples, and descriptions according to the test results	2022-03-28
R2.7	Revise the parameter of cold start in RESET command; Add NAVATT command (navigation attitude); Revise the SBAS satellite number	2022-08-15
R2.8	Add GYOACC-V message	2022-12-28

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Foreword

This manual provides detailed description of the protocol commands used by UFirebird products, applicable to UM220-INS NF and UM220-INS NL products.

Audience

This manual is created for the technical personnel, who possess the expertise of GNSS receivers.

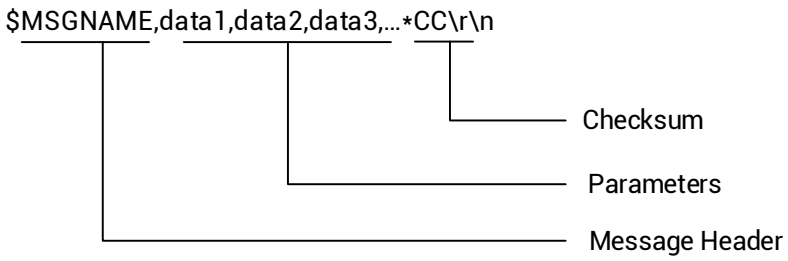
Contents

1 Messages

In the Unicore protocol, input and output statements are collectively called messages. Each message is a string of full ASCII characters.

The basic format of the message is:

$MSGNAME,data1,data2,data3,…*CC\r\n



All messages contain three data blocks:

The first data block is the message header, which starts with '$' (0x24).

The second data block is the data field consisting of a number of parameters or data. The message header and data field are separated by ',' (0x2C).

The last data block is an optional checksum, which is separated from the previous data with '*' (0x2A).

The input message ends with 'r' (0x0D) or '\n' (0x0A) or any combination of the two.

The output message ends with ' \r\n'. The total length of each message does not exceed 128 bytes.

Message header and parameters, as well as letters in checksums are not case-sensitive.

Certain parameters of certain input commands can be omitted (marked as optional in the command description). These parameters can be empty, that is, there is no character between the two commas.

Then, if there is no special instruction, this parameter will be ignored and the options it controls will remain unchanged.

Most of the message headers can be used for both input commands and output messages. The same message header is used as input to set parameters or to query the current configuration, and as output to output receiver information or configuration.

2 Checksum

The two characters after '*' (0x2A) in the message are the checksum, which is calculated as the xor of all characters (excluding '$' and '*') from '$' to '*', in hexadecimal.

The checksum in the input command is optional. If the input statement contains '*' followed by the two characters, the checksum is examined. If the examination result is wrong, the command is not executed, and the receiver outputs the $fail message, in which a checksum error is indicated. If the statement does not contain a checksum, the command is executed directly.

If the parameters of the input message are empty and a checksum needs to be added, it should be followed by ','. It's not allowed to add an extra ',' when the parameter is not null.

Example: $PDTINFO,*62

The output message always contains a checksum. The description of the checksum in the Unicore protocol will be omitted in the following message definition.

3 Formats

In the Unicore protocol, the data in the message contains the following types:

String (STR)

The string consists of up to 32 ASCII characters except '\ r' and '\ n', such as GPSL1.

Unsigned Integer (UINT)

Unsigned integers range from 0 to 4294967295, and are defined in both decimal and hexadecimal. A decimal unsigned integer consists of ASCII characters from 0 to 9. Such as 123, 4291075193. A hexadecimal unsigned integer starts with the character h or H, followed by a string of 0 to 9 and a-f (or A-F), with a maximum of 8 characters (excluding the starting h or H). Such as hE10, hE41BA7C0.

Signed Integer (INT)

Signed integers are composed of ASCII characters from 0 to 9 and a negative sign, with a range of -2147483648 to 2147483647. Such as 123217754, -245278.

Unsigned Long Integer (UINT64)

Unsigned long integers range from 0 to 18446744073709551615, and are defined in both decimal and hexadecimal. A decimal unsigned long integer consists of ASCII characters from 0 to 9. Such as 123 and 4291075193. A hexadecimal unsigned long integer is a string of ASCII characters from 0 to 9 and a-f (or A-F), with a maximum of 16 characters (excluding the starting h, H, 0x, and 0X). Such as hE10, hE41BA7C0, or 0xFFFFFF, 0XFFFFF.

DOUBLE

Double-precision floating-point data consists of ASCII characters from 0 to 9, with a negative sign and a decimal point, ranging from -2^1023 to 2^1023. Such as 3.1415926, -9024.12367225.

4 Coordinates

The position value observed by the product is based on the WGS84 coordinate system. If the position value of the output message is based on other coordinate system, it will be noted in the message explanation of this documentation. If the user expects to use a different reference coordinate, the position is very likely to be off by tens or even hundreds of meters.

5 Message Definition

5.1 Common Message

5.1.1 PDTINFO

Read Product Information

Syntax	$PDTINFO
Example	$PDTINFO
Description	Read product information, the receiver outputs PDTINFO message after receiving this command
Input/Output	Input
No parameters	

Output the Product Information

Syntax	$PDTINFO,pdtName,config,hwVer,fwVer,PN,SN	
Example	$PDTINFO,UM220,G1B1,V4.1,R3.0Build13260,080101000001,000101114303845	
Description	Output the message of the product information	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
pdtName	STR	Product name
config	STR	Product configuration
hwVer	STR	Hardware version
fwVer	STR	Firmware version
PN	STR	Product ID
SN	STR	Product serial number

5.1.2 RESET

Reset the Receiver

Syntax	$RESET,type,clrMask	
Example	$RESET,0,h01 (Warm start)	
Description	Receiver reset	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description
Type	UINT (optional)	Reset type 0 - Software reset 1 - Chip-level reset (watchdog reset)

		2 - Board-level reset 3 - Receiver stopped
clrMask	UINT (optional)	Reset to clear the receiver's saved information. Setting the bit to 1 clears the signal upon reset. bit0 – Clear ephemeris bit1 – Reserve0 bit2 – Clear receiver position and time bit3 – Clear inertial device parameters bit4 – Clear ionospheric correction and UTC parameters bit5 – Reserve2 bit6 – Reserve3 bit7 – Clear almanac Several commonly used startup methods, the parameters are listed as follow: h00 – Hot start h01 – Warm start hff – Cold start

☞ When a leap second occurs, the receiver may take up to 25 minutes to sync to the correct UTC time after a cold start reset.

5.1.3 Command Echo(1)

Output the Current Unicore Command Entered By the User

Syntax	# User command
Example	#CFGPRT,1,h0,115200,3,35
Description	Display the current Unicore command input by users
Input/Output	Output
No parameters	

(1): This command is only supported in the firmware of R3.4.0.0 and above.

5.1.4 OK

Output the Message That the Receiver Executes Command Correctly

Syntax	$OK
Example	$OK
Description	A response that the receiver executes command correctly. The message is only output on the port where the command is received.
Input/Output	Output
No parameters	

5.1.5 FAIL

Output the Message That the Receiver Executes Command in Error

Syntax	$FAIL,errorCode	
Example	$FAIL,0	
Description	A response that the input command is incorrect The message is only output on the port where the command is received	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
errorCode	UINT	Error code 0 –Illegal instruction or incorrect parameter 1 –Checksum error

5.2 Config Message

5.2.1 CFGPRT

Read Port Configuration

Syntax	$CFGPRT,portID	
Example	$CFGPRT,1	
Description	Read the receiver port configuration. The receiver outputs a CFGPRT message after receiving this command.	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description
portID	UINT (optional)	Port number,1~2 If empty, output the current port configuration

Set/Output the Port Configuration

Syntax	$CFGPRT,uartNum,reserved,baud,inProto,outProto	
Example	$CFGPRT,1,h0,115200,1,3	
Description	Set or output the port configuration	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
portID	UINT (optional)	Port number: 1 – UART1 2 – UART2 If empty, configure the current UART
addr	UINT	h0

Baud	UINT (optional)	When the output port is a serial port, the baud rate can be set as: 9600 /115200/460800(1) Meaningless if the output port is not a serial port.
inProto	UINT (optional)	Input protocol of the port, enabled by setting the corresponding bit to 1 bit0-UNICORE(2) bit7-RTCM3.2 (set the baud rate to 115200 and above) bit9-odometer input protocol (only supported by ADR version) bit10-Map matching input protocol
outProto	UINT (optional)	Output protocol of the port, enabled by setting the corresponding bit to 1 bit0-UNICORE bit1-NMEA bit2-RTCM3.2 (set the baud rate to 115200 and above) bit5-Command echo(3)

(1): 460800 baud rate is only supported in the firmware of R3.4.0.0 and above.

(2): COM1 cannot disable the Unicore input protocol.

(3): Only supported in the firmware of R3.4.0.0 and above.

☞ Concurrent input or output of RTCM 3.2 protocol at two serial ports is NOT supported.

☞ When continuously sending CFGPRT command, the time interval should be larger than 1s.

5.2.2 CFGMSG

Read Message Output Configuration

Syntax	$CFGMSG,msgClass,msgID
Example	$CFGMSG,0,1
Description	Read the message output configuration. The receiver outputs CFGMSG configuration information after receiving this command.
Input/Output	input

Parameter Definition		
Parameter	Format	Description
msgClass	UINT	Message class
msgID	UINT	Message ID

Set/Output Message Output Configuration

Syntax	$CFGMSG,msgClass,msgID,switch	
Example	$CFGMSG,0,1,1	
Description	Set or output the output configuration of a message	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
msgClass	UINT	Message class
msgID	UINT (optional)	Message ID
switch	UINT	Message control

Message Class and ID

Message Name	Class	ID	Message Control
GGA	0	0	0: disable 1: enable
GLL	0	1	0: disable 1: enable
GSA	0	2	0: disable 1: enable
GSV	0	3	0: disable 1: enable

RMC	0	4	0: disable 1: enable
VTG	0	5	0: disable 1: enable
ZDA	0	6	0: disable 1: enable
GST	0	7	0: disable 1: enable
POS	1	0	0: disable 1: enable
VEL	1	1	0: disable 1: enable
TIME	1	2	0: disable 1: enable
ACC	1	3	0: disable 1: enable
GYOACC(1)	4	0	0: disable 1: enable
SNRSTAT	4	1	0: disable 1: enable
NAVATT	4	2	0: disable 1: enable
GYOACC-V	4	3	0: disable 1: enable

(1): Firmware below R3.4.0.0 only supports 5Hz output, and the firmware above R3.4.0.0 supports 10Hz output.

☞It's required to set the baud rate to 460800 for 10Hz NMEA output.

5.2.3 CFGTP

Read Timing Pulse Configuration

Syntax	$CFGTP
Example	$CFGTP
Description	Read the current timing pulse configuration. The receiver outputs a CFGTP message after receiving this command.
Input/Output	Input
No parameters	

Set/Output Timing Pulse Configuration

Syntax	$CFGTP,interval,length,flag,antDelay,rfDelay,usrDelay	
Example	$CFGTP,1000000,500000,1,0,800,0	
Description	Set or output timing pulse configuration	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
interval	UINT (optional)	Timing pulse frequency, unit: μs; set to 1000000 by default
length	UINT (optional)	Timing pulse width, unit: μs, and the maximum value is no more than interval – 1 μs. (High-level width when the rising edge is aligned with the integral timing pulse frequency , and low-level width when the falling edge is aligned with the integral timing pulse frequency)
flag	UINT (optional)	Configuration of the timing pulse: bit0 0 – Disable the time pulse output 1 – Enable the time pulse output bit1 0 – Rising edge aligned to an integral number of seconds

		1 – Falling edge aligned to an integral number of seconds bit2 0 – Output when the timing is reliable (reliably synchronized to the set time scale) 1 – Always output timing pulses bit3 0 –Disable TIMTP 1 – Enable TIMTP
antDelay	INT (optional)	Antenna delay, unit: ns; (-32768 ~ 32767)
rfDelay	INT (optional)	RF unit delay, unit: ns; (-32768~32767)
usrDelay	INT (optional)	User-set delay, unit: ns, range: -32768~32767

5.2.4 CFGNMEA

Read NMEA Configuration

Syntax	$CFGNMEA
Example	$CFGNMEA
Description	Read the NMEA configuration. The receiver outputs a CFGNMEA message after receiving this command.
Input/Output	Input
No parameters	

Set/Output NMEA Configuration

Syntax	$CFGNMEA,nmeaVer,InsNmeaOpen
Example	$CFGNMEA,h51,1
Description	Set or output the NMEA configuration
Input/Output	Input/output

Parameter Definition		
Parameter	Format	Description
nmeaVer	UINT	Output NMEA protocol version h30- Extend Beidou related statements based on NMEA standard version 3.0 h51- Extend Beidou related statements based on standard NMEA 4.1 ($GBGSA)
InsNmeaOpen	UINT	0- 1Hz NMEA message output 1- Enable 5Hz NMEA message output (release mode, baud rate 115200) 2- Enable 10Hz NMEA message output (release mode, baud rate 460800)

☞ Set the baud rate of serial port 1 and serial port 2 to 460800 to enable 10Hz;
Set the baud rate of serial port 1 and serial port 2 to 115200 and above to enable 5Hz;

5.2.5 CFGSYS

Read Satellite System Configuration

Syntax	$CFGSYS
Example	$CFGSYS
Description	Read the current satellite system configuration. The receiver outputs a CFGSYS message after receiving this command.
Input/Output	Input
No parameters	

Set/Output Satellite System Configuration

Syntax	$CFGSYS,sysMask
Example	$CFGSYS,H11

Description	Set or output satellite system configuration. The receiver automatically resets while receiving the command, the configuration of enabling the satellite system works after the reset.	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
sysMask	UINT	H01(1) – GPS L1+SBAS+QZSS joint positioning H10 – BDS B1 H101(2) – GPS+GLONASS+GALILEO+SBAS+QZSS joint positioning H11(3) – GPS+BDS+GALILEO+SBAS+QZSS joint positioning

(1): Firmware below the R3.4.0.0 version only supports GPS L1; firmware R3.4.0.0 and above support GPS L1 + SBAS + QZSS joint positioning.

(2): Only supported by the firmware R3.4.0.0 and above

(3): Firmware below the R3.4.0.0 version only supports GPS L1+BDS B1; firmware R3.4.0.0 and above support GPS+BDS+GALILEO+SBAS+QZSS joint positioning.

5.2.6 CFGSAVE

Save the Configuration

Syntax	$CFGSAVE
Example	$CFGSAVE
Description	Save the current receiver configuration, which is stored in NOR Flash
Input/Output	Input
No parameters	

☞ Do NOT cut off the power within one second after inputting $cfgsave. Power off will damage the configuration of the receiver, and the receiver will be restored to factory settings.

5.2.7 CFGCLR

Clear the Configuration

Syntax	$CFGCLR
Example	$CFGCLR
Description	Clear the current receiver configuration, the current configuration and that saved in Flash are restored to factory settings concurrently, which takes effect after the receiver is reboot or powered on again.
Input/Output	Input
No parameters	

5.2.8 CFGCWOUT

Query Interference Detection Command Configuration

Syntax	$CFGCWOUT
Example	$CFGCWOUT
Description	Query the output configuration of the interference detection command
Input/Output	Input
No parameters	

Set Interference Detection Command Configuration

Syntax	$CFGCWOUT,CWOutCtrl	
Example	$CFGCWOUT,1	
Description	Control the output of interference detection command	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
CWOutCtrl	UINT	1: Enable CWOUT output 0: Disable CWOUT output

5.2.9 CFGINS

Read INS Configuration

Syntax	$CFGINS
Example	$CFGINS
Description	Read INS configuration. The receiver outputs the CFGINS message after receiving the command
Input/Output	Input
No parameters	

Set/Output INS Configuration

Syntax	$CFGINS,mode,ImusrcType,OdosrcType,MapsrcType	
Example	$CFGINS,1,1,1,4	
Description	Set/output INS mode and IMU input source	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
mode	UINT (Optional)	Mode configuration 0- Disable INS, and output NMEA which is from GNSS positioning 1- Vehicle mode (Land Vehicle, with non-integrity constraints enabled), default configuration
ImusrcType	UINT (Optional)	0- Disable IMU input 1- Built-in IMU chip input, default configuration 2- I2C connection of external IMU device 3- SPI connection of external IMU device

		4- UART input of external IMU device Note: Currently only 0, 1 supported
OdosrcType	UINT (Optional)	0-Disable ODO input 1- Built-in odometer pulse counter 2- reserved 3- reserved 4- reserved
MapsrcType	UINT (Optional)	0- Disable map input 4- Map matching input information, use UART input

5.2.10 CFGROTAT

Read Installation Angle

Syntax	$CFGROTAT
Example	$CFGROTAT
Description	Read the current installation angle of the positioning module, and the receiver outputs the CFGROTAT message after receiving this command
Input/Output	Input
No parameters	

Set/Output Installation Angle

Syntax	$CFGROTAT,angleX,angleY,angleZ,mode	
Example	$CFGROTAT,0,0,0,2	
Description	Set or output the installation angle configuration of the module relative to the body coordinates	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description

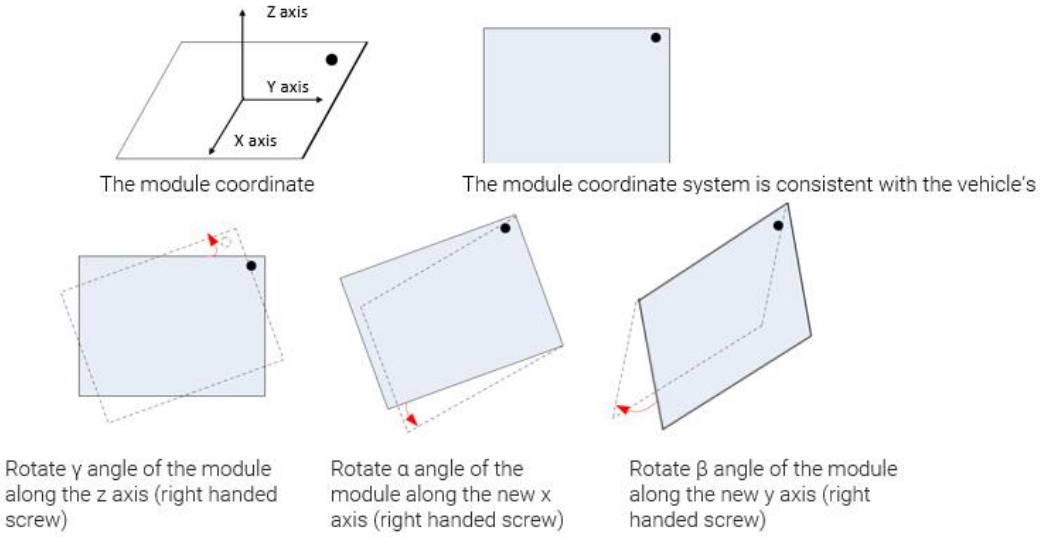
angleX	UINT (optional)	Rotation angle of module X axis relative to body coordinate X axis (right hand spiral) , 0 ~ 36000, in 0.01 degree
angleY	UINT (optional)	Rotation angle of module Y axis relative to body coordinate Y axis (right hand spiral) , 0 ~ 36000, in 0.01 degree
angleZ	UINT (optional)	Rotation angle of module Z axis relative to body coordinate Z axis (right hand spiral) , 0 ~ 36000, in 0.01 degree
mode	UINT (optional)	Install angle configuration mode: 0-General installation mode, the input installation angle precision is rough (within 10deg) 2-Automatic installation mode, no need to input installation angle

Definition of the installation angle:

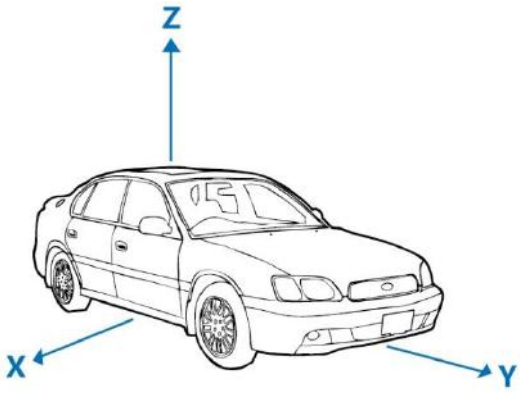
The vehicle coordinate is XYZ, and the module coordinate is xyz, confirm angleX, angleY, angleZ as follows:

1. Coincide the initial state of XYZ coordinate with xyz coordinate's
2. Rotate γ angle of the module along the z axis
3. Rotate α angle of the module along the new x axis
4. Rotate β angle of the module along the new y axis
5. Confirm that the module is fixed to the actual installation state

With that, angleX=α, angleY=β, angleZ=γ



Module Coordinate System (xyz)



Body Coordinate System (XYZ)

- Normal installation mode. The user can configure an installation angle with average accuracy. In this mode, the convergence rate of the algorithm is very high, but the navigation accuracy may be slightly worse in the initial stage after the first alignment, such as when entering a tunnel or other complex environment.
- Automatic installation mode. The user does not need to input the installation angle, even if the installation angle is input, it will be treated as 0. The calibration of the installation angle is completely completed by the algorithm. During the calibration process, good signal environment of the antenna needs to be guaranteed, and the carrier needs to perform several accelerations and decelerations. Calibration time is also related to the duration of the above operation.
- Note: The estimation of the installation angle and the update result of the algorithm will

be stored in the module's built-in Flash, so the automatic installation mode only needs to be done once after the user first installation or reinstallation is completed, and then reboot, the software automatically reads the installation configuration from Flash to speed up the initialization of the inertial navigation, which needs to be recalibrated when the firmware is reburned.

5.2.11 CFGGEOID

Read Elevation Configuration

Syntax	$CFGGEOID
Example	$CFGGEOID
Description	Read the current elevation configuration. The receiver outputs a CFGGEOID message after receiving this command.
Input/Output	Input
No parameters	

Set/Output Elevation Configuration

Syntax	$CFGGEOID,Model	
Example	$CFGGEOID,0	
Description	Set/Output elevation Configuration	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
Model	UINT (optional)	0 - Elevation output is ellipsoid 1 - Elevation output is altitude

5.2.12 CFGODOFWD

Read Direction Signal Configuration

Syntax	$CFGODOFWD
Example	$CFGODOFWD
Description	Read odometer direction signal configuration
Input/Output	Input
No parameters	

Set/Output Direction Signal Configuration

Syntax	$CFGODOFWD,FWD	
Example	$CFGODOFWD,1	
Description	Set or output the odometer direction signal configuration information in the integrated navigation module	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
FWD	UINT (optional)	Mode configuration 0- Low level forward, high level backward 1- High level forward, low level backward

5.2.13 CFGCOG(1)

Read the Configuration of Course Angle

Syntax	$CFGCOG
Example	$CFGCOG
Description	Read the configuration of the course angle
Input/Output	Input
No parameters	

Set/Output the Output Configuration of the Course Angle

Syntax	$CFGCOG,mode	
Example	$CFGCOG,0	
Description	Set/output the output configuration of the course angle	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
mode	UINT (optional)	0- Course angle is consistent with the front of the vehicle 1- Course angle is consistent with driving direction

(1): Only supported by firmware R3.4.0.0 and above.

5.2.14 AIDTIME

Input Time Assistance Information

Syntax	$AIDTIME,year,month,day,hour,minute,second,millisecond	
Example	$AIDTIME,2018,4,9,17,41,36,200	
Description	Input time assistance information, UTC time	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description
year	UINT	Year, range: > 1980
month	UINT	Month, range: 1~12
day	UINT	Day, range: 1~31
hour	UINT	Hour, range: 0~23
minute	UINT	Minute, range: 0~59

second	UINT	Second, range: 0~59
millisecond	UINT	Millisecond, range: 0~999

☞ Returning OK only indicates that the format of the protocol is correct; it does not indicate the validity of the input time and location.

5.2.15 AIDPOS

Input Position Assistance Information

Syntax	$AIDPOS,Latitude,N,Longitude,E,altitude	
Example	$AIDPOS,4002.229934,N,11618.096855,E,37.254	
Description	Input position assistance information	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description
Latitude	DOUBLE	Latitude in the format of ddmm.mmmmmm dd- Degree mm.mmmmmm- Minute
N	STRING	North or South latitude indication N - North latitude S - South latitude
Longitude	DOUBLE	Longitude in the format of dddmm.mmmmmm ddd- Degree mm.mmmmmm- Minute
E	STRING	East longitude or west longitude indication E - East longitude W - West longitude
altitude	DOUBLE	Ellipsoid height in the unit of meter

☞ Returning OK only indicates that the format of the protocol is correct; it does not indicate the validity of the input time and location.

5.2.16 AIDINFO

Query the Status of Auxiliary Data

Syntax	$AIDINFO
Example	$AIDINFO
Description	Query the status of auxiliary data, the receiver outputs $AIDINFO message after receiving this command
Input/Output	Input
No parameters	

Output the Status and Types of Auxiliary Data

Syntax	$AIDINFO,GPSRS,GPSUS,BDSRS,BDSUS,GALRS,GALUS,GLORS,GLOUS,AType	
Example	$AIDINFO,0x003FFFFFF7,0x000000FA00,0x0000003F7F,0x0000001A3F,0x0000000000,0x0000000000,,,7	
Description	Output status and types of auxiliary data	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
GPSRS	UINT64	Receiving state of GPS ephemeris, as long as the received data is verified, the corresponding bit is set to 1. If the GPS system is not enabled, this field is empty.
GPSUS	UINT64	GPS ephemeris is valid and can be used for positioning, the corresponding bit is set to 1, if the GPS system is not enabled, this field is empty.

BDSRS	UINT64	Receiving state of BDS ephemeris, as long as the received data is verified, the corresponding bit is set to 1. If the BDS system is not enabled, this field is empty.
BDSUS	UINT64	BDS ephemeris is valid and can be used for positioning, the corresponding bit is set to 1. If the BDS system is not enabled, this field is empty.
GALRS	UINT64	Receiving state of GAL ephemeris, as long as the received data is verified, the corresponding bit is set to 1. If the GAL system is not enabled, this field is empty.
GALUS	UINT64	GAL ephemeris is valid and can be used for positioning, the corresponding bit is set to 1. If the GAL system is not enabled, this field is empty.
GLORS	UINT64	Receiving state of GLO ephemeris, as long as the received data is verified, the corresponding bit is set to 1. If the GLO system is not enabled, this field is empty.
GLOUS	UINT64	GLO ephemeris is valid and can be used for positioning, the corresponding bit is set to 1. If the GLO system is not enabled, this field is empty.
Atype	UINT	Auxiliary Type: bit0~3: with GPS/BDS/GAL/GLO ephemeris assistance bit4: auxiliary position is valid Bit5: use auxiliary position Bit6~7: reserve Bit8: auxiliary time is valid Bit9: use auxiliary time Bit10-15: reserve

5.2.17 CFGATT

Read the Configuration of NAVATT Output Frequency

Syntax	$CFGATT
Example	$CFGATT
Description	Read the configuration of NAVATT output frequency. The receiver outputs CFGATT message after receiving this command.
Input/Output	Input
No parameters	

Set/Output the NAVATT Output Frequency

Syntax	$CFGATT,freq	
Example	$CFGATT,1	
Description	Set or output the NAVATT (navigation attitude) message output frequency.	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
freq	UINT	Output frequency of the attitude information NAVATT 1 – 1Hz 10 – 10Hz

5.3 Sensor Fusion Message

5.3.1 GYOACC

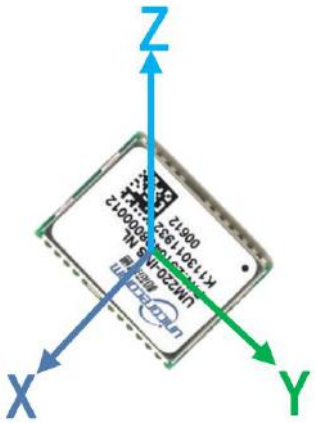
Output MEMS Sensor Data

Syntax	$GYOACC,date,time,gyroX,gyroY,gyroZ,gyroPeriod,accX,accY,accZ,accPeriod,temp,speed,pulsePeriod,fwd*cs	
Example	$GYOACC,081118,053152.000,0.017618,0.031686,0.019729,200,6.489322,-6.913150,2.960812,200,0,5,200,1*2C	
Description	Output MEMS sensor data The message is only output in GNSS and INS integrated positioning products	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
date	STR	UTC date in the format of ddmmyy dd-Day mm-Month yy-Year If the exact date is not resolved from the satellite, the date section appears empty
time	STR	UTC time in the format of hhmmss.sss hh-Hour mm-Minute ss.sss-Second If the exact hour, minute, and second are not resolved, the time portion appears empty
gyroX	DOUBLE	Angular velocity along the x axis of the inertial device, rad/s, output 6 decimal places

gyroY	DOUBLE	Angular velocity along the y axis of the inertial device, rad/s, output 6 decimal places
gyroZ	DOUBLE	Angular velocity along the z axis of the inertial device, rad/s, output 6 decimal places
gyroPeriod	UINT	Gyro data output interval, unit: ms
accX	DOUBLE	Acceleration along the x axis of the inertial device, m/s^2, output 6 decimal places
accY	DOUBLE	Acceleration along the y axis of the inertial device, m/s^2, output 6 decimal places
accZ	DOUBLE	Acceleration along the z axis of the inertial device, m/s^2, output 6 decimal places
accPeriod	UINT	Accelerometer data output interval, unit: ms
temp	INT	Temperature, unit: Celsius (°C) If the temperature sensor is not connected, the display is meaningless
speed	UINT	Number of vehicle speed pulses If the vehicle pulse signal is not connected, the display is meaningless
pulsePeriod	UINT	Pulse number output time interval, unit: ms If the vehicle pulse signal is not connected, the display is meaningless
fwd	UINT	Vehicle reverse signal 0: forward 1: reverse If the vehicle reverse signal is not connected, the display is meaningless
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

☞ If the GYOACC message is required to output at 10 Hz, set the baud rate of the serial port to 230400 bps.

The GYOACC message is based on the GNSS module's coordinate system defined below:



5.3.2 GYOACC-V

Output the Vehicle's Movement Information Based on the MEMS Sensor

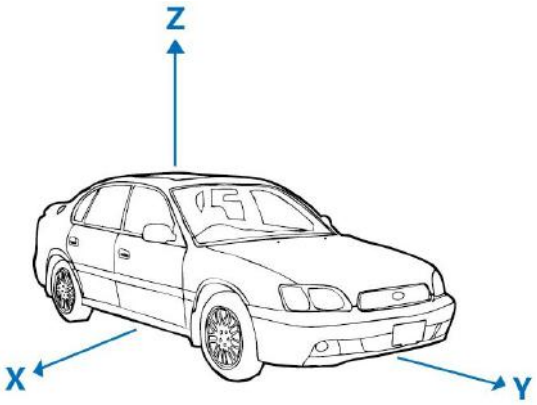
Syntax	$GYOACC-V,date,time,gyroX,gyroY,gyroZ,gyroPeriod,accX,accY,accZ,accPeriod,temp,speed,pulsePeriod,fwd*cs	
Example	$GYOACC-V,081118,053152.000,0.017618,0.031686,0.019729,200,6.489322,-6.913150,2.960812,200,0,5,200,1*2C	
Description	Output the vehicle's movement information based on the MEMS sensor. The message is only output in GNSS and INS integrated positioning products. It is valid only after the MEMS sensor is aligned. Before the MEMS sensor is aligned, the angular velocity and acceleration output are null.	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
date	STR	UTC date in the format of ddmmyy

		dd-Day mm-Month yy-Year Null field if the exact date is not resolved from the satellite
time	STR	UTC time in the format of hhmmss.sss hh-Hour mm-Minute ss.sss-Second Null field if the exact hour, minute, and second are not resolved.
gyroX	DOUBLE	Angular velocity along the x axis of the vehicle, rad/s, output 6 decimal places; null field before the MEMS sensor is aligned.
gyroY	DOUBLE	Angular velocity along the y axis of the vehicle, rad/s, output 6 decimal places; null field before the MEMS sensor is aligned.
gyroZ	DOUBLE	Angular velocity along the z axis of the vehicle, rad/s, output 6 decimal places; null field before the MEMS sensor is aligned.
gyroPeriod	UINT	Gyro data output interval, unit: ms
accX	DOUBLE	Acceleration along the x axis of the vehicle, m/s^2, output 6 decimal places; null field before the MEMS sensor is aligned.
accY	DOUBLE	Acceleration along the y axis of the vehicle, m/s^2, output 6 decimal places; null field before the MEMS sensor is aligned.
accZ	DOUBLE	Acceleration along the z axis of the vehicle, m/s^2, output 6 decimal places; null field before the MEMS sensor is aligned.
accPeriod	UINT	Accelerometer data output interval, unit: ms
temp	INT	Temperature, unit: Celsius (°C) If the temperature sensor is not connected, the display is meaningless
speed	UINT	Number of vehicle speed pulses

		If the vehicle pulse signal is not connected, the display is meaningless
pulsePeriod	UINT	Pulse period, unit: ms If the vehicle pulse signal is not connected, the display is meaningless
fwd	UINT	Vehicle reverse signal 0: forward 1: reverse If the vehicle reverse signal is not connected, the display is meaningless
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

☞ If the GYOACC-V message is required to output at 10 Hz, set the baud rate of the serial port to 230400 bps.

☞ The GYOACC-V message is based on the vehicle's coordinate system defined below:
Positive direction of X axis: the driver's right hand direction, horizontal;
Positive direction of Y axis: the vehicle's moving direction, horizontal;
Positive direction of Z axis: vertical to the plane of the vehicle body, upward.



5.3.3 SNRSTAT

Output Initialization Status

Syntax	$SNRSTAT,insstatus,odostatus,InstallState,mapstat*cs	
Example	$SNRSTAT,3,0,0,2*5C	
Description	Output initialization status	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
insstatus	INT	INS initialization state: -1: IMU device failure 0: Disable 1: Initialization started 2: Known installation angle 3: Initialization completed
odostatus	INT	Odometer initialization status: -1: Odometer device failure 0: Disable 1: initialization of scale factor 2: Initialization of scale factor is completed 3: Scale factor calibration is completed
InstallState	INT	-1: IMU device failure, unable to estimate the installation angle 0: Calibration in progress 1: The quality of current satellite information is insufficient and better satellite conditions are needed

		2: The current vehicle mobility conditions are insufficient, and acceleration is required 3: The current carrier speed is too low, it' required to increase the speed
mapstat	INT	-1: Serial port is not configured to input MAP information 0: The serial port did not receive MAP information or the MAP information transmission timed out 1: The MAP information is received but not applied to the integrated navigation 2: The MAP information is received and applied to the integrated navigation -2: The MAP information is abnormal
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

5.3.4 MAPFB

Input Map Feedback

Syntax	$MAPFB,hhmmss.sss,TotalRoadCount,RoadIdx,RoadType,Probability,LatDiff,LonDiff,UpDiff,RoadWidth,RoadAzi*CS	
Example	$MAPFB, 082324.000,3,1,1,520,15,-4,0,4,4945*78 $MAPFB, 082324.000,3,2,1,320,25,8,0,3,4745*56 $MAPFB, 082324.000,3,3,1,160,-17,-4,0,8,4645*56	
Description	Input map feedback	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description

hhmmss.sss	STR	UTC time stamp, corresponding to the integer time when position is output, i.e. the time in RMC or GGA message, not the real time; input at 1Hz
TotalRoadCount	INT	Number of matching roads
RoadIdx	INT	Road number, each message sends only one road matching information
RoadType	INT	Road type, 0-invalid, 1-normal, 2-tunnel, 3-roundabout, 4- viaduct, 5-bridge
Probability	INT	Matching probability, unit: 10^{-3}
LatDiff	INT	Latitude offset, unit:10^{-6} deg Delta = latitude output at integer time – latitude on the map (positive in North Latitude; negative in South Latitude)
LonDiff	INT	Longitude offset, unit:10^{-6} deg Delta = longitude output at integer time – longitude on the map (positive in East Longitude; negative in West Longitude)
UpDiff	INT	Elevation offset, unit: m Delta = elevation output at integer time – elevation on the map (see CFGGEOID configuration)
RoadWidth	INT	Road width, unit: m
RoadAzi	INT	Road angle, unit: 10^{-2} deg The North is 0 degree, and the East is 90 degrees.
CS	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

☞ The command needs to be sent to the module within 700ms after the current integer seconds, for example, the current is 1 second, and the matching protocol needs to be sent to the module within 1.7 seconds

5.4 NMEA Message

The message format described in this section is for the versions shown as below:

- The version of Beidou related messages extended on the basis of NMEA 3.0 (nmeaVer in CFGNMEA command is h30)
- The version of Beidou related messages extended on the basis of standard NMEA4.1 ($GBGSA, nmeaVer in CFGNMEA command is h51)

BD3 satellites are involved in NMEA4.1 to support BDS satellites with number of 1~37. With the increasing of satellites, only output GGA, GSV, GSA and RMC messages by default to prevent data loss at the rate of 9600. When the amount of data at 9600 baud rate is allowed, the maximum number of satellites will be output, but it is limited to the amount of output data at 9600 baud rate. Under the strong sky signal, there will be a phenomenon of incomplete output of the number of satellites. If the user inputs other commands, priority is given to ensuring the complete output of the message added by the user. The number of satellites and satellite information in the GSV message will be reduced accordingly.

The baud rate of 115200 is supported, which is able to output all satellite information, and the default output messages include GGA, GSV, GSA and RMC after switching. If other messages are required, send the command separately.

5.4.1 NmeaVer h51

5.4.1.1 GGA

GNSS Positioning Data

Syntax	$--GGA,time,Lat,N,Lon,E,FS,NoSV,HDOP,msl,M,Altref,M,DiffAge,DiffStation*cs
Example	$GPGGA,060845.00,4004.74005,N,11614.19613,E,1,10,0.85,53.5,M,,M,,*7B
Description	GNSS positioning data
Input/Output	Output
Parameter Definition	

Parameter	Format	Description
--	STR	Positioning system flag GP- GPS+SBAS+QZSS joint positioning(1) GB-BDS system standalone positioning GA - Galileo system standalone positioning GL - GLONASS system standalone positioning GN- Multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.ss hh- Hour mm- Minutes ss.ss- Seconds
Lat	STR	Latitude, in the format of ddmm.mmmmm dd- Degrees mm.mmmmm- Minutes
N	STR	North or south latitude indicator N - North latitude S - South latitude
Lon	STR	Longitude, in the format of dddmm.mmmmm ddd- Degrees mm.mmmmm- Minutes
E	STR	East longitude or west longitude indicator E - East longitude W - West longitude
FS	UINT	Positioning status indicator 0-Invalid 1-Point positioning

		2-Differential positioning 6-INS positioning
NoSV	UINT	Number of satellites participating in positioning
HDOP	DOUBLE	Horizontal dilution of precision, 0.00 ~ 99.99, the value is 99.99 when not positioning
msl	DOUBLE	Ellipsoid height, fixed output one decimal place or altitude (CFGGEOID is set to 1)
M	STR	Unit of ellipsoid height or altitude, specified to constant M. The field is empty when not positioning
Altref	DOUBLE	Sea level separation, fixed output one decimal place. Only valid when CFGGEOID is set to 1, otherwise it is fixed to empty.
M	STR	Unit of sea level separation, specified to constant M. The field is empty when not positioning
DiffAge	DOUBLE	Differential correction latency in seconds Null for non-differential positioning
DiffStation	DOUBLE	Reference station ID Null for non-differential positioning
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

5.4.1.2 GLL

Geographic Longitude/Latitude

Syntax	$--GLL,Lat,N,Lon,E,time,Valid,Mode*cs
Example	$GPGLL,4004.74005,N,11614.19613,E,060845.00,A,A*6F
Description	Geographic longitude/latitude

Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP- GPS+SBAS+QZSS joint positioning(1) GB-BDS system standalone positioning GN- Multiple system joint positioning
Lat	STR	Latitude, in the format of ddmm.mmmmm dd- Degrees mm.mmmmm- Minutes
N	STR	North or south latitude indicator N – North latitude S – South latitude
Lon	STR	Longitude, in the format of dddmm.mmmmm ddd- Degrees mm.mmmmm- Minutes
E	STR	East longitude or west longitude indicator E – East longitude W – West longitude
time	STR	UTC time, in the format of hhmmss.ss hh - Hours mm - Minutes ss.ss - Seconds
Valid	STR	Position valid indicator V – Invalid A – Valid

Mode	STR	Positioning system mode indicator N – Not positioning A – Point positioning D – Differential positioning E-INS positioning
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

5.4.1.3 GSA

GNSS Dilution of Precision and Effective Satellite Information

Syntax	$--GSA,Smode,FS,sv1,sv2,sv3,sv4,sv5,sv6,sv7,sv8,sv9,sv10,sv11,sv12,PDOP,HDOP,VDOP,systemID*cs	
Example	$GPGSA,A,3,02,03,06,09,12,17,19,23,28,25,,,1.34,0.85,1.04,1*1E	
Description	GNSS dilution of precision and effective satellite information	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP- GPS+SBAS+QZSS joint positioning(1) GB-BDS system standalone positioning GA - Galileo system standalone positioning GL - GLONASS system standalone positioning GN- Multiple system joint positioning

Smode	STR	Positioning mode specified states M– Manually specify 2D or 3D positioning A– Automatically switch to 2D or 3D positioning
FS	UINT	Positioning mode 1– Not positioning 2– 2D positioning or INS positioning 3– 3D positioning
sv1~sv12	UINT	Participating satellite ID When there are less than 12 satellites participating in the positioning, the insufficient area is filled in empty and it only outputs the first 12 satellites if there are more than 12 satellites GPS satellite ID is 01~32 BDS satellite ID is 01~37 GLONASS satellite ID is 65~92(2) Galileo satellite ID is 01~36(3) QZSS satellite ID is 193, 194, 195, 199(4) SBAS satellite ID is 33~64(5)
PDOP	DOUBLE	Position dilution of precision, 0.00~99.99, the value is 99.99 when not positioning
HDOP	DOUBLE	Horizontal dilution of precision, 0.00 ~ 99.99, the value is 99.99 when not positioning
VDOP	DOUBLE	Vertical dilution of precision, 0.00 ~ 99.99, the value is 99.99 when not positioning
systemID	UINT	GNSS system ID as defined by the NMEA protocol 1-GPS system ID 2-GLONASS system ID(6)

		3-Galileo system ID(7) 4-BDS system ID
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

(2) (3) (4) (5) (6) (7): Only supported by firmware with the version of R3.4.0.0 or above.

5.4.1.4 GSV

Visible GNSS Satellites

Syntax	$--GSV,NoMsg,MsgNo,NoSv,sv1,elv1,az1,cn01,sv2,elv2,az2,cn02,sv3,elv3,az3,cn03,sv4,elv4,az4,cn04,signalID*cs	
Example	$GPGSV,3,01,11,02,34,277,41,03,16,043,35,05,04,215,35,06,69,333,48,0*57 $GPGSV,3,02,11,09,25,110,41,12,31,305,43,17,55,116,46,19,76,088,46,0*56 $GPGSV,3,03,11,23,23,077,40,25,04,328,32,28,05,171,36,0*67 $GBGSV,3,01,12,01,37,145,42,02,34,225,39,03,44,188,42,04,25,123,37,0*4C $GBGSV,3,02,12,05,17,249,36,06,30,169,38,07,03,188,31,08,69,027,43,0*4E $GBGSV,3,03,12,09,09,186,34,10,15,211,36,12,26,306,40,13,60,316,44,0*48	
Description	Visible GNSS satellites Each GSV message contains information for only 4 satellites. When the number of satellites exceeds 4, the receiver sends multiple GSV messages continuously	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	System identification

		GP-GPS satellite information GB-BDS satellite information GL-GLONASS satellite Information(1) GA-Galileo satellite Information(2)
NoMsg	UINT	Total number of GSV messages, the minimum value is 1 NoMsg is the total number of GSV messages in this system, for example: NoMsg in GPGSV is the total number of GPGSV messages, excluding the number of GBGSV messages
MsgNo	UINT	Number of this GSV message. The minimum value is 1. MsgNo is the number of the GSV message in this system
NoSv	UINT	Total number of visible satellites in this system
sv1~sv4	UINT	Satellite number of the first to fourth satellite GPS satellite number is 01~32 BDS satellite number is 01~14 GLONASS satellite number is 65~92(3) Galileo satellite number is 01~36(4) QZSS satellite number is 193, 194, 195, 199(5) SBAS satellite number is 33~64(6)
elv1~elv4	UINT	Elevation angle of the first to fourth satellite (0 ~ 90 degrees), fixed output of 2 digits, add zero up front if less than 2 digits
az1~az4	UINT	Azimuth of the first to fourth satellite (0 ~ 359 degrees), fixed output of 3 digits, add zero up front if less than 3 digits
cn01~cn04	UINT	CNR of the first to fourth satellite (0 ~ 90dBHz), fixed output of 2 digits, add zero up front if less than 2 digits fill null for untracked satellites
signalID	UINT	Signal ID defined by NMEA protocol (fixedly output 0)

cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1) (2) (3) (4) (5) (6): Only supported by firmware with the version of R3.4.0.0 or above

☞ Due to the excessive number of satellites in GN mode, at 9600 baud rate, GSV will have the problem of incomplete printing of satellite information. For complete satellite information, please switch the baud rate to 115200

5.4.1.5 RMC

The Recommended Minimum Data

Syntax	$--RMC,time,status,Lat,N,Lon,E,spd,cog,date,mv,mvE,mode,navStates*cs	
Example	$GPRMC,060845.00,A,4004.74005,N,11614.19613,E,0.000,,180817,,,A,V*0B	
Description	The recommended minimum data	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP-GPS+ SBAS+QZSS joint positioning(1) GB-BDS system standalone positioning GA - Galileo system standalone positioning GL - GLONASS system standalone positioning GN- Multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.ss hh-Hours mm-Minutes ss.ss-Seconds
status	STR	Position valid indicator

		V – Invalid A – Valid
Lat	STR	Latitude, in the format of ddmm.mmmmm dd- Degrees mm.mmmmm- Minutes
N	STR	North or south latitude indicator N - North latitude S – South latitude
Lon	STR	Longitude, in the format of dddmm.mmmmm ddd- Degrees mm.mmmmm- Minutes
E	STR	East longitude or west longitude indicator E – East longitude W – West longitude
spd	DOUBLE	Speed over ground, unit: knot, fixed output of three decimal places
cog	DOUBLE	Course over ground, unit: degree Calculated clockwise from north
date	STR	UTC date, in the format of ddmmyy dd- Day mm- Month yy- Year
mv	DOUBLE	Magnetic declination, specified to null
mvE	STR	Magnetic declination direction, specified to null
mode	STR	Positioning mode N – Not positioning

		A – Point positioning D – Differential positioning E-INS positioning
navStates	STR	Navigation states flag, fixedly output 'V' V-Device does not provide navigation state information
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

5.4.1.6 VTG

Course Over Ground and Ground Speed

Syntax	$--VTG,cogt,T,cogm,M,sog,N,kph,K,mode*cs	
Example	$GPVTG,,T,,M,0.000,N,0.000,K,A*23	
Description	Course over ground and ground speed	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP-GPS+ SBAS+QZSS joint positioning(1) GB-BDS system standalone positioning GN- Multiple system joint positioning
cogt	DOUBLE	Course over ground with reference to true north (0.000 ~ 359.999 degrees)
T	STR	Course flag, specified to constant T

cogm	DOUBLE	Course over ground with reference to MN (0.000 ~ 359.999 degrees). The field is empty by default
M	STR	Course flag, specified to constant M
sog	DOUBLE	Speed over ground, unit: knot
N	STR	Unit of speed, specified to constant N
kph	DOUBLE	Speed over ground, unit: km/h
K	STR	Unit of speed, specified to constant K
mode	STR	Positioning mode N – Not positioning A – Point positioning D – Differential positioning E-INS positioning
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

5.4.1.7 ZDA

Output Date and Time

Syntax	$--ZDA,time,day,mon,year,ltzh,ltzn*cs	
Example	$GPZDA,060845.00,18,08,2017,00,00*6C	
Description	Date and time	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag

		GP-GPS+ SBAS+QZSS joint positioning(1) GB - BDS system standalone positioning GA - Galileo system standalone positioning GL - GLONASS system standalone positioning GN - Multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.ss hh- Hours mm- Minutes ss.ss- Seconds
day	UINT	UTC day with two digits, 01 ~ 31
mon	UINT	UTC month with two digits, 01 ~ 12
year	UINT	UTC year with four digits
ltzh	UINT	Hours in local time zone (fixed output 00)
ltzn	UINT	Minutes in local time zone (fixed output 00)
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

5.4.1.8 GST

Output GNSS Pseudorange Error

Syntax	$--GST,time,rngRMS,stdMajor,stdMinor,hdg,stdLat,stdLon,stdAlt*cs
Example	$GPGST,060845.00,0.6,,,,0.07,0.09,0.09*47
Description	GNSS pseudorange error statistics
Input/Output	Output
Parameter Definition	

Parameter	Format	Description
--	STR	Positioning system flag GP-GPS+ SBAS+QZSS joint positioning(1) GB - BDS system standalone positioning GN - Multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.ss hh- Hours mm- Minutes ss.ss- Seconds
rngRMS	DOUBLE	Mean square error of pseudorange error in meters, with a maximum of 3750000
stdMajor	DOUBLE	Semi-major axis of the error ellipse, in meters. Specified to null
stdMinor	DOUBLE	Semi-minor axis of the error ellipse, in meters. Specified to null
hdg	DOUBLE	Semi-major axis direction of the error ellipse in degrees, clockwise from north. Specified to null
stdLat	DOUBLE	The mean square error along the latitudinal direction, in meters
stdLon	DOUBLE	The mean square error along the longitudinal direction, in meters
stdAlt	DOUBLE	The mean square error along the altitudinal direction, in meters
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

5.4.2 NmeaVer h30

5.4.2.1 GGA

Output GNSS Positioning Data

Syntax	$--GGA,time,Lat,N,Lon,E,FS,NoSV,HDOP,msl,M,Altref,M,DiffAge,DiffStation*cs	
Example	$GPGGA,063952.000,4002.229934,N,11618.096855,E,1,4,2.788,37.254,M,0,M,,*76	
Description	GNSS positioning data	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP-GPS+ SBAS+QZSS joint positioning(1) GB- BDS system standalone positioning GA - Galileo system standalone positioning GL - GLONASS system standalone positioning GN- Multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.sss hh- Hours mm- Minutes ss.sss- Seconds
Lat	STR	Latitude, in the format of ddmm.mmmmmm dd- Degrees mm.mmmmmm- Minutes
N	STR	North or south latitude indicator N – North latitude

		S – South latitude
Lon	STR	Longitude, in the format of dddmm.mmmmmm ddd- Degrees mm.mmmmmm- Minutes
E	STR	East longitude or west longitude indicator E – East longitude W – West longitude
FS	UINT	Positioning status indicator 0-Invalid 1-Point positioning 2-Differential positioning 6-INS positioning
NoSV	UINT	Number of satellites participating in positioning
HDOP	DOUBLE	Horizontal dilution of precision, 0.0~127.000
Msl	DOUBLE	Ellipsoid height, fixed output one decimal place or altitude (CFGGEOID is set to 1)
M	STR	Unit of ellipsoid height or altitude, specified to constant M. This field is empty when not positioning.
Altref	DOUBLE	Sea level separation, fixed output one decimal place. Only valid when CFGGEOID is set to 1, otherwise it is fixed to empty.
M	STR	Unit of sea level separation, specified to constant M. The field is empty when not positioning
DiffAge	DOUBLE	Differential correction latency in seconds Null for non-differential positioning
DiffStation	DOUBLE	Reference station ID Null for non-differential positioning

cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

5.4.2.2 GLL

Geographic Longitude/Latitude

Syntax	$--GLL,Lat,N,Lon,E,time,Valid,Mode*cs	
Example	$GPGLL,4002.217867,N,11618.105743,E,123400.000,A,A*5B	
Description	Geographic longitude/latitude	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP-GPS+ SBAS+QZSS joint positioning(1) GB-BDS system standalone positioning GN- Multiple system joint positioning
Lat	STR	Latitude, in the format of ddmm.mmmmmm dd- Degrees mm.mmmmmm- Minutes
N	STR	North or south latitude indicator N – North latitude S – South latitude
Lon	STR	Longitude, in the format of dddmm.mmmmmm ddd- Degrees mm.mmmmmm- Minutes

E	STR	East longitude or west longitude indicator E – East longitude W – West longitude
time	STR	UTC time, in the format of hhmmss.sss hh- Hours mm- Minutes ss.sss- Seconds
Valid	STR	Position valid indicator V – Invalid A – Valid
Mode	STR	Positioning mode V – Invalid A – Valid
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

5.4.2.3 GSA

GNSS Dilution of Precision and Effective Satellite Information

Syntax	$--GSA,Smode,FS,sv1,sv2,sv3,sv4,sv5,sv6,sv7,sv8,sv9,sv10,sv11,sv12,PDOP,HDOP,VDOP*cs
Example	$GPGSA,A,3,14,22,18,31,,,,,,,,,5.572,2.788,4.824*36
Description	GNSS dilution of precision and effective satellite information
Input/Output	Output

Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP-GPS+SBAS+QZSS joint positioning(1) BD-BDS system standalone positioning GA - Galileo system standalone positioning GL - GLONASS system standalone positioning GN- Multiple system joint positioning
Smode	STR	Positioning mode specified states M – Manually specify 2D or 3D positioning A – Automatically switch to 2D or 3D positioning
FS	UINT	Positioning mode 1– Not positioning 2– 2D positioning or INS positioning 3– 3D positioning
sv1~sv12	UINT	Participating satellite ID When there are less than 12 satellites participating in the positioning, the insufficient area is filled in empty and it only output the first 12 satellites if there are more than 12 satellites GPS satellite ID is 1~32 BDS satellite ID is 161~197 (160 + BDS PRN) GLONASS satellite ID is 65~92(2) Galileo satellite ID is 101~136(3) QZSS satellite ID is 193, 194, 195, 199(4) SBAS satellite ID is 33~64(5)
PDOP	DOUBLE	Position dilution of precision, 0.0~127.000

HDOP	DOUBLE	Horizontal dilution of precision, 0.0~127.000
VDOP	DOUBLE	Vertical dilution of precision, 0.0~127.000
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

(2) (3) (4) (5): Only supported by firmware with the version of R3.4.0.0 or above.

5.4.2.4 GSV

Output Visible GNSS Satellites

Syntax	$--GSV,NoMsg,MsgNo,NoSv,sv1,elv1,az1,cn01,sv2,elv2,az2,cn02,sv3,elv3,az3,cn03,sv4,elv4,az4,cn04*cs	
Example	$GPGSV,3,1,11,3,82,133,50,6,70,73,50,7,21,311,45,13,46,275,50*75 $GPGSV,3,2,11,16,52,51,49,19,52,194,49,21,12,49,37,23,40,222,49*7C $GPGSV,3,3,11,30,31,69,46,31,8,127,19,1,5,,44*77 $BDGSV,2,1,5,161,35,140,47,163,33,224,47,164,24,124,43,167,47,73,48*65 $BDGSV,2,2,5,168,5,,50*52	
Description	Visible GNSS satellites Each GSV message contains information for only 4 satellites. When the number of satellites exceeds 4, the receiver sends multiple GSV messages continuously	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag

		GP-GPS+SBAS+QZSS joint positioning(1) BD - BDS system standalone positioning GA - Galileo satellite information GL - GLONASS satellite information
NoMsg	UINT	Total number of GSV messages, the minimum value is 1 NoMsg is the total number of GSV messages in this system, for example: NoMsg in GPGSV is the total number of GPGSV messages, excluding the number of BDGSV messages
MsgNo	UINT	Number of this GSV message. The minimum value is 1. MsgNo is the number of this GSV message in this system. Continuous output GPGSV and BDGSV are numbered separately
NoSv	UINT	Total number of visible satellites in this system
sv1~sv4	UINT	Satellite number of the first to fourth satellite GPS satellite number is 1~32 BDS satellite number is 161~197 (160 + BDS PRN) GLONASS satellite number is 65~ 92(2) Galileo satellite number is 101~136(3) QZSS satellite number is 193, 194, 195, 199(4) SBAS satellite number is 33~64(5): WAAS satellite number is 53, 55, 58 EGNOS satellite number is 40, 44, 46 MSAS satellite number is 49, 57 GAGAN satellite number is 47, 48
elv1~elv4	UINT	Elevation of the first to fourth satellite (0 ~ 90 degrees)
az1~az4	UINT	Azimuth of the first to fourth satellite (0 ~ 359 degrees)

cn01~cn04	UINT	CNR of the 1st to 4th satellites (0 ~ 90dBHz), fill null for untracked satellites
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

(2) (3) (4) (5): Only supported by firmware with the version of R3.4.0.0 or above.

☞ Due to the excessive number of satellites in GN mode, GSV at 9600 baud rate will have the problem of incomplete printing of satellite information. For complete satellite information, please switch the baud rate to 115200

5.4.2.5 RMC

Output the Minimum Recommended Data

Syntax	$--RMC,time,status,Lat,N,Lon,E,spd,cog,date,mv,mvE,mode*cs	
Example	$GPRMC,123400.000,A,4002.217821,N,11618.105743,E,0.026,181.631,180411,,E,A*28	
Description	The minimum recommended data	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP-GPS+SBAS+QZSS joint positioning BD-BDS system standalone positioning GA - Galileo system standalone positioning GL - GLONASS system standalone positioning GN- Multiple system joint positioning

time	STR	UTC time, in the format of hhmmss.sss hh- Hours mm- Minutes ss.sss- Seconds
status	STR	Position valid indicator V – Invalid A – Valid
Lat	STR	Latitude, in the format of ddmm.mmmmmm dd- Degrees mm.mmmmmm- Minutes
N	STR	North or south latitude indicator N – North latitude S – South latitude
Lon	STR	Longitude, in the format of dddmm.mmmmmm ddd- Degrees mm.mmmmmm- Minutes
E	STR	East longitude or west longitude indicator E – East longitude W – West longitude
spd	DOUBLE	Speed over ground, unit: knot
cog	DOUBLE	Course over ground, unit: degree Calculated clockwise from north

date	STR	UTC date, in the format of ddmmyy dd - Day mm - Month yy - Year If the exact year, month, and day are not parsed, the date part appears blank
mv	DOUBLE	Magnetic declination, specified to null
mvE	STR	Magnetic declination direction, specified to constant E
mode	STR	Positioning mode N – Not positioning A – Point positioning D – Differential positioning E – INS positioning
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

5.4.2.6 VTG

Course Over Ground and Ground Speed

Syntax	$--VTG,cogt,T,cogm,M,sog,N,kph,K,mode*cs	
Example	$GNVTG,0.000,T,,M,0.000,N,0.000,K,A*13	
Description	Course over ground and ground speed	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag

		GP-GPS+SBAS+QZSS joint positioning(1) BD- BDS system standalone positioning GN - Multiple system joint positioning
cogt	DOUBLE	Course over ground with reference to true north (0.000 ~ 359.999 degrees)
T	STR	Course flag, specified to constant T
cogm	DOUBLE	Course over ground with reference to MN (0.000 ~ 359.999 degrees). The field is empty by default
M	STR	Course flag, specified to constant M
sog	DOUBLE	Speed over ground, unit: knot
N	STR	Unit of speed, specified to constant N
kph	DOUBLE	Speed over ground, unit: km/h
K	STR	Unit of speed, specified to constant K
mode	STR	Positioning mode N – Not positioning A – Point positioning D – Differential positioning E – INS positioning
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

5.4.2.7 ZDA

Output Date and Time

Syntax	$--ZDA,time,day,mon,year,ltzh,ltzn*cs	
Example	$GNZDA,083927.000,21,11,2013,00,00*4C	
Description	Date and time	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP-GPS+SBAS+QZSS joint positioning(1) BD- BDS system standalone positioning GA - Galileo system standalone positioning GL - GLONASS system standalone positioning GN - Multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.sss hh - Hours mm - Minutes ss.sss - Seconds
day	UINT	UTC day with two digits, 01 ~ 31
mon	UINT	UTC month with two digits, 01 ~ 12
year	UINT	UTC year with four digits
ltzh	UINT	Hours in local time zone (fixedly output 00)
ltzn	UINT	Minutes in local time zone (fixedly output 00)
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

(1): GPS+SBAS+QZSS joint positioning is only supported by firmware with the version of R3.4.0.0 or above.

5.5 Navigation Result Message

5.5.1 NAVPOS

Output the Receiver Position Information

Syntax	$NAVPOS,time,system,quality,X,Y,Z,lat,lon,height*cs	
Example	$NAVPOS,282201000,5,3,-2160481.168,4383619.182,4084735.203,40.078998,116.236534,52.843847*1C	
Description	Output the receiver position information	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
time	UINT	Time corresponding to the positioning solution The time definition depends on the current positioning system, the priority is GPS>BDS>GAL>GLO
system	UINT	Current positioning system bit0-GPS bit2-BDS bit5-GAL bit4-GLO
quality	UINT	Current positioning quality 0 - Invalid 1 – External configuration 2 - Coarse 3 - precise

X	DOUBLE	X of ECEF, in meters
Y	DOUBLE	Y of ECEF, in meters
Z	DOUBLE	Z of ECEF, in meters
lat	DOUBLE	The latitude of the receiver, which is positive in north latitude and negative in south latitude, in degrees
lon	DOUBLE	The longitude of the receiver, which is positive in east longitude and negative in west longitude, in degrees
height	DOUBLE	The height of the receiver ellipsoid, in meters
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

5.5.2 NAVVEL

Output the Receiver Velocity Information

Syntax	$NAVVEL,time,system,quality,Vx,Vy,Vz,clockDrift*cs	
Example	$NAVVEL,282201000,5,3,0.000,0.000,0.000,31.785*2F	
Description	Output the receiver velocity information	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
time	UINT	Same as time definition in NAVPOS
system	UINT	Same as system definition in NAVPOS
quality	UINT	Same as quality definition in NAVPOS
Vx	DOUBLE	Vx of ECEF coordinate system, in m/s
Vy	DOUBLE	Vy of ECEF coordinate system, in m/s
Vz	DOUBLE	Vz of ECEF coordinate system, in m/s

clockDrift	DOUBLE	Equivalent speed of crystal drift, in m/s
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

5.5.3 NAVTIME

Output Time Information

Syntax	$NAVTIME,GPSW,GPST,GPSQ,BDW,BDT,BDQ,GALW,GALT,GALQ,GLOW,GLOD,GLOT,GLOQ*cs
Example	$NAVTIME,2050,99974.000222664,3,694,99960.000222685,3,1026,99974.000222660,3,6,1208,24356.000222657,0*65
Description	Output the receiver time information
Input/Output	Output

Parameter Definition		
Parameter	Format	Description
GPSW	UINT	GPS week
GPST	DOUBLE	GPS seconds into the week
GPSQ	UINT	GPS time quality 0 - Invalid 1 – External configuration 2 - Coarse 3 - Precise
BDW	UINT	BDS week
BDT	DOUBLE	BDS seconds into the week
BDQ	UINT	BDS time quality, the definition is same as that of GPSQ
GALW	UINT	GAL week
GALT	DOUBLE	GAL seconds into the week

GALQ	UINT	GAL time quality, the definition is same as that of GPSQ
GLOY	UINT	GLO year
GLOD	UINT	GLO day
GLOT	DOUBLE	GLO seconds into the day
GLOQ	UINT	GLO time quality, the definition is same as that of GPSQ
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

5.5.4 NAVACC

Output Accuracy Information of Receiver Positioning Speed Measurement

Syntax	$NAVACC,time,status,pAcc,vAcc,cAcc*cs	
Example	$NAVACC,085206.00,A,2480,70,1250*7D	
Description	Output accuracy information of receiver positioning speed measurement	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
time	STR	UTC time, in the format of hhmmss.sss hh - Hours mm - Minutes ss.sss - Seconds
status	UINT	Data validity identification V - Invalid A - Valid
pAcc	UINT	Horizontal positioning accuracy, mean square deviation of two-dimensional horizontal positioning error, in 0.001m

vAcc	UINT	Accuracy of horizontal velocity measurement, mean square error of two-dimensional velocity measurement in Horizontal Direction, unit: 0.001 m/s
cAcc	UINT	Ground course accuracy, in 0.001 degrees
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

5.5.5 NAVATT

Output the Attitude Information

Syntax	$NAVATT,time,quality,roll_v,pitch_v,yaw_v,roll_acc,pitch_acc,yaw_acc *cs	
Example	$NAVATT,060917.00,7,-168753,114146,159559,15459,16206,19998*17	
Description	Output the vehicle attitude information	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
time	STR	UTC, in the format of hhmmss.ss hh – hour mm – minute ss.ss - second
quality	UINT	Quality indicator of the output information bit0 – 1: roll valid, 0: roll invalid bit1 – 1: pitch valid, 0: pitch invalid bit2 – 1: yaw valid, 0: yaw invalid
roll_v	INT	Roll, in degrees * 10^{-5} Range: -180E+5 ~ 180E+5
pitch_v	INT	Pitch, in degrees * 10^{-5}

		Range: -90E+5 ~ 90E+5
yaw_v	INT	Yaw, in degrees * 10^{-5} Range: 0 ~ 360E+5
roll_acc	UINT	Accuracy of roll (standard deviation), in degrees * 10^{-5}
pitch_acc	UINT	Accuracy of pitch (standard deviation), in degrees * 10^{-5}
yaw_acc	UINT	Accuracy of yaw (standard deviation), in degrees * 10^{-5}
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this statement

5.6 Misc Message

5.6.1 LSF

Query Leap Seconds Forecast Information

Syntax	$LSF,system	
Example	$LSF,0	
Description	Query leap seconds information of the specified satellite, the receiver outputs LSF message after receiving the command	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description
system	UINT	Query the system corresponding to the leap seconds forecast information 0: GPS 1: BDS 2: GLO 3: GAL

Output Leap Seconds Forecast Information

Syntax	$LSF,system,flag,utcTLS,utcTLSF,utcTOT,utcWN,utcDN,utcWNLSF,utcA0,utcA1	
Example	$LSF,0,1,15,16,462836,82,6,86,7811626,14	
Description	Output leap seconds forecast information	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
System	UINT	The system corresponding to the output of leap second forecast information, which is the same as the query instruction parameter
Flag	UINT	Valid flag of leap second forecast information 0: Invalid 1: Valid
utcTLS	UINT	Time difference between UTC and system before a leap second event, in seconds; GLO system does not have this parameter
utcTLSF	UINT	Time difference between UTC and system after a leap second event, in seconds; GLO system does not have this parameter ;
utcTOT	UINT	UTC reference seconds into the week, in seconds(BDS system parameter is 0) GLO system: the parameter corresponds to GLO UTC A0;
utcWN	UINT	Number of UTC reference week, in weeks (BDS system parameter is 0) GLO system: the parameter corresponds to GLO UTC A1;

utcDN	UINT	Days into the week when leap second event occurs, in days. GLO system: the parameter corresponds to GLO UTC DN;
utcWNLSF	UINT	Number of UTC week when leap second event occurs, in weeks GLO system: the parameter corresponds to GLO UTC KP;
utcA0	INT	Constant coefficient A0 of UTC polynomial (scale factor 2-30) , in s GLO system: the parameter corresponds to GLO UTC tc;
utcA1	INT	First-order coefficient A1 of UTC polynomial (scale factor 2-50) , in s/s GLO system: the parameter corresponds to GLO UTC tg;

- GPS Week (GPS Week) is the time system adopted in the GPS system. Time Zero is defined as: 0 a.m. on January 6, 1980. Every 1024 weeks (7168 days) is a cycle. The first GPS cycle point is 0000:00 and 000:00 on August 22, 1999. That is, from this moment on, the number of weeks starts again from zero. The rule for counting the number of weeks is: Sunday is 1, and in turn is 1-7.
- The Beidou satellite navigation time system starts at 000:00 and 000:00 UTC ON 1 January 2006. Use Week and seconds into the week count. The rule for counting the number of weeks is: Sunday is 0, and in turn is 0-6
- utcWNLSF: A decimal number converted from the lower eight bits of the binary week when a leap second occurs. For example: A leap second occurs in the 900th week (binary: 1110000100) and it is broadcast in 132 (Binary: 10000100).
- Conversion method of GPS leap second occurrence week:

  STEP1: Convert GPSW in Navtime to binary, set the lower eight bits to zero, and then convert to decimal.

  STEP2: Add the number in step1 to utcWNLSF to get the week when a leap second occurs.

- Conversion method of BDS leap second occurrence week:

  STEP1: Convert the BDW in Navtime to binary, set the lower eight bits to zero, and then convert to decimal.

STEP2: Add utcWNLSF to the number in Step1 to get the week when a leap second occurs.

☞ UTCDN: Days of the week in which a leap second occurs: GPS: 1-7 from Sunday to Saturday; BDS: 0-6 from Sunday to Saturday

☞ Leap seconds occur at 23:59:59

5.6.2 CWOUT

Output Interference Detection Information

Syntax	$CWOUT,CWFlagOut,CWRatioOut	
Example	$CWOUT,1,0	
Description	Output interference detection information	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
CWFlagOut	UINT	Interference 1: No interference 2: Interference detected 3: Strong interference, has affected the receiver positioning
CWRatioOut	UINT	Interference intensity, 0~255, 0 means no interference, 255 means strong interference

5.7 NOTICE Message

Notice maintenance information output message is developed for internal use with UNICORECOMM. The output message is as follows:

$NOTICE,1,10000,10000,10000,20,0,FFFF,FFFF,FFFF,1000*29

6 Default Configuration

6.1 Serial Port Configuration (CFGPRT)

Serial Port Configuration

Parameter	Default Configuration	Description
UART1		
baud	115200	
inProto	1185	Input UNICORE+RTCM3.2 + RTCM2.3+ Map matching protocol
outProto	35/3	– 35: Default configuration for the firmware with the version of R3.4.0.0, output UNICORE+NMEA+command echo – 3: Default configuration for the firmware with the version of R3.2.0.0, output UNICORE+NMEA protocol
UART2		
baud	115200	
inProto	1	Input UNICORE protocol
outProto	35/3	– 35: Default configuration for the firmware with the version of R3.4.0.0, output UNICORE +NMEA +command echo protocol – 3: Default configuration for the firmware with the version of R3.2.0.0, output UNICORE+NMEA protocol

6.2 Message Configuration (CFGMSG)

Message Output Frequency

Parameter	Default Configuration	Description
NMEA Message		
GGA	1	Output at 1Hz
GLL	1	Output at 1Hz
GSA	1	Output at 1Hz
GSV	1	Output at 1Hz
RMC	1	Output at 1Hz
VTG	1	Output at 1Hz
ZDA	0	Disabled
GST	0	Disabled
Navigation Result Message		
POS	0	Disabled
VEL	0	Disabled
TIME	0	Disabled
ACC	0	Disabled
Sensor Fusion Message		
GYOACC	0	Disabled
GYOACC-V	0	Disabled
SNRSTAT	1	Output at 1Hz
NOTICE Message		
NOTICE	1	Output at 1Hz
Attitude Message		
NAVATT	0	Disabled

6.3 NMEA Configuration (CFGNMEA)

NMEA Configuration

Parameter	Default Configuration	Description
nmeaVer	H51	Extended BEIDOU messages Based on NMEA standard version 4.1
InsNmeaOpen	0	0- 1Hz NMEA message output

6.4 Satellite System Configuration (CFGSYS)

Satellite System Configuration

Parameter	Default Configuration	Description
sysMask	H11	– Firmware with the version of R3.4.0.0 defaults to support GPS+BDS+Galileo+SBAS+QZSS – Firmware with the version of R3.2.0.0 defaults to support GPS+BDS

6.5 Interference Detection Configuration (CFGCWOUT)

Interference Detection Configuration

Parameter	Default Configuration	Description
CWOutCtrl	0	Disabled

6.6 Installation Angle Configuration (CFGROTAT)

Installation Angle Configuration

Parameter	Default Configuration	Description
angleX	0	The X axis of the module coincides with the X axis of the car body coordinate
angleY	0	The Y axis of the module coincides with the Y axis of the car body coordinate
angleZ	0	The Z axis of the module coincides with the Z axis of the car body coordinate
mode	2	Free installation configuration

6.7 Odometer Direction Signal Configuration (CFGODOFWD)

Odometer Direction Signal Configuration

Parameter	Default Configuration	Description
FWD	1	Mode Setting. High forward, low back

6.8 INS Configuration (CFGINS)

INS Configuration

Parameter	Default Configuration	Description
mode	1	Integrated navigation function is enabled, vehicle mode
ImusrcType	1	Built-in IMU chip input
OdosrcType	1	Built-in odometer pulse counter
MapsrcType	4	Map matching input information

6.9 Elevation Configuration (CFGGEOID)

Elevation Configuration

Parameter	Default Configuration	Description
Model	0	Elevation is ellipsoid height

6.10 Course Angle Configuration (CFGCOG)(1)

Course Angle Configuration

Parameter	Default Configuration	Description
mode	0	The default course angle is consistent with the front of the vehicle

(1) Only supported by firmware R3.4.0.0 and above.

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