STANDARD POSITIONING

PROTOCOL SPECIFICATION

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Unicore Firebird II

GNSS Full-system Dual-frequency Positioning Products

Revision History

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Target Readers

This manual applies to technicians who have certain knowledge in GNSS modules.

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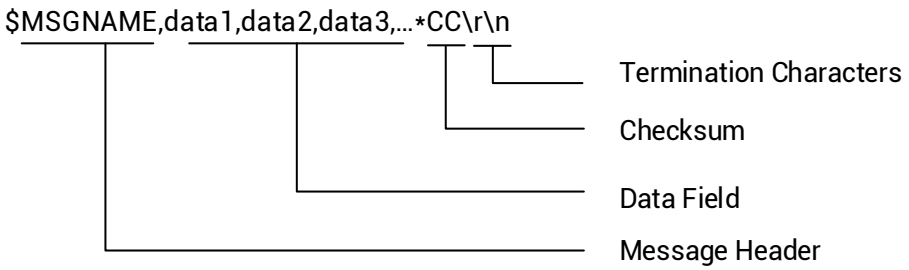
1 General Protocol

1.1 Messages

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

The basic format of the message is:



All messages include the following parts:

- Message header. It starts with '$' (0x24).
- Data field. It follows a delimiter "," and consists of a number of parameters or data. The adjacent data are also separated by the delimiter ",".
- Checksum. It is separated from the previous data by '*' (0x2A). See section 1.2 for the details.
- Termination characters. 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 cannot exceed 128 bytes.

> ☞ Message header and parameters, as well as letters in the checksum are case-sensitive, and the command echoes according to your inputs.

Some parameters of the commands can be omitted (marked as optional in the command description), which means that those parameters can be empty and there is no character between the two delimiters ',,' or ',*'. If there is no special instruction, the parameter is ignored and the option it controls remains unchanged.
Most of the message headers can be used for both input commands and output messages. As the input, it sets parameters or queries the current configuration; as the output, it outputs the receiver information or configuration.

1.2 Checksum

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

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

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

1.3 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 Integers (UINT)

Unsigned integers range from 0 to 4294967295, and are defined in both decimal and hexadecimal. A decimal unsigned integer consists of ASCII characters 0 - 9 with a maximum of 10 characters, such as 123, 4291075193. A hexadecimal unsigned integer starts with the ASCII character h or H, followed by a string of 0 - 9 and a - f (or A - F), with a maximum of 8 characters (excluding the starting h or H), such as hE10, hE41BA7C0.

Signed Integers (INT)

Signed integers are composed of the ASCII characters 0 - 9 and a negative sign, in the range of -2147483648 to 2147483647, such as 123217754, -245278. It has 10 characters (excluding the negative sign) at most.

Double-precision Floating-point Data (DOUBLE)

Double-precision floating-point data consists of ASCII characters 0 - 9, a negative sign and decimal points, ranging from -2^1023 to 2^1023, such as 3.1415926, -9024.12367225. It has 20 characters at most.

Unsigned Long Integers (UINT64)
The integer has 16 characters (excluding the starting h or H) at most if it is in hexadecimal.

1.4 Message Definition

1.4.1 General Messages

1.4.1.1 PDTINFO: Product Information Inquiry

Table 1-1 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	

Table 1-2 Output Product Information

Syntax	$PDTINFO,pdtName,config,hwVer,fwVer,PN,SN	
Example	$PDTINFO,UM621N-01,G1B1L1E1,V1.0,R4.0.0Build5428, 2310414000002,000101114303845*4A	
Description	The receiver outputs product information.	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
pdtName	STR	Product model
config	STR	Flag of satellite system: Gx - GPS Bx - BDS Lx - GLONASS Ex - Galileo Nx - IRNSS Note: This flag does not change with configuration changes.
hwVer	STR	Hardware version
fwVer	STR	Firmware version
PN	STR	Product number (null for a chip)
SN	STR	Serial number (chip ID for a chip)

1.4.1.2 RESET

Table 1-3 Receiver Reset

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 (not supported currently) 3 - Receiver stops working
clrMask	UINT (Optional)	Set the corresponding bit to 1 to clear the saved information during the reset. bit0 - Clear ephemeris bit1 - Reserve0 bit2 - Clear receiver position and time bit3 - Clear initial navigation parameter bit4 - Clear ionosphere correction parameter and UTC parameter bit5 - Reserve2 bit6 - Reserve3 bit7 - Clear almanac Three common start methods: h00 - Hot start h01 - Warm start h85/hff - Cold start

☞ Use h85 or hff (recommended) to have a cold start, and an incorrect parameter can cause the receiver to start in a wrong state.

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

1.4.1.3 Command Echo

Table 1-4 Command Echo

Syntax	$--TXT,01,01,00,command	
Example	$GNTXT,01,01,00,PDTINFO*1F	
Description	Output the command that input by the user currently	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP - GPS system standalone positioning GB - BDS system standalone positioning GA - GAL system standalone positioning GL - GLO system standalone positioning GI - IRNSS system standalone positioning GN - Dual or multiple system joint positioning
01	INT	Total number of sentences, specified to constant 01
01	INT	Current sentence number, specified to constant 01
00	INT	Message ID, specified to constant 00
Command	STR	Unicore command currently input by users

1.4.1.4 OK: Message Response Mechanism

Table 1-5 Correct Execution of a Command

Syntax	$OK
Example	$OK*04
Description	A response that the receiver executed the command correctly. This message only outputs at the port receiving the command.
Input/Output	Output
No parameters	

1.4.1.5 FAIL: Message Response Mechanism

Table 1-6 Incorrect Execution of a Command

Syntax	$FAIL,errorCode	
Example	$FAIL,0*1E	
Description	A response that the parameters or the checksum in the input command is incorrect. No response to the illegal command. This message only outputs at the port receiving the command.	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
errorCode	UINT	Error code: 0 - Incorrect parameters 1 - Incorrect checksum

1.4.2 Configuration Messages

1.4.2.1 CFGPRT: Configure the Output Port

Table 1-7 Read Port Configuration

Syntax	$CFGPRT,portID	
Example	$CFGPRT,1	
Description	Read the receiver port configuration. The receiver outputs CFGPRT message after receiving this command.	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description
portID	UINT	Port number: 0, 1, 2, 4

Table 1-8 Set/Output Port Configuration

Syntax	$CFGPRT,portID,addr,baud,inPro,outPro	
Example	$CFGPRT,1,0,115200,1,3	
Description	Set or output the port configuration.	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
portID	UINT (optional)	Port number: 0 - I2C 1 - UART0 2 - UART1 4 - SPI If empty, configure the current port

addr	UINT (optional)	UART: fixed at 0 or null; I2C: slave address[1], specified to constant 0
baud	UINT (optional)	If the port is UART, the baud rate could be set as: 115200/230400/ 460800
inPro	UINT (optional)	Port input protocol. Set the corresponding bit to 1 to enable it. bit0 - UNICORE bit7 - RTCM3.3 (compatible with RTCM3.2) bit10 - MapInfo input protocol (applicable for integrated navigation product)
outPro	UINT (optional)	Port output protocol. Set the corresponding bit to 1 to enable it. bit0 - UNICORE bit1 - NMEA bit2 - RTCM3.3 (compatible with RTCM3.2) bit5 - Command echo

☞ If you need to output a message at a higher rate, such as 10 Hz, increase the baud rate. Otherwise, incomplete satellite information may appear.

☞ Do not disable the UNICORE input, otherwise it can cause an abnormal command receiving.

1.4.2.2 CFGMSG: Configure Message Output Frequency

Table 1-9 Read Message Output Configuration

Syntax	$CFGMSG,msgClass,msgID	
Example	$CFGMSG,0,1	
Description	Read the message output configuration. The receiver outputs CFGMSG message after receiving this command.	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description
msgClass	UINT	Message class (see Table 1-11 Message Class and ID)
msgID	UINT	Message ID (see Table 1-11 Message Class and ID)

[1] The default slave address is 0x56 which cannot be changed via commands.

Table 1-10 Set/Output Message Output Frequency

Syntax	$CFGMSG,msgClass,msgID,rate/switch	
Example	$CFGMSG,0,1,1	
Description	Set or output the message output frequency.	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
msgClass	UINT	Message class (see Table 1-11 Message Class and ID)
msgID	UINT (optional)	Message ID (see Table 1-11 Message Class and ID) If empty, set/output all messages under the above class
rate/switch	UINT	Output frequency The actual output frequency of the NMEA/NOTICE message is based on the receiver positioning frequency, and that of the raw data is based on the observation frequency. The receiver selects a message to output after performing N times positioning solutions/observations. For example, if you use the CFGNAV to set a positioning rate to 2 Hz, and the parameter rate/switch is set to 1, then the message outputs twice every second. If the parameter rate/switch is set to 1, then the message outputs once every second. The message is disabled when rate/switch is 0. Each message has a specified range, and the message would be invalid if the parameter exceeds the range.

Table 1-11 Message Class and ID

Message	**Class**	**ID**	**Rate**	**Maximum Output Frequency**
NMEA Message				
GGA	0	0	0 to 100	≤ Positioning frequency
GLL	0	1	0 to 100	
GSA	0	2	0 to 100	
GSV	0	3	0 to 100	
RMC	0	4	0 to 100	
VTG	0	5	0 to 100	
ZDA	0	6	0 to 100	
GST	0	7	0 to 100	
GBS	0	8	0 to 100	

Raw Measurement Message				
RTCM MSM	2	2	0 to 100	≤ Observations frequency
RTCM EPH	2	3	0 to 100	
RTCM STM	2	4	0 to 100	
Sensor Fusion Message (For Integrated Navigation Products Only)				
GYOACC	4	0	0: Disable 1: Enable	Fixed at 10 Hz
SNRSTAT	4	1	0: Disable 1: Enable	Fixed at 1 Hz
NAVATT	4	2	0: Disable 1: Enable	Fixed at 1 Hz
IMURAW	4	3	0: Disable 1: Enable	Fixed at 100 Hz
Misc Message				
CWOUT	5	0	0: Disable 1: Enable	Fixed at 1 Hz
NOTICE Message				
TXT (single message)	6	0	0 to 100	≤ Positioning frequency
TXT (multiple messages)	6	1	0 to 100	

1.4.2.3 CFGNMEA: Read NMEA Configuration

Table 1-12 Read NMEA Configuration

Syntax	$CFGNMEA
Example	$CFGNMEA
Description	Read the current NMEA configuration. The receiver outputs the NMEA version H52 (NMEA 4.11) after receiving this command. The output is $CFGNMEA,H52*26.
Input/Output	Input
No parameters	

1.4.2.4 CFGNAV: Configure Positioning Frequency

Table 1-13 Read Positioning Frequency Configuration

Syntax	$CFGNAV
Example	$CFGNAV
Description	Read the positioning frequency configuration. The receiver outputs CFGNAV message after receiving this command.
Input/Output	Input
No parameters	

Table 1-14 Set/Output Positioning Frequency Configuration

Syntax	$CFGNAV,measRate,navRate,DRRate	
Example	$CFGNAV,1000,1000,10	
Description	Set or output positioning frequency configuration	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
measRate	UINT	Observations interval, unit: ms; 1000 (1 Hz), 200 (5 Hz), 100 (10 Hz)
navRate	UINT	Positioning interval, unit: ms; 1000 (1 Hz), 200 (5 Hz), 100 (10 Hz)
DRRate	UINT	Initial navigation interval, unit: ms; 1000 (1Hz), 100 (10 Hz), 10 (100Hz)

1.4.2.5 CFGSYS: Configure Satellite System

Table 1-15 Read Satellite System Configuration

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

Table 1-16 Set/Output Satellite System Configuration

Syntax	$CFGSYS,sysMask	
Example	$CFGSYS,h35155	
Description	Set or output satellite system configuration. The receiver resets automatically after receiving the command, and the enabled frequencies take effect after the reset.	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
sysMask	UINT	Enabled frequency. Set the corresponding bit to 1 to enable it. bit0 - GPS L1CA bit1 - GPS L2 (reserved) bit2 - GPS L5 bit3 - GPS L1C (reserved) bit4 - BDS B1I bit5 - BDS B2b (reserved) bit6 - BDS B2a bit7 - BDS B1C (reserved) bit8 - GLONASS L1 bit9 - GLONASS L2 (reserved) bit10:11 - Reserved bit12 - GALILEO E1 bit13 - GALILEO E5b (reserved) bit14 - GALILEO E5a bit15 - Reserved bit16 - QZSS bit17 - SBAS bit18 - IRNSS L5 SPS (reserved) bit19:31 - Reserved for other navigation systems and augmentation systems

1.4.2.6 CFGGEOID: Configure Height

Table 1-17 Read Height Configuration

Syntax	$CFGGEOID
Example	$CFGGEOID
Description	Read the current height configuration. The receiver outputs the CFGGEOID message after receiving the command.
Input/Output	Input
No parameter	

Table 1-18 Set/Output Height Configuration

Syntax	$CFGGEOID,Model	
Example	$CFGGEOID,1	
Description	Set or output the height configuration.	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
Model	UINT (Optional)	0 - Outputs the ellipsoid height 1 - Outputs the geoid height

1.4.2.7 CFGSAVE: Save the Configuration

Table 1-19 Save the Configuration

Syntax	$CFGSAVE
Example	$CFGSAVE
Description	Save the current configuration, which is stored in the memory.
Input/Output	Input
No parameter	

☞ Do NOT power off the product within one second after entering the **$cfgsave** command. A power off during this process may cause damage to the receiver's configuration, and the configuration will be restored to factory settings.

☞ This command is only applicable for the flash-version products.

1.4.2.8 CFGCLR: Clear the Configuration

Table 1-20 Clear the Configuration

Syntax	$CFGCLR
Example	$CFGCLR
Description	Clear current receiver's configuration.
Input/Output	Input
No parameter	

☞ The configuration changed by this command takes effect after resetting the receiver.

1.4.2.9 AIDTIME: Configure Assisted Time

Table 1-21 Input Assisted Time Information

Syntax	$AIDTIME,year,month,day,hour,minute,second,millisecond	
Example	$AIDTIME,2018,4,9,17,41,36,200	
Description	Input the assisted time, UTC time	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description
year	UINT	Year
month	UINT	Month
day	UINT	Day
hour	UINT	Hour
minute	UINT	Minute
second	UINT	Second
millisecond	UINT	Millisecond

1.4.2.10 AIDPOS: Configure Assisted Position

Table 1-22 Input Assisted Position

Syntax	$ AIDPOS,Latitude,N,Longitude,E,altitude	
Example	$ AIDPOS,4002.229934,N,11618.096855,E,37.254	
Description	Input the assisted position	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description
Latitude	DOUBLE	Latitude in the format of ddmm.mmmmmm dd - Degree mm.mmmmmm - Minute Range: 0 to 90
N	STRING	North or south latitude indicator N - North latitude S - South latitude
Longitude	DOUBLE	Longitude in the format of dddmm.mmmmmm ddd - Degree mm.mmmmmm - Minute Range: 0 to 180
E	STRING	East or west longitude indicator E - East longitude W - West longitude
altitude	DOUBLE	Ellipsoid height, unit: m

1.4.2.11 AIDINFO: Configure Assisted Information

Table 1-23 Read Assisted Information Configuration

Syntax	$AIDINFO
Example	$AIDINFO
Description	Read the assisted information configuration. The receiver outputs AIDINFO message after receiving this command.
Input/Output	Input
No parameter	

Table 1-24 Output Assisted Information

Syntax	$AIDINFO,GPSRS,GPSUS,BDSRS,BDSUS,GALRS,GALUS,GLORS,GLOUS,IRNRS,IRNUS,AType
Example	$AIDINFO,H003FFFFFF7,H000000FA00,H0000003F7F,H0000001A3F,H0000000000,H0000000000,H0000000000,H0000000000,,,H0000000F*52
Description	Output the status and type of the assisted information
Input/Output	Output
Parameter Definition	

Parameter	Format	Description
GPSRS	UINT64	Receiving status of the GPS ephemeris. Set the corresponding bit to 1 as long as the received data pass the verification. Fill Null when the GPS is not enabled.
GPSUS	UINT64	Set the corresponding bit to 1 when GPS ephemeris is effective and can be used in positioning. Fill Null when the GPS is not enabled.
BDSRS	UINT64	Receiving status of the BDS ephemeris. Set the corresponding bit to 1 as long as the received data pass the verification. Fill Null when the BDS is not enabled.
BDSUS	UINT64	Set the corresponding bit to 1 when BDS ephemeris is effective and can be used in positioning. Fill Null when the BDS is not enabled.
GALRS	UINT64	Receiving status of the GAL ephemeris. Set the corresponding bit to 1 as long as the received data pass the verification. Fill Null when the GAL system is not enabled.
GALUS	UINT64	Set the corresponding bit to 1 when GAL ephemeris is effective and can be used in positioning. Fill Null when the GAL system is not enabled.
GLORS	UINT64	Receiving status of the GLO ephemeris. Set the corresponding bit to 1 as long as the received data pass the verification. Fill Null when the GLO system is not enabled.
GLOUS	UINT64	Set the corresponding bit to 1 when GLO ephemeris is effective and can be used in positioning. Fill Null when the GLO system is not enabled.
IRNRS	UINT64	Receiving status of the IRNSS ephemeris. Set the corresponding bit to 1 as long as the received data pass the verification. Fill Null when the IRNSS system is not enabled.
IRNUS	UINT64	Set the corresponding bit to 1 when IRNSS ephemeris is effective and can be used in positioning. Fill Null when the IRNSS system is not enabled.
Atype	UINT	Assistance type Bit 0:4 - Corresponding to the assisted GPS/BDS/GAL/GLO/IRNSS ephemeris respectively Bit 5 - Assisted position valid Bit 6 - Using the assisted position Bit 7:8 - Reserved Bit 9 - Assisted time valid Bit 10 - Using the assisted time Bit 11:16 - Reserved

1.4.2.12 CFGACC: Configure Awakening Command (For Integrated Navigation Product)

Table 1-25 Read Awakening Threshold Configuration

Syntax	$CFGACC
Example	$CFGACC
Description	Read the parameter of the receiver's accelerometer threshold. The receiver outputs the awakening threshold of the accelerometer after receiving the command.
Input/Output	Input
No parameter	

Table 1-26 Set/Output Awakening Command Configuration

Syntax	$CFGACC,accthreshold,modeenable	
Example	$CFGACC,100,1	
Description	Set or output the awakening configuration	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
accthreshold	UINT	Configure the accelerometer threshold under the awakening mode, unit: mg
modeenable	UINT	Enable or disable awakening function 0: Disable 1: Enable

1.4.2.13 CFGODOFWD: Configure Direction Signal (For Integrated Navigation Product)

Table 1-27 Read Direction Signal Configuration

Syntax	$CFGODOFWD
Example	$CFGODOFWD
Description	Read the configuration of odometer's direction signal
Input/Output	Input
No parameter	

Table 1-28 Set/Output Direction Signal Configuration

Syntax	$CFGODOFWD,FWD	
Example	$CFGODOFWD,1	
Description	Set or output the odometer's direction signal 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

1.4.2.14 CFGINS: Configure Integrated Navigation (For Integrated Navigation Products Only)

Table 1-29 Read Integrated Navigation Configuration

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

Table 1-30 Set/Output Integrated Navigation Configuration

Syntax	$CFGINS,mode,ImusrcType,OdosrcType,MapsrcType	
Example	$CFGINS,1,1,1,4	
Description	Set or output the integrated navigation mode and IMU input.	
Input/Output	Input/Output	
Parameter Definition		
Parameter	Format	Description
mode	UINT (Optional)	Mode configuration: 0 - Disable the integrated navigation function. The NMEA messages only output the GNSS positioning results. 1 - Vehicle-mounted mode 9 - Reserved
ImusrcType	UINT (Optional)	0 - Disable IMU input 1 - Built-in IMU chip input
OdosrcType	UINT (Optional)	0 - Disable the odometer's signal input 1 - Input from the built-in odometer pulse counter
MapsrcType	UINT (Optional)	0 - Disable Map input 4 - Use the UART to input the map-matching information

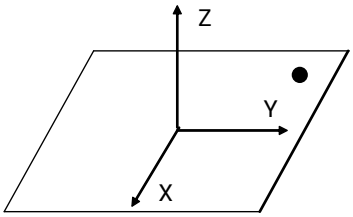
1.4.2.15 CFGROTAT: Configure Installation Angle (For Integrated Navigation Products Only)

Table 1-31 Read Configuration of Installation Angle

Syntax	$CFGROTAT
Example	$CFGROTAT
Description	Read the current installation angle of the positioning module. The receiver outputs the CFGROTAT message after receiving the command.
Input/Output	Input
No parameter	

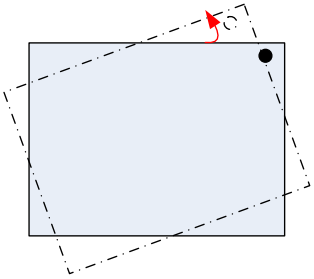
Table 1-32 Set/Output Configuration of Installation Angle

Syntax	$CFGROTAT,angleX,angleY,angleZ,mode	
Example	$CFGROTAT,0,0,0,2	
Description	Set or output the configuration of the module's installation angle relative to the vehicle body coordinate.	
Input/Output	Input/Output	
Parameter Definition		
Parameter	Format	Description
angleX	UINT (Optional)	Rotation angle of the module X axis relative to the vehicle body coordinate X axis (right-hand screw rule) , 0 to 36000, unit: 0.01 degree
angleY	UINT (Optional)	Rotation angle of the module Y axis relative to the vehicle body coordinate Y axis (right-hand screw rule) , 0 to 36000, unit: 0.01 degree
angleZ	UINT (Optional)	Rotation angle of the module Z axis relative to the vehicle body coordinate Z axis (right-hand screw rule), 0 to 36000, unit: 0.01 degree
mode	UINT (Optional)	Configuration mode of installation angle 0 - General installation mode. The accuracy of input installation angle is rough (within 10 degrees) 2 - Auto installation mode. No need to input the installation angle but need to complete a calibration.

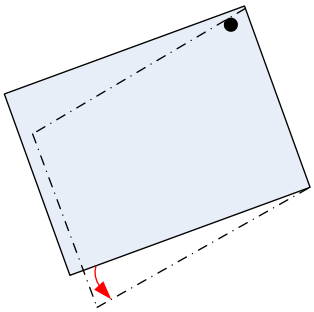


Module Coordinate

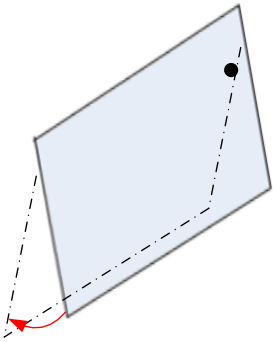
Align the module coordinate with the body coordinate



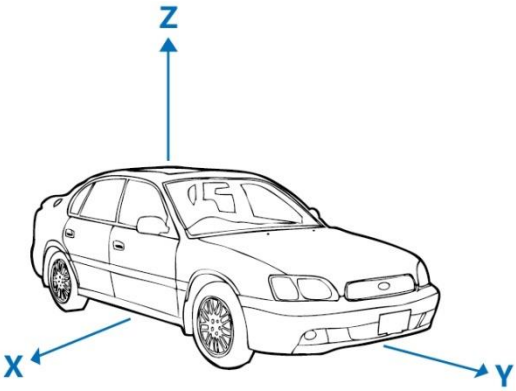
Rotate the module γ deg around the Z axis (right-hand screw rule)



Rotate the module α deg around the X axis (right-hand screw rule)



Rotate the module β deg around the Y axis (right-hand screw rule)



1.4.2.16 CFGCOG: Configure Heading Angle (For Integrated Navigation Products Only)

Table 1-33 Read Configuration of Heading Angle

Syntax	$CFGCOG
Example	$CFGCOG
Description	Read the output configuration of heading angle
Input/Output	Input
No parameter	

Table 1-34 Set/Output Configuration of Heading Angle

Syntax	$CFGCOG,mode	
Example	$CFGCOG,0	
Description	Set or output heading angle configuration	
Input/Output	Input/Output	
Parameter Definition		
Parameter	Format	Description
mode	UINT (Optional)	0 - Heading angle is aligned with the front of the vehicle 1 - Heading angle is aligned with the driving direction

1.4.2.17 CFGTP: Configure PPS

Table 1-35 Set/Output Time Pulse Configuration

Syntax	$CFGTP,interval,length,flag,antDelay,rfDelay,usrDelay	
Example	$CFGTP,1000000,500000,1,0,800,0	
Description	Set or output time pulse configuration.	
Input/Output	Input/output	
Parameter Definition		
Parameter	Format	Description
interval	UINT (optional)	Time pulse frequency, unit: μs. (specified to constant 1000000)
length	UINT (optional)	Time pulse width, unit: μs (1 ≤ length < Interval) (High-level when the rising edge is aligned to top of second; low-level when the falling edge is aligned to top of second)
flag	UINT (optional)	Time pulse configuration: Bit 0

		0 - Disable time pulse output 1 - Enable time pulse output Bit 1 0 - Rising edge at top of second 1 - Falling edge at top of second Bit 2 0 - Output when positioning 1 - Output when switching on the receiver
antDelay	INT (optional)	Antenna delay, unit: ns (-32768 to 32767)
rfDelay	INT (optional)	RF delay, unit: ns (-32768 to 32767)
usrDelay	INT (optional)	User-set delay, unit: ns (-2147483648 to 2147483647) Modifying the delay may result in a loss of precision when time pulse is adapting to the value.

1.4.2.18 MAPFB: Map Feedback Message (For Integrated Navigation Products Only)

Table 1-36 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 $MAPFB, 082324.000,3,2,1,320,25,8,0,3,4745 $MAPFB, 082324.000,3,3,1,160,-17,-4,0,8,4645	
Description	Input map feedback	
Input/Output	Input	
Parameter Definition		
Parameter	Format	Description
hhmmss.sss	STR	UTC timestamp
TotalRoadCount	INT	Total number of the matched road
RoadIdx	INT	Road number Each message only outputs 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
LonDiff	INT	Longitude offset, unit: 10^{-6} deg
UpDiff	INT	Height offset, unit: m

RoadWidth	INT	Road width, unit: m
RoadAzi	INT	Road angle, unit: 10^{-2} deg
CS	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this message

☞ 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.

1.4.3 Output Messages

1.4.3.1 NmeaVer h52

GGA

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 system standalone positioning GB - BDS system standalone positioning GA - GAL system standalone positioning GL - GLO system standalone positioning GI - IRNSS system standalone positioning GN - Dual or multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.ss hh - Hour mm - Minute ss.ss - Second
Lat	STR	Latitude, in the format of ddmm.mmmmm dd - Degree mm.mmmmm - Minute
N	STR	North or south latitude indicator N - North latitude S - South latitude
Lon	STR	Longitude, in the format of dddmm.mmmmm ddd - Degree

		mm.mmmmm - Minute
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 4 - RTK fixed solution 5 - RTK float solution 7 - 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	Altitude, fixedly output 1 decimal place
M	STR	Unit of altitude, specified to constant M
Altref	DOUBLE	Geoidal separation, fixedly output one decimal place.
M	STR	Unit of Geoidal separation, specified to constant M
DiffAge	DOUBLE	Differential correction latency, in seconds Null for non-differential positioning
DiffStation	DOUBLE	Differential 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 message

GBS

Syntax	$-GBS,time,errLat,errLon,Lon,errAlt,Svid,Prob,Bias,Std,systemID*cs	
Example	$GPGBS,121314.00,0.5,0.6,0.9,03,,100.4,5.0,1,0*5C	
Description	RAIM error information	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP - GPS system standalone positioning GB - BDS system standalone positioning GA - GAL system standalone positioning GL - GLO system standalone positioning GI - IRNSS system standalone positioning GN - Dual or multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.ss

		hh - Hour mm - Minute ss.ss - Second
errLat	STR	Latitude error in the format of e.e, unit: m
errLon	STR	Longitude error in the format of e.e, unit: m
errAlt	STR	Altitude error in the format of e.e, unit: m
Svid	STR	Number of satellites that most likely have problems. In the format of nn
Prob	UINT	Probability of missed detection for the satellites that most likely have problems. Specified to constant null.
Bias	UINT	Estimation error of the satellites that most likely have problems.
Std	UINT	Standard deviation of the estimation error
systemID	UINT	GNSS system ID 1 - GPS/WAAS system ID 2 - GLO/SDCM system ID 3 - GAL/EGNOS system ID 4 - BDS/BDSSBAS system ID 5 - QZSS/MSAS system ID 6 - IRNSS/GAGAN system ID
signalID	UINT	Signal ID defined by NMEA protocol. GPS: 1 = L1 C/A 5 = L2C-M 8 = L5-Q Galileo: 1 = E5a 2 = E5b 7 = L1 BC BeiDou: 1 = B1I 3 = B1C 5 = B2a 6 = B2b GLONASS: 1 = G1 C/A 3 = G2 C/A IRNSS: 1 = L5 SPS

		QZSS: 1 = L1 5 = L2C-M 8 = L5-Q

GLL

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 position - Longitude/Latitude	
Input/Output	Output	
Parameter Definition		
Format	Format	Format
--	STR	Positioning system flag GP - GPS system standalone positioning GB - BDS system standalone positioning GA - GAL system standalone positioning GL - GLO system standalone positioning GI - IRNSS system standalone positioning GN - Dual or multiple system joint positioning
Lat	STR	Latitude, in the format of ddmm.mmmmm dd - Degree mm.mmmmm - Minute
N	STR	North or south latitude indicator N - North latitude S - South latitude
Lon	STR	Longitude, in the format of dddmm.mmmmm ddd - Degree mm.mmmmm - Minute
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 - Hour mm - Minute ss.ss - Second
Valid	STR	Position valid indicator V - Invalid A - Valid
Mode	STR	Positioning system mode indicator N - Not positioning A - Single 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 message

GSA

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 active satellites	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP - GPS system standalone positioning GB - BDS system standalone positioning GA - GAL system standalone positioning GL - GLO system standalone positioning GI - IRNSS system standalone positioning GN - Dual or 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 to sv12	UINT	ID of satellites participating in positioning When there are less than 12 satellites participating in positioning, the insufficient area is filled in empty; when there are more than 12 satellites, it only outputs the first 12 satellites. Satellite IDs are as follows. GPS: 01 to 32; WAAS: 33 to 64 BDS: 01 to 64; BDSSBAS: 65 to 79 GLO: 65 to 99; SDCM: 33 to 64 GAL: 01 to 36; EGNOS: 37 to 64 QZSS: 01 to 10; MSAS: 33 to 64 IRNSS: 01 to 15; GAGAN: 33 to 64
PDOP	DOUBLE	Position dilution of precision, 0.00 to 99.99, the value is

		99.99 when not positioning
HDOP	DOUBLE	Horizontal dilution of precision, 0.00 to 99.99, the value is 99.99 when not positioning
VDOP	DOUBLE	Vertical dilution of precision, 0.00 to 99.99, the value is 99.99 when not positioning
systemID	UINT	GNSS system ID 1 - GPS/WAAS system ID 2 - GLO/SDCM system ID 3 - GAL/EGNOS system ID 4 - BDS/BDSSBAS system ID 5 - QZSS/MSAS system ID 6 - IRNSS/GAGAN system ID
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this message

GSV

Syntax	$--GSV,NoMsg,MsgNo,NoSv,sv1,elv1,az1,cno1,sv2,elv2,az2,cno2,sv3,elv3,az3,cno3,sv4,elv4,az4,cno4, 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	GNSS satellites in view 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/WAAS satellite information GB - BDS/BDSSBAS satellite information GA - GAL/EGNOS satellite information

		GL - GLO/SDCM satellite information GI - IRNSS/GAGAN satellite information GQ - QZSS/MASAS 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 GBGSV messages
MsgNo	UINT	Number of the current GSV message. The minimum value is 1. MsgNo is the number of the GSV message in the current satellite system
NoSv	UINT	Total number of visible satellites in the current system
sv1 to sv4	UINT	Satellite IDs of the first to fourth satellite GPS: 01 to 32; WAAS: 33 to 64 BDS: 01 to 64; BDSSBAS: 65 to 79 GLO: 65 to 99; SDCM: 33 to 64 GAL: 01 to 36; EGNOS: 37 to 64 QZSS: 01 to 10; MSAS: 33 to 64 IRNSS: 01 to 15; GAGAN: 33 to 64
elv1 to elv4	UINT	Elevation of the first to fourth satellite (0 to 90 degrees), fixed output of 2 digits, add leading zeros if less than 2 digits
az1 to az4	UINT	Azimuth of the first to fourth satellite (0 to 359 degrees), fixed output of 3 digits, add leading zeros if less than 3 digits
cno1 to cno4	UINT	CNR of the first to fourth satellite (0 to 99 dB-Hz), fixed output of 2 digits, add leading zeros if less than 2 digits. Fill null for untracked satellites
signalID	UINT	Signal ID defined by NMEA protocol. GPS: 1 = L1 C/A 5 = L2C-M 8 = L5-Q Galileo: 1 = E5a 2 = E5b 7 = L1 BC BeiDou: 1 = B1I 3 = B1C 5 = B2a

		6 = B2b GLONASS: 1 = G1 C/A 3 = G2 C/A IRNSS: 1 = L5 SPS QZSS: 1 = L1 5 = L2C-M 8 = L5-Q
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this message

RMC

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 system standalone positioning GB - BDS system standalone positioning GA - GAL system standalone positioning GL - GLO system standalone positioning GI - IRNSS system standalone positioning GN - Dual or multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.ss hh - Hours mm - Minute ss.ss - Second
status	STR	Position valid indicator V - Invalid A - Valid
Lat	STR	Latitude, in the format of ddmm.mmmmm dd - Degree mm.mmmmm - Minute

N	STR	North or south latitude indicator N - North latitude S - South latitude
Lon	STR	Longitude, in the format of dddmm.mmmmm ddd - Degree mm.mmmmm - Minute
E	STR	East longitude or west longitude indicator E - East longitude W - West longitude
spd	DOUBLE	Speed over ground, unit: knot Fixedly output 3 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 variation, specified to null
mvE	STR	Magnetic variation 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 message

VTG

Syntax	$--VTG,cogt,T,cogm,M,sog,N,kph,K,mode*cs	
Example	$GPVTG,,T,,M,0.000,N,0.000,K,A*23	
Description	Course over ground and ground speed	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
--	STR	Positioning system flag GP - GPS system standalone positioning GB - BDS system standalone positioning GA - GAL system standalone positioning GL - GLO system standalone positioning GI - IRNSS system standalone positioning GN - Dual or multiple system joint positioning
cogt	DOUBLE	Course over ground with reference to true north (0.000 to 359.999 degrees)
T	STR	Course flag, specified to constant T
cogm	DOUBLE	Course over ground with reference to magnetic north (0.000 to 359.999 degrees)
M	STR	Course flag, specified to constant M
sog	DOUBLE	Speed over ground, unit: knot
N	STR	Unit of speed, specified to constant N
kph	DOUBLE	Speed over ground, unit: km/h
K	STR	Unit of speed, specified to constant K
mode	STR	Positioning mode N - Not positioning A - Point positioning D - Differential positioning E - Inertial positioning
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this message

ZDA

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

		GP - GPS system standalone positioning GB - BDS system standalone positioning GA - GAL system standalone positioning GL - GLO system standalone positioning GI - IRNSS system standalone positioning GN - Dual or multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.ss hh - Hours mm - Minute ss.ss - Second
day	UINT	UTC day with two digits, 01 to 31
mon	UINT	UTC month with two digits, 01 to 12
year	UINT	UTC year with four digits
ltzh	UINT	Local zone hours (fixed output 00)
ltzn	UINT	Local zone minutes (fixed output 00)
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this message

GST

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 system standalone positioning GB - BDS system standalone positioning GA - GAL system standalone positioning GL - GLO system standalone positioning GI - IRNSS system standalone positioning GN - Dual or multiple system joint positioning
time	STR	UTC time, in the format of hhmmss.ss hh - Hour mm - Minute ss.ss - Second
rngRMS	DOUBLE	Standard deviation of pseudorange error, in meters, with a maximum of 99.9
stdMajor	DOUBLE	Standard deviation of semi-major axis of the error ellipse, in meters.

		Specified to null
stdMinor	DOUBLE	Standard deviation of semi-minor axis of the error ellipse, in meters. Specified to null
hdg	DOUBLE	Orientation of semi-major axis of the error ellipse, in degrees, clockwise from north. Specified to null
stdLat	DOUBLE	Standard deviation of latitude error , in meters
stdLon	DOUBLE	Standard deviation of longitude error, in meters
stdAlt	DOUBLE	Standard deviation of altitude error , in meters
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this message

1.4.3.2 Sensor Fusion Message (For Integrated Navigation Products Only)

GYOACC

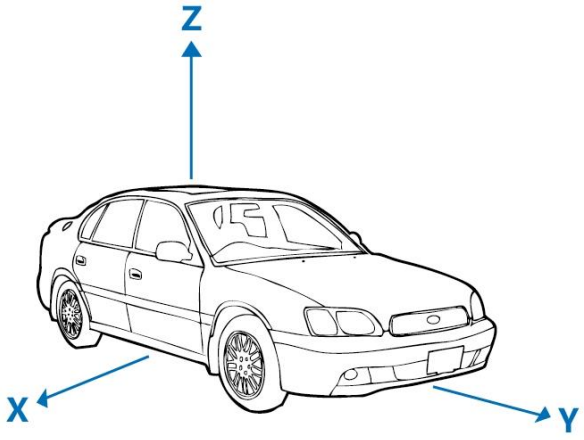
Table 1-37 Output MEMS Sensor Data

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*01	
Description	Output the sensor data of MEMS and odometer etc. This message is only used in GNSS + INS integrated products.	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
date	STR	UTC date in the format of ddmmyy dd - Day mm - Month yy - Year Fill null if no exact year, month and day are parsed.
time	STR	UTC time in the format of hhmmss.sss hh - Hour mm - Minute ss.sss - Second Fill null if no exact hour, minute and second are parsed.
gyroX	DOUBLE	X-axis angular velocity of inertial device, unit: rad/s
gyroY	DOUBLE	Y-axis angular velocity of inertial device, unit: rad/s
gyroZ	DOUBLE	Z-axis angular velocity of inertial device, unit: rad/s
gyroPeriod	UINT	Output interval of gyroscope data, unit: ms
accX	DOUBLE	X-axis acceleration of inertial device, unit: m/s^2

accY	DOUBLE	Y-axis acceleration of inertial device, unit: m/s^2
accZ	DOUBLE	Z-axis acceleration of inertial device, unit: m/s^2
accPeriod	UINT	Output interval of accelerometer data, unit: ms
temp	INT	Temperature, unit: °C No meaning if not connecting a temperature sensor
speed	INT	Vehicle speed pulse No meaning if not accessing the pulse signal.
pulsePeriod	UINT	Output interval of pulses. Unit: ms No meaning if not accessing the pulse signal.
fwd	UINT	Vehicle direction signal 0: Forward 1: Backward No meaning if not accessing the signal.
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this message

Note:

- To output GYOACC message at 10 Hz, you need to set the baud rate of UM621N serial port 1 or 2 to 230400 bps.
- GYOACC message is based on the body coordinate defined as follows:
  - Positive direction of X axis: Driver's right-hand direction, horizontal.
  - Positive direction of Y axis: Vehicle forward direction, horizontal.
  - Positive direction of Z axis: Vertical to the body plane, upward.



SNRSTAT

Table 1-38 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, and it' required to increase the speed
mapstat	INT	-2: Abnormal map data is detected -1: Serial port is not configured to input MAP information 0: The serial port does not receive MAP information or the MAP information transmission times 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
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this message

IMURAW

Table 1-39 Output MEMS Sensor Data

Syntax	$IMURAW,date,time,gyroX,gyroY,gyroZ,accX,accY,accZ*cs	
Example	$IMURAW,020822,111025.150,0.005127,0.000999,0.000000,-0.087065,-0.052059,9.891868*03	
Description	Output the raw data of the MEMS sensor This message is only applicable for the GNSS and INS integrated product	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
date	STR	UTC date in the format of ddmmyy dd - Day mm - Month yy - Year Fill null if no exact year, month and day are parsed.
time	STR	UTC time in the format of hhmmss.sss hh - Hour mm - Minute ss.sss - Second Fill null if no exact hour, minute and second are parsed.
gyroX	DOUBLE	X-axis angular velocity of inertial device, unit: rad/s
gyroY	DOUBLE	Y-axis angular velocity of inertial device, unit: rad/s
gyroZ	DOUBLE	Z-axis angular velocity of inertial device, unit: rad/s
accX	DOUBLE	X-axis acceleration of inertial device, unit: m/s^2
accY	DOUBLE	Y-axis acceleration of inertial device, unit: m/s^2
accZ	DOUBLE	Z-axis acceleration of inertial device, unit: m/s^2
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this message

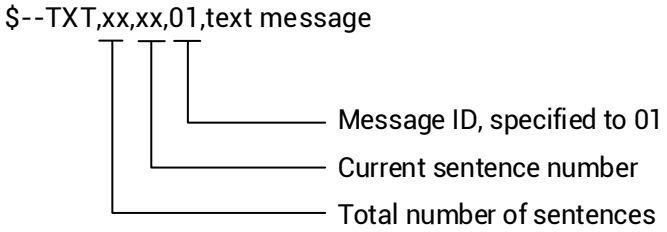
NAVATT

Table 1-40 Output Attitude and Heading Information

Syntax	$NAVATT,time,quality, roll_v,pitch_v,yaw_v,roll_acc,pitch_acc,yaw_acc*cs	
Example	$NAVATT,091649.00,0,-3562,-43265,0,0,0,0*31	
Description	Output the vehicle's attitude and heading information	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
time	STR	UTC time in the format of hhmmss.sss hh - Hour mm - Minute ss.sss - Second
quality	UINT	Current quality 0 - Invalid 1 - Externally set 2 - Coarse 3 - Precise
roll_v	DOUBLE	Roll; Unit: degree; Range: 0.00001
pitch_v	DOUBLE	Pitch; Unit: degree; Range: 0.00001
yaw_v	DOUBLE	Yaw; Unit: degree; Range: 0.00001
roll_acc	DOUBLE	Roll accuracy; Unit: degree; Range: 0.00001
pitch_acc	DOUBLE	Pitch accuracy; Unit: degree; Range: 0.00001
yaw_acc	DOUBLE	Yaw accuracy; Unit: degree; Range: 0.00001
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '$' to '*' in this message

1.4.3.3 NOTICE Message

NOTICE maintenance information, which is used by Unicore for research and development. See the following for the syntax of the output message.



1.4.3.4 Misc Message

CWOUT

Table 1-41 Output Interference Detection Information

Syntax	$CWOUT,CWFlagOut,CWToneFreqOut_GPL1,CWRatioOut-GPL1,CWToneFreqOut_GL,CWRatioOut-GL,CWToneFreqOut_BDB1,CWRatioOut-BDB1,CWToneFreqOut_L5,CWRatioOut-L5	
Example	$CWOUT,1,1575620,-100,1602100,-80,1561088,-90,1176470,-79*7E	
Description	Output interference detection information	
Input/Output	Output	
Parameter Definition		
Parameter	Format	Description
CWFlagOut	UINT	Interference flag 0: No interference 1: Having interference
CWToneFreqOut_GPL1	UINT	GPSL1 interference signal frequency; Unit: KHz
CWRatioOut-GPL1	INT	GPSL1 interference strength; -150 to 0 in dBm
CWToneFreqOut_GL	UINT	GLONASSL1interference signal frequency; Unit: KHz
CWRatioOut-GL	INT	GLONASSL1 interference strength; -150 to 0 in dBm
CWToneFreqOut_BDB1	UINT	BDS B1 interference signal frequency; Unit: KHz
CWRatioOut-BDB1	INT	BDS B1 interference strength; -150 to 0 in dBm
CWToneFreqOut_L5	UINT	L5 interference signal frequency; Unit: KHz
CWRatioOut-L5	INT	L5 interference strength; -150 to 0 in dBm

LSF

Table 1-42 Query Leap Seconds Forecast Information

Syntax	$LSF,system	
Example	$LSF,1	
Description	Query leap seconds forecast information of the specified satellite, and 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 4 - IRNSS

Table 1-43 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	Output the system corresponding to the leap seconds forecast information 0 - GPS 1 - BDS 2 - GLO 3 - GAL 4 - IRNSS
Flag	UINT	Validity flag of lead seconds forecast information 0: Invalid 1: Valid
utcTLS	UINT	Time difference between UTC and the system before a leap second event occurs, in seconds; GLO system does not have this parameter
utcTLSF	UINT	Time difference between UTC and the system after a leap second event occurs, in seconds; GLO system does not have this parameter

utcTOT	UINT	UTC reference seconds of week, in seconds (Fill 0 for BDS) GLO system: the parameter corresponds to GLO UTC A0;
utcWN	UINT	UTC reference week number, in weeks (Fill 0 for BDS) GLO system: the parameter corresponds to GLO UTC A1;
utcDN	UINT	Days of week when the leap second event occurs, in days. GLO system: the parameter corresponds to GLO UTC DN;
utcWNLSF	UINT	UTC week number when the 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;

Note

- GPS Week is the time system adopted in the GPS system. Time Zero is defined as: 00:00 on January 6,1980 and every 1024 weeks (7168 days) is a cycle. The first roll-over happened at 00:00:00 on August 22,1999. That is, from this moment on, the week number starts again from zero. In GPST, 1 to 7 corresponds to Sunday to Saturday.
- The BDS time starts at 00:00:00 UTC on 1 January 2006, and uses week and day of week to count. 0 to 6 corresponds to Sunday to Saturday.
- utcWNLSF: The decimal number converted from the binary lower eight bits of the week when a leap second occurs.

  For example: A leap second occurred in the week 900 (binary: 1110000100), then the utcWNLSF broadcasts 132 (binary: 10000100).
- Calculating the GPS week when a leap second occurs:
  1. Convert the RMC date into GPS week;
  2. Convert the GPS week into binary, set the lower eight bits to zero, and then convert to decimal.
  3. Add utcWNLSF to the number got from step 2.
- Calculating the BDS week when a leap second occurs:
  1. Convert the RMC date into BDS week;
  2. Convert the BDS week into binary, set the lower eight bits to zero, and then convert to decimal.

3. Add utcWNLSF to the number got from step 2.

- utcDN: Day of week when a leap second occurs. GPS: 1 to 7 corresponding to Sunday to Saturday; BDS: 0 to 6 corresponding to Sunday to Saturday
- Leap seconds occur at 23:59:59

1.4.4 RAWDATA Message Format

Refer to RTCM 3.2/3.3 messages.

2 Reference

[1] RTCM STANDARD 10403.3, DIFFERENTIAL GNSS(GLOBAL NAVIGATION SATELLITE SYSTEMS) SERVICES: VERSION 3
[2] NMEA 0183 Standard for Interfacing Marine Electronic Devices, Version 4.11

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