



SIM66 Series_NMEA Message_User Guide

GNSS Module

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About Document

Version History

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V1.01	2021.11.04	Wenjie.lai	Add SIM66M in scope

Scope

This document applies to the following products

Name	Type	Size(mm)	Comments
SIM66MB	GPS+BDS	9.7*10.1*2.5	N/A
SIM66M	GPS+GLONASS	9.7*10.1*2.5	N/A

Contents

About Document	3
Version History	3
Scope	3
Contents	4
1 Introduction	5
1.1 Purpose of the document	5
1.2 Related documents	5
1.3 Conventions and abbreviations	5
2 NMEA Messages	6
2.1 General Format of NMEA Messages.....	6
2.2 General Type of NMEA Messages	7
2.3 NmeaVer h51	7
2.3.1 Message ID GGA: GNSS Positioning Data	7
2.3.2 Message ID GLL: GNSS Eographic Longitude/Latitude.....	8
2.3.3 Message ID GSA: GNSS Dilution of Precision and Effective Satellite Information.....	9
2.3.4 Message ID GSV: Visible GNSS Satellites.....	11
2.3.5 Message ID RMC: The Minimum Recommended Data.....	12
2.3.6 Message ID VTG: Track Direction and Ground Speed.....	13
2.3.7 Message ID ZDA: Output Date and Time	14
2.3.8 Message ID GST: Output GNSS Pseudorange Error	15
2.4 NmeaVer h30	16
2.4.1 Message ID GGA: Output GNSS Positioning Data	16
2.4.2 Message ID GLL: Output Eographic Longitude/Latitude	17
2.4.3 Message ID GSA: Output GNSS Dilution of Precision and Effective Satellite Information	18
2.4.4 Message ID GSV: Output Visible GNSS Satellites	19
2.4.5 Message ID RMC: Output the Minimum Recommended Data	20
2.4.6 Message ID VTG: Output Track Direction and Ground Speed	21
2.4.7 Message ID ZDA: Output Date and Time	22
2.5 Navigation Result Message.....	23
2.5.1 NAVPOS: Output the Receiver Position Information	23
2.5.2 NAVVEL: Output the Receiver Velocity Information	23
2.5.3 NAVTIME: Output Time Information	24
2.5.4 NAVACC: Output Accuracy Information of Receiver Positioning Speed Measurement ..	25

1 Introduction

1.1 Purpose of the document

At present, has been built and is planning the construction of a satellite navigation system apart from United States GPS system, and Russia's GLONASS system, the European Galileo system, Beidou satellite navigation system in China and Japan and Indian regional satellite navigation systems.

Based on module AT command manual, this document will introduce GNSS NEMA Message application process.

Developers could understand and develop application quickly and efficiently based on this document.

1.2 Related documents

1.3 Conventions and abbreviations

2 NMEA Messages

2.1 General Format of NMEA Messages

NMEA messages use the ASCII character set and have a defined format. Each message begins with a \$ (hex 0x24) and end with a carriage return and line feed (hex 0x0D 0x0A, represented as <CR><LF>). Each message consists of one or more fields of ASCII letters and numbers, separated by commas. After the last field, and before the <CR><LF> is a checksum consisting of an asterisk (*, hex 0x2A) followed by two ASCII characters representing the hexadecimal value of the checksum.

Parameter	Example	Contents
Start	\$GPGGA	Message Identifier. Input messages begin at MID 100
Payload	<Data>	Message specific data. Refer to a specific message section for <data>...<data> definition
Checksum	*CKSUM	CKSUM is a two-hex ASCII character. Checksums is required in all input messages
End	<CR> <LF>	Each message is terminated using Carriage Return (CR) Line Feed (LF) which are \r\n. Because \r\n are not printable ASCII characters, they are omitted from the example strings, but must be sent to terminate the message and cause the receiver to process that input message

NOTE

- All fields in all proprietary NMEA messages are required, none are optional and are comma delimited
- In some numeric fields representing a single data element, leading zeros before a decimal are suppressed. A single "0" character preceding the decimal point is maintained. In compound numeric structures (such as LAT or LONG), leading zeros are suppressed only on the leftmost element Trailing zeros are not suppressed

2.2 General Type of NMEA Messages

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 standardNMEA4.1 (\$GBGSA, nmeaVer in CFGNMEA command is h51)

The version of Beidou related messages extended on the basis of standardNMEA4.1 (\$BDGSA, nmeaVer in CFGNMEA command is h52)

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 opens other sentences, 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

2.3 NmeaVer h51

2.3.1 Message ID GGA: GNSS Positioning Data

Syntax: \$GGA,time,Lat,N,Lon,E,FS,NoSV,HDOP,msl,M,Altref,M,DiffAge,DiffStation*cs

Example: \$GPGSA,A,3,07,02,26,27,09,04,15,,,,,1.8,1.0,1.5*33<CR><LF>

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 Hour mm Minutes ss.ss Seconds
Lat	STR	Latitude, in the format of ddm.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
<CR><LF>		End of message termination

NOTE

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

2.3.2 Message ID GLL: GNSS Eographic 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

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
<CR><LF>		End of message termination

NOTE

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

2.3.3 Message ID 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,VDO

P, systemID*cs		
Example:\$GPGSA,A,3,02,03,06,09,12,17,19,23,28,25,,,1.34,0.85,1.04,1*1E		
Parameter	Format	Description
--	STR	Positioning system flag GP GPS+SBAS+QZSS joint positioning(1) GB BDS 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 33~51(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
<CR><LF>		End of message termination

NOTE

(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

2.3.4 Message ID GSV: Visible GNSS Satellites

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

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 (6): 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 angle of the first to fourth satellite (0~90 degrees),fixed output of 2 digits, add zero up front if less than 2 bits
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 bits

cno1~cno4	UINT	CNR of the first to fourth satellite (0~90dBHz), fixed output of 2 digits, add zero up front if less than 2 bits 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
<CR><LF>		End of message termination

NOTE

(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

2.3.5 Message ID RMC: The Minimum Recommended 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

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
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
<CR><LF>		End of message termination

NOTE

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

2.3.6 Message ID VTG: Track Direction and Ground Speed

Syntax: \$--VTG,cogt,T,cogm,M,\$og,N,kph,K,mode*cs

Example: \$GPVTG,,T,,M,0.000,N,0.000,K,A*23

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
<CR><LF>		End of message termination

NOTE

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

2.3.7 Message ID ZDA: Output Date and Time

Syntax:\$ZDA,time,day,mon,year,ltzh,ltzn*cs

Example:\$GPZDA,060845.00,18,08,2017,00,00*6C

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
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
<CR><LF>		End of message termination

NOTE

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

2.3.8 Message ID 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

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 pseudo range 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
<CR><LF>		End of message termination

NOTE

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

2.4 NmeaVer h30

2.4.1 Message ID 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,,*71

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.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
<CR><LF>		End of message termination

NOTE

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

2.4.2 Message ID GLL: Output 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

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 ddm.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.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
<CR><LF>		End of message termination

NOTE

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

2.4.3 Message ID GSA: Output 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

Parameter	Format	Description
--	STR	Positioning system flag GP GPS+Galileo+SBAS+QZSS joint positioning(1) BD BDS 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 33~51(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
<CR><LF>		End of message termination

NOTE

(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

2.4.4 Message ID GSV: Output Visible GNSS Satellites

Syntax:\$GSV,NoMsg,MsgNo,NoSv,sv1,elv1,az1,cno1,sv2,elv2,az2,cno2,sv3,elv3,az3,cno3,sv4,elv4,az4,cno4*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*54

\$BDGSV,2,2,5,168,5,,50*52

Parameter	Format	Description
--	STR	Positioning system flag GP GPS+SBAS+QZSS joint positioning(1) BD BDS system standalone positioning GN Multiple system joint positioning
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 GLONASS satellite number is 65~ 92(2) Galileo satellite number is 101~136(3) QZSS satellite number is 193, 194, 195, 199(4) SBAS (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)
cno1~cno4	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
<CR><LF>		End of message termination

NOTE

(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

2.4.5 Message ID 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*2C

Parameter	Format	Description
--	STR	Positioning system flag GP GPS+SBAS+QZSS joint positioning BD BDS 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 ddm.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.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
<CR><LF>		End of message termination

2.4.6 Message ID VTG: Output Track Direction 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

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
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 E INS positioning
cs	STR	Checksum A hexadecimal number obtained by calculating an XOR of all characters from '\$' to '*' in this statement
<CR><LF>		End of message termination

NOTE

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

2.4.7 Message ID ZDA: Output Date and Time

Syntax: \$ZDA,time,day,mon,year,ltzh,ltzn*cs

Example: \$GNZDA,083927.000,21,11,2013,00,00*4C

Parameter	Format	Description
--	STR	Positioning system flag GP GPS+SBAS+QZSS joint positioning(1) BD BDS 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
<CR><LF>		End of message termination

NOTE

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

2.5 Navigation Result Message

2.5.1 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

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
<CR><LF>		End of message termination

2.5.2 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

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
<CR><LF>		End of message termination

2.5.3 NAVTIME: Output Time Information

Syntax: \$NAVTIME,GPST,GPST,GPST,GPST,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

Parameter	Format	Description
GPST	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
<CR><LF>		End of message termination

2.5.4 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*cs

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
<CR><LF>		End of message termination

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