Neoway 有方

G2 & G7A Commands Manual

Issue 1.0

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Neoway Product Document

Notice

This document provides guide for users to use G2 & G7A.

This document is intended for system engineers (SEs), development engineers, and test engineers.

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Contents

About This Document

Scope

This document is applicable to G2 & G7A series.

Audience

This document is intended for system engineers (SEs), development engineers, and test engineers.

Change History

Issue	Date	Change	Changed By
1.0	2019-01	Initial draft	Zhuo

Conventions

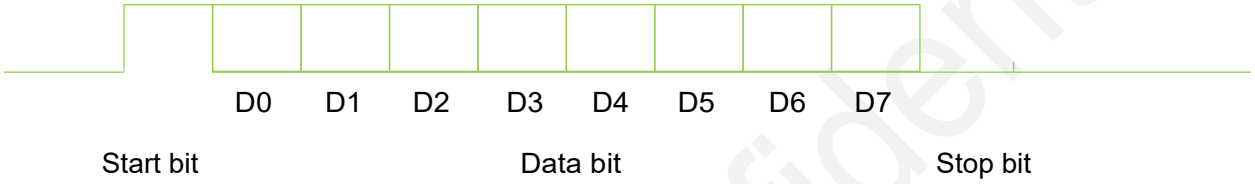
Symbol	Indication
	This warning symbol means danger. You are in a situation that could cause fatal device damage or even bodily damage.
	Means reader be careful. In this situation, you might perform an action that could result in module or product damages.
	Means note or tips for readers to use the module

1 Overview

G2 and G7A Global Navigation Satellite System (GNSS) receivers are compatible with the NMEA 0183 standard. They support NMEA 0183 version 4.1 by default and are compatible with version 2.3 and 3.X. NMEA 0183 V4.0 and versions earlier than V2.3 are supported by sending commands.

Data is transmitted in serial asynchronous form. The first bit is a start bit, followed by data bits. Least significant bit first is shown in Figure 1-1.

Figure 1-1 Data transmission mode



The following parameters are used:

Table 1-1 Parameters used in data transmission

Baud rate (bps)	4800, 9600, 19200, 38400, 57600, 115200
Data bit	8 bit
Stop bit	1 bit
Checksum	None

2 Data Format Protocol

NMEA messages are transmitted by GNSS receivers and comply with the NMEA0183 protocol.

Table 2-1 Data format

$	**<address>**	**{,<data>}**	***<checksum>**	**<CR><LF>**
Start sign	Address field	Data fields	Checksum field	Sequential message identifier field
Each sentence starts with a "$" sign.	Two parts: Talker identifier and sentence format	Start with a ",", followed by data of fixed length and variable length	The 8-bit exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters. The hexadecimal value of the most significant and least significant 4 bits of the result is converted to two ASCII characters (0-9, A-F (upper case)) for transmission.	Each sentence ends with the termination delimiter <CR><LF>

For detailed NMEA protocol, visit http://www.nmea.org/.

This Commands Manual adds custom sentences based on NMEA data format protocol to control the work mode and query the product information of the GNSS receivers. The identifier of custom sentences is 'P'.

3 NMEA Identifiers and Field Type

3.1 Talker Identifier

Talker Identifier sent in NMEA sentence serves to define the GNSS mode. The following table lists Talker Identifier supported.

Talker	Identifier
BeiDou Navigation Satellite System (BDS)	BD
Global Positioning System (GPS, SBAS, QZSS)	GP
Global Navigation Satellite System (GLONSS)	GL
Global Navigation Satellite System (GNSS)	GN
Custom information	P

3.2 Satellite ID

Satellite System	Satellite ID Number in NMEA	PRN Number of Satellite	Relationship between Satellite ID Number and PRN Number
GPS	1~32	1~32	0+PRN
SBAS	33~51	120~138	87+PRN
GLONASS	65~88	1~24	64+PRN
BDS	1~37	1~37	0+PRN
QZSS	33~37	193~197	PRN-160

3.3 System Identifier

G2 and G7A receivers support multiple versions of the NMEA data format protocol. Different versions

vary with the system identifier.

	NMEA4.0 and Earlier Versions	NMEA4.1
GGA	[1]Identifier	[1]Identifier
ZDA	[1]Identifier	[1]Identifier
GLL	[1]Identifier	[1]Identifier
RMC	[1]Identifier	[1]Identifier
VTG	[1]Identifier	[1]Identifier
GSA	[2]Identifier	[1] Identifier, additional fields are used to identify different GNSS constellations.
GSV	[2]Identifier	[2]Identifier

[1]Identifier: If satellites of only one GNSS constellation are used to calculate locations, the transmission identifier is BD, GP, GL, or GA. If satellites of multiple GNSS constellations are used to fix the position, the transmission identifier is GN.

[2]Identifier: GP (GPS), BD (BDS), GL (GLONASS)

G2 and G7A receivers support three versions of the NMEA0183 protocol.

NMEA 2.2 is different from 2.3/4.0 in the following items:

- Mode is not output in GLL, RMC, and VTG sentences.
- In GGA sentence, the quality indicator (FS) is displayed as 1 for both estimated mode and SPS mode. In NMEA 2.3/4.0, this field is displayed as 6 for estimated mode.

NMEA 4.1 added some fields compared to NMEA 4.0:

- systemId in GSA sentence
- signalId in GSV sentence
- navStatus in RMC sentence

For details, see 5 Input Messages (Custom NMEA Sentences).

3.4 Field Type

Field Type	Symbol	Definition
Special Format Fields		

Status	A	Single character field A=Yes, Data Valid, Warning Flag Clear V=No, Data Invalid, Warning Flag Set
Latitude	ddmm.mmmm	Fixed/variable length field Degrees minutes. Decimal - 2 fixed digits of degrees, 2 fixed digits of minutes and a variable number of digits for decimal-fraction of minutes.
Longitude	dddmm.mmmm	Fixed/variable length field Degrees minutes. Decimal - 3 fixed digits of degrees, 2 fixed digits of minutes and a variable number of digits for decimal-fraction of minutes.
Date	hhmmss.sss	Fixed length field Hours minutes seconds. Decimal - 2 fixed digits of hours, 2 fixed digits of minutes, 2 fixed digits of seconds and 3 fixed digits for decimal-fraction of seconds.
Defined field		Some fields are specified to contain pre-defined constants.
Numeric Value Fields		
Variable numbers	x.x	Variable length integer or floating numeric field
Fixed HEX field	hh	Fixed length HEX numbers only, MSB on the left
Variable HEX field	h—h	Variable length HEX numbers only, MSB on the left
Information Fields		
Fixed alpha field	aa	Fixed length field of upper-case or lower-case alpha characters
Fixed number field	xx	Fixed length field of numeric characters
Variable text field	c—c	Variable length field of valid characters

4 Sentence Identifiers

Sentence Formatter	Class/ID	Description
Standard NMEA Sentence		Standard Sentence
GGA	0x4E 0x00	Global Positioning System Fix Data
GLL	0x4E 0x01	Geographic Position—Latitude/Longitude
GSA	0X4E 0x02	GNSS DOP and Active Satellites
GSV	0x4E 0x03	GNSS Satellites in View
RMC	0x4E 0x04	Recommended Minimum Specific GNSS Data
VTG	0x4E 0x05	Course Over Ground and Ground Speed
GST	0x4E 0x07	GNSS Pseudorange Error Statistics
ZDA	0x4E 0x08	Time & Date
ANT	0x4E 0x11	Antenna Status
DHV	0x4E 0x13	Design Hourly Volume
Custom NMEA Sentence		Custom Sentence
CAS00	-	Save Configurations
CAS01	-	Communication Protocol and Serial Interface Configurations
CAS02	-	Set Update Frequency of Position Fix
CAS03	-	Enable or Disable Message Output and Frequency
CAS04	-	Set Quantity of Initial Systems and Channels
CAS05	-	Set Talker Identifier of NMEA Sentences
CAS10	-	Set Start Mode

5 Input Messages (Custom NMEA Sentences)

5.1 CAS-Start GAGAN

Identifier	CAS		
Description	Start GAGAN		
Type	Input		
Format	$PCAS,N,M*CS<CR><LF>		
Example	$PCAS,4,FFF*77		
Parameter Description			
Field	**Name**	**Format**	**Parameter Description**
1	$PCAS	Character string	Message ID, sentence header
2	N	Numeric value	4 by default
3	M	Character string	FFF by default
4	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
5	<CR><LF>	Character	Carriage return and line feed

5.2 CAS00-Save Configurations

Identifier	CAS00
Description	Save current configurations to FLASH Data in FLASH will not be lost even though the receiver is powered down.
Type	Input
Format	$PCAS00*CS<CR><LF>

Example	$PCAS00*01		
Parameter Description			
Field	**Name**	**Format**	**Parameter Description**
1	$PCAS00	Character string	Message ID, sentence header
2	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
3	<CR><LF>	Character	Carriage return and line feed

5.3 CAS01-Set UART Baud Rate

Identifier	CAS01		
Description	Set the baud rate of the UART.		
Type	Input		
Format	$PCAS01,br*CS<CR><LF>		
Example	$PCAS01,1*1D		
Parameter Description			
Field	**Name**	**Format**	**Parameter Description**
1	$PCAS01	Character string	Message ID, sentence header
2	Br	Numeric value	Baud rate 0=4800bps 1=9600bps 2=19200bps 3=38400bps 4=57600bps 5=115200bps
3	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
4	<CR><LF>	Character	Carriage return and line feed

5.4 CAS02-Set Update Frequency of Position Fix

Identifier	CAS02		
Description	Set Update Frequency of Position Fix		
Type	Input		
Format	$PCAS02,fixInt*CS<CR><LF>		
Example	$PCAS02,1000*2E		
Parameter Description			
Field	**Name**	**Format**	**Parameter Description**
1	$PCAS02	Character string	Message ID, sentence header
2	fixInt	Numeric value	Interval between position fix updates, unit: ms 1000=1Hz, 1 position fixed is output every second 500=2Hz, 2 position fixed is output every second 250=4Hz, 4 position fixed is output every second 200=5Hz, 5 position fixed is output every second 100=10Hz, 10 position fixed is output every second
3	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
4	<CR><LF>	Character	Carriage return and line feed

5.5 CAS03-Enable or Disable Message Output

Identifier	CAS03
Description	Enable or disable the output of NMEA messages
Type	Input
Format	$PCAS03,nGGA,nGLL,nGSA,nGSV,nRMC,nVTG,nZDA,nANT,nDHV,nLPS,res,res,nUTC*CS<CR><LF>
Example	$PCAS03,1,1,1,1,1,1,1,1,0,1,0,0,1,0*02
Parameter Description	

Field	Name	Format	Parameter Description
1	$PCAS03	Character string	Message ID, sentence header
2	nGGA	Numeric value	GGA output frequency, determined by update frequency of position fix n indicates that the message is output once after position is fixed for n times. n ranges from 0 to 9. 0 indicates that this sentence is not output and if n is not set to any value, keep the previous settings.
3	nGLL	Numeric value	GLL output frequency, same as nGGA
4	nGSA	Numeric value	GSA output frequency, same as nGGA
5	nGSV	Numeric value	GSV output frequency, same as nGGA
6	nRMC	Numeric value	RMC output frequency, same as nGGA
7	nVTG	Numeric value	VTG output frequency, same as nGGA
8	nZDA	Numeric value	ZDA output frequency, same as nGGA
9	nANT	Numeric value	ANT output frequency, same as nGGA
10	nDHV	Numeric value	DHV output frequency, same as nGGA
11	nLPS	Numeric value	LPS output frequency, same as nGGA
12	res		Reserve
13	res		Reserve
14	nUTC	Numeric value	UTC output frequency, same as nGGA
15	nGST	Numeric value	GST output frequency, same as nGGA
16	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
17	<CR><LF>	Character	Carriage return and line feed

5.6 CAS04-Set Talker Identifier

Identifier	CAS04

Description	Set Talker Identifier
Type	Input
Format	$PCAS04,mode*hh<CR><LF>
Example	$PCAS04,3*1A BDS and GPS $PCAS04,1*18 GPS $PCAS04,2*1B BDS

Parameter Description

Field	Name	Format	Parameter Description
1	$PCAS04	Character string	Message ID, sentence header
2	Mode	Numeric value	Talker Identifier The following configurations are supported: 1=GPS 2=BDS 3=GPS+BDS 4=GLONASS 5=GPS+GLONASS 6=BDS+GLONASS 7=GPS+BDS+GLONASS
3	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
4	<CR><LF>	Character	Carriage return and line feed

5.7 CAS05-Set NMEA Protocol Type

Identifier	CAS05
Description	Set NMEA protocol type Multi-GNSS receivers supports different protocols and the data format protocols are also various. G2 and G7A receivers support multiple protocols (optional)
Type	Input

Format	$PCAS05,ver*CS<CR><LF>		
Example	$PCAS05,1*19		
Parameter Description			
Field	**Name**	**Format**	**Parameter Description**
1	$PCAS05	Character string	Message ID, sentence header
2	Mode	Numeric value	Set NMEA protocol type (Remark [1])
3	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
4	<CR><LF>	Character	Carriage return and line feed
Remark [1] NMEA protocol types			
2	Compatible with NMEA 4.1 and later versions		
5	Compatible with the BDS/GPS Dual-GNSS protocol of China Transport Telecommunications & Information Center (CTTIC), NMEA 4.0 protocol and versions later than NMEA 2.3		
9	Compatible with NMEA0183 GPS protocol and NMEA 2.2		

5.8 CAS10-Set Start Mode

Identifier	CAS10		
Description	Restart the receiver		
Type	Input		
Format	$PCAS10,rs*CS<CR><LF>		
Example	$PCAS10,0*1C hot start $PCAS10,1*1D warm start $PCAS10,2*1E cold start $PCAS10,3*1F factory start		
Parameter Description			
Field	**Name**	**Format**	**Parameter Description**
1	$PCAS10	Character string	Message ID, sentence header

2	rs	Numeric value	Set start mode 0=Hot start Without initialization, all data in backup buffer is valid. 1=Warm start Without initialization, ephemeris is cleared. 2=Cold start Without initialization, all data except configurations in backup buffer is cleared. 3=Factory start All data in backup buffer is cleared and the receiver is reset to factory settings.
3	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
4	<CR><LF>	Character	Carriage return and line feed

6 Output Messages (Standard NMEA Sentences)

6.1 GGA-Fix Data

Identifier	GGA		
Description	Time, position, and fix related data for the receiver		
Type	Output		
Format	$--GGA,UTCtime,lat,uLat,lon,uLon,FS,numSv,HDOP,msl,uMsl,sep,uSep,diffAge, diffSta*CS<CR><LF>		
Example	$GPGGA,235316.000,2959.9925,S,12000.0090,E,1,06,1.21,62.77,M,0.00,M,,*7B		
Parameter Description			
Field	**Name**	**Format**	**Parameter Description**
1	$--GGA	Character string	Message ID, GGA sentence header, '--' is the talker identifier
2	UTCtime	hhmmss.sss	UTC of position
3	lat	ddmm.mmmm	Latitude
4	uLat	Character	N/S indicator
5	lon	dddmm.mmmm	Longitude
6	uLon	Character	E/W indicator
7	FS	Numeric value	GNSS quality indicator (Remark [1]), mandatory
8	numSv	Numeric value	Number of satellites in use, 00 - 24
9	HDOP	Numeric value	Horizontal dilution of precision (HDOP)
10	msl	Numeric value	Antenna altitude above mean-sea-level
11	uMsl	Character	units of antenna altitude, meters, M
12	sep	Numeric value	Geoidal separation, the difference between the WGS-84 earth ellipsoid surface and mean-sea-level (geoid) surface, "-" = mean-sea-level surface below WGS-84 ellipsoid surface.

13	uSep	Character	units of antenna altitude, meters, M
14	diffAge	Numeric value	Age of Differential GPS data (seconds) null field when DGPS is not used
15	diffSta	Numeric value	Differential reference station ID
16	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
17	<CR><LF>	Character	Carriage return and line feed

Remarks [1] GPS Quality indicator

GPS Quality indicator	Description
0	Fix unavailable or invalid
1	SPS Mode, fix valid
6	Estimated (dead reckoning) Mode, valid only for NMEA 2.3 and later versions

6.2 GLL-Geographic Position-Latitude/Longitude

Identifier	GLL
Description	Latitude and Longitude of vessel position, time of position fix and status.
Type	Output
Format	$--GLL,lat,uLat,lon,uLon, UTCtime,valid,mode*CS<CR><LF>
Example	$GPGLL,2959.9925,S,12000.0090,E,235316.000,A,A*4E

Parameter Description

Field	Name	Format	Parameter Description
1	$--GLL	Character string	Message ID, GLL sentence header, '--' is the talker identifier
2	lat	ddmm.mmmm	Latitude
3	uLat	Character	N/S indicator
4	lon	dddmm.mmmm	Longitude

5	uLon	Character	E/W indicator
6	UTCtime	hhmmss.sss	UTC of position
7	valid	Character	Status (Remark [1])
8	mode	Character	Mode Indicator (Remark [2]), valid only for NMEA 2.3 and later versions
9	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
10	<CR><LF>	Character	Carriage return and line feed
Remark [1] Data Status			
GPS Quality indicator		Description	
A		Data valid	
V		Data not valid	
Remark [2] Mode Indicator			
Mode Indicator		**Description**	
A		Autonomous mode	
E		Estimated (dead reckoning) mode	
N		Data not valid	
D		Differential Mode	
M		Manual input mode	

6.3 GSA-GNSS DOP and Active Satellites

Identifier	GSA
Description	GNSS receiver operating mode, satellites used in the navigation solution reported by the GGA or GNS sentence, and DOP values. This sentence is output no matter whether position is fixed or any satellite is available. If GNSS systems are combined to obtain the reported position solution, GSA sentences are produced receptively for each GNSS system. Each of these GSA sentences shall have talker ID GN, to indicate that the satellites are used in a

	combined solution and each shall have the PDOP, HDOP and VDOP for the combined satellites used in the position.
Type	Output
Format	$--GSA,smode,FS{,SVID},PDOP,HDOP,VDOP*CS<CR><LF>
Example	$GPGSA,A,3,05,21,31,12,18,29,,,,,,,2.56,1.21,2.25*01

Parameter Description

Field	Name	Format	Parameter Description
1	$--GSA	Character string	Message ID, GSA sentence header, '--' is the talker identifier
2	Smode	Character	Mode switch indicator (Remark [1])
3	FS	Numeric value	Fix status indicator (Remark [2])
4	{,SVID}	Numeric value	ID numbers of satellites used in solution 12 satellites are displayed in this field.
5	PDOP	Numeric value	Position Dilution of Precision (PDOP)
6	HDOP	Numeric value	Horizontal dilution of precision (HDOP)
7	VDOP	Numeric value	Vertical Dilution of Precision (VDOP)
8	systemId	Numeric value	GNSS ID defined in NMEA (Remark [3]) Valid only for NMEA 4.1 and later versions
9	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
10	<CR><LF>	Character	Carriage return and line feed

(Remark [1]) Mode switch indicator

Mode switch indicator	Description
M	Manual, forced to operate in 2D or 3D mode
A	Automatic, allowed to automatically switch 2D/3D

(Remark [2]) Fix status indicator

Position fix status	Description
1	Fix not available
2	2D

3	3D
Remark [3] GNSS ID	
System ID	**Description**
1	GPS
2	GLONASS
4	BDS

6.4 GSV-GNSS Satellite in View

Identifier	GSV
Description	Number of satellites (SV) in view, satellite ID numbers, elevation, azimuth, and SNR value. A variable number of "Satellite ID-Elevation-Azimuth-SNR" sets are allowed up to a maximum of four sets per sentence. Null fields are not required for unused sets when less than four sets are transmitted.
Type	Output
Format	$--GSV,numMsg,msgNo,numSv{,SVID,ele,az,cn0} *CS<CR><LF>
Example	$GPGSV,3,1,10,25,68,053,47,21,59,306,49,29,56,161,49,31,36,265,49*79 $GPGSV,3,2,10,12,29,048,49,05,22,123,49,18,13,000,49,01,00,000,49*72 $GPGSV,3,3,10,14,00,000,03,16,00,000,27*7C

Parameter Description

Field	Name	Format	Parameter Description
1	$--GSA	Character string	Message ID, GSV sentence header, '--' is the talker identifier
2	numMsg	Character	Total number of sentences Depending on the number of satellites tracked, multiple messages of GSV data may be required.
3	msgNo	Numeric value	Sentence number
4	numSv	Numeric value	Total number of GNSS Satellites in View

5	{,SVID,ele,az,cn0}	Numeric value	Satellite ID number Elevation, degrees, 0 to 90 Azimuth, degrees True, 0 to 359 SNR (C/No) 00-99 dB-Hz, null when not tracking (Remark [3])
6	signalId	Numeric value	GNSS signal ID defined in NMEA, 0 indicates all signals Valid only for NMEA 4.1 and later versions
7	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
8	<CR><LF>	Character	Carriage return and line feed

6.5 RMC-Recommended Minimum Navigation Information

Identifier	RMC
Description	Recommended Minimum Navigation Information
Type	Output
Format	$--RMC,UTCtime,status,lat,uLat,lon,uLon,spd,cog,date,mv,mvE,mode*CS<CR><LF>
Example	$GPRMC,235316.000,A,2959.9925,S,12000.0090,E,0.009,75.020,020711,,,A*45

Parameter Description

Field	Name	Format	Parameter Description
1	$--RMC	Character string	Message ID, RMC sentence header, '--' is the talker identifier
2	UTCtime	hhmmss.sss	UTC of position
3	status	Character string	Status V=Navigation receiver warning A=Data valid
4	lat	ddmm.mmmm	Latitude
5	uLat	Character	N/S indicator

6	lon	dddmm.mmmm	Longitude
7	uLon	Character	E/W indicator
8	spd	Numeric value	Speed over ground, knots
9	cog	Numeric value	Course Over Ground, degrees True
10	date	ddmmyy	Date
11	mv	Numeric value	Magnetic variation, degrees E/W null
12	mvE	Character	E/W indicator null
13	mode	Character	Mode Indicator (Remark [1]) Valid only for NMEA 2.3 and later versions
14	navStatus	Character	Navigation Status Indicator (V indicates that the system does not output navigation status) Valid only for NMEA 4.1 and later versions
15	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
16	<CR><LF>	Character	Carriage return and line feed

Remark [1] Mode Indicator

Mode Indicator	Description
A	Autonomous mode
E	Estimated (dead reckoning) mode
N	Data not valid
D	Differential Mode
M	Manual input mode

6.6 VTG-Course Over Ground and Ground Speed

Identifier	VTG
Description	Course Over Ground and Ground Speed
Type	Output

Format	$--VTG,cogt,T,cogm,M,sog,N,kph,K,mode*CS<CR><LF>
Example	$GPVTG,75.20,T,,M,0.009,N,0.017,K,A*02

Parameter Description

Field	Name	Format	Parameter Description
1	$--VTG	Character string	Message ID, VTG sentence header, '--' is the talker identifier
2	cogt	Numeric value	Course Over Ground, degrees True
3	T	Character	True north
4	cogm	Numeric value	Course Over Ground, degrees Magnetic
5	M	Character	Magnetic north
6	sog	Numeric value	Speed over ground, knots
7	N	Character	Knots
8	kph	Numeric value	Speed over ground, km/hr
9	K	Character	km/h
10	mode	Character	Mode Indicator (Remark [1]) Valid only for NMEA 2.3 and later versions
11	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
12	<CR><LF>	Character	Carriage return and line feed

Remark [1] Mode Indicator

Mode Indicator	Description
A	Autonomous mode
E	Estimated (dead reckoning) mode
N	Data not valid
D	Differential Mode
M	Manual input mode

6.7 GST-GNSS Pseudorange Error Statistics

Identifier	GST
Description	GNSS Pseudorange Error Statistics
Type	Output
Format	$--GST,UTCtime,RMS,stdDevMaj,stdfDevMin,orientation,stdLat,stdLon,stdAlt*CS <CR><LF>
Example	$BDGST,081409.000,0.5,,,,0.2,0.1,0.4*5E

Parameter Description

Field	Name	Format	Parameter Description
1	$--GST	Character string	Message ID, GST sentence header, '--' is the talker identifier
2	UTCtime	hhmmss.sss	UTC
3	RMS	Numeric value	RMS value of the standard deviation of the range inputs to the navigation process
4	stdDevMaj	Numeric value	Standard deviation of semi-major axis of error ellipse (meters), not supported
5	stdfDevMin	Numeric value	Standard deviation of semi-minor axis of error ellipse (meters), not supported
6	orientation	Numeric value	Orientation of semi-major axis of error ellipse (degrees from true north), not supported
7	stdLat	Numeric value	Standard deviation of latitude error (meters)
8	stdLon	Numeric value	Standard deviation of longitude error (meters)
9	stdAlt	Numeric value	Standard deviation of altitude error (meters)
10	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
11	<CR><LF>	Character	Carriage return and line feed

6.8 ZDA-Time & Date

Identifier	ZDA
Description	UTC, day, month, year and local time zone.
Type	Output
Format	$--ZDA,UTCtime,day,month,year,ltzh,ltzn*CS<CR><LF>
Example	$GPZDA,235316.000,02,07,2011,00,00*51

Parameter Description

Field	Name	Format	Parameter Description
1	$--ZDA	Character string	Message ID, ZDA sentence header, '--' is the talker identifier
2	UTCtime	hhmmss.sss	UTC of position
3	day	Numeric value	Day, 01 to 31
4	month	Numeric value	Month, 01 to 12
5	year	Numeric value	Year, four digits
6	ltzh	Numeric value	Local zone hours, not supported, 00
7	ltzn	Numeric value	Local zone minutes, not supported, 00
8	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
9	<CR><LF>	Character	Carriage return and line feed

6.9 ANT-Antenna Status

Identifier	ANT
Description	Antenna Status
Type	Output
Format	$GPTXT,xx,yy,zz,info*hh<CR><LF>
Example	$GPTXT,01,01,01,ANTENNA OPEN*25

	$GPTXT,01,01,01,ANTENNA OK*35 $GPTXT,01,01,01,ANTENNA SHORT*63

Parameter Description

Field	Name	Format	Parameter Description
1	$GPTXT	Character string	Message ID, TXT sentence header
2	Xx	Numeric value	Total number of sentences, 01 to 99 Depending on the length of text message, multiple messages of GPTXT are required. For G2 and G7A, this field is fixed to 01.
3	Yy	Numeric value	Sentence number, 01 to 99 For G2 and G7A, this field is fixed to 01.
4	Zz	Numeric value	Text identifier For G2 and G7A, this field is fixed to 01.
5	info		Text message ANTENNA OPEN ANTENNA OK ANTENNA SHORT
6	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
7	<CR><LF>	Character	Carriage return and line feed

6.10 DHV-Design Hourly Volume

Identifier	DHV
Description	Details of GNSS receiver speeds
Type	Output
Format	$--DHV,UTCtime,speed3D,spdX,spdY,spdZ,gdspd*CS<CR><LF>
Example	$GNDHV,021150.000,0.03,0.006,-0.042,-0.026,0.06*65

Parameter Description

Field	Name	Format	Parameter Description
1	$--DHV	Character string	Message ID, DHV sentence header, '--' is the talker identifier
2	UTCtime	hhmmss.sss	UTC
3	speed3D	Numeric value	GNSS receiver 3D speed, m/s
4	spdX	Numeric value	GNSS receiver ECEF-X speed, m/s
5	spdY	Numeric value	GNSS receiver ECEF-Y speed, m/s
6	spdZ	Numeric value	GNSS receiver ECEF-Z speed, m/s
7	gdspd	Numeric value	GNSS receiver ground speed, m/s
8	CS	HEX numeric value	Checksum, exclusive OR (no start or stop bits) of all characters in the sentence, including "," and "^" delimiters, between but not including the "$" and the "*" delimiters.
9	<CR><LF>	Character	Carriage return and line feed