AT3340

BDS、GPS Dual Mode Timing Board

Product Manual

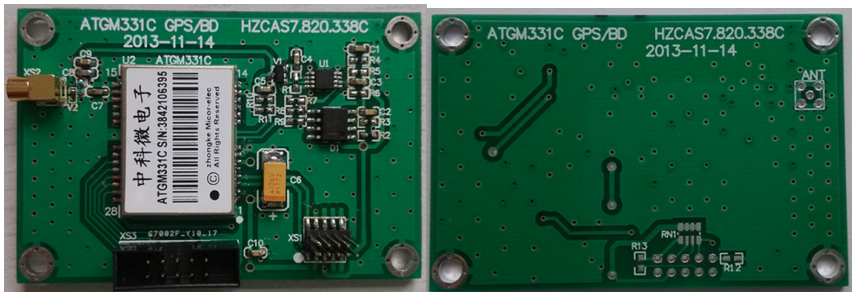
Version：2016.01

Directory

Function Description

1.1 Summary

The AT3340 is a high precision BDS/GPS dual-mode timing board,and support GPS,BDS single system positioning and dual system joint positioning.Both the RF front-end chip and baseband chip are the core products of the company independent research and development, with completely independent intellectual property rights. AT3340 contains 32 tracking channels, you can receive all the GPS and BDS visible satellite at the same time. AT3340 can directly replace the foreign timing board, and the main interface signal is Pin-Pin compatible.



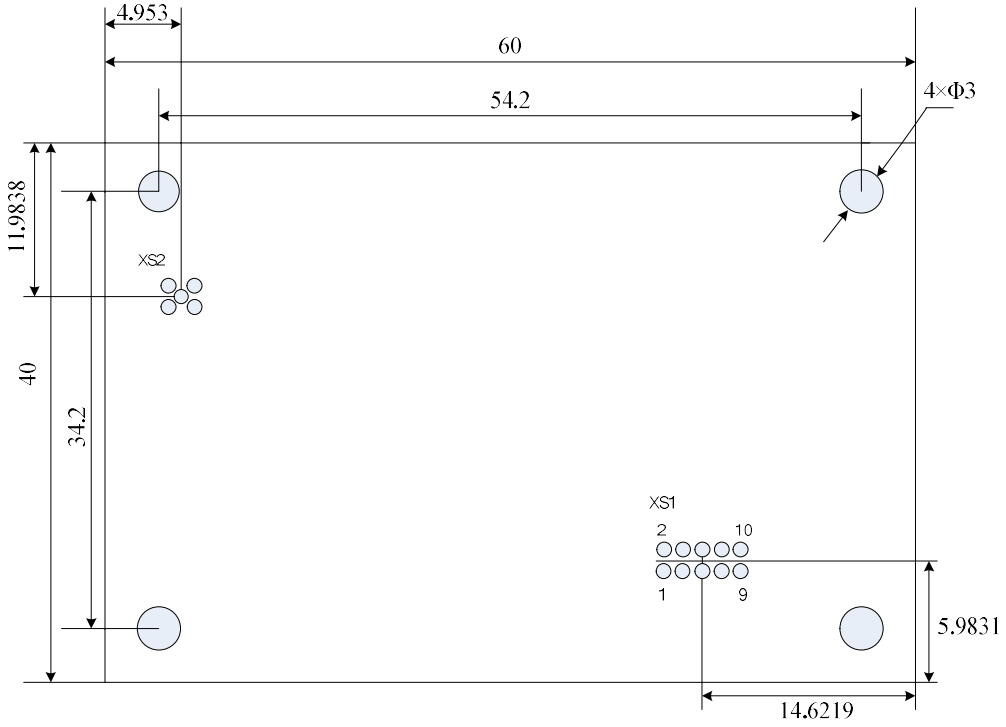
1.2 Product Features

- Timing Precision：20ns
- Support BDS-ONLY、GPS-ONLY、BDS+GPS
- Working Current：62Ma
- Built-in Antenna Short-circuit Protection Function
- Built-in Antenna Detection Function
- Antenna Short-circuit Current：50mA@(3.00V~5.00V)
- Antenna Open-circuit Current：5mA@(3.00V~5.00V)

Technical Description

2.1 Appearance Size

- Size：60mm×40mm×10mm（Unit : mm）



2.2 Hardware Interface Definition

The definition of timing board's serial pin, PPS pins and power pins respectively is:

Pin	Signal	Function
1	TXD	Send, LVCMOS Logic Level
2	RXD	Receive ,LVCMOS Logic Level
3	+3.3VDC	3.3V±0.3V DC
4	1PPS	Second Pulse ,LVCMOS Logic Level
5	GND	Ground
6	Reserved	Reserved
7	Reserved	Reserved
8	Reserved	Reserved
9	Antenna Power Supply	(3.0V~5.0V)±0.25V, DC
10	Reserved	Reserved

The serial port's TTL level and the baud rate are adjustable. The baud rate can be options: 4800bps, 9600bps, 19200bps, 38400bps, 115200bps, and the default value is 9600bps. Transmission protocol: 1 start bit, 8 data bits, 1 stop bit, no check. Data protocol: support UBX protocol and NMEA protocol. 1PPS features: LVCMOS level (3.3V) pulse width is 100ms (duty cycle 10%) by default.

2.3 Electrical Parameters

Limit Parameters

Parameters	Symbol	Minimum value	Maximum value	Unit
Power				
Module power supply voltage (VCC)	Vcc	-0.3	3.6	V
Antenna power supply voltage (ANT_PWR)	Vant	0	5.5	V
Input Pin				
Digital input pin voltage	Vin	-0.3	3.6	V

Operating Conditions

Parameters	Symbol	Minimum value	Typical value	Maximum value	Unit
Antenna power supply voltage	VDC	2.75	5.0	5.25	V
Moudle power supply voltage	Vcc	3.0	3.3	3.6	V
Vcc Peak Current (not including antenna)	Ipeak		60	120	mA
Input Pin	Vil			0.2*Vcc	V
	Vih	0.7*Vcc			V
Output Pin	Vol Io=-12mA			0.4	V
	Voh Io=12mA	Vcc-0.5			V
Antenna Short-circuit Current,Power from ANT_PWR(=5.0V)	Iant short		50		mA

Antenna Open-circuit Current,Power from ANT_PWR(=5.0V)	Iant open		5		mA
1PPS High Level Width	Thw		100		ms

2.4 Technical Specifications

Indicators	Technical Parameters
Band	L1，1575.42MHz；B1，1561.098MHz
Channel Number	32 Channels
GPS only、BDS only、GPS&BDS Cold Start Sensitivity	-148dBm
GPS only、BDS only、GPS&BDS Tracking Sensitivity	-160dBm
GPS&BDS Positioning Sensitivity	2.5m（CEP50%, Open Ground）
GPS only Positioning Sensitivity	3 m（CEP50%, Open Ground）
BDS only Positioning Sensitivity	5m（CEP50%, Open Ground）
GPS only、BDS only、GPS&BDS Speed Sensitivity	0.1m/s（50%@10m/s）
GPS only、BDS only、GPS&BDS The Time To First Fix (Cold start)	<32s （Open Ground）
GPS only、BDS only、GPS&BDS The Time To First Fix (Hot start)	<1s （Open Ground）
GPS only、BDS only、GPS&BDS The Time To First Fix(Recapture)	<1s （Open Ground）
Positioning Update Rate	1Hz（default ）

	Maximum 10Hz
GPS only、GPS&BD Dual-mode Timing	20nS
BD Single mode Timing	50nS
Serial Port Characteristic	Baud rate range ： 4800 bps ~115200 bps, default 9600bps, 8 data bits , No check, 1 stop bit ; User can customize （Note 1）
Protocol	NMEA0183
Maximum Height	18000m
Maximum Speed	515m/s
Maximum Acceleration	4g
Supply Voltage	3.3V±0.3V
GPS&BDS Minimum Power	<60mA
Working Temperature	-40 to +85℃
Storage Temperature	-45 to +125℃
Size	60mm×40mm×10mm
weight	20.0g

[Note 1]

Users can customize products by selecting the baud rate in the procurement of information table .

Example.：

Serial Baud Rate	□4800bps	√9600bps	□57600bps	□115200bps

2.5 Module Application Note

In order to give full play to the excellent performance of AT3340, users need to pay attention to the following points when using this module:

●Low ripple LDO power supply, the ripple control within the 50mVpp.

●AT3340 module try not to go near other high frequency, large amplitude of digital signals. All the modules below are filled with ground wire.

●The module itself has the active antenna access, pull out, short circuit detection circuit, while in the antenna accidental short circuit, to limit the power supply current (50mA) and play the role of protection. In the above 3 kinds of antenna port state changes, you can output the corresponding information from the serial port. Such as :

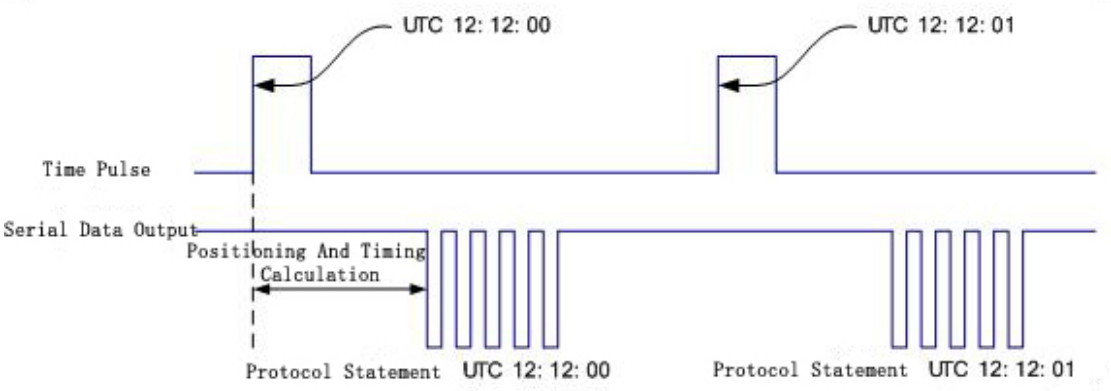
$GPTXT,01,01,01,ANTENNA SHORT*63
$GPTXT,01,01,01,ANTENNA OPEN*25
$GPTXT,01,01,01,ANTENNA OK*35

If the user on the outside of the module uses its own antenna test and power supply circuit, need to be in the RF input terminal string into the DC capacitor.

2.6 PPS Signal Description

The default output of the AT3340 dual mode receiver module board and UTC whole second moment corresponding to the time pulse, the rising edge of the pulse is aligned with the time.

As shown in the figure below ,with the time pulse of the corresponding UTC time, will be a certain delay after the output through the protocol.



AT3340 dual mode receiver module board support for the configuration of PPS pulse output mode. Configurable items include: pulse interval, pulse width, pulse on and off, pulse polarity, time reference, time information source and pulse delay. The configuration statement is shown in the following table:

Information	CFG-TP				
Description	Read / set time pulse parameters				
Type	Read / Set				
Note					
Information Structure	Head	Length (byte)	Identifier	Effective load	Checksum
	0xBA 0xCE	0x10 0x00	0x06 0x03	Table bellow	4 Bytes

Effective load					
Character Deviation	Data Type	Proportion zoom	Name	Unit	Description
0	U4	-	interval	us	Time interval between pulses (pulse period)

4	U4	-	width	us	Pulse width
8	U1	-	enable	-	Pulse enable flag （Note [1]）
9	U1	-	polar	-	Pulse polarity configuration （Note [2]）
10	U1	-	timeRef	-	Reference time （Note [3]）
11	U1	-	timSource	-	Time Source（Note [4]）
12	R4[Note 5]	-	userDelay	s	User delay time

Note [1]：Pulse enable flag	
Value	Description
0	Closing pulse
1	Enable pulse
Note [2]：Pulse polarity configuration	
0	Rising edge
1	Falling edge
Note [3]：Reference time	
0	UTC Time
1	Satellite Time
Note [4]：Satellite time source	
0	GPS Time
1	BDS Time
2	GLONASS Time
Other	Automatic selection

Note [5]：U4 for the unsigned, 4 bytes; U1for the unsigned characters, 1 byte; R4 for the float, 4 bytes; Checksum is the accumulated sum of length, identifier, effective load with character as a unit.

One configuration example is:

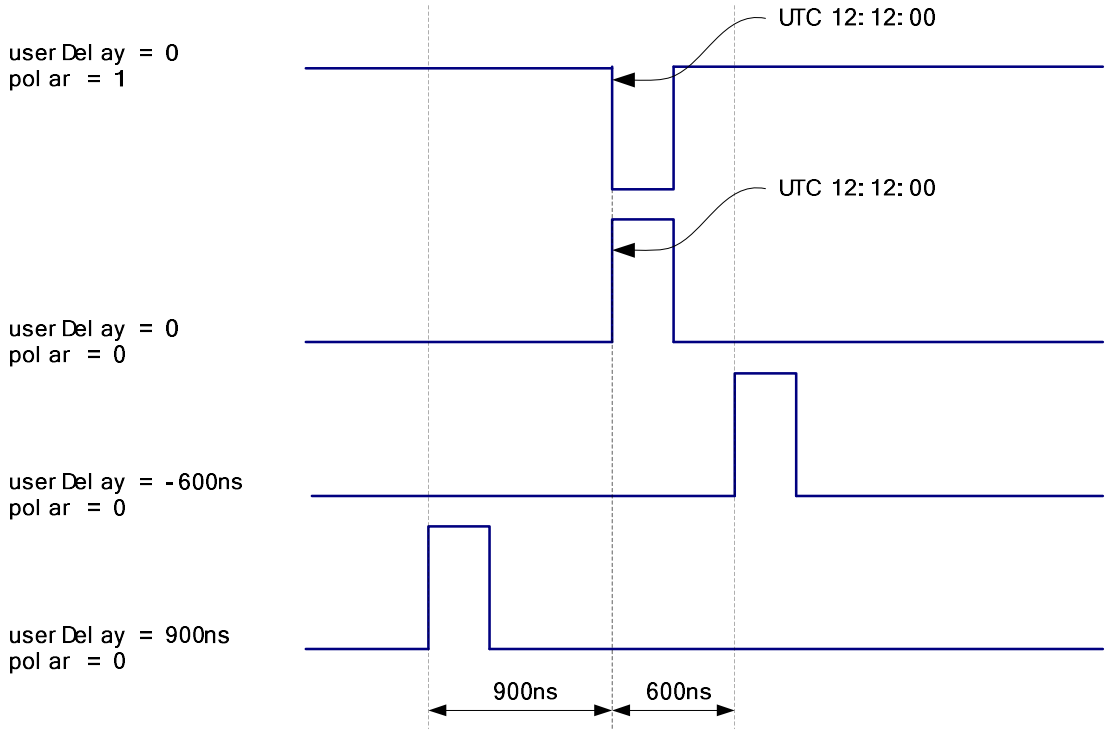
Parameter	Unit	value	Meaning
interval	us	1000000	Time interval 1s
width	us	1000	Pulse width 1ms
enable	-	1	PPS pulse enable
polar	-	1	Falling edge
timeRef	-	0	Align with UTC time
timSource	-	1	Time source for the BD
userDelay	s	8e-7	User delay 800ns
CheckSum	--	0x396C06CE	0x03060010 + 0x000f4240 +

			0x000003E8 + 0x01000101 + 0x3556bf95

Corresponding to the configuration statement sixteen decimal character sequence (data for Little Endian alignment format):

BA CE 10 00 06 03 40 42 0F 00 E8 03 00 00 01 01 00 01 95 BF 56 35 CE 06 6C 39

In addition, if the user delay parameters configured by the numerical range of userDelay is positive, the output of the PPS pulse reference edge forward; if it is negative, the reference edge delays, as shown below. In addition, the influence of the polar data field on the PPS signal is also listed.



User Interface

AT3340 output the positioning data of NMEA protocol format through a UART interface.UART interface default baud rate is 9600bps , a start bit, 8 data bits, 1 stop bit bit, no parity bit.

Field type：

Field type	Symbol	Definition
Special format field		
State	A	Single character field: A= is, the data is valid, the alarm sign is eliminated; V= no, invalid data, alarm sign set
Latitude	ddmm.mm	Fixed / variable length field dd identifies the degree that fixed length is 2. The mm before the decimal point identifies the minute that fixed length is 2.The mm after the decimal point identifies the decimal minute that length is variable.
Longitude	ddmm.mm	Fixed / variable length field dd identifies the degree that fixed length is 2. The mm before the decimal point identifies the minute that fixed length is 2.The mm after the decimal point identifies the decimal minute that length is variable.
Time	hhmmss.sss	Fixed / variable length field hh identifies the hour that fixed length is

		2.mm identifies the minute that fixed length is 2. The ss before the decimal point identifies the second that fixed length is 2. The sss after the decimal point identifies the decimal second that fixed length is 3.
Determine field		Some fields are specified for predefined constants

3.1 NMEA Protocol

AT3340 supports the following statement of the NMEA0183 protocol; the user can customize the output frequency of the following statement (Note1).

NMEA Sentence	Function Description
GGA	Positioning Data
GLL	Positioning and Time Data
GSA	DOP and Effective Satellite Information
GSV	Visible Satellite Information
RMC	Recommend The Most Streamlined PVT Data
VTG	Receiver Speed and Heading Data
ZDA	Time and Date Information

AT3340 supports TXT statement that identification of the CASIC, the statement includes software, hardware, manufacturers and other informations.

[Note1]

The user can customize the statement output frequency in the order information table. When the baud rate is 4800bps, the output data is more, so this time not all output statements.

Example

NMEA Sentence	GGA	GLL	GSA	GSV	RMC	VTG	ZDA
Update Period, （S）	1	0	1	3	1	0	0

3.1.1 GGA

Information	GGA
Description	Receiver time, location and positioning dependent data
Type	Output

Instruction

If you only use BDS, GPS, GLONASS, Galileo and other satellite for position calculation , transfer identifier is BD, GP, GL, GA,etc.. If you use the multiple satellite systems to obtain the position calculation, transfer identifier is GN.

Structure

$--GGA,hhmmss.ss,ddmm.mm,a,dddmm.mm,a,x,xx,x.x,x,x,M,x.x,M,xxxx,x.x*hh<CR><LF>

Field	Symbol	Meaning	Range of Values	Unit	Note
1	$--GGA	Statement initiation			
2	hhmmss.ss	Position time (UTC time)			
3	ddmm.mm	Latitude			
4	A	Latitude direction	N/S		N—North latitude ，S—south latitude
5	dddmm.mm	Longitude			
6	A	Longitude direction	E/W		E—East longitude ，W—west longitude
7	X	Status indication	0-8		Note1
8	Xx	Number of satellites involved in positioning			

9	x.x	HDOP value			
10	x.x	Antenna earth height			
11	M	Antenna earth height unit		metr e	
12	x.x	Height anomaly			
13	M	Height anomaly unit		metr e	
14	Xxxx	Differential data age			
15	x.x	Differential platform ID			
16	*hh	Checksum			
17	<CR><LF>	Carriage Return &Line Feed			

[Note1]：Status indication

Status indication	Description
0	Positioning unavailable or invalid
1	SPS Positioning mode ，Effective positioning
6	Estimation model （Dead reckoning）

3.1.2 GLL

Information	GLL
Description	Latitude, longitude, positioning time and positioning status and other informations.
Type	Output

Instruction

If you only use BDS, GPS, GLONASS, Galileo and other satellite for position calculation , transfer identifier is BD, GP, GL, GA,etc.. If you use the multiple satellite systems to obtain the position calculation, transfer identifier is GN.

Structure

$--GLL,ddmm.mm,a,dddmm.mm,a,hhmmss.ss,A,x*hh<CR><LF>

Field	Symbol	Meaning	Range of Values	Unit	Note
1	$--GLL	Statement initiation			
2	ddmm.mm	Latitude		Degree/minute	
3	A	Latitude direction	N/S		N－North Latitude ，S－South Latitude
4	dddmm.mm	Longitude		Degree/minute	
5	A	Longitude direction	E/W		E－East Longitude ，W－West Longitude
6	hhmmss.ss	UTC time		hour/minute/second	
7	A	Data state	A/V		A- valid，V- invalid
8	X	Positioning mode indication	0～5		Note1
9	*hh	Checksum			

10	<CR><LF>	Carriage Return &Line Feed			

[Note1]：Positioning mode indication

Non Ministry of communications protocol	Ministry of communications protocol	Description
A	0	Autonomous Mode
D	1	Difference Mode
E	2	Estimation Mode （Dead reckoning ）
M	3	Manual Input Mode
N	4	Simulator Mode
S	5	DATA INVALID

3.1.3 GSA

Information	GSA
Description	Satellite number and DOP information for positioning.
Type	Output

Instruction

Whether satellite positioning or available, output GSA statement.When receiver is in multi-system joint work, each system available satellite corresponds to a GSA statement, each GSA statement contains PDOP, HDOP and VDOP according to the combination of satellite system.

Structure

$--GSA,a,x{,xx},x.x,x.x,x.x,x.x*hh<CR><LF>

Field	Symbol	Meaning	Range of Values	Note
1	$--GSA	Statement initiation		
2	A	Positioning mode indication	M/A	Note1
3	X	Selection model	1～3	Note2
4	{,xx}	12 satellites for positioning PRN	Fixed length number	
5	x.x	PDOP		
6	x.x	HDOP		
7	x.x	VDOP		
8	*hh	Checksum		
9	<CR><LF>	Carriage Return &Line Feed		

[Note1~2]：

Number	Content	Description	
1	Positioning mode	M	Manual, mandatory for 2D or 3D mode
		A	Automatic, allows 2D/3D to automatically switch

	indication		
2	Selection mode	1	Positioning unavailable or invalid
		2	2D positioning
		3	3D positioning

3.1.4 GSV

Information	GSV
Description	Visible satellite number and its elevation, azimuth, carrier noise ratio and other informations.
Type	Output

Instruction

When the receiver is in a multi system joint operation, each system outputs a corresponding GSV statement, and the GSV statement identifier of each system is the identifier of the current system. Even if there is no visible satellite, but also the output GSV statement.

Structure

$--GSV,x,x,xx{,xx,xx,xxx,x.x}*hh<CR><LF>

Field	Symbol	Meaning	Range of Values	Unit	Note
1	$--GSV	Statement initiation			
2	X	Total number of GSV statements			Note1
3	X	Current GSV statement serial number			
4	Xx	Number of satellites in the field of vision			
5	{,xx,xx,xxx,x.x}	Visible satellite information group			Note2
	Xx	Satellite number			
	Xx	Satellite elevation	0～90	degree	
	Xxx	Satellite azimuth	0～359	degree	
	x.x	Carrier to noise ratio	0～99	dB-Hz	
6	*hh	Checksum			
7	<CR><LF>	Carriage Return &Line Feed			

[Note1~2]：

Number	Content	Description
1	Total number of GSV statements	Each GSV statement output up to 4 visible satellite information, so when the system can be seen more than 4 satellites, the need for more than one GSV statement.
2	Visible satellite information group	parameter group of each GSV statement{satellite number, elevation, azimuth, carrier noise ratio} is variable, up to 4 groups. When the number of groups is less than 4, it is not necessary to use an empty field for the unused parameter group.

3.1.5 RMC

Information	RMC
Description	Recommended minimum navigation transmission data
Type	Output

Structure

$--RMC,hhmmss.ss,A,ddmm.mm,a,dddmm.mm,a,x.x,x.x,xxxxxx,x.x,a,a*hh<CR><LF>

Field	Symbol	Meaning	Range of Values	Unit	Note
1	$--RMC	Statement initiation			
2	hhmmss.ss	Positioning time of UTC		hour/minute/second	
3	A	Positioning state	A/V		A- valid，V-invalid
4	ddmm.mm	Latitude			
5	A	Latitude direction	N/S		N-North Latitude ，S-South Latitude
6	dddmm.mm	Longitude			
7	A	Longitude direction	E/W		E- East longitude ，W-west Longitude
8	x.x	speed referring to earth		knot	
9	x.x	course referring to earth		degree	Reference datum for true north ，along the

					clockwise direction to the Angle of the course
10	Xxxxxx	Date		Day/Month/Year	
11	x.x	Declination		degree	
12	A	Declination direction	E/W		E- East，W- west
13	A	Mode indication			Note1
14	*hh	Checksum			
15	<CR><LF>	Carriage Return &Line Feed			

[Note1]：Positioning mode indication

Positioning mode indication	Description	Whether support
A	Autonomous Mode	Y
D	Difference Mode	N
E	Estimation Mode（Dead reckoning）	Y
M	Manual input Mode	N
N	DATA INVALID	N
S	Simulator Mode	N

3.1.6 VTG

Information	VTG
Description	speed referring to earth and course referring to earth information
Type	Output

Structure

$--VTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>

Field	Symbol	Meaning	Range of Values	Unit	Note
1	$--VTG	Statement initiation			
2	x.x	True north course referring to earth		degree	
3	T	True north instructions			
4	x.x	Magnetic north course referring to earth		degree	
5	M	Magnetic north instructions			
6	x.x	speed referring to earth		knot	
7	N	Speed unit knot			
8	x.x	speed referring to earth		Kilometer per hour	
9	K	Speed unit			

10	A	Positioning mode indication			Note1
11	*hh	Checksum			
12	<CR><LF>	Carriage Return &Line Feed			

[Note1]：Positioning mode indication

Positioning mode	Description	Whether support
A	Autonomous Mode	Y
D	Difference Mode	N
E	Estimation Mode（Dead reckoning）	Y
M	Manual input Mode	N
N	DATA INVALID	N
S	Simulator Mode	N

3.1.7 ZDA

Information	ZDA
Description	Time and date information
Type	Output

Structure

$--ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh<CR><LF>

Field	Symbol	Meaning	Range of Values	Unit	Note
1	$--ZDA	Statement initiation			
2	hhmmss.ss	Positioning time of UTC			
3	Xx	Day	01~31		
4	Xx	Month	01~12		
5	Xxxx	Year			
6	Xx	Time zone hour			Do not support, fixed to 00
7	Xx	Time zone minute			Do not support, fixed to 00
8	*hh	Checksum			
9	<CR><LF>	Carriage Return &Line Feed			

3.1.8 TXT

Information	TXT
Description	Text information
Type	Output

Structure

$GPTXT,xx,xx,xx,c—c*hh<CR><LF>

Example

Sentence	Instruction
$GPTXT,01,01,02,MA=CASIC*27	Module vendor information
$GPTXT,01,01,02,HW=ATGM330B,0032011101304*18	Module type and serial number
$GPTXT,01,01,02,IC=ATGB03+HZG10V2*72	Main chip information of module
$GPTXT,01,01,02,SW=URANUS2,V2.0.6.0*18	Software version of the module （Note1）
$GPTXT,01,01,02,MO=GB*77	Module working mode （Note2）
$GPTXT,01,01,02,CI=03*79	Customer ID information
$GPTXT,01,01,01,ANTENNA OPEN*25	Open antenna tip
$GPTXT,01,01,01,ANTENNA OK*35	Antenna connection good tip
$GPTXT,01,01,01,ANTENNA SHORT*63	Antenna short tip

Field	Symbol	Meaning	Range of Values	Unit	Note
1	$GPTXT	Statement initiation			
2	Xx	Total number of sentences	01~99		
3	Xx	Sentences number	01~99		
4	Xx	Text identifier			（Note 3）

5	c—c	Text information			
6	*hh	Checksum			
7	<CR><LF>	Carriage Return &Line Feed			

[Note1]

In the $GPTXT,01,01,02,SW=URANUS2,V2.0.6.0*18,URANUS2,V2.0.6.0 is module software version .The software version can be specified in the purchase information table when the user is purchasing.

[Note2]

$GPTXT,01,01,02,MO=GB*77 is GPS、BD dual mode operation .

G represents GPS；B represents BDS；R represents GLONASS

[Note3]：Text identifier

Text	Description
00	Error
01	Warning
02	Notice
07	User

3.2 NMEA Extension

In order to meet the requirements of BDS/GPS dual mode receiver, the protocol is extended as follows on the basis of standard NMEA protocol.

3.2.1 CAS00

Information	CAS00
Description	Save the current configuration information to FLASH.
Type	Input

Structure

$PCAS00*hh<CR><LF>

Example

$PCAS00*01

Field	Symbol	Field description	Example
1	$PCAS00	Statement initiation	$PCAS00
2	*hh	Checksum	*01
3	<CR><LF>	Carriage Return &Line Feed	-

3.2.2 CAS01

Information	CAS01
Description	Set the baud rate of serial communication.
Type	Input

Structure

$PCAS01,x *hh<CR><LF>

Example

$PCAS01,1*1D

Field	Symbol	Field description	Example
1	$PCAS01	Statement initiation	$PCAS01
2	X	Baud rate flag （Note1）	1
3	*hh	Checksum	*1D
4	<CR><LF>	Carriage Return &Line Feed	-

[Note1]：Baud rate flag

Baud rate flag	Description
0	4800bps
1	9600bps
2	19200bps
3	38400bps
4	57600bps
5	115200bps

3.2.3 CAS02

Information	CAS02
Description	Set positioning update rate
Type	Input

Structure

$PCAS02,xxxx*hh<CR><LF>

Example

$PCAS02,1000*2E

Field	Symbol	Field description	Example
1	$PCAS02	Statement initiation	$PCAS02
2	Xxxx	Positioning update time interval ， Unit is ms （Min 100ms）	1000
3	*hh	Checksum	*2E
4	<CR><LF>	Carriage Return &Line Feed	-

3.2.4 CAS03

Information	CAS03
Description	Sets the NMEA statement that requires the output or stops the output.
Type	Input

Structure

$PCAS03,x,x,x,x,x,x,x,x*hh<CR><LF>

Example

$PCAS03,1,1,1,1,1,1,0,0*02

Field	Symbol	Field description	Example
1	$PCAS03	Statement initiation	$PCAS03
2	X	GGA Output interval （Note1）	1
3	X	GLL Output interval	1
4	X	GSA Output interval	1
5	X	GSV Output interval	1
6	X	RMC Output interval	1
7	X	VTG Output interval	1
8	X	ZDA Output interval	0
9	X	Reserved	0
10	*hh	Checksum	*02
11	<CR><LF>	Carriage Return &Line Feed	-

[Note1]：Output frequency

N (1~9) indicates that the output once per n times positionging and 0 indicates that the statement is not output .The space is maintained the original configuration.

3.2.5 CAS04

Information	CAS04
Description	Configuration working system
Type	Input

Structure

$PCAS04,x *hh<CR><LF>

Example

$PCAS04,3*1A

Field	Symbol	Field description	Example
1	$PCAS04	Statement initiation	$PCAS04
2	X	Satellite system indication （Note1）	3
3	*hh	Checksum	*1A
4	<CR><LF>	Carriage Return &Line Feed	-

[Note1] ： Satellite system indication

The field is the sixteen decimal, and each bit indicates a system.

Effective bit	Effective system
bit0	GPS
bit1	BDS
bit2	GLONASS
bit3~bit7	Reserved ， must be 0

3.2.6 CAS06

Information	CAS06
Description	Query module information
Type	Input

Structure

$PCAS06,x*hh<CR><LF>

Example

$PCAS06,1*1A

Field	Symbol	Field description	Example
1	$PCAS06	Statement initiation	$PCAS06
2	X	Information type （Note1）	1
3	*hh	Checksum	*1A
4	<CR><LF>	Carriage Return &Line Feed	-

[Note1]

1	Query module serial number
2-9	Reserved

3.2.7 CAS10

Information	CAS10
Description	Receiver restart
Type	Input

Structure

$PCAS10,x *hh<CR><LF>

Example

$PCAS10,0*1C

Field	Symbol	Field description	Example
1	$PCAS10	Statement initiation	$PCAS10
2	X	Start mode configuration （Note1）	0
3	*hh	Checksum	*1C
4	<CR><LF>	Carriage Return &Line Feed	-

[Note1]：Start Mode

Start Mode	Description
0	Hot start :Without initialization information, all data in the backup store are valid.
1	Warm start:Without initialization information, clear ephemeris.
2	Cold start :Without initialization information ,and clear all data except configuration in the backup store.
3	Clear memory of all data, and reset the receiver to the factory default configuration.

3.2.8 CAS11

Information	CAS11
Description	Set up the dynamic model of the current navigation platform .
Type	Input

Structure

$PCAS11,x*hh<CR><LF>

Example

$PCAS11,0*1D

Field	Symbol	Field description	Example
1	$PCAS11	Statement initiation	$PCAS11
2	X	The dynamic model of the current navigation platform（Note1）	0
3	*hh	Checksum	*1D
4	<CR><LF>	Carriage Return &Line Feed	-

[Note1]：Dynamic Model

Number	Mode	Applicable scenarios	Maximum height (m)	Maximum speed (m/s)	Maximum vertical speed (m/s)	Maximum position error
0	Portable mode	Default mode. The acceleration is relatively small, suitable for most of the scene.	12000	310	50	Medium
1	Static mode	Timing or other static	9000	10	6	Small

		scene, the speed limit is 0.				
2	Walking mode	Low speed and low acceleration.	9000	30	20	Small
3	Vehicle mode	Dynamic is similar to passenger cars, assuming a low vertical acceleration.	6000	84	15	Mediu m
4	Voyage mode	Applications at sea , no vertical speed.	500	25	5	Mediu m
5	Aviation mode <1g	2D positioning is not supported	50000	100	100	Large
6	Aviation mode <2g	2D positioning is not supported	50000	250	100	Large
7	Aviation mode <4g	2D positioning is not supported	50000	500	100	Large

3.3 UBX Information Definition

3.3.1 Information Type Description

Number	Information Type And ID		Description
1	NAV-SOL	0x06 0x01	Time and position status information
2	NAV-POSLLH	0x02 0x01	Latitude and longitude altitude estimation
3	NAV-UTCTIME	0x21 0x01	UTC time information
4	NAV-GPSTIME	0x20 0x01	GNSS time information

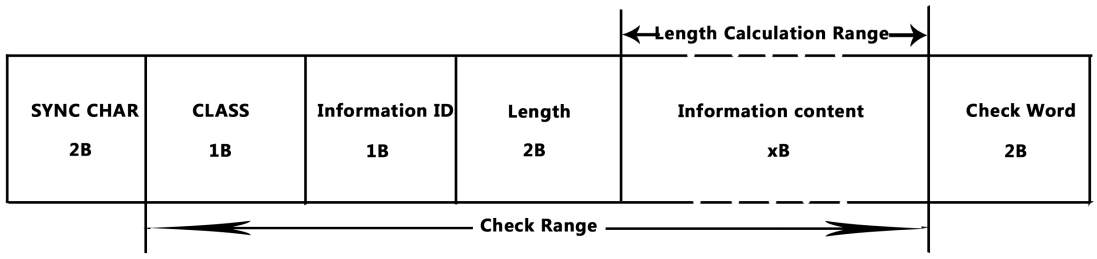
5	NAV-GPSINFO	0x30 0x01	GNSS satellites information
6	MON-HW	0x09 0x0A	Antenna and other hardware status monitoring information

3.3.2 Data Type Description

Type Abbreviations	Type description	Size	Notes	Range
U1	Unsigned Char	1		0 - 255
I1	Signed Char	1	Complement representation	-128 – 127
U2	Unsigned Short	2		0 – 65535
I2	Signed Short	2	Complement representation	-32,768 – 32,767
U4	Signed Long	4		0 - 4,294,967,295
I4	Signed Long	4	Complement representation	-2,147,483,648–2,147,483,647
CH	ASCII	-	Variable length	Character string

3.3.3 Message Format Definition

UBX protocol frame format as follows:



Each part of the frame format is described as follows:

- SYNC CHAR：2bits（0Xb5 0x62）。
- CLASS：1bit，It rules the basic classification of the message.
- Information ID：1bit，It rules 1bit，and define the information content .
- Length ：2bits，Only include the number of bytes of information content.
- Information content ： The length of the information content is decided by its information categories and ID.

Check word：2bits，Check the contents include information category, the information ID, length and information content, using the algorithm of Fletcher: a CK CK B, calculation formula is as follows (n indicates the need to compute the checksum field length with byte as a unit., Buffer[i] indicates the need to calculate the ith bytes of the checksum field.)

```
CK_A = 0，CK_B = 0
for (i = 0; i < n; i++)
{
    CK_A = CK_A + Buffer[i]
    CK_B = CK_B + CK_A
}
```

Instruction ： If there is no particular note, the multi byte information is a Little Endian emissions, the internal byte is low bit first.

3.3.4 Interface Message Definition

3.3.4.1 NAV-POS (0x06 0x01)

Information	NAV-POS
Description	Navigation solution information

Type	Periodic reporting per second				
Note	This information contains the position, speed and time solution of the ECEF coordinate system and the corresponding accuracy information.				
Message Structure	Head	Identifier	Length (Byte)	Effective Load	Checksum
	0xB5 0x62	0x01 0x06	52	Table Below	CK_A CK_B

Effective Load：

Character Deviation	Data Type	Proportion zoom	Name	Unit	Description
0	U4	-	iTOW	ms	GNSS system week time
4	I4	-	fTOW	ns	The decimal number after the time integer to iTOW
8	I2	-	Week	-	GNSS weeks
10	U1	-	gpsFix	-	Positioning type: 0- No Positioning 1- Dead-Reckoning (DR) mode 2-2D positioning mode 3-3D positioning mode 4- Combined positioning DR/GNSS mode 5- Only PPS timing mode 6~0xff:Not defined
11	X1	-	flags	-	Positioning mark: Bit0: Effective Positioning

					Bit1:DGPS mark Bit2: the week number is valid. Bit3: effective during the week
12	I4	-	ecefX	cm	ECEF position coordinates of X axis
16	I4	-	ecefY	cm	ECEF position coordinates of Y axis
20	I4	-	ecefZ	cm	ECEF position coordinates of Z axis
24	U4	-	pAcc	cm	3D position estimation accuracy
28	I4	-	ecefVX	cm/s	The ECEF speed of X axis
32	I4	-	ecefVY	cm/s	The ECEF speed of Y axis
36	I4	-	ecefVZ	cm/s	The ECEF speed of Z axis
40	U4	-	sAcc	cm/s	Speed estimation precision
44	U2	0.01	pDOP	-	Position DOP
46	U1	-	res1	-	Reserved
47	U1	-	numSV	-	Number of satellites used for positioning
48	U4	-	res2	-	Reserved

3.3.4.2 NAV-POSLLH (0x02 0x01)

Report the timing module working state of alarm information

Information	NAV-POSLLH
Description	Geographical position solution

Type	Periodic reporting per second				
Note	The geographical position of the output WGS84 coordinate system				
Message Structure	Head	Identifier	Length (Byte)	Effective Load	Checksum
	0Xb5 062	0x01 x02	28	Table Below	CK_A CK_B

Effective Load：

Character Deviation	Data Type	Proportion zoom	Name	Unit	Description
0	U4	-	iTOW	ms	GNSS system week within milliseconds
4	I4	1e-7	Lon	deg	Longitude
8	I4	1e-7	Lat	deg	Dimension
12	I4	-	Height	mm	Ellipsoidal height
16	I4	-	hMSL	mm	Altitude

3.3.4.3 NAV-UTCTIME(0x21 0x01)

Information	NAV-UTCTIME				
Description	Report the leap second adjustment time and leap second value				
Type	Periodic reporting per second				
Note	-				
Message Structure	Head	Identifier	Length (Byte)	Effective Load	Checksum
	0Xb5 062	0x01 0x21	20	Table Below	CK_A CK_B

Effective Load：

Character Deviation	Data Type	Proportion zoom	Name	Unit	Description
0	U4	-	iTOW	ms	GNSS system week within milliseconds
4	U4	-	tAcc	ns	Time estimation precision
8	I4	-	nano	ns	Nanosecond part of time
12	U2	-	year	Y	Year
14	U1	-	month	month	Month
15	U1	-	day	d	Day
16	U1	-	hour	h	Hour
17	U1	-	min	min	Minute
18	U1	-	sec	s	Second
19	X1	-	valid	-	Effective mark: Bit0: Effective in week Bit1: Effective number of weeks Bit2:UTC effective (The leap second information known)

3.3.4.4 NAV-GPSTIME (0x20 0x01)

Information	NAV-GPSTIME
Desc	Reported GNSS time

riptio n					
Type	Periodic reporting per second				
Note	-				
Mess age	Head	Identifier	Length (Byte)	Effective Load	Checksum
Struc ture	0Xb5 062	0x01 0x20	16	Table Below	CK_A CK_B
0	U4	-	iTOW	ms	GNSS system week time
4	I4	-	fTOW	ns	The decimal number after the time integer to iTOW
8	I2	-	Week	-	GNSS weeks
10	I1	-	leapS	s	Leap seconds （GNSS-UTC）
11	X1	-	valid	-	Effective mark: Bit0: Effective in week Bit1: Effective number of weeks Bit2:UTC effective (The leap second information known)
12	U4	-	tAcc	ns	Time estimation precision

3.3.4.5 NAV-GPSINFO (0x30 0x01)

Informat	NAV-GPSINFO

ion					
Description	Reported GNSS satellite information				
Type	Periodic reporting per second				
Note	-				
Message Structure	Head	Identifier	Length (Byte)	Effective Load	Checksum
	0Xb5 062	0x01 0x30	8+12*num	Table Below.	CK_A CK_B
0	U4	-	iTOW	ms	GNSS system week time
4	U1	-	num	-	The decimal number after the time integer to iTOW
5	X1	-	globalFlags	-	GNSS weeks
6	U2	-	res2	-	Leap seconds （GNSS-UTC）
Start a series of satellite information （num）					
8+12*N	U1	-	chn	ns	Time estimation precision
9+12*N	U1	-	svid	-	Satellite ID
10+12*N	X1	-	flags	-	Bit mark Bit0: satellite for navigation Bit1: differential information available Bit2: Track information effectively,

					ephemeris or almanac effectively Bit3:Track information is ephemeris Bit4: satellite is not healthy Bit5: Track information is almanac
11+12*N	X1	-	quality	-	Sign 0: channel is empty 1: channel in search satellite 2: signal capture to 3: detected signal but not available 4: code phase lock 5, 6, 7: code phase and carrier phase lock
12+12*N	U1	-	cn0	dBHz	Carrier to noise ratio
13+12*N	I1	-	elev	deg	Elevation
14+12*N	I2	-	azim	deg	Azimuth

16+12*N	I4	-	prRes	cm	Pseudo range residue

3.3.4.6 MON-HW (0x09 0x0A)

Information	NAV-GPSINFO				
Description	Reporting hardware test information, only to report the antenna status effectively.				
Type	Periodic reporting per second				
Note	-				
Message Structure	Head	Identifier	Length (Byte)	Effective Load	Checksum
	0Xb5 062	0x0A 0x09	68	Table Below.	CK_A CK_B
0	X4	-	pinSel	-	-
4	X4	-	pinBank	-	-
8	X4	-	pinDir	-	-
12	X4	-	pinVal	-	-
16	U2	-	noisePerMS	-	-
18	U2	-	agcCnt	-	-
20	U1	-	aStatus	-	Antenna state monitoring ： 0：Initialization 1：Unknown state 2：Normal state 3：Short circuit 4：Open circuit
21	U1	-	aPower	-	-
22	X1	-	flags	-	-

23	U1	-	res1	-	-
24	X4	-	usedMask	-	-
28	U1[25]	-	VP	-	-
53	U1[3]	-	res2	-	-
56	X4	-	pinIrq	-	-
60	X4	-	pullH	-	-
64	X4	-	pullL	-	-

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