WTGPS-300 Protocol Manual

1 GNGGA

For example:
$GNGGA,062938.00,3110.4700719,N,12123.2657056,E,1,12,0.6,58.9666
,M,0.000,M,99,0 000*50

serial number	name	describe	symbol	Example
1	$GPGGA	Log header		$GPGGA
2	utc	UTC time (hour / minute / second)	hhmmss.ss	202134.00
3	lat	Latitude: -90~90 degrees	llll.lllllll	3110.4693903
4	latdir	Latitude direction: N : North; S : South	a	N
5	lon	Longitude: -180~180 degrees	yyyyy.yyyyyyy	12123.2621695
6	londir	Longitude direction: E : East; W : West	b	W
7	QF	Solution Status 0 : invalid solution; 1 : Single point positioning solution; 2 : Pseudorange difference; **6:** Pure inertial navigation solution	q	1
8	sat No.	Number of satellites	n	12
9	**GPS_Precision**	Satellite positioning accuracy	**xx**	**0.6**
10	alt	Elevation	hh	58.9666
11	a-units	Elevation Units	M	M
12	Geoidal	Geoid	xxx.x	0.000
13	a-units	unit	M	M
14	age	Differential Delay	dd	1
15	ID	Base station ID	xxxx	0000
16	*xx	Checksum	*hh	
17	[CR][LF]	Sentence terminator		[CR][LF]

Description: **WTGPS-300** modifies **two** fields of the **GGA** official protocol .

(1) Field 7 : QF adds inertial navigation solution status

When entering an environment with poor satellite positioning, such as a tunnel or elevated road, WTGPS-300 will output status 6 in this field , indicating the pure

inertial navigation solution status.

（2） Field 9：HDop is changed to Gps_Precision

Gps_Precision is the satellite positioning accuracy in meters provided by WTGPS-300 . For example, in an open environment, the satellite positioning accuracy Gps_Precision of WTGPS-300 is generally around 0.4 meters. It is strongly recommended that users use Gps_Precision to facilitate product maintenance.

2 GNRMC

For example:
$GNRMC,064401.65,A,3110.4706987,N,12123.2653375,E,0.604,243.2,30
0713,40.0,W,A* 3E

serial number	name	describe	symbol	Example
1	$GPRMC	Log header		$GPRMC
2	utc	UTC time (hour / minute / second)	hhmmss.ss	143550.00
3	Pos status	Solution status: A = valid positioning V = invalid positioning	A	A
4	lat	Latitude: -90~90 degrees	llll.lllllll	3110.4854911
5	latdir	Latitude direction: N : North; S : South	a	N
6	lon	Longitude: -180~180 degrees	yyyyy.yyyyyy	12123.9129278
7	londir	Longitude direction: E : East; W : West	b	E
8	SPEED IN	Ground speed	q	0.29
9	Track True	Ground heading angle	n	108.5
10	Date	UTC Date	ddmmyy	010909
11	Installation angle	Installation angle of inertial navigation	40.0	40.0
12	Vardir	Direction of magnetic declination, E (east) or W (west)	M	M
13	Mode ind	Mode indication (NMEA0183 only Version 3.00 output , A= autonomous positioning, D= differential, E= estimation, N= Invalid data)	a	A

14	*xx	Checksum	*hh	*57
15	[CR][LF]	Sentence terminator		[CR][LF]

Reminder: After the inertial navigation module is powered on, the installation angle is the installation angle recognized by the module last time. If the installation angle is very different from the last time, it is recommended to send the command log Clear . Avoid the influence of installation angle error on inertial navigation derivation.

3 GPATT

$GPATT,0.00,p,0.00,r,0.00,y,20230206,S,003E009,ID,1,INS,3335,01,0,0.00,1,7,01,99.00,0,1,D,00, 3,4,0.000,0,1,00,B,-5,0,357,0,0,3,2*77

Edit	name	describe	symbol	Example

Number				
1	$GPATT	Log header		$GPATT
2	Pitch	Pitch angle	ddd.mm	1.34 (unit: degree)
3	Angle Channel	P: pitch , r: roll , y: yaw	P	P
4	Roll	Roll Angle	ddd.mm	2.56 (unit: degree)
5	Angle Channel	P: pitch , r: roll , y: yaw	A	R
6	Yaw	Yaw angle	ddd.mm	132.45 (unit: degrees)
7	Angle Channel	P: pitch , r: roll , y: yaw		Y
8	Soft Version	Software version number	xxxxxxxx	20180518
9	Version Channel	S: Software version number		S
10	Products ID	96 -bit unique ID		003E0038510D343439373239
11	ID Channel	ID: Product ID	ID	ID
12	**INS**	Inertial navigation is turned on by default	**X**	**1** : On, **0** : Off
13	INS Channel	INS: Is inertial navigation turned on?	INS	INS
14	hardware version	Named after the main control chip	401	
15	**Run_State_Flag**	Algorithm status flags	**d**	**1->3For** details, please see Table **A below**
16	Mis_Angle_Num	Number of installation angle identifications	d	9
17	Custom Logo	Custom Logo	d	X
18	Custom Logo	Custom Logo	d	X
19	Custom Logo	Custom Logo	A	A
20	**StaticFlag**	Static flag	**d**	**1** : static, **0** : dynamic
twenty one	Uer_Code	user ID	d	1
twenty two	GST_Data	User satellite accuracy	dd	04
twenty three	**LineFlag**	Straight driving sign	**d**	**1** : Straight driving, **0** : Turning driving

twenty four	customize	Custom Logo	F	F
25	Mis_Att_Flag	Whether to install adaptively	d	1 : Enable, 0 : Disable
26	IMU_Kind	sensor type	d	0:BMI055,1:BMI160,2: lsm6ds3-c;3lsm6dsow; 7: lsm6dsr;8:bmi323
27	**UBI_Kind**	**UBI** Types	**d**	**1** : small car version, **2** : large car version, **4** : universal version
28	Mileage	driven distance	ddd.mm	21.547 (unit: km), maximum 9999 km
29	Custom Logo	Custom Logo	d	D
30	Custom logo`	Custom Logo	d	X
31	**Run_Inetial_Flag**	Inertial navigation convergence flag	d	1->4 Please see Table **B below for details**
32	Custom Logo	Custom Logo	C	B
33	Custom Logo	Custom Logo	d	X

34	Custom Logo	Custom Logo	d	X
35	Custom Logo	Custom Logo	d	X
36	**SpeedEnable**	Is speed fusion successful?	**d**	**1:** represents speed fusion success, **0** : represents failure
37	Custom Logo	Custom Logo	d	X
38	Custom Logo	Custom Logo	d	X
39	**SpeedNum**	Number of times speed signal is received	**d**	**0-99** , add one each time, return to zero after reaching **99**
40	Scalable			
41	*xx	Checksum	*hh	*2c
42	[CR][LF]	Sentence terminator		[CR][LF]

Note **1** : The conditions for inertial navigation to work formally are:

1 GPATT protocol 12 field **INS** is **1** ;

2 GPATT protocol 15 field **State_Flag** is **03/04** .

If the user wants to obtain good inertial performance, such as vehicle speed, UBI alarm and other parameters, in addition to the above two judgments, it is recommended to wait for the inertial navigation to converge, that is,

(1) GPATT protocol 31 field **Run_Inetial_Flag** is **4** ;

Table A Physical meaning of each bit in the **Run_State_Flag** field of GPATT protocol 15

Numeric	describe	Requirements
0	Prepare for initialization	System Power On
1	Posture initialization completed	The car is stationary for 5-10 seconds,
2	Position initialization completed	Get Location
3	Get the installation angle and enter the combined navigation	The vehicle speed exceeds 5m/s for a period of time
4	Installation angle identification completed	Drive for a while

Table B Physical meaning of each bit in the **Run_Inetial_Flag** field of GPATT protocol 31

Numeric	describe	system status
0	Prepare for initialization	
1	Inertial navigation has just converged	Copy only satellite positioning, **Run_State_Flag=01/02**
2	Initial convergence of inertial navigation	Inertial navigation can be started, **Run_State_Flag=03/04**
3	Inertial navigation is converging	Inertial navigation can be started, **Run_State_Flag=03/04**
4	Inertial navigation completes convergence	Inertial navigation can be started, **Run_State_Flag=03/04**

4 ERROR

Example：$ERROR,075620.00,0,0,0,0,0*61

Bit	name	describe	symbol	Example
1	$ ERROR	Log header		$ERROR
2	UTC	075620.00		
3	Code_Flag	Is there a problem with the encryption chip?	d	1 : There is a problem, 0 : Normal
4	Gset_Flag	Is there a problem with the positioning chip?	d	1 : There is a problem, 0 : Normal
5	Sset_Flag	Is there a problem with the sensor chip?	d	1 : There is a problem, 0 : Normal
6	customize	customize	d	0-20
7	customize	customize	Float	customize
8	*xx	Checksum	*hh	*57
9	[CR][LF]	Sentence terminator		[CR][LF]

Note: Under normal circumstances, this protocol is not output. It will be output only if there is a problem.

5 DEBUG

Example : $DEBUG,1,1,2,5.000,-32.0,0,1,00,00,-6,-18,23,1,0,75,1,4,816,1,82*75

serial number	name	describe	Symbol / Data Type	Example
1	$ DEBUG	Log header		$ DEBUG
2	ANG_DGet_Flag	Installation azimuth	D	1: with azimuth, 0: without azimuth
3	Fix_Kind_Flag	Type of installed coordinate system	D	
4	Ins_Run_Flag	Forced inertial navigation state	D	1 : Forced inertial navigation state, 0 : Normal

				state	
5	Fix_Roll_Flag	Installation roll angle	ddd.mm	-2.500	
6	Fix_Pitch_Flag	Installation pitch angle	ddd.mm	3.500	
7	UBI_On_Flag【1】	UBI	D	0->8 , see Table C for details	
8	UBI_Kind_Flag [2]	UBI_Kind_Flag	D	0: none 1 : UBI event 2 : UBI alarm	
9	UBI_A_Set【3】	UBI_A Parameter setting value	D	16	
10	UBI_B_Set【3】	UBI_B Parameter setting value	D	3	
11	Acc_X_Data【4】	Vehicle longitudinal acceleration	16 -bit signed integer	-400 to 400	Unit：0.1m/s2
12	Acc_Y_Data【4】	Vehicle lateral acceleration	16 -bit signed integer	-400 to 400	Unit：0.1m/s2
13	Gyr_Z_Data【4】	Vehicle Z- axis angular velocity	16 -bit signed integer	-250 to 250	Unit：Degree/s

14	Pitch_Angle 【4】	Vehicle pitch angle	16 -bit signed integer	-180 to 180	Unit : Degree
15	Roll_Angle 【4】	Vehicle roll angle	16 -bit signed integer	-180 to 180	Unit : Degree
16	Yaw_Angle [4]	Vehicle direction change angle	16 -bit signed integer	-180 to 180	Unit : Degree
17	Car_Speed [4]	Vehicle speed	16 -bit signed integer	0 to 100	Unit : m/s
18	INS_Flag【5】	Inertial navigation convergence flag	8- bit unsigned integer	0 to 4	Unit: None
19	UBI_Num [6]	Serial number	16 -bit unsigned integer	0 to 65536	Single:
20	UBI_Valid	UBI valid flag	D	0 or 1	1 : valid, 0 : invalid
twenty one	Coll_T_Data	Collision Factor	16 -bit signed integer	-800 to 800	
twenty two	Coll_T_Heading	Collision direction	16 -bit signed integer	-180 to 180	Please see the notes for instructions
twenty three	Custom Logo	Custom Logo	d		
twenty four	Custom Logo	Custom Logo	d		
25	Custom Logo	Custom Logo	d		
26	Custom Logo	Custom Logo	d		
27	Custom Logo	Custom Logo	d		
28	Custom Logo	Custom Logo	d		
29	*xx	Checksum	*hh	*57	
30	[CR][LF]	Sentence terminator		[CR][LF]	

Note **1** :

Table C Physical meaning of field **UBI_On_Flag** in DESBI protocol 7 ,

Numeric	describe	Triggering conditions
0	none	
1	Rapid acceleration	more than the An event in which the longitudinal acceleration is greater than BS_Acce_Deta for a period of time equal to BS_Acce_Time.
2	Rapid	The longitudinal acceleration is less than BS_Dece_Deta 's Events

	decele ration	
3	Sharp right lane chang e	The absolute value of the lateral acceleration is greater than BS_ Lane_Deta , the satellite positioning direction change is less than BS_Lane_Angle
4	Sharp left lane chang e	The absolute value of the lateral acceleration is greater than BS_ Lane_Deta , the satellite positioning direction change is less than BS_Lane_Angle
5	Horizo ntal impact	The absolute value of the vehicle's acceleration is greater than BS_Coll_Deta , and the vehicle's attitude angle change does not exceed BS_Coll_Angle event
6	Vehicle stabilit y	An event in which the heading angle is continuously changed at an angular velocity greater than BS_Stab_Rate for a period greater than BS_Stab_Time .
7	Vehicle flip	The pitch or roll angle changes by more than BS_Roll_Angle event
8	Abnor mal postur e	The maximum change of pitch and roll angle exceeds SAtt_Min_Deta , and the event is not greater than SAtt_Max_Deta
11	Norma l acceler ation	more than the Events where the longitudinal acceleration is greater than BS_Acce_Peta for a period of time BS_Acce_Time
12	Norma l decele ration	The longitudinal acceleration is less than BS_Dece_Peta 's Event
13	Sharp right turn	The absolute value of the lateral acceleration is greater than BS_Turn_Deta , and the satellite positioning direction changes by more than BS_Turn_Angle event
14	Sharp left turn	The absolute value of the lateral acceleration is greater than BS_Turn_Deta , and the satellite positioning direction changes by more than BS_Turn_Angle event
15	Right normal turn	The absolute value of the lateral acceleration is less than BS_Turn_Deta , but the satellite positioning direction changes by more than BS_Turn_Angle event
16	Left normal turn	The absolute value of the lateral acceleration is less than BS_Turn_Deta , but the satellite positioning direction changes by more than BS_Turn_Angle event
19	Bumpy road	The absolute value of the vehicle's bump factor is greater than BS_bump_Deta event

Note **2** :

Physical meaning of field

UBI_Kind_Flag in DESBI

protocol 7 :0 : No UBI alarm or

UBI event

1 : **UBI** event refers to driving behavior when the acceleration or angular velocity reaches a value above the UBI event setting value .

The deceleration acceleration threshold is -2.0 m / s2 , so any driving behavior with a longitudinal acceleration less than -2 m / s2 is considered a UBI event. The various accelerations, angular velocities, attitude angles, etc. corresponding to the event are output to GSM and uploaded to the server, which facilitates the server to perform big data analysis of driving behavior. Once a UBI event occurs, it is recommended that GSM report data to the server once per second.

According to the China Insurance Industry Association standard "Motor Vehicle Insurance Internet of Vehicles Data Collection Specifications" and based on actual tests
, define the UBI event data
type as follows:

Table D - Data Type + Data Content

type	variable	content	default value	scope	unit
0x01	BJ_X_Acce_D	Rapid acceleration threshold of the vertical axis	8(0x08)	5->16	0.1m/s2
0x02	BJ_X_Dece_D	Rapid deceleration acceleration threshold of the vertical axis	-20(0XED)	-10->-40	0.1m/s2
0x03	BJ_Y_Lane_D	Acceleration threshold for sudden lane change on the horizontal axis	12(0x0C)	10->25	0.1m/s2
0x04	BJ_XY_Coll_D	Collision acceleration thresholds for the vertical and horizontal axes	12(0x0C)	10->20	m/s2
0x05	BJ_Z_Stab_R	Angular velocity threshold for vehicle stability on the Z axis	15(0x0F)	10->30	Degree/s
0x06	BJ_Att_Min_D	Pitch and roll angle thresholds	10(0x0A)	5->20	Degree
0x07	BJ_Acc_T_Data	Collision factor threshold for horizontal collisions	40(0x28)	20->80	

2 : **UBI** alarm refers to any driving behavior that reaches the UBI alarm setting value .

Note **3** :

As shown in Table E : The values of UBI_A_Set and UBI_B_Set change according to the type of **UBI_On_Flag** . In this way, every time a UBI alarm occurs, the user's UBI setting value is reported at the same time.

Table E Physical meaning of fields 9 and 10 of the DESBI protocol

UBI_On_F	UBI_A_S	UBI_B_S

lag		et	et
1	Rapid acceleration	BS_Acce_Deta	BS_Acce_Time
2	Rapid deceleration	BS_Dece_Deta	none
3	Sharp right lane change	BS_Lane_Deta	BS_Lane_Angle
4	Sharp left lane change	BS_Lane_Deta	BS_Lane_Angle
5	Horizontal impact	BS_Coll_Deta	BS_Coll_Angle
6	Vehicle stability	BS_Stab_Rate	BS_Stab_Time
7	Vehicle flip	BS_Roll_Angle	none
8	Abnormal posture	SAtt_Min_Deta	SAtt_Max_Deta
11	Normal acceleration	BS_Acce_Peta	none
12	Normal deceleration	BS_Dece_Peta	none
13	Sharp right turn	BS_Turn_Deta	BS_Turn_Angle
14	Sharp left turn	BS_Turn_Deta	BS_Turn_Angle
15	Right normal turn	BS_Turn_Angle	none
16	Left normal turn	BS_Turn_Angle	none
19	Bumpy road	BS_bump_Deta	none

Table **F** Value ranges and default values of various thresholds

type	data	Factory Defaults	scope	unit
BS_Acce_Deta	Acceleration setting threshold for rapid acceleration	16	8->50	0.1m/s2

BS_Acce_Peta	Normal acceleration acceleration setting threshold	12	10->50	0.1m/s2
BS_Acce_Time	Rapid acceleration time setting threshold	3	2->8	S
BS_Dece_Deta	Acceleration setting threshold for rapid deceleration	-27	-60->-30	0.1m/s2
BS_Dece_Peta	Normal deceleration acceleration setting threshold	-twenty two	-60->-10	0.1m/s2
BS_Turn_Deta	Acceleration setting threshold for sharp turns	30	15->60	0.1m/s2
BS_Turn_Angle	Angle setting threshold for sharp turns	40	30->80	Degree
BS_Lane_Deta	Acceleration setting threshold for sudden lane change	17	10->60	0.1m/s2

BS_Lane_Angle	Angle setting threshold for sudden lane change	20	10->30	Degree
BS_Coll_Deta	Collision factor threshold for horizontal collision accidents	55	40->200	m/s^2
BS_Coll_Time	Delay time threshold for horizontal collision accidents	10	6->18	10 seconds
BS_Roll_Angle	Threshold setting for attitude angle of rollover accident	50	30->90	Degree
BS_Stab_Time	Time setting threshold for vehicle stability warning	3	2->10	S
BS_Stab_Rate	Angular velocity setting threshold for vehicle stability warning	25	10->30	Degree/s
SAtt_Min_Deta	The minimum angle setting threshold for abnormal vehicle posture	30	10->40	Degree
SAtt_Max_Deta	The maximum angle setting threshold for abnormal vehicle posture	50	40->80	Degree
BS_bump_Deta	Threshold setting for vehicle bumpy road	55	45-100	

Note **4** :

When any UBI event occurs, it is recommended that GSM report the following data to the server once per second :

Table G Various physical meanings of the data of UBI events

Bit	describe	Physical meaning	Triggering conditions
1	Acc_X_Data	Longitudinal acceleration	Used for judging sudden acceleration UBI, sudden deceleration UBI and horizontal collision UBI
2	Acc_Y_Data	Lateral acceleration	Used for judging sudden lane change UBI, sharp turn UBI and horizontal collision UBI
3	Gyr_Z_Data	Z-axis angular velocity	Used for vehicle stability UBI judgment
4	Pitch_Angle	Vehicle pitch angle	Used for rollover accident UBI and abnormal posture UBI judgment
5	Roll_Angle	Vehicle roll angle	Used for rollover accident UBI and abnormal posture UBI judgment
6	Yaw_An	Vehicle	Used for judging UBI for sharp lane changes

	gle	direction change angle	and sharp turns
7	Car_Speed	Vehicle speed	Used for UBI judgment of sudden lane change
8	Ins_Flag	Inertial navigation convergence flag	Used for judging UBI for sharp lane changes and sharp turns

Note **5** :

When Yaw_Angle refers to the turning angle of the turning process, for example, the process of a vehicle turning 90 degrees is as follows: When the vehicle starts to move straight,Yaw_Angle is 0 , and then the vehicle starts to turn and outputs a Yaw_Angle angle every second, 15 degrees in the first second , 30 degrees in the second second , 4 degrees in the third second . 5 degrees, 60 degrees at the 4th second , 75 degrees at the 5th second , 90 degrees at the 6th second . After the turn is completed, the vehicle goes straight and Yaw_Angle immediately becomes 0 degrees.

In addition, if Yaw_Angle is greater than zero, it means the vehicle is turning right, and if Yaw_Angle is less than zero, it means the vehicle is turning left;

Note **6** :

INS_Flag refers to the inertial navigation convergence flag. When INS_Flag is 4 , it means that the algorithm has converged and the UBI alarm can be judged.

Table H Physical meaning of DESBI protocol 18 field Ins_Flag

Numeric	describe	Whether UBI can be started
Ins_Flag =0	Prepare for initialization	Unable to start UBI judgment
Ins_Flag =1	Inertial navigation has just converged	Unable to start UBI judgment
Ins_Flag =2	Initial convergence of inertial navigation	Unable to start UBI judgment
Ins_Flag =3	Inertial navigation is converging	Unable to start UBI judgment
Ins_Flag =4	Inertial navigation completes convergence	UBI judgment can be started

Note **7** :

UBI_Num: is a variable-length serial number ranging from 0 to 65535. Once a UBI

event is sent, it increases by 1 per second and is reset to zero after reaching 65535.

If the inertial navigation software is reset, the serial number will also be reset to zero.

Note **8** :

UBI_Valid : When the algorithm converges, UBI_Valid is 1 , and the entire UBI protocol is valid; if it is 0 , it is invalid.

Note **9** :

It is recommended that users make collision judgments based on the collision factor. At present, in order to balance data analysis and data volume, the inertial navigation strategy for collision judgment is:

:

1 When the absolute value of the collision factor is less than the collision factor threshold (the default value is 55), the inertial navigation system determines that no collision has occurred.

2 When the absolute value of the collision factor is greater than 100 , the inertial navigation system directly determines it as a collision and continuously sends UBI events for 15 seconds .
The terminal can analyze 15 seconds of data.

3 When the absolute value of the collision factor is between the threshold (default value is 55) and 100 , the inertial sensor continues to send UBI events for 15 seconds ;
It will not be directly judged as a collision, and misjudgment will be eliminated by judging the vehicle speed. The specific process is as follows:
A. From 1 to 15 seconds, the inertial navigation system gives the vehicle 10 seconds to slow down, and then determines the vehicle speed from 10 to 15 seconds. If the vehicle speed during this period is greater than 5 km/h , it is considered a misjudgment of a collision ; otherwise, the inertial navigation system determines the subsequent vehicle speed. (The cloud can also analyze the 1-15 second data)
B1.15- Time threshold (default 100 seconds) + 10 seconds, the inertial navigation system determines the vehicle speed within this time period. 5km/h , it is considered a misjudgment of collision . Otherwise, the inertial navigation system believes that the vehicle has been stationary in order to resolve the collision, which is a vehicle collision(Considering traffic, the inertial navigation system does not transmit the above data to the cloud, but only analyzes it locally).

Data Protocol:

(1) As shown below, if the collision factor exceeds 100 , the inertial navigation system immediately determines that it is a collision and sends a set of UBI events:

$DESBI,1,1,0,0.000,0.000, 5,2,55,10 ,0,0,0,0,0,0,0,0,0,18,0, 272 *6A

(2) As shown below, if the collision factor exceeds the threshold (the default value is 55), the inertial navigation system immediately outputs a set of data:

$DESBI,1,1,0,0.000,0.000 ,0,1,00,00 ,0,0,0,0,0,0,0,0,0,33,0, -76 *7C

After judging the vehicle speed within the time period of 1- time delay threshold, at any time, if the inertial navigation finds that it is a misjudgment of collision, it will immediately send a set of

UBI_A The collision alarm when UBI_B is zero, the cloud can eliminate the above collision alarm judgment.

$DESBI,1,1,0,0.000,0.000, 5,1,00,00 ,0,0,0,0,0,0,0,0,0,48,0,0*4C

Special emphasis: The existence of 5,1,00,00 in DESBI does not mean a collision alarm! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! ! !!! ...

After judging the vehicle speed for a period of 1- time delay threshold, if the inertial navigation finds that the vehicle is in collision, it will send a set of UBI_A The collision alarm with UBI_B as the set value can be considered as a collision alarm by the cloud.

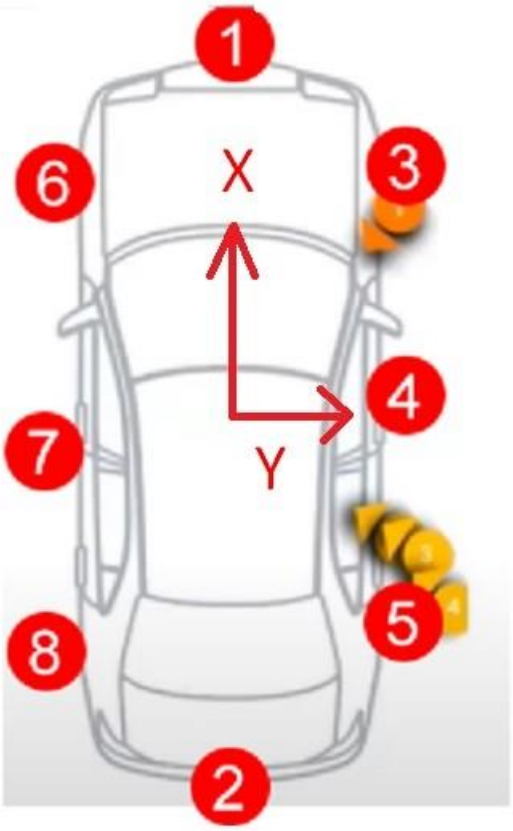
$DESBI,1,1,0,0.000,0.000, 5,2,55,10, 0,0,0,0,0,0,0,0,0,48,0,0*6B

Note **10** :

The so-called collision angle is simply the angle between the external force and the contact point of the car in the car coordinate system when the car collides.

As shown in the figure, the vehicle coordinate system is established, with the X axis facing forward and the Y axis facing right. The collision angle, starting from the X axis, is positive in clockwise direction.

, counterclockwise is negative, for example, point 1 is 0 degrees, point 4 is 90 degrees, point 2 is 180 degrees or -180 degrees, point 7 is -90 degrees, and so on for other angles.



6 SPEED

Example :
$SPEED,020406.10,20.96,2,A,-0.44,-1.15,-9.48,G,-0.42,-0.42,-0.42,S,0,0,0.000*52

serial number	name	describe	symbol	Example
1	$SPEED【1】	Log header		$SPEED
2	Utc	UTC time (hour / minute / second)	hhmmss.ss	143550.00
3	Speed	Ground speed (knots)	dd.mm	20.96
4	Status【2】	Solution status: 0 = Invalid data 1 = Converging 2 = Valid data	D	2
5	A	Delimiter	A	Represents acceleration
6	Acc_X	X- axis acceleration	ddd.mm	-0.26 (m / s / s)
7	Acc_Y	Y- axis acceleration	ddd.mm	0.075 (m / s / s)
8	Acc_Z	Z- axis acceleration	ddd.mm	-9.8 (m / s / s)
9	G	Delimiter	G	Represents angular velocity
10	Gyr_X	X- axis angular velocity	ddd.mm	0.42 (rad / sec)
11	Gyr_Y	Y- axis angular velocity	ddd.mm	0.42 (rad / sec)
12	Gyr_Z	Z- axis angular velocity	ddd.mm	0.42 (rad / sec)
13	S	Delimiter	S	Representation status
14	UBI_State_Flag	Status Flags	D	0: smooth driving , 1: unsteady driving
15	UBI_State_Kind	Status Type	D	See Table I
16	UBI_State_Value	Status Threshold	d.mmm	See Table I
17	*xx	Checksum	*hh	*57
18	[CR][LF]	Sentence terminator		[CR][LF]
19	S	Delimiter	S	Representation status

Note **1** : This protocol is output at a frequency of 10zh .

Note **2** : Since the inertial navigation supports arbitrary installation, the inertial navigation must determine the installation angle (pitch angle, roll angle, heading angle) before the sensor value can be converted to the vehicle coordinate system and the acceleration and angular velocity data of the X/Y/Z axis can be obtained. Conversely, if the installation angle is not determined, the data of the inertial sensor is installed arbitrarily and cannot be converted to the XYZ axis of the vehicle coordinate system . Refer to Section 7.4.1 of this manual for initialization under adaptive installation. The inertial navigation module must be rigidly linked to the vehicle. Then, there are two situations:

Case 1 : After the inertial navigation module is powered on, if it is installed for the first time, there is no installation angle in the Flash , and the Status value is 0. The vehicle must be driven, and the WTGPS-200 recognizes the installation angle through vehicle movements such as acceleration and deceleration ; the Status will become 1. After the vehicle drives for about 3 minutes again and the inertial navigation training is completed, the Status will become 2 ; at this time, the acceleration and angular velocity values are reliable values.

Case 2 : After the inertial navigation module is powered on, if it is not the first installation, the installation angle is already in the Flash, and the Status value is 1. After the vehicle drives for about 3 minutes again, after the inertial navigation training is completed, the Status becomes 2 ; at this time, the acceleration and angular velocity values are reliable values.

Note **3** : The unit of angular velocity is radians per second. If you want to convert it to degrees per second, please multiply it by the factor 180/3.14;

Table I SPEED protocol 13 fields UBI_State_Kind and UBI_State_Kind physical meaning

UBI_State_Kind [1]	Status meaning	**UBI_State_Value [2]**	Data source [3]	default value	unit

0	Normal driving status	0			
1	Normal acceleration state	YZ_Acce_Peta	BS_Acce_Peta/10.0	1.2	m/s/s
2	Rapid acceleration state	YZ_Acce_Deta	BS_Acce_Deta/10.0	1.6	m/s/s
3	Normal deceleration state	YZ_Dcce_Peta	BS_Dcce_Peta/10.0	-2.2	m/s/s
4	Rapid deceleration state	YZ_Dcce_Deta	BS_Dcce_Deta/10.0	-3.2	m/s/s
5	Emergency Road Status	YZ_Lane_Deta	BJ_Y_Lane_Deta/10.0	1.2	m/s/s
6	Normal turning state	YZ_Rate_Peta	BS_Turn_Deta/10.0	2.2	d/s
7	Sharp turn state	YZ_Rate_Deta	BS_Turn_Deta*4/10.0	8.8	d/s
8	Abnormal posture	YZ_Atti_Deta	BJ_Att_Min_D	10	d

Note 1 :

(1) UBI_State_Kind value is 1, 2, 3, or 4 , the state is obtained based on the comparison between the longitudinal acceleration and the UBI_State_Value

threshold value;

(2) UBI_State_Kind value is 5 , the state is obtained based on the comparison between the horizontal axis acceleration and the UBI_State_Value threshold value;

(3) UBI_State_Kind value is 6 or 7 , the state is obtained by comparing the vertical axis angular velocity with the UBI_State_Value threshold value;

(4) UBI_State_Kind value is 8 , the state is obtained based on the comparison between the pitch angle and the roll angle and the UBI_State_Value threshold value;

Note 2 :

1 UBI_State_Value is the same acceleration unit as SPEED , but the angular velocity threshold and SPEED units are different;

Note 3 :

(1) The data source of UBI_State_Value is determined by Table D and Table F. Users can modify it through communication rules. In other words, different thresholds can be set according to different vehicle models in the future.

7 ALL

$GPATT,0.000,p,0.000,r,0.000,y,20190830,s,0043001E5005434E38562036,ID,1,INS,406,02,00,3,B,B,1,1,99,1,F,0,1

,0,0.000,0000,0,00,00*64

$GNRMC,024850.00,A,3116.79750,N,12127.23841,E,0.00,7.640,301120,0.000,0,A*63

$GNGGA,024850.00,3116.79750,N,12127.23841,E,1,12,1.02,60.10,M,31.49,M,0.00,0000*6D

$SPEED,024850.00,0.000,0,A,-0.01,0.018,-9.18,G,0.003,S,0,0,0.000*05

$DEBUG,1,1,0,0.000,0.000,0,0,00,0,0,0,0,0,0,0,0,0,0,0,0,0*43
$SPEED,024850.10,0.000,0,A,-0.01,0.016,-9.19,G,0.004,S,0,0,0.000*5F
$SPEED,024850.20,0.000,0,A,-0.01,0.009,-9.18,G,0.003,S,0,0,0.000*5F
$SPEED,024850.30,0.000,0,A,-0.01,0.018,-9.18,G,0.003,S,0,0,0.000*5F
$SPEED,024850.40,0.000,0,A,-0.01,0.028,-9.18,G,0.004,S,0,0,0.000*5F
$SPEED,024850.50,0.000,0,A,-0.01,0.009,-9.18,G,0.004,S,0,0,0.000*5F
$SPEED,024850.60,0.000,0,A,-0.01,0.009,-9.18,G,0.004,S,0,0,0.000*5F
$SPEED,024850.70,0.000,0,A,-0.00,0.009,-9.18,G,0.003,S,0,0,0.000*5F
$SPEED,024850.80,0.000,0,A,-0.01,0.025,-9.19,G,0.004,S,0,0,0.000*5F
$SPEED,024850.90,0.000,0,A,-0.01,0.001,-9.21,G,0.004,S,0,0,0.000*5F