AIR530 GPS Module User Manual

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Produced by: Https://Securethings.Uk

Contents

1. Introduction

Air530 module is a high-performance, highly integrated multi-mode satellite positioning and navigation module. Small size, low power consumption, can be used for vehicle navigation
Navigation, smart wear, drones and other GNSS positioning applications. Moreover, it provides software and hardware interfaces compatible with other module manufacturers. This greatly reduces the user's development cycle. The module supports GPS/Beidou/GLONASS/Galileo/QZSS/SBAS. Adopt the integrated design of radio frequency baseband, integrate DC/DC, LDO, LNA, RF front-end, baseband processing, 32-bit RISC CPU, RAM, FLASH storage, RTC and power supply Management and other functions. Provide ultra-high performance, even in weak signal places, it can quickly and accurately locate.

2. Module performance:

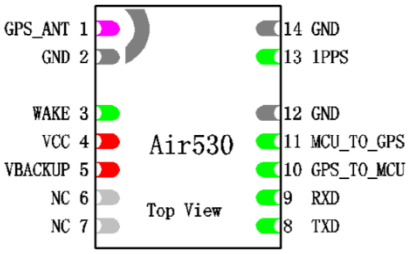
Category	Index item	Typical value	Unit
Positioning time [Test	Pure hardware cold start	27.5	s

condition 1]	Pure hardware hot start	<1	s
	Pure hardware recapture	<1	s
	Software-assisted A-GNSS (second positioning)	<5	s
Sensitivity [Test condition 2]	Cold start	-148	dBm
	Hot Start	-162	dBm
	Recapture	-164	dBm
	track	-166	dBm
Precision [Test condition 3]	Horizontal positioning accuracy	2.5	m
	High positioning accuracy	3.5	m
	Speed accuracy	0.1	m/s
	Timing accuracy	30	ns
Power consumption [Test condition 4]	Capture current value @3.3v	42.6	mA
	Tracking current value @3.3v	36.7	mA
	Low power mode @3.3V (Send command: $PGKC051,0)	0.85	mA
	Ultra-low power consumption mode @3.3V (Send command: $PGKC105,4)	31	nA
Environment	Operating temperature	-35℃- 85℃	
	Storage temperature	-55℃- 100℃	
	humidity	5%-95%	

Note: The above result is GPS/Beidou dual mode working mode
[Test Condition 1]: The number of receiving satellites is greater than 6, the signal strength of all satellites is -130dBm, and the average value is taken after 10 tests, and the positioning error is less than 10 meters.
[Test condition 2]: The external LNA has a noise figure of 0.8, the number of receiving satellites is greater than 6, and the received signal strength value is locked within five minutes or without losing lock.
[Test condition 3]: Open and unobstructed environment, 24 hours continuous power-on test, 50% CEP.
[Test condition 4]: The number of receiving satellites is greater than 6, and the signal strength of all satellites is -130dBm.

3. Module pin assignment:

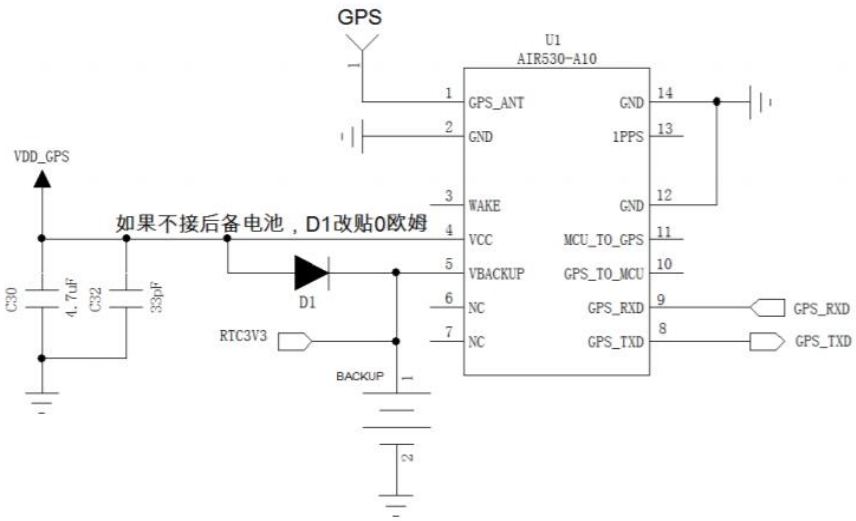
The following is the pinout of the device.



Pin No	Pin Definition	Pin description
1	GPS_ANT	GPS antenna input
2	GND	Ground
3	WAKE	Input, high effective (2.8V), when the module enters ultra-low power consumption mode, only Wake up the module by pulling up WAKE
4	VCC	Main power supply, 2.8V-4.2V
5	VBACKUP	If you want to support hot start, VBACKUP must be maintained when the module is shut down The voltage range of the backup battery is 2.8V-3.3V,

		VBACKUP must have power supply, otherwise the module will not work; If the backup battery is not connected, please connect VBACKUP and VCC together;
6	NC	Reserved pins, can be left floating
7	NC	Reserved pins, can be left floating
8	TXD	Serial port TX (2.8V), output GPS NMEA0183 data, The default baud rate is 9600bps
9	RXD	Serial RX (2.8V)
10	GPS_TO_MCU	Reserved pins, can be left floating
11	MCU_TO_GPS	Reserved pins, can be left floating
12	GND	Ground
13	1PPS	One pulse per second (2.8V)
14	GND	Ground

4. Reference design circuit:



4.1 Design considerations

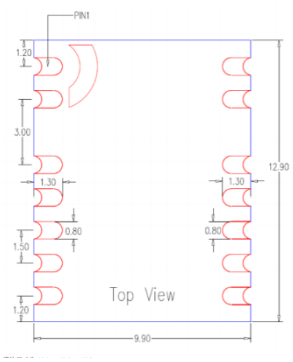
1. The VCC supply voltage range is 2.8-4.2V, and the VBACKUP supply voltage range is 2.8-3.3V. If you want to support GPS hot start when the VCC power supply is turned off, the VBACKUP must always be supplied with power.
2. Place the module as close as possible to the GPS antenna, keep the antenna trace at 50ohm impedance matching, and keep the trace as short as possible to avoid acute angles.
3. It is recommended to use a ceramic antenna with a size of 25*25*4mm for the GPS antenna.
4. The serial port TXD and RXD are 2.8V TTL level. If connected to a PC, RS232 level conversion is required. Users can use this serial port to receive positioning information data and software upgrades
5. This module is a temperature-sensitive device, and drastic temperature changes will cause its performance to decrease. Try to stay away from high-temperature airflow and high-power during use. Heating device.

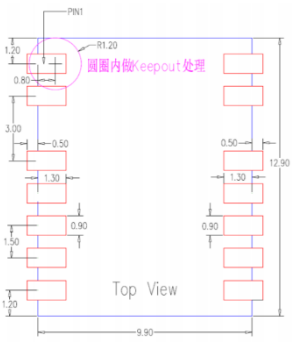
4.2 GPS antenna

GPS antennas can be selected as passive antennas or active antennas according to needs. Active antennas are more effective than passive antennas, but the cost is high.
1. Passive antenna: If a passive antenna is used, it is recommended that the trace between the antenna and the module be as short as possible. The most ideal situation is that the GPS module is directly placed Place it on the back of the antenna so that there is zero distance between the antenna pad of the module and the GPS antenna feed point, as shown in the following figure:

2. Active antenna: When using an active antenna, pay attention to the power supply voltage range of the active antenna. If the power supply of the active antenna is shared with the power supply of the module For a power supply, a 47nH inductor needs to be connected in series, and a 1000pF capacitor is connected in parallel near the antenna. There is no need to add an external DC blocking capacitor.
The reference circuit is as follows:

5. Module recommended PCB package size diagram





In order to facilitate the soldering of the stamp hole, the stamp hole pad needs to be extended by at least 0.5mm, so the package size of the module is recommended to be 12.9mm*10.9mm*2.3mm; Please go to Luat Technical Support Forum to download the module package:
http://bbs.openluat.com/forum.php?mod=viewthread&tid=2615&extra=page%3D1

6. NMEA0183 Data protocol

The AIR530 module supports the NMEA 0183 V4.1 protocol and is compatible with previous versions. For more information about NMEA 0183 V4.1, please refer to NMEA 0183 V4.1 official document.

6.1 NMEA 0183 in brief

GGA: Time, location, number of satellites
GLL: Longitude, latitude, UTC time
GSA: GPS receiver operating mode, satellites used for positioning, DOP value, positioning status
GSV: Visible GPS satellite information, elevation angle, azimuth angle, signal-to-noise ratio
RMC: Time, date, location, speed
VTG: Ground speed information

6.2 Goke NMEA command

Air530 has customized some commands to control cold, hot, warm start and satellite positioning mode, etc., you can send commands directly through the serial port. To control the module, the command format is as follows:

1. Start command
   System hot start command: $PGKC030,1,1*2C<CR><LF>
   System warm start command: $PGKC030,2,1*2F<CR><LF>
   System cold start command: $PGKC030,3,1*2E<CR><LF>
   System reset cold start: $PGKC030,4,1*29<CR><LF>
2. Satellite positioning mode setting
   Single GPS: $PGKC115,1,0,0,0*2B<CR><LF>
   GPS+BEIDOU: $PGKC115,1,0,1,0*2A<CR><LF>

GPS+GLONASS: $PGKC115,1,1,0,0*2A<CR><LF>
GPS+GALILEO: $PGKC115,1,0,0,1*2A<CR><LF>

6.3 GKC interface data format

The GKC interface is the interface for interaction between the user system and the Air530. The command format is as follows and the CheckSum, this can be calculated by https://nmeachecksum.eqth.net/ . The command format is as follows:

$PGKC Command Arguments,*, CheckSum ,CR, LF

The command number sent is made up of an "Arguments" that Indicates the parameters needed to send the command. There can be multiple parameters. Different commands correspond to different data and refer to the following for specific values. The * indicated the end of the data. The CheckSum: Check data of the entire command the is followed by CR, LF: e.g. Sample data: $PGKC030,3,1*2E <CR><LF>

7. GKC commands

7.1. Command: 001

Reply message, respond to the message processing result sent by the other party
Arguments:
Arg1: The command of the message that this message answers.
Arg2: "1", the received message is not supported
"2", valid message, but incorrect execution
"3", valid message, and executed correctly
Example:
$PGKC001,101,3*2D<CR><LF>

7.2 Command: 030

System restart command
Arguments:
Arg1: "1", hot start
"2", warm start
"3", cold start
Arg2: "1", software restart
Example:
$PGKC030,1,1*2C<CR><LF>

7.3 Command: 040

Erase auxiliary positioning data in flash
Arguments: no
Example: $PGKC040*2B<CR><LF>

7.4 Command: 051

Enter standby low power consumption mode
Arguments: Arg1: "0", stop mode "1", sleep mode
Example: $PGKC051,1*36<CR><LF>

7.5Command: 101

Configure the interval for outputting NMEA messages (in mS)
Arguments: Arg1: 200-10000
Example: $PGKC101,1000*02<CR><LF>

7.6 Command: 105

Enter periodic low power mode
Arguments:
Arg1:

"0", normal operation mode
"1", cycle ultra-low power tracking mode, need to pull up WAKE to wake up
"2", periodic low power consumption mode
"4", directly enter the ultra-low power tracking mode, need to pull up WAKE to wake up
"8", automatic low power consumption mode, can wake up via serial port
"9", automatic ultra-low power tracking mode, need to pull up WAKE to wake up

Arg2: running time (milliseconds), this parameter works in the periodic mode where Arg1 is 1, 2
Arg3: Sleep time (milliseconds), this parameter works in the periodic mode where Arg1 is 1, 2
Example: $PGKC105,8*3F<CR><LF>

7.7 Command: 113

Enable or disable QZSS NMEA format output
Arguments: Arg1: "0", close "1", turn on
Example: $PGKC113,1*31<CR><LF>

7.8 Command: 114

Turn QZSS function on or off
Arguments: Arg1: "0", turn on "1", close
Example: $PGKC114,0*37<CR><LF>

7.9 Command: 115

It is noted that this command when tested did not behave as the manufactures specification and failed to Generate "GA" messages when used as a single setting or combined with GPS to detect **GALILEO GNSS and from testing this is a function that does not work.** This is does not comply with the setting process**. It is also worth noting that the Air530 can only support 2 GNSS system and not 4 as expected**. So, based on testing for Europe then the settings that give the most satellites visible and hence accuracy, is with GPS and GLONASS set for the search mode.
Arguments:

Arg1: "1", GPS on
"0", GPS off
Arg2: "1", Glonass on
"0", Glonass off
Arg3: "1", Beidou on
"0", Beidou off
Arg4: "1", Galileo on

"0", Galileo off
Example: $PGKC115,1,0,0,0*2B<CR><LF>

7.10 Command: 147

Set NMEA output baud rate
Arguments:
Arg1: 9600, 19200, 38400, 57600, 115200...921600.
Example: $PGKC147,115200*06<CR><LF>
Or: $PGKC147,57600*35<CR><LF>

7.11 Command: 149

Set NMEA serial port parameters
Arguments:
Arg1: "0", NMEA data "1", Binary data
Arg2: 9600, 19200, 38400, 57600, 115200...921600.
Example: $PGKC149,0,38400*2C<CR><LF>

7.12 Command: 161

PPS settings
Arguments:
Arg1: "0", turn off PPS output
"1", the first fix
"2", 3D fix
"3", 2D/3D fix
"4", always on
Arg2: PPS pulse width (mS)
Requires less than 999
Arg3: PPS period (mS) Requires greater than PPS pulse width
Example: $PGKC161,2,500,1000*
2E<CR><LF>

7.13 Command: 201

Query the interval of NMEA messages
Arguments:
no
Example:
$PGKC201*2C<CR><LF>

7.14 Command: 202

Return interval of NMEA message (response to 201 command)
Arguments:
no
Example:
$PGKC202,1000,0,0,0,0*02<CR><LF>

7.15 Command: 239

Turn SBAS function on or off
Arguments:
Arg1: "0", turn on "1", close
Example: $PGKC239,1*3A<CR><LF>

7.16 Command: 240

Query whether SBAS is enabled
Arguments: no
Example: $PGKC240*29<CR><LF>

7.17 Command: 241

Return whether SBAS is enabled (response 240 command)
Arguments:
Arg1: "0", close "1", open
Example: $PGKC241,1*35<CR><LF>

7.18 Command: 242

Set NMEA sentence output enable
Arguments:

Arg1: GLL "0", close; "1", open
Arg2: RMC "0", close; "1", open
Arg3: VTG "0", close; "1", open
Arg4: GGA "0", close; "1", open
Arg5: GSA "0", close; "1", open
Arg6: GSV "0", close; "1", open
Arg7: GRS "0", close; "1", open
Arg8: GST "0", close; "1", open
Arg9~ Arg19: reserved

Example: $PGKC242,1,1,1,1,1,1,1,0,0,0,0,0,0,0,0,0,0,0,0,0*37 <CR><LF>

7.19 Command: 243

Query output frequency of NMEA sentences
Arguments: no
Example: $PGKC243*2A<CR><LF>

7.20 Command: 244

Returns the output frequency of NMEA sentences (response to the 243 command)
Arguments: Args: Refer to 242 command
Example: $PGKC244,1,1,1,1,1,1,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0*31<CR><LF>

7.21 Command: 278

Set RTC time
Arguments:

Arg1: year
Arg2: Month, 1~12
Arg3: day, 1~31
Arg4: Hour, 0~23
Arg5: minutes, 0~59
Arg6: seconds, 0~59

Example: $PGKC278,2017,3,15,12,0,0*12<CR><LF>

7.22 Command: 279

Query RTC time
Arguments: no
Example: $PGKC279*23<CR><LF>

7.23 Command: 280

Returns the output frequency of NMEA sentences (response to the 243 command)
Arguments: Args: Refer to the 278 command
Example: $PGKC280,2017,3,15,12,0,0*15<CR><LF>

7.24 Command: 284

Set the speed threshold, when the speed is lower than the threshold, the output speed is 0
Arguments: Arg1: Threshold
Example: $PGKC284,0.5*26<CR><LF>

7.25 Command: 356

Set the HDOP threshold, when the actual HDOP is greater than the threshold, no positioning
Arguments: Arg1: Threshold
Example: $PGKC356,0.7*2A<CR><LF>

7.26 Command: 357

Get HDOP threshold
Arguments: no
Example: $PGKC357*2E<CR><LF>

7.27 Command: 462

Query the version number of the current software
Arguments: no
Example: $PGKC462*2F<CR><LF>

7.28 Command: 463

Return the version number of the current software (response to 462 command)
Arguments: no
Example: $PGKC463,GOKE9501_1.3_17101100*22<CR><LF>

7.29 Command: 639

Set approximate location information and time information to speed up positioning
Arguments:

Arg1: Latitude, for example: 28.166450
Arg2: Longitude, for example: 120.389700
Arg3: height, for example: 0
Arg4: year
Arg5: month
Arg6: day
Arg7: When the time is UTC time
Arg8: points
Arg9: seconds

Example: $PGKC639,28.166450,120.389700,0,2017,3,15,12,0,0*33<CR><LF>

8. Support NMEA0183 protocol

Air530 supports the NMEA0183 V4.1 protocol and is compatible with previous versions. The detailed information about NMEA0183 V4.1 from the official document. Common output formats are as follows:

- GGA: time, location, number of satellites
- GSA: GPS receiver operating mode, satellites used for positioning, DOP value, positioning status
- GSV: visible GPS satellite information, elevation angle, azimuth angle, signal-to-noise ratio
- RMC: time, date, location, speed
- VTG: Ground speed information

Statement Identifier Meaning:

- BD BDS, Beidou Second Generation Satellite System
- GP GPS
- GL GLONASS
- GA Galileo
- GN GNSS, Global Navigation Satellite System

8.1 GGA

$--GGA,hhmmss.ss,llll.ll,a,yyyyy.yy,a,x,xx,xx,xx,M,xx,M,xx,xxxx*hh

Sample data: $GPGGA,065545.789,2109.9551,N,12023.4047,E,1,9,0.85,18.1,M,8.0,M,,*5E

Name	Sample unit	Units	description
Message ID	$GPGGA		GGA protocol header
UTC time	065545.789		hhmmss.sss
Latitude	2109.9551		ddmm.mmmm
N/S indication	N		N=North, S=South
Longitude	12023.4047		dddmm.mmmm
E/W indication	E		W=West, E=East
Positioning instructions	1		0: not positioned 1 1: SPS mode, positioning is valid 2: Differential, SPS mode, positioning is valid 3: PPS mode, positioning is valid
Number of satellites	9		Range 0 to 12 (Seams to go over this limit)
HDOP	0.85		Horizontal accuracy
Mean Sea Level	18.1	M	Earth is -2.2 M

Differential time	8.0	s	When there is no DGPS, invalid
Differential ID	0000		If DGPS used
Checksum	* 5E		Calculated with an NEMA check sum calculator
<CR><LF>			End of message

8.2 GSA

Sample form $--GSA,a,a,x,x,x,x,x,x,x,x,x,x,x,x,x,x,xx,xx,xx*hh

Sample data: $GPGSA,A,3,10,24,12,32,25,21,15,20,31,,,,1.25,0.85,0.91*04

Name	Sample	Unit	Description
Message ID	$GPGS	GSA protocol header	
Mode 1	A		M=Manual, forced in 2D or 3D mode A=Auto
Mode 2	3		1: Invalid positioning 2: 2D positioning 3: 3D positioning
Satellite use	10		Channel 1
Satellite use	24		Channel 2
Satellite use	12		Channel 3
Satellite use	32		Channel 4
Satellite use	25		Channel 5
Satellite use	21		Channel 6
Satellite use	15		Channel 7
Satellite use	20		Channel 8
,,,	,,,	,,,	,,,
Satellite use			Channel 12
PDOP	1.25		Position accuracy
HDOP	0.85		Horizontal accuracy

VDOP	0.91		Vertical accuracy
Checksum	*04		
<CR><LF>			End of message

8.3 GSV

Format $--GSV,x,x,x,x,x,x,x,...*hh

Sample data:

$GPGSV,3,1,12,14,75,001,31,32,67,111,38,31,57,331,33,26,47,221,20*73
$GPGSV,3,2,12,25,38,041,29,29,30,097,32,193,26,176,35,22,23,301,30*47
$GPGSV,3,3,12,10,20,185,28,44,20,250,,16,17,217,21,03,14,315,*7D

The following is one lines worth of the GSV data can be up to 4 lines (12 Satellites)

Name	Sample	unit	description
Message ID	$GPGSV		GSV protocol header
Number of messages	3		Range 1 to 3
Message number	1		Range 1 to 3
Number of satellites	12		
Satellite ID	14		Range 1 to 32
Elevation	75	degree	Up to 90°
Azimuth	001	degree	Range 0 to 359°
Carrier to noise ratio (C/No)	31	dBHz	Range 0 to 99, empty when there is no tracking
Satellite ID	32		Range 1 to 32
Elevation	67	degree	Up to 90°
Azimuth	111	degree	Range 0 to 359°
Carrier to noise ratio (C/No)	38	dBHz	Range 0 to 99, empty when there is no tracking

Satellite ID	31		Range 1 to 32
Elevation	57	degree	Up to 90°
Azimuth	331	degree	Range 0 to 359°
Carrier to noise ratio (C/No)	33	dBHz	Range 0 to 99, empty when there is no tracking
Satellite ID	26		Range 1 to 32
Elevation	47	degree	Up to 90°
Azimuth	221	degree	Range 0 to 359°
Carrier to noise ratio (C/No)	20	dBHz	Range 0 to 99, empty when there is no tracking
Checksum	*73		
<CR><LF			> End of message

8.4 RMC

Format: $--RMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,a,xx,xx,xxxx,xx,a*hh

Sample data:
$GPRMC,100646.000,A,3109.9704,N,12123.4219,E,0.257,335.62,291216,,,A*59

name	Sample	unit	description
Message ID	$GPRMC		RMC protocol header
UTC time	100646.000		hhmmss.ss
status	A		A=Data is valid; V=Data is invalid
latitude	2109.9704		ddmm.mmmm
N/S indication	N		N=North, S=South

longitude	11123.4219		dddmm.mmmm
E/W indication	E		W=West, E=East
Ground speed	0.257	Knot (section)	
position	335.62	degree	
date	291216	ddmmyy	
Magnetic variable			
Checksum	*59		
<CR><LF>			End of message

8.5 VTG

Sample Format $--VTG,xx,T,xx,M,xx,N,xx,K*hh

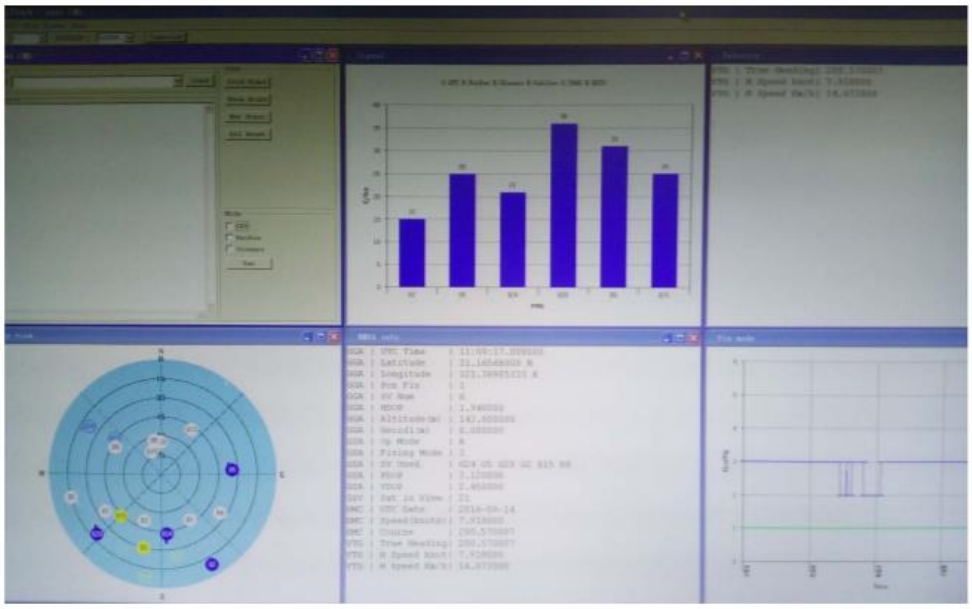
Sample data: $GPVTG,335.62,T,,M,0.257,N,0.477,K,A*38

Name	Sample	Units	description
Message ID	$GPVTG		VTG protocol header
Position	335.62	degree	
Reference	T		True
Position	335.62	degree	reference
Unit	M		Magnetic
Speed	0.257	Knot	
Unit	N		Section
Speed	0.477	Km/h	
Unit	K	Km/h	
Positioning system mode indication:	A		A—Autonomous mode;

			D—Differential mode; E—Estimation (dead reckoning) mode; M—Manual input mode; S—simulator mode; N—The data is invalid.
Checksum	*10		

9. GNSS tool naviTrack

The naviTrack is a GNSS tool specially developed for Air530. It provides users with an easy-to-use, Powerful visual PC-side tools. Other tools such as u-Center and PowerGPS can also be used.



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