FSS-NAV680D

High precision Integrated Navigation system User manual

FORSENSE （SHANGHAI） Technology CO.，LTD

Please read this manual carefully before using this product.

Contents

1. Product overview

1.1 Product List

When you open the packing case, please confirm the products in the packing case:

Name	Quantity	Schematic diagram
①NAV680D Integrated Navigation system	1	
② Satellite antenna	2	
③ Antenna cable Main antenna model :TNC male head to fakra female head (Type C)(Blue) Secondary antenna model :TNC male head to fakra female head (Type D)(purple)	2	
④ Antenna suckers	2	
⑤ antenna column	2	
⑥ Harness (including 3 RS232, 2 CAN, 1 PPS, 1 power interface (9-24V).	1	

Figure 1 Product physical picture

If anything is missing, please contact the sales staff in time

1.2 Product Introduction

FSS-NAV680D is a multi-sensor integrated navigation product launched by Yuan Ji Technology based on the vehicle gauge level IMU platform and the whole system full frequency dual antenna RTK. NAV680D built-in high precision IMU module of the original pole, support external odometer information, and then provide accurate and continuous real-time attitude, speed and position information in urban canyons, tunnel viaducts and other scenes.

Application fields:

Passenger cars, commercial vehicles, engineering vehicles, inspection vehicles and other high-precision scenarios

1.3 Product Features

(1) Built-in full-system full-frequency high-precision RTK board, support BDS B1/B2/B3 +GPS L1/L2/L5+GLONASS L1/L2 +Galileo E1/E5b.

(2) The built-in high precision IMU module of the primary pole provides real-time and accurate attitude/speed/position information through the perfect combination algorithm and spatio-temporal synchronization mechanism.

(3) Support internal storage of log data (2G storage).

(4) Support the recording of RTK original observations and ephemeris.
(5) Support external odometer.

1.4 Product Specifications

1. Performance indicators

RTK indicators	Positioning Accuracy (RMS)	Single point: 1.5mRTK : Level: 1cm+1ppm Elevation: 2cm+1ppm				
	Dual antenna directional accuracy (RMS)	0.1°/1m baseline				
	Velocity Accuracy (RMS)	0.03 m/s				
	PPS Accuracy (RMS)	20ns				
	Renewal rate	20hz				
	RTK initialization time	<5s				
< IMU indicators	Gyro range	±300°/s				
	Zero bias gyroscopic instability	XY:1.6deg/h Z:1.2deg/h				
	Gyro random Walk	XY:0.09 °/√ hr Z:1 °/√ hr				
	Accelerometer range	±6g				
	Accelerometer zero bias instability	0.015 mg				
	Renewal rate	100hz				
	Accelerometer random walk	XYZ: 0.035m /s/√ hr				
Integrated navigation system performance	GNSS outage time	Location precision	Roll over Precision	Pitching Precision	Heading Precision	Speed Precision
		Sigm a (2)	Sigma (2)	Sigma (2)	Sigma (2)	Sigma (2)
	0s	1cm	0.1 °	0.1 °	0.1 °	0.02 m/s
	60s (wheeled speedometer combination)	2.0 ‰	0.15 °	0.15 °	0.15 °	0.1 m/s
Interface	3×RS232 2xCAN					
	1 x LAN network port 2 x GNSS antenna port 1 x power port 1 x PPS interface					

2、 electrical and physical characteristics

Parameters	Symbols	Minimum	Typical value	Max	Units
Power input	V IN	9	12	32	V
Power source	GND				
Power consumption	P	1.5	2	2.5	W
Service temperature	T	-40	\	85	℃
Storage temperature	T	-40	\	95	℃
Humidity	95% non-condensation				
Level of protection	IP67				
Size	116 * 85.9 * 32 mm				
Weight	263g				

Note: The receiver is IP67 waterproof and dust-proof design, but the connection between the power supply is not waterproof. If water is sprayed, short circuit may occur. If the use environment is humid, please shield the power supply interface.

1.5 Structure and size

The size specifications are shown below

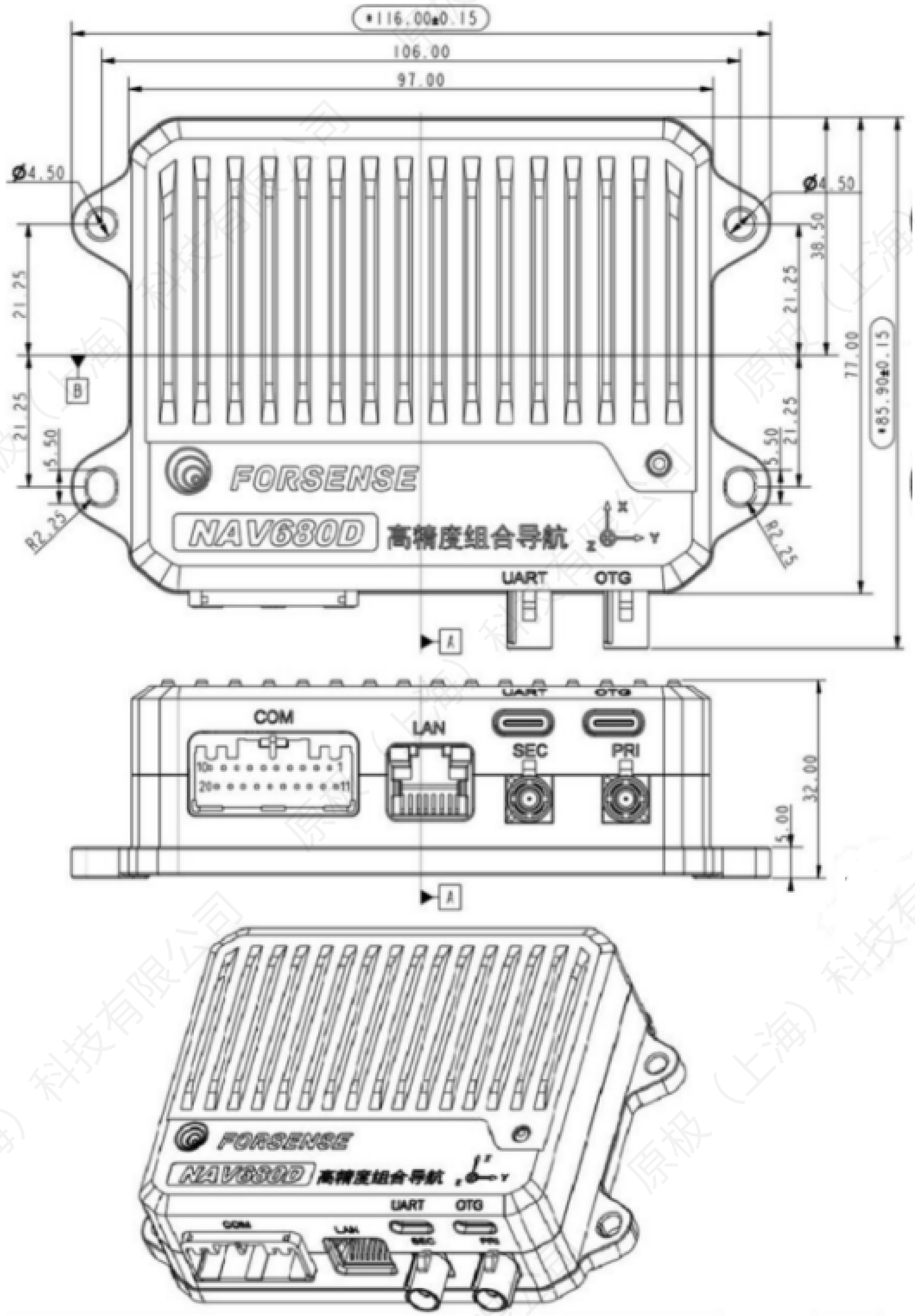


Figure 2 NAV680D size specification diagram

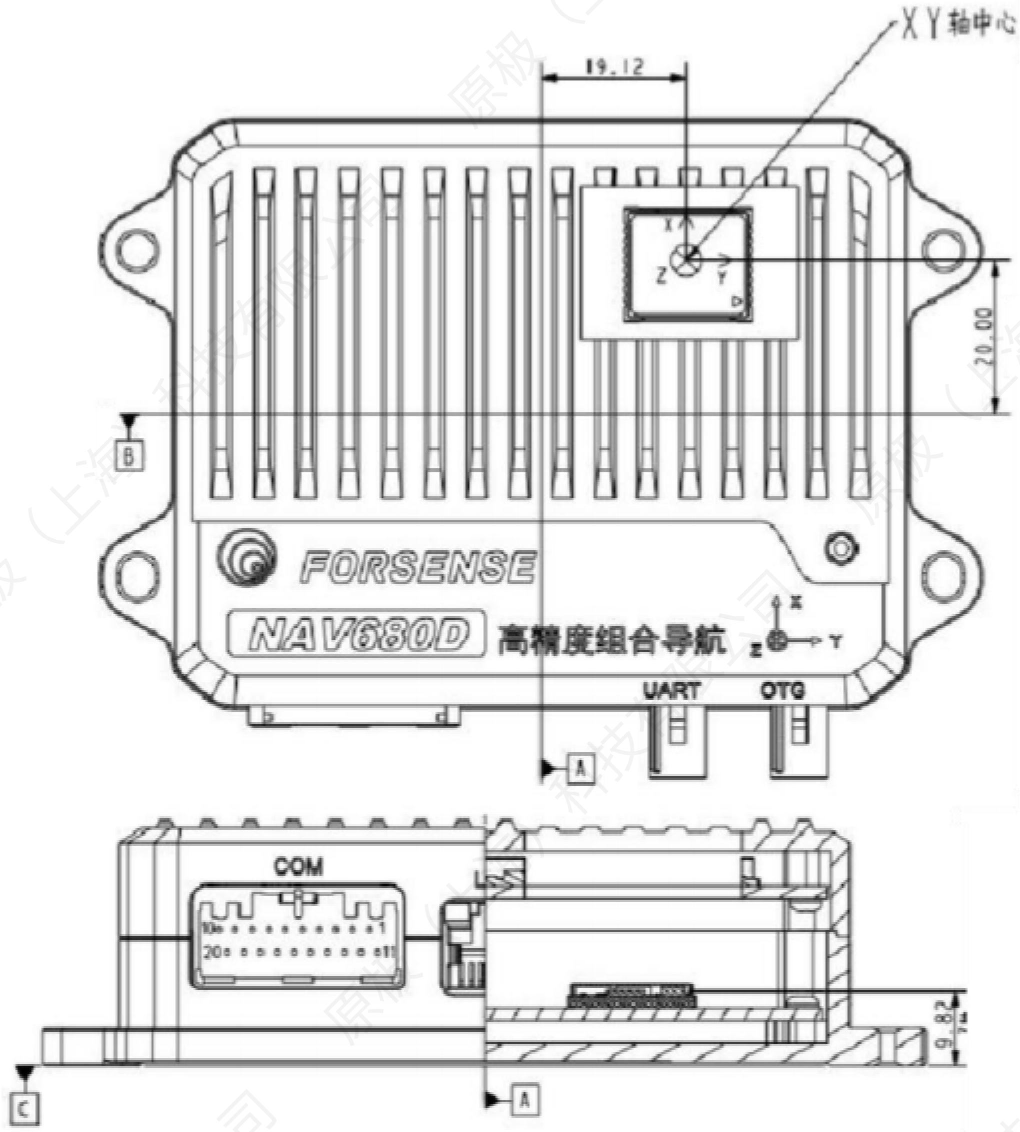


Figure 3 NAV680DXYZ phase center diagram

1.6 Connector and PIN Pin Definitions

1.6.1 User Interface

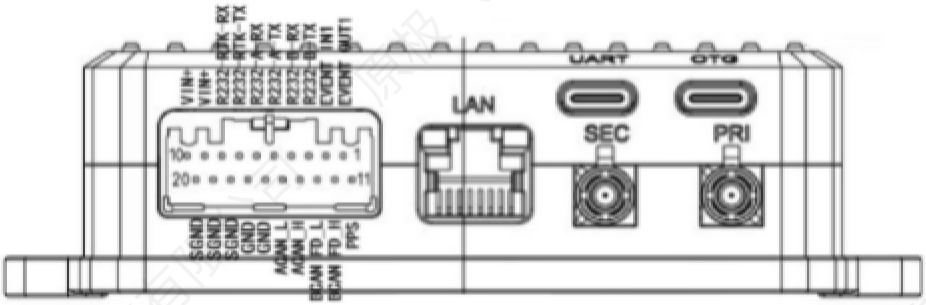


Figure 4 Schematic diagram of the NAV680D front panel

The NAV680D front panel has six ports, which are COM port, LAN port, UART port, SEC port, OTG port and PRI port from left to right.

COM: One power port, three RS232 ports, two CAN ports, and one PPS port;

LAN: network port;

UART: connection type-c;

SEC: connect the secondary antenna;

OTG: connect type-c;

PRI: connects the main antenna.

The physical image is below, front view:

Figure 5 Front view of the product Above the front view are six ports of NAV680D.	Figure 6 Top view of the product In the top view, the front side is marked with the product name NAV680D and the X, Y and Z coordinate axes.

1.6.2 Data line interface definition

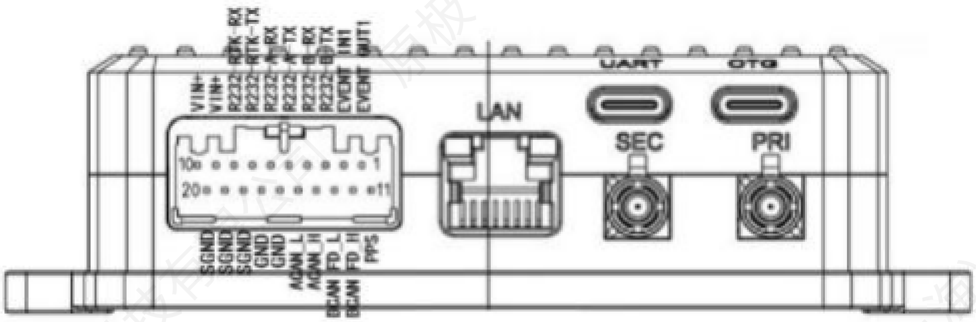


Figure 7 Data line interface definition diagram

Corresponding pins are defined as follows

PIN order	Definition	Ports
1	EVENT OUT1	IO port (reserved)
2	EVENT IN1	
3	MCU TX3 232	R232-B
4	MCU RX3 232	
5	MCU TX2 232	R232-A
6	MCU RX2 232	
7	RTK TX1 232	R232-RTK
8	RTK RX1 232	
9	VIN+	Power supply positive 9-24V
10	VIN+	Power supply positive 9-24V
11	PPS	RTK second pulse signal
12	BCAN FD_H	CAN_FD B (reserved)
13	BCAN FD_L	
14	ACAN_H	CAN_A (500k, mode Motorola, input wheel speed, gear, etc signals)
15	ACAN_L	
16	GND	Power ground (negative power source)
17	GND	
18	SGND	Signalland
19	SGND	
20	SGND	

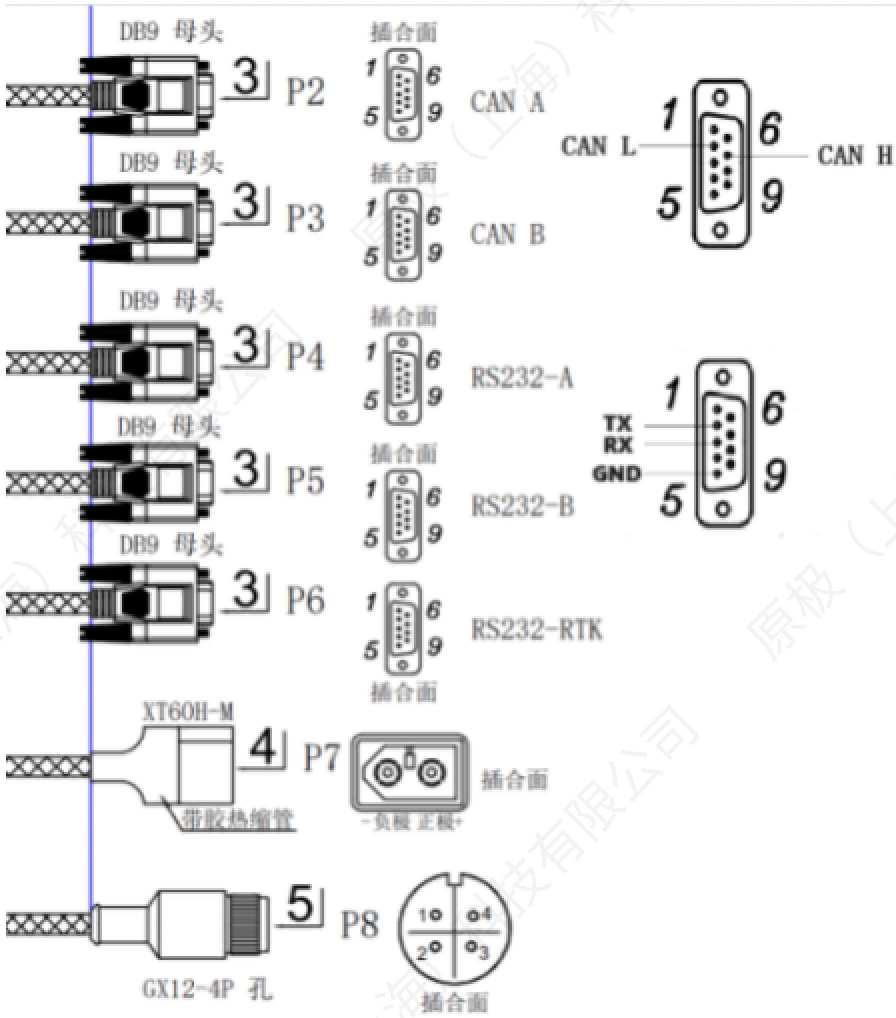


Figure 18 Harness definition

The description of each interface of the harness:

P2: CAN A interface: the default baud rate is 500k, input vehicle (wheel speed, gear, etc.) signal, mode Motorola, output CAN protocol data

P3: CAN FD B interface: reserved

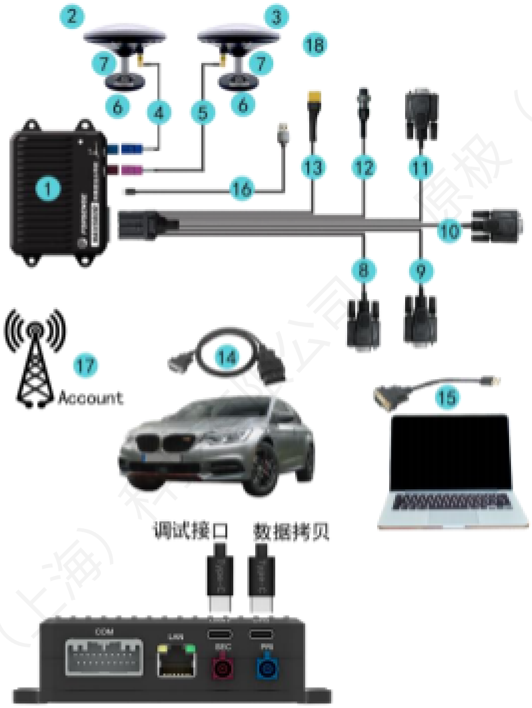
P4: RS232-A interface: The default baud rate is 460800, Parameter can be configured using AT instruction, and the output nmea protocol

P5: RS232-B interface: The default baud rate is 460800. It can be connected to the Upper computer software and configured Parameter by using the AT command to output the integrated navigation binary protocol

P6: RS232-RTK interface: the default baud rate is 115200, filling differential data to upgrade the guide module

P7: Power interface: 9-32V power supply

P8: PPS interface: Output PPS pulses, triggered by rising edge by default, with a amplitude of 3.3V and a period of 1S



	名称	数量
1	NAV680-D组合导航系统	1个
2	主天线（定位天线）	1个
3	副天线（定位天线）	1个
4	主天线连接线	1个
5	副天线连接线	1个
6	天线吸盘	2个
7	天线柱	2个
8	集线束-RS232-A接口	1个
9	集线束-RS232-B接口	1个
10	集线束-CAN A接口	1个
11	集线束-CAN B接口	1个
12	集线束-IO接口	1个
13	集线束-电源接口	1个
	附件名称	数量
14	OBD转DB9线	1根
15	RS232串口线	1根
16	Type-C线	1根
17	RTK服务账号	客户端采购
18	电源线束	客户端制作

Figure 7 Physical connection diagram

2. Basic usage example

This chapter provides basic usage examples of 680D. Follow the sequence of operations in this chapter to quickly build a use environment

2.1 Device Installation

2.1.1 Antenna Installation

1. Installation requirements

1) Single antenna installation. It needs to be installed on a carrier and connected to the integrated navigation, the satellite antenna is in the air and the carrier has no obstruction to the antenna. The antenna is connected to the PRI interface as shown in Figure 21 for positioning, and the installation diagram is shown in Figure 19;

2) Double antenna installation. To use the dual-antenna orientation function, you need to install two antennas (primary and secondary antennas) on the carrier and connect the integrated navigation, the satellite antenna is to air and the carrier has no obstruction to the antenna, the primary antenna is connected to PRI for positioning, and the secondary antenna is connected to the SEC interface as shown in Figure 21 for orientation. The distance between the two antennas, that is, the baseline length, should be greater than 0.5m. The height of the two antennas should be consistent as far as possible, as shown in FIG. 20;

3) Away from interference sources such as vehicle electrical devices or systems that can produce electromagnetic interference signals;

4) the GNSS antenna is screwed on the strong magnetic chuck and fixed in the center of the test carrier, and it is placed in the highest place of the test carrier as far as possible to ensure that it can receive a good GNSS signal;

5) In order to obtain the best performance, the distance between the main GNSS antenna and the equipment host should be minimized, especially the horizontal distance.

2) Installation schematic diagram

	
Figure 8 Single antenna installation diagram	Figure 9 Dual antenna installation diagram

2.1.2 Device installation

1. Installation requirements

1) The installation surface of the product should be flat, and rigidly connected with the car body, horizontal installation, can not easily loose or shake;

2) The installation position should be far away from the vibration source, such as the engine, air conditioning compressor, etc.;

3) Product installation should avoid electromagnetic interference (EMI) equipment, such as motors, cameras, etc., to reduce electromagnetic interference;

4) Fixing suggestions: use bolts and nuts for fixing, and do not disassemble and move the product after installation and calibration, if it moves, it needs to be re-installed and calibrated.

2. Installation schematic diagram

The coordinate system surface marked on the host nameplate is parallel to the datum plane of the carrier to be measured as far as possible, and the X-axis is parallel to the central axis of the forward direction of the carrier. The installation diagram is as follows, where X points to the front direction is positive, Y points to the right side of the body is positive, and Z points to the center of the earth is positive.

FIG. 10 Schematic diagram of the main engine

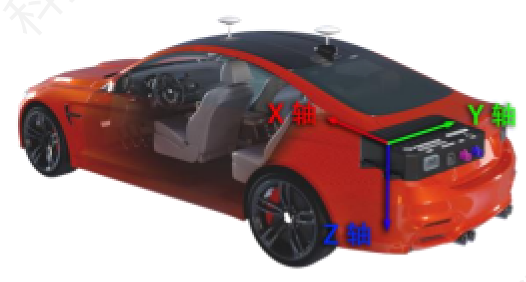


Figure 11 Schematic diagram of coordinate system

2.1.3 Disassembly requirements

1. When installing the antenna feeder interface, insert the terminal in parallel, and install it in place when the clip releases a "click".

2. When removing the antenna feeder interface, press the position in the red box as shown in the figure, and then pull out the terminal in parallel.

Figure 24 Schematic diagram of removing and inserting the antenna feeder

2.2 Download on Upper computer software

Upper computer software software download address:

https://data.forsense-imu.com/page/download.html

Figure 2 shows the NAV680D Upper computer software software. There is no need to install it. You can use it by double-clicking it and connecting the COM B.

FIG. 4 Software diagram of Upper computer software

2.3 Acquisition of differential data

This product supports external direct injection of differential data through RTK-232 COM, and also supports connecting computer or router through LAN network port to access the Internet. After configuring differential account information and IP address information, the built-in NTRIP program directly obtains differential data through the Internet.

2.3.1 Connecting the computer or router through the LAN network port to access the Internet to obtain differential data

Note: Currently only static ids are supported

Configure the differential account information and IP, connect the OTG interface using TYEP-C, and find the update folder

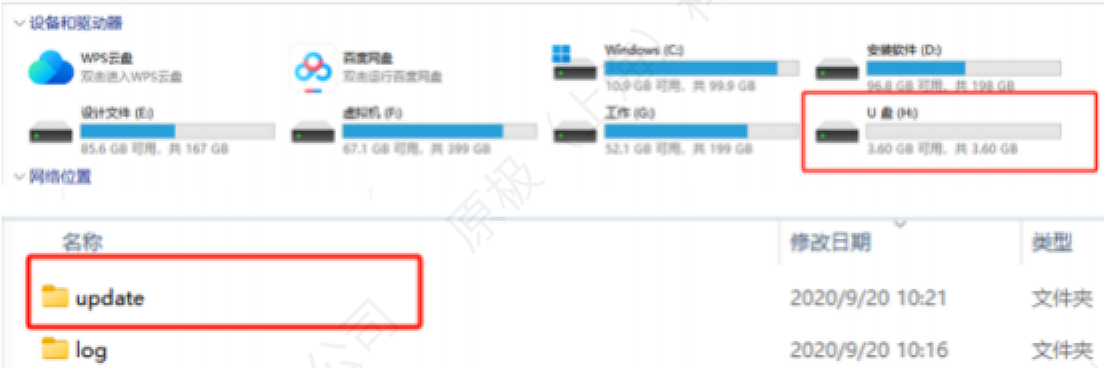


Figure 34 update folder

Open the config.ini file

Figure 35 config.ini file

Configure the following information

Figure 36 Configuration information

Save the configuration and wait for 30s to restart NAV680D. The modification of differential account and IP address takes effect.

2.3.2 Differential data is directly imported from the outside

Use DTU or computer or other devices through RTK-232 COM input differential data, the default baud rate 115200, COM default output GNGGA statements.

2.4 Parameter Configuration

You need to set Parameter when using the NAV680D for the first time.

The following parameters are required for Parameter configuration:

1. Main mast arm, rear axle center rod arm
2. Dual antenna installation Angle (must be configured when Dual antenna is used),

3. Low speed mode (suitable for carrier with maximum speed not exceeding 20KM/H),

4. Smooth mode (depending on the requirements of the control system, for example, when exiting the tunnel, the track needs to be quickly to the correct position, then do not open, and the track needs to be smooth to the correct position, then open)

5. Dual antenna (checked to turn on the full fusion Dual antenna, suitable for low speed carrier, off only use the Dual antenna heading at rest)

1, the equipment, antenna, differential data, etc. are normally installed and configured.

2. Open the NAV680D Upper computer software, on the IMU setting page of Upper computer software Parameter setting, click refresh and fill in the corresponding Parameter. After clicking the setting, there will be a pop-up window, click OK and then click refresh to confirm that the entered Parameter is correct, power off and restart after confirmation, and reconnect the Upper computer software.

Figure 27 Parameter configuration page

2.4.1 Parameter Measurement

2.4.1.1 Main mast arm measurement

The Parameter of the main mast arm is a three-position vector (x,y,z) of the phase center of the main antenna relative to the center of the device, in meters.
Measure the distance from the center of the antenna to the center of the equipment along the X/Y/Z axis of the whole system coordinate system, and get three values of X1 Offset/Y1 Offset/Z1 Offset, paying attention to the positive and negative.
If the RTK main antenna is in front of the device, the number is positive, otherwise it is negative;
If the RTK main antenna is on the right side of the device, the number is positive, otherwise it is negative;
If the RTK main antenna is above the device, it is a **negative number**, otherwise it is a positive number (generally the antenna is above the device).

The coordinate system diagram is as follows

Figure 26 Diagram of coordinate system

2.4.1.2 Measuring the center of the device relative to the rear axis

The center rod arm of the device-rear axle is measured in the same way as the main antenna rod arm, and the three-vector distance (x,y,z) from the center of the rear axle of the vehicle to the center of the equipment is measured, in meters.

If the center of the rear axle is in front of the equipment, the number is positive, otherwise it is negative;

If the center of the rear wheel shaft is on the right side of the device, it is positive, otherwise it is negative;

If the center of the rear axle is above the equipment, it is positive, otherwise it is negative (generally the center of the rear axle is below the equipment).

The coordinate system diagram is as follows

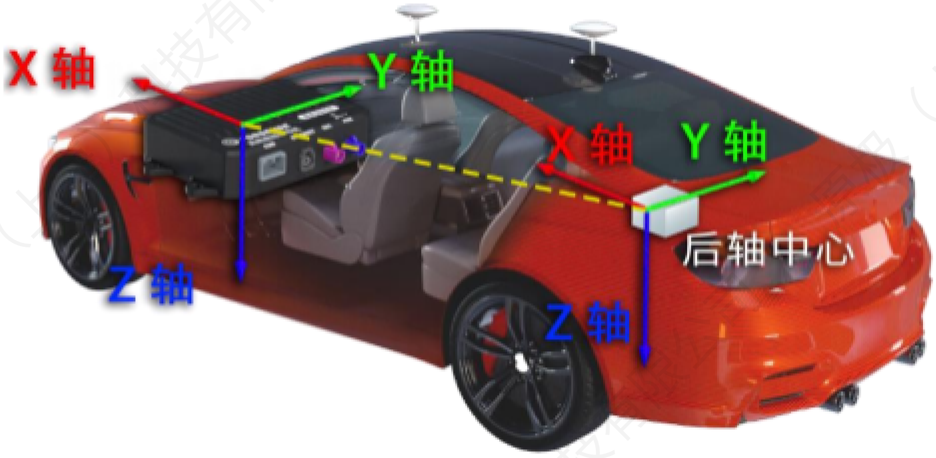


Figure 28 Diagram of coordinate system

2.4.1.3 Configuring RTK Dual antenna Installation Angle measurement and setting

Refer to the figure below to confirm the actual double antenna installation Angle, configure the corresponding double antenna installation Angle and fill in the column of double antenna installation deviation Angle on the parameter setting page

After measuring the above three parameters, fill in the corresponding parameters on the Upper computer software parameter configuration page

2.4.1 Parameter measurement

After the rod arm is configured, it is necessary to calibrate the main mast arm to reduce the measurement error and improve the positioning accuracy.

Note that the rod arm calibration is optimized for manual measurement, manual measurement data as accurate as possible, the error is controlled within 8cm, otherwise the calibration accuracy cannot be guaranteed

If the rod arm data is not measured manually, but from the vehicle model 3D data diagram (the main antenna position and integrated navigation position are confirmed), there is no need to calibrate the rod arm

If you need to use double antennas, you must check the double antennas first and then carry out double antenna calibration. The calibration result of double antennas should be within ±1 degree. If the calibration result exceeds ±1 degree, please correct the double antenna installation (parallel to the body as far as possible).

After the configuration, the calibration can be started. If the subsequent product and antenna installation position do not change, only one calibration can be carried out.

The calibration process is as follows.

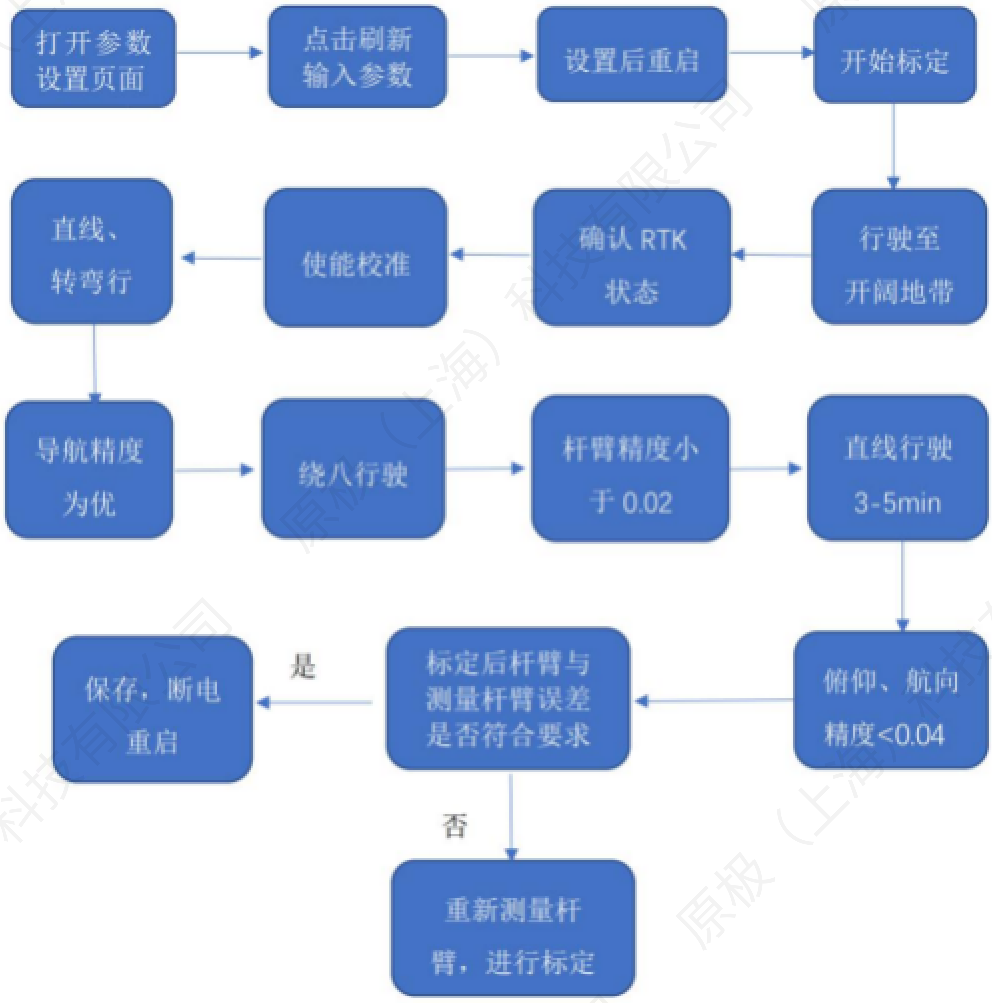


FIG. 25 Calibration flow chart

The steps are as follows:

1. Drive the car to the empty scene, open the NAV680D Upper computer software, and switch to the navigation data page.

As shown in the following picture, three conditions should be met

- The RTK state must be a fixed solution state, i.e., narrow lane fixed
- The number of stars must be at least 30
- The difference delay should be as small as possible (less than 5)

Figure 30 Navigation data page

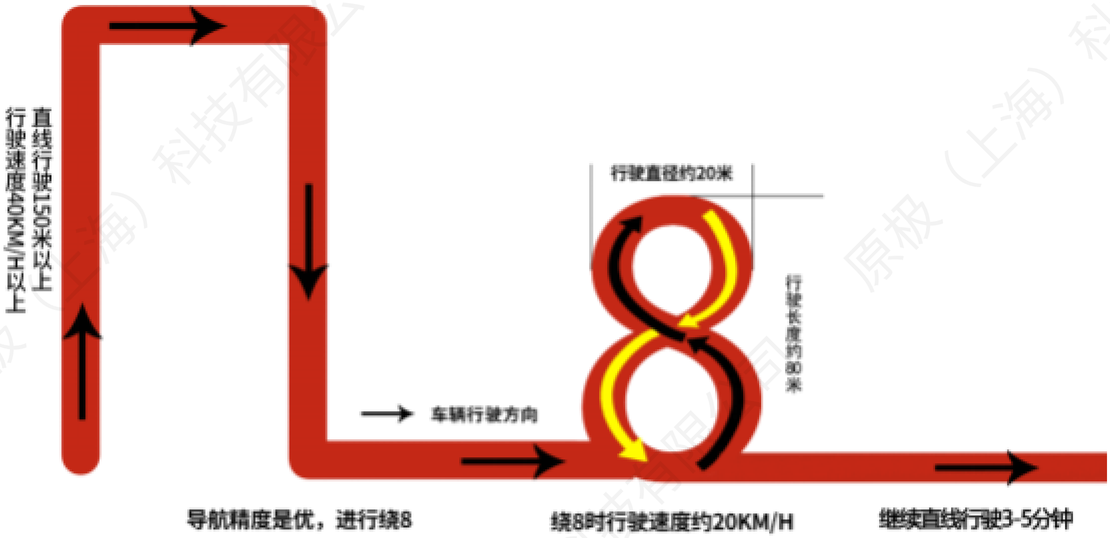
2. After the above conditions are met, open the calibration page of Upper computer software parameter setting and click Enable calibration, as shown in the figure below.

Start to drive, straight line driving more than 150 meters, the speed of 40km/h, then turn or turn, straight line driving more than 150 meters, the speed of 40km/h. At this time, check whether the navigation accuracy in the parameter setting is excellent. If it is excellent, proceed to the next step. Otherwise, it is still necessary to drive in a straight line until the navigation accuracy is excellent.

Figure 31 Calibration page diagram

When the navigation accuracy is optimal, the vehicle drives around the figure 8, as shown in Figure 29. At this time, see the estimated accuracy of the rod arm in the above figure. When the estimated accuracy of the rod arm is less than 0.02, the vehicle drives in the open area for 3-5 minutes in a straight line until the estimated accuracy of the installation deviation Angle of the pitch Angle and the estimated accuracy of the installation deviation Angle of the course are both less than 0.04, then the calibration of the rod arm is completed.

Check the rod arm value on the page shown in FIG. 28. If the difference is less than 5cm from the manually measured result, click Save and power on again. If the difference is more than 5cm, it needs to be re-calibrated until the difference between the calibrated result and the measured result is within 5cm.



组合导航杆臂在线标定行驶示意图

FIG. 32 Schematic diagram of vehicle driving

3. Download and use PC software

3.1 Software Download

Host computer software download address:

https://data.forsense-imu.com/page/download.html

Figure 2 is the upper computer software of NAV680D, no need to install, double-click can be used.

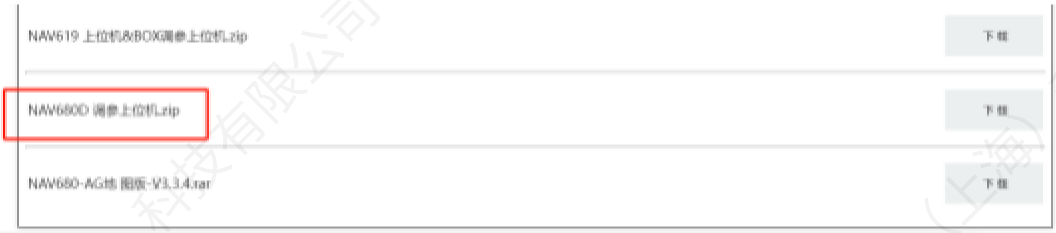


Figure 4 Upper computer software diagram

Note: After connecting the host computer, the serial port automatically switches the log data stream, the data stream protocol is not open to the outside world, and needs to use the MATLAB decoding script provided by the official website of the original pole to decode, as shown in Figure 5, link: https://data.forsense-imu.com/page/download.html

Figure 4 Log data flow decoding script

3.2 NAV680D host computer use

3.2.1 Connecting the Upper Computer

Figure 4 is the page display diagram of the upper computer just opened

1 Select serial port number, connect NAV680D with USB to RS232 serial cable, and supply power to NAV680D correctly, you can display serial port number;

2 places click connection;

3 function selection, where the status display function is not supported;

The hardware name, firmware version number, connection status (offline/connected), and Upper computer software version number are displayed on 4.

FIG. 5 Upper computer software display page diagram

3.2.2 Navigation data page

The navigation data interface is shown in Figure 5, displaying IMU, Integrated Navigation position/speed/attitude, RTK status/data information, and displaying odometer information after accessing the odometer. The online map function is not supported for the time being.

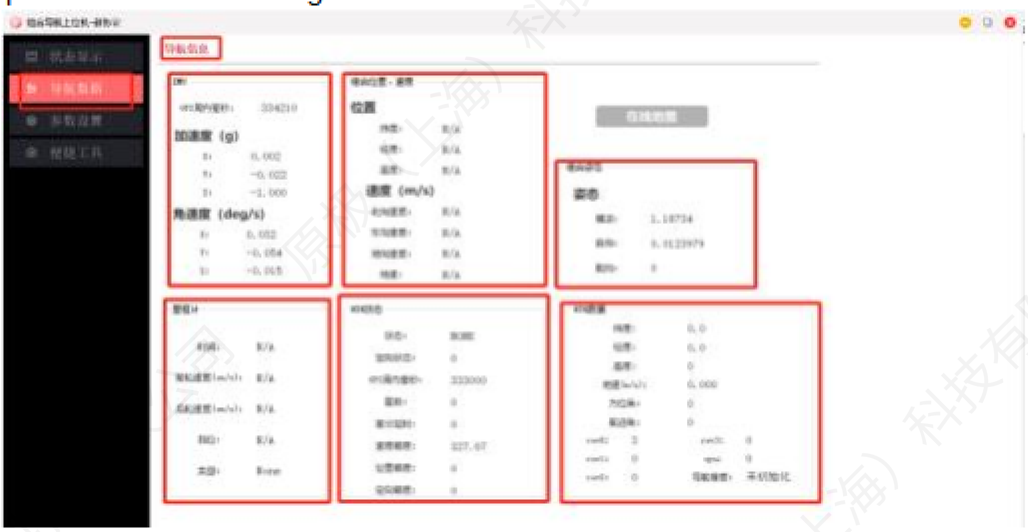


FIG. 6 Navigation data page diagram

3.2.3 Parameter setting page

3.2.3.1 Setting the main mast arm

The main mast arm is measured by taking the center of NAV680D as the coordinate origin and establishing a three-axis coordinate system. The positive direction of X axis points to the front, the positive direction of Y axis points to the right side of the body, and the positive direction of Z axis points to the center of the earth. The distance from the projection point of the phase center of the main antenna to the coordinate origin in the direction of X, Y and Z axis is accurately measured by tools, in meters.

3.2.3.2 Set the center pole arm of the rear axis

Equipment - The center rod arm of the rear axle is measured in the same way as the main antenna rod arm. The three-vector distance (x,y,z) from the center of the rear axle of the vehicle to the center of the equipment is measured in meters.

3.2.3.3 Setting of deviation Angle of double antenna installation

If a single antenna is connected, set it to 0 here; If two antennas are connected, it is necessary to measure the Angle between the ray directed by the main antenna to the secondary antenna and the direction of the front, clockwise is positive and counterclockwise is negative, in degrees. As shown in Figure 7, the left installation mode is +90°, and the right installation mode is 0°.

3.2.3.4 Projection point rod arm

The default longitude and latitude coordinates output of this product are those of the main antenna position. If the longitude and latitude coordinates need to be changed to the coordinates of other positions of the car body, it can be realized by setting the projection point rod arm.

The projection point rod arm, in the same way as the main antenna rod arm, measures the three-vector distance (x,y,z) from the projection point to the center of the equipment, in meters.

Before setting all parameters, it is necessary to click refresh and fill in the corresponding parameters and position reference selection, as shown in Figure 6. Then click Set. After the setting is completed, a pop-up window will be displayed indicating that the setting is successful.

Figure 7 Page diagram of IMU setting

2. Calibration page

The calibration page is shown below. This page is needed when calibrating the lever arm. See section 4.2 Lever arm calibration for the specific process.

FIG. 9 Schematic diagram of calibration page

3.2.4 **Firmware upgrade**

3.2.4.1 Upgrading the Integrated Navigation Algorithm on the Upper computer software

On the Convenient Tool page, you can upgrade the firmware. Click Open File, select the firmware to be upgraded, and click Upgrade. Do not power off during the upgrade. After the upgrade, back up the firmware.

Figure 10 Convenient tool page

3.2.4.2 Firmware Upgrade through OTG interface

Currently there are two firmware upgrade packages,

The file name "Forsen680D" starts with the internal storage and network port driver running firmware.

"NAV680D"- File name starts with Integrated Navigation algorithm firmware,

Upgrade method: After the device is powered on, connect one end of the type-c cable harness to the computer and the other end to the OTG interface of the device, open the update folder, run the firmware of the internal storage and network port driver, and put the firmware of the Integrated Navigation algorithm into the update folder.

Then change the file name to "Forsen680D" and "NAV680D#" respectively, restart the device and wait for 3-5 minutes to complete the upgrade (if there is no algorithm firmware, the time is about 1 minute).

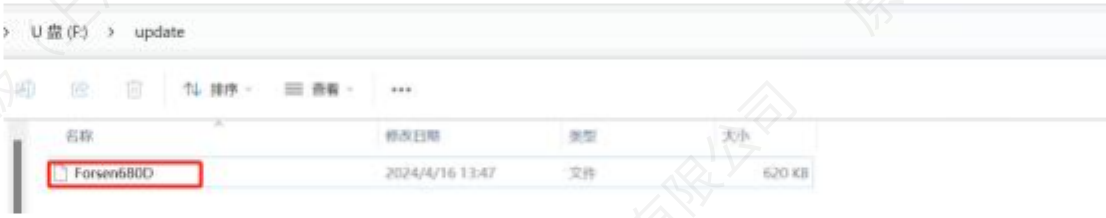


Figure 11 6ul firmware name

3.2.5 Data storage

3.2.5.1 Use the host computer to save data

After the host computer is connected to the host computer, data is automatically stored in the nav680D_test folder in the log folder of the software package, and a dat file named according to the time is generated, as shown in the following example:

For example, '2024_0416_1400_42.dat', when the host computer is disconnected, the data will stop saving. The data is a log data stream, and the protocol content is not open to the public for the time being. You need to use the MALTB script of the original official website to parse. See Figure 12. After parsing, a CSV file can be obtained, the format of which is shown in Figure 13. Website address: https://www.forsense.cn/

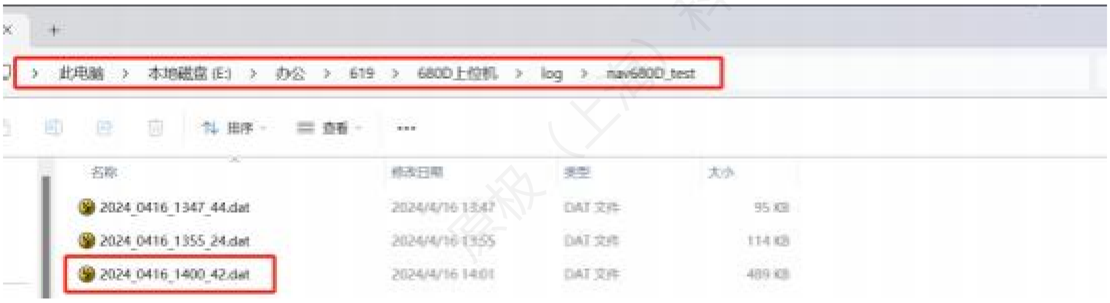


Figure 12 Location of data stored on the host computer

3.2.5.2 Internal storage of data

Note: The internal storage space is 2GB, which will be self-checked after power-on. If the remaining storage space is less than 500M, the data of 2 days ago will be cleared. Please use the internal storage data and copy it in time

After the device is powered on and the satellite signal is read, the data will be automatically stored inside the device. After the test is over, use the type-c wiring harness to connect one end of the computer and the other end of the OTG interface of the device to enter the log file and copy the files recorded that day

The file description:

.dat file: combined navigation data (internal debugging data flow, protocol content is not open to the public, can use the official website matlab data decoding script to decode)

.rtcm file: differential data of RTK base station obtained after this power-on

raw file: raw RTK data obtained during this power-on

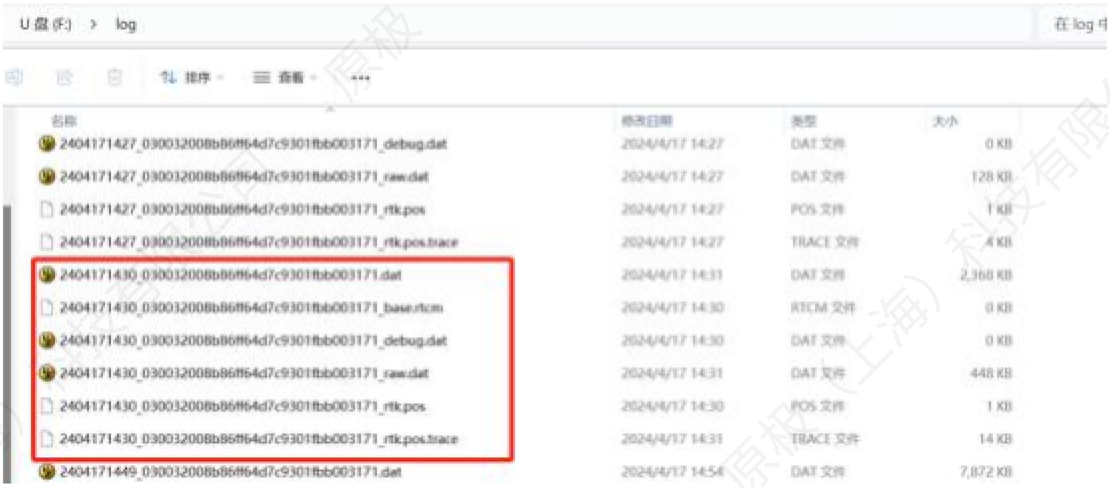


Figure 13 Internally stored data

3.2.5.3 Basic analysis of data

If an exception occurs during the test, you can try the internal analysis script provided on the official website to analyze the basic data (using only the internally stored debugging data flows). The official website is https://www.forsense.cn/


原极（上海）科技有限公司
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4. Combine navigation output protocols

4.1 Binary protocol data flow

Support serial port R232-B output, baud rate 460800, support network port output, port number 6100

Note:

- CRC check starts from the frame header, does not include CRC check bit itself, CRC check for all bytes of the frame, check calculation method and routine see folder "integrated navigation data decoding routine".
  - The frame length is the total number of all data bytes except the frame header, frame ID, frame length and check bit. The number of bytes is 104.
  - In small-endian mode, the low bytes are sent first.
- The output attitude Angle is the attitude in the body coordinate system

In the fixed solution state, the speed is greater than 20km/h, and the integrated navigation can complete the initialization and enter the working state

The CONTENT	Type	Relative position
Frame head 1:0 xAA	Uint8	0
Frame header 2:0x55	Uint8	1
Frame ID: 0x0166	Uint16	2
Frame length: 0x005E	Uint16	4
Seconds within a GPS week (ms)	Uint32	6
GPS Weekly count	Uint16	10
Latitude (degrees x 10000000)	Int32	12
Longitude (degrees x 10000000)	Int32	16
Height (mm) (height of ellipsoid)	Int32	20
Northbound speed (m/s)	Float	24
Eastbound velocity (m/s	Float	28
Ground velocity (m/s)	Float	32
Roll Angle (degree)	Float	36
Pitch Angle (degree)	Float	40
Heading Angle (degree)	Float	44
Dual antenna course (degrees)	Float	48
Reserved	Float	52
Accelerometer X axis (g)	Float	56
Accelerometer Y-axis (g)	Float	60
Accelerometer Z-axis (g)	Float	64
Gyroscope X axis (deg/s)	Float	68

Gyro Y-axis (deg/s)	Float	72
Gyro Z axis (deg/s)	Float	76
IMU Temperature (C)	Float	80
RTK positioning status (see table below for details) 0: unpositioned 16: single point positioning 17: Pseudo-distance differential positioning 34: floating-point solution 50: fixed solution	Uint8	84
Number of satellites	Uint8	85
Differential delay	Uint8	86
Dual antenna directional status 50 indicates directional others indicate undirectional	Uint8	87
Position precision factor (cm) Integrated Navigation is valid after initialization	Uint16	88
Status bits: Bit0:1 indicates that the RTK data is valid and 0 indicates that it is invalid Bit1:1 indicates that the PPS signal is valid and 0 indicates that it is invalid Bit2:1 indicates that Integrated Navigation is initialized and 0 indicates that it is not initialized (Initialization conditions: Single antenna, positioning fixed solution + access odometer, speed greater than 2m/s can be initialized Single antenna, positioning fixed solution + no access odometer, speed greater than 5m/s can be initialized, Dual antenna, positioning fixed solution + orientation state 50 lasting more than 20 seconds can be initialized) Bit3: Reserved Bit4: Reserved Bit5: Reserved Bit6: Reserved	Uint16	90
GNSS dual antenna heading within milliseconds	Uint32	92
Reserved 2	Uint32	96
CRC check	Uint32	100

4.2 nmea protocol

- Support the output of combined data according to nmea format.
- With binary data stream can not be output at the same time, output nmea data stream can not output binary data stream, before switching data stream need to stop the current data stream output according to 6.4 instruction.
- Currently, the following statements are supported. See Section 6.3 for configuration
- Supports serial port R232-A output, baud rate 460800, supports network port output, port 6000

GPGGA

GPRMC

GPHDT (Course Information)

GPVTG (Ground Speed information)

GPZDA (UTC time and date)

GPATT (Forsense Custom message)

The following table describes the format of GPATT

Name	*Unit*	*Format*	*Example*	*Description*
Sentence Identifier		String	$GNATT	
Time		hhmmss.sss	170834.000	17:08:34 UTC
Status		Character	1	0: invalid 1: valid
Roll Angle	degree	3 decimal places	-4.891	range ±90, right side down defined as positive
Indicator for roll		character	R	Roll indicator
Pitch Angle	degree	3 decimal places	3.122	range ±90, head up defined as positive
Indicator for Pitch		character	P	Pitch indicator
Heading Angle	degree	3 decimal places	124.005	range 0~360, to true North, counter clockwise defined as positive
Roll Angle uncertainty	degree	3 decimal places	0.432	range 0~360
Pitch Angle uncertainty	degree	3 decimal places	0.811	range 0~360
Heading Angle uncertainty	degree	3 decimal places	1.202	range 0~360
Checksum		Hex	*68	Used by program to check for transmission errors

4.3 CAN Output protocol

The default output frequency of Integrated Navigation information is 100HZ

Default baud rate: 500K

4.3.1 CAN DBC file

Note: The corresponding DBC file can be decoded in real time on the official website. Download address:

https://data.forsense-imu.com/page/download.html

4.3.2 CAN protocol

INS_Acc(0x500), default 100hz, the coordinate system is the shell coordinate system, with Bias instability compensation

The X axis indicates that the vehicle forward is positive; The Y-axis means the vehicle is positive to the right; The Z axis means the vehicle is positive down.

NAME	StartBit	Length Bit	ValueType	Byte Order	Range	factor	offset	Unit	Conversion
ACC_X	8	16	Unsigned	Motorola	[4, 4]	8/65536	4	g	D=N*8/65536 4
ACC_Y	24	16	Unsigned	Motorola	[4, 4]	8/65536	4	g	D=N*8/65536 4
ACC_Z	40	16	Unsigned	Motorola	[4, 4]	8/65536	4	g	D=N*8/65536 4

INS_GYRO(0x501), default 100hz, the coordinate system is the shell coordinate system, with zero bias compensation

GYRO_X takes the forward direction of the vehicle as the X-axis, right hand rule, thumb forward, four finger direction (clockwise about the X-axis is positive);

GYRO_Y takes the vertical vehicle forward direction as the Y-axis, right hand rule, thumb to the right, four fingers direction (clockwise around the Y-axis is positive);

GYRO_Z takes the vertical vehicle horizontal line direction as the Z axis, right hand rule, thumb down, four finger direction (positive clockwise around the Z axis).

NAME	StartBit	Length Bit	ValueType	Byte Order	Range	factor	offset	Unit	Conversion
GYRO _X	8	16	Unsigned	Motorola	[250250]	0.0076293	-250	deg/s	D = N * 0.0076293-250
GYRO _Y	24	16	Unsigned	Motorol	[250250]	0.0076293	-250	deg/s	D = N *

				a					0.0076293-250
GYRO _Z	40	16	Unsigned	Motorol a	[250250]	0.0076293	-250	deg/s	D = N * 0.0076293-250

INS_HeadingPitchRoll(0x502), default 100hz, the coordinate system is the shell coordinate system

The Pitch is positive clockwise about the Y-axis; Roll is positive clockwise about the X-axis; Heading is positive clockwise about the Z axis, as shown in Figure 33.

NAME	StartBit	Length Bit	ValueType	Byte Order	Range	factor	offset	Unit	Conversion
Pitch	8	16	Unsigned	Motorola	[- 90, living]	0.010986	-360	deg/s	D = N * 0.010986-360
Roll	24	16	Unsigned	Motorola	[- 90, living]	0.010986	-360	deg/s	D = N * 0.010986-360
Heading	40	16	Unsigned	Motorola	[180180]	0.010986	-360	deg/s	D = N * 0.010986-360

Roll, pitch, course Angle diagram is as follows:

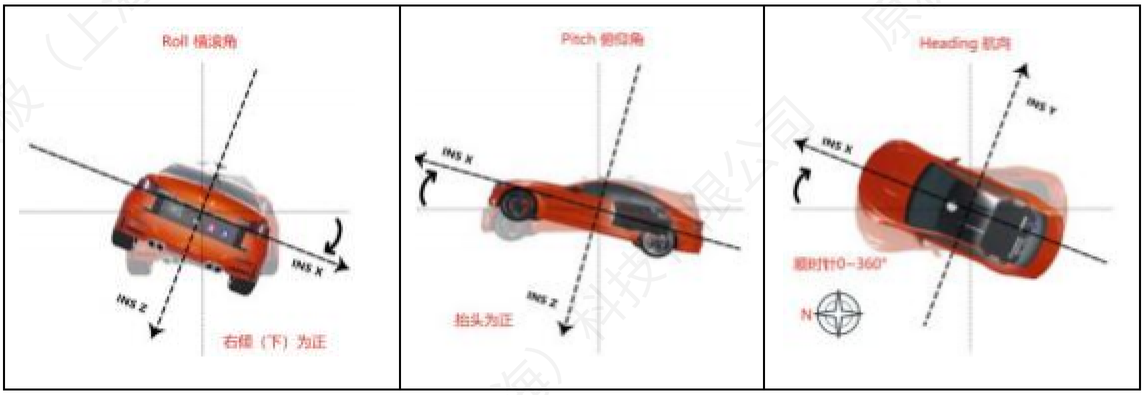


Figure 33 Schematic diagram of roll, pitch and heading Angle

INS_HeightAndTime(0x503), default 100hz, altitude: default output main antenna phase center height

NAME	StartBit	Length Bit	ValueType	Byte Order	Range	factor	offset	Unit	Conversion
High altitude	24	32	Unsigned	Motorola	[00-10000100]	0.001	-10000	m	D = N * 0.001-10000
Milliseconds in GPS week	56	32	Unsigned	Motorola	[0604999] 99	1	0	ms	D=N*1

INS_LatitudeLongitude(0x504), default 100hz

The device adopts WGS84 coordinate system, longitude and latitude output the phase center position of the main antenna;

Latitude is 0°at the equator, Latitude greater than 0°for the northern Hemisphere, and vice versa for the southern hemisphere;

Longitude is 0°for the prime meridian, Longitude is greater than 0°for the Eastern Hemisphere, and vice versa for the Western Hemisphere.

NAME	StartBit	Length Bit	ValueType	Byte Order	Range	factor	offset	Unit	Conversion
Latitude	24	32	Unsigned	Motorola	[- 90, living]	1.00E-07	-180	deg	D=N*1e-7-180
Longitude	56	32	Unsigned	Motorola	[180180]	1.00E-07	-180	deg	D=N*1e-7-180

INS_Speed(0x505), default 100hz, N/E speed is due north/due East speed, ground speed is vertical horizontal face down speed

NAME	StartBit	Length Bit	ValueType	Byte Order	Range	factor	offset	Unit	Conversion
Northbound speed	8	16	Unsigned	Motorola	[100100]	200/65536	-100	m/s	D=N*200/65536-100
Eastbound speed	24	16	Unsigned	Motorola	[100100]	200/65536	-100	m/s	D=N*200/65536-100
Ground velocity	40	16	Unsigned	Motorola	[100100]	200/65536	-100	m/s	D=N*200/65536-100

INS_Std(0x507), default 100hz

NAME	StartBit	Length Bit	ValueType	ByteOrder	Range	factor	offset	Conversion
Standard deviation of latitude	8	16	Unsigned	Motorola	,65.535 [0]	0.001	0	D = N * 0.001
Standard deviation of longitude	24	16	Unsigned	Motorola	,65.535 [0]	0.001	0	D = N * 0.001
Height standard deviation	40	16	Unsigned	Motorola	,65.535 [0]	0.001	0	D = N * 0.001
Course standard deviation	56	16	Unsigned	Motorola	,65.535 [0]	0.001	0	D = N * 0.001

GNSS_UTC(0x508), default 5hz

Note: GPS time - Leap second =UTC time, currently leap second is 18S, UTC time is GPS time 18S slower

NAME	StartBit	Length Bit	ValueType	ByteOrder	Range	factor	offset	Conversion
UTC_year	0	8	Unsigned	Motorola	[2000225]	1	2000	D=N*1+2000
UTC_month	8	8	Unsigned	Motorola	[0, 12]	1	0	D=N*1
UTC_day	16	8	Unsigned	Motorola	[0, 31]	1	0	D=N*1
UTC_hour	24	8	Unsigned	Motorola	[0, 24]	1	0	D=N*1
UTC_min	32	8	Unsigned	Motorola	[0, 60]	1	0	D=N*1
UTC_sec	40	8	Unsigned	Motorola	[0, 60]	1	0	D=N*1
UTC_msec	56	16	Unsigned	Motorola	[0999]	0.001	0	D = N * 0.001

INS_DataInfo(0x506), default 100hz

NAME	StartBit	LengthBit	ValueType	ByteOrder	Conversion
GNSS Positioning status	0	8	Unsigned	Motorola	0_NONE_ No solution 16_SINGLE_ Single point positioning 17_PSRDIFF_ Pseudo distance differential positioning 32_L1_FLOAT_L1 floating-point solution 33_ionofree_float_ionooide-floating-point solution 34_narrow-lane floating-point solution 48_L1_INT_ L1 Fixed solution 49_WIde_int_Wide lane fixed solution 50_narrow_int_narrow lane fixed solution
Number of GNSS satellites	8	8	Unsigned	Motorola	D=N*1
GNSS directional status	16	8	Unsigned	Motorola	0_NONE_ No solution 16_SINGLE_ Single point positioning 17_PSRDIFF_ Pseudo distance differential positioning 32_L1_FLOAT_L1 floating-point solution 33_ionofree_float_ionooide-floating-point solution 34_narrow-lane floating-point solution 48_L1_INT_ L1 Fixed solution 49_WIde_int_Wide lane fixed solution 50_narrow_int_narrow lane fixed solution
Differential delay (S)	24	8	Unsigned	Motorola	D=N*1

Vehicle wheel speed flag bit	32	8	Unsigned	Motorola	0_ No wheel speed information 1_ With wheel speed information
Combined navigation status bits	40	8	Unsigned	Motorola	0_NONE1_ Attitude initialization (heading not initialized) 2_ Integrated navigation

4.4 RTK Locating Status Table

Binary	ASCII	Description
0	NONE	No solution
1	FIXEDPOS	The location is specified by the FIX POSITION command
2	FIXEDHEIGHT	Not supported yet
8	DOPPLER_VELOCITY	Velocity is derived from instant Doppler information
16	SINGLE	Single point positioning
17	PSRDIFF	Pseudo-distance difference decomposition
18	WAAS	SBAS Positioning
32	L1_FLOAT	L1 floating point solution
33	IONOFREE_FLOAT	Ionospheric floating-point solution
34	NARROW_FLOAT	Narrow lane floating-point solution
48	L1_INT	L1 fixed solution
49	WIDE_INT	Wide lane fixed solution
50	NARROW_INT	Narrow lane fixed solution

5. Run the **AT command to set COM parameters**

In addition to parameter configuration through the host computer, the product can also be configured by sending instructions through the COM

5.1 Configuring the Main Mast Arm

For example, configure the pole arm vector as X=1.2m,Y=0.2m,Z=-1.0m
Instruction: AT+CLUB_VECTOR=1.2,0.2,-1.0\r\n
Answer: GPS_POS_X=1.2,GPS_POS_Y=0.2,GPS_POS_Z=-1.0/r/n
Note: After the configuration instruction is saved, power off and restart it to take effect

5.2 Configuring the output binary data stream

Instruction: AT+SETNAV\r\n
Answer: OK\r\n
Stop output if configured
Instruction: AT+SETNO\r\n
Answer: OK\r\n

5.3 Configure the output NMEA format data stream

If NEMA statement output is configured, the 6.2 Integrated Navigation data flow is not output

To switch to 6.2 Integrated Navigation data stream output, stop the current data stream output by following instructions 6.2

NMEA protocol only supports COM A output

Configuration instructions are as follows
GPGGA
Example: Output GPGGA statement with a frequency of 5hz: AT+GPGGA=5\r\n
Answer: OK\r\n
GPRMC
Example: Output GPRMC statement AT 1hz: AT+GPRMC=1\r\n
Answer: OK\r\n
GPHDT (Heading information)
Example: Output GPHDT statement AT 1hz frequency: AT+GPHDT= 1\r\n
Answer: OK\r\n
GPVTG (Ground Speed information)
Example: Output GPVTG AT 1hz frequency statement: AT+GPVTG= 1\r\n
Answer: OK\r\n
GPZDA (UTC time and date)
Example: Output GPZDA statement AT 1hz: AT+GPZDA= 1\r\n
Answer: OK\r\n
GPATT (Custom message)
Example: Output GPATT statement AT 1hz frequency: AT+GPATT= 1\r\n
Answer: OK\r\n
Stop output if configured
Instruction: AT+SETNO\r\n
Answer: OK\r\n

5.4 Configure the current data stream to stop output

Instruction: AT+SETNO\r\n

Answer: OK\r\n

5.5 Configuring the position and velocity projection point for the Integrated Navigation output

If the configuration outputs the projection point result (in m) set by the Integrated Navigation, the configuration instruction is:

Instruction: AT+PROJ_VECTOR=1.0,2.0,3.0\r\n

Answer: PROJ_VECTOR_X=1.0, PROJ_VECTOR_Y=2.0, PROJ_VECTOR_Z=3.0/r/n

Note: The default output of Integrated Navigation is the result of the projection point of the antenna phase center. If the result of other positions needs to be output, the lever arm vector for this position needs to be configured. The configuration method is the same as 4.1 lever arm configuration

Note: After the configuration instruction is saved, power off and restart it to take effect

5.6 Configuring the RTK Dual antenna mounting Angle

If the RTK dual antenna mounting Angle is set to 0 degrees, the configuration instructions are:

Instruction: AT+RTK_ANGLE=0\r\n

Answer: ANGLE=0\r\n

Description: The installation Angle is the Angle between the main antenna pointing to the secondary antenna and the direction of the front, clockwise is positive, counterclockwise is negative, Angle input range -180°~180°

Note: After the configuration instruction is saved, power off and restart it to take effect; The distance between Dual antenna must be greater than 50cm

5.7 Configuring the Baud rate of the CAN port

The default baud rate of the CAN interface is 500K. To change the baud rate to another one, follow the instructions below

For example, if the baud rate needs to be set to 250K, the configuration command is as follows:

Instruction: AT+CAN_BAUD=250
Answer: OK

Note: After the configuration instruction is saved, power off and restart it to take effect; Currently supported baud rate is 250K, 500K, 1M

5.8 Enable Position smoothing

Note: If it is turned on, the track will be smoothed under the signal recovery production mechanism after the lock is lost. If it is turned off, the track will be quickly pulled back to the correct position and the track will appear jagged

Please choose to open or close according to your needs

Instruction: AT+POS_SMOOTH=1\r\n

Answer: OK\r\n

If position smoothing is turned off:

Instruction: AT+POS_SMOOTH=0\r\n

Answer: OK\r\n

5.9 Enable Low speed mode

Note: It is suitable for the use of carriers running at low speed for a long time, such as unmanned cars

Instruction: AT+LOW_SPEED_MODE=1\r\n

Answer: OK\r\n

If Low speed mode is off:

Instruction: AT+LOW_SPEED_MODE=0\r\n
Answer: OK\r\n

5.10 Turn on dual antenna heading constraint

Note: On indicates that dual antenna heading is used in all scenarios. Off indicates that dual antenna heading is used only at rest

Instruction: AT+USE_GNSS_HEADING=1\r\n
Answer: OK\r\n

If the dual antenna course constraint is turned off
Instruction: AT+USE_GNSS_HEADING=0\r\n

Answer: OK\r\n

5.11 Print all current configuration information

To query all configured information, the instructions are:
AT+CONFIG\r\n

5.12 Query version number

AT+VERSION\r\n

5.13 Saving Parameter

Instruction: AT+SAVE\r\n
Answer: OK\r\n

6. Set Parameter by using network ports

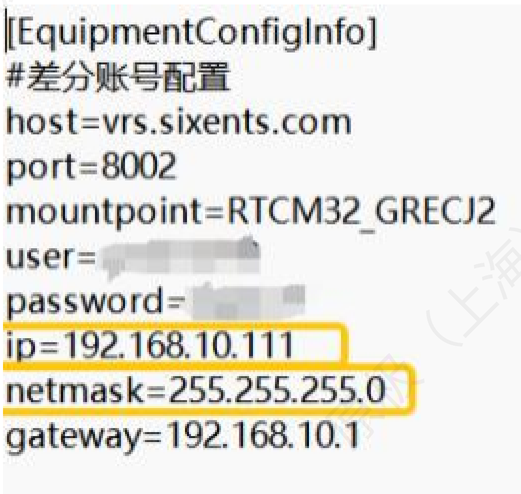
6.1 Connecting the Upper computer software Using a Network Cable

The IP address of the PC must be in the same network segment as the IP address of NAV680D. You can view the IP address of NAV680 in the update config saved in the internal storage.

Note: If there is encryption software in the computer, the TCP connection between the NAV680D device and the computer may be affected

Note: Do not remove and insert the network cable when using, otherwise the IP configuration of NAV680D will be lost, and you need to restart NAV680D to recover.

Note: If the IP address of the NAV680D device cannot be pinged, connect the NAV680D device to the PC using a network cable and restart the NAV680D device.

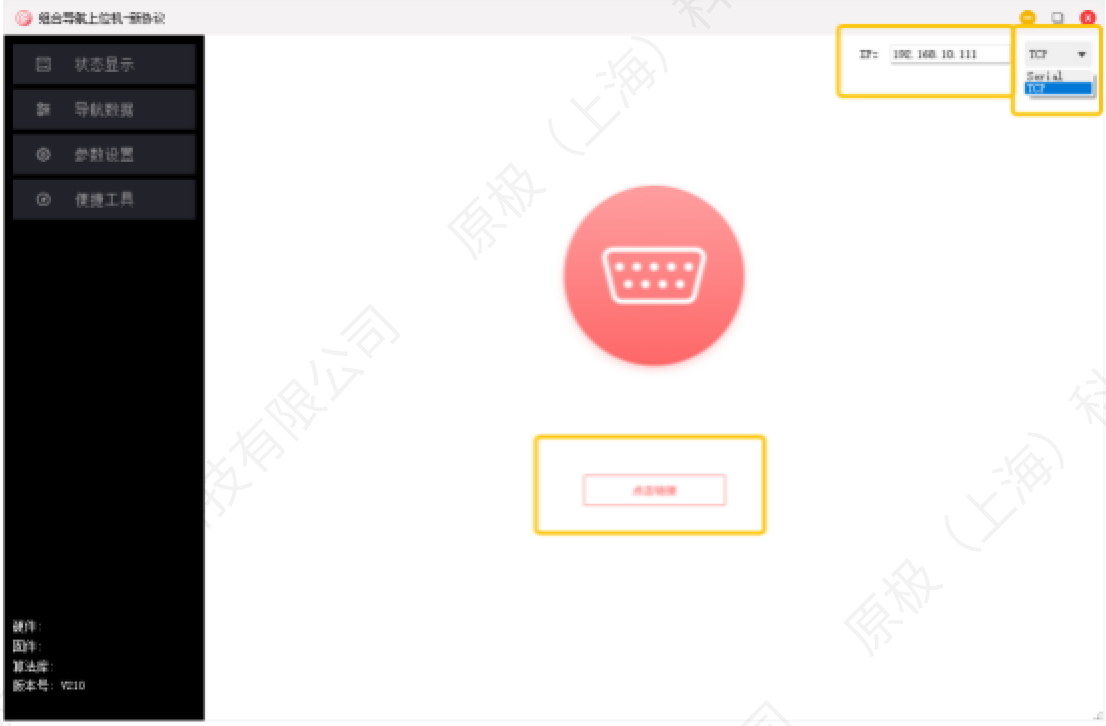


```
[EquipmentConfigInfo]
#差分账号配置
host=vrs.sixents.com
port=8002
mountpoint=RTCM32_GRECJ2
user=
password=
ip=192.168.10.111
netmask=255.255.255.0
gateway=192.168.10.1
```

Configure the nav680D in config

IP configuration on the PC

After turning on the Upper computer software, enter the IP address of the device in the corresponding input box, and click tcp to connect to the Upper computer software



Start the Upper computer software in Windows

Open Upper computer software under Ubuntu

Ubuntu Step 1: Go to the nav680d folder

Ubuntu Step 2: If it is a new ubuntu system, run sudo gpasswd -a $USER dialout

Ubuntu Step 3: Type./AppRun to run Upper computer software

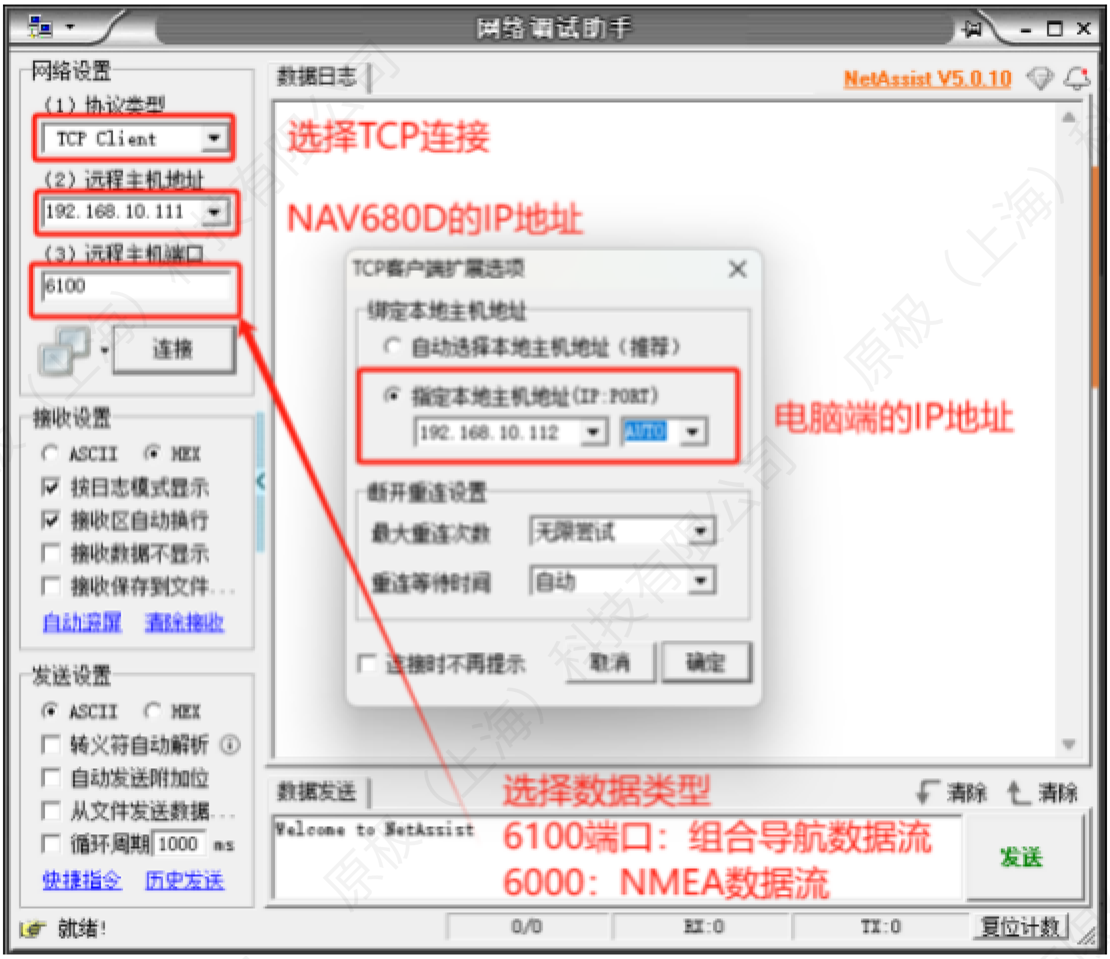
After the connection, you can view navigation data, Parameter configuration, and use convenient tools. For details, see 3.2 Upper computer software Use

6.2 Network Ports Output Integrated Navigation Data

flows

Note: Currently only static ids are supported

The network port is connected to the COM assistant and input the corresponding IP address in the COM assistant. Port 6100 is used to output Integrated Navigation data, and port 6000 is used to output NMEA data stream



7. ROS driver

Note: You need to configure the NAV680D output to a data stream of 0x166 first. See Section 6.2 of the NAV680D product manual for details.

6.2 配置输出组合导航数据流

配置输出 5.所示组合导航数据流，指令为：

指令：AT+SETNAV\r\n

应答：OK\r\n

The default output is 0x166 data stream. You can configure the Parameter before saving it. For details, see section 6.7 of the NAV680D product manual.

6.7 保存参数

指令 ：AT+SAVE\r\n

应答 ：OK\r\n

ROS driver download address: https://data.forsense-imu.com/page/download.html, currently supported ROS1, ROS2

7.1 Installing ROS serial

Install the ROS serial package. This routine relies on the serial package provided by ROS for COM communication.

To download and install the serial package, run the following command:

sudo apt-get install ros -melodic-serial

Then enter the roscd serial command to enter the serial download location, if the installation is successful, it will appear as

The following information:

/opt/ros/melodic/share/serial

7.2 Compiling the Code

cd NAV680D_ROS/

catkin_make

```
[ 10%] Generating Javascript code from forsense_ins/forsense_insData.msg
Scanning dependencies of target forsense_ins_generate_messages_eus
Scanning dependencies of target forsense_ins_generate_messages_py
[ 20%] Generating Lisp code from forsense_ins/forsense_insData.msg
[ 30%] Generating EusLisp code from forsense_ins/forsense_insData.msg
[ 40%] Generating Python from MSG forsense_ins/forsense_insData
[ 40%] Built target forsense_ins_generate_messages_nodejs
[ 50%] Generating EusLisp manifest code for forsense_ins
[ 50%] Built target forsense_ins_generate_messages_lisp
Scanning dependencies of target forsense_ins_generate_messages_cpp
[ 60%] Generating C++ code from forsense_ins/forsense_insData.msg
[ 70%] Generating Python msg __init__.py for forsense_ins
[ 70%] Built target forsense_ins_generate_messages_cpp
[ 70%] Built target forsense_ins_generate_messages_py
[ 70%] Built target forsense_ins_generate_messages_eus
Scanning dependencies of target forsense_ins_generate_messages
Scanning dependencies of target forsense_ins
[ 70%] Built target forsense_ins_generate_messages
[ 90%] Building CXX object CMakeFiles/forsense_ins.dir/serial_parse.cpp.o
[ 90%] Building CXX object CMakeFiles/forsense_ins.dir/forsense_ins.cpp.o
[100%] Linking CXX executable /home/wenfeng/nav619_ros1/devel/lib/forsense_ins/f
orsense_ins
[100%] Built target forsense_ins
wenfeng@ubuntu:~/nav619_ros1$
```

Compile complete

7.3 Connect the IMU to the system via USB

To check whether the IMU is connected:

lsusb

```
wenfeng@ubuntu:~$ lsusb
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 002 Device 005: ID 0403:6001 Future Technology Devices International, Ltd FT
232 USB-Serial (UART) IC
Bus 002 Device 004: ID 0e0f:0008 VMware, Inc.
Bus 002 Device 003: ID 0e0f:0002 VMware, Inc. Virtual USB Hub
Bus 002 Device 002: ID 0e0f:0003 VMware, Inc. Virtual Mouse
Bus 002 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
wenfeng@ubuntu:~$
```

Check the USB port number:

ls /dev/ttyU*

```
wenfeng@ubuntu:~$ ls /dev/ttyU*
/dev/ttyUSB0
wenfeng@ubuntu:~$
```

Configure the permission to open USB to COM:

sudo chmod 777 /dev/ttyUSB0

7.4 Viewing Data

Do roscore to open ROS

Go back to the serial_imu_ws folder and execute

source devel/setup.bash

Do start rosrun

rosrun forsense_ins forsense_ins

```
wenfeng@ubuntu:~/nav619_ros1$ rosrun forsense_ins forsense_ins
[ INFO] [1695457979.128623440]: /dev/ttyUSB0 is opened.
```

Open new window

source devel/setup.bash

rostopic list

```
wenfeng@ubuntu:~/nav619_ros1$ rostopic list
/nav619Data
/rosout
/rosout_agg
```

Enter commands to view IMU data

rostopic echo /nav619Data

```
  frame_id: "WGS84"
itow: 549636980
week_num: 2280
lat: 312627286
lon: 1216155393
hgt: 38859
vn: 0.00240602344275
ve: 0.000262897461653
vd: 0.00270945159718
roll: -0.169113516808
pitch: -0.286453634501
yaw: 0.0
rtk_yaw: 359.766906738
wheel_angle: 0.0
imu: [-0.00536619778722524 6, 0.0035326573997735977, -1.004271149635315, -0.04756
217822432518, -0.11066819727420807, -0.06515973061323166, 35.8017578125]
fix_type: 16
sv_num: 28
diff_age: 0
heading_type: 0
pos_acc: 0
status: 3
---
```

8. Q&A

Questions	resolve
The Upper computer software cannot be connected	Check whether the COM is occupied and whether the product is powered on normally. If the Upper computer software is disconnected during the connection, the COM may be loose. Plug and remove the COM cable and turn on the Upper computer software.
Disconnect after running for a period of time after power-on	Check the following factors: 1. Check whether the power supply is in the range of 9-32V . 2. Check whether the Voltage for Circuit to Circuit (VCC) is stable 3. Check whether the COM cable or network cable is securely connected and interrupted
The binary data installation manual protocol cannot be resolved	After connecting to the Upper computer software, the log data stream will be automatically cut into the log data stream, which is not open to the public and is only used for debugging, and can only be decoded using the MATLAB script of the official website. Please use the AT command to switch to the Integrated Navigation data stream and NMEA data stream.
The device does not search for stars	Check by following these steps: 1. Must be outside, or have a GPS signal transponder indoors 2. Check whether the physical connection of the primary antenna is normal . 3. If the physical connection of the secondary antenna is normal, connect the RTK COM and input GNGGAH. 1 Print the location information of the secondary antenna and confirm the comparison. If the secondary antenna is located properly and the primary antenna is not located properly, the test environment and the antenna power supply are normal. For example, the cable is damaged
The output data of the COM is garbled or full of dots	Check whether the baud rate is set, the following is the default baud rate of each interface 1.RS232-A 460800 2.RS232-B 460800 3.RS232-RTK 115200
There is a fixed error between the CAN protocol elevation and the reference value	At present, there are two main elevation formats in the navigation protocol, altitude and ellipsoidal height . CAN output elevation data as altitude, confirm whether the reference value is altitude, if not, you can change the elevation output of reference value to altitude
The positioning state is always 1	1. If you use a LAN network port to connect a computer or router to access the Internet to obtain the differential, check whether the differential account information and IP address in the config.ini file are correctly configured 2. If you use RTK-232 COM to input differential data, please check whether the baud rate matches, the COM is 115200 by default, and then check whether the COM normally outputs

	GNGGA statements (there is output by default, the differential server needs to receive gga statements from the device before sending differential data). If no output, To output the configuration statement for the RTK-232 COM, run the following command in sequence: log gngga ontime 1saveconfig
The data trace deviation is too large	Check the following factors: 1. Check whether the rod arm configuration is correctly configured ; 2. Check whether it is calibrated ; 3. Whether the algorithm is initialized
Unable to initialize	1. Confirm whether the positioning state has entered the narrow lane fixed solution. If the narrow lane fixed solution cannot be entered, please drive the vehicle to a more open location 2. Single antenna, in the case of access to the odometer, the driving speed is required to be greater than 2m/sto initialize 3. Single antenna, without access to the odometer, requires a travel speed greater than 5m/ sto initialize 4. In the case of dual antennas, the positioning state and the orientation state both require the narrow lane fixed solution state at the same time, and the duration is greater than 30 seconds, in order to initialize
10.5 How Do I Copy Files in an SD Card	Use type-C harness to connect the OTG COM of the device, the computer will display the corresponding virtual USB flash drive, open the USB flash drive, in the log folder, the record file name is recorded in Beijing time. 6 folders in a group
Double antenna directional state never reaches 50	Check the following factors: 1. If the directional status is always 0, check whether the secondary antenna is being connected and whether the antenna feeder is damaged. 2. If the directional status is not 0 but does not reach 50, please confirm whether the test environment is open and whether the distance between the two antennas is more than 50CM.
When the active antenna is connected, the signal is normal, and when the passive antenna is connected , there is no signal	The feed line of the passive antenna cannot exceed 1.5M.
When the antenna is connected to an active power splitter, the signal is normal. When the device supplies power to the antenna, there is no signal	Check whether there is a short circuit in the antenna feeder or whether the antenna is inserted or removed during power-on. The antenna power supply circuit is abnormal due to static electricity. A fuse has been designed in the current circuit design and can be restored after power-on.
COM packet loss	Check the following factors: 1. The COM cable must support 460800 baud rate 2. The COM delay must be set to 2ms
If signals are recovered after exiting the tunnel, the trajectory convergence is not smooth	When the smoothing mode is not enabled, the RTK will be quickly pulled back to the correct point when the fixed solution is restored. The problem can be solved by enabling the

	smoothing mode or smoothing the automatic driving control system
Large error with Lidar track	1. In the open scene, the fixed solution path of RTK can reach the centimeter level, which can be used as a reference to confirm whether the problem is LiDAR or Integrated Navigation
Can the nmea protocol and binary protocol be output synchronously?	No, only one of these protocols can be output simultaneously
Why is there still satellite count when the antenna is unplugged?	UM982 signal tracking ability is strong, if there is a signal source around, unplugging the antenna will continue to track for a period of time through the coupling mode, the actual satellite lock-out scenario antenna is still connected, external signals can not enter, does not affect the use
The use of a metal pot cover to block the antenna simulates the loss of lock, and the state is still fixed	Wrong test method: The metal pot cover can only block the signal directly above, and the side signal is reflected through the roof to the bottom of the pot cover and then reflected to the antenna, which will cause false fixation
The ROS driver cannot read the data	The default power-on output combination data stream is not configured for the device. Configuring the default power-on output combination data stream can solve the problem
Large heading error	There can be several reasons: 1. rod arm, wheelbase misconfiguration, unit is magnified by 10x , 2. Confirm that it is rigid and fixed 3. It is faraway from strong vibration sources
The attitude error with the reference standard exceeds the standard	Confirm whether the installation error is deducted during statistics (generally, the average error between the benchmark and the installation error)

9. Accessories

Standard accessories:

	
Harness	
	
Main antenna	Secondary antenna (directional antenna)
	
Primary antenna connection cable	Secondary antenna connection cable

Optional accessories:

	
Type-C wire	RS232 serial cable
	
OBD to DB9 cable (for access odometer use)	

10 Update the record

Latest version of manual:FSS-NAV680D_Datasheet_ Product Manual

Versions	Dates	Status/Comments
Version 1.0	2024.01.20	First Issue
Version 1.1	2024.04.17	Added 6ul firmware upgrade mode
Version 1.2	2024.07.18	Add quick use process, add list of frequently asked questions