

USER MANUAL WT901C(RS232)

Inclinometer Sensor



WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english - 1 -



Tutorial Link

Google Drive

Link to instructions DEMO: WITMOTION Youtube Channel WT901C Playlist

If you have technical problems or cannot find the information that you need in the provided documents, please contact our support team. Our engineering team is committed to providing the required support necessary to ensure that you are successful with the operation of our AHRS sensors.

Contact

Technical Support Contact Info

Application

- AGV Truck
- Platform Stability
- Auto Safety System
- 3D Virtual Reality
- Industrial Control
- Robot
- Car Navigation
- UAV
- Truck-mounted Satellite Antenna Equipment

WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english - 2 -



Contents

Tutorial Link 2 -
Contact 2 -
Application 2 -
Contents 3 -
1 Introduction - 5 -
1.1 Warning Statement 6 -
2 Use Instructions with PC 7 -
2.1 Connection Method 7 -
2.1.1 Serial Connection 7 -
2.2 Software Introduction 11 -
2.2.1 Main Menu 11 -
2.2.2 Menu of Configuration 12 -
2.3 Calibration 16 -
2.3.1 Accelerometer Calibration
2.3.2 Magnetic Field Calibration
2.3.3 Gyroscope Automatic Calibration
2.3.4 Reset Z-axis Angle 21 -
2.3.5 Reset Height to 0 21 -
2.4 Configuration - 22 -
2.4.1 Return Content 22 -
2.4.2 Output Rate 23 -
2.4.3 Baud Rate 24 -
2.4.4 Data Recording 25 -
2.4.5 Data Playback 27 -
2.4.6 Standby and Wake Up 29 -
2.4.7 Placement Direction 30 -



2.4.8 Bandwidth 31	-
2.4.9 Restore Factory Setting 33	-
2.4.10 6-axis/ 9-axis Algorithm 34	-
3 Use Instructions with Android Phone 35	-
3.1 APP Installation	-
3.2 Hardware Preparation 36	-
3.3 Connection 37	-
3.4 Calibration - 41	-
3.4.1 Acceleration Calibration 41	-
3.4.2 Magnetic Field Calibration 42	-
4 MCU Connection - 43	-
4.1 Arduino 43	-
4.2 STM32 43	-
4.3 Raspberry pi 43	-
4.4 C# 43	-
4.5 C++ 44	-
4.6 Matlab 44	_



1 Introduction

The WT901C is a multi-sensor device detecting acceleration, angular velocity, angle as well as magnetic filed. The small outline makes it perfectly suitable for industrial retrofit applications such as condition monitoring and predictive maintenance. Configuring the device enables the customer to address a broad variety of use cases by interpreting the sensor data by smart algorithms.

WT901C's scientific name is AHRS IMU sensor. A sensor measures 3-axis angle, angular velocity, acceleration, magnetic field. Its strength lies in the algorithm which can calculate three-axis angle accurately.

WT901C is employed where the highest measurement accuracy is required. It offers several advantages over competing sensor:

• Heated for best data availability: new WITMOTION patented zero-bias automatic detection calibration algorithm outperforms traditional accelerometer sensor

• High precision Roll Pitch Yaw (X Y Z axis) Acceleration + Angular Velocity + Angle + Magnetic Field output

• Low cost of ownership: remote diagnostics and lifetime technical support by WITMOTION service team

• Developed tutorial: providing manual, datasheet, Demo video, free software for Windows computer, APP for Android smartphones , and sample code for MCU integration including 51 serial, STM32, Arduino, Matlab, Raspberry Pi, communication protocol for project development

• WITMOTION sensors have been praised by thousands of engineers as a recommended attitude measurement solution



1.1 Warning Statement

- Putting more than 5 Volt across the sensor wiring of the main power supply can lead to permanent damage to the sensor.
- VCC cannot connect with GND directly, otherwise it will lead to the burning of the circuit board.
- For proper instrument grounding: use WITMOTION with its original factory-made cable or accessories.
- For secondary developing project or integration:
 use WITMOTION with its compiled sample code.



2 Use Instructions with PC

2.1 Connection Method

PC software is only compatible with Windows system.

WT901C Playlist

2.1.1 Serial Connection

Step 1. Connect the sensor with a serial converter

PIN Connection:

- VCC 5~36V
- TX Yellow
- RX Green
- GND GND

(When connecting with computer, VCC-5-36V is recommended.)





Please check the wiring picture to help you connect.









Recommended tools:



Step 2. Unzip the software and install the driver CH340 or CP2102 (Depending on which accessory for usage.)

Link to tutorial of 3-in-1 serial converter/ RS232 serial cable (CH340 driver)

Link to tutorial of 6-in-1 serial converter (CP2102 driver)

Step 3. Plugin the converter to computer and confirm the "com port" in device manager



Step 4. Open the software(Minimu.exe) Data will appear after auto-search finishes

Notice: If not successful, please operate manually Choose the com port and baud rate 9600, data will be shown on the software.



2.2 Software Introduction

Link to download software

2.2.1 Main Menu



Main Menu of software				
Button		Function		
File		Launch recorded HEX file (Bin format)		
Tools		Hide or display tools box on left side		
Record		Record function		
3D		3D DEMO		
Config		Configuration setting		
	Language	English or Chinese		
Help	Bluetooth Set	Binding device or unbind		
	Firmware update	Option for firmware update		
	About Minimu	Info about Minimu.exe		
Factory test		For manufacturer internal test only		
Auto-search		Auto searching the sensor		
Port		Com port selection		
Baud		Baud rate selection		
Туре		Fixed setting as Normal for WT901C		
Open		Open com port		
Close		Close com port		

WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english - 11 -



2.2.2 Menu of Configuration

	LOCK UN	lock Calibrate	e Time				
System							
Reset	Sleep	Alarm	Algrithm:	9 - axis 🗸 🗸	Install Direction:	rizontal ~	Instruction Startup
Calibrate							
Acce	eleration	Mag	gnetic Filed	Reset Z-	axis Angle	Gyro Gyro	Auto Calibrate
Rese	t Height	Angl	e Reference				
Range							
Accleratio	m: 16 g	 Gyro: 	2000 deg/s ~	Band Width:	20 Hz V	GPS Time Zone:	UTC-12 V
	···						
Communicat	tion	_					
Baud Rate:	9600	✓ Outp	out Rate: 10Hz	~	Device Add	Iress: 0x50	change
Content							
Content		celeration 🖂	Velocity	Angle	Magnetism		Port
Content	Ac	celeration 🗹	Velocity	🗹 Angle	Magnetism		Port
Content Time Pressu	☑ Ac	cceleration 🗹	Velocity PDOP	✓ Angle ☐ Quaternion	☑ Magnetism □ Positioning	Accuracy	Port GPS Original
Content Time Pressu Port	☑ Ac	celeration 🗹	Velocity PDOP	☑ Angle □ Quaternion	☑ Magnetism	Accuracy 🗌	Port GPS Original
Content Time Pressu Port	☑ Ac	cceleration	Velocity PDOP	✓ Angle Quaternion	✓ Magnetism □ Positioning	Accuracy	Port GPS Original
Content Time Pressu Port D0 model:	✓ Ac	cceleration 🔽 ccation 🗌 pulse width:	Velocity PDOP	Angle Quaternion	Magnetism Positioning	Accuracy	Port GPS Original
Content Time Pressu Port D0 model: D1 model:	✓ Ac	cceleration cation pulse width: pulse width:	Velocity PDOP 0 ÷	Angle Quaternion	Magnetism Positioning	Accuracy	Port GPS Original
Content Time Pressu Port D0 model: D1 model:	✓ Ac	cceleration ccation pulse width: pulse width:	Velocity PDOP	Angle Quaternion	Magnetism Positioning	Accuracy	Port GPS Original
Content Time Pressu Port D0 model: D1 model: D2 model:	 ✓ Ac ure ↓ Lc ▲IN ~ ▲IN ~ ▲IN ~ 	cceleration cation pulse width: pulse width: pulse width:	Velocity PDOP 0 • 0 •	Angle Quaternion	Magnetism Positioning	Accuracy	Port GPS Original
Content Time Pressu Port D0 model: D1 model: D2 model: D3 model:	✓ Ac ure □ Lc AIN ~ AIN ~ AIN ~ AIN ~	pulse width: pulse width: pulse width: pulse width:	Velocity PDOP 0 ÷ 0 ÷ 0 ÷	Angle Quaternion	✓ Magnetism Positioning	Accuracy	Port GPS Original
Content Time Pressu Port D0 model: D1 model: D2 model: D3 model:	 ✓ Ac ure ↓ Lc ▲IN ~ ▲IN ~ ▲IN ~ ▲IN ~ 	cceleration pulse width: pulse width: pulse width: pulse width: pulse width:	Velocity PDOP 0 * 0 * 0 * 0 *	Angle Quaternion	Magnetism Positioning	Accuracy	Port GPS Original
Content Time Pressu Port D0 model: D1 model: D2 model: D3 model:	 ✓ Ac ure □ Lc AIN ~ AIN ~ AIN ~ AIN ~ 	cceleration cation pulse width: pulse width: pulse width: pulse width:	Velocity PDOP 0 • 0 • 0 • 0 •	Angle Quaternion	✓ Magnetism □ Positioning c	Accuracy	Port GPS Original
Content Time Pressu Port D0 model: D1 model: D2 model: D3 model: Save Co	✓ Ac ure □ Lc AIN ~ AIN ~ AIN ~	cceleration ccation pulse width: pulse width: pulse width: pulse width:	Velocity PDOP 0 • 0 • 0 • 0 • 0 •	Angle Quaternion	✓ Magnetism Positioning	Accuracy	Port GPS Original

Menu of Configuration			
Button	Function		
Read Config	Reading the current configuration		
Lock	Lock the sensor		
Unlock	Unlock the sensor		
Calibrate Time	Calibration time of chip		
Save Config	Save configuration		



System			
Reset Sleep Alarm Algrit	hm: 9 - axis V Install Direction: Horizontal V Distantup		
Me	enu of System		
Button	Function		
Reset	Reset to factory setting		
Sleep	Sleep function		
Alarm	Alarm function		
Algorithm	6-axis algorithm or 9-axis		
Installation Direction	Vertical or horizontal installation		
Instruction Start-up	Instructions sending to start-up the sensor		

Instruction Start-up:

This function is used to prevent the data sent by the module after connecting to the computer to conflict with the mouse, causing the mouse to jump. After checking this function, the function will take effect the next time the module is used, or it can take effect when the module is powered on again.

Calibrate				
Acceleration	Magnetic Filed	Reset Z-axis Angle 🗹 Gyro Auto Calibrate		
Reset Height	Angle Reference			
	Mer	nu of Calibrate		
Button		Function		
Acceleration		Accelerometer calibration		
Magnetic Field		Magnetometer calibration		
Reset Height		Reset height data to 0		
		(only for sensor built-in barometer,		
		including WT901B, WTGAHRS2,		
		WTGAHRS1, HWT901B)		
Reset Z-axis Angle		Reset Z-axis angle to 0 degree, not available		
		for WT901C in 9-axis algorithm		
Angle Reference		Setting current angle as 0 degree		
Gyro Auto Calibrate		Auto-calibration of gyroscope		

Range Accleration:	16 g 🗸 🗸	Gyro: 2000 deg/s ∨	Band Width:	20 Hz ~	GPS Time Zone:	UTC-12	~
W	T901C RS2	32 manual v070	7 http - 13 -	://wiki.wi	t-motion.com	n/englis	h



Menu of Range		
Button Function		
Acceleration	Acceleration measurement range	
Gyro	Gyroscope measurement range	
Band Width Bandwidth range		
GPS Time Zone GPS positioning of time zone		

Communication

Baud Rate: 9600

 \sim

Output Rate: 10Hz v

Device Address: 0x50 change

Menu of Communication			
Button	Function		
Baud Rate	Baud rate selection		
Output Rate	Return rate selection		
Device Address	Interface for R&D		

Content					
🗹 Time	Acceleration	☑ Velocity	🗹 Angle	🗹 Magnetism	Port
Pressure	Location		Quaternion	Positioning Accuracy	GPS Original

Menu of Content			
Button	Function		
Time	Time data output		
Acceleration	Acceleration data output		
Velocity	Angular velocity data output		
Angle	Angle data output		
Magnetism	Magnetic field data output		
Port	Port data output		
Pressure	Pressure output, only available with the		
	sensor built-in barometer like HWT901B,		
	WTGAHRS2, WT901B, etc		
Location	Latitude&Longitude data output, only for		
	GPS IMU series, such as WTGAHRS1,		
	WTGAHRS2		
PDOP	Ground velocity data output, only for GPS		
	IMU series, such as WTGAHRS1,		
	WTGAHRS2		
Quaternion	Quaternion data output		
Positioning Accuracy	Option for GPS positioning accuracy output,		
	including Satellite quantity, PDOP, HDOP,		
	VDOP data, only for GPS IMU series, such as		
	WTGAHRS1, WTGAHRS2		
WT001C RS2221 manual v0707 L http://wil/i wit motion.com/onglish			



GPS Original	Only output GPS raw data, only for GPS IMU						
	series, such as WTGAHRS1, WTGAHRS2						
Menu of Port							
D0 Model	Extended port D0						
D1 Model	Extended port D1						
D2 Model	Extended port D2						
D3 Model	Extended port D3						
Pulse width	Pulse width of PWM						
Cycle	Cycle of PWM						

Port						
D0 model:	AIN ~	pulse width:	0	•	cycle:	0
D1 model:	AIN ~	pulse width:	0	•	cycle:	0
D2 model:	AIN ~	pulse width:	0		cycle:	0
D3 model:	AIN ~	pulse width:	0	•	cycle:	0



2.3 Calibration

Preparation: Make sure the sensor is "Online".

Calibration on PC software:

It is required to calibrate for the first time usage.

2.3.1 Accelerometer Calibration

Purpose:

The accelerometer calibration is used to remove the zero bias of the accelerometer. Before calibration, there will be different degrees of bias error. After calibration, the measurement will be accurate.

Methods:

- Step 1. Keep the module horizontally stationary
- Step 2. Click the accelerometer calibration
- Step 3. Click the "Start calibration" and wait for 3 seconds



Step 4. Click "Complete Calibration" WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english

http://wiki.wit-motion.com/english - 16 -



🐲 WitMotion Shenzhen	Co.,Ltd									- 0	×
<u>File T</u> ools <u>R</u> ecord	<u>3</u> D <u>C</u> onfig <u>H</u> elp	 Auto-search 									
Port COM4	Main Acceleration	Angular Veloc	ity Angle	Magnetic Fi	eld Data F	law Data			(\cdot)	1	
Baudi 9600	Time		Accelera	tion	Angular	Velocity	Magnet	tic Filed		_	20
	System: 1	1:00:26	X:	-0.0020 g	X:	-3.2349 °/s	X:	1		_	20
Open Close	Chip:	0-0-0	Y:	0.0024 g	Y:	0.3662 °/s	Y:	-239		_	
Туре		0:0:0.0	Z:	1.0000 g	Z:	0.4272 °/s	Z:	-146			10
Normal	Relative: 2	75.628	T:	1.0000 g	T:	3.2834 °/s	H :	280		_	
										-	1
	Dent		Descent				Oracto			-	
	Port		Pressi	ac of sc	Ar		Quate				- 10
	D0:	0 Tem	pratur	30.91 C	Χ:	-1.538	qu:	0.00000		_	
	D1:	0 Pre	ssure:	0 Pa	Y:	-1.077*	q1:	0.00000	-		- 20
	D2:	0 He	eight:	0.00 m	Z:	179.412 °	q2:	0.00000		—	
	D3:	0 Vol	ltage:		T:	36.91 ℃	q3:	0.00000		_	- 20-
HWT9018 Inclinenser	Location		PDO	P					5	S	
And	Longitude: 0°0.	00000' Sat	ellite	0					4		2
	Latitude: 0°0.	00000° PE	DOP:	0.00					u		- 2
	GPS H:	0.0 m	DOP-	0.00						×.	
and the	GPS Vaw		DOP	0.00					In I	Υ,	11
WIKI	CDS V	0.000		0.00						N	/
-	GPS-V:	0.000								-	
COM4 open success, bau	d:9600										

Step 5. Judge the result--confirm if there is 1g on Z-axis acceleration

1. After $1 \sim 2$ seconds, the three axial acceleration value of the module is about 0, 0, 1, the X and Y axis Angle is around 0°. After calibration, the x-y axis Angle is accurate.

Note: When putting the module horizontal, there is 1g of gravitational acceleration on the Z-axis.

2.3.2 Magnetic Field Calibration

Purpose:

Magnetic calibration is used to remove the zero bias of the magnetic field sensor. Usually, the magnetic field sensor will have a large zero error when it is manufactured. If it is not calibrated, it will bring a large measurement error, which will affect the accuracy of the measurement of the z-axis Angle of the heading Angle.



Preparation:

Sensors should be 20CM away from magnetic and iron and other materials

Methods:

Step 1. Open the Config menu

Step 2. Click the magnetic field calibration button. click the "Start calibration"



Step 3. Slowly rotate the module 360° around X, Y, Z, 3-axis accordingly

WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english - 18 -





Step 4. After rotation, click "End calibration"



Successful result:

Most of data dots will be within the ellipse.

If not successful, please stay away from the objective that can create magnetic field interference.

```
WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english - 19 -
```



2.3.3 Gyroscope Automatic Calibration

The gyroscope calibration is to calibrate the angular velocity, and the sensor will calibrate automatically.

It is recommended that the automatic calibration of gyroscopes can be inactivated only if the module rotates at a constant speed.



2.3.4 Reset Z-axis Angle

Note: If you want to avoid magnetic interference, you can change the algorithm to Axis 6,then you can use reset function of "Reset Z-axis angle".

The z-axis angle is an absolute angle, and it takes the northeast sky as the coordinate system can not be relative to 0 degree.

Z axis to 0 is to make the initial angle of the z axis angle is relative 0 degree. When the module is used before and z - axis drift is large, the z - axis can be calibrated, When the module is powered on, the Z axis will automatically return to 0.

Calibration methods as follow: firstly keep the module static, click the "Config" open the configuration bar and then click "Reset Z-axis Angle" option, you will see the the angle of the Z axis backs to 0 degree in the module data bar.

2.3.5 Reset Height to 0

Only available for the module built-in barometer like WT901B, HWT901B, WTGAHRS1, WTGAHRS2.



2.4 Configuration

2.4.1 Return Content

Setting method: The content of the data return can be set according to user needs, click the configuration option bar, and check the data content to be output.

Taking WT901C as an example, the default output of the module is acceleration, angular velocity, angle, and magnetic field.

w WitMotion Shenzhen Co.,Ltd	🛩 Normal - Config >	< — — ×
<u>File Tools Record 3D Config</u>	Read Config Lock Unlock Calibrate Time	
Port Main Acc	System	
Port: COM4 ~	Reset Sleep Alarm Algrithm: 9 - axis V Install Horizontal V Instruction	No di seria 🔺 👘 📝
Baud: 9600 ~	Calibrata	<u> </u>
Open Close		20
	Acceleration Magnetic Filed Reset Z-axis Angle I Gyro Auto Calibrate	<u> </u>
Туре	Reset Height Angle Reference	<u> </u>
Norma ~	Range	<u>—</u>
	Accleration: 16 g v Gyro: 2000 deg/s v Band Width: 20 Hz v GPS Time Zone: UTC+8 v	
		<u> </u>
		10
	Baud Rate: 9000 V Output Rate: 10Hz V Device Address: 0x00 Change	
	Content	
	🗌 Time 🗹 Acceleration 🗹 Velocity 🖾 Angle 📝 Magnetism 🗌 Port	20
	Pressure Location PDOP Quaternion Positioning Accuracy GPS Original	
		30
	Port	
	D0 model: AIN y pulse width: 0 + cycle: 0 +	
		e S
HW/1901B McChOREE/ Anthreas Agentality Age to 5 of Registric Gill (M. Bennin		4
	D2 model: AIN v pulse width: 0 🛊 🗸 cycle: 0 🛊	
	D2 model AIN V pulse width: 0 🗘	
		I S
Wiki		
Web	Online	
Contact	Jure coming	
COM4 open success, baud:9600	Read Configuration Completed	

Notice: If choosing the GPS Original, there will be no other data output.



2.4.2 Output Rate

🐲 WitMotion Shenzhen Co.,Ltd	➡ Normal - Config ×	- 🗆 X
<u>File Iools Record 3D Config</u>	<u>R</u> ead Config Lock Unlock Calibrate Time	
Port Main Acc	System	
Port: COM4 ~	Reset Sleep Alarm Algrithm: 9 - axis Install Horizontal Instruction Startup Startup Startup Startup Startup Startup	
Baud: 9600 V	Calibrate	20
	Acceleration Magnetic Filed Reset Z-axis Angle 🗹 Gyro Auto Calibrate	20
Туре	Reset Height Angle Reference	<u> </u>
Norma	Range	<u> </u>
	Accleration: 16 g v Gyro: 2000 deg/s V Band Width: 20 Hz V GPS Time Zone: UTC+8 V	
	Communication	
	Baud Rate: 9600 V Output Rate: 10Hz V Device Address: 0x50 change	10
		20
		<u> </u>
	Pressure Location PDOP Quaternion Positioning Accuracy GPS Original	30
	Port	
	D0 model: AIN v pulse width: 0 + cycle: 0 +	
SINDT Inclinimeter Academics Jaguite Velocity Angleryce)	D1 model: AIN v pulse width: 0 + cycle: 0 +	6 S
	D2 model: AIN v pulse width: 0 + cycle: 0 +	
	D3 model: AIN V pulse width: 0 🔹 cycle: 0 🔹	₩ - Q - ₹
		W -
WiKi		
<u>Web</u>	Save Config	
Contact	Read Configuration Completed	
COM4 open success baud:9600		

The default return rate of the module is 10Hz, the highest return rate supports 200Hz.

10Hz refers to the return of 10 data packets in 1S. 1 data packet is 33 bytes by default.

Note: If there are more backhaul contents and the communication baud rate is lower, it may not be possible to transmit so much data. Then the module will automatically reduce the frequency and output at the maximum allowable output rate. To put it simply, if the return rate is high, the baud rate should also be set higher, generally 115200.



2.4.3 Baud Rate

The module supports multiple baud rates, and the default baud rate is 9600. To set the baud rate of the module, you need to select the baud rate to be changed in the communication rate drop-down box in the configuration bar based on the correct connection between the software and the module.

Note: After the change, the module will no longer output data at the original baud rate. The data will be output only when the baud rate that has been changed is selected on the PC software again.



2.4.4 Data Recording

Method are as follows:

Step 1: Click "Record" and "Begin"

Step 2: Click "Stop"





Step 3: Extract the data as "txt" file



Notice: If there is repeated "TIME" of data, that's caused by low-resolution of the Windows system's time. The changes in other data is correct.

It is highly recommended that data can be pasted to an Excel file. In this way, all data will be shown in order.

StartTim	e: 2020-04	1-11 16:54	:24.437												
address	Time(s)	ChipTime	ax(g)	ay(g)	az(g)	wx(deg/s)	wy(deg/s)	wz(deg/s)	AngleX(deg	AngleY(deg	AngleZ(deg)	T(°)	hx	hy	hz
0x50	43:06.4	02:40.4	0.4443	0.1777	-0.8696	3.1738	-0.3662	-29.541	166.0364	-29.2072	120.6299	29.97	0	50	313
0x50	43:06.5	02:40.5	0.02	0.5796	-0.7739	-192.0166	283.9355	-700.2563	142.0532	-24.884	154.8907	30	-29	7	312
0x50	43:06.6	02:40.6	-0.2896	0.8599	-0.5571	-8.2397	-3.7842	-264.5264	124.0741	20.0171	-158.2196	30	-7	-85	291
0x50	43:06.7	02:40.7	-0.771	0.5322	-0.4761	36.0718	43.8232	-226.8677	132.984	41.4514	-138.0872	30	38	-93	289
0x50	43:06.8	02:40.8	-0.5601	0.4233	-0.5562	55.7861	101.9897	274.1699	144.5087	35.5792	-132.4292	30	22	-58	301
0x50	43:06.9	02:40.9	-0.0059	0.5503	-1.0103	139.0991	-32.7759	432.251	141.4929	1.8073	-174.1113	30	-22	-9	308
0x50	43:07.0	02:41.0	0.2656	0.3887	-0.8594	124.3896	7.8735	341.1865	154.6985	-15.5896	157.3077	30.01	-14	46	307
0x50	43:07.1	02:41.1	0.3911	0.1104	-0.8467	40.7715	11.9019	257.1411	177.3303	-25.7684	127.7325	30	0	104	294
0x50	43:07.2	02:41.2	0.3896	0.3022	-0.8994	-90.0879	135.3149	-268.9819	163.4601	-31.9867	128.6829	30.03	-2	67	308
0x50	43:07.3	02:41.3	0.2939	0.9531	-0.2837	-251.5259	48.645	-750.4272	119.0149	-0.3625	-174.1608	30.03	-30	-56	295
0x50	43:07.4	02:41.4	-0.4614	0.7075	-0.3384	-27.3438	-19.4702	-226.9287	112.8021	30.6519	-161.4001	30	33	-122	272
0x50	43:07.5	02:41.5	-0.7988	0.6279	-0.5044	28.0762	81.7261	122.1924	122.0087	39.8035	-151.1389	30	63	-110	275
0x50	43:07.6	02:41.6	-0.2495	0.8135	-0.5327	36.377	5.6763	93.0176	121.8494	15.7214	-161.109	30	12	-108	288
0x50	43:07.7	02:41.7	0.3057	0.7432	-0.5996	74.0356	-0.061	379.7607	126.7603	-11.4478	-176.6711	30.03	-51	-68	295
0x50	43:07.8	02:41.8	0.4922	0.4653	-0.7129	134.7656	24.231	268.9819	145.3656	-32.4756	163.3832	30.02	-83	10	295
0x50	43:07.9	02:41.9	0.4507	0.4272	-0.7871	-186.5234	-36.3159	420.6543	166.2616	-49.1583	130.2924	30.02	-86	71	292
0x50	43:08.0	02:42.0	0.6045	-0.062	-0.8027	37.9028	7.6294	-138.0005	173.4357	-45.8514	118.0206	30.03	-66	75	298
0x50	43:08.1	02:42.1	0.4712	0.6011	-0.5688	-172.6685	-7.1411	-537.6587	137.6312	-31.2396	163.8171	30.03	-78	20	300
0x50	43:08.2	02:42.2	-0.0649	0.873	-0.4028	-115.6616	2.3193	-276.2451	113.6481	4.6417	-169.8761	29.98	-37	-101	283
0x50	43:08.3	02:42.3	-0.4092	0.856	-0.1816	-134.8877	-38.208	-155.7007	99.8822	26.933	-165.943	30.03	32	-166	244
0x50	43:08.4	02:42.4	-0.5171	0.8809	-0.1152	84.1064	0.9155	86.2427	94.8285	33.2666	-167.5415	30.06	72	-186	218
0x50	43:08.5	02:42.5	-0.1782	0.9595	-0.2793	243.2861	29.3579	406.8604	110.7367	13.3429	-169.0686	30.03	29	-156	254



2.4.5 **Data Playback**

New function: When creating recorded file each time, there will a BIN file created in the folder of record file in path of installed software meanwhile. Recorded data playback method:

Step 1: Disconnect the sensor

Step 2: Click "File" Button and then click "Load"



Step 3: Choose the original path of software installation and load the Bin file



WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english - 27 -



WitMotion Shenzhen Co.,Ltd					- [
<u>File Tools Record 3D Co</u> o	nfig <u>H</u> elp • Auto-search					
Port Main	Acceleration Angular Velocity An	gle Magnetic Field Da	ta Raw Data			1
Port: V						
Baud: 115200 ~	XA7' + N.4 - + *	C1 1	C 1	. 1		— 2
	WitMotic	on Shenzh	en Co.,	Ltd		
Open Close	Attitudo	logging	ont Cure	tom		
Туре	Attitude	reasurem	ent sys	tem	- 16	
Please choose file				×	-	
← → × ↑ <mark> </mark>	PC software-Normal > recordFile	V Či Se	arch recordFile	٩		Г
		• 0 30	arenteeoranie	-		
Organize New folder						- 1
This PC Nam	e	Date modified	Туре	Size ^	_	
3D Objects	lormal_200410113009.BIN	4/10/2020 11:30 AM	BIN File			_ •
Desiton	lormal_200411174256.BIN	4/11/2020 5:42 PM	BIN File			
	Normal_200411174305.BIN	4/11/2020 5:43 PM	BIN File			
	Vormal_200426111241.BIN	4/26/2020 11:12 AM	BIN File			
Downloads	Normal_200426111250.BIN	4/26/2020 11:12 AM	BIN File			
Music	Normal_200426111253.BIN	4/26/2020 11:13 AM	BIN File			
📰 Pictures 📄 N	Vormal_200426111311.BIN	4/26/2020 11:13 AM	BIN File			
Videos 🗋 N	Vormal_200515171516.BIN	5/15/2020 5:15 PM	BIN File			1 A
Local Disk (C:)	Normal_200528103951.BIN	5/28/2020 10:39 AM	BIN File			1
DATA (D:)	lormal_200528104200.BIN	5/28/2020 10:42 AM	BIN File		3-0	
Play (E:)	lormal_200528104215.BIN	5/28/2020 10:43 AM	BIN File			
PROGRAM & FIL	lormal_200528110529.BIN	5/28/2020 11:05 AM	BIN File	~	E.	C C
		_		>	S	2
File <u>n</u> ame:		~ 8	nary file(*.bin)	~		
		T	<u>O</u> pen	Cancel		

Step 4: Click "Run" and the Binary file will be playback When playback, the rate can be editable.





2.4.6 Standby and Wake Up

Sleep: The module paused working and entered the standby mode. Power consumption is reduced after sleeping.

Wake Up: The module enters the working state from the standby state.

The module defaults to a working state, in the "Config" of the software, click

"Sleep" option to enter the sleep state, click "Sleep" again to release sleep.

	Sleep	Alarm	Algrithm	n: 9 - axis ∨	Direction:	Horizonta		
Calibrate								
Accele	ration	Mag	gnetic Filed	Reset Z	-axis Angle		🗹 Gyro Au	to Calibrate
Reset I	Height	Angl	e Reference					
lange								
Accleration:	16 g	 ✓ Gyro: 	2000 deg/s ~	Band Width:	20 Hz 🗸	GPS Tir	me Zone: U	TC+8 、
communicatio	n							
Baud Rate: 9	600	✓ Out;	out Rate: 10Hz	~	Device 4	ddress:	0x50 (hange
			Charles and the second s					1.1
Content								
Content	☑ Ac	celeration 🗹	Velocity	☑ Angle	✓ Magneti:	sm	D Po	ort
Content	A C	cceleration	Velocity	Angle	☑ Magneti	sm		ort
Content	☑ Ad	cceleration	Velocity PDOP	✓ Angle Quaternion	☑ Magneti: □ Positioni	sm ng Accura	□ Pc	ort PS Original
Content	☑ Ac	cceleration 🗹	Velocity PDOP	☑ Angle □ Quaternion	☑ Magneti: □ Positioni	sm ng Accura	□ Pc	ort PS Original
Content Time Pressure ort 00 model:	e □ Lc	cceleration 🗹	Velocity PDOP	☑ Angle □ Quaternion	☑ Magneti: □ Positioni	sm ng Accura cycle:	Pc lcy Gl	ort PS Original
Content Time Pressure Cort D0 model:		cceleration 🔽 pocation 🗆 pulse width: pulse width:	Velocity PDOP	☑ Angle □ Quaternion	☑ Magneti: □ Positioni	sm ng Accura cycle: cycle:	Pc C	ort PS Original
Content Time Pressure Port 00 model: 01 model:		cceleration 🗹 ocation 🗆 pulse width: pulse width:	Velocity PDOP 0 ÷	Angle Quaternion	☑ Magneti: □ Positioni	sm ng Accura cycle: cycle:	Pc C	ort PS Original
Content Time Pressure Port 00 model: 01 model: 22 model: 22 model: 2		pulse width: pulse width:	Velocity PDOP 0 + 0 +	Angle Quaternion	☑ Magneti:	sm ng Accura cycle: cycle: cycle:	Pe Pe O	ort PS Original
Content Time Pressure Port D0 model: D1 model: D2 model: D3 model: Content D3 model: Content		cceleration pulse width: pulse width: pulse width: pulse width: pulse width:	Velocity PDOP 0 ÷ 0 ÷ 0 ÷	Angle Quaternion	☑ Magneti:	sm ng Accura cycle: cycle: cycle: cycle:	Pc C	ort PS Original

WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english - 29 -



2.4.7 Placement Direction

The default installation direction of the module is horizontal. When the module needs to be installed vertically, the vertical installation can be set. Step 1: Rotate the module 90 degrees around the X-axis

Step 2: Place the sensor 90 degrees vertically

Toola Necolu	Read Config Lock Unlock Calibrate Time	
	System	CALL IN
COM4 ~	Reset Sleep Alarm Algrithm: 9 - axis V Install Direction: Vertical Vertical Instruction Startup	4
9600 ~	Calibrate	
en Close	Acceleration Magnetic Filed Reset Z-axis Angle 🗹 Gyro Auto Calibrate	
	Reset Height Angle Reference	
~	Range	-
	Accleration: 16 g v Gyro: 2000 deg/s v Band Width: 20 Hz v GPS Time Zone: UTC+8 v	
	Communication	
	Baud Rate: 9600 V Output Rate: 10Hz V Device Address: 0x50 change	- 10
	Content	
	🗌 Time 🗹 Acceleration 🗹 Velocity 🔽 Angle 📝 Magnetism 🗌 Port	
	□ Time	
	Time Acceleration Velocity Angle Magnetism Port Pressure Location PDOP Quaternion Positioning Accuracy GPS Original Port	1/1/1/1
	□ Time ✓ Acceleration ✓ Velocity ✓ Angle ✓ Magnetism □ Port □ Pressure □ Location □ PDOP □ Quaternion □ Positioning Accuracy □ GPS Original	1/1/1 1/1/1
	□ Time ✓ Acceleration ✓ Velocity ✓ Angle ✓ Magnetism □ Port □ Pressure □ Location □ PDOP □ Quaternion □ Positioning Accuracy □ GPS Original Port □ □ □ □ □ □ □ D0 model: AIN ∨ pulse width: □ □ □ □ □	≈
	□ Time ✓ Acceleration ✓ Velocity ✓ Angle ✓ Magnetism □ Port □ Pressure □ Location □ PDOP □ Quaternion □ Positioning Accuracy □ GPS Original Port □ model: AIN ∨ pulse width: □ ÷	1/1/1/ Sk
File Learner Marine Marine	□ Time ✓ Acceleration ✓ Velocity ✓ Angle ✓ Magnetism □ Port □ Pressure □ Location □ PDOP □ Quaternion □ Positioning Accuracy □ GPS Original Port □ □ □ □ □ □ □ D0 model: AIN ∨ pulse width: □ □ □ □ □ D1 model: AIN ∨ pulse width: □ □ □ cycle: □ □ D2 model: AIN ∨ pulse width: □ □ □ cycle: □ □	111/11 10
THE ADDRESS	□ Time ✓ Acceleration ✓ Velocity ✓ Angle ✓ Magnetism □ Port □ Pressure □ Location □ PDOP □ Quaternion □ Positioning Accuracy □ GPS Original Port □ □ □ □ □ □ □ D0 model: AIN ∨ pulse width: □ □ □ □ □ D1 model: AIN ∨ pulse width: □ □ □ □ □ D2 model: AIN ∨ pulse width: □ □ □ □ □ D3 model: AIN ∨ pulse width: □ □ □ □ □	
	□ Time ✓ Acceleration ✓ Velocity ✓ Angle ✓ Magnetism □ Port □ Pressure □ Location □ PDOP □ Quaternion □ Positioning Accuracy □ GPS Original Port □ model: ▲IN ∨ pulse width: □ ÷	
	□ Time ✓ Acceleration ✓ Velocity ✓ Angle ✓ Magnetism □ Port □ Pressure □ Location □ PDOP □ Quaternion □ Positioning Accuracy □ GPS Original Port □ model: ▲IN ∨ pulse width: □ ÷ □ cycle: □ ÷ □ model: ▲IN ∨ pulse width: □ ÷ □ cycle: □ ÷ □ model: ▲IN ∨ pulse width: □ ÷ □ cycle: □ ÷ □ model: AIN ∨ pulse width: □ ÷ □ cycle: □ ÷ □ model: AIN ∨ pulse width: □ ÷ □ cycle: □ ÷ □ model: AIN ∨ pulse width: □ ÷ □ cycle: □ ÷ □ model: AIN ∨ pulse width: □ ÷ □ cycle: □ ÷ □ model: AIN ∨ pulse width: □ ÷ □ cycle: □ ÷ □ save Config □ Conline □ cycle: □ ÷ □ cycle: □ ÷	

Step 3: Click "Vertical" as install directions on "Config" menu

WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english - 30 -



2.4.8 Bandwidth

Default bandwidth is 20Hz.

🐲 WitMotion Shenzhen (🐭 Normal - Config 🛛 👋	– 🗆 X
<u>File Tools Record</u>	Read Config Lock Unlock Calibrate Time	
Port	System	
Port: COM4 v	Reset Sleep Alarm Algrithm: 9 - axis Virtual Vertical Startup	4
Baud: 9600 ~	Calibrate	
Open Close	Acceleration Magnetic Filed Reset Z-axis Angle 🖸 Gyro Auto Calibrate	- 40
Туре	Reset Height Angle Reference	- 30
Morma	Range	
	Accleration: 16 g v Gyro: 2000 deg/s v Band Width: 20 Hz v GPS Time Zone: UTC+8 v	
	Communication	
	Baud Rate: 9600 V Output Rate: 10Hz V Device Address: 0x50 change	10
	Content	~
	🗌 Time 🗹 Acceleration 🗹 Velocity 🗹 Angle 🕼 Magnetism 🗌 Port	
	Pressure Location PDOP Quaternion Positioning Accuracy GPS Original	-
	Port	
	D0 model: AIN pulse width:	
WT901WHT Wirefess Inclinometer	D1 model: AIN v pulse width: 0 😧 🖡 cycle: 0 🕏	SIM
Angle Association Caro Magnetic D.Y.Z.	D2 model: AIN v pulse width: 0 🗘 🖡 cycle: 0 🗘	2
VIIIT	D3 model: AIN v pulse width: 0 🛊 🛛 cycle: 0 🛊	
		W / 4
WiKi	Online	J/N V
Web	Save Config	
Contact	Successfully set installation direction!	
COM4 open success baud	1:9600	

Function:

1. The higher rate of bandwidth setting will lead to the higher fluctuation in data waveform. Conversely, the lower rate of bandwidth, data will become more fluent.

For example:

Bandwidth as 20Hz, Output rate as 10Hz. The waveform is very steady.





Bandwidth as 256Hz, Output rate as 10Hz. The waveform will show more fluctuation.



2. The higher rate of bandwidth will solve the data-repeating problem.

For example, if the bandwidth setting is 20Hz, retrieval rate as 100Hz, there will be 5 repeating data.

If you prefer there is no repeating data, it is required to increase the bandwidth more than 100Hz.



2.4.9 Restore Factory Setting

Operation method:

Connect the WT901C module and the computer through the USB-TTL module, click the setting tab, and click to restore the default. After restoring the factory settings, power on the module again. (This method needs to know the baud rate of the module in advance, if the baud rate does not match the instruction will not take effect, please try to use the short circuit method to recover)



2.4.10 6-axis/ 9-axis Algorithm

6-axis algorithm: Z-axis angle is mainly calculated based on angular velocity integral. There will be calculated error on Z-axis angle.

9-axis algorithm: Z-axis angle is mainly calculated and analyzed based on the magnetic field. Z-axis angle will have few drift.

The default algorithm of WT901C is 9-axis. If there is magnetic field interference around installed environment, it is recommended to switch to 6-axis algorithm to detect the angle.

Method:

Step 1: Switch to the "6-axis" algorithm on "Config" menu

Step 2: Proceed the "Accelerometer calibration" and "Reset Z-axis angle" calibration.

🛩 WitMotion Shenzhen Co.,Ltd	🐭 Normal - Config	× – 🗆 ×
<u>File T</u> ools <u>R</u> ecord <u>3</u> D <u>C</u> onfig	H Read Config Lock Unlock Calibrate Time	
Port Main A	cc System	
Port: COM4 ~	Reset Sleep Alarm Algrithm 9-axis V Install Horizontal V Instruction:	an 🔪 🥍 🎽
Baud: 9600 ~	Calibrate 6 - axis	—
Open Close	Acceleration Magnetic Filed Reset Z-axis Angle 🗹 Gyro Auto Calibrate	20
Туре	Reset Height Angle Reference	<u> </u>
Norma	Range	
	Accleration: 16 g v Gyro: 2000 deg/s v Band Width: 20 Hz v GPS Time Zone: UTC+8	
	Communication	
	Baud Rate: 9600 V Output Rate: 10Hz V Device Address: 0x51 change	<u> </u>
	Content	20
	Time 🗹 Acceleration 🗹 Velocity 🗹 Angle 🗹 Magnetism 🗌 Port	20
10.	Pressure Location PDOP Quaternion Positioning Accuracy GPS Original	<u> </u>
	Port	
	D0 model: AIN v pulse width: 0 + cycle: 0 +	
SINDT Inclinement Anotenien August Volkers Augustein	D1 model: AIN v pulse width: 0 - cycle: 0 -	
	D2 madel. AIN V pulse width: 0 0	
	D3 model: AIN Y pulse width: C C C C C C C C C C C C C C C C C C C	
WiKi		8 e a
Web	Save Config	
Contact		
COM4 open success, baud:9600	Read Configuration Completed	.4

After the calibration is completed, it can be used normally.



3 Use Instructions with Android Phone

For APP configuration introduction, please referring to the Chapter 2.2

3.1 APP Installation

Install the APK file, give permission of Location and Storage

wite sportions		\bigcirc		
WitMotion		WitMotion		
All permissions	5 🗸			
SEARCH IN APPGALLERY		PERMISSIONS	_	
INSTALL		Storage		
CANCEL		Location	All the time >	

Link to download Android APP

My Drive > WITMOTION Document Center > WT901C-RS232

ame	
	Android APP.Zip
₹	CH340& CP2102 Driver.zip
₹	Sample Code.zip 🚢
₹	Standard Software for Windows PC.zip
POF	WT901C Manual_V1.1.pdf
	WT901C RS232 DEMO.mp4 🚢



3.2 Hardware Preparation

Connecting with Android smartphone requires a serial cable and a Type-C converter or OTG converter according to phone's interface.





3.3 Connection

Step 1. Install the APK file, give permission of Storage.

Step 2: Connect the sensor with TTL cable. Then connect the cable with type-c converter. Plug in the device "type-c converter" to the phone.

Notice:

1. After successful connection, there will be a notification reminding that "Choose an APP for the USB device", which means that the device has been detected. Choose "WitMotion", " JUST ONCE" or "ALWAYS" is optional.

2. Only CH340 driver can be detected via WitMotion APP.



Choose an app for the USB device











Step 4. Select the baud rate- 9600.



After selection and wait for a few seconds, the data will show automatically.





DATA CONFIG HELP DATA CONFIG HELP



3.4 Calibration

WT901C-232 Playlist

3.4.1 Acceleration Calibration

Step 1. Keep the module horizontally stationary

- Step 2. Click the "Calibration" menu
- Step 3. Click the "Acceleration Calibration" and wait for 3 seconds

Step	5.	Judge	the	resultconfirm	if there	is :	1q on	Z-axis	acceleration
------	----	-------	-----	---------------	----------	------	-------	--------	--------------

🔟 ".ill 🗟 🌑 🚾 🛞 🗭		🔊 🕸 💷 4:35	🖽 "II 🕾 🗣 🚾 🔘 🗩		🔊 🕸 💷 4:36			
> System	SCAN		PAUSE	D	ata	SCAN		
V Calibration		ANGLE	SYSTEM	A	w	ANGLE		
Acceleration Calibration	Data ou	ıtput: 🗩	Data output: 🕠					
Magnetic Calibration		200	1.8			2.1		
Magnetic Calibration Finish		100	1.2			1.4		
Reset Height to 0		0	0.6			0.7		
Gyroscope Automatic Calibration		-100	-0.6			-0.7		
Reset Z-axis angle to 0		Angles chart -200	-1.2			-1.4 Acceleration chart		
Set Angle Reference	31.8 232.8 224.6 225.6 53.2 53.4 53.6 53.8 54.0 54.2 54.5 54.7 54.9 55.1 55.3 55.5 - ax - ay - az							
> Range		1.15°	ax: 0					
> Communication	-0.87°		ay:		0.03			
> Dert mede	-18.71°		az:		1.01g			
Port mode		35.52°C	a			1.01g		
> PWM pulse width		_						
> PWM cycle	(D			REC	CORD			
Accelerator is calibrating, horizontal for 3 seconds!	please st	ay						
	G		DATA	со	NFIG	HELP		

WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english - 41 -



3.4.2 Magnetic Field Calibration

- Step 1. Click "Calibration" menu
- Step 2. Click the "Magnetic calibration" button
- Step 3. Slowly rotate the module 360° around X, Y, Z, 3-axis accordingly

Step 4. After rotation, click "Magnetic Calibration Finish"

🖽 ⁴⁴ .11 🔶 🗞 🚾 🗷 🗭	🕅 券 💶 4:52			¹⁴ .11 🗟 🌑 🚾 (8 🗭	🕄 券 🎟 4:5		
> System		P	AUSE	Data		SCAN		
V Calibration	ANGLE	MAG	M	А	W	ANGLE	MAG	
Acceleration Calibration	Data output	Data output: 🤍						
Magnetic Calibration		200	200				200	
Magnetic Calibration Finish		100	100				100	
Reset Height to 0		0	-100				-100	
Gyroscope Automatic Calibration		-200	-200				-200	
Reset Z-axis angle to 0		-300	-300				-300	
Set Angle Reference	32.9 33.1 3	33.3 33.5		53.0 53.3 hx hy hy	53.6 53.9 54.2 hz	54.5 51.0 51.2	51.5	
> Range		-35		hx:			-5	
> Communication		-263	_	hy:			-337	
	-158		hz:			-116		
> Port mode		309		h			356	
> PWM pulse width					'			
> PWM cycle	۲D				RECO	RD		
					Calibrate fin	ished!		
	G H			DATA	CONF	IG H	IELP	

Check the result: The Z-axis angle will have fewer drift than before. Notice: If not successful, please stay away from the objective that can create magnetic field interference.

WT901C RS232| manual v0707 | http://wiki.wit-motion.com/english - 42 -



4 MCU Connection



Link to download all sample code

Link to sample code instructions demo

Notice: There is no sample code provided for Linux or Python system at present.

4.1 Arduino

Download link

Arduino UNO3 Demo Link

4.2 STM32

Download link

4.3 Raspberry pi

Tutorial link

4.4 C#

DEMO link



4.5 C++

DEMO link

4.6 Matlab

Receive Sample Code

Dataplot DEMO