AIT



TS-2322-R03 Series

Modbus Dual-Axis Inclinometer

Technical Manual

V1.0

Product Features

- Dual axis tilt measurement
- Resolution：0.02°
- Power supply：9-36V
- Volume：L55*W37*H24（mm）
  L2.17*W1.46*H0.95(inch)
- Highest accuracy：0.2°
- Range：±90°
- Output：RS232/RS485/TTL for optional
- IP67 Protection level

Applications

- Industrial automatic leveling
- Medical instruments
- Photovoltaic automatic tracking
- Tower tilt monitoring
- Special valve
- Oil drilling equipment
- Industrial converter
- Lifting equipment inclination control

Product Description

TS-2322-R03 is a low-cost, small-volume, dual-axis inclinometer with Modbus output developed and produced by AIT Sensing. It adopts a mature industrial-grade MEMS accelerometer with a measurement range of ±90°, the highest accuracy of 0.2°, and an operating temperature of -40°C-+85°C, small size and light weight, it can meet the application requirements with limited space. This product converts the change of the static gravity field into the change of the inclination angle, and directly outputs the horizontal inclination value digitally.

It has the characteristics of low cost, small temperature drift, simple use, and strong anti-interference ability. It is photovoltaic power generation, pan-tilt control, Ideal for inclination measurement in industries such as tower monitoring!

Technical Specifications

Table 1. Performance Index

Measurement Range (°)	Condition	±10	±30	±60	±90
Measurement axis	Mutually perpendicular	X-Y	X-Y	X-Y	X-Y
Accuracy(°)	Room temperature	0.2	0.2	0.2	0.2
Resolution(°)	Completely still	0.02	0.02	0.02	0.02
Cross axis error	-40∽85℃	0.1	0.1	0.1	0.2
Start-up time		＜50ms	＜50ms	＜50ms	＜50ms
Output frequency (Hz）	5-100Hz adjustable	Up to 100	Up to 100	Up to 100	Up to 100
Mean time between failures MTBF		≥90000 h			
Electromagnetic compatibility		According to GBT17626			
Insulation resistance		≥100 MΩ			
Impact resistance		2000g，0.5ms，3times/ axis			
Weight (g）		210（ Without outer packaging）			

Resolution: The smallest change value of the measured value that the sensor can detect and distinguish within the

measurement range.

Accuracy: The root mean square error of the actual angle and the sensor measuring angle for multiple (≥16 times) measurements.

Table 2. Electrical Index

Parameter	Condition	Minimum	Typical value	Maximum
Power voltage(V)		9	12	36
Operating current(mA)	No load	20	30	40
Operating temperature(℃)		-40		85
Storage temperature(℃)		-55		100

Electrical interface

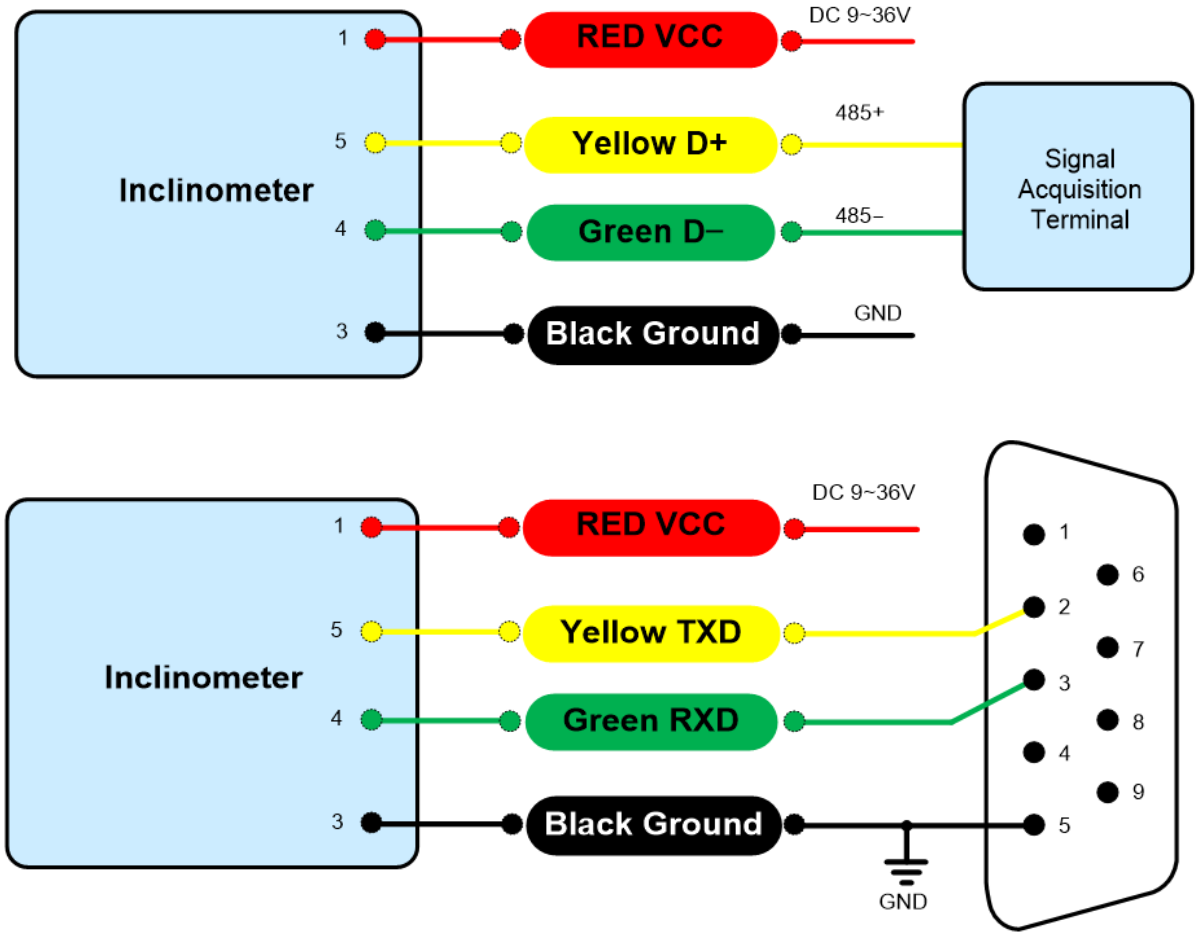


Figure 1. RS 485 / RS 232 Wiring Diagram

Table 3. Wiring Definition

Color Wiring Function	RED	BLUE	BLACK	GREEN	YELLOW
	1	2	3	4	5

	VCCDC 9-36V	NC	GND Place	Receive RXD (B、D-)	Send TXD(A、D+)

Debugging and Testing

You can download the serial debugging assistant directly on the official website, or you can use the more convenient and intuitive host computer software.

TS-2322-R03 supporting serial port debugging software can connect the inclination sensor on the computer to display the angle. The software debugging interface is shown in the figure below. Using the tilt angle to debug the host computer, you can conveniently display the current X direction and Y direction tilt angle, and you can also modify and set other parameters.

Operating Steps:

① Connect the serial port hardware of the inclinometer correctly, and connect the power supply.

② Select computer serial port and baud rate and click connect serial port.

③ Click start button and the current inclination Angle of the incliner in X and Y directions will be displayed on the screen.

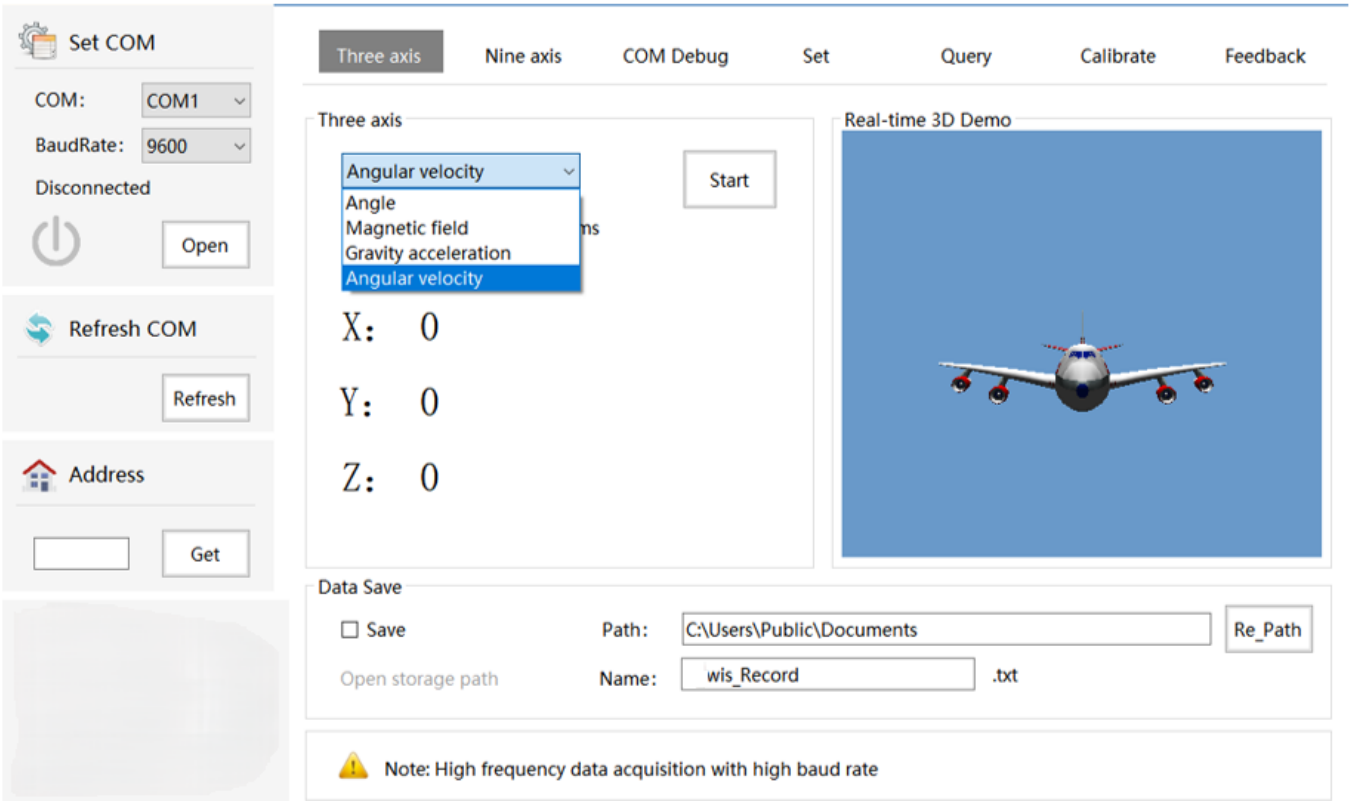


Figure 2. Software Debugging Interface

Installation

The correct installation method can avoid measurement errors. When installing the sensor, please do the following: First of all, make sure that the sensor mounting surface is completely close to the measured surface, and the measured surface should be as level as possible. There should be no included angles as shown in Figure A and Figure C. The correct installation method is shown in Figure B and Figure D.

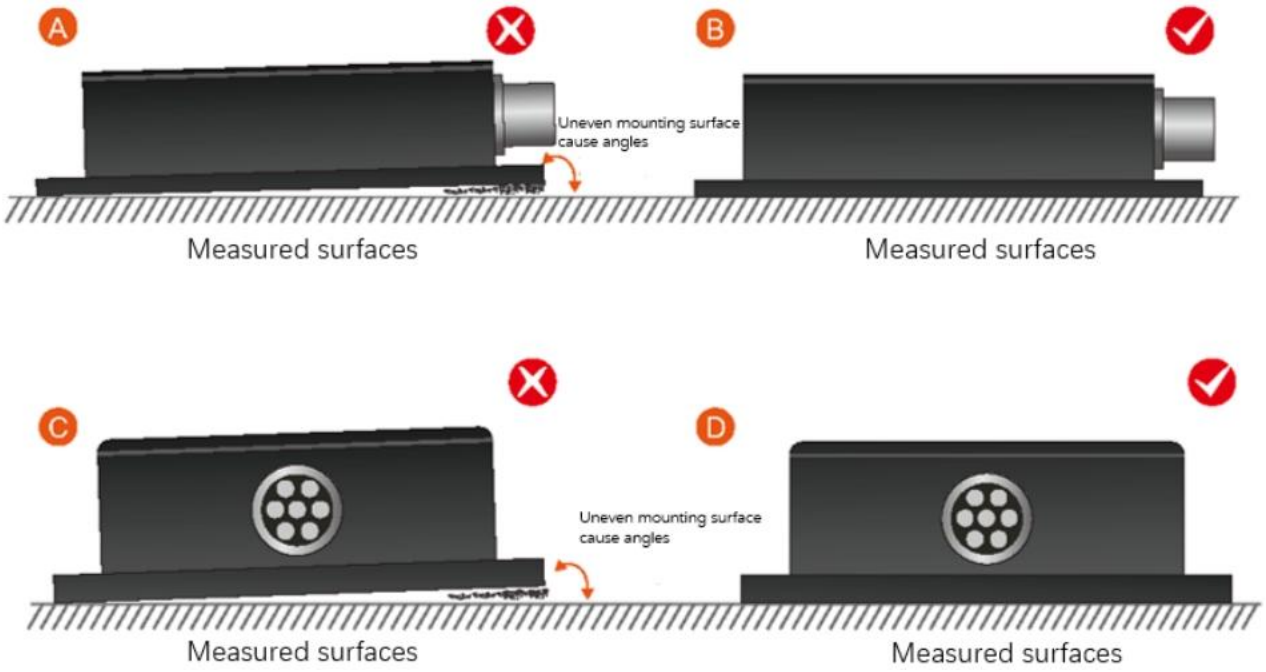


Figure 3. Correct and Incorrect Installation Methods (A/B/C/D)

Secondly, the bottom line of the sensor and the axis of the measured object cannot have an angle as shown in Figure E, and the bottom line of the sensor should be kept parallel or orthogonal to the axis of rotation of the measured object during installation. This product can be installed horizontally or vertically (vertical installation needs to be customized), and the correct installation method is shown in Figure F.

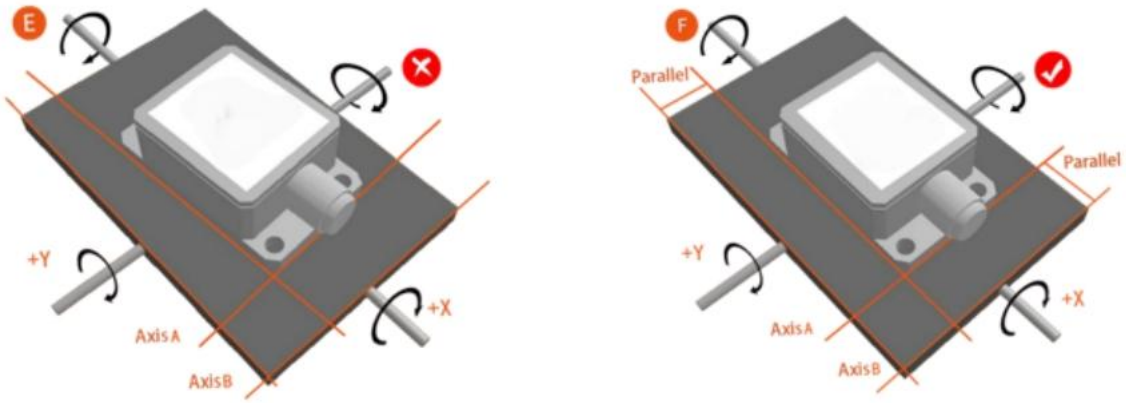


Figure 4. Installation Methods (E/F)

Finally, the mounting surface of the sensor and the surface to be measured must be tightly fixed, smooth in contact, and stable in rotation, and measurement errors due to acceleration and vibration must be avoided.

Dimensions

Overall Dimensions

Product size：L55*W37*H24（mm）

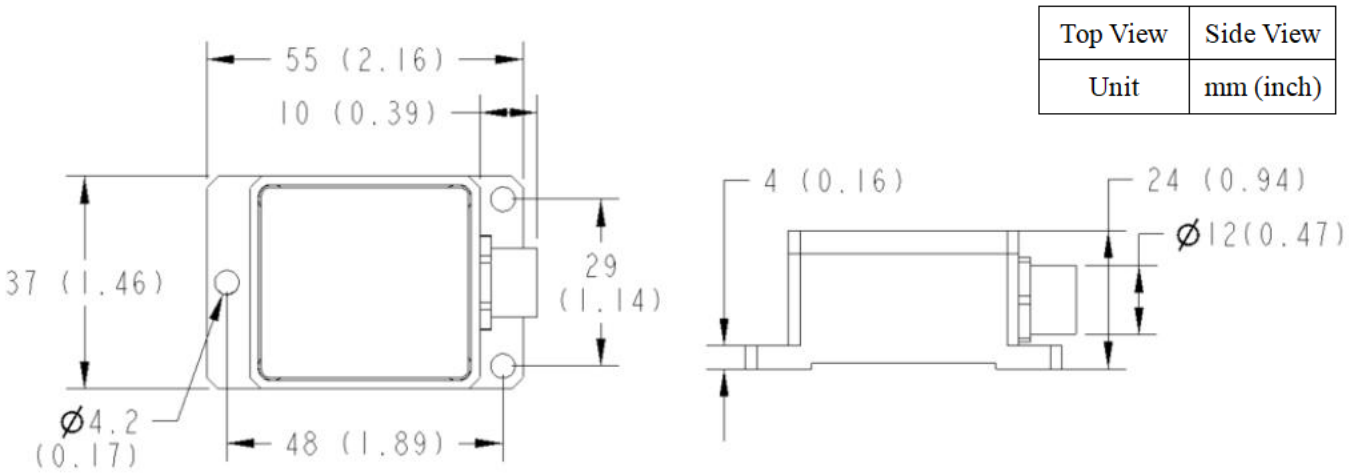


Figure 5. Overall Dimensions

PCB Dimensions

Product size：L33*W27*H6（mm） The length and width may have an error of ±1mm, please refer to the actual product

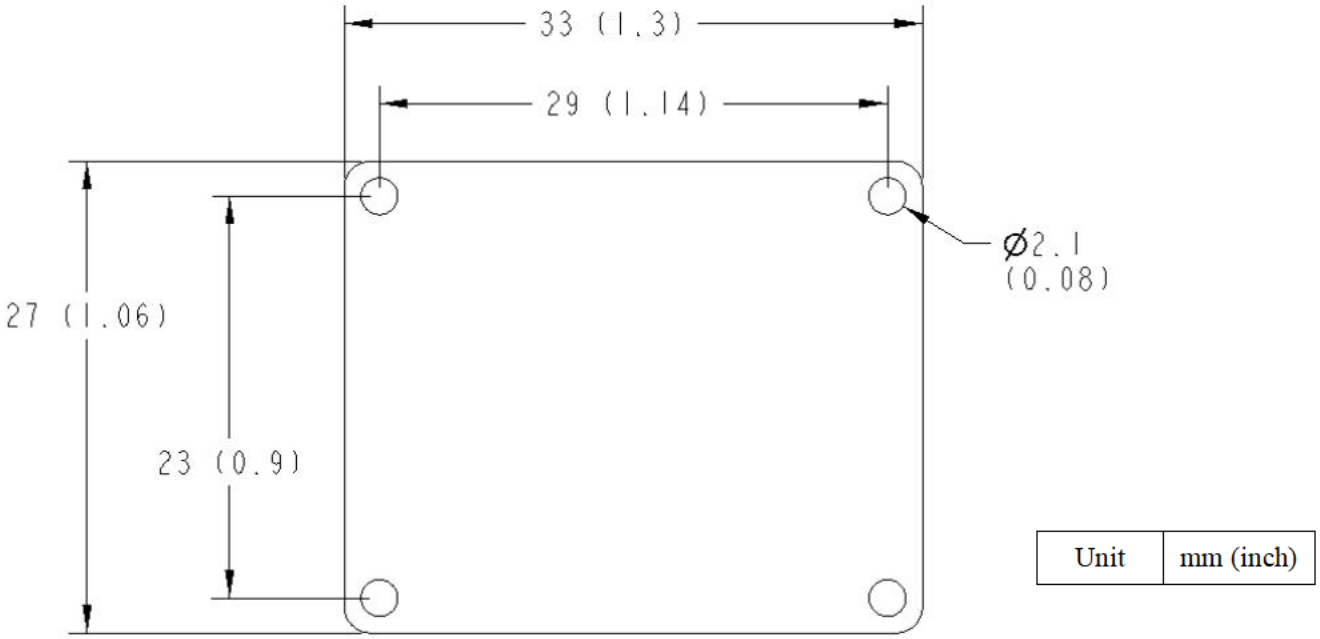


Figure 6. PCB Dimensions

Table 4. Mechanical Specifications

Connector	Metal joint（Cable 1.5m)
Protection level	IP67
Shell material	Magnesium aluminum alloy oxidation
Installation	Three M4 screws

Ordering Information

Model	Communication mode	Package situation
TS-2322-R03-90-485	RS485	IP67 Package/Metal joint
TS-2322-R03-90-232	RS232	IP67 Package/Metal joint
TS-2322-R03-90-TTL	TTL	IP67 Package/Metal joint