AIT



TS-5424-R03 Series
Modbus Dual Axis Inclinometer
Technical Manual

V1.0

Modbus Dual Axis Inclinometer

TS-5424-R03

FEATURES

- Dual Axis Inclination Measurement
- Resolution: 0.01°
- Power Supply: 9-36V
- Size: 2.17 × 1.46 × 0.94 (inch)
  55 × 37 × 24 (mm)
- Highest Accuracy: 0.02°
- Measurement Range: ±90°
- Output: RS232/RS485/TTL for optional
- IP67 Protection Level

APPLICATIONS

- Industrial Automatic Leveling
- Medical Instruments
- Photovoltaic Automatic Tracking
- Tower Tilt Monitoring
- Structural deformation monitoring
- Surveying and Mapping Instruments
- Equipment automation
- Lifting Equipment Inclination Control

DESCRIPTION

The TS-5424-R03, developed and manufactured by AIT Sensing, is a cost-effective dual-axis inclinometer. It adopts MEMS technology and modbus output. The measurement range is ±90°, the highest accuracy is 0.02°, and the working temperature is -40°C-+85°C. The product uses a high-precision MEMS accelerometer and a high-resolution differential digital-to-analog converter, with built-in automatic compensation and filtering algorithms, which largely eliminates errors caused by environmental changes. Convert the change of the static gravity field into the inclination change, and directly output the horizontal inclination value through the voltage method. This product has high long-term stability, low temperature drift, simple use, and strong ability to resist external interference. It is a recommended choice to be used for surveying and mapping, industrial automation and other industries.

SPECIFICATIONS

Table 1.

Parameter	Test Conditions	Min.	Typ.	Max.	Unit/Note
Power Supply Voltage		9	12	36	V
Operating Current	No load	20	30	40	mA
Storage Temperature Range		−55	25	100	°C
Operating Temperature Range		−40	25	85	°C
Measurement Range			±90		°
Measurement Axis		X	X-Y		
Accuracy				0.02	°
Resolution	Completely still		0.01		°

Parameter	Test Conditions	Min.	Typ.	Max.	Unit/Note
Zero Bias	−40°C ~ 85°C	−0.005		0.005	°/°C
Output Frequency	5-100Hz adjustable				Hz
Mean Time Between Failures MTBF		90000			h
Cross axis error	−40°C ~ 85°C		0.01		°
Insulation Resistance		100			MΩ
Impact Resistance		2000g, 0.5ms, 3 times/axis			
Weight			300		g
			0.66		lbs
			10.6		Oz

*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.

ELECTRICAL INTERFACE

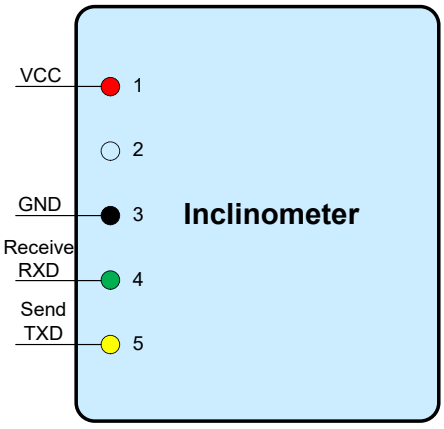


Figure 1. Pin Names

Table 2. Pin Number, Colors and Functions

No.	Color		Functions
1		Red	VCC: DC 9V ~ 36V
2		Blue	-
3		Black	Ground
4		Green	Receive RXD (B、D-)
5		Yellow	Send TXD(A、D+)

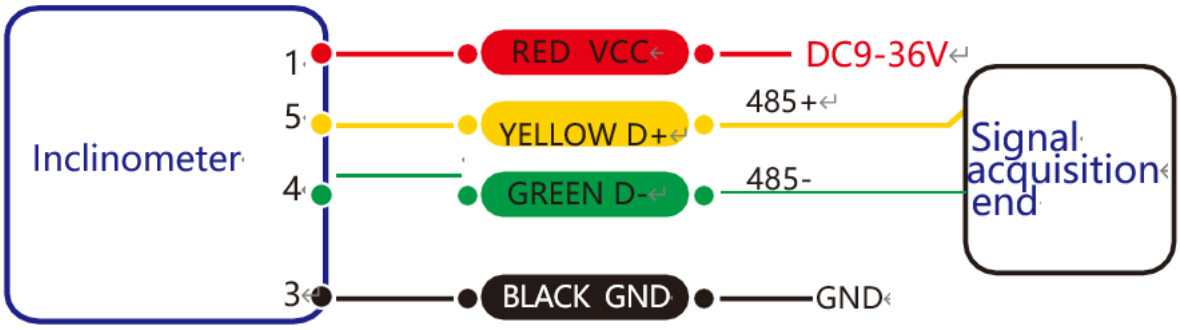


Figure 2. RS 485 Wiring Diagram

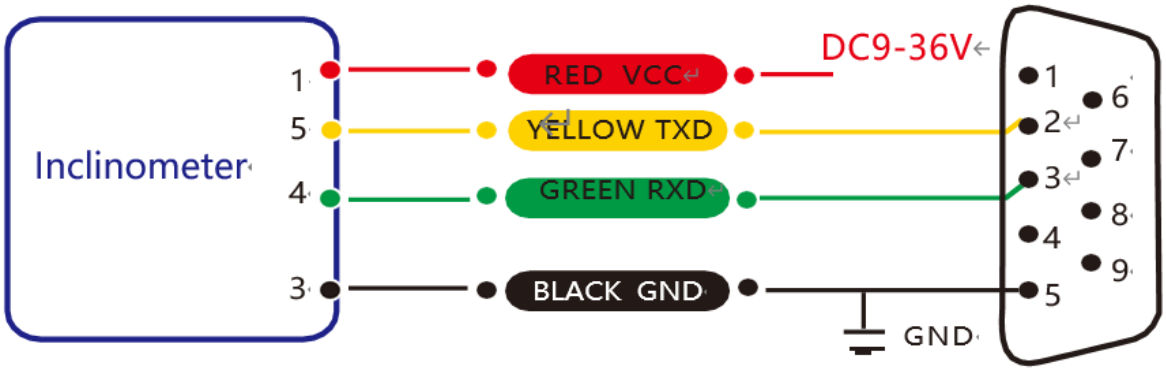


Figure 3. RS 232 Wiring Diagram

DEBUGGING SOFTWARE

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-5424-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.

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.

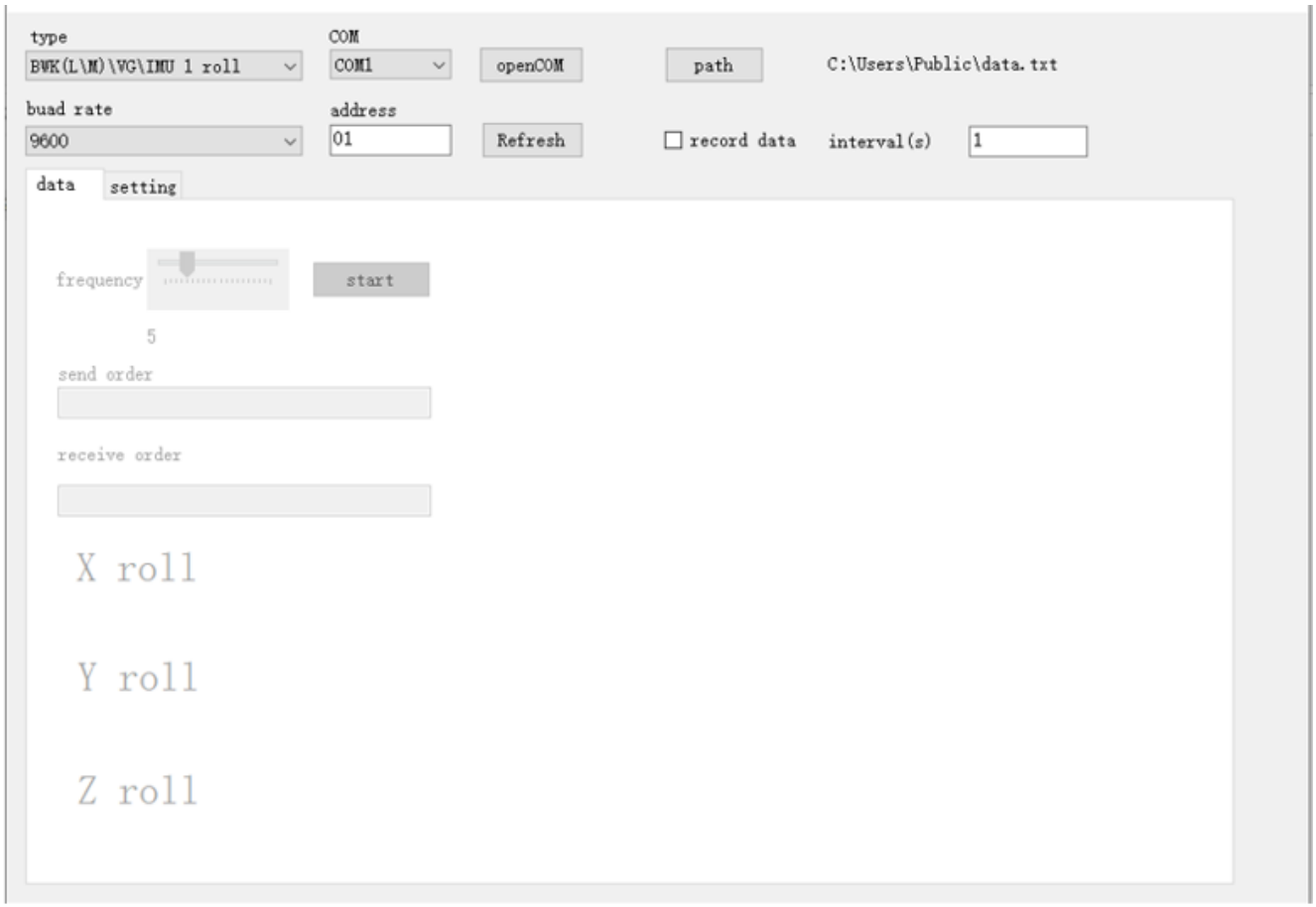
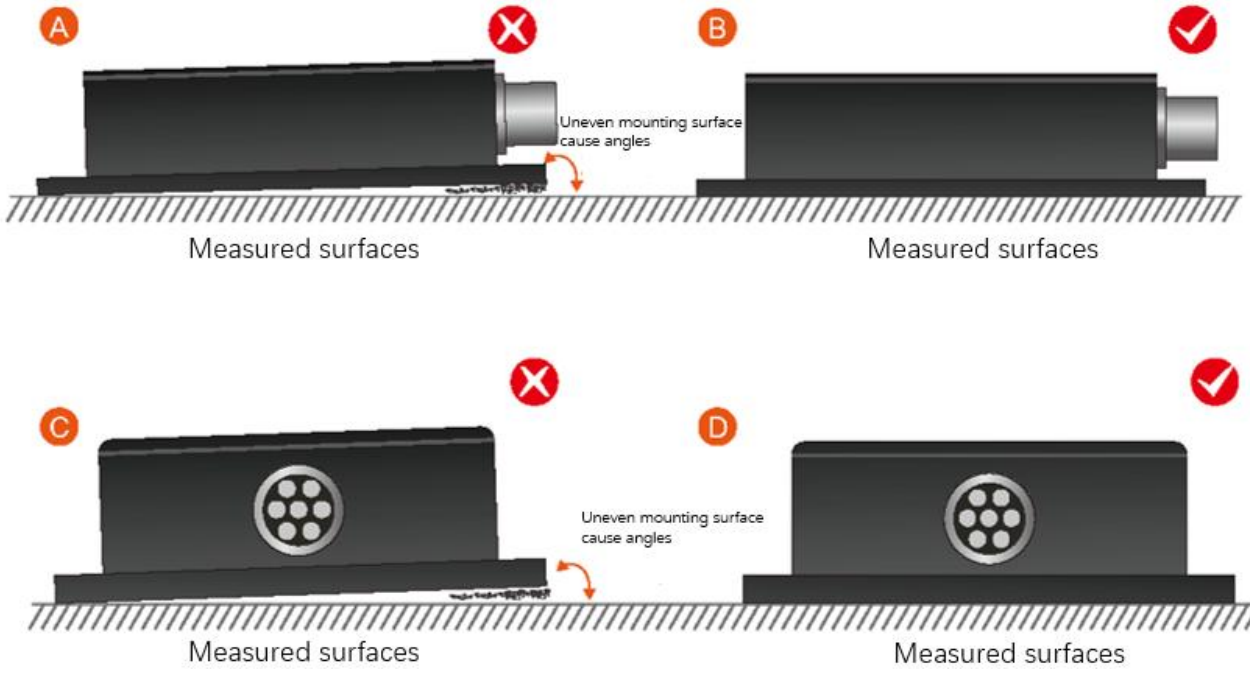


Figure 4. Software Debugging Interface

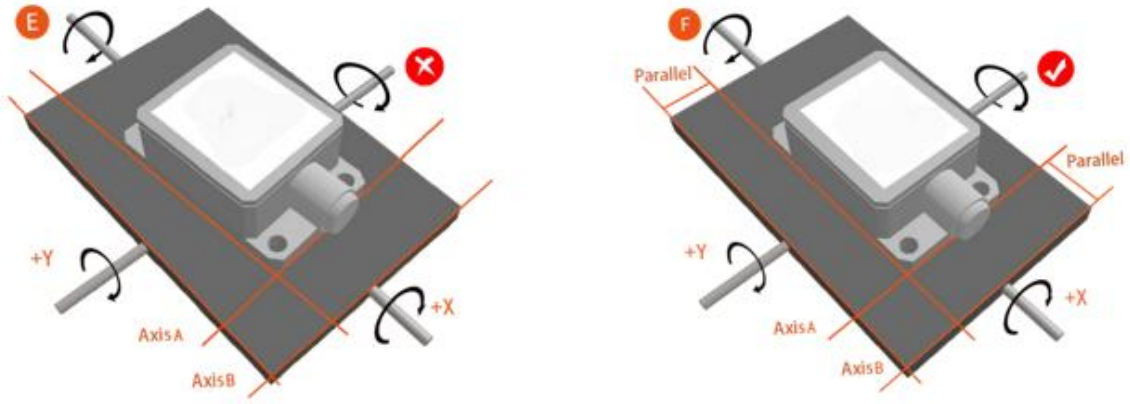
INSTALLATION

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.



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.



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

Outline Dimensions

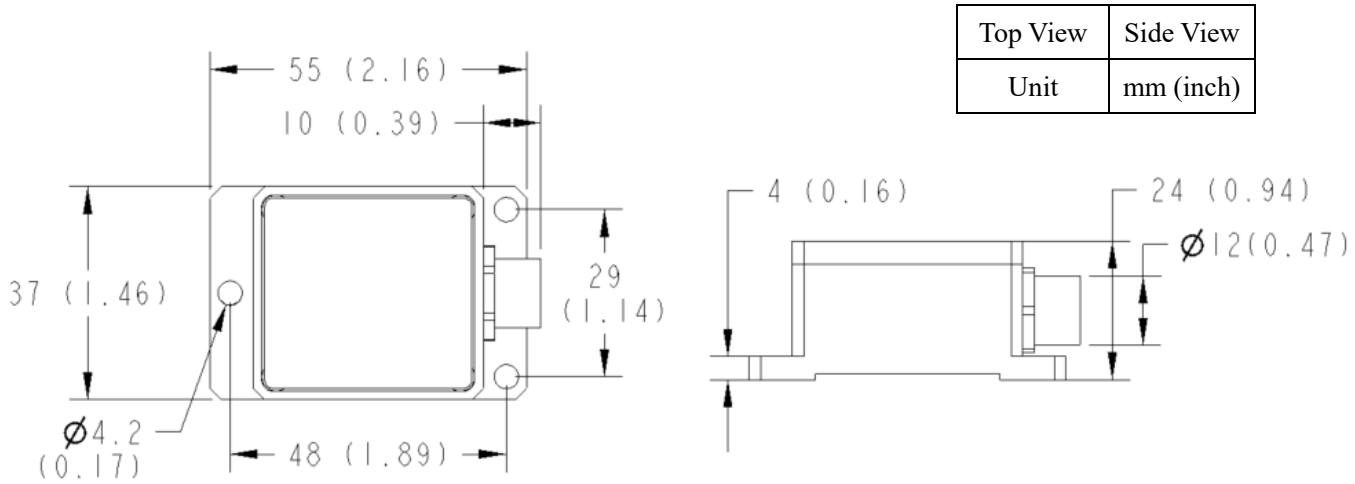


Figure 5. Outline Dimensions

PCB Dimensions

The length and width may have an error of ±1mm, please refer to the actual product.

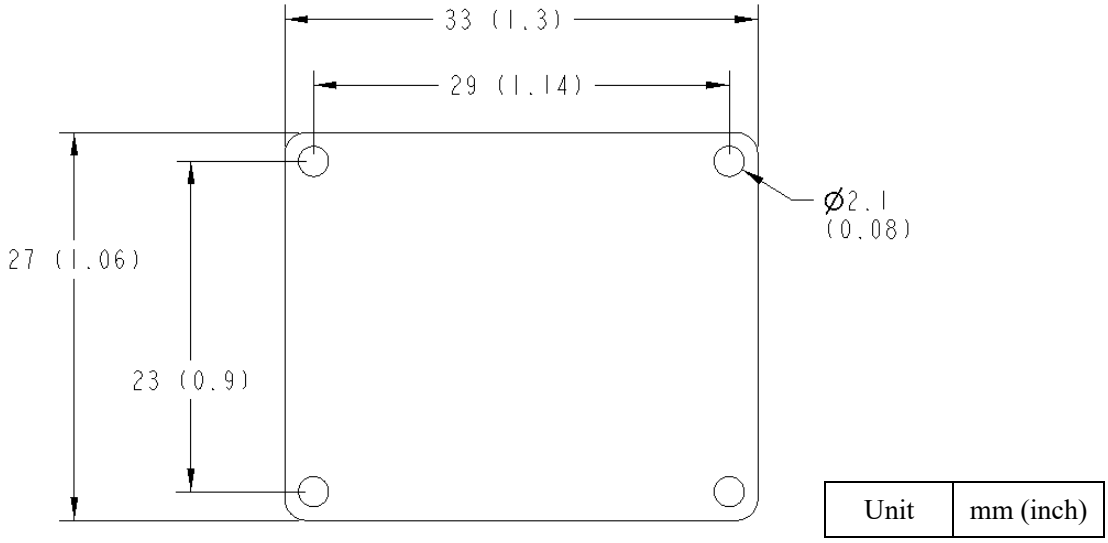


Figure 6. PCB Dimensions



Figure 7. Top View of TS-5424-R03

Table 3. Mechanical Index

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