



**IMU-1221-R02 Series**

**Low Cost Inertial Measurement**

# **Technical Manual**

**V1.0**

### FEATURES

- Dynamic Compensation, Quadrature Compensation
- Gyro Drift 150°/h
- RS232, RS485, TTL Output Optional
- Wide Temperature Range:  $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$   
Temperature Compensation
- Small Size:  $2.165 \times 1.46 \times 0.94$  (inch)  
 $55 \times 37 \times 24$  (mm)

### APPLICATIONS

- Dump Truck
- Balance Car
- Stable Platform
- AGV Unmanned Guided Vehicle
- Marine Survey
- Under Water Robot Navigation
- Robots
- Unmanned Aircrafts

### DESCRIPTION

IMU-1221-R02 is a low-cost inertial measurement unit that can measure the angular velocity and acceleration of a moving carrier. The data deviation is estimated by the 6-state Kalman filter with appropriate gain, which is suitable for inertial attitude measurement in motion or vibration state.

IMU-1221-R02 uses highly reliable MEMS accelerometers and gyroscopes, and it uses algorithms to ensure measurement accuracy. At the same time, the sealing design and strict production process ensure that the product can accurately measure movement parameters such as the angular velocity, acceleration and attitude of the carrier in harsh environments. Through various compensations such as nonlinear compensation, quadrature compensation, temperature compensation and drift compensation, the error source of IMU-1221-R02 can be greatly eliminated and the product accuracy level can be improved. BW-IMU50 has a digital interface, which can be easily integrated into the user's system.

### SPECIFICATIONS

**Table 1.**

Parameter		Min.	Typ.	Max.	Unit/Note
Power Supply Voltage			5		VDC
Operating Current			30	40	mA
Operating Temperature Range		-40		85	$^{\circ}\text{C}$
Gyro	Resolution		0.01		$^{\circ}/\text{s}$
	Range		$\pm 400$		$^{\circ}/\text{s}$
	Bias Stability at Room Temperature	$<2^{\circ}/\text{h}$ (100s, $1\sigma$ ) $<150^{\circ}/\text{h}$ (10s, $1\sigma$ )			
	Bias Repeatability at Room Temperature	$<50^{\circ}/\text{h}$ ( $1\sigma$ )			
	ARW			0.1	$^{\circ}/\sqrt{\text{h}}$

Parameter		Min.	Typ.	Max.	Unit/Note
	Scale Factor Repeatability			100	ppm
	Scale Factor Non-Linearity			100	ppm
	Bandwidth		100		Hz
Accelerometer	Range X-Y-Z		±2		g
	Resolution		0.01		mg
	Add Zero Offset		0.15		mg
	Bias Stability	0.001mg (25°C, 100s, 1σ) 0.01mg (25°C, 10s, 1σ)			

## ELECTRICAL CONNECTIONS

Table 2. Pin Number, Colors and Functions

No.	1	2	3	4	5
Color					
	RED	BLUE	BLACK	GREEN	YELLOW
Functions	VCC DC 5V	NC	GND	Receive RXD (B, D-)	Send TXD (A, D+)

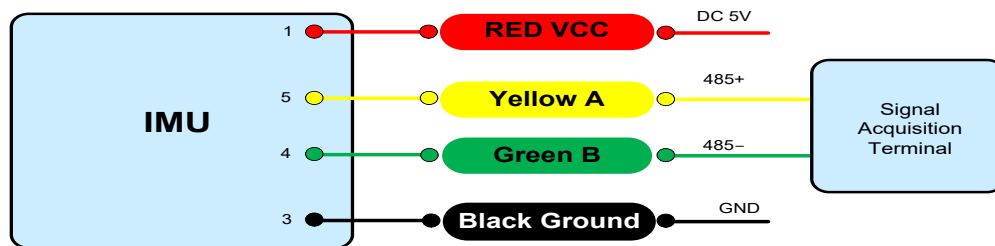


Figure 1. RS 485 Wiring Diagram

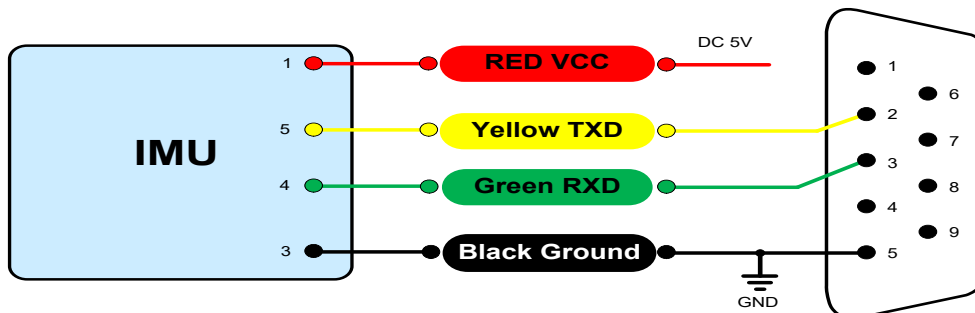
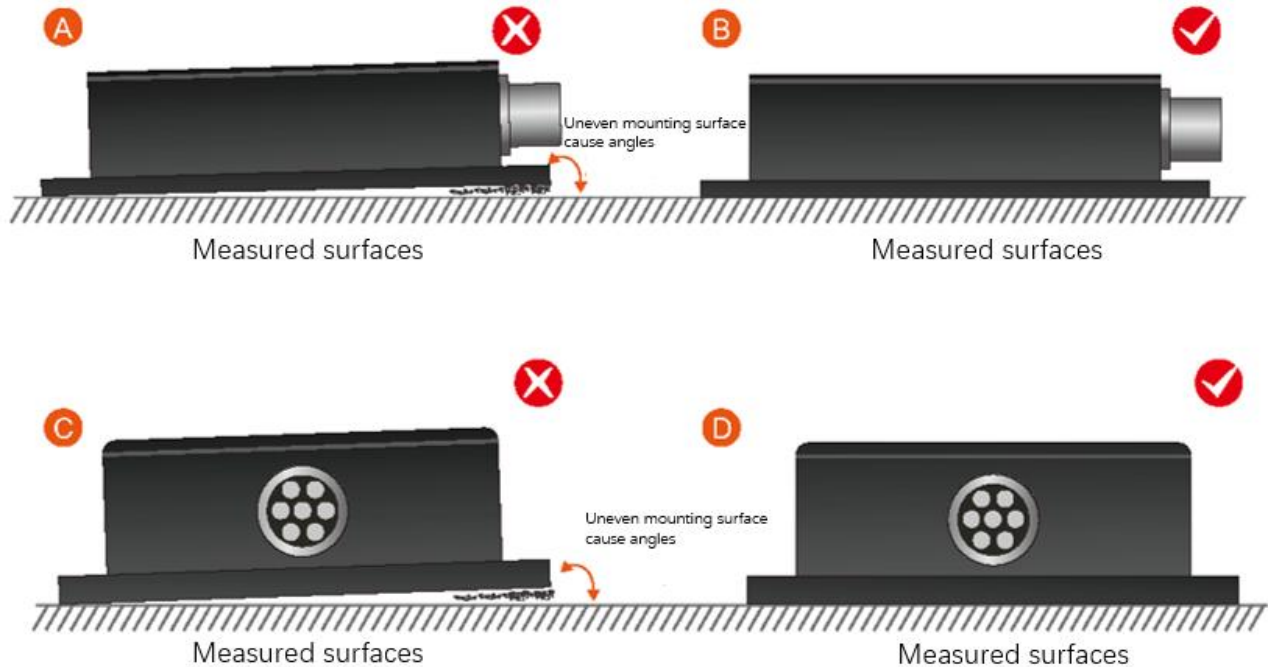


Figure 2. RS 232 Wiring Diagram

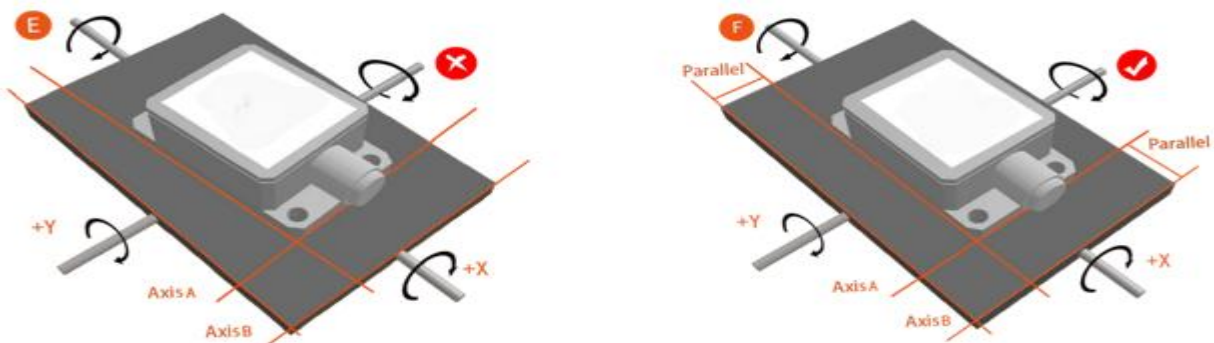
### INSTALLATION

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.

### TEST SOFTWARE

You can download the serial debugging assistant directly on the official website (technical service -> download area), or you can use the more convenient and intuitive host computer software.

IMU 1221 R02 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 easily display the current X and Y directions, and you can also modify and set other parameters.

Steps for use:

- 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.

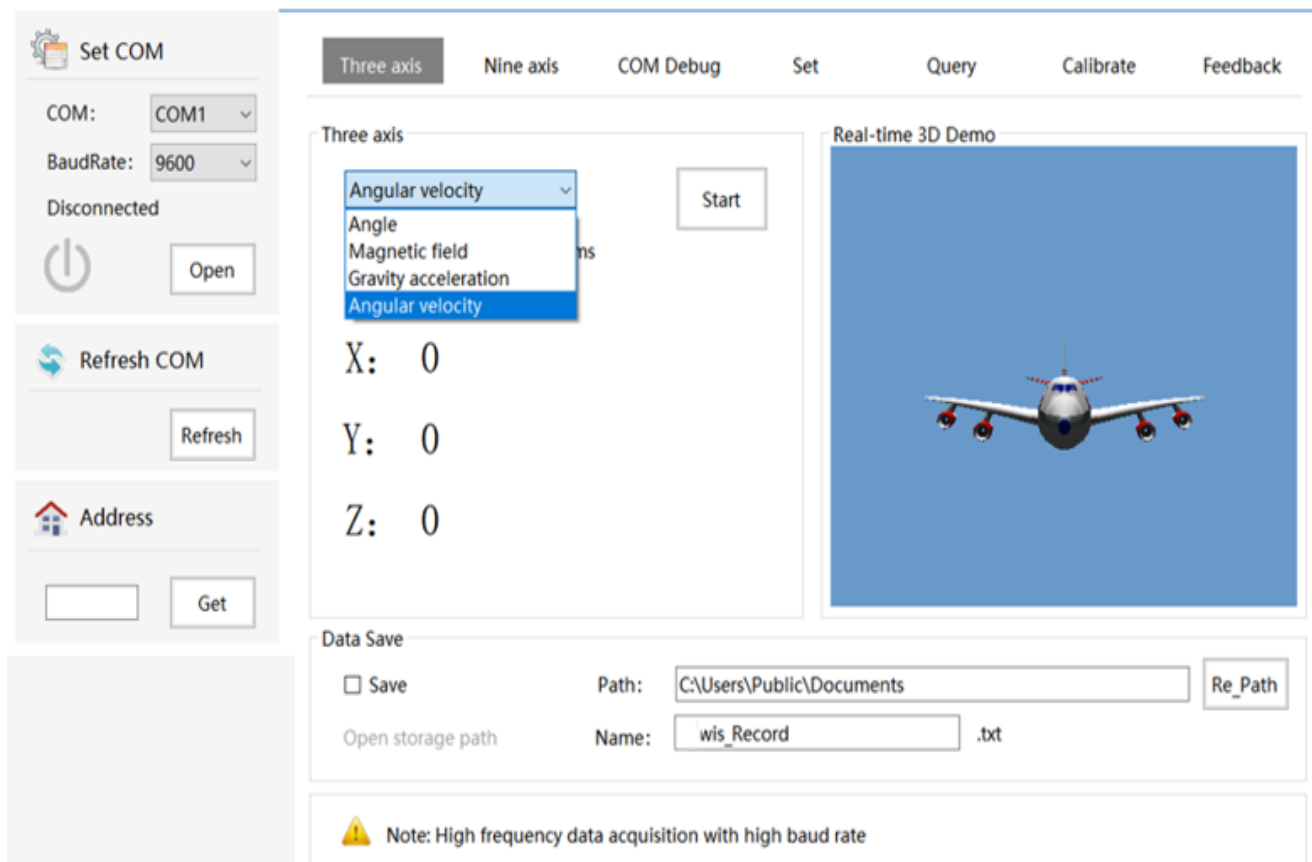


Figure 3. Software Debugging Interface

### DIMENSIONS

#### Outline Dimensions

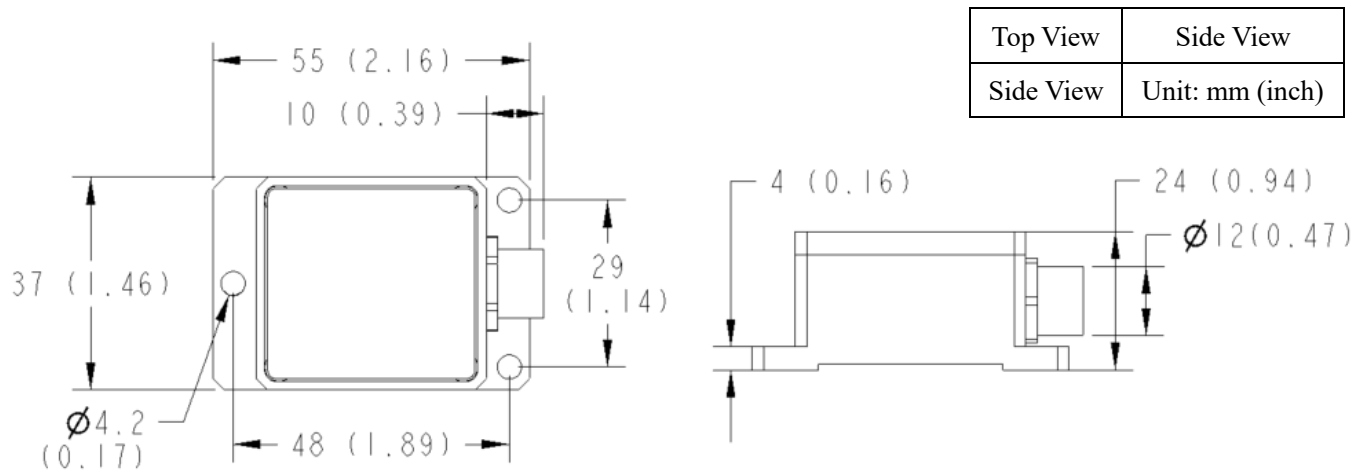


Figure 4. Outline Dimensions

#### PCB Size

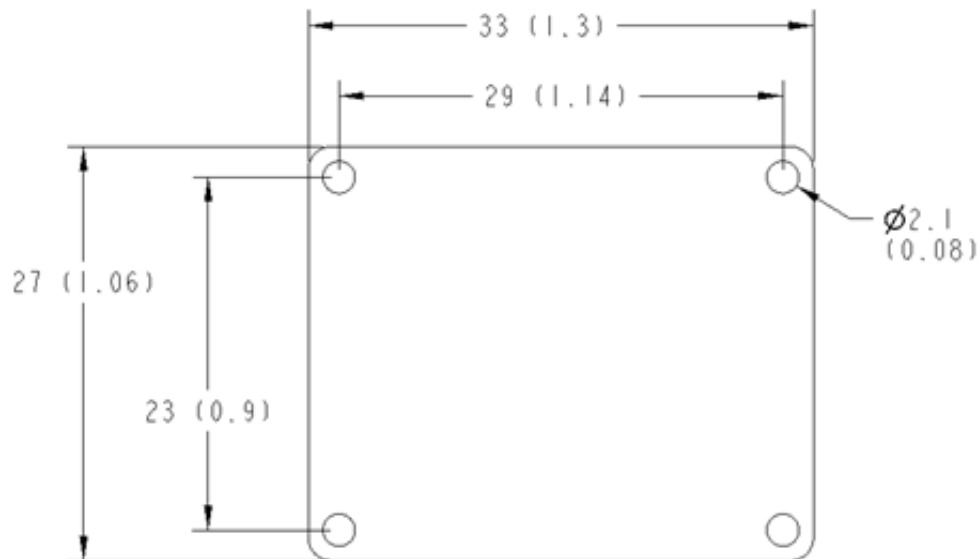


Figure 5. PCB Outline



Figure 6. Top View of IMU-1221-R02

## MECHANICAL CHARACTERISTIC

Connector	Metal Joint (Cable 1.5m)
Protection Level	IP67
Shell Material	Magnesium aluminum alloy anodizing
Installation	Four M4 screws

## EXECUTIVE STANDARD

- National Standard for Static Calibration of Biaxial Inclination Sensors (Draft)
- GB/T 191 SJ 20873-2003 General Specification for Tiltmeters and Levelling Devices