



# **BW-VG220 Series**

**Low-cost Voltage  
Dynamic Inclinometer**

## **Technical Manual**

V3.0



## Introduction

The VG220 Dynamic Inclination Sensor product is a low cost attitude measurement device that measures the inertial attitude parameters of roll and pitch as well as angular velocity and acceleration of a moving carrier. Attitude deviations are estimated by a 6-state Kalman filter with appropriate gain for inclination measurements in motion or vibration. The VG220 utilizes high quality and reliable MEMS accelerometers and gyroscopes with algorithms to ensure measurement accuracy, and a hermetically sealed design and rigorous workmanship to ensure that the product can accurately measure carrier attitude parameters in harsh environments. Through non-linear compensation, quadrature compensation, temperature compensation and drift compensation and other compensation, can greatly eliminate the error generated by the interference, improve the level of accuracy of the product. VG220 has a digital interface, can be very easily integrated into the user's system.

## Feature

- Non-linear compensation, quadrature compensation
- Dynamic and static measurement
- Gyro drift compensation
- Special offset tracking algorithm to eliminate drift
- Power supply: 12~36V
- Wide temperature range: -40℃~+85℃
- High-performance Kalman filter algorithm
- Small Size: L103.8 x W55.4 x H26 (mm)

## Application

- Marine vessels
- Construction Machinery
- Platform stability
- Agricultural machinery
- ROV underwater robot navigation
- Unmanned Drive
- Robot
- Unmanned Craft

## Feature



### Electrical indicators

Parameters	Condition	Minimum	Typical value	Maximum
Voltage (V)		12		36
Working current(mA)	No load	20	50	60
Output load (kΩ)	Resistive	10		
Output load (nF)	Capacitive			20
Operating temperature		-40		85
Storage temperature(°C)		-55		100



### Performance Index

Attitude Parameter	Dynamic Accuracy	0.5°
	Static Accuracy	0.01°
	Resolution	0.01°
	Tilt range	Pitch ± 90°, Roll ± 180°
Physical properties	Dimension	L103.8×W55.4×H26(mm)
	Weight (with cable)	320g
	Weight (with package)	400g
Interface characteristics	Voltage Output Range (v)	(0-5 optional) (0-10 optional)
	Startup Delay	<50ms
	Serial Communication Rate	2400 to 115200 baud rate
	Digital Output Format	Binary High Performance Protocol
Mean Time	≥90,000 hours	
Electromagnetic	According to GBT17626	
Insulation	≥100MΩ	
Shock resistance	2000g, 0.5ms, 3 times/axis	

**Resolution:** The smallest change in the measured value that the sensor can detect and distinguish within the measurement range.

**Accuracy:** The root mean square error between the actual angle and the angle measured by the sensor for multiple times (≥16 times).



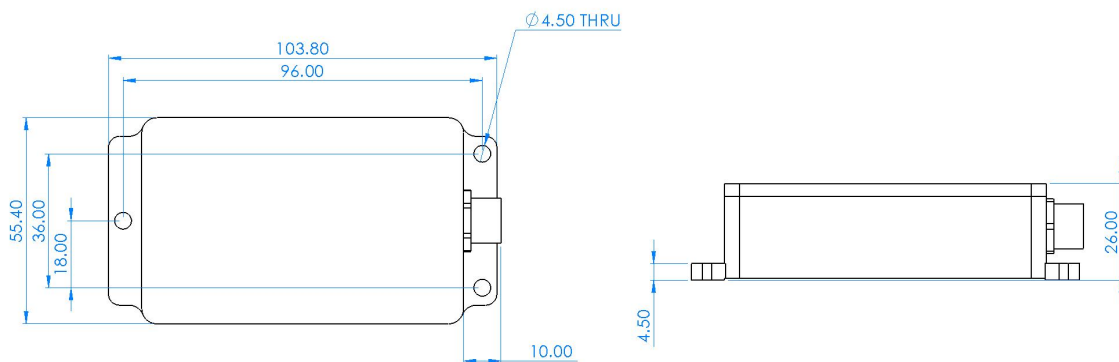
## Mechanical properties

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



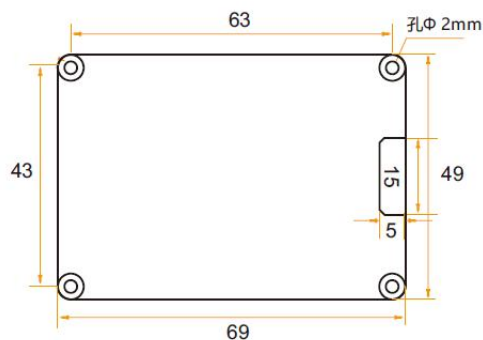
## Package product size

Product Size: L103.8\*W55.4\*H26 (mm)



## Bare board product size

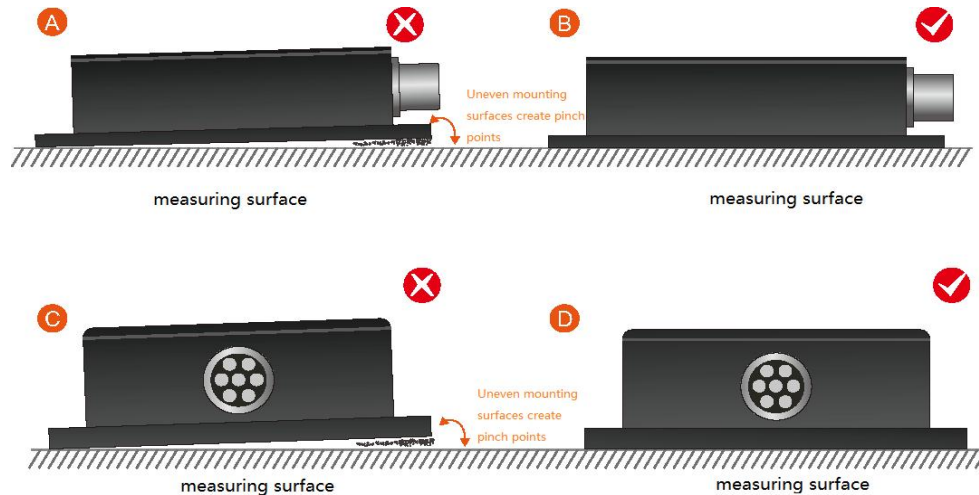
Product Size: L69\*W49\*H12 (mm) The length and width may have an error of  $\pm 1$ mm, please refer to the actual product



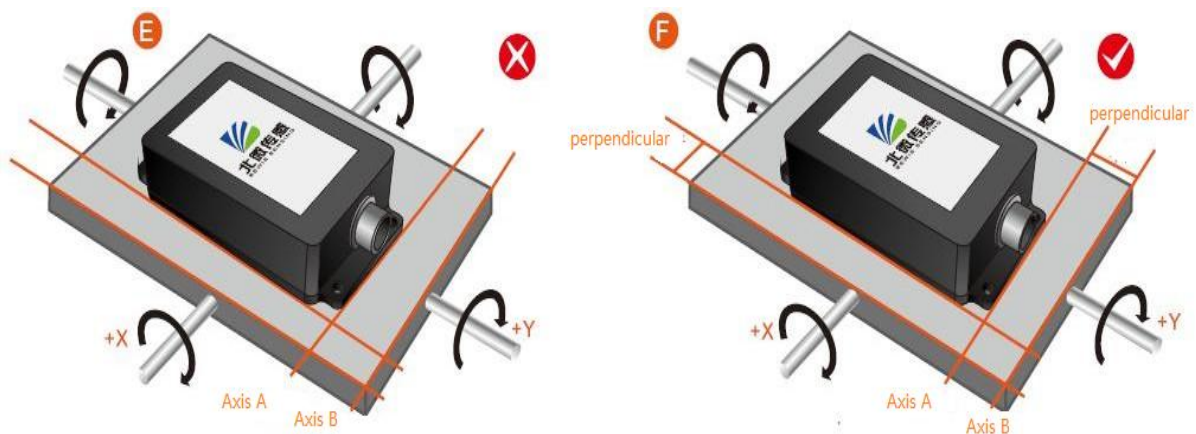
## Installation

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.

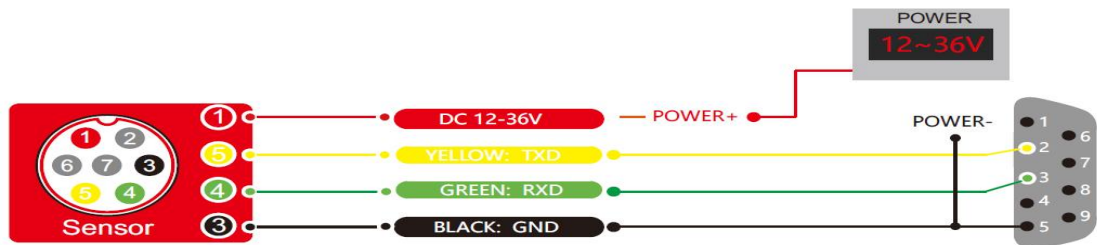


Finally, the mounting surface of the sensor and the surface to be measured must be tightly fixed, smooth in contact, and stable in rotation, and measurement errors due to acceleration and vibration must be avoided.

## Electrical Interface

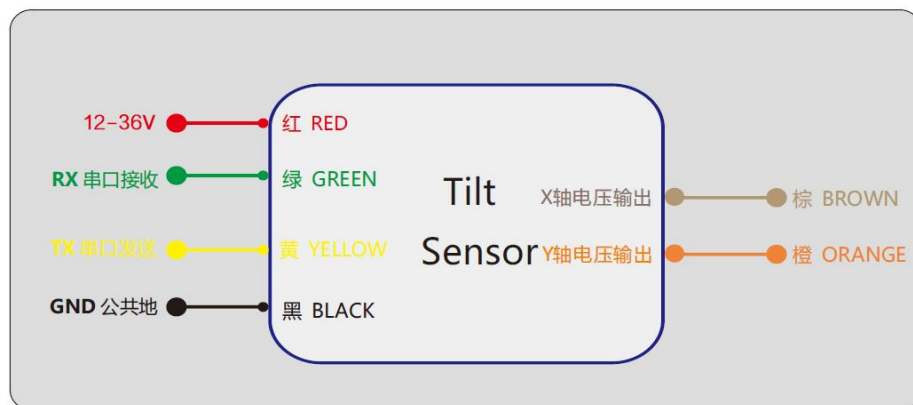
### Wiring definition

	红色 RED	蓝色 BLUE	黑色 BLACK	绿色 GREEN	黄色 YELLOW
Line Color	1	2	3	4	5
Function	VCC DC 12-36V	NC	GND	Receive RXD (B、D-)	Send TXD (A、D+)



### Wiring definition

Line Color	红色 RED	黑色 BLACK	绿色 GREEN	黄色 YELLOW	棕色 BROWN	橙色 ORANGE
Function						
	1	3	4	5	8	9
	DC DC 12-36V	Power negative	Receive RXD	Send TXD	X axis voltage output	Y axis voltage output



## Order Information

Model	communication mode	Package situation
BW-VG220-05	0-5V voltage/RS232	IP67/ Metal interface
BW-VG220-010	0-10V voltage/RS232	IP67/ Metal interface

## Executive standard

- National Standard for Static Calibration of Biaxial Inclination Sensors (Draft)
- GB/T 191 SJ 20873-2003 General Specification for Tiltmeters and Leveling Devices
- GJB150-3A High temperature test
- GJB150-4A Low temperature test

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