DMC620-USB

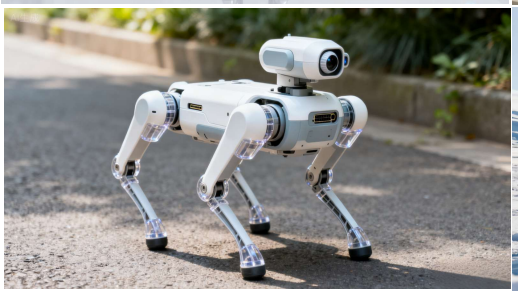
Small Size High Precision

Attitude Heading Reference System

Technical Manual

V1.5






Introduction

The DMC620-USB is a high-precision attitude sensor specifically developed for omnidirectional intelligent robots. It integrates BWSENSING's independently developed rapid calibration and anti-interference algorithms. The product undergoes aerospace-grade turntable calibration before leaving the factory, and intelligently eliminates cross-axis errors introduced during installation. It can self-calibrate periodically as needed without requiring return to the factory, ensuring accurate attitude data even in extremely complex environments.

This product features IAP upgrade functionality, allowing firmware updates via software while the device is running. When strong magnetic interference is detected (e.g., high torque output from the robot's own motors), the algorithm intelligently reduces the magnetometer's weight in the data fusion process, increases the weight of the gyroscope and accelerometer, or automatically switches to "six-axis mode." Once the interference lessens or disappears, the magnetometer data is then fused, making it an ideal choice for omnidirectional robots.

Feature

- Nine-axis AHRS sensor intelligent fusion algorithm
- Maximum heading accuracy ≤0.05° /cycle, pitch and roll accuracy ≤0.05°
- AEC-Q100 certification and manufacturing process
- Accuracy is CNAS traceable
- Wide temperature range: -40℃~ +85℃
- Volume: L24.05*W22.4*H9.41 (mm)
- ISO26262 automotive-grade functional safety certification
- 1000Hz raw data output frequency

Application

- Humanoid robots
- Rotary-wing drones
- Quadruped robots
- Collaborative robots
- Motion capture
- Low-speed unmanned vehicles
- Observation and aiming equipment
- Fixed-wing unmanned aerial vehicles

Specifications

Electrical index

Power supply	5V DC
Operating current	80mA
Operating temperature	-40℃~+85℃
Storage temperature	-55℃~+100℃

Performance index

Azimuth Angle	Measurement Range	±180°	
	Accuracy [1]	Magnetic reference ≤1°（RMS）[2]	Non-magnetic reference ≤0.05°/circle[3]
	Resolution	0.1°	0.02°
	Power-On Repeatability	0.5°（RMS）	
Pitch angle	Measurement Range	±90°	
	Accuracy	Static≤0.05°（1σ）	Low-level dynamics [4] ≤ 0.05° (1σ)
			Medium-level dynamics [5] ≤ 0.2° (1σ)
			High-level dynamics [6] ≤ 0.5° (1σ)
	Resolution	0.02°	
	Power-On Repeatability	0.05°（RMS）	
Roll angle	Measuring range	±180°（Pitch angle≤±75°）	
	Accuracy	Static≤0.05°（1σ）	Low-level dynamics [4] ≤ 0.05° (1σ)
			Medium-level dynamics [5] ≤ 0.2° (1σ)
			High-level dynamics [6] ≤ 0.5° (1σ)
	Resolution	0.02°	
	Power-On Repeatability	0.05°（RMS）	
Environments	Baud rate	9600~921600 (default 115200)	
Output frequency	Original data mode	Max 1000Hz	
	integration mode	Max 500Hz	

[1]Accuracy: Root mean square error of the actual angle compared to the sensor's measured angle after multiple measurements (≥16 times) at 25℃.

[2] Magnetic Reference Heading Accuracy: Measured after spatial calibration in a favorable magnetic environment. This product defaults to using a self-developed algorithm to determine the reliability of magnetic data and automatically switches the heading data source.

[3]Non-Magnetic Reference Heading Accuracy: Measured in a laboratory environment by rotating 360° at 100°/s.

[4]Low-Level Dynamics: Motion frequency below 0.2Hz, harmful acceleration below 0.01g.

[5]Medium-Level Dynamics: Motion frequency below 1Hz, harmful acceleration below 0.05g.

[6]High-Level Dynamics: Motion frequency below 5Hz, harmful acceleration below 0.2g.

Device performance parameters

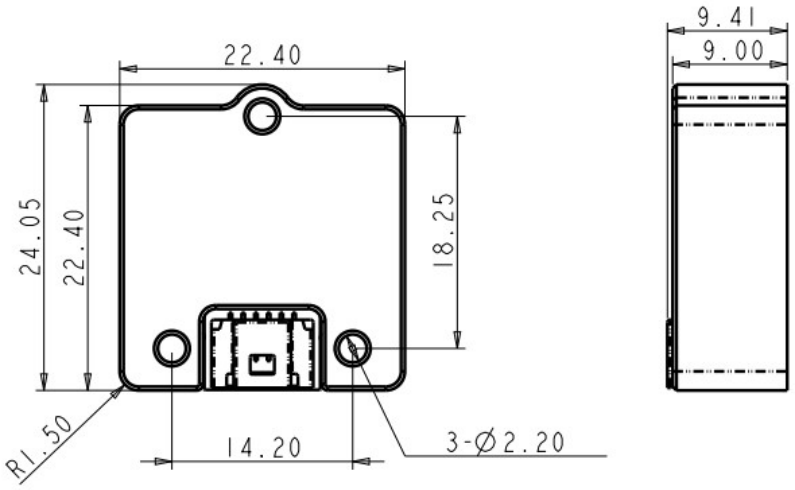
Accelerometer	Measurement Range	±8g	
	Noise Density	100 μg/√Hz	
	Bandwidth (-3dB)	100Hz	
	Zero-Bias Stability (10s Smoothing)	0.15mg	
	Zero-Bias Stability (ALLAN)	55ug	
	Zero-Point Temperature Drift	±5mg	
Gyroscope	Measurement Range	±400°/s	±1000°/s
	Noise Density	3 mdps/√Hz	8 mdps/√Hz
	Bandwidth (-3dB)	100Hz	
	Zero-Bias Stability (10s Smoothing)	8 °/h	12°/h
	Zero-Bias Stability (ALLAN)	4 °/h (1σ, Relevant time130s-260s)	4.5 °/h (1σ, Relevant time130s-260s)
	Zero-Point Temperature Drift (1σ RMS, -40~85°C)	±0.1°/s	±0.5°/s
Magnetometer	Measurement Range	±2Gauss	
	Noise Density	1.5 mGauss/√Hz	

Mechanical Index

Connector	MOLEX, 5015680607, 1*6P, SMD,P=1mm
House Material	Magnesium-Aluminum Alloy Anodized
Installation	2 *M2 Copper Bolts
Weight	7.2g±1g

Product package size

Product size：L21.2*W21.2*H9.1 （mm) The length and width may have an error of ±1mm, please refer to the actual product



Electrical connect

Pin Definitions

红色 RED	黑色 BLACK	白色 WHITE	绿色 GREEN	黄色 YELLOW	蓝色 BLUE
1	2	3	4	5	6
VCC 5V	GND 地	USB_DM /TXD	USB_DP /RXD	NC	NC

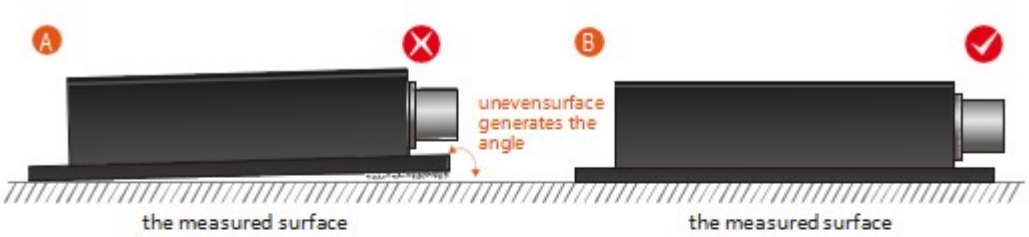
The DMC620-USB USB TYPE-A male connector cable has a female connector on one end that matches the DMC620-USB interface, and a USB TYPE-A male connector on the other end.

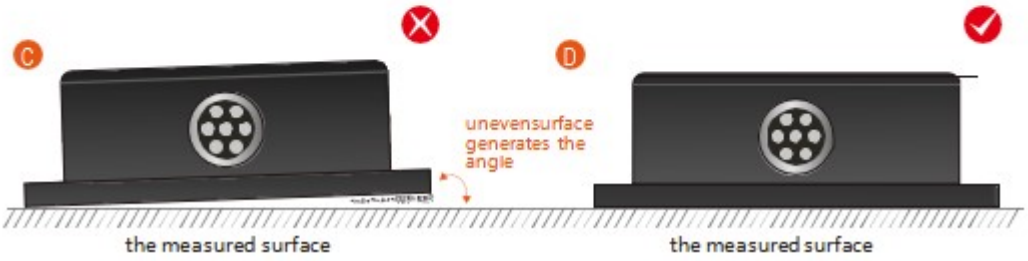
The DMC620-USB bare wire connector cable has a female connector on one end that matches the DMC620-USB interface, and a bare wire end on the other end.

Installation

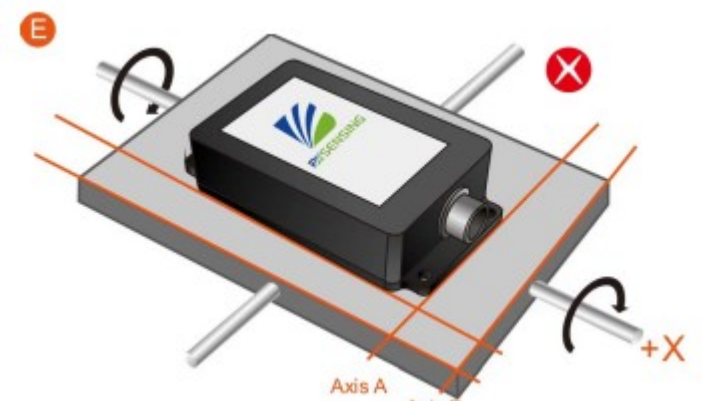
The correct installation method can avoid measurement errors. When installing the sensor, please do the following:

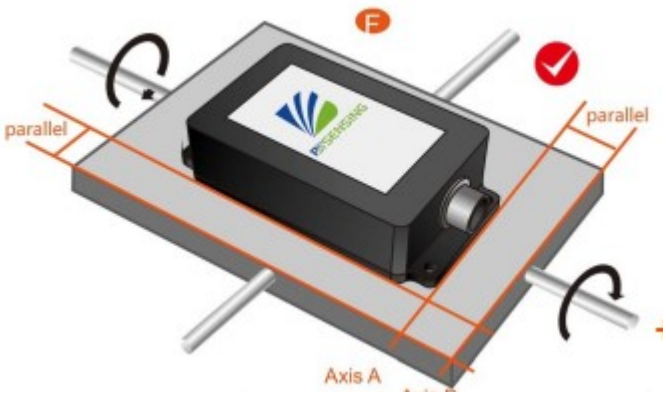
First of all, make sure that the sensor mounting surface is completely close to the measured surface, and the measured surface should be as level as possible. There should be no included angles as shown in Figure A and Figure C. The correct installation method is shown in Figure B and Figure D.





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.

Note:It should be kept away from strong magnetic field materials such as magnets, iron, nickel, etc. to avoid irreversible damage to the product's magnetic field sensitive components.

It should be far away from electric motors, wires, capacitors, inductors and other materials that can easily generate magnetic fields due to electric currents, so as to avoid changes in the electromagnetic field of these parts due to energisation, which will affect the heading accuracy of the sensors during continuous measurements.

Keep away from moving iron parts, such as mechanical arms, flywheels, engines, etc., to avoid the magnetic field changes caused by the movement of its ferromagnetic parts, which will affect the heading accuracy of the sensor.

Calibration

The calibration uses a rapid calibration method, with the following steps:

1. Open the serial port and set it to HEX transmit and HEX receive, and put the sensor in acknowledgment mode.
2. Place the sensor with a pitch angle of 0°, a roll angle of 0°, and a yaw angle pointing due north. Use this direction as the reference direction. If you don't know where due north is, you can use any direction as the reference direction. Keep the sensor stationary and send the "Start Calibration" command to initiate calibration mode. After calibration mode is initiated, a calibration count will be automatically sent. This value will iterate continuously during the motion calibration process and converge and begin to increase when stationary. If the sensor remains stationary, the calibration count will also automatically increase over time, and the calibration result will be unreliable.
3. Slowly rotate the sensor one revolution around the X-axis.
4. Slowly rotate the sensor one revolution around the Y-axis.
5. Slowly rotate the sensor one revolution around the Z-axis. The rotation steps are now complete.
6. Place the sensor stationary and wait for the calibration count in the returned command to be greater than or equal to 0x0A. The calibration is considered complete.
7. Send the "End Calibration" command. Calibration is complete.

Order

Model	Number	Remark
DMC620-USB	1	Sensor
Bare-End Cable	1	Optional, compatible with TTL
USB TYPE-A Male Cable		Optional, compatible with USB

Executive standard

- National Standard for Static Calibration Specifications for Dual-axis Inclination Sensors (Draft)
- GB/T 191 SJ 20873-2003 General Specification for Inclinometers and Levels

DMC620-USB

Small Size High Precision

Attitude Heading Reference System

Wuxi Bewis Sensing Technology LLC

Add: Building 30, NO. 58, Xiuxi Road, Binhu District,

Wuxi City, Jiangsu Province, China

Tel: +86 18921292620

Mail : sales@bwsensing.com

Web: www.bwsensing.com