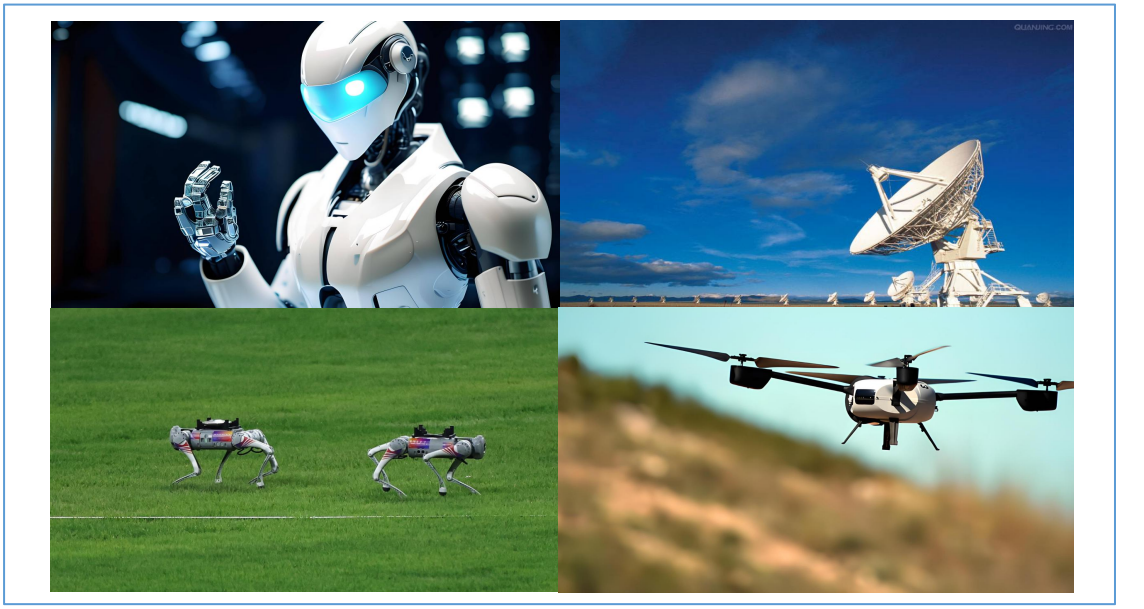


DMC640 series

Small Size High-Cost Effective Attitude and Heading Reference System

Technical Manual

DMC640 small size high-cost effective attitude and heading reference system



Introduction

The DMC640 high-precision attitude and heading reference system employs industrial-grade microcontrollers renowned for their reliability and robust interference resistance, alongside high-precision magnetic sensors and driver chips. It integrates BWSENSING's proprietary rapid calibration algorithm and anti-interference algorithm, enabling spatial manoeuvring during magnetic field calibration while resisting transient magnetic disturbances. This product employs a three-axis accelerometer and three-axis gyroscope to compensate for tilt angles, ensuring accurate heading data even in extremely harsh environments.

Featuring IAP upgrade capability, subsequent functionalities and interfaces will be delivered via IAP updates following programme revisions. Customisable to client requirements, it facilitates the swift and straightforward integration of attitude and heading reference system functionality into diverse products.

Feature

- Three-axis gyroscope, magnetometer, accelerometer
- IMU output up to 1000HZ
- Rapid calibration algorithm
- High precision, compact size
- Wide operating temperature range: -40°C to +85°C
- Dimensions: L10 × W10 × H2.4(mm)
- TTL/CAN/USB interface

Application

- Human Robots
- Rotary-wing Drones
- Automated Guided Vehicles (AGVs)
- Medical Assistive Devices
- Motion capture
- Buoy attitude
- Observation and aiming equipment
- Night vision devices

Electrical index

Power voltage	3.3V DC
Working current	＜150mA
Operating temperature	-40℃~+85℃
Storage temperature	-55℃~+100℃

Performance index

	Accelerometer	Gyroscope	
Range	±8g	±400°/s	±1000°/s
Noise density	200 μg/√Hz	1.5mdps/√Hz	5 mdps/√Hz
Bandwidth	100Hz	100Hz	
Zero bias stability	0.15ug	3 °/h	
Environment	Baud Rate	9600–921600 (default 115200)	
User Calibration Procedure	Calibration	Rapid calibration	

Resolution: The smallest measurable change in the quantity being measured that the sensor can detect and distinguish within its measurement range.

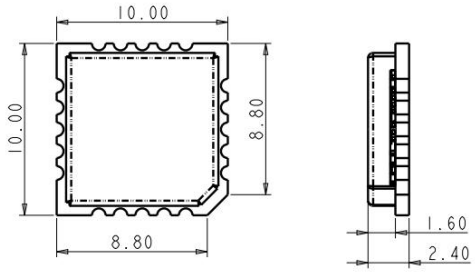
Accuracy: The root mean square error between the actual angle and the sensor's measured angle, determined through multiple measurements (≥16 times). (In product testing, the current accuracy data is for reference only.))

Mechanical index

Connector	USB Type-A cable (1m length)
Protection level	Not specified (does not represent final product protection
Shell material	Magnesium-aluminium alloy anodised finish
Installation	2 x M2 copper bolts

Package size

Size：Dimensions: L10 × W10 × H2.4(mm)



Electrical Connection

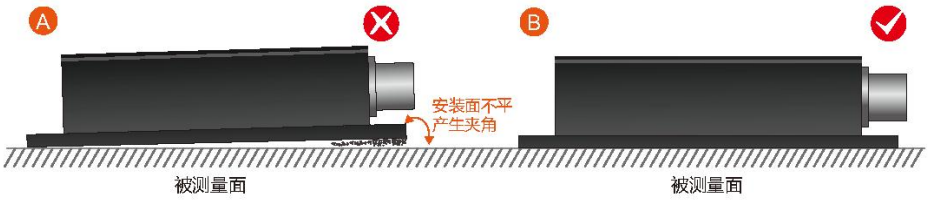
Wiring Definition

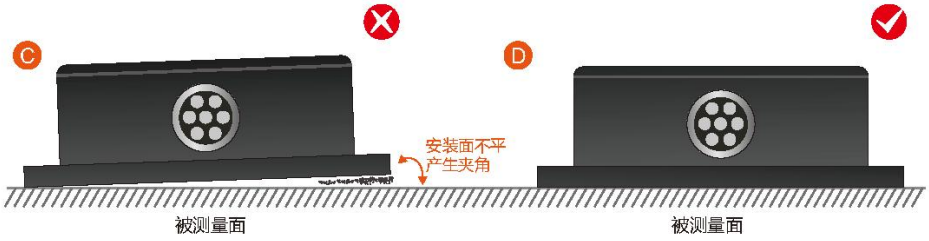
RED	BLACK	WHITE	GREEN	YELLOW	BLUE
1	2	3	4	5	6
VCC 5V	GND Ground	USB_DM	USB_DP	NC	NC

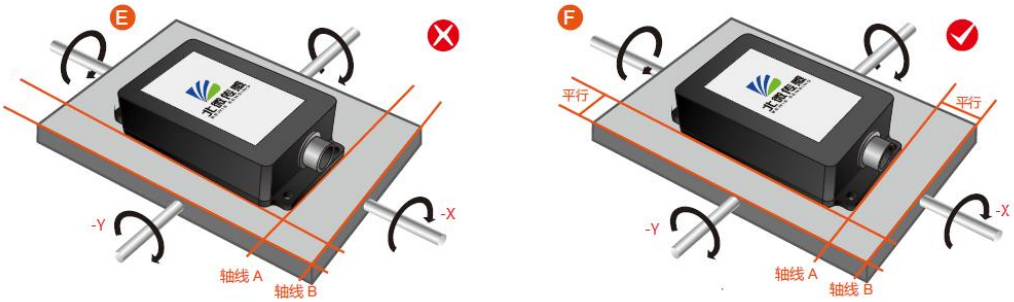
The DMC640 USB Type-A male connector cable features a female connector compatible with the DMC640 interface at one end, and a USB Type-A male connector at the other.

Installation

The product must be installed horizontally and used in a horizontal position. It should be positioned flush against the measurement surface, avoiding the angles depicted in pictures A and C. Correct installation methods are illustrated in pictures B and D. Secondly, the sensor's base edge must not form an angle with the measured object's axis as depicted in Figure E. During installation, ensure the sensor's base edge remains parallel or perpendicular to the object's rotational axis, aiming for the configuration shown in Picture F. Secure the sensor using screws to prevent loosening.。







Keep away from strong magnetic field materials such as magnets, iron, and nickel to prevent irreversible damage to the product's magnetic-sensitive components.
Keep clear of motors, wires, capacitors, inductors, and other components that generate magnetic fields due to current flow. This prevents continuous measurement from being affected by electromagnetic field fluctuations caused by energised components, thereby safeguarding the sensor's heading accuracy.
Maintain distance from moving iron components such as robotic arms, flywheels, and engines. This prevents magnetic field variations induced by the motion of ferromagnetic parts from compromising the sensor's heading precision.

Calibration

Calibration is performed using the quick calibration method as follows:

1. Open the serial port and set it to HEX transmit, HEX receive, and put the sensor in answer mode;
2. Position the sensor in the direction where the pitch angle is 0°, the roll angle is 0°, and the heading angle is pointing to the direction of due north, and use this direction as the reference direction, if you do not know where the due north is, you can use any direction as the reference direction. Keeping the sensor stationary, send the start calibration command 77 05 00 E4 01 EA , the sensor returns 77 05 00 E4 01 EA to start the calibration mode. When calibration mode is initiated, it will automatically send 77 05 00 E5 XX YY where XX is the calibration count, which will iterate through the motion calibration process and converge and begin to increase when stationary. If you are stationary at this time, XX will also increase automatically over time, and the calibration results are not reliable at this time.
3. Slowly rotate the sensor once around the X axis.;
4. Slowly rotate the sensor once around the Y-axis;
5. Slowly rotate the sensor once around the Z-axis, the rotation step is completed.;
6. Place the sensor in a static position and wait for XX in the return command to be greater

Order

Model	Communication	Package situation
DMC640	USB TYPE-A cable	Not available at present

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

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