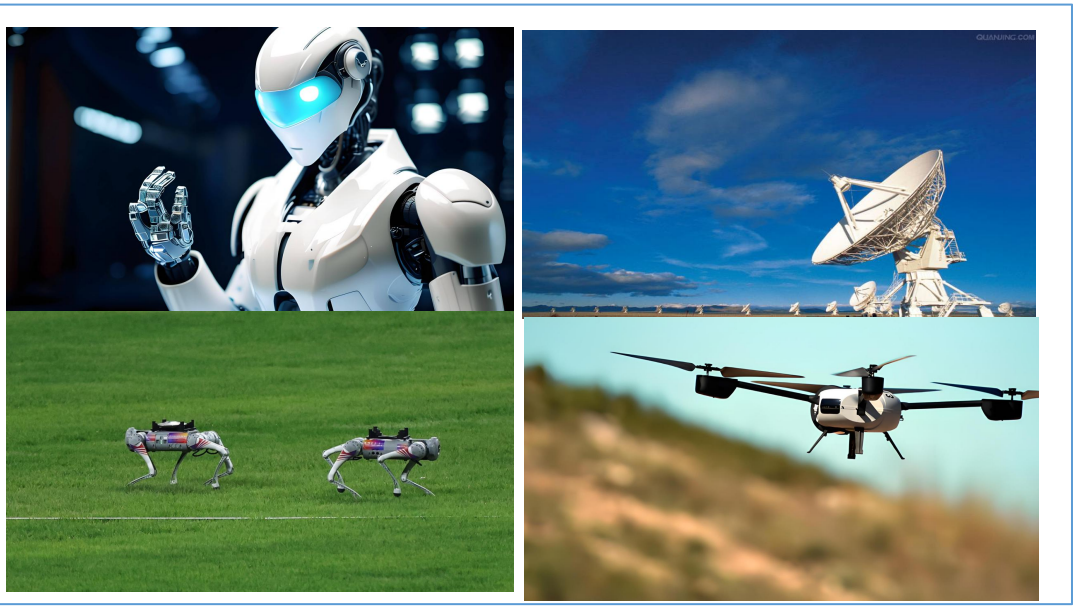
DMC630 series

Small Size High Precision

Attitude Heading Reference System

Technical Manual

V3.0



Introduction

DMC630 high-precision heading reference system adopts industrial grade microcontroller with high reliability and strong anti-interference ability and high-precision magnetic sensor and driver chip. It also integrates the fast calibration algorithm and anti-interference algorithm independently developed by BeiMicro Sensing, so that it can move in space at will and carry out magnetic field calibration to resist short-time magnetic interference. This product uses a three-axis accelerometer and gyroscope to compensate for the tilt angle, making it able to provide accurate heading data even in extremely harsh environments.

This product comes with IAP upgrade function. Subsequent functions and interfaces will be upgraded through IAP after the programme is updated. It can be customized according to customers' requirements, and can be very conveniently and quickly integrated into various products with electronic compass functions.

Feature

- 3-axis accelerometer, 3-axis Magnetometer,3-axis Gyroscope
- Heading accuracy 1° , pitch and roll accuracy 0.2°
- Fast Calibration Algorithm
- High precision, low cost
- Wide temperature range: -40℃~ +85℃
- Volume: L33*W31*H12(mm)
- Resistance to Short-Time Magnetic Interference
- Standard RS232/TTL/CAN output interface

Application

- Humanoid robots
- Rotary-wing drones
- AGV
- Medical assistive devices
- Motion capture
- Buoy attitude
- Observation equipment
- Night Vision

Specifications

Electrical index

Power supply	5~24V DC
Operating current	40mA (for 9V)
Operating temperature	-40℃~+85℃
Storage temperature	-55℃~+100℃
Output interface	TTL(RS232/CAN is under upgrade)

Performance index

Azimuth Angle	Measuring range	0~360°
	Accuracy	⩽ 1° (RMS) after spatial calibration
	Resolution	0.1°
	Repeatability	0.5° (RMS)
Pitch angle	Measuring range	±90°
	Accuracy	⩽0.2° (RMS)
	Resolution	0.05° (RMS)
	Repeatability	0.05° (RMS)
Roll angle	Measuring range	±180°
	Accuracy	⩽0.2° (RMS)
	Resolution	0.05° (RMS)
	Repeatability	0.05° (RMS)
Range	Accelerometer range	±4g
	Gyroscope range	±500° /s
Environments	Baud rate	9600~460800 (default 9600)
User calibration	Calibration	16-point calibration

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

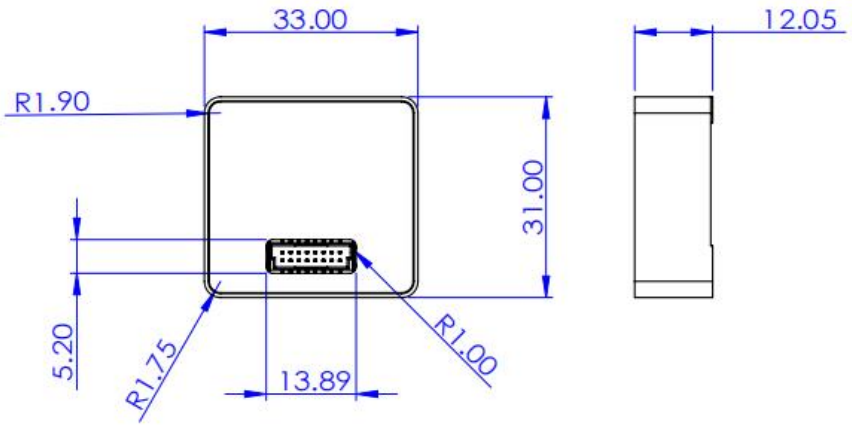
Accuracy: The root mean square error of the actual angle and the sensor measuring angle for multiple (≥16 times) measurements.

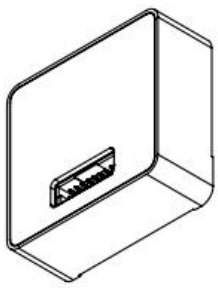
Mechanical Index

Connector	Phoenix Contact (FP 1,27/ 16-MV 1,75 – 1714936)
Protection level	Not available (does not represent the final product protection level)
Housing Material	Magnesium aluminium alloy anodised
Product weight	＜20g (not filled with glue)
Mounting	3pcs M2 copper bolts

Product package size

Product size：L33*W31*H12（mm) The length and width may have an error of ±1mm, please refer to the actual product





Electrical connect

The communication interface of this product adopts Phoenix Contact (FP 1,27/ 16-MV 1,75 – 1714936)

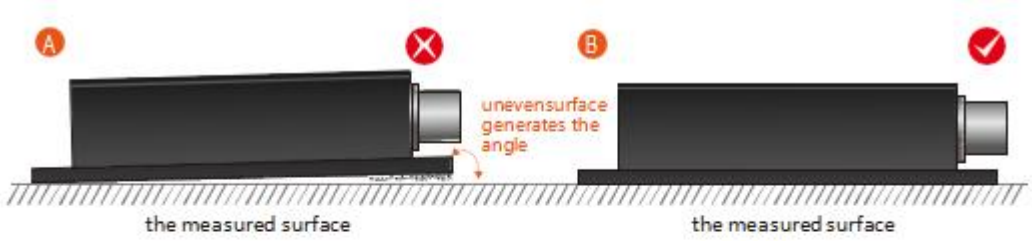
Pinout	Definition	Interface	Description	Opening Situation
1	VIN	Power supply	Power Input	OK
2	GND	Power supply	Power Ground	OK
3	CAN_H	I/O	CAN High	OK
4	CAN_L	I/O	CAN low	OK
5	232 TXD	O	232 Send data	OK
6	232 RTS	O	232 Request to send	
7	232 RXD	I	232 Accept data	OK
8	232 CTS	I	232 Clear Transmit	
9	SYNC IN1	I	Synchronised input 1	
10	SYNC IN2	I	Synchronised input 2	
11	GNSS TXD	O	Sending data in GNSS mode	
12	GNSS RXD	I	Accepting data in GNSS mode	
13	SYNC OUT	O	Synchronised output	
14	GND	Power supply	Power ground	OK
15	TTL TXD	O	TTL output	OK
16	TTL RXD	I	TTL input	OK

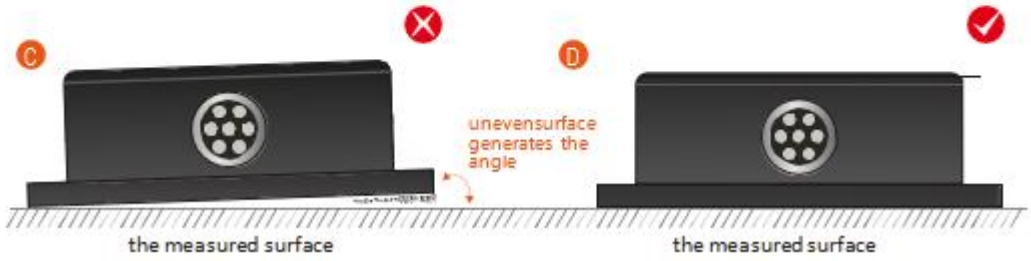
Currently only the pins labelled OK are open for use, the rest of the pins will be opened gradually in subsequent updates.

Installation

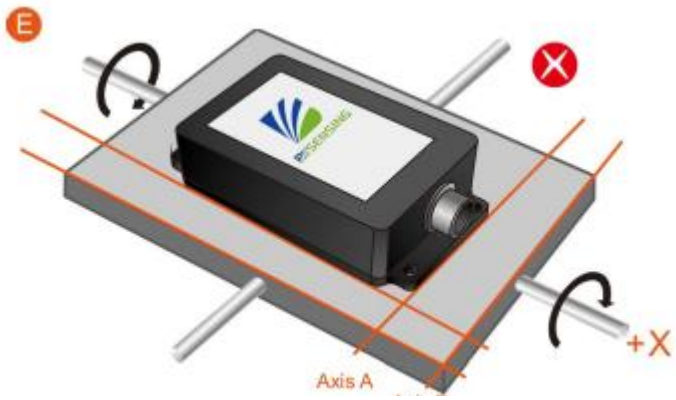
The correct installation method can avoid measurement errors. When installing the sensor, please do the following:

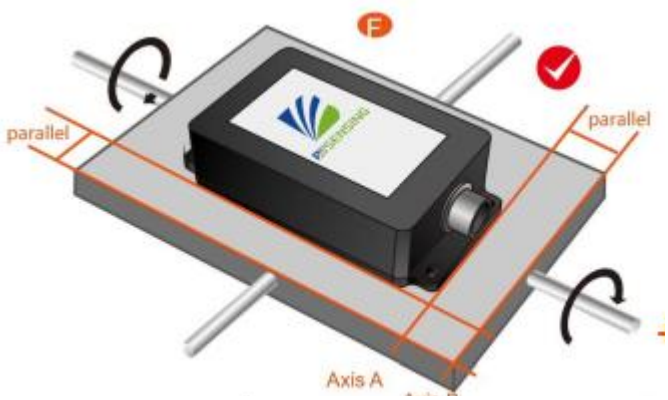
First of all, make sure that the sensor mounting surface is completely close to the measured surface, and the measured surface should be as level as possible. There should be no included angles as shown in Figure A and Figure C. The correct installation method is shown in Figure B and Figure D.





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

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 around the X axis.;
4. Slowly rotate the sensor 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 than or equal to 0x0A, then calibration is considered complete.
7. Send the end calibration command 77 05 00 E4 02 EB, calibration is complete!;

Order

Model	Communication	Package situation
DMC630	TTL(RS232/CAN under upgrade)	Phoenix Contact

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

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