

EC2000

High Accuracy 3D Electronic Compass



Main Features

- 3D Angle Output (Heading, Pitch, Roll)
- Hard/Soft Magnetic Compensation, Tilt Compensation
- Heading Accuracy: 0.3° RMS (25° C, Tilt Angle $<30^\circ$)
- Pitch and Roll Accuracy: $\pm 0.1^\circ$ (25° C, Full Range)
- Wider Input Voltage: 5~24VDC (up to 36VDC)
- Interface: RS232 (default) or RS485
- Wide Working Temperature: $-40\sim+85^\circ\text{C}$
- Small Size: L113*20*20mm

EC2000 digital compass is a high-performance, low-power consumption, tilt-compensated electronic compass module that provides industry-leading heading accuracy. EC2000 adopts hard and soft magnetic calibration algorithm, uses special calibration technology and provides high accuracy inclination signal, and it has perfect cross connect performance.

EC2000 integrates 3-axis magneto-inductive sensors, 3-axis MEMS accelerometer and central processing unit to calculate the heading data in real time and compensate the heading when it has inclination angle. EC2000 enjoys compact size, high accuracy, low power consumption, which is widely used in antenna pointing, vehicle, system integration fields.

- ✓ 12-Step Quality Control, Super Reliability, More Functions
- ✓ Adopting Original Big Brand Component, High-class Material, Competitive Price

- ✓ Real Actual Precise after Calibration, Perfect Performance
- ✓ Successful Applications in Tens of Fields, More than 1000 Customers are Using

Typical Applications



High Accuracy Platform



Artillery Launching System



Antenna Pointing



Ship Platform

Super Reliability & Performance

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Focus on MEMS Measurement & Control Technologies, Products include:

| | | | | |
|----------|-----------|-----------|---------------|------|
| MEMS Acc | MEMS Gyro | IMU | Vertical Gyro | AHRS |
| INS | GNSS/INS | E-compass | Inclinometer | FOG |

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Technical Specifications

| Technical Specs | | |
|---------------------------------|--------------------------|----------------------|
| Parameters | Value | Comments |
| Heading | | |
| Range | 0~360° | |
| Accuracy | 0.3° RMS | 25°C, tilt angle<30° |
| | 0.5° RMS | 25°C, tilt angle<60° |
| | 1° RMS | 25°C, tilt angle<85° |
| Resolution | 0.1° | Deg RMS |
| Tilt Angle | | |
| Range | roll: ±180°, pitch: ±85° | |
| Accuracy (full range) | 0.1° | 25°C |
| | 0.5° | -40~+70°C |
| Resolution | < 0.01° | |
| Hard Iron Calibration | Yes | |
| Soft Iron Calibration | Yes | |
| Tilt Calibration | Yes | |
| Electronical performance | | |
| Input voltage | 5~24VDC | |
| Current | 11mA@12VDC | |
| Power consumption | <0.2W | |
| Startup time | ≤500ms | |
| Environment condition | | |
| Working temperature | -40~+85°C | |
| Protection level | IP67 | |
| Communication protocol | | |
| Interface | RS232 or RS485 | |
| Baud rate | 2400~115200 | settable |
| Maximum output speed | 20Hz | ODM supported |
| Physical parameter | | |
| Dimensions (L x W x H) | 113*20*20 | mm |
| Weight | 80 | g |

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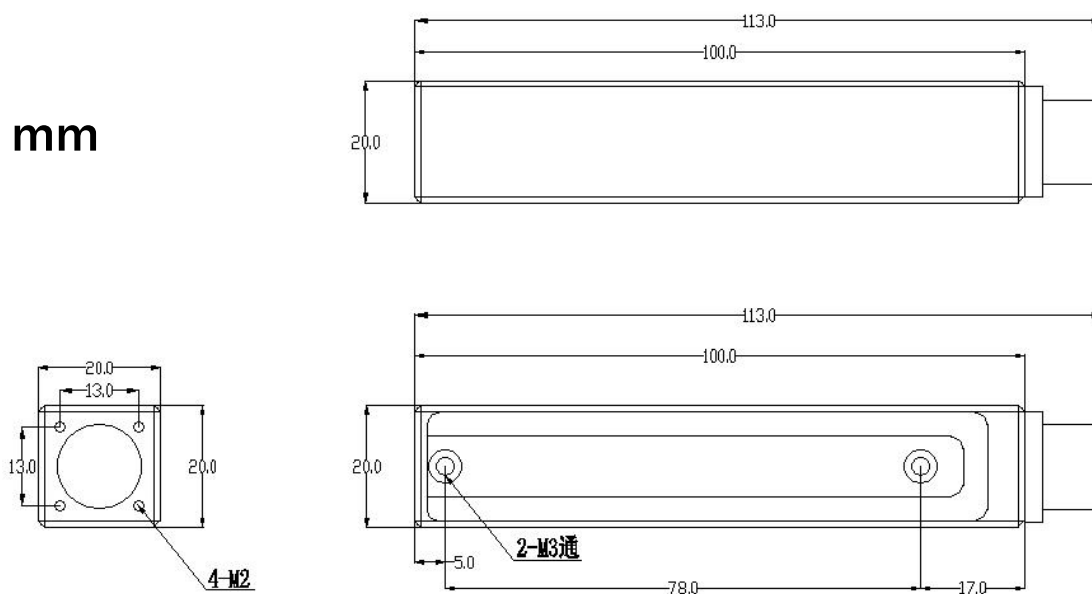
High Accuracy 3D Electronic Compass

Pins Definition

| No. | Line Color | Name | Comments |
|-----|------------|-----------------|---|
| 1 | Red | Vcc | Power supply positive pole (5~24VDC) |
| 2 | Black | GND | Power GND |
| 3 | White | RS232-RX/RS485+ | RS232 data receiving/RS485 positive pole |
| 4 | Green | RS232-TX/RS485- | RS232 data transmitting/RS485 negative pole |

Dimensions

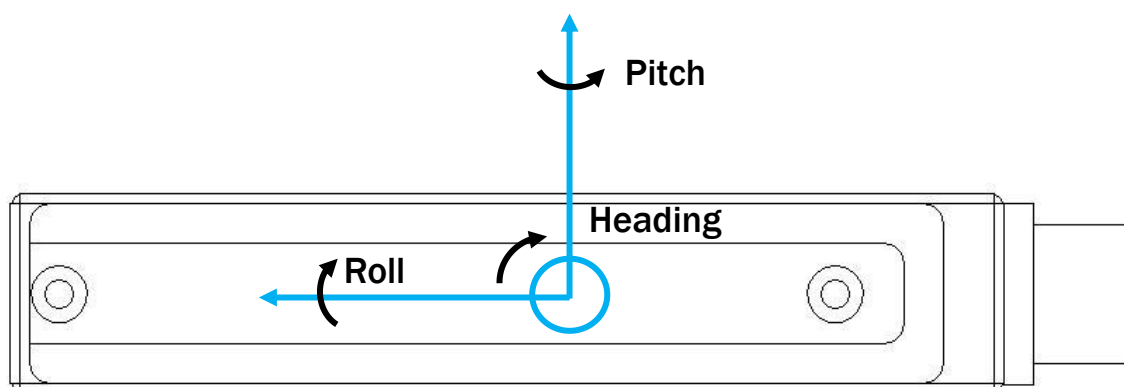
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Axis/Angle Definition



Remarks:

- Arrow direction indicates positive angle direction
- Heading angle that directs true north is 0°
- Heading angle that directs true south is 180°

Installation

Though SkyMEMS E-Compass can compensate magnetic interference, please install and use the compass in the environment that has no or very little magnetic interference. And please keep the compass far away from iron, nickel, magnetic-iron, motors and other types of magnetic materials.

Be sure that keeping strong magnetic materials (such as magnetic iron and motors) away from the compass, which will damage the compass' accuracy, and the damage can't be recovered.

SkyMEMS E-Compass has done calibration in the factory, if using it in the environment where there is no or less magnetic interference, it can be used without the environment calibration. It is better to do the magnetic calibration in the actual application. The calibration procedure please refers to "User Manual of SkyMEMS E-Compass Second Calibration Software".

Remarks: during the calibration, the operator should not have mobile phone, keys, and other material that can generate the magnetic field.

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Communication protocol

You may get direct access to the product through communication protocol (**RS232**), with which the product can be easily integrated into your system

1 Data Frame Format: (the default rate is 115200)

Send the Command:

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|-------------|----------------------|
| 68 | XX | XX | XX | XX | XX |

Data format: Hexadecimal System

Preamble Code: 68 (fixed)

Data Length: the length from Data Length to Checksum (including Checksum)

Address: the module's address, the default address is 00)

Data Domain: the content and length of Data Domain will be different according to the different command.

Checksum: it is the sum of Data Length, Address, Command Code (command response), (No carry). for example, if the command is 68 06 00 06 02 08 16, so the checksum=06+00+06+02+08=16

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Communication protocol

2 Command Description

2.1 Read Angle of Pitch, Roll, Yaw

Send Command: 68 04 00 04 08

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|-------------|----------------------|
| 68 | 04 | 00 | 04 | - | 08 |

Command response:

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Pitch (3bytes) | Roll (3bytes) | Yaw (3 bytes) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|----------------|------------------|---------------|----------------------|
| 68 | 0D | 00 | 84 | SXXXYY | SXXXYY | SXXXYY | XX |

Remarks: the data domain is 9 bytes, they are representing Pitch, Roll, and Yaw. S is sign bit (0: positive, 1 negative), XXX is 3 bit integer value, YY is decimal fraction, for example, if the command response is 68 0D 00 84 00 10 50 10 10 05 01 04 01 1C, it means that the pitch: +010.50°, roll: -010.05°, yaw: +104.01°

2.2 Set magnetic declination angle

Send Command: 68 06 00 06 02 08 16

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (2 bytes) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|--------------------------|----------------------|
| 68 | 06 | 00 | 06 | SXXY | XX |

Remarks: the data domain is 2 bytes, SXXY, S is sign bit (0: positive, 1 negative), XX is 2 bit integer value, YY is decimal fraction, for example, if the command response is 68 06 00 06 02 08 16, it means that the data domain is 02 08, it is +20.8degree.

Command response:

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (1 byte) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|---|----------------------|
| 68 | 05 | 00 | 86 | 00 (setting success) FF (setting failed) | 8B 8A |

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Communication protocol

2.3 Read magnetic declination angle

Send Command: 68 04 00 07 0B

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (2 bytes) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|--------------------------|----------------------|
| 68 | 04 | 00 | 07 | - | 0B |

Command response:

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (2 bytes) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|--------------------------|----------------------|
| 68 | 06 | 00 | 87 | SXXY | XXXX |

Remarks: the data domain is the returned magnetic declination angle, 2 bytes, SXXY, S is sign bit (0: positive, 1 negative), XX is 2 bit integer value, YY is decimal fraction, for example, if the command response is 68 06 00 87 02 08 97, it means that the magnetic declination angle is +20.8degree.

2.4 Set communication rate

Send Command: 68 05 00 0B 02 12

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (1 byte) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|-------------------------|----------------------|
| 68 | 05 | 00 | 0B | XX | XX |

Remarks: the data domain is 1 byte, XX is the baud rate option: 00 means 2400, 01 means 4800, 02 means 9600, 03 means 19200, 04 means 115200, the default is 02: 9600.

Command response:

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (1 byte) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|---|----------------------|
| 68 | 05 | 00 | 8B | 00 (setting success) FF (setting failed) | 90 8F |

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Communication protocol

2.5 Set module address

Send Command: 68 05 00 0F 01 15

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (1 byte) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|-------------------------|----------------------|
| 68 | 05 | 00 | 0F | XX | XX |

Remarks: the data domain is address XX, the range is from 00 to FE; we reserved FF address as backup address, if forgetting the setting address, user can use FF to operate the module.

Command response:

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (1 byte) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|---|----------------------|
| 68 | 05 | 00 | 8F | 00 (setting success) FF (setting failed) | 94 93 |

2.6 Set output mode

Send Command: 68 05 00 0C 00 11

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (1 byte) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|--------------------------------|----------------------|
| 68 | 05 | 00 | 0C | 00 (QA mode) 01 (Auto mode) | 11 12 |

Remarks: output mode: 00 is question and answer mode, 01 is output automatically (default)

Command response:

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (1 byte) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|---|----------------------|
| 68 | 05 | 00 | 8C | 00 (setting success) FF (setting failed) | 91 90 |

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Communication protocol

2.7 Query output mode

Send Command: 68 04 00 42 46

| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (0 byte) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|-------------------------|----------------------|
| 68 | 04 | 00 | 42 | - | 46 |

Command response:

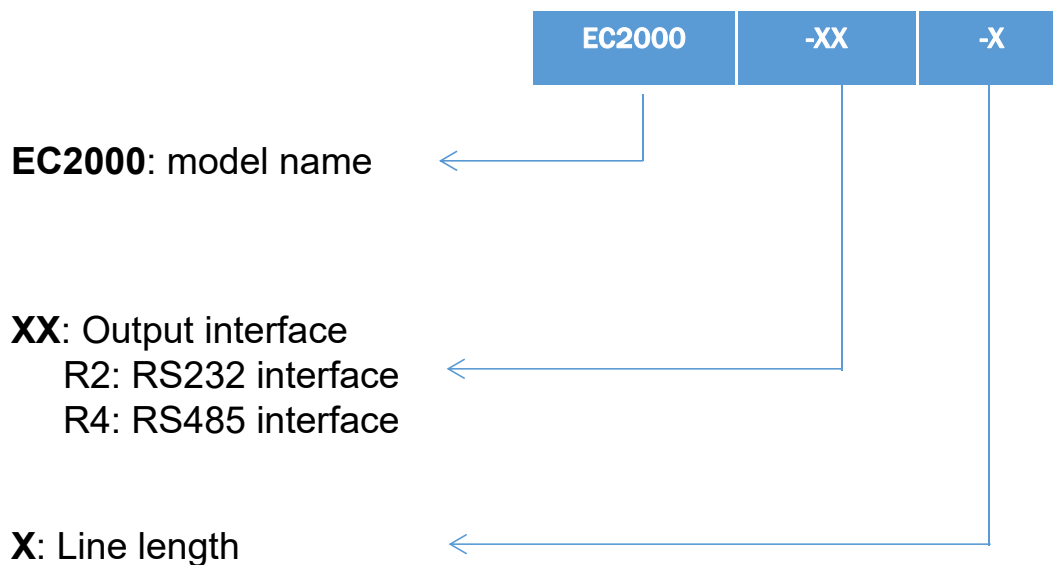
| Preamble Code (1 byte) | Data Length (1 byte) | Address (1 byte) | Command Code (1 byte) | Data Domain (1 byte) | Checksum (1 byte) |
|---------------------------|-------------------------|---------------------|--------------------------|-------------------------|----------------------|
| 68 | 05 | 00 | C2 | 00 | C7 |

Remarks: The data domain indicate the output mode : 00 is question and answer mode, 01 is output automatically.

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Order Information



For example, EC2000-R2-1 means that the EC2000 with RS232 interface and 1 meter length cable.