

PRODUCT USER MANUAL

IMU400

Inertial Measurement Unit User and Maintenance Manual

1 Overview

The IMU400 Inertial Measurement Unit (hereinafter referred to as the “Product”) consists of three high-precision MEMS gyroscopes and three accelerometers. It can measure acceleration and angular velocity along three axes in real time and transmits the measurement results to an external application control system via a single RS422 asynchronous serial port as required.

2 Performance Specifications

2.1 Power Supply.

Power Supply Specifications: DC (5±0.3) V.

2.2 Power Consumption

Power Consumption: ≤1 W.

2.3 Gyroscope Performance Specifications

- (1) Measurement Range: -400°/s to +400°/s
- (2) Zero-offset repeatability: ≤3°/h (1σ, full temperature range)
- (3) Zero-offset Stability: ≤3°/h (1σ, full temperature range)
- (4) Zero-offset instability: ≤0.3°/h
- (5) Scale Factor Nonlinearity: ≤200 ppm (1σ, ambient temperature)
- (6) Angular random walk: ≤0.05°/√h
- (7) Orthogonal error: ≤0.05%
- (8) Bandwidth: ≥200 Hz
- (9) Noise: 0.05°/s (3σ)

2.4 Accelerometer Performance Specifications

- (1) Measurement Range: -50 g to +50 g
- (2) Zero drift: ≤2 mg (over the full temperature range)
- (3) Zero-offset repeatability: ≤0.1 mg (1σ, ambient temperature)
- (4) Zero-offset Stability: ≤0.1 mg (1σ, ambient temperature)
- (5) Linearity Error: ≤0.05% (F.S.)
- (6) Cross-coupling: ≤0.05%
- (7) Resolution: ≤50 μg
- (8) Bandwidth: ≥200 Hz

2.5 Three-Axis Output Polarity

The product's coordinate system and axes are shown in Figure 2. The polarity of acceleration is positive in the direction of the arrow and negative in the opposite direction; the polarity of the gyroscope must satisfy the right-hand rule.

3 Equipment Composition, Structural Features, and Operating Principles

3.1 Product Composition

This product (hereinafter referred to as the “product”) consists of three high-precision MEMS gyroscopes and three accelerometers. It can measure acceleration and angular velocity along three axes in real time and transmits the measurement results to an external application control system via a single RS422 asynchronous serial port as required.

3.2 Product Dimensions and Mounting Specifications

The product's external dimensions and mounting dimensions are shown in Figure 1. Dimensions: $(38.6 \text{ mm} \pm 0.2) \times (44.8 \text{ mm} \pm 0.2) \times (21.5 \text{ mm} \pm 0.5)$

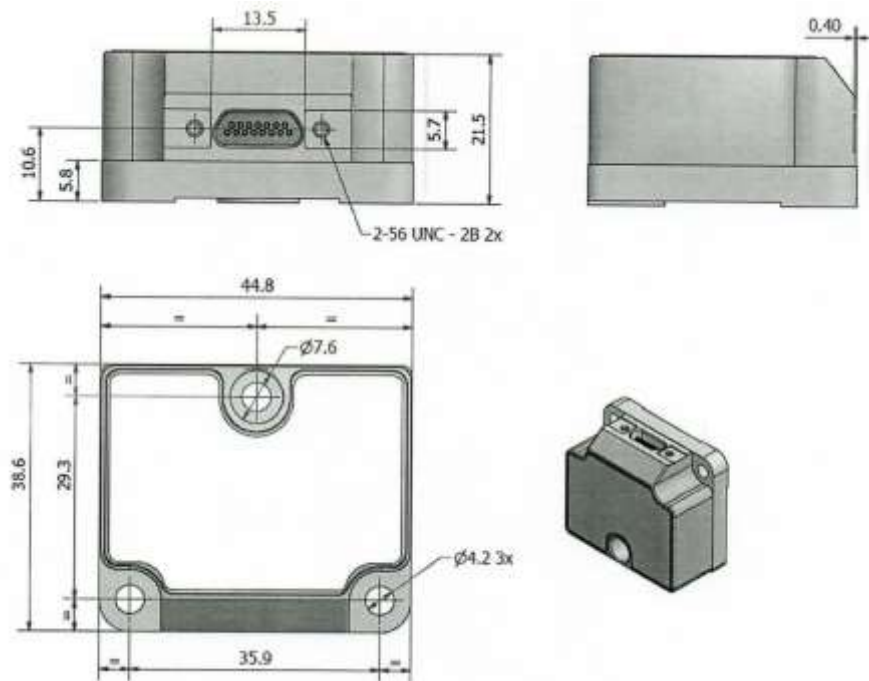


Figure 1 Product Outline

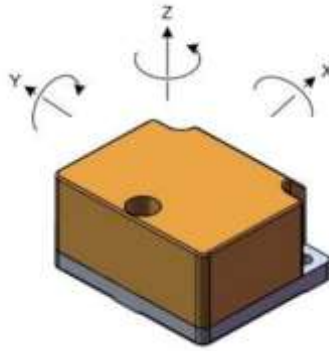


Figure 2: Product Polarity Diagram

3.3 Product Weight

Not more than 50 g.

3.4 Environmental Conditions

Operating temperature: -45°C to +85°C;

3.4 Product Interfaces

3.4.1 Product Electrical Interface Requirements

Product fixed-end connector part number: J30J-15ZKP; the connector is mounted on the front face. See Table 1 for the pin definitions of the electrical plug, and Table 2 for the data output format.

The product's output frequency is configurable; specific options include 100 Hz, 200 Hz, 500 Hz, 1000 Hz, and 2000 Hz, with **the default output set to 200 Hz**; (users must select their preference before placing an order).

The product's serial port baud rate is configurable, with options including 115200, 460800, and 921600; **the default is 921600**. (Users must select their preference before placing an order.)

The product's output protocol is customizable; the default data format is as shown in Table 2

Table 1. Conductor Definitions

J30J-15TJL	Definition
1	TxD — RS-422 low-level transmit
2	RxD — RS-422 low-level receive
3	TST (For testing; do not connect)
4	+3.3V
5	NRST (Reset)
6	GND (Digital ground; internally tied to power ground; may be left unconnected)
7	—
8	VSUP Power Supply (+5V)
9	TXD+ — RS-422 transmit high
10	RXD+ — RS-422 receive high
11	IO (External synchronous trigger; leave unconnected if unused; voltage range 0–3.6V)
12	—
13	—
14	—
15	GND (Power ground)

Table 2. Output Data Frame Format (Default)

No.	Content	Unit	Remarks
1	0xAA	–	Frame Header
2	0x55	–	Frame Header
3	0x24	–	Frame Length
4–7	X-axis angular velocity	°/s	4-byte float
8–11	Y-axis angular velocity	°/s	4-byte float
12–15	Z-axis angular velocity	°/s	4-byte float
16–19	X-axis acceleration	g	4-byte float
20–23	Y-axis acceleration	g	4-byte float
24–27	Z-axis acceleration	g	4-byte float
28–31	Gyro temperature	–	4-byte float
32–35	Accelerometer temperature	–	4-byte float
36	Check digit	–	Single byte; cumulative sum of all data

5 Installation and Commissioning

Secure the product with three M4 screws. Connect the product using a J30J-TJL cable and wire it according to the definitions in Table 1. After powering on the product, the serial data acquisition software should be able to successfully collect hexadecimal data. After decoding this data using the host computer's decoding software, gyro and accelerometer data should be output normally.

6 Usage and Operation

6.1 Precautions

This product is not waterproof; avoid direct exposure to rain.

6.2 Installation and Protection

When installing the product, ensure it is secured as parallel as possible to the reference plane of the mounting surface (the installation error relative to the reference plane should be less than 0.05°).

As this is a precision testing instrument, although it is protected by a housing, users should handle it with care to prevent damage. Avoid dropping the product during use or when moving it and ensure that it does not suffer severe impacts with other components during operation to maintain the accuracy of its reference surface.

7 Maintenance

The product is maintenance-free throughout its service life.

8 Fault Detection, Localization, and Isolation

Failures in individual sensors can be located via software status flags;

If the product has no output after power-on, first check whether the power supply and interface cable connections are normal. If the product still does not output data, return it to the factory for inspection and repair.

If the product's accuracy does not meet operational requirements during system use, re-test each accuracy parameter individually to verify whether they meet the technical specifications. If the product still fails to meet the technical specifications, return it to the factory for inspection and repair.

9 Fault Analysis and Troubleshooting

See Table 3 for an analysis of product failure causes and troubleshooting methods.

Table 3. Analysis of Product Failure Causes and Troubleshooting Methods

Fault Symptoms	Cause Analysis	Troubleshooting Method	Remarks
Abnormal output data from the gyroscope or accelerometer	Sensor hardware damage	Return to factory for repair	—
No output upon power-up	① Power supply issue ② Incorrect interface connection ③ Damaged interface hardware	① Check if the power supply voltage is normal ② Check if the interface cable pinout is correct ③ Return to the manufacturer for repair	—

10 Safety Precautions and Notes

This product operates at low voltage and poses no risk of injury to humans. Due to its small size and light weight, it will not cause injury in the event of a malfunction;

If the product malfunctions, disconnect the power immediately to prevent further damage, then contact our company for factory inspection and repair.

11 Transportation and Storage

When placed in a shock-absorbing bag, the product is suitable for various modes of transportation (rail, road, water, and air); When storing the product, keep it in a dry environment at room temperature.

12 Other

If you have any questions regarding the use of the product, please feel free to contact our marketing or technical staff at any time for technical assistance.