FORSENSE
原极科技

Tactical-grade MEMS 6-DOF Inertial Sensors

FSS-IMU16460-DM Product Sheet

Features

Tactical-grade MEMS Gyroscope

- Bias Instability: 2.5°/hr
- Angle Random Walk: XY:0.4 °/√hr Z:0.3 °/√hr
- Temperature Drift: 0.015°/s (-40℃ ~ 85℃, ≤1℃/min @1σ)

Tactical-grade MEMS Accelerometer

- Bias Instability: 25μg
- Velocity Random Walk: 0.04m/s /√hr
- Temperature Drift: 0.5mg (-40 ~ 85℃, ≤1℃/min @1σ)

Wide and refined temperature compensation

- Temperature compensation: -40℃ to 85℃
- Precise Temperature Calibration

Independent Rotary Table Calibration

- Independent calibration for every module includes: sensitivity, bias instability, and misalignment

High-intensity Operating Condition Tolerance

- Ultra Shock Resistance: 2000g（0.5ms, half-sine shock pulse, 3-axis）
- Superb Vibration Resistance: 10g（10~2KHz, 3-axis）
- Stable Operating Temperature Range: -40℃ ~ 85℃
- 100% Magnetic Shielding

Real-time and Flexible Digital Interface with a Small Size

- Configurable output sampling rate up to 1KHz
- Serial port 485 and TTL supported
- 22.4*22.4*9.91mm, about 9g

Description

FSS-IMU16460-DM is a MEMS inertial measurement unit (IMU) module with 6 degrees of freedom (DOF) developed by Forsense (Shanghai) Technology Co., Ltd. It features three-axis gyroscopes and three-axis accelerometers.

High precision and resolution combined to help capture subtle vibration and tilt. The output with a large measuring range enables motion perception under large dynamic conditions. All IMU modules are calibrated independently on a rotary table and adjusted precisely over an ultra-wide temperature range in a temperature chamber before leaving the factory, so that they can deliver stable and consistent performance in most extreme conditions.

Applications

- Autonomous Driving: Automobile, Robotics, Engineering Vehicles, and Underwater Scenarios
- Supports embodied intelligence applications, including humanoid robots, quadruped robots, and robotic arms.
- Autonomous Driving: Automobile, Robotics, Engineering Vehicles, and Underwater Scenarios
- Precision Measurement: Underground Environments, Tunnels, Vibration Scenarios, and Tilted Surfaces
- Stabilized Platforms: Pan tilt, Satellite Communication on the Move (Satcom on the Move)
- Automatic Control: Automation System, Fixed-wing
- UAV

Apart from standard performance and output parameters, Forsense also provides **customized services, including software development and LOGO design, to better your products!**

CONTENT

1 Performance Parameters

1.1 Gyroscope Key Specifications

Table 1 Gyroscope Key Specifications

Parameter	Test Conditions/Remarks	Min.	Typical	Maximum	Unit
Measurement Range			±2000		°/s
Bias Instability[1]	@25℃, ALLAN Variance, 1σ		2.5		°/hr
Bias Stability	GJB, 10s smoothing		7		°/hr
Bias Repeatability	GJB		7		°/hr
Resolution			0.0305		°/s
Non-orthogonal between axes			0.02		deg
Internal Low-pass Cutoff Frequency	Adjustable Software		116		Hz
ODR			1000	2000	Hz
Measure Delay			3		ms
Offset Error over Temperature[2]	-40℃ ~ 85℃, ≤1℃/min @1σ		0.015		°/s
Random Walk[3]	@25℃, ALLAN Variance, 1σ		XY: 0.4 Z: 0.3		°/√hr
Scale Coefficient Error			2.5		‰
Scale Factor Nonlinear			100		ppm

Note 1: 2000 Hz output frequency requires a custom protocol.

Note 2: 1σ value of full-temperature zero-bias variation under a temperature ramp of 1°C/min.

Note 3: IEEE standard values acquired from Allan Variance analysis in a static environment (25°C).

1.2 Accelerometer Key Specifications

Table 2 Accelerometer Key Metrics

Parameter	Test Conditions/Remarks	Min.	Typical	Maximum	Unit
Measurement Range			±6		g
Bias Instability[1]	@25℃, ALLAN Variance, 1σ		25		μg
Bias Stability	GJB, 10s smoothing		55		μg
Bias Repeatability	GJB		0.2		mg
Resolution			0.0916		mg
Misalignment between axes			0.02		deg
Internal Low-pass Cutoff Frequency	Adjustable Software		116		Hz
ODR			1000	2000	Hz
Measure Delay			3		ms
Offset Error over Temperature[2]	-40℃ ~ 85℃, ≤1℃/min @1σ		XY: 0.5 Z: 2		mg
Random Walk[3]	@25℃, ALLAN Variance, 1σ		0.04		m/s/√hr
Scale Coefficient Error			0.5		‰
Scale Factor Nonlinear			200		ppm

Note 1: 2000 Hz output frequency requires a custom protocol.

Note 2: 1σ variation of full-temperature bias at a heating rate of 1°C/min.

Note 3: IEEE standard values acquired from Allan Variance analysis in a static environment (25°C).

Fig. 1 Gyroscope - Typical Allan Variance Curve

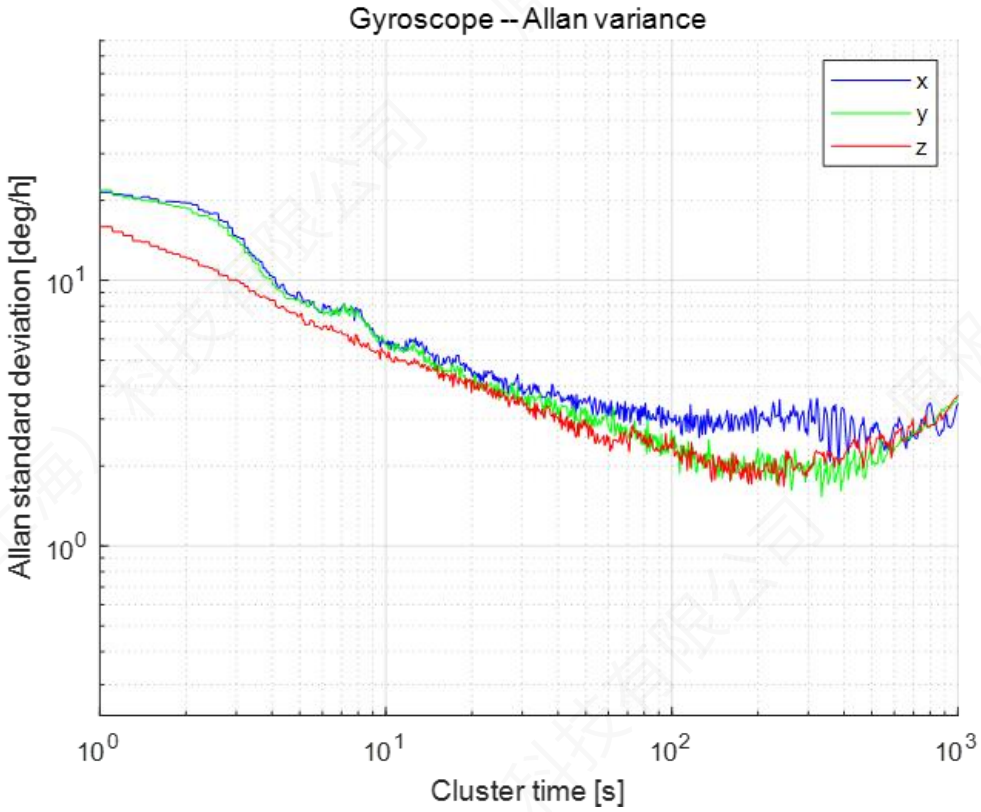
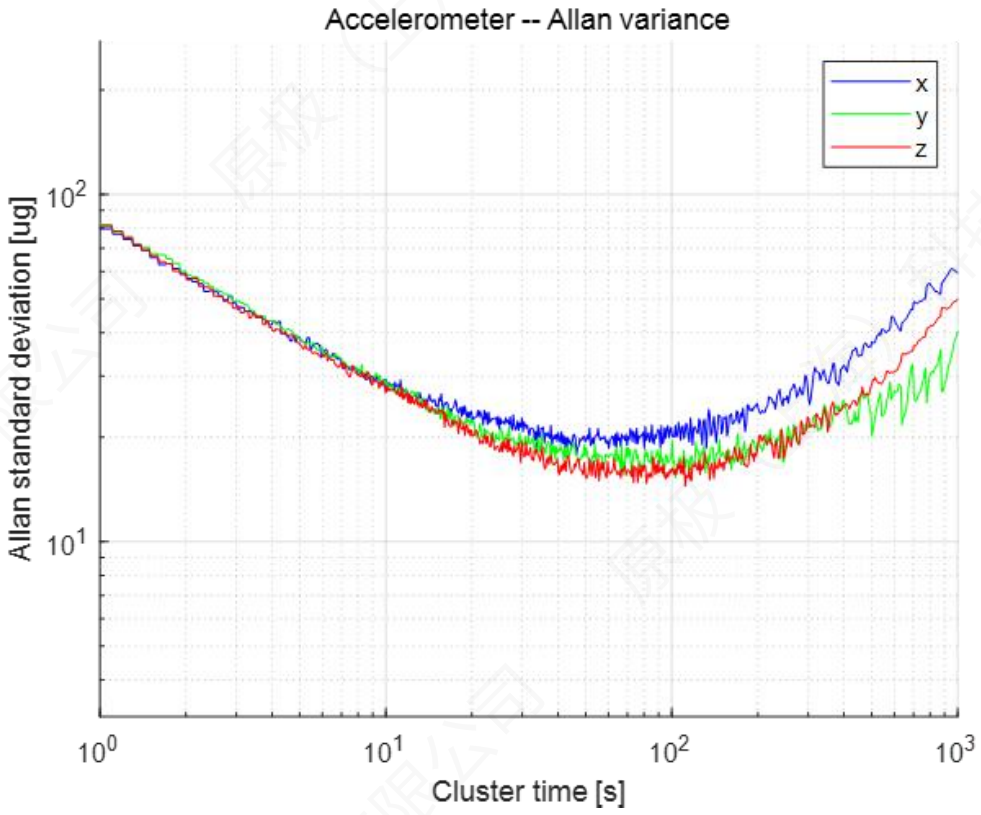


Fig. 2 Accelerometer - Typical Allan Variance Curve



2. External Structure

Fig. 3 Structure and Size (unit: mm)

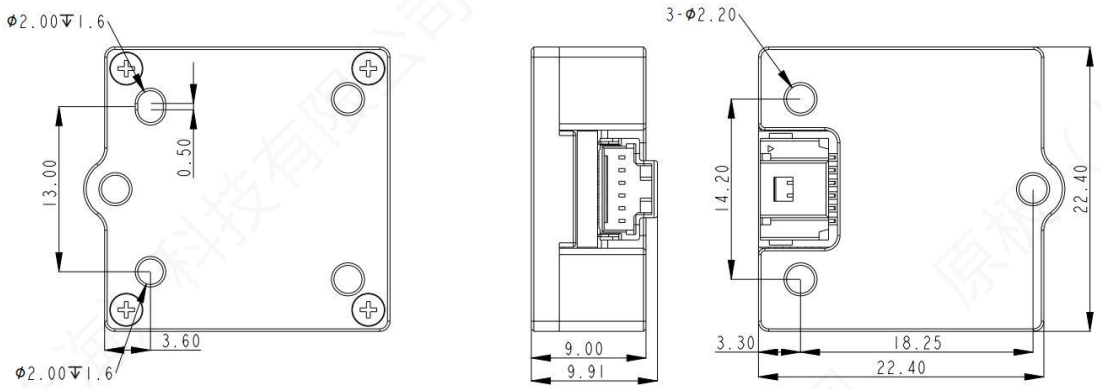
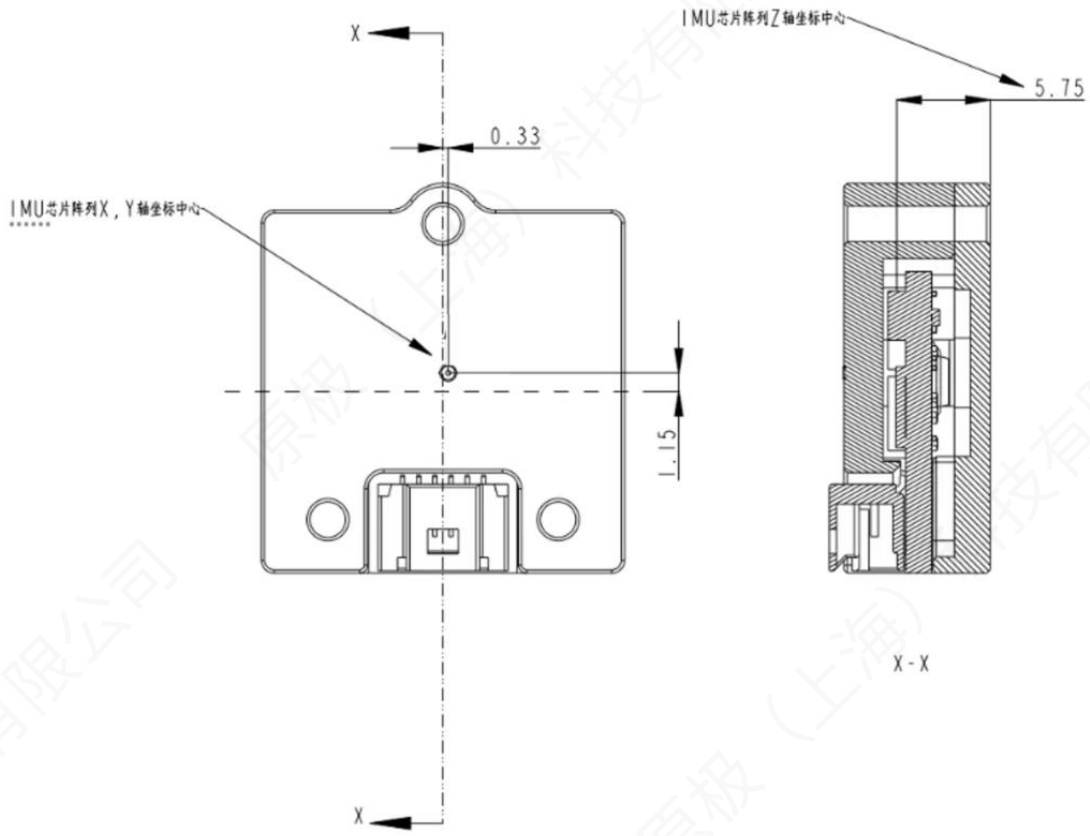


Fig. 4 IMU Array Center (unit: mm)



3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3 Absolute Maximum Ratings

Parameter	Symbol	Range	Unit
Supply Voltage	VCC	-0.3 to 6.5	V
Ground	GND	-	-
Input Pin Voltage	Vin	-0.3 to 5.8	V
Operating Temperature	Tot	-40 to 85	℃
Storage Temperature	Tstg	-40 to 85	℃

3.2 Operating Conditions

Table 4 Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Supply Voltage	VIN	4.5	5	5.5	V
VIN Maximum Ripple	Vrpp		±40		mV
Power Consumption	P		0.2		W
Operating Temperature	Tot	-40		85	℃
Storage Temperature	Tstg	-40		85	℃

Note: When the power supply voltage is higher than 6V, the internal voltage protection circuit will cut off the power supply, putting the device in a reset state until the voltage returns to nominal operating voltage.

3.3 IO Threshold Characteristics

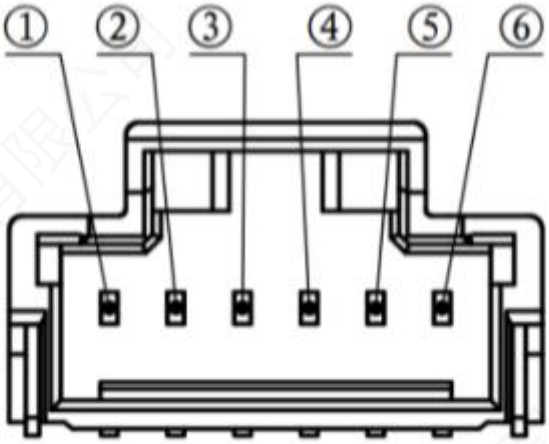
Table 5 IO Threshold Characteristics

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Input Pin Low Level	Vin_low	0		VCC*0.2	V
Input Pin High Level	Vin_high	VCC*0.7		VCC+0.2	V
Output Pin Low Level	Vout_low	0		0.45	V
Output Pin High Level	Vout_high	VCC-0.45		VCC	V

Note: VCC=3.3V

4. Pin Definitions

Fig. 5 Pin Diagram



Connector Model for Interface: MOLEX：5013300600

Table 6 Pin Definitions

Pin No.	Pin Name	Pin Description
1	RS485_A	RS485
2	RS485_B	
3	RX	Receive data input / RMC
4	TX	Receive data output / PPS / DATA READY
5	GND	Ground
6	VIN	Power input, +5V input

Pin 4 function switching serial command is:

AT+SET_TIME_SYNC=0 Tx（default 0）

AT+SET_TIME_SYNC=1 PPS

AT+SET_TIME_SYNC=2 DATA READY

5. Communication Protocols

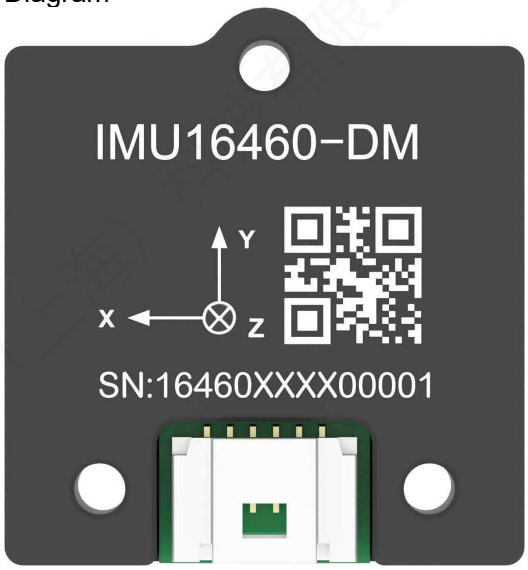
Reference Profile: Forsense IMU Communication Protocols

The document includes serial communication protocol, coordinate system definition, filter configuration, parameter settings, OTA upgrade method, time synchronization, etc.

6. Definition of Coordinate System

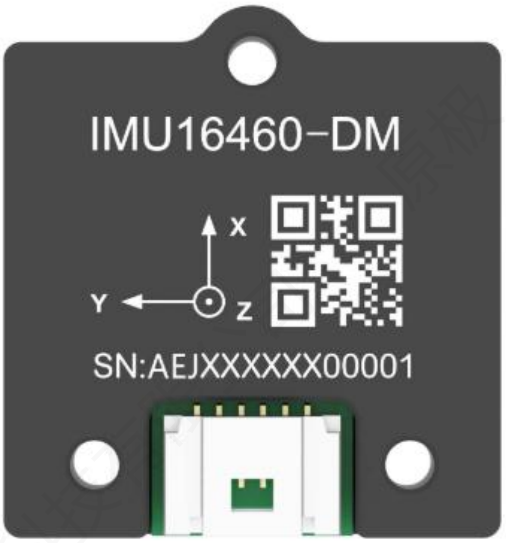
Distinction between standard and custom models: Units with SN prefix "AEJ" are custom models, while those with SN prefix "16460" are standard models.

Fig. 6 Standard Coordinate System Diagram



This product is equipped with the Front-Right-Down (FRD) coordinate system, and the range of Euler angles is as follows:
Rotate around Z-axis: Yaw angle: 0° ~360°;
Rotate around X-axis: Roll angle: -180°~180°;
Rotate around Y-axis: Pitch angle: -90°~90°。

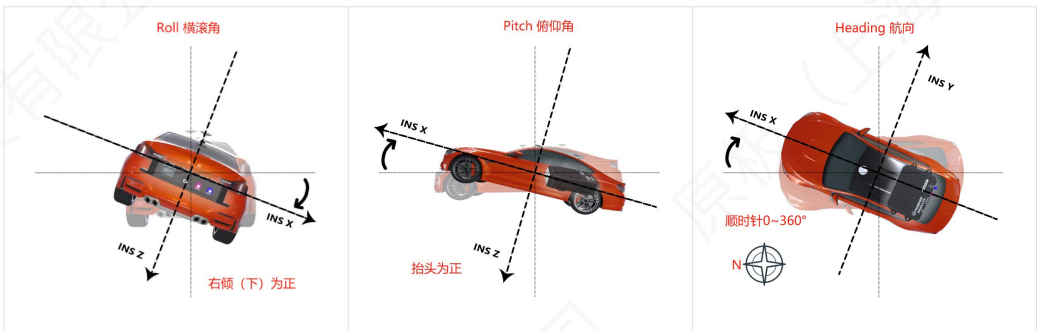
Fig. 7 Custom Coordinate System Diagram



This product uses a Front-Left-Up (FLU) coordinate system. The Euler angle ranges are as follows:
Rotate around Z-axis: Yaw angle: 0° ~360°;
Rotate around X-axis: Roll angle: -180°~180°;
Rotate around Y-axis: Pitch angle: -90°~90°。

The diagram of roll, pitch, and yaw Angles are as follows:

Fig. 8 Diagram of Roll, Pitch, and Yaw Angles



7 Revision History

Latest Manual Version:

Version	Date	Status/Notes
Version 1.0	03/05/2025	First Edition
Version 1.1	03/31/2025	AT Command Update
Version 1.2	07/10/2025	Coordinate System Update
Version 1.3	07/31/2025	The communication protocol section uses a dedicated document.
Version 1.4	09/28/2025	Replace outline structure and dimension diagrams
Version 1.5	01/24/2026	Output frequency