FORSENSE
原极科技

Tactical-grade MEMS 6-DOF inertial sensor

FSS-IMU16460-DM

Product manual



Forsense (Shanghai) Technology Co., Ltd

Please read this user manual carefully before using this product.

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Tactical-grade MEMS 6-DOF inertial sensor

FSS-IMU16460-DM-Product Sheet（en）

Features

Tactical-grade MEMS Gyroscope

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

Tactical-Grade MEMS Accelerometer

- 25μg Bias instability
- 0.04m/s/√hr Velocity Random Walk
- Temperature Drift: XY 0.5 mg, Z 2 mg(-40℃~85℃, ≤1℃/min @1σ)

Wide-Range refined temperature compensation

- Temperature Compensation from -40°C to 85°C
- Precise Temperature Calibration

independent rotary table calibration

- Independent Calibration of Each Module: Sensitivity, Bias, Misalignment

High Intensity Operating Condition Tolerance

- Extreme Shock Tolerance: 2000g (0.5ms, Half-Sine, 3-Axis)
- Superior Vibration Resistance: 10g (10~2kHz, 3-axis)
- Stable Operation Across Full Temperature Range: -40°C ~ 85°C
- 100% Magnetic Shielding

Real-time and Flexible Digital Interface, Compact Size

- Supports up to 2KHz Custom Protocol Output
- Supports Serial Port485 and TTL Output
- 22.4*22.4*9.91mm, Weight9g

Product Overview

IMU16460-DMIt is a 6 degrees of freedom (DOF) MEMS inertial sensor module meticulously crafted by Forsense Technology. It standardly outputs tri-axial Gyroscope and acceleration data.

High precision and high resolution enable the capture of subtle vibrations and tilts. The wide-range output facilitates motion sensing under large dynamic conditions. All modules undergo fine-grained temperature compensation across an ultra-wide temperature range and independent calibration before shipment, ensuring stable performance under extreme operating conditions while maintaining high consistency in product performance.

Application Areas

- Embodied Intelligence: Humanoid Robots, Quadruped Robot Dogs, Robotic Arms
- Autonomous Driving: Vehicle-mounted, Robotics, Engineering Vehicles, Underwater
- Precision Measurement: Downhole, Tunnel, Vibration, Tilt
- Stabilized Platform: Pan tilt, Satellite Communication on the Move (Satcom on the Move)
- Navigation Control: Automation System, Fixed-wing UAV

Based on standard performance and Parameter output, Forsense also provides**customized software and LOGO customization services**, to support your product needs!

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1. Performance Parameter

1.1 Gyroscope Key Metrics

Table 1 Gyroscope Key Metrics

Parameter	Test Conditions/Notes	Min	Typ	Max	Unit
Measurement Range			±2000		°/s
Bias instability[3]	@25℃, Allan Variance,1σ		2.5		°/hr
Bias stability	GJB, 10s smoothing		7		°/hr
Bias Repeatability	GJB		7		°/hr
Resolution			0.0305		°/s
Misalignment between axes			0.02		deg
Internal low-pass cutoff frequency	Software Adjustable		116		Hz
ODR[1]			1000	2000	Hz
measure delay			3		ms
Bias 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: A 2000Hz output frequency requires a custom protocol

Note 2: The 1σ variation of the full-temperature Bias under a heating rate of 1°C/min

Note 3: IEEE standard, provided by the Allan variance curve in a static environment at 25°C

1.2 Accelerometer Key Metrics

Table 2 Accelerometer Key Metrics

Parameter	Test Conditions/Notes	Min	Typical	Max	Unit
Measurement Range			±6		g
Bias instability[3]	@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	Software Adjustable		116		Hz
ODR[1]			1000	2000	Hz
measure delay			3		ms
Bias 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: A 2000Hz output frequency requires a custom protocol output

Note 2: The 1σ value of Bias variation over the full temperature range at a heating rate of 1°C/min

Note 3: IEEE standard, given by the Allan Variance curve in a static environment at 25°C

Figure 1 Gyroscope Allan Variance Typical Curve

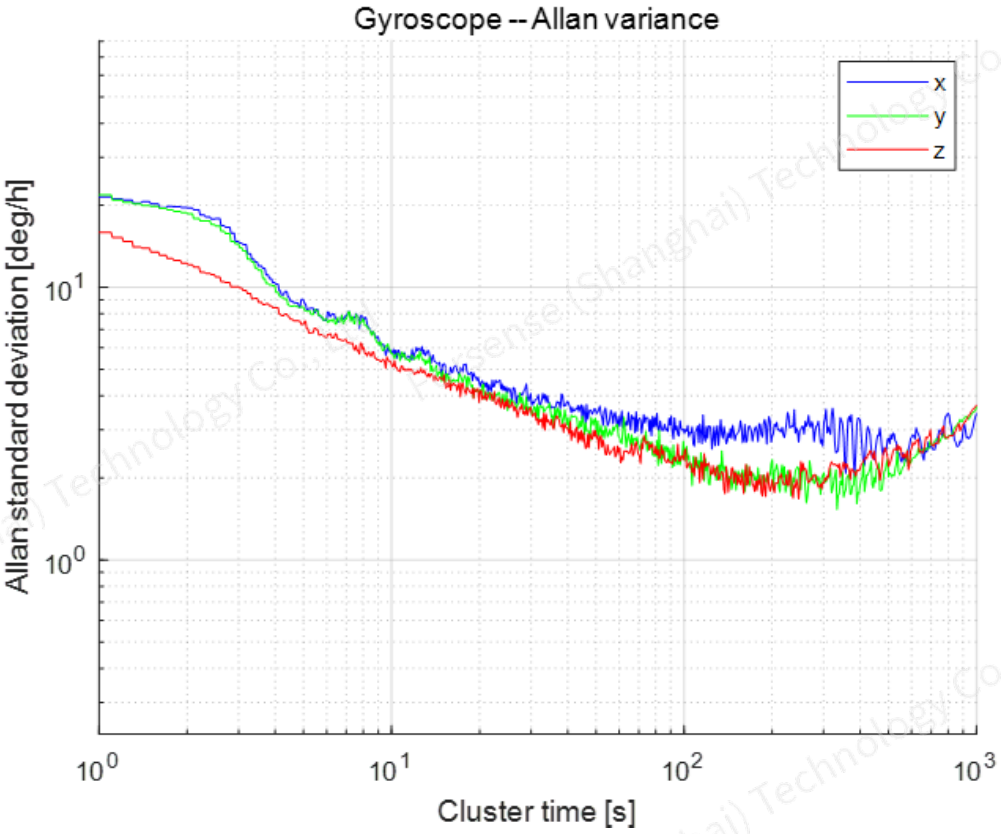
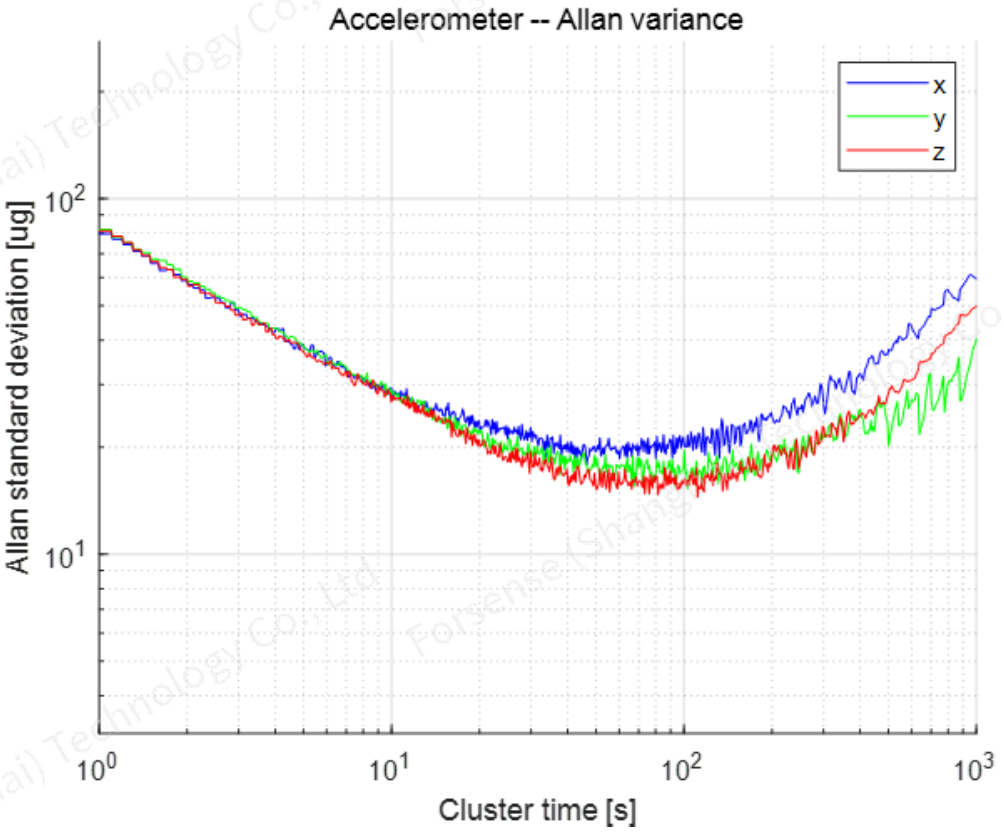


Figure 2 Accelerometer Allan Variance Typical Curves



2. Outline Structure

Figure 3 Outline Structure and Dimensions (Unit: mm)

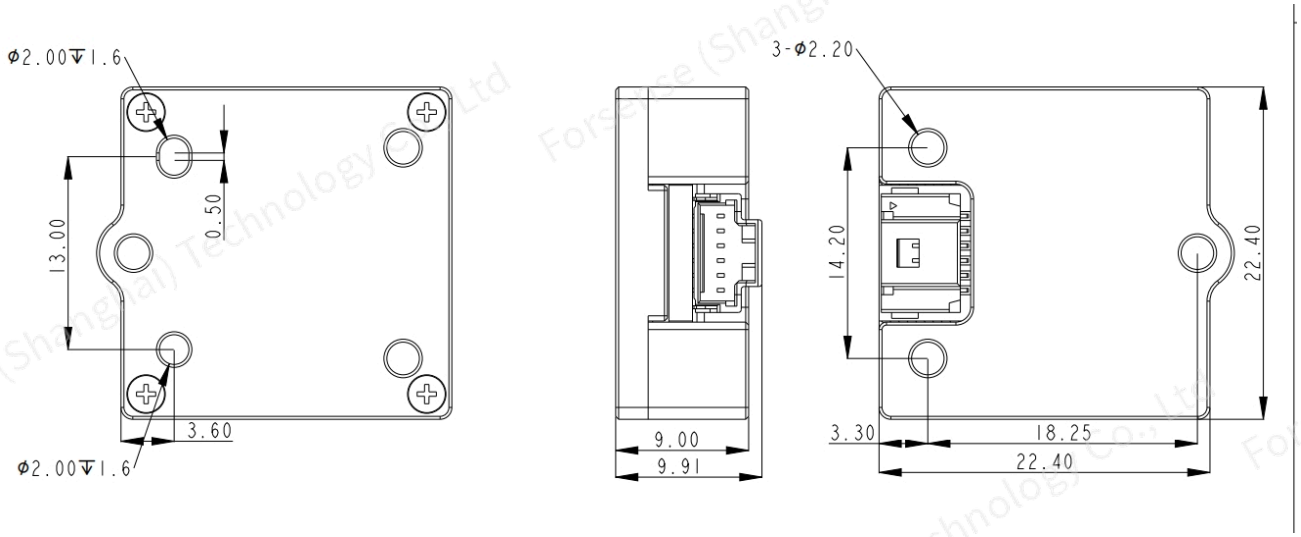
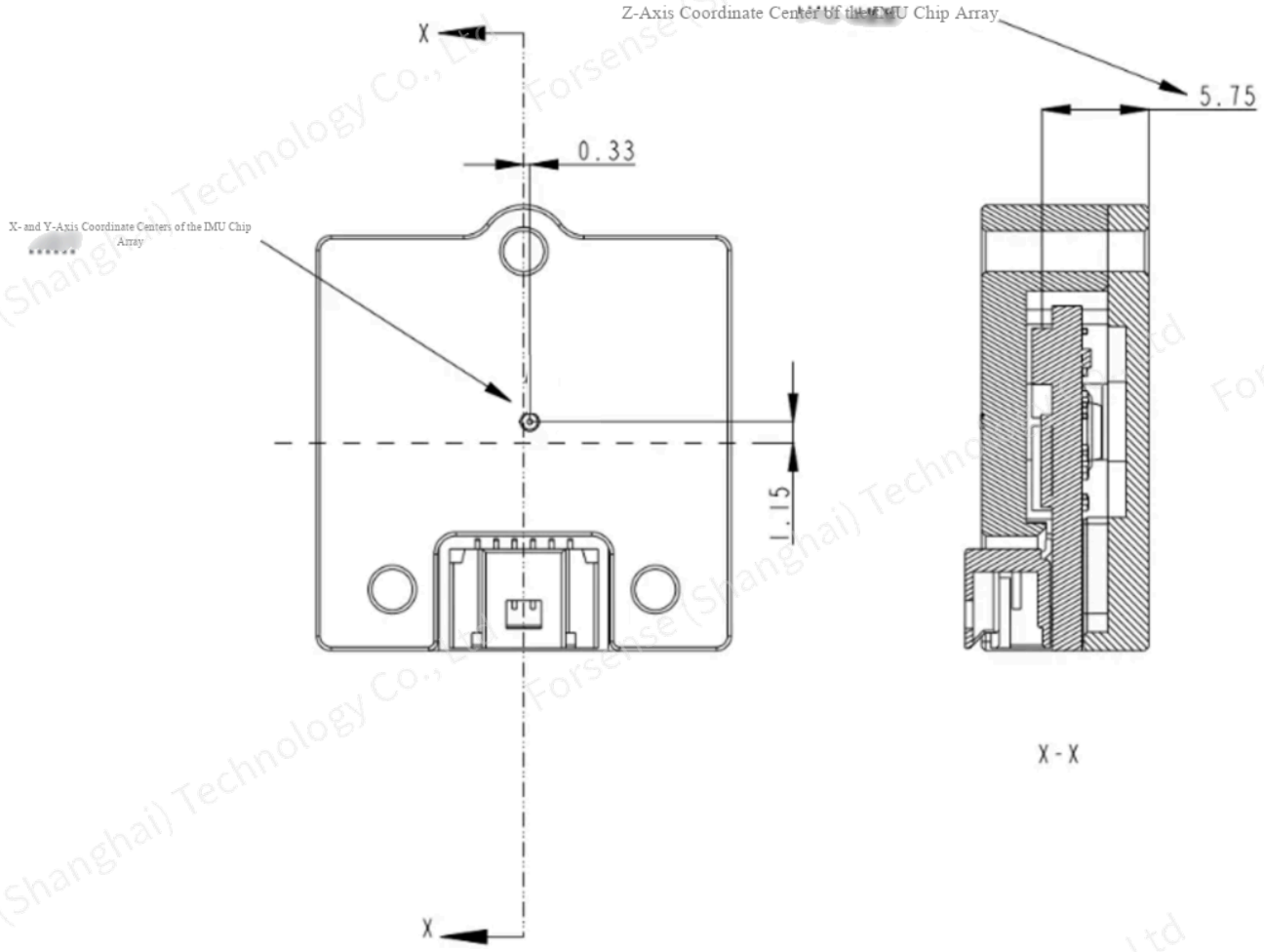


Figure 4 IMU Center Position (Unit: mm)/)



3. Electrical Characteristics

3.1 Maximum Ratings

Table 3 Absolute Maximum Ratings

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

3.2 Operating Conditions

Table 4 Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum Value	Unit
supply voltage	VIN	4.5	5	5.5	V
Max VIN Ripple	Vrpp		±40		mV
Power Consumption	P		0.2		W
Operating Temperature (Tot)	Tot	-40		85	℃
Storage Temperature (Tstg)	Tstg	-40		85	℃

Note: When the supply voltage exceeds 6V, the internal voltage protection circuit will cut off power and put the device into a reset state until the voltage returns to operating conditions, at which point normal operation resumes.

3.3 IO Threshold Characteristics

Table 5 IO Threshold Characteristics

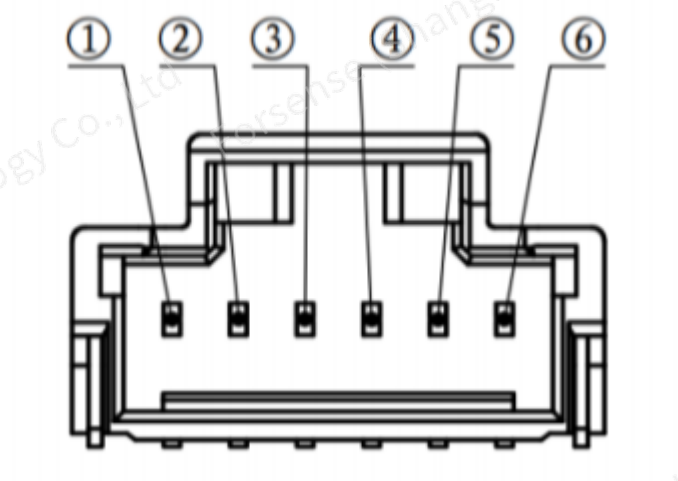
Parameter	Symbol	Minimum	Typical	Maximum	Unit
Input Pin Low Level	Vin_low	0		VCC*0.2	V
Input Pin High Level	Vin_high	VCC*0.7		VCC+0.2	V
Output Pin Low power level	Vout_low	0		0.45	V
Output Pin High power level	Vout_high	VCC-0.45		VCC	V

Note: VCC=3.3V

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4. Pin Definition

Figure 5 Pin Schematic



Docking Connector Model: MOLEX: 5013300600

Table 6 Pin Definitions

Pin No.	Pin Name	Pin Description
1	RS485_A	RS485
2	RS485_B	
3	RX	Data Input / RMC
4	TX	Data Output / PPS / DATA READY
5	GND	Ground (GND)
6	VIN	+5V Power Input

Pin 4 Function Switching Serial Port commands are: AT+SET_TIME_SYNC=0 TX (Note: Default is 0) AT+SET_TIME_SYNC=1 PPSAT+SET_TIME_SYNC=2 DATA READY

5. Communication Protocol

Reference Document Forsense IMU Communication Protocols（en）

Includes serial communication protocols, Coordinate System Settings, Filter Settings, Parameter Settings, OTA Update Method, Time Synchronization, etc.

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6. Coordinate System Definition

Distinction between Standard and Custom Models: SNs starting with AEJ are Custom Models, SNs starting with 16460 are Standard Models.

Figure6 Schematic of the Universal Coordinate System



The coordinate system of this product uses Front-Right-DownCoordinate System, and the Euler angle ranges are as follows:

Rotation around the Z-axis: Yaw angle Yaw Range: 0° ~360°;

Rotation around the X-axis: Roll angle Roll Range: -180°~180°;

Rotation around the Y-axis: Pitch angle Pitch Range: -90°~90°.

Figure7 Custom Coordinate System Diagram



This product uses the Forward-Left-Up coordinate system. The Euler angle ranges are as follows:

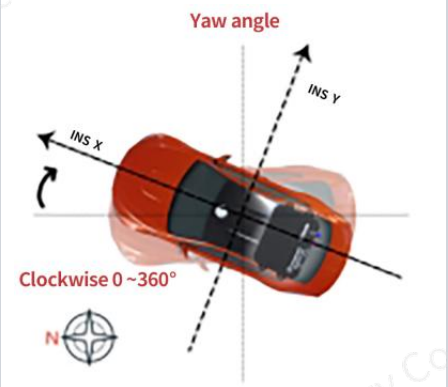
Rotation about the Z-axis: Yaw angle Yaw Range: 0° ~360°;

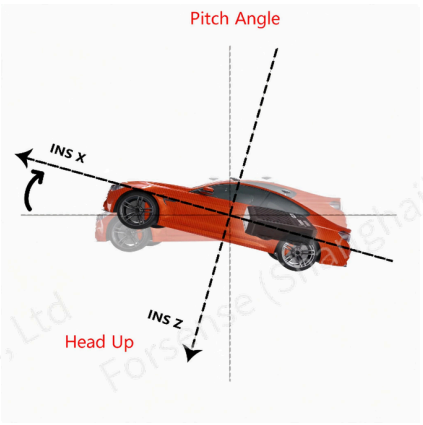
Rotation about the X-axis: Roll angle Roll Range: -180°~180°;

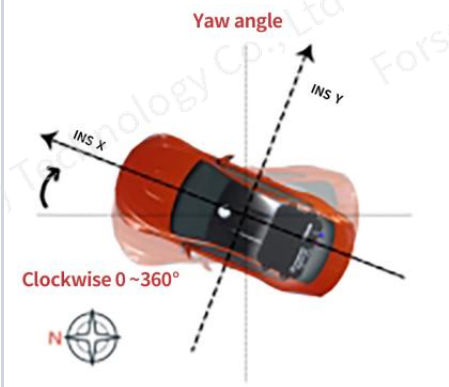
Rotation about the Y-axis: Pitch angle Pitch Range: -90°~90°.

Schematic of Yaw angle angles (Roll, Pitch, and Yaw) is shown below:

Figure8Schematic of Roll, Pitch, and Yaw angle


Yaw angle
INS Y
INS X
Clockwise 0 ~360°
N


Pitch Angle
INS X
INS Z
Head Up


Yaw angle
INS Y
INS X
Clockwise 0 ~360°
N

7. Update Records

Latest Manual Version: IMU16460-DM_Product Sheet（en）

Version	Date	Status/Notes
Version 1.0	2025.03.05	Initial Release
Version 1.1	2025.03.31	AT Command Update
Version 1.2	2025.07.10	Coordinate System Update
Version 1.3	2025.07.31	The communication protocol section uses a dedicated document
Version 1.4	2025.09.28	Updated outline structure and dimension diagrams
Version 1.5	2026.01.24	Supplementary Output Frequency Content