IMU618-H_Product Sheet

Features

Tactical-grade MEMS Gyroscope

- Bias Instability: 0.5°/hr
- Angle Random Walk: 0.04°/√hr
- Temperature Drift: 0.02°/s (-40°C ~ 85°C, ≤1°C/min @1σ)

Tactical-grade MEMS Accelerometer

- Bias Instability: 20μg
- Velocity Random Walk: 0.038m/s /√hr
- Temperature Drift: 0.8mg (-40 ~ 85°C，≤1°C/min @1σ)

Wide and refined temperature compensation

- Temperature Range: -40°C to 85°C
- Precise Temperature Calibration

Independent Rotary Table Calibration

- Independent calibration for every module includes: sensitivity, bias instability, and misalignment
- Providing a user interface for calibrating installation errors

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°C ~ 85°C
- 100% Magnetic Shielding

Real-time and Flexible Digital Interface with a Small Size

- Configurable output sampling rate up to 1000Hz
- Serial ports, I2C and SPI supported
- 23.7*23.7*9.9mm, about 10g

Description

IMU618-H 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. A large number of output parameters enable the perception of motion despite large dynamic. 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
- 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 Metrics

Table 1 Gyroscope Key Specifications

Parameter	Test Conditions/Remarks	Min.	Typical	Maximum	Unit
Measurement Range			±300		°/s
Bias Instability³	@25°C, ALLAN Variance, 1σ		XY:1.0 Z:0.5		°/hr
Bias Stability	GJB, 10s smoothing		XY:5.0 Z:1.0		°/hr
Bias Repeatability	GJB		X: 15 YZ: 5		°/hr
Resolution			0.0006		°/s
Misalignment between axes			0.02		deg
Internal Low-pass Cutoff Frequency	Adjustable Software		68		Hz
Sampling Rate			100	1000	Hz
Measure Delay			6		ms
Offset Error over Temperature²	-40°C ~ 85°C, ≤1°C/min @1σ		0.02		°/s
Random Walk2	@25°C, ALLAN Variance, 1σ		0.04		°/√hr
Scale Coefficient Error			1.5		‰
Scale Factor Nonlinear			200		ppm

Note 1: Limited by the serial port bandwidth, if the serial port baud rate is set to 115200, the maximum output frequency is 100Hz.

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).

1.2 Accelerometer Key Metrics

Table 2 Accelerometer Key Metrics

Parameter	Test Conditions/Remarks	Min.	Typical	Maximum	Unit
Measurement Range			±8		g
Bias Instability[3]	@25°C, ALLAN Variance, 1σ		20		μg
Bias Stability	GJB, 10s smoothing		35		μg
Bias Repeatability	GJB		0.1		mg
Resolution			0.0312		mg
Misalignment between axes			0.02		deg
Internal Low-pass Cutoff Frequency	Adjustable Software		68		Hz
Sampling Rate			100	1000	Hz
Measure Delay			6		ms
Offset Error over Temperature[2]	-40°C ~ 85°C, ≤1°C/min @1σ		0.8		mg
Random Walk[3]	@25°C, ALLAN Variance, 1σ		0.038		m/s/√hr
Scale Coefficient Error			0.2		‰
Scale Factor Nonlinear			100		ppm

Note 1: Limited by the serial port bandwidth, if the serial port baud rate is set to 115200, the maximum output frequency is 100Hz.

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).

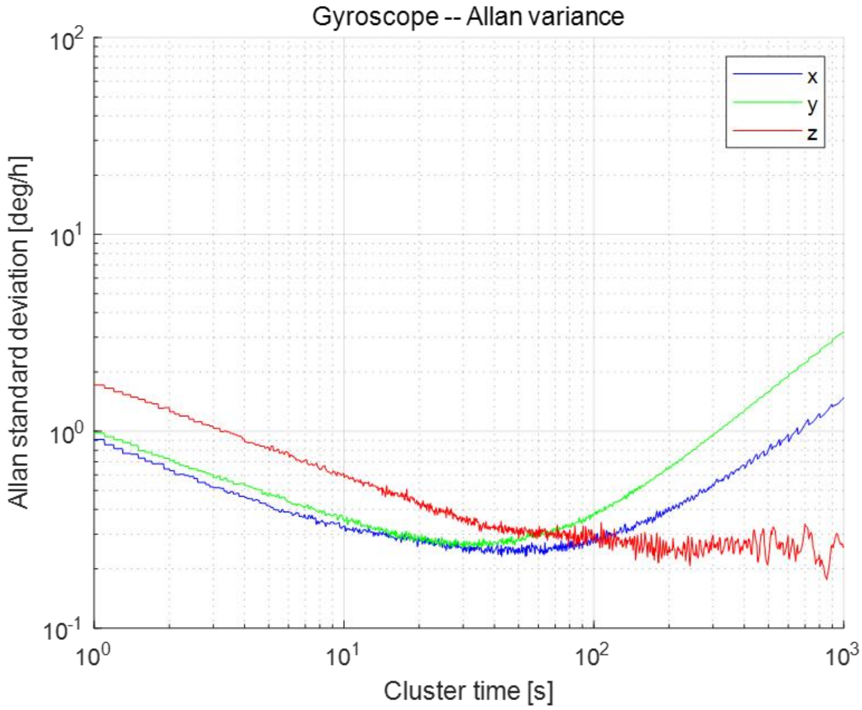


Fig. 1 Gyroscope - Typical Allan Variance Curve

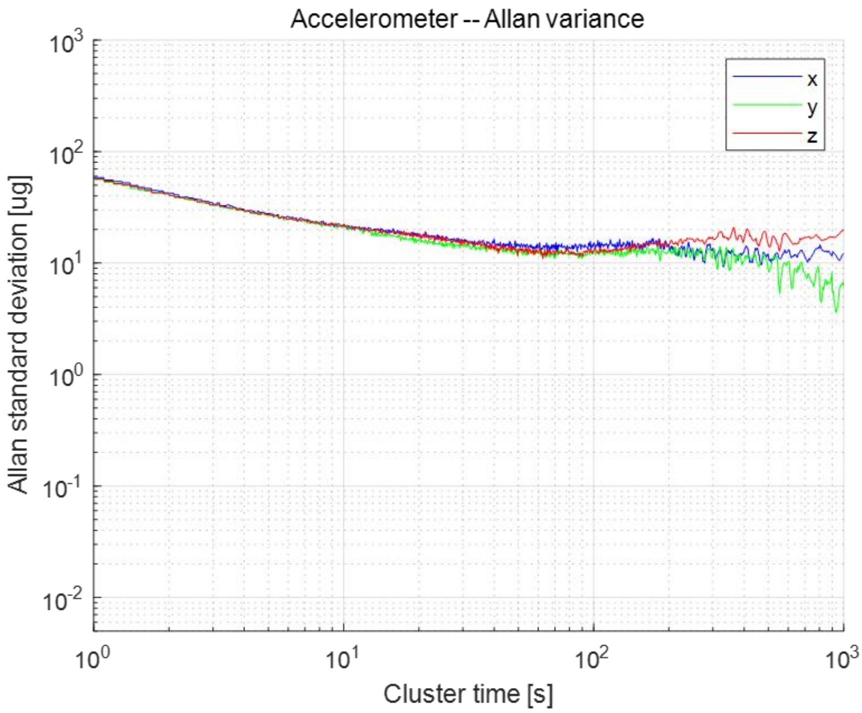


Fig. 2 Accelerometer - Typical Allan Variance Curve

2 External Structure

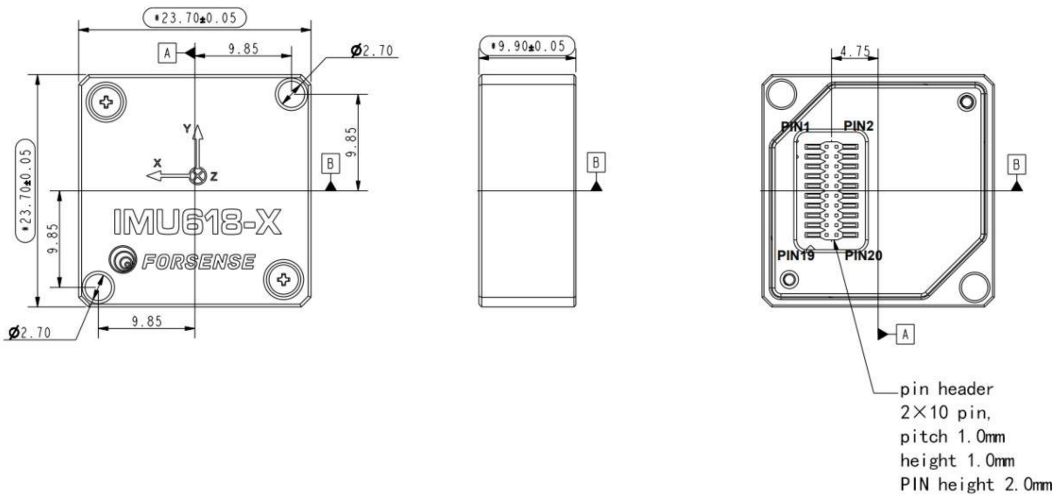


Fig. 3 Structure and Size (unit: mm)

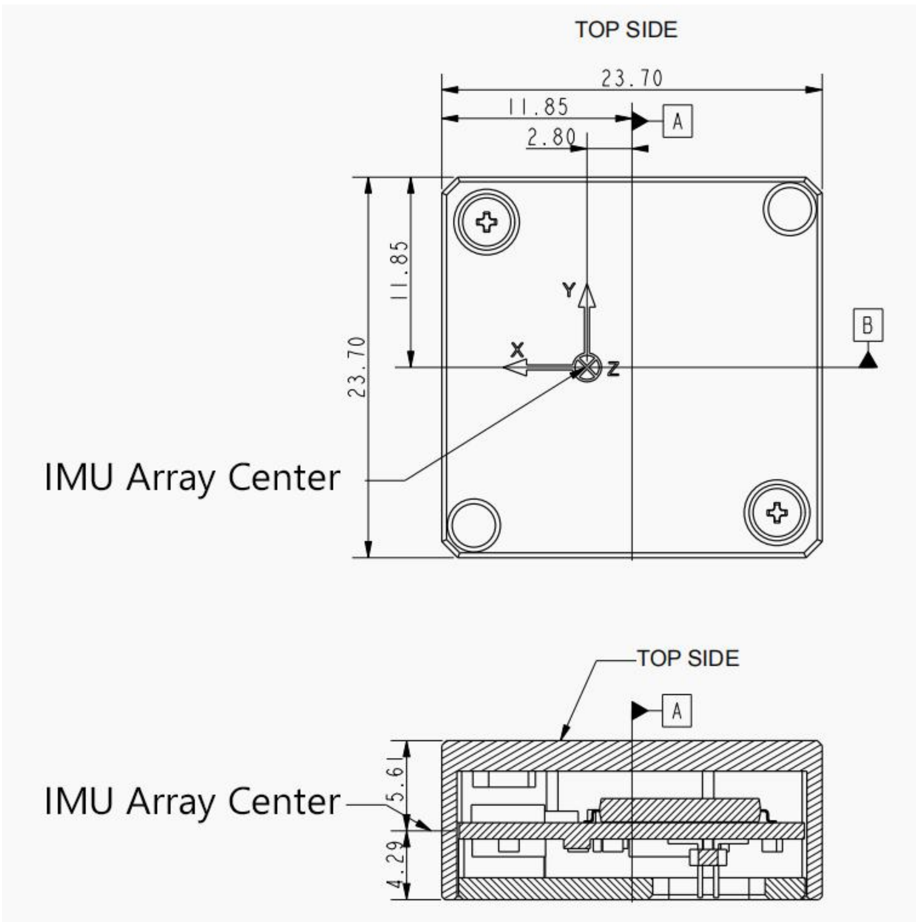


Fig. 4 IMU Array Center (unit: mm)

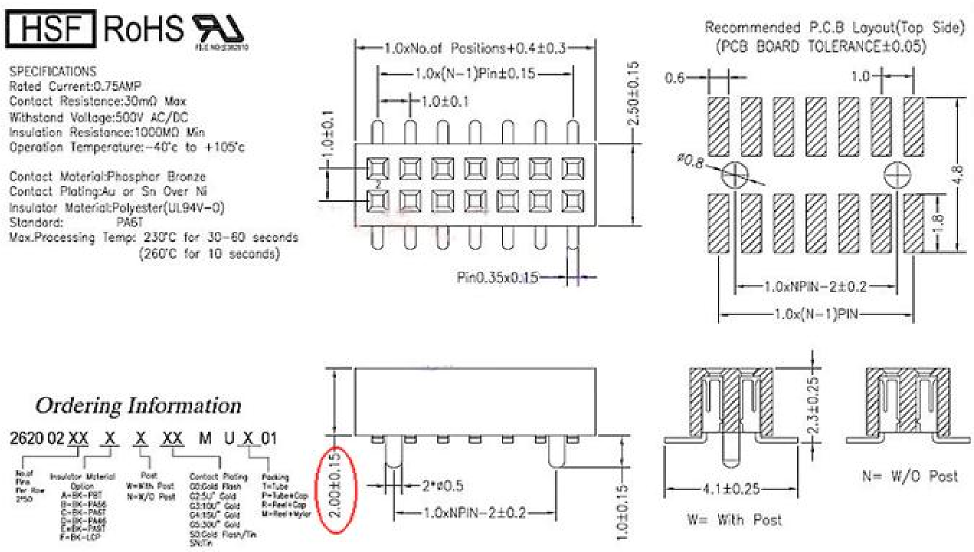


Fig. 5 Reference to the Specifications of the Pairs of Female Plugs and Sizes (unit: mm)

3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3 Absolute Maximum Ratings

Parameter	Symbol	Range	Unit
Supply Voltage	VCC	-0.3 to 4.0	V
Ground	GND	-	-
Input Pin Voltage	Vin	-0.3 to VCC+0.2	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	VCC	3.2	3.3	3.4	V
VCC Maximum Ripple	Vrpp		±40		mV
Power Consumption	P		0.3		W
Operating Temperature	Tot	-40		85	℃
Storage Temperature	Tstg	-40		85	℃

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

4 Pin Definitions

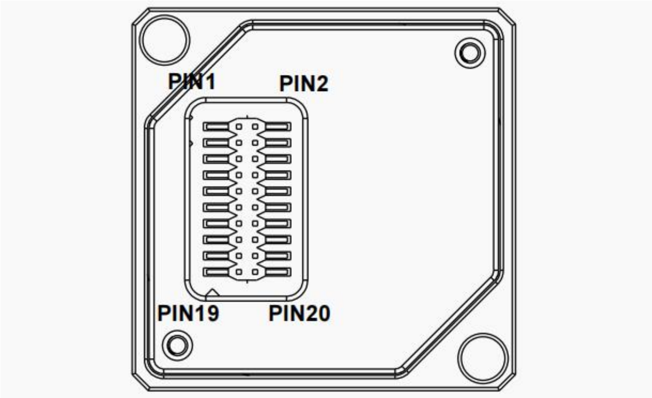


Fig. 6 Pin Diagram

Table 6 Pin Definitions

Pin No.	Pin Name	Pin Description
1	SCLK	SPI Clock
2	SDO	SPI Data MISO
3	GND	Ground
4	GND	Ground
5	SDI	SPI Data MOSI
6	/CS	SPI Chip Select
7	TX	Serial Port output
8	CAN_Tx	CAN transmitter, when not connected, it is left floating.
9	RX	Serial Port input
10	NC	No connection
11	VCC	Power input, +3.3V input
12	VCC	Power input, +3.3V input
13	DRDY/SCL	Data Ready/ I2C clock
14	EXT/SDA	External Sampling/ I2C data
15	CAN_Rx	CAN receiver, when not connected, it is left floating.
16	/RST	External hardware reset input
17	NC	No connection
18	NC	No connection
19	SEL	SPI/I2C, mode control Floating or Grounding: SPI High Voltage Level: I2C
20	NC	No connection

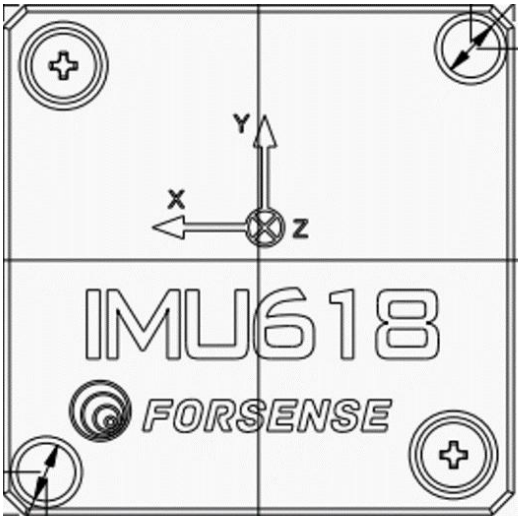
Note 1: IMU hardware needs to be reset by triggering /RST to reset the IMU hardware.

5 Communication Protocols

Reference Profile: Forsense IMU Communication Protocols

The document include SPI/CAN/Serial port communication protocols, definition of the coordinate system, filter configuration, parameter settings, OTA upgrade method and time synchronization etc.

6 Definition of Coordinate System



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°。

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

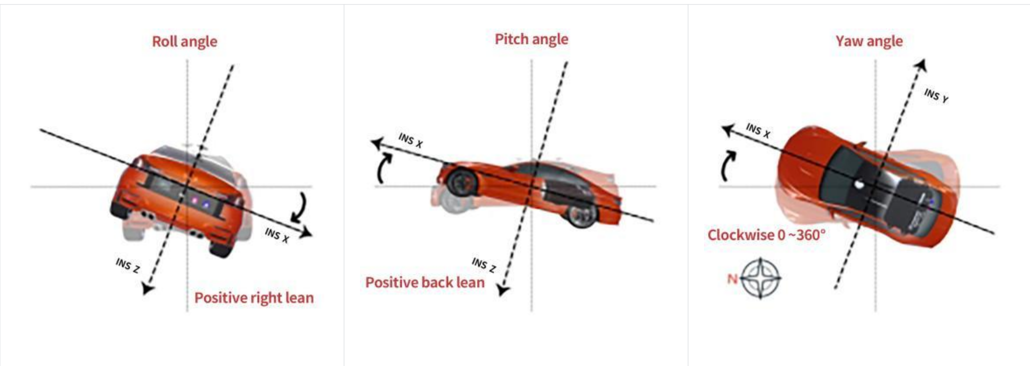


Fig. 7 Diagram of Roll, Pitch, and Yaw Angles

7 Usage Examples

7.1 Device Installation

1. The module should be firmly fixed on a rigid plane rather than in a position of high vibration;

2. The module should be installed toward the front of the vehicle;

Fig. 8 Module Installation Diagram

The correct installation method is as follows

X-axis toward the front of the vehicle

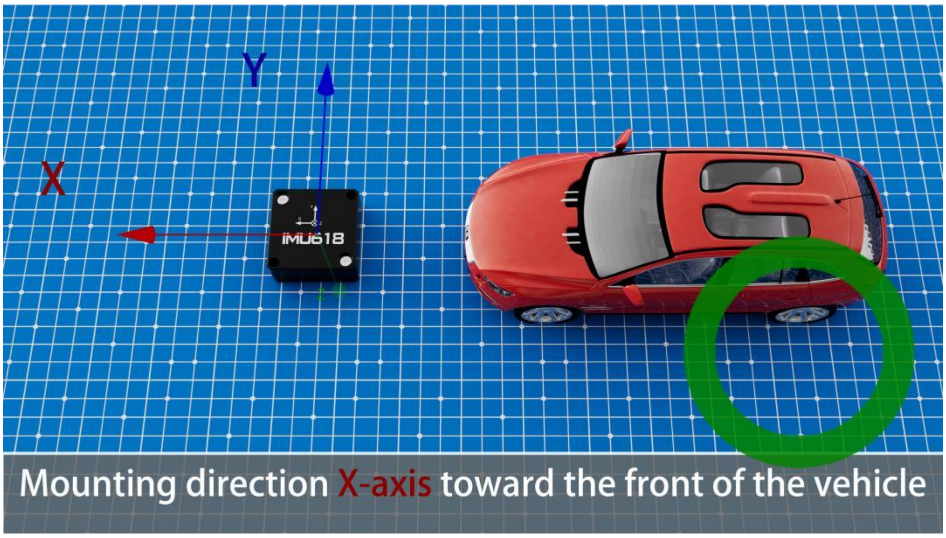
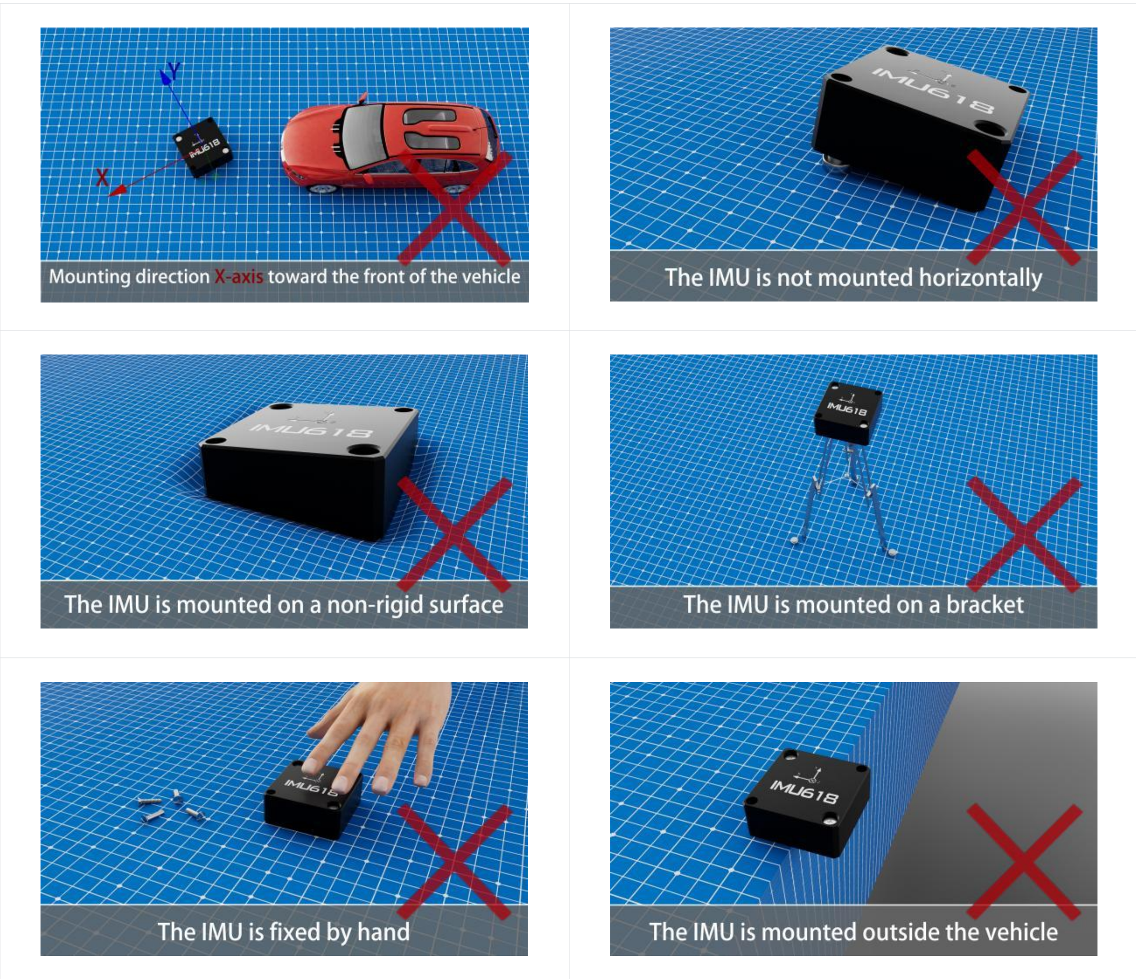


Fig. 9 Correct Installation Diagram

The following mounting methods are incorrect:



8 Revision History

Version	Date	Status/Notes
Version 1.0	06/12/2024	First Draft
Version 1.1	01/24/2025	Release
Version 1.2	08/01/2025	Simplified communication protocol