IMU618-C_Product Sheet

Features

Tactical-grade MEMS Gyroscope

- Bias Instability: 0.8°/hr
- Angle Random Walk: 0.05°/√hr
- Temperature Drift: 0.03°/s (-40℃ ~ 85℃，≤1℃/min @1σ)

Tactical-grade MEMS Accelerometer

- Bias Instability: 10μg
- Velocity Random Walk: 0.015m/s /√hr
- Temperature Drift: 1.5mg(-40℃ ~ 85℃，≤1℃/min @1σ)

Wide and refined temperature compensation

- Temperature Range: -40℃ to 85℃
- 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℃ ~ 85℃
- 100% Magnetic Shielding

Real-time and Flexible Digital Interface with a Small Size

- Configurable output sampling rate up to 1kHz
- Serial ports, I2C and SPI supported
- 23.7*23.7*9.9mm, about 10g

Description

IMU618-C 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!

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1 Performance Parameters

1.1 Gyroscope Key Metrics

Table 1 Gyroscope Key Specifications

Parameter	Test Conditions/Remarks	Min.	Typical	Maximum	Unit
Measurement Range			±500		°/s
Bias Instability[3]	@25°C, ALLAN Variance, 1σ		0.8		°/hr
Bias Stability	GJB, 10s smoothing		2		°/hr
Bias Repeatability	GJB		10		°/hr
Resolution			0.0062		°/s
Misalignment between axes			0.02		deg
Internal Low-pass Cutoff Frequency	Adjustable Software		40		Hz
Sampling Rate			1000		Hz
Measure Delay			7.0		ms
Offset Error over Temperature[2]	-40°C ~ 85°C, ≤1°C/min @1σ		0.03		°/s
Random Walk2	@25°C, ALLAN Variance, 1σ		xy: 0.09 z: 0.05		°/√hr
Scale Coefficient Error			xy: 2 z: 1.5		‰
Scale Factor Nonlinear			50		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℃, ALLAN Variance, 1σ		10		μg
Bias Stability	GJB, 10s smoothing		50		μg
Bias Repeatability	GJB		0.2		mg
Resolution			0.0863		mg
Misalignment between axes			0.02		deg
Internal Low-pass Cutoff Frequency	Adjustable Software		40		Hz
Sampling Rate			1000		Hz
Measure Delay			7		ms
Offset Error over Temperature[2]	-40℃ ~ 85℃, ≤1℃/min @1σ		1.5		mg
Random Walk[3]	@25℃, ALLAN Variance, 1σ		0.015		m/s/√hr
Scale Coefficient Error			0.5		‰
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).

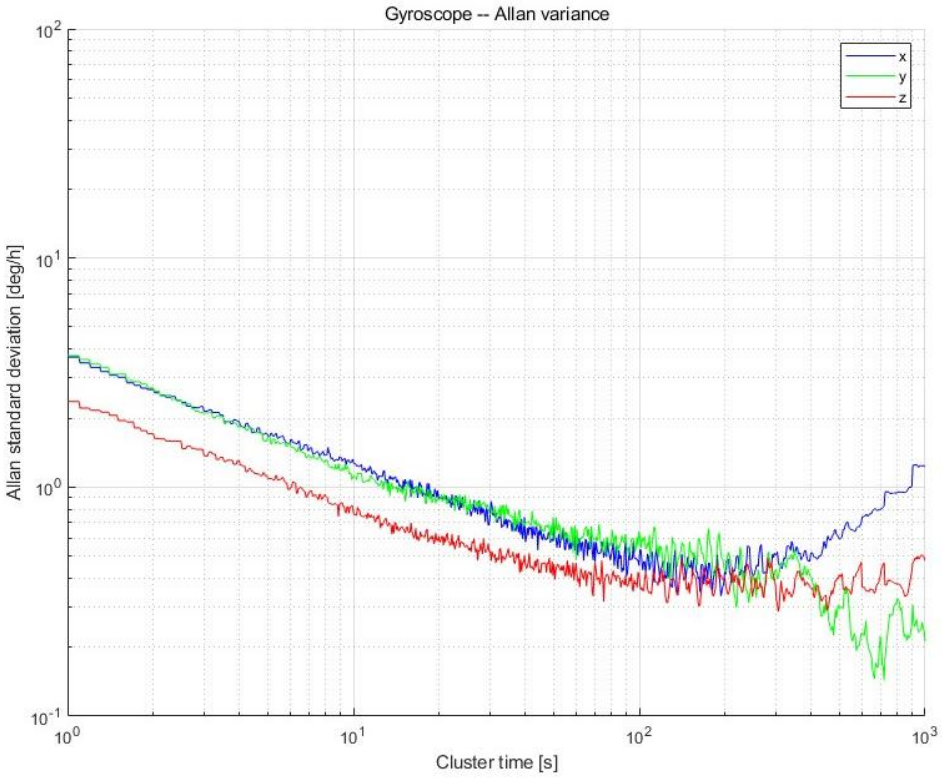


Fig. 1 Gyroscope - Typical Allan Variance Curve

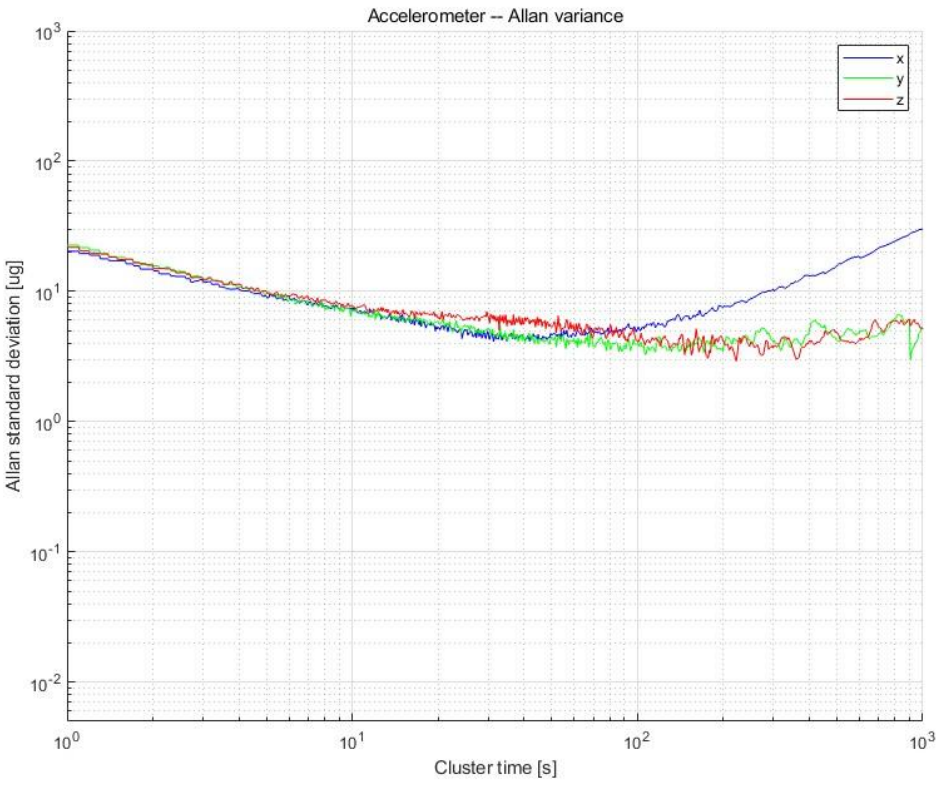


Fig. 2 Accelerometer - Typical Allan Variance Curve

2 External Structure

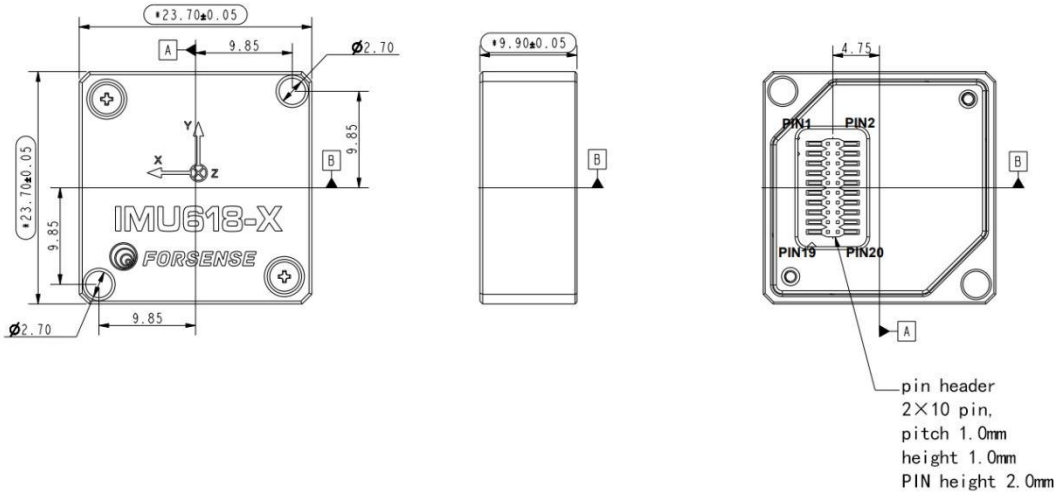


Fig. 3 Structure and Size (unit:mm)

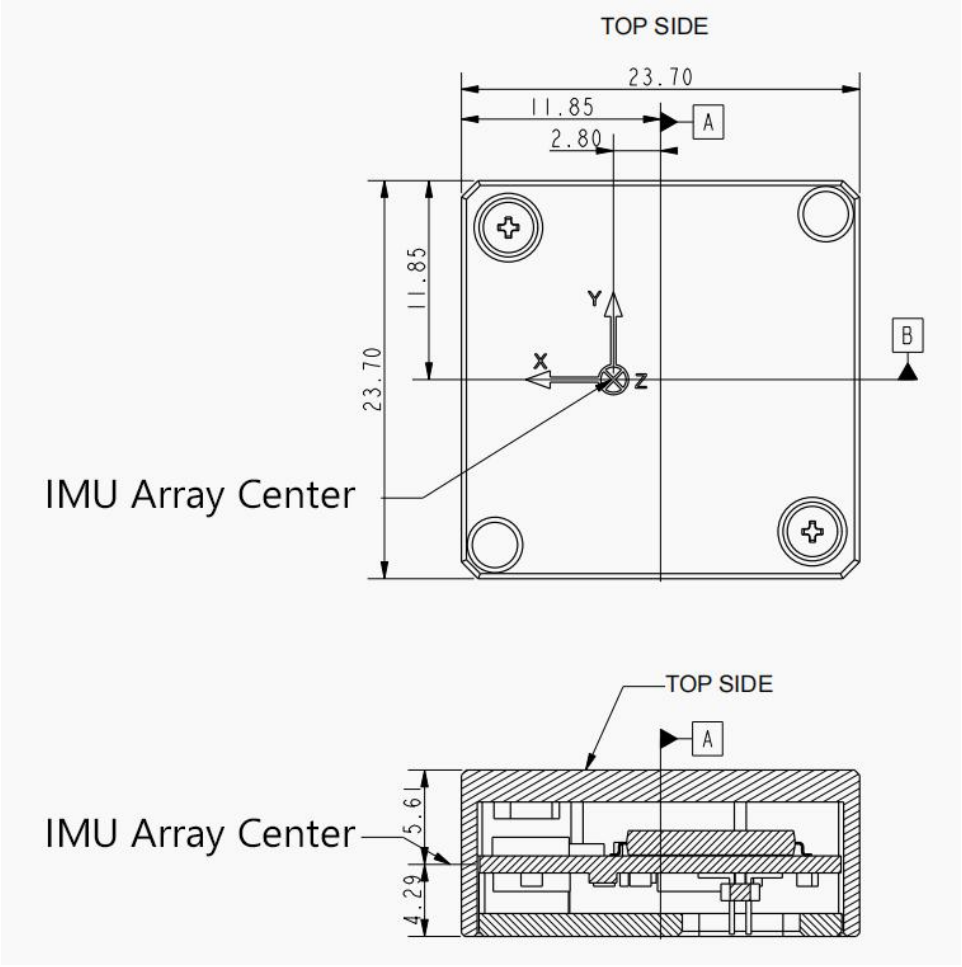


Fig. 4 IMU Array Center (unit: mm)

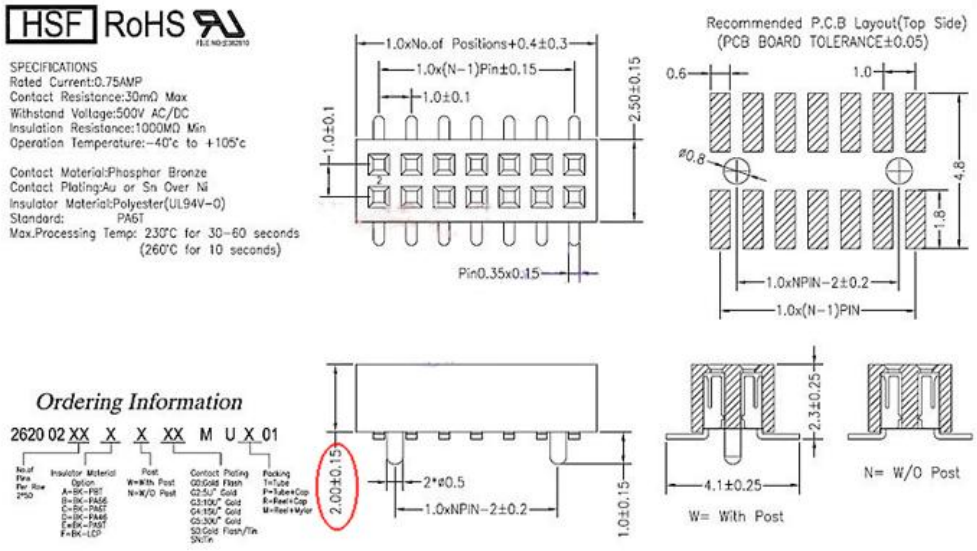


Fig. 5 Reference to the Specifications of the Pairs of Female Plugs and Sizes (unit: mm)

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3 Absolute Maximum Ratings

Parameter	Symbol	Range	Unit
Supply Voltage	VCC	-0.3 to 4	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		0.09		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

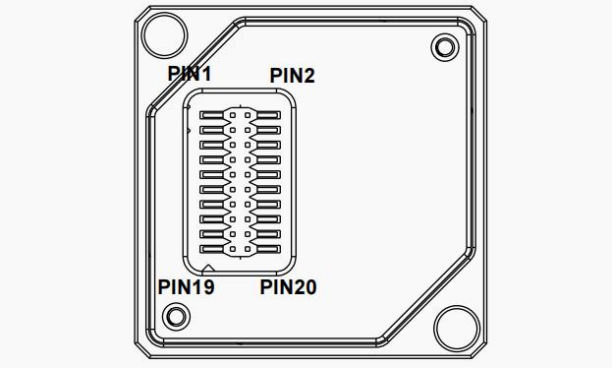


Fig. 6 Pin Diagram

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 Voltage Level: SPI, High Voltage Level: I2C
20	NC	No connection

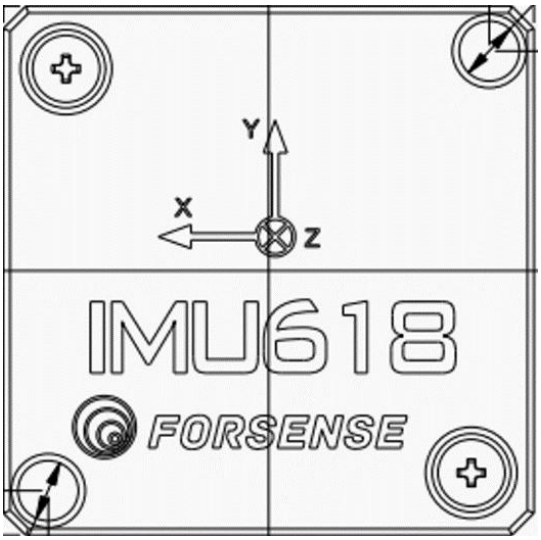
Note 1: IMU hardware needs to be reset by triggering /RST to reset the IMU hardware.

5 Communication Protocols

Reference Profile: Forsense IMU Communication Protocols

The document includes 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:

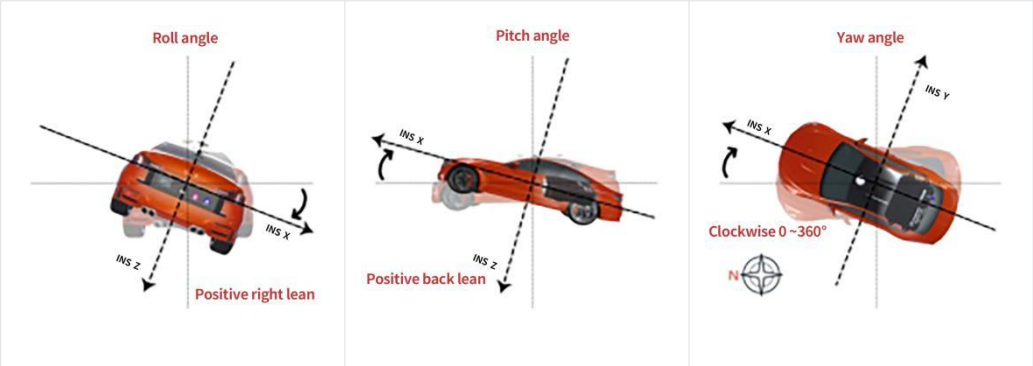


Fig. 7 Diagram of Roll, Pitch, and Yaw Angles

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

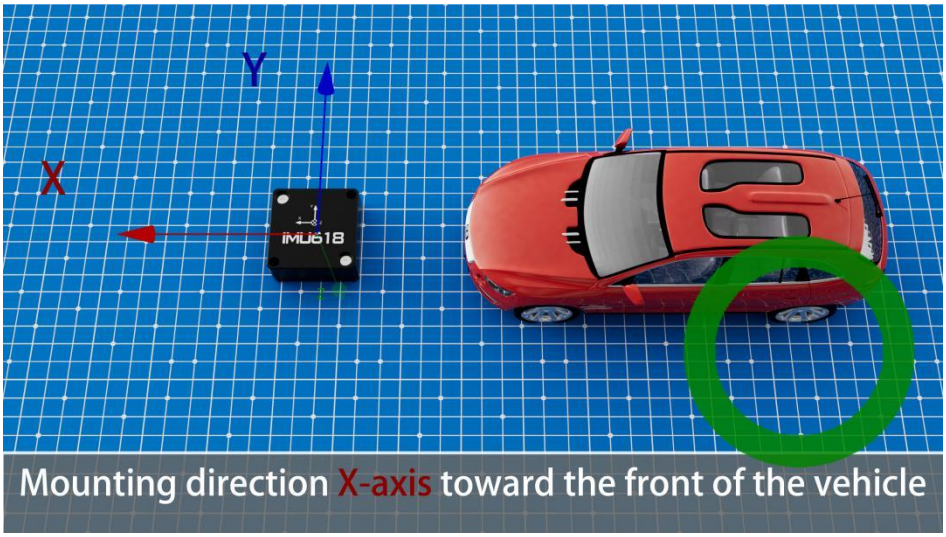
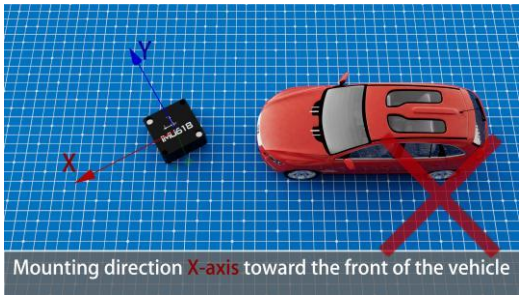
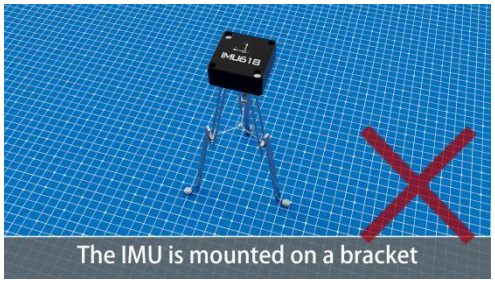
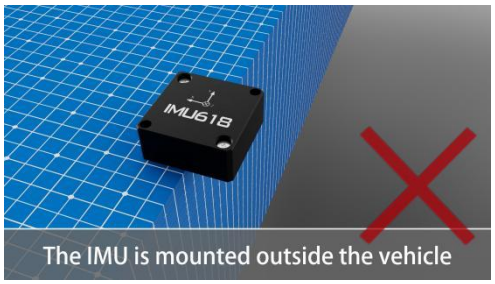


Fig. 9 Correct Installation Diagram

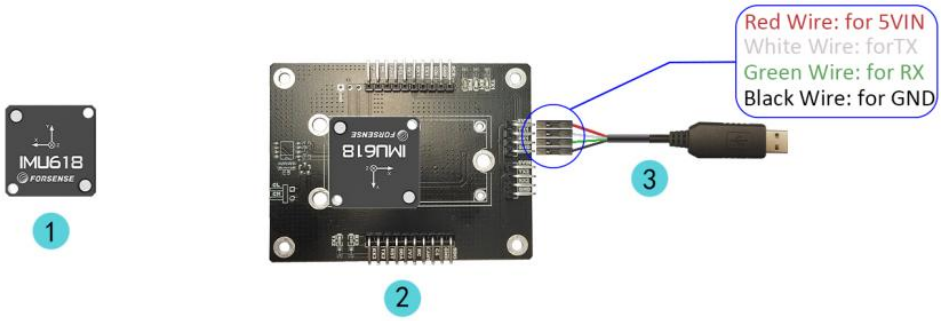
The following mounting methods are incorrect:







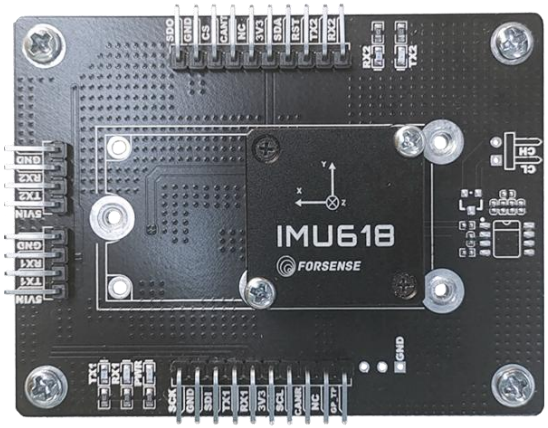
7.2 Connecting PC software



	Name	Quantity
1	IMU618	1
	Accessories Name	Quantity
2	IMU618 Test Board	1
3	TTL Serial Cable	1

Fig. 10 Connection Diagram

8 Accessories



IMU618 Test Base Plate

TTL Serial Cable

9 Revision History

Version	Date	Status/Notes
Version 1.0	03/29/2024	First release
Version 1.1	10/05/2024	Updated the instructions for PC software connection
Version 1.2	01/24/2025	Release
Version 1.3	08/01/2025	Simplified communication protocol