SensorsX
SX-MIXHC Series

High Performance MEMS IMU

Motion & Inertial | 6-Axis IMU with Attitude Angle Output



±450 °/s Gyroscope Range (X, Y, Z)	**±20 g** Accelerometer Range (X, Y, Z)	**0.5 °/h** Gyro Bias Instability
RS-422 Interface (output 200 – 1000 Hz)	**−40 to +85 °C** Working Temp. (−40 to +185 °F)	**5 V DC / 1 W** Voltage / Power Consumption

■ PRODUCT OVERVIEW

The SX-MIXHC Series is a compact 6-axis MEMS inertial measurement unit integrating a three-axis gyroscope and a three-axis accelerometer. It outputs three-axis angular rate, acceleration, and roll, pitch, and yaw data through an RS-422 interface. The gyroscope and accelerometer measurement ranges are ±450 °/s and ±20 g, respectively. The unit supports periodic transmission and external triggering, with a 3.3 V LVTTL falling-edge trigger input. Temperature compensation covers −40 to +85 °C. Typical applications include industrial automation, robotics, vehicle motion sensing, and platform stabilization.



■ KEY FEATURES

◆ Three-Axis Gyroscope with ±450 °/s Measurement Range	◆ Three-Axis Accelerometer with ±20 g Measurement Range
◆ Bandwidth: 268 Hz	◆ Temperature compensation range: −40 °C to +85 °C (−40 °F to +185 °F)
◆ RS-422 Communication Interface	◆ Small size: 38.6±0.1 × 44.8±0.1 × 10.8±0.1 mm (1.52 × 1.76 × 0.43 in)

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■ TYPICAL APPLICATIONS

Application Fields

- Attitude Measurement and Control
- Platform Stabilization and Control
- Automated Machinery
- Robot Control

■ PERFORMANCE SPECIFICATIONS

Gyroscope	
Measuring Range: X, Y, Z	±450 °/s
Bias Instability	0.5 °/h
Random Walk	0.03 °/√hr
Scale Factor Nonlinearity	300 ppm
Orthogonality	100 ppm
Bandwidth	268 Hz
Accelerometer	
Measuring Range: X, Y, Z	±20 g
Bias Instability	15 μg
Random Walk	0.025 m/s/√hr
Scale Factor Nonlinearity	250 ppm
Orthogonality	100 ppm
Bandwidth	268 Hz
Attitude Angle	
Rolling Angle Range	±180°
Pitch Angle Range	±90°
Heading Angle Range	±180°
Dynamic Accuracy	0.5°
Static Accuracy	0.1°

■ ELECTRICAL SPECIFICATIONS

Power	
Voltage	5 V DC
Power Consumption	1 W
Output Signal	
Interface	RS422
Output Frequency	200–1,000 Hz
External Trigger Level	LVTTL 3.3 V
Electrical Connection	
Socket (on unit)	J30J-15ZKNP2-J
Mating Plug	J30J-15ZKL-300MM

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■ ENVIRONMENTAL SPECIFICATIONS

Temperature	
Working Temperature	−40 to +85 °C (−40 to +185 °F)
Storage Temperature	−55 to +105 °C (−67 to +221 °F)
Temperature Compensation Range	−40 to +85 °C (−40 to +185 °F)
Mechanical & Environmental	
Vibration	6.06 g (20 – 2000 Hz)
Shock	1500 g / 0.5 ms
Weight & Size	
Size	38.6±0.1 × 44.8±0.1 × 10.8±0.1 mm (1.52 × 1.76 × 0.43 in)
Weight	50 g (1.76 oz)

■ COMMUNICATION PROTOCOLS

External Trigger

The SX-MIXHC supports two operating modes:
1) Timed transmission mode: Output is performed according to the configured output rate.
2) External trigger mode: Data is transmitted only upon detection of a falling edge on the external trigger input.
SX-MIXHC has a separate digital input pin to be used when the unit has been configured to transmit only upon external trigger. The measurements themselves will be continuously running at the highest output rate (2000 Hz) in order to ensure shortest possible latency when a transmission is requested. The input is set to trigger on the falling edge of the input signal and will then transmit one datagram containing the result of the latest measurement. The input has an internal pull-up. Hence the input could be left floating if not in use.
The timing diagram is shown in Figure 1. Latency is the time between the moment at which the sample has been digitized + low pass-filtered and the external trigger.

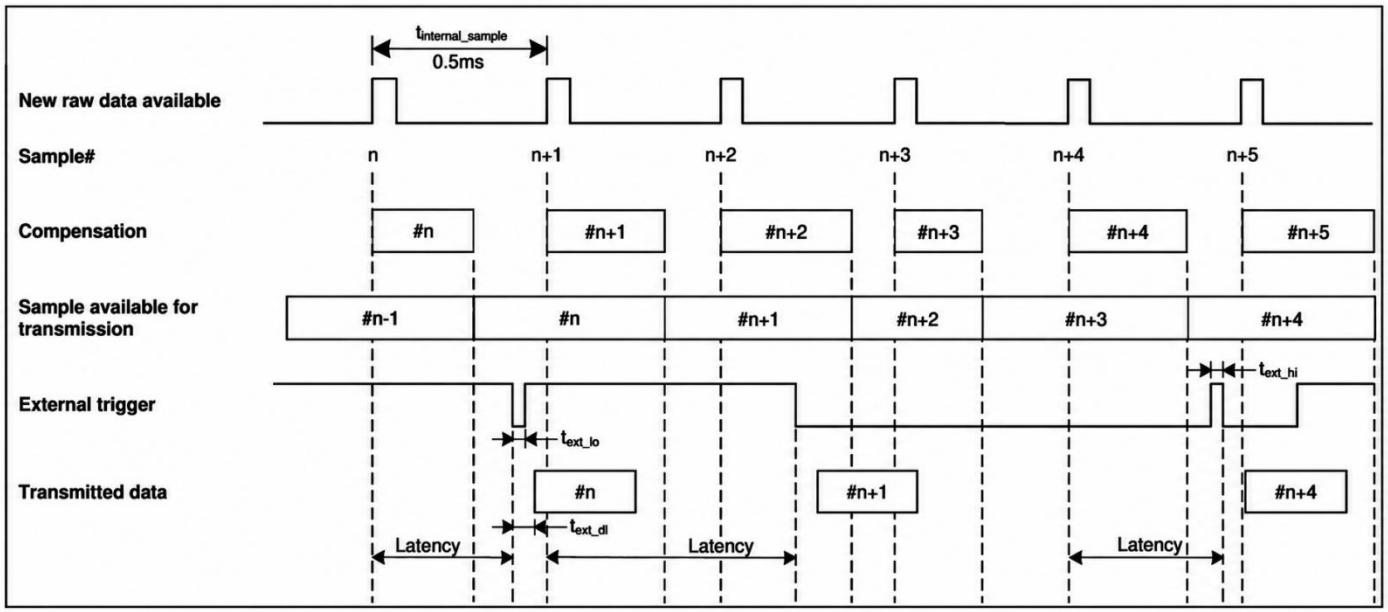


Figure 1 Timing of external trigger

Time of Validity (TOV)

The TOV-output serves 2 purposes:

- Provide a synchronisation-signal derived from the internal clock of SX-MIXHC
- Provide means to signal when a datagram is being transmitted (NB: not when configured to external trigger)

The TOV falling edge occurs synchronous to the sample rate. The raising edge occurs after the last bit of the datagram has been transmitted. Figure 2 and Figure 3 show the timing diagram of the TOV-output.

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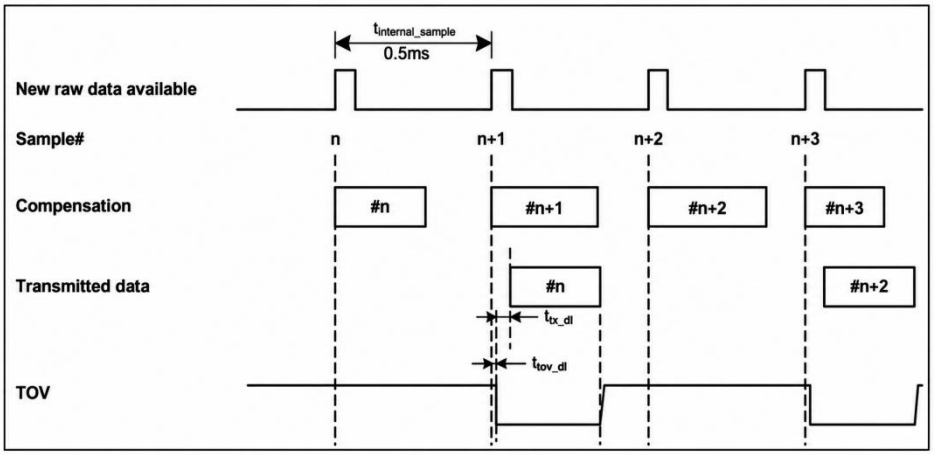


Figure 2 Timing of TOV (example: the output rate = 2000 Hz)

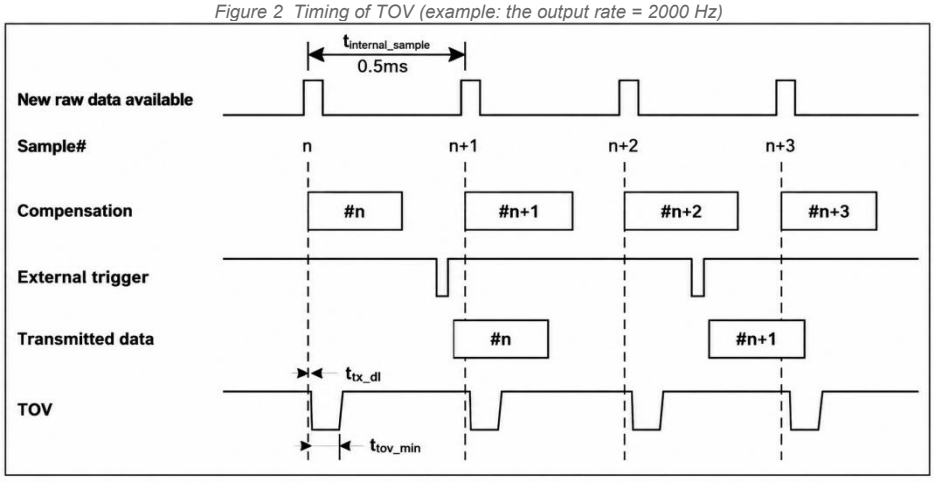


Figure 3 Timing of TOV with external trigger

Software Interface Definition

Data is output via a serial port, with default parameters as follows:

Serial Port Default Parameters	
Baud Rate	921600
Start Bit	1
Data Bits	8
Stop Bit	1
Parity Check	None
Output Frequency	2,000 Hz
Byte Order	The low-order byte comes first.

The product can be configured with two different output protocols, with the default protocol being the C4 protocol. The output protocols and parsing examples are as follows:

B6 Output Protocol

Example: 7F 82 FF FE 54 7E 00 0A 26 7B F8 01 B6 16 FF FB 96 FE FF FC 45 6C FF FF A3 C0 00 00 00 00 00 00 00 00 00 00 00 E7 1F 1F

Variable	Data Format	Endianness	Scale	Example	Parsing
Protocol header	2 Bytes			7F 82	B6
ACC_X	4 Bytes (int32)	Big-endian	134217728.0	FF FE 54 7E	-109442.0 / 134217728.0 = -0.000815 (g)
ACC_Y	4 Bytes (int32)	Big-endian	134217728.0	00 0A 26 7B	665211.0 / 134217728.0 = 0.0049 (g)
ACC_Z	4 Bytes (int32)	Big-endian	134217728.0	F8 01 B6 16	-134105,578.0 / 134217728.0 = -0.9991 (g)
GYRO_X	4 Bytes (int32)	Big-endian	134217728.0	FF FB 96 FE	-289026.0 / 134217728.0 = -0.0021 (rad/s)
GYRO_Y	4 Bytes (int32)	Big-endian	134217728.0	FF FC 45 6C	-244372.0 / 134217728.0 = -0.0018 (rad/s)
GYRO_Z	4 Bytes (int32)	Big-endian	134217728.0	FF FF A3 C0	-23616.0 / 134217728.0 = -0.000176 (rad/s)
ROLL	4 Bytes (int32)	Big-endian	536870912.0	00 00 00 00	0 / 536870912.0 = 0 (rad)

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Variable	Data Format	Endianness	Scale	Example	Parsing
PITCH	4 Bytes (int32)	Big-endian	536870912.0	00 00 00 00	0 / 536870912.0 = 0 (rad)
YAW	4 Bytes (int32)	Big-endian	536870912.0	00 00 00 00	0 / 536870912.0 = 0 (rad)
TEMP_BOARD	2 Bytes (int16)	Little-endian	65536/200	E7 1F	8167 × 200 / 65536 = 24.9237 (°C) (76.86 °F)
checksum	1 Byte			1F	Checksum and inversion from ACC_X to TEMP_BOARD

Table 4 Description of B6 Output Protocol

Examples of B6 Data Parsing

Note: In this example, buffer starts at the first byte of ACC_X and excludes the two-byte protocol header. The code parses the nine 32-bit acceleration, angular rate, and attitude angle fields. Temperature and checksum must be handled separately.

```
double[] sensors = new double[9];

sensors[0] = (int)((byte)buffer[3] + ((byte)buffer[2] << 8) + ((byte)buffer[1] << 16) + ((byte)buffer[0] << 24));
sensors[1] = (int)((byte)buffer[7] + ((byte)buffer[6] << 8) + ((byte)buffer[5] << 16) + ((byte)buffer[4] << 24));
sensors[2] = (int)((byte)buffer[11] + ((byte)buffer[10] << 8) + ((byte)buffer[9] << 16) + ((byte)buffer[8] << 24));
sensors[3] = (int)((byte)buffer[15] + ((byte)buffer[14] << 8) + ((byte)buffer[13] << 16) + ((byte)buffer[12] << 24));
sensors[4] = (int)((byte)buffer[19] + ((byte)buffer[18] << 8) + ((byte)buffer[17] << 16) + ((byte)buffer[16] << 24));
sensors[5] = (int)((byte)buffer[23] + ((byte)buffer[22] << 8) + ((byte)buffer[21] << 16) + ((byte)buffer[20] << 24));
sensors[6] = (int)((byte)buffer[27] + ((byte)buffer[26] << 8) + ((byte)buffer[25] << 16) + ((byte)buffer[24] << 24));
sensors[7] = (int)((byte)buffer[31] + ((byte)buffer[30] << 8) + ((byte)buffer[29] << 16) + ((byte)buffer[28] << 24));
sensors[8] = (int)((byte)buffer[35] + ((byte)buffer[34] << 8) + ((byte)buffer[33] << 16) + ((byte)buffer[32] << 24));
// Accel x, y, z
Ax = sensors[0] / Accel_Scale;
Ay = sensors[1] / Accel_Scale;
Az = sensors[2] / Accel_Scale;

// Gyro x, y, z
Gx = sensors[3] / Rate_Scale;
Gy = sensors[4] / Rate_Scale;
Gz = sensors[5] / Rate_Scale;

// Roll, Pitch, Yaw
Roll = sensors[6] / Angle_Scale;
Pitch = sensors[7] / Angle_Scale;
Yaw = sensors[8] / Angle_Scale;
```

Note:

1. The unit of the accelerometer is g (g = 9.80665 m/s² = 32.174 ft/s²), the unit of the gyroscope is rad/s, and the unit of the attitude angle is rad.
2. Accel Scale = 134217728.0, Rate Scale = 134217728.0, Angle Scale = 536870912.0.
3. int is a signed 32-bit data type. Please note that when converting sensor data, you must perform a type-cast.

C4 Output Protocol (default)

Example: 7F 94 FF FF FF 7F FF FF FF F4 FF FF D8 EE 00 00 00 E1 FF FF FF 97 FF FF FF 8E 00 00 00 00 00 00 00 00 00 00 00 32 1F 7D

Variable	Data Format	Endianness	Scale	Example	Parsing
Protocol header	2 Bytes			7F 94	Fixed value
ACC_X	4 Bytes (int32)	Big-endian	10000	FF FF FF 7F	-129 ÷ 10,000 = -0.0129 (g)
ACC_Y	4 Bytes (int32)	Big-endian	10000	FF FF FF F4	-12 ÷ 10,000 = -0.0012 (g)
ACC_Z	4 Bytes (int32)	Big-endian	10000	FF FF D8 EE	-10,002 ÷ 10,000 = -1.0002 (g)
GYRO_X	4 Bytes (int32)	Big-endian	10000	00 00 00 E1	225 ÷ 10,000 = 0.0225 (dps)
GYRO_Y	4 Bytes (int32)	Big-endian	10000	FF FF FF 97	-105 ÷ 10,000 = -0.0105 (dps)
GYRO_Z	4 Bytes (int32)	Big-endian	10000	FF FF FF 8E	-114 ÷ 10,000 = -0.0114 (dps)
ROLL	4 Bytes (int32)	Big-endian	10000	00 00 00 00	0
PITCH	4 Bytes (int32)	Big-endian	10000	00 00 00 00	0
YAW	4 Bytes (int32)	Big-endian	10000	00 00 00 00	0
TEMP_BOARD	2 Bytes (int16)	Little-endian	327.68	32 1F	7986 ÷ 327.68 = 24.37 (°C) (75.87 °F)
checksum	1 Byte			7D	Checksum and inversion from ACC_X to TEMP_BOARD

Table 5 Description of C4 Output Protocol

Examples of C4 Data Parsing

Note: In this example, buffer starts at the first byte of ACC_X and excludes the two-byte protocol header. The code parses the nine 32-bit acceleration, angular rate, and attitude angle fields. Temperature and checksum must be handled separately.

```
Double[] sensors = new double[9];

sensors[0] = (int)((byte)buffer[3] + ((byte)buffer[2] << 8) + ((byte)buffer[1] << 16) + ((byte)buffer[0] << 24));
sensors[1] = (int)((byte)buffer[7] + ((byte)buffer[6] << 8) + ((byte)buffer[5] << 16) + ((byte)buffer[4] << 24));
sensors[2] = (int)((byte)buffer[11] + ((byte)buffer[10] << 8) + ((byte)buffer[9] << 16) + ((byte)buffer[8] << 24));
sensors[3] = (int)((byte)buffer[15] + ((byte)buffer[14] << 8) + ((byte)buffer[13] << 16) + ((byte)buffer[12] << 24));
sensors[4] = (int)((byte)buffer[19] + ((byte)buffer[18] << 8) + ((byte)buffer[17] << 16) + ((byte)buffer[16] << 24));
sensors[5] = (int)((byte)buffer[23] + ((byte)buffer[22] << 8) + ((byte)buffer[21] << 16) + ((byte)buffer[20] << 24));
```


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```
sensors[6] = (int)((byte)buffer[27] + ((byte)buffer[26] << 8) + ((byte)buffer[25] << 16) + ((byte)buffer[24] << 24));
sensors[7] = (int)((byte)buffer[31] + ((byte)buffer[30] << 8) + ((byte)buffer[29] << 16) + ((byte)buffer[28] << 24));
sensors[8] = (int)((byte)buffer[35] + ((byte)buffer[34] << 8) + ((byte)buffer[33] << 16) + ((byte)buffer[32] << 24));

// Accel x, y, z
Ax = (double)sensors[0] / Accel_Scale;
Ay = (double)sensors[1] / Accel_Scale;
Az = (double)sensors[2] / Accel_Scale;

// Gyro x, y, z
Gx = (double)sensors[3] / Rate_Scale;
Gy = (double)sensors[4] / Rate_Scale;
Gz = (double)sensors[5] / Rate_Scale;

// Roll, Pitch, Yaw
Roll = (double)sensors[6] / Angle_Scale;
Pitch = (double)sensors[7] / Angle_Scale;
Yaw = (double)sensors[8] / Angle_Scale;
```

Note:
1. The unit of the accelerometer is g (g = 9.80665 m/s² = 32.174 ft/s²), the unit of the gyroscope rotation speed is dps, and the unit of the attitude angle is degree.
2. Accel_Scale = 10000.0, Rate_Scale = 10000.0, Angle_Scale = 10000.0.
3. int here is a 32-bit signed data type. Please make sure to perform a forced type conversion when converting sensor data.

■ MECHANICAL DIMENSIONS

System size: 38.6±0.1 × 44.8±0.1 × 10.8±0.1 mm (excluding mounting holes and connectors), as shown below.

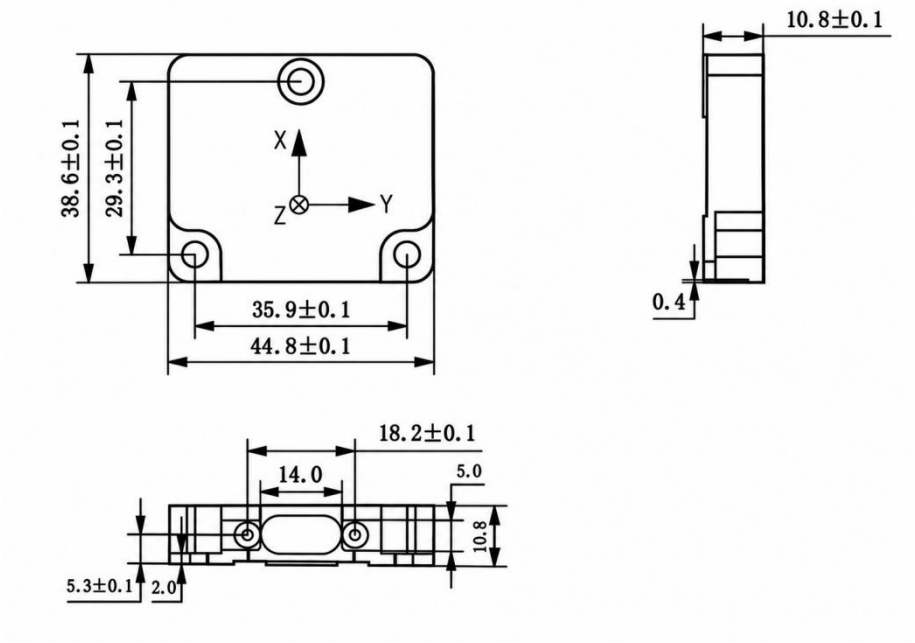


Figure 4 Mechanical dimensions (unit: mm)

Key Dimensions

Dimensions — mm (in)	
Length (connector side)	44.8 ± 0.1 mm (1.764 ± 0.004 in)
Width	38.6 ± 0.1 mm (1.520 ± 0.004 in)
Height	10.8 ± 0.1 mm (0.425 ± 0.004 in)
Horizontal Mounting Hole Spacing	35.9 ± 0.1 mm (1.413 ± 0.004 in)
Vertical Mounting Hole Spacing	29.3 ± 0.1 mm (1.154 ± 0.004 in)
Connector Width / Screw Spacing	14.0 mm (0.551 in) / 18.2 ± 0.1 mm (0.717 ± 0.004 in)
Connector Center Height	5.3 ± 0.1 mm (0.209 ± 0.004 in)

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■ WIRING DIAGRAM

Electrical Interface — Pin Configuration

The external socket interface model of SX-MIXHC is J30J-15ZKNP2-J, and the plug model to be inserted is J30J-15ZKL-300MM. The connector pin configuration is shown in Figure 5:

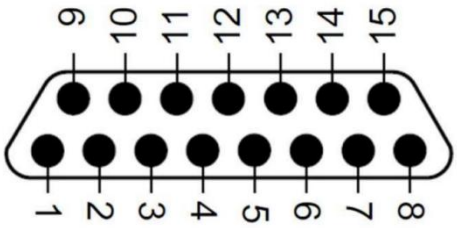


Figure 5 Pin configuration

Pin Definitions of Main Connector

Pin Number	Name	Types	Description
1	422-TX-	output	RS422 send
2	422-RX-	input	RS422 receive
3	Boot	input	Factory Upgrade Firmware Pin
4	TOV	output	Time of Validity
5	Reset	input	reset
6 – 7	NC	-	None
8	Vcc	5V power	Power supply
9	422-TX+	output	RS422 send
10	422-RX+	input	RS422 receive
11	Trigger	input	Synchronization Pin
12 – 14	NC	-	None
15	Gnd	power	Power ground

Note: The external trigger LVTTL level of SX-MIXHC is 3.3 V.

■ ORDERING INFORMATION

Complete model number example: SX-MIXHC-045020g±1803D

Angular Velocity Measurement Range	
0450	±450 °/s
Acceleration Measurement Range	
20g	±20 g
Angle Measurement Range (Roll / Yaw Angle Range)	
±180	±180°
Output	
3	RS-422
Customization Options	
D	Custom Configuration — Specify Requirements When Ordering

Example: SX-MIXHC-045020g±1803D represents an SX-MIXHC Series IMU with a ±450 °/s gyroscope range, a ±20 g accelerometer range, a ±180° attitude angle range, an RS-422 interface, and a custom configuration.

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