IMU100 Datasheet

Inertial Measurement Unit (Ten Degrees of Freedom Inertial Sensor)

1. Overview

The IMU100 Micro-inertial Measurement Unit (IMU) is a small, high-performance, low-cost inertial measurement unit (IMU) based on MEMS technology, which can measure 3-axis gyroscopes, 3-axis accelerometers, 3-axis magnetometers (optional) and barometer (optional).

This device provides stable measurement performance because of its error compensation of temperature and axes. It ensures excellent performance under static and dynamic conditions and ensures reliable measurement data under harsh environments.

1.1 Product Features

- Gyroscope, accelerometer, magnetometer (optional), pressure sensor (optional) and other core devices can be controlled autonomously
- Full temperature compensation, unique calibration technology and method
- Excellent environmental adaptability, meeting vehicle-grade requirements
- Operating Temperature: −40 ℃ ~ +75 ℃
- Storage Temperature: −40 ℃ ~ +95 ℃
- Small size, high precision, high reliability, strong anti-interference ability

1.2 Application Field

- Unmanned aerial vehicle
- Unmanned driving
- Robot
- Surveying and mapping
- Platform stabilization and control

2. Package Information

Figure 2.1 shows IMU100 outline and mechanical data.

- Dimension: 22.4 mm × 22.4 mm × 9.5 mm

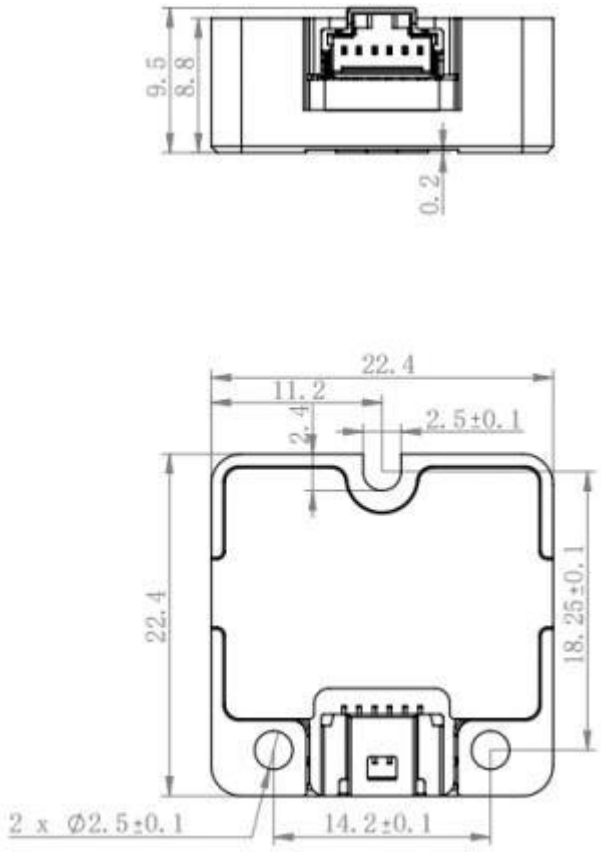

Figure 2.1 IMU100 package outline and mechanical data

3. IMU100 Specifications

Gyros Performance

Parameter	Specification
Range	±300 °/s
Bias in Full temperature (1σ,10s on average)	≤150 °/h
Bias Stability (Allan)	≤1°/h
Bias Stability (1σ,10s on average)	≤6 °/h
Bias Repeatability (1σ)	≤6 °/h
Angular Random Walk	≤0.15 °/ √Hz
Scale Factor Non-linearity	≤50 ppm
Installation Error	≤ 0.5 °
Bandwidth	≥100 Hz

Accelerometers Performance

Parameter	Specification
Range	±8 g
Bias in Full temperature (1σ,10s on average)	≤2.0 mg
Bias Stability (1σ, 10s on average)	≤0.2 mg
Bias Repeatability (1σ)	≤0.2 mg
Scale Factor Non-linearity (±1g)	≤200 ppm
Installation Error	≤ 0.5°
Bandwidth	≥100 Hz

Magnetometers Performance (Optional)

Parameter	Specification
Range	±8gauss
Repeatability Error	0.1%FS
Output Noise	0.3mgauss rms
Scale Factor Non-linearity	≤0.1%
Installation Error	≤ 1°
Bandwidth	≥50 Hz

Barometer Performance (Optional)

Parameter	Specification
Range	-1500m~+9000m
Relative pressure accuracy	0.051 m/830 m step
Pressure Temperature-induced offset	±5.0cm/k
Noise	1.5cm rms

System Performance

Parameter	Specification
Refresh Rate	400 Hz(max)
Weight	≤25 g
Size	22.4mm x 22.4mm x 9.5mm
Supply Voltage	5±0.3 V
Power Consumption	≤0.35 W
Interface	UART/RS422/RS485
Connector	Molex
Operating Temperature	-40 °C~+75 °C
Storage Temperature	-40 °C~+95 °C

4. Pin Description and Digital Interfaces

4.1 Pin Description

The Molex connector is used for information exchange by UART/RS422 between IMU100 and upper computer. Product End Model: Molex connector 5015680607. Model of the opposite end: Molex connector 5013300600.

Table 3.1 TTL Pin connection

Pin#	Name	Function
1	VCC(+5V)	Power supply
2	GND	Connect to GND
3	TXD	Transmitter
4	RXD	Receiver
5	DNC	Do not connect
6	DNC	Do not connect

Notes: The information transfer pins (TXD, RXD) are based on IMU100

Table 3.2 RS422 Output Pin connection

Pin#	Name	Function
1	VCC(+5V)	Power supply
2	GND	Connect to GND
3	RS422_TX-	RS422 Transmitter Negative
4	RS422_RX+	RS422 Receiver Positive
5	RS422_TX+	RS422 Transmitter Positive
6	RS422_RX-	RS422 Receiver Negative

Table 3.3 RS485 Output Pin connection

Pin#	Name	Function
1	VCC(+5V)	Power supply
2	GND	Connect to GND
3	DNC	Do not connect
4	RS485_RX-	RS485 Receiver Negative
5	DNC	Do not connect
6	RS485_RX+	RS422 Receiver Positive

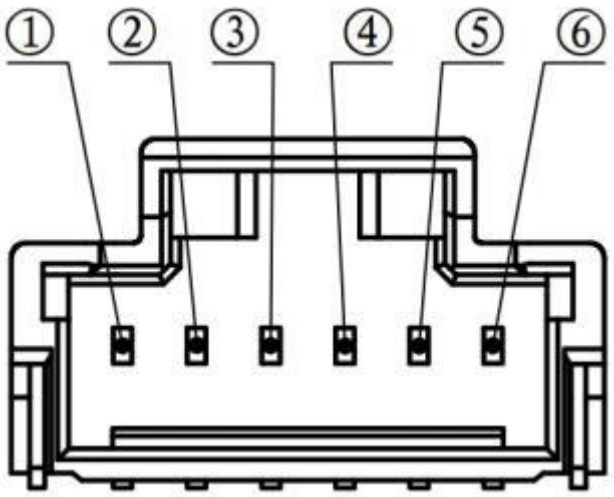

Figure 3.1 Pin connections

4.2 Digital Interfaces

The default baud rate of IMU100 is 921600, with 8-bit data bits, 1-bit stop bit and without parity bit. The refresh rate of 400 Hz. The interface communication protocol is shown as below.

Table 3.4 Frame 1 Communication data structure (Gyro+Acc)

Byte	Values	Value Type	Description
0	0xBD	-	-
1	0xDB	-	-
2	0x0A	-	-
3~6	LSB MID1 MID2 MSB	Float	Gx Factor 1 Unit deg/s
7~10	LSB MID1 MID2 MSB	Float	Gy Factor 1 Unit deg/s
11~14	LSB MID1 MID2 MSB	Float	Gz Factor 1 Unit deg/s
15~18	LSB MID1 MID2 MSB	Float	Ax Factor 1 Unit g
19~22	LSB MID1 MID2 MSB	Float	Ay Factor 1 Unit g
23~26	LSB MID1 MID2 MSB	Float	Az Factor 1 Unit g
27	LSB	Signed	Temperature Factor 0.006 Min -60 Max +125 Unit ℃
28	MSB	-	-
29	BIT	Unsigned	Built-in Test Self Check Error (00)
30	Reserved	Reserved	Reserved (00)
31	LSB	Unsigned	Counter Factor 1
32	MSB	Unsigned	Minimum 0 Maximum 65535 Unit ms

33	Check	Byte	XOR, including bytes 0~32

Table 3.5 Frame 2 Communication data structure (Gyro+Acc+magnetic+Barometer)

Byte	Values	Value Type	Description
0	0xBD	-	-
1	0xDB	-	-
2	0x0B	-	-
3~6	LSB MID1 MID2 MSB	Float	Gx Factor 1 Unit deg/s
7~10	LSB MID1 MID2 MSB	Float	Gy Factor 1 Unit deg/s
11~14	LSB MID1 MID2 MSB	Float	Gz Factor 1 Unit deg/s
15~18	LSB MID1 MID2 MSB	Float	Ax Factor 1 Unit g
19~22	LSB MID1 MID2 MSB	Float	Ay Factor 1 Unit g
23~26	LSB MID1 MID2 MSB	Float	Az Factor 1 Unit g
27~30	LSB MID1 MID2 MSB	Float	Mx Factor 1 Unit uT(10mG)
31~34	LSB MID1 MID2 MSB	Float	My Factor 1 Unit uT(10mG)
35~38	LSB MID1 MID2 MSB	Float	Mz Factor 1 Unit uT(10mG)
39~42	LSB MID1 MID2 MSB	Float	Barometer Factor 1 Unit m
43	LSB	Signed	Temperature Factor 0.006 Min -60 Max +125 Unit ℃
44	MSB	-	-
45	BIT	Unsigned	Built-in Test Self Check Error (00)
46	Reserved	Reserved	Reserved (00)
47	LSB	Unsigned	Counter Factor 1 Min 0 Max 65535 Unit ms
48	MSB	Unsigned	Factor 1 Min 0 Max 65535 Unit ms XOR, inc. bytes 0~48
49	Check	Byte	-

5. Installation Requirements

IMU100 is recommended to be fixed with M2.5 or M2 screws, the mounting hole distance is as shown in the mechanical drawing, and the surface machine M2.5 or M2 threaded holes are installed.

6. Operating Steps

- Set the input voltage according to the voltage specified by the product, and power on the product according to the electrical interface definition;
- Check whether the output signal meets the performance specifications based on the communication protocol Settings.
- Product installation and electrical connection can be normal use.

7. Ordering Information

IMU100-X0-X1-X2-X3

- X0: A = 8g
- X1: A = 3-axis gyroscope, 3-axis accelerometer | B = 3-axis gyroscope, 3-axis accelerometer, 3-axis magnetometer | C = 3-axis gyroscope, 3-axis accelerometer, 3-axis magnetometer, barometer
- X2: T = UART(TTL) | R = RS422

8. Attentions

- Micromechanical sensors are designed to sense acceleration with high accuracy at low amplitudes and contain highly sensitive structures inside the sensor element.
- The MEMS sensor can tolerate mechanical shocks up to several thousand g's. However, these limits might be exceeded in conditions with extreme shock loads such as e.g., hammer blow on or next to the sensor, dropping of the sensor onto hard surfaces etc.
- Pay attention to the definition of the electrical interface of the product. Please strictly follow the arrangement of the leading end to avoid incorrect connection.
- Product installation diagonal velocity measurement has a great impact; in order to avoid introducing installation errors, installation plane is required to have good flatness.
- To ensure the accuracy of measurement, the product must be installed firmly and reliably to avoid loose measurement errors.
- We recommend avoiding g-forces beyond the specified limits during transport, handing and mounting of the sensors in a defined and qualified installation process.
- This device has built-in protections against high electrostatic discharges or electric fields (e.g., 2kV HBM); however, anti-static precautions should be taken as for any other CMOS component during all phases of manufacturing, testing, packaging, shipment and handing.
- Unless otherwise specified, proper operation can only occur when all terminal voltages are kept within the supply voltage range. Unused inputs must always be tied to a defined logic voltage level.

The following guidelines are recommended:

- Always manipulate the devices in an ESD-controlled environment;
- Always store the devices in a shielded environment that protects against ESD damage (at minimum an ESD-safe tray and an antistatic bag);
- Always wear a wrist strap when handling the devices and use ESD-safe gloves.

Please strictly follow the requirements of this manual to ensure that the external environment is consistent with the application requirements. If there is any problem, please do not remove the cover of the product or change the internal structure of the product. If there is any problem, please contact our technical staff on time.

ESD (electrostatic discharge) sensitive device.

Charged device and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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