MEMS Inertial Measurement Unit V 1.00

BS-IC209-M-D6EC

Product characteristics

- Gyro measuring range: 500 °/s
- 3 °/H gyroscope bias stability (Allan variance)
- Acceleration range: 30g
- Zero bias stability (Allan variance) for acceleration of 0.1 mg

Field of application

UAV Navigation Robot Navigation AUV Navigation

Various air carriers flight navigation land vehicle navigation ROV navigation

1. Product overview

The BS-IC209-M-D6EC is an inertial measurement unit (IMU) based on micromachining technology (MEMS) with built-in high-performance MEMS gyroscope and MEMS accelerometer, which outputs 3 angular velocities and 3 accelerations. The utility model has the advantages of high reliability and strong environmental adaptability. By matching different software, the product can be widely used in tactical and industrial UAV, smart ammunition, seeker and other fields.

2. Product features

1) Three-axis digital gyroscope:

A) ± 500º/s dynamic measuring range;

B) Zero bias stability: 15 °/H (GJB, 10s), 3 °/H (ALLAN);

2) Triaxial digital accelerometer:

A) ± 30g dynamic measuring range;

C) Zero-bias stability: 0.5 mg (GJB, 10s), 0.1 mg (ALLAN);

3) High reliability: MTBF > 20000h;

4) Guaranteed accuracy within the full temperature range (-40 ℃ ~ 80 ℃): built-in high-performance temperature calibration and compensation algorithm;

5) Suitable for working under strong vibration conditions;

3. Product indicators

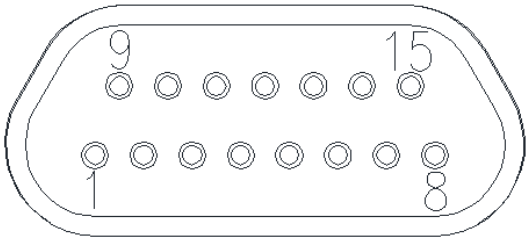
Parameter		Test conditions	Design accuracy	Unit
Peg-top	Dynamic measuring range	-	±500	º/s
	Zero bias stability	Allan variance (500 °/s range, normal temperature)	3	º/h
		10 s average (-40 ℃ ~ + 80 ℃, constant temperature)	15	º/h
	Zero bias	Zero bias range	≤±0.05	º/s
		Zero bias variation over full temperature range (10 s average)	±0.07	º/s
		Start repeatability	0.01	º/s
		Ffect of linear acceleration on bias	0.002	º/s/g

Parameter		Test conditions	Design accuracy	Unit
	Scale factor	Scale factor accuracy	0.2	%FS
		Scale factor nonlinearity	0.05	%FS
	Angular random walk	-	0.06	°/√hr
	Bandwidth	-	200	Hz
Accelerometer	Dynamic measuring range	-	30	g
	Zero bias stability	Allan variance (16g range, normal temperature)	0.1	mg
		10 s average (-40 ℃ ~ + 80 ℃, constant temperature)	0.5	mg
	Zero bias	Zero bias range	±2	mg
		Zero-bias variation over full temperature range	±2	mg
		Start repeatability	0.2	mg
	Scale factor	Scale factor accuracy	0.2	%
		Scale factor nonlinearity	0.05	%FS
	Speed random walk	-	0.08	m/s/√hr
	Bandwidth	-	200	Hz
Communication interface	1-way SR422	Baud rate	460.8	MHz
Electrical characteristics	Voltage	-	5±0.5	V
	Power consumption	-	1.5	W
	Ripple	P-P	150	mV
Structural characteristics	Size	-	44.8×38.6×13.5	mm
	Weight	-	45±1	g
Use environment	Operating temperature	-	-40~80	℃
	Storage	-	-45~85	℃

Parameter		Test conditions	Design accuracy	Unit
	temperature			
	Vibration	-	20~2000Hz，6.06g	
	Impact	-	8000g，0.5ms	
Reliability	MTBF	-	20000	h
	Continuous working time	-	120	h

4. Electrical interface

The model of connector connecting BS-IC209-M-D6EC product to the outside is J30JE-15ZKN-J, and its schematic diagram and pin definition are as follows.

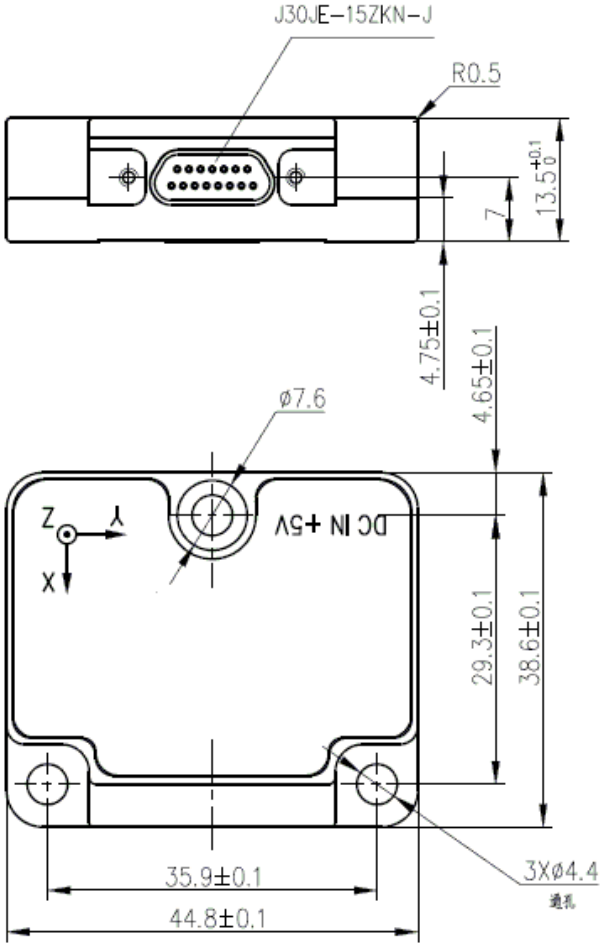


Graph 1 Connector node configuration

Contact number	Pin definition	Type	Explain
1	TxD-	OUTPUT	Product RS422 output interface negative terminal
2	RxD-	INPUT	Product RS422 receiving interface negative terminal
8	VSUP	SUPPLY	Positive end of product power supply, DC + 5V power supply
9	TxD+	OUTPUT	Product RS422 output interface positive terminal
10	RxD+	INPUT	Product RS422 receiving interface positive terminal
15	422GND	OUTPUT	Product RS422 serial port ground
12	GND	SUPPLY	Product ground, power ground

			and serial port ground
13	GND	SUPPLY	Product ground, power ground and serial port ground
3~7、11、14	Reserved by the manufacturer	/	/

5. Fabric interface



Graph 2Schematic diagram of structure outline

6. Instructions for use

6.1 Communication protocol description

The product communicates with external equipment through RS422 serial communication interface. During data transmission, each character includes 8 data bits, 1start bit, 1stop bit, and no parity bit. The definition of the data packet output by the product is shown in Table 3, and the communication cycle is 1ms.

Parameter name	Effective range	Byte	Scale	Remark
Frame header	99 H	1	——	——
X-axis angular velocity	[-512，512]	3	2^{-14}	Unit: (/s, from high to low, the most significant bit of the first byte is the sign bit. See Note 1 for the specific algorithm.
Y-axis angular velocity	[-512，512]	3	2^{-14}	
Z-axis angular velocity	[-512，512]	3	2^{-14}	
Gyro status	——	1	——	All zeros are normal. See Table 3 for specific definitions.
X-axis temperature	[-128，128]	2	2^{-8}	Unit: ℃，from high to low, the most significant bit of the first byte is the sign bit. See Note 2 for the specific algorithm.
Y-axis temperature	[-128，128]	2	2^{-8}	
Z-axis temperature	[-128，128]	2	2^{-8}	
Frame count	[0，255]	1	1	0-255 continuous count
Checksum	——	1	——	CRC check, polynomial x^8+x^2+x+1

Note: If the Z-axis gyroscope does not output angular velocity, this bit of data will be set to zero.

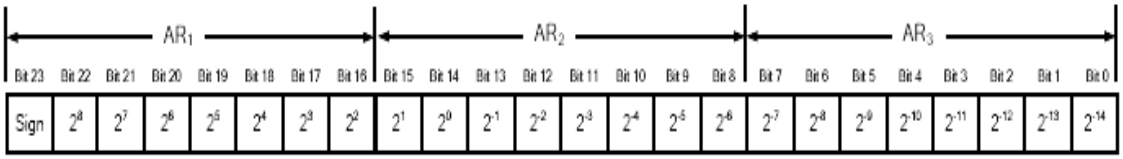
Explain

A) gyro angular velocity output [°/s] = $\frac{AR_1 \cdot 2^{16} + AR_2 \cdot 2^8 + AR_3}{2^{14}}$? See Figure 1 for data bit format;

Among AR_1 Outputting the high eight bits of the three bytes for the angular velocity of each axis of the gyroscope;

AR_2 Outputting the middle eight bits of the three bytes for the angular velocity of each axis of the gyroscope;

AR_3 Outputs the lower eight bits of the three bytes for the angular velocity of each axis of the gyro.



Graph 3 **Convert gyro angular velocity output to [°/s]**

B) gyro temperature output [℃] = $\frac{T_1 \cdot 2^8 + T_2}{2^8}$ The data bit format is shown in Figure 2.

Among T_1 Outputting high eight bits in two bytes for the temperature of each axis of the gyroscope;

T_2 Outputs the lower eight bits of the two bytes for the temperature of each axis of the gyro.

Graph 4 **Convert gyro temperature output to [℃]**

7. Update the record

Serial number	Version	Change the date	Before the change	After the change	Reason for the change	Changed by
1	1.00	20230103		New establishment	New establishmen	Asl

					t	

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Specifications subject to change without notice