BS-IU109-M-D6EC

Inertial Measurement Unit User Manual

1. Product overview

BS-IU109-M-D6EC is an inertial measurement unit (IMU) based on micro-mechanical technology (MEMS), which contains high-performance MEMS gyroscope and MEMS accelerometer, and outputs 3 angular velocities and 3 accelerations.

BS-IU109-M-D6EC has high reliability and strong environmental adaptability. By matching different software, the product can be widely used in intelligent driving, tactical and industrial UAV, intelligent ammunition, seeker, mobile communication, mapping, stable platform and other fields.

2. Product features

1) Three-axis digital gyroscope:
   a) ± 250º/s dynamic measurement range (configurable ± 500 °/s);
   b) Bias stability (GJB, 10S, typical value): X axis, y axis: 6 °/H; Z axis: 5 °/H;
   c) Zero-bias instability (ALLAN, typ.): 3.5 °/H X, y; 3 °/H Z;
2) Triaxial digital accelerometer:
   a) ± 4 G dynamic measurement range (configurable ± 16 G);
   b) Bias stability (GJB, 10S, typical value): 0.1mg;
   c) Zero-bias instability (ALLAN, typical value): 0.055mg;
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;
6) Interface 1-way UART.

3. Field of application

1) Intelligent driving
2) Tactical and Industrial UAV
3) Smart Munitions
4) Seeker
5) Communication in motion
6) Mapping
7) Stabilize the platform

4. Product indicators

表1. Product indicators

Parameter		Test conditions	Minimum value	Typical value	Maximum value	Unit
Peg-top	Dynamic measuring range			250	500	°/s
	Bias stability	Allan variance: x-axis, y-axis		3.5	4.5	°/h
		Allan variance: z-axis		3	4	°/h
		The x-axis, y-axis, 10 s average (-40 ℃ ~ + 80 ℃, constant temperature)		6	8	°/h
		Z-axis 10 s average (-40 ℃ ~ + 80 ℃, constant temperature)		5	7	°/h
	Bias	Zero-bias range		±0.1		°/s
		Bias variation over full temperature		±0.1		°/s

Parameter		Test conditions	Minimum value	Typical value	Maximum value	Unit
	Scale factor	range EQ \ o \ AC (○, 1) Scale factor accuracy Scale factor nonlinearity		0.15 0.015		% %FS
	Bandwidth			80		Hz
Accelero meter	Dynamic measuring range			4	16	g
	Bias stability	Allan variance 10 s average (-40 ℃ ~ + 80 ℃, constant temperature)		0.055 0.1	0.06 0.12	mg mg
	Bias	Zero-bias range		±1.5		mg
		Zero-bias change in full temperature range, peak-to-peak value EQ \ o \ AC (○, 1)		±1.5		mg
	Scale factor	Scale factor accuracy Scale factor nonlinearity		0.3 0.03		% %FS
	Bandwidth			80		Hz
Commun ication interface	1-way UART	Baud rate		115.2	460.8	Kbps
	Sampling frequency	UART		200	1000	Hz
Electrical characteri stics	Voltage		4.5	5	5.5	V
	Power consumption				0.4	W
	Ripple	P-P			20	mV
Structural characteri stics	Size			22.4×22.4×10.54		mm
	Weight			20		g
Use environm ent	Operating temperature		-40		80	℃
	Storage temperature		-45		85	℃
	Vibration			20~2000Hz，3g		
	Impact			1000g，0.5 ms		
Reliabilit y	MTBF			20000		h
	Continuous working time			120		h

: Calculate the zero deviation of the whole temperature change process, the temperature change rate is ≤ 1 ℃/min, and the temperature range is -40 ℃ ~ + 80 ℃;

5. Electrical interface

The schematic diagram of BS-IU109-M-D6EC interface definition is shown in the figure below, and the pin definition and specific functions are shown in the table below.
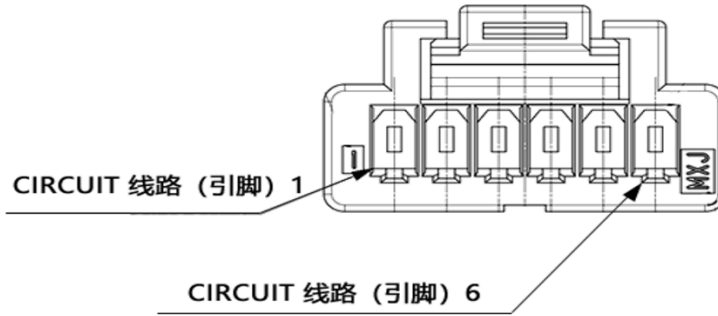
图1   Stitch indication

表2.   Stitch definition diagram

Serial number	Definition	Explain	Signal type	Cable color
1	+5V	5V power supply		Red
2	GND	Power ground		Black
3	USART_TX	Serial port sending		Ash
4	USART_RX	Serial port receiving		Brown
5	SYNC	Synchronous control signal input	3.3 V TTL level	Blue
6	MCLR#	Emulator Reserved		White

6. Fabric interface

The BS-IU109-M-D6EC has overall dimensions of 22.4mm X 22.4mm X 10.54 mm and a weight of 20g ± 2g.
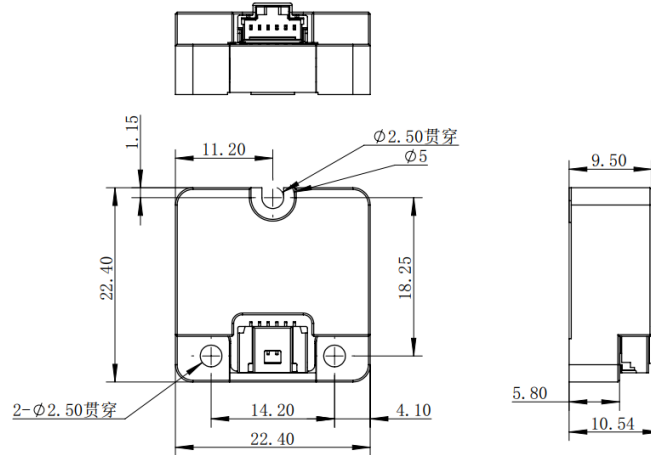

图2   Schematic diagram of structure outline

7. Instructions for use

7.1. Coordinate system definition

3 gyros (g_x, g_y, g_z) and 3 accelerometers (a_x, a_y, a_z) is defined as shown in the figure below, and the direction of the arrow is positive.
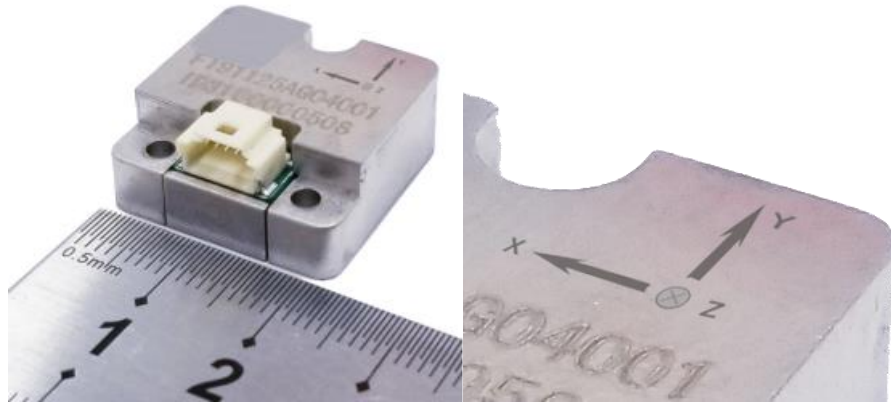
图3　Appearance and coordinate diagram

7.2. UART reads and writes data

7.2.1. Interface

Default configuration: 115200bps, 8 data bits, 1stop bit, no parity;

7.2.2. Protocol format

It is divided into protocol head, protocol body and protocol tail; 200 Hz; the coordinate axis is defined as left front bottom

表3.　Serial port protocol table

Offset	Definition	Format	Length	Coefficient	Unit	Explain
0	0xBD		1			
1	0xDB		1			
2	0x0A		1			
3	Gyro x-axis	FLOAT	4	(LSB_first)	deg/s	
7	Gyro y-axis	FLOAT	4	(LSB_first)	deg/s	
11	Gyro z-axis	FLOAT	4	(LSB_first)	deg/s	
15	Add x-axis of the table	FLOAT	4	(LSB_first)	m/s2	
19	Add the y-axis of the table	FLOAT	4	(LSB_first)	m/s2	
23	Add z-axis of the table	FLOAT	4	(LSB_first)	m/s2	
27	Temperature	INT16	2	(LSB_first)	℃	200.0/32768.0
29	Reserved	U16	2			
31	Frame count	U16	2	(LSB_first)		
33	Check digit	U8	−	−	−	Xor check, including data from 0 to 32

- U8 is Explain a 1-byte unsigned integer;
- U16 is a 2-byte unsigned integer, with the low byte preceding and the high byte following;
- INT16 is a 2-byte signed integer, with the low byte preceding and the high byte following;
- U32 is a 4-byte unsigned integer, with the low byte preceding and the high byte following;
- FLOAT is a single-precision signed floating-point type, with the low byte preceding and the high byte following;