BS-IU103N-M-D6EC

Inertial Measurement Unit User Manual

Update the record

Preface Number	Edition Ben	Change Date	Before the change	After the change	Change Reason	Changed by
1	1.00	20220908		New establishment	New establishment	fyg

1. Product overview

The BS-IU103N-M-D6EC is an inertial measurement unit (IMU) based on micromachining technology (MEMS), with built-in high-performance MEMS gyroscope and MEMS accelerometer, outputting 3 angular velocities and 3 accelerations.

The BS-IU103N-M-D6EC features 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) ± 500º/s dynamic measuring range;
   b) Zero bias stability (GJB, 10S, typical value): 2.5 °/H;
   c) Zero-bias instability (ALLAN, typical): 1 °/H;
2) Triaxial digital accelerometer:
   a) ± 16 G dynamic measuring range;
   b) Zero-bias stability (GJB, 10s, typical value): 0.035 mg;
   c) Zero-bias instability (ALLAN, typical): 0.02 mg;
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			500		º/s
	Zero bias stability	Allan variance		1		º/h
		10 s average (-40 ℃ ~ + 80 ℃, constant temperature)		2.5		º/h
	Zero bias	Zero bias range		±0.03		º/s
		Zero bias variation over full temperature range EQ \ o \ AC (○, 1)		±0.01		º/s
	Scale factor	Scale factor accuracy		0.15		%
		Scale factor nonlinearity		0.005		%FS
	Bandwidth			80		Hz
Accelero	Dynamic			16		g

Parameter		Test conditions	Minimum value	Typical value	Maximum value	Unit
meter	measuring range					
	Zero bias stability	Allan variance		0.02		mg
		10 s average (-40 ℃ ~ + 80 ℃, constant temperature)		0.035		mg
	Zero bias	Zero bias range		±0.75		mg
		Zero-bias change in full temperature range, peak-to-peak value EQ \ o \ AC (○, 1)		±1		mg
	Scale factor	Scale factor accuracy		0.2		%
		Scale factor nonlinearity		0.03		%FS
	Bandwidth			80		Hz
Communication interface	1-way UART	Baud rate		115.2	460. 8	Kbps
	Sampling frequency	UART		200	1000	Hz
Electrical characteristics	Voltage		4.5	5	5.5	V
	Power consumption				1.5	W
	Ripple	P-P			20	mV
Structural characteristics	Size			30×30×16		mm
	Weight			40		g
Use environment	Operating temperature		-40		80	℃
	Storage temperature		-45		85	℃
	Vibration			20~2000Hz □6.06g		
	Impact			1000g□0.5ms		
Reliability	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-IU103N-M-D6EC interface definition is shown in the figure below, and the pin definition and specific functions are shown in the table below.

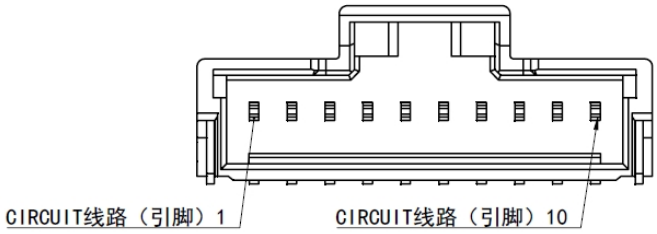

图1　Stitch indication

表2.　Stitch definition diagram

Pin	Definition	Explain	Remark
1	POWER_5V	Power supply positive	DC 5V (4-6V)
2	PGND	Power ground	Power ground
3	Uart_Tx	Serial port sending	3.3 V TTL level
4	Uart_Rx	Serial port receiving	3.3 V TTL level
5	PPS	Pulse per second input	3.3 V TTL level, rising ed
6	NC	Do not connect	Leave the pin floating
7	NC	Do not connect	Leave the pin floating
8	NC	Do not connect	Leave the pin floating
9	NC	Do not connect	Leave the pin floating
10	NC	Do not connect	Leave the pin floating

6. Fabric interface

The BS-IU103N-M-D6EC has overall dimensions of 30 mm X 30 mm X 16 mm and weighs 40 G ± 2 G.

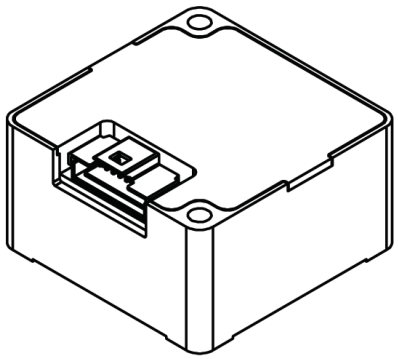

图2　3D appearance

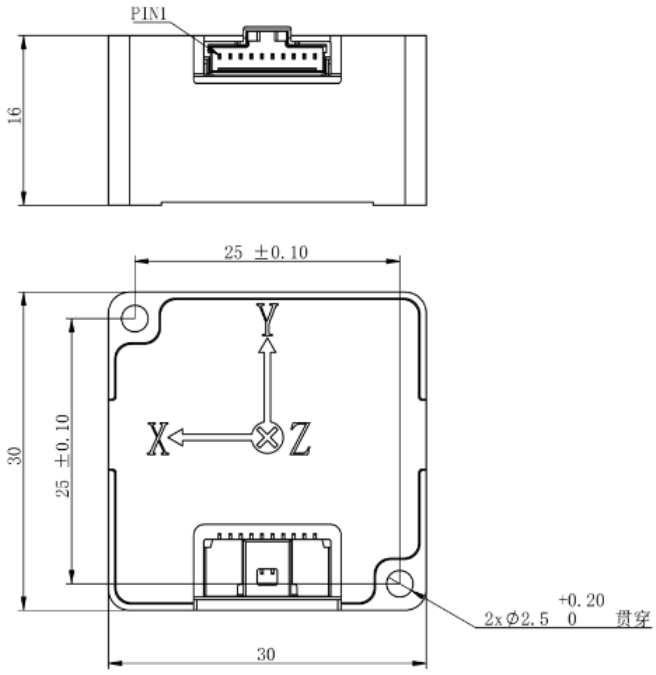

图3　Structure outline diagram and coordinate diagram

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 Figure 3, and the direction of the arrow is positive.

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	Byte order	Explain
0	0xAB	U8	1	-	-	-	Header (fixed value)
1	0x54	U8	1	-	-	-	Header (fixed value)
2	0x8B	U8	1	-	-	-	Function code (output data frame)
3	Reserved	U8	1	-	-	-	
4-5	Data length	U16	2			(LSB_first)	Length of data part
6-9	Timestamp	U32	4			(LSB_first)	Timestamp in milliseconds
10	0x00~FF	U8	1				Incremental sequence number (0 ~ 255)
11-14	Gx	FLOAT	4	1	deg/s	(LSB_first)	Data section
15-18	Gy	FLOAT	4	1	deg/s	(LSB_first)	Data section
19-22	Gz	FLOAT	4	1	deg/s	(LSB_first)	Data section
23-26	Ax	FLOAT	4	1	m/s2	(LSB_first)	Data section
27-30	Ay	FLOAT	4	1	m/s2	(LSB_first)	Data section
31-34	Az	FLOAT	4	1	m/s2	(LSB_first)	Data section
35-36	Temperature	INT16	2	200.0/32768.0	℃	(LSB_first)	Data section
37	Reserved	U8	1	-	-	-	

38	Reserved	U8	1	-	-	-	
39-40	Check digit	U16	2	1	-	(LSB_first)	CRC16 (including 0-38 bytes)

Explain

- U8 is 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;

7.2.3. CRC check algorithm

CRC verification includes the verification of the whole message header and data segment. The protocol adopts 16-bit CRC verification. The standard parameters for verification calculation are as follows:Table 4For detailed parameter definitions, please refer to AUTOSAR _ SWS _ CRC Library, Release 4.3.1 and Specification of CRC Routines.

表4. CRC check calculation standard parameter

CRC result width	16 bits
Polynomial	1021h
Initial value	FFFFh
Input data reflected	No
Result data reflected	No
XOR value	0000h
Check	29B1h
Magic check	0000h

An example of the calculation result is shown in Table 5, and the algorithm can be checked according to the input and output corresponding to the example:

表5. CRC calculation example

Data Bytes (Hex)									CRC
00	00	00	00						84C0
F2	01	83							D374
0F	AA	00	55						2023
00	FF	55	11						B8F9
33	22	55	AA	BB	CC	DD	EE	FF	F53F
92	6B	55							0745
FF	FF	FF	FF						1D0F