

BS-IU203-xy-D6EW Inertial Measurement

Unit Instructions for use

1. Product overview

BS-IU203-xy-D6EW 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-IU203-xy-D6EW features 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) $\pm 500^\circ/\text{s}$ (Max: $\pm 2000^\circ/\text{s}$) dynamic measurement range;
 - b) Zero bias stability: $8^\circ/\text{H}$ (GJB, 10s), $1.9^\circ/\text{H}$ (ALLAN);
- 2) Triaxial digital accelerometer:
 - a) $\pm 16\text{ G}$ (Max: $\pm 200\text{ G}$) dynamic measuring range;
 - b) 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 ($-40^\circ\text{C} \sim 80^\circ\text{C}$): built-in high-performance temperature calibration and compensation algorithm;
- 5) Suitable for working under strong vibration conditions
- 6) Overload resistant up to 20000 G
- 7) Interface 1-way RS422

3. Field of application

- 1) Tactical and Industrial UAV
- 2) Smart Munitions
- 3) Seeker

Part numbers: BS-IU203-xy-D6EC where BS-IU203 - series; -D6EC - digital output, encapsulated

x - gyroscope options, y - accelerometer options

To see all models available please go to the end of the specification.

4. Product indicators

Table 1 Technical Index

Parameter		Test conditions	BS-IU203-1y	BS-IU203-2y	BS-IU203-3y	Unit	
Angular velocity	Range	Turntable	500	1000	2000	$^\circ/\text{s}$	
	Zero bias	Stability	10 s average, $+70^\circ\text{C}$, $+20^\circ\text{C}$, -40°C	8	12	16	$^\circ/\text{h}$
			Allan variance, $+20^\circ\text{C}$	1.9	2.85	3.8	$^\circ/\text{h}$
		Repeatability of successive starts	$+70^\circ\text{C}$, $+20^\circ\text{C}$, -40°C	15	22.5	30	$^\circ/\text{h}$
		Daily start repeatability	$+70^\circ\text{C}$, $+20^\circ\text{C}$, -40°C	30	45	60	$^\circ/\text{h}$
		Monthly Start Repeatability	$+70^\circ\text{C}$, $+20^\circ\text{C}$, -40°C	60	90	120	$^\circ/\text{h}$
		Zero-bias total temperature variation	$-40^\circ\text{C} \sim +70^\circ\text{C}$, $1^\circ\text{C}/\text{min}$, 10 s average, 1σ	0.02	0.03	0.04	$^\circ/\text{s}$
		Zero bias	Life-cycle change, accelerated testing	0.15	0.225	0.3	$^\circ/\text{s}$
Scale	Repeatability of	$+70^\circ\text{C}$, $+20^\circ\text{C}$, -40°C	100	150	200	ppm	

Parameter		Test conditions	Typical value			Unit	
	factor	successive starts					
		Daily start repeatability	+70℃、+20℃、-40℃	200	300	400	ppm
		Monthly Start Repeatability	+70℃、+20℃、-40℃	400	600	800	ppm
		Non-linearity	+20℃	200	300	400	ppm
		Full temperature change	1℃/min、1σ	400	600	800	ppm
		Scale factor	Life-cycle change, accelerated testing	3000	4500	6000	ppm
	Acceleration sensitive term			8	12	16	°/h/g
	Random walk			0.4	0.6	0.8	°/vhr
	Noise density			0.008	0.012	0.016	°/s/vHz
	Bandwidth		3dB	200			Hz
Data delay		Excluding transmission time	5ms			ms	
Acceler ation	Range			BS-IU203-xA 16	BS-IU203-xB 200	g	
	Zero bias	Stability	10 s average, + 70 °C, + 20 °C, -40 °C	0.5		mg	
			Allan variance, + 20 °C	0.1		mg	
		Repeatability of successive starts	+70℃、+20℃、-40℃	0.2		mg	
		Daily start repeatability	+70℃、+20℃、-40℃	0.4		mg	
		Monthly Start Repeatability	+70℃、+20℃、-40℃	0.8		mg	
		Zero-bias total temperature variation	-40 °C ~ + 70 °C, 1 °C /min variation	1.6		mg	
		Zero bias	Life-cycle change, accelerated test instead	5		mg	
	Scale factor	Repeatability of successive starts	+70℃、+20℃、-40℃	100	1500	ppm	
		Daily start repeatability	+70℃、+20℃、-40℃	200	3000	ppm	
		Monthly Start Repeatability	+70℃、+20℃、-40℃	400	6000	ppm	
		Non-linearity	+20℃	200	3000	ppm	
		Full temperature change	After full temperature calibration and compensation, 1 °C/min, 10 s average peak-peak value	400	6000	ppm	
		Scale factor	Life-cycle change, accelerated test instead	3000	45000	ppm	
	Bandwidth		3dB	200			Hz
Data delay		Excluding transmission	5ms			ms	

Parameter	Test conditions	Typical value	Unit
	time		
Start time	Time from power up to output valid data	500	ms
Reset time	Time from reset to output valid data (hard reset)	500	ms
	Time from reset to output valid data (soft reset)	300	ms
3 gyro axes and 3 acceleration axes The degree of nonorthogonality between any two ax	+70°C、+20°C、-40°C	0.05	°
Power supply		5±0.1	V
Power consumption		0.8	W
Communication update rate	1-way RS422	500 (default) 1000 (Max)	Hz
Communication baud rate	1-way RS422	460.8 (default) 921.6 (Max.)	kbps

5. Electrical interface

Table 2 Electrical Definition Table

Color	Name	Type	Description
Red	5V	Power source	
Black	GND	Power source	
White	R+	Input	RS422, 460800 bps by default
Brown	R-	Input	
Green	T-	Output	
Yellow	T+	Output	
Orange	Spare		
Blue	Spare		

6. Fabric interface

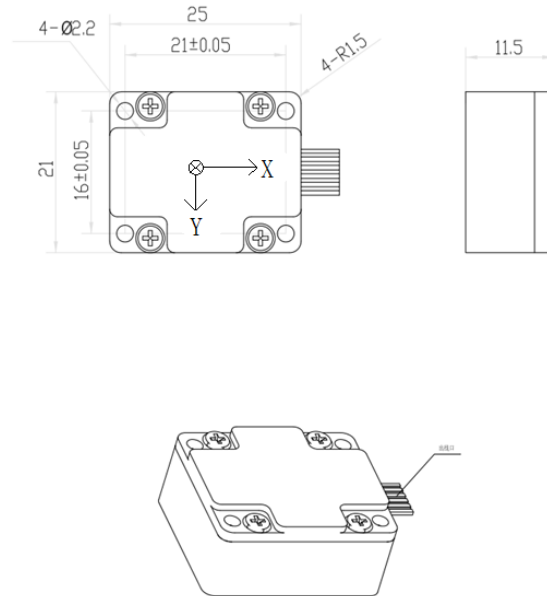


Fig. 1 Schematic diagram of structure outline

7. Instructions for use

7.1. UART reads and writes data

7.1.1. Interface

Default configuration: 460800bps, 8 data bits, 1stop bit, no parity;

7.1.2. Configuration commands

- 1) \$GPENB
Enable UART power-on automatic output
- 2) \$GPDIS
Close UART power-on automatic output
- 3) \$GPSER
View the serial number
- 4) \$GPINF
View configuration information

7.1.3. Protocol format

It is divided into protocol head, protocol body and protocol tail; 500 Hz; the coordinate axis is defined as front right bottom.

Table 3 Software protocol table

Agreement	Byte sequence number	Data	Unit	Data type	Remark
Protocol header	0	0x5a			
	1	0x5a			
Protocol body	2~5	X-axis gyro	°/s	float	
	6~9	Y-axis gyro	°/s	float	
	10~13	Z-axis gyro	°/s	float	

	14~17	X-axis plus table	g	float	
	18~21	Y-axis plus table	g	float	
	22~25	Z-axis plus table	g	float	
	26~29	Spare			
	30~33	Spare			
	34~37	Spare			
	38~41	Spare			
	42~45	Spare			
	46~49	Temperature	°C	float	
	50~53	Spare			
	54~57	Spare			
End of agreement	58	Checksum			Accumulate and sum 2 to 57 bytes, take the low byte

All models available:

- BS-IU203-1A-D6EW - gyro 500 °/s, accelerometer 16 g
- BS-IU203-1B-D6EW - gyro 500 °/s, accelerometer 200 g
- BS-IU203-2A-D6EW - gyro 1000 °/s, accelerometer 16 g
- BS-IU203-2B-D6EW - gyro 1000 °/s, accelerometer 200 g
- BS-IU203-3A-D6EW - gyro 2000 °/s, accelerometer 16 g
- BS-IU203-3B-D6EW - gyro 2000 °/s, accelerometer 200 g