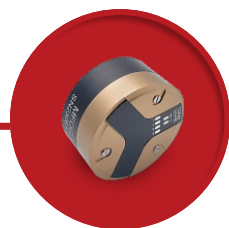
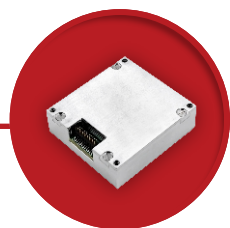




PRODUCTS



ACCELEROMETER · GYRO · IMU · INS · RATE TABLE

FIREPOWER TECHNOLOGY (SHENZHEN) CO.,LTD.

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ABOUT FIREPOWER

Firepower Technology (Shenzhen) Co., Ltd. was established in 2013 and registered in Shenzhen Nanshan High-tech Park. The company is high-tech enterprise dedicated to R&D and production of quartz accelerometer, FOG, IMU, INS, rate table and other products.

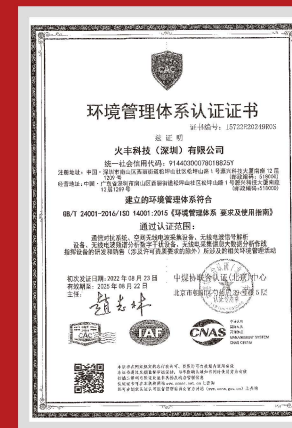


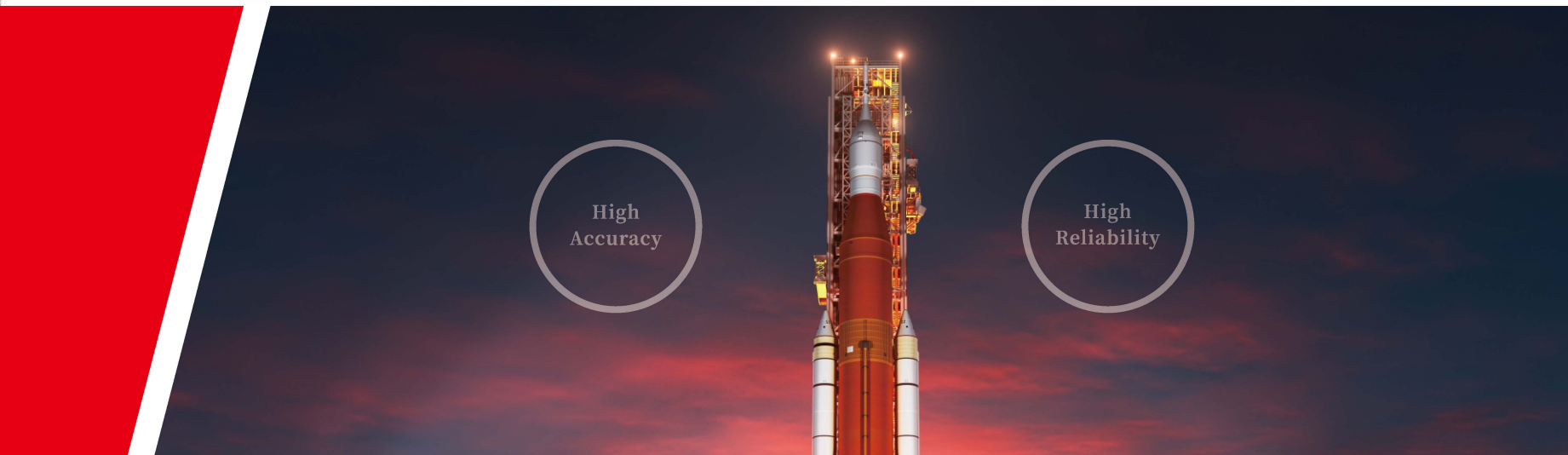
Firepower technology has invested in several automatic production lines in xi'an, shenzhen,hebei, including fiber optic gyroscope, mems inertial navigation, quartz accelerometer, electronic countermeasure communication products, inertial simulation equipment production lines in china. Firepower technology always puts scientific research innovation, technological exploration and self-control in the first place. The company has developed a series of autonomous navigation products with independent intellectual property rights, which are specially used in the field of autonomous navigation including uavs, vehicles, ships with the self-developed array algorithm as the core technology, the company has developed a series of inertial navigation products to solve the current position, three-dimensional attitude and speed of the user carrier,realizing the autonomous navigation control of the carrier.



QUALIFICATION FIREPOWER

Firepower technology belongs to "national High-tech Enterprise" and has obtained "national Military Standard System Certification", "Level II Confidentiality," "Qualification Of Weapon And Equipment Manufacturing (class A)". It has become one of the enterprises with complete qualifications for obtaining four certificates of military industry in shenzhen now it has obtained 17 authorized patents, including 3 invention patents, 4 utility models and other patents. there are 20 + patents, and 5 national defense patents have been submitted.





CULTURE FIREPOWER



Mission

Provide products and services to customers.
Create value for customers.
Achieve co-creation and win-win development!



Core values

Honesty and pragmatism
Innovation and Win-Win



Vision

Become the first-class inertial
device supplier in China

Development Policy: One Heart, Two Integration, Three Leading Four Autonomy

“One Heart”

Firmly Dedicated To Patriotism And Serving The Country, And Earnestly Fulfilling The Mission Of Strengthening The Country;

“Two Integration”

Implementing The New Development Mode Of "industrial Integration";

“Three Leading

Become "leading In Innovation, Leading In Cultural Strength And Leading In Competitiveness"
A World-class Chinese National Leading High-tech Enterprise;







“Four Autonomy”

Stick To The Development Route Of Hardware Autonomy, Software Autonomy, Scheme Autonomy And
Production Autonomy



TEAM FIREPOWER

Firepower technology has a strong independent r & d team, which can provide users with professional design, development, production and service of inertial devices and related simulation software. There are more than 135 staff members in the headquarters and 42 r & d team members, including 7 doctors studying in the united states and in china.there are more than 40 post-service personnel.

	<p>Liu Zhiya (Chairman)</p> <ul style="list-style-type: none"> ▶ Founder of Firepower ▶ Central European EMBA ▶ Technician 		<p>Oscar Li (CEO)</p> <ul style="list-style-type: none"> ▶ IPAG Business School ▶ Firepower Technology Founder ▶ Rion Technology Founder ▶ Osnav Founder
<p>Liu Xiaoping (CTO)</p> <ul style="list-style-type: none"> ▶ PhD from Columbia University ▶ Former Researcher in OFS, USA ▶ Professor at Nanjing University 		<p>Li Hanzhou (inertial navigation expert)</p> <ul style="list-style-type: none"> ▶ PhD from Xi'an University of Technology ▶ Director of the Aerospace Research Institute 	
	<p>Jiao Feng (Chief Engineer)</p> <ul style="list-style-type: none"> ▶ Senior engineer ▶ Poly Defense 		<p>Fu Tianjiao (CFO)</p> <ul style="list-style-type: none"> ▶ Four major audits of China ▶ Europe MBA and BGI Gene

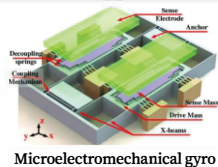
TECHNICAL ADVANTAGES

Firepower technology fully possesses independent design capabilities in micro nano integrated fiber optic gyroscopes, silicon optical chip integrated fiber optic gyroscopes, and complete inertial navigation system technologies. We have accumulated over ten years of research and development experience in the fields of optical sensing, mems sensing, and inertial navigation, with strong technical strength. We have mastered multiple core technologies including mems gyroscope and acceleration chip design, multi-core fusion technology, silicon optical chip technology, optical sensing, and inertial navigation. With the accumulation of technology, we have the ability to scale up industries and are in a leading position worldwide. Not only can we provide customers with high-performance products, but we can also significantly reduce production costs.

SILICON OPTICAL CHIP + OPTICAL FIBER SENSING UNIT

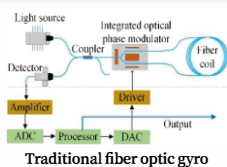
High Precision

10 times higher
Than MEMS Gyroscope



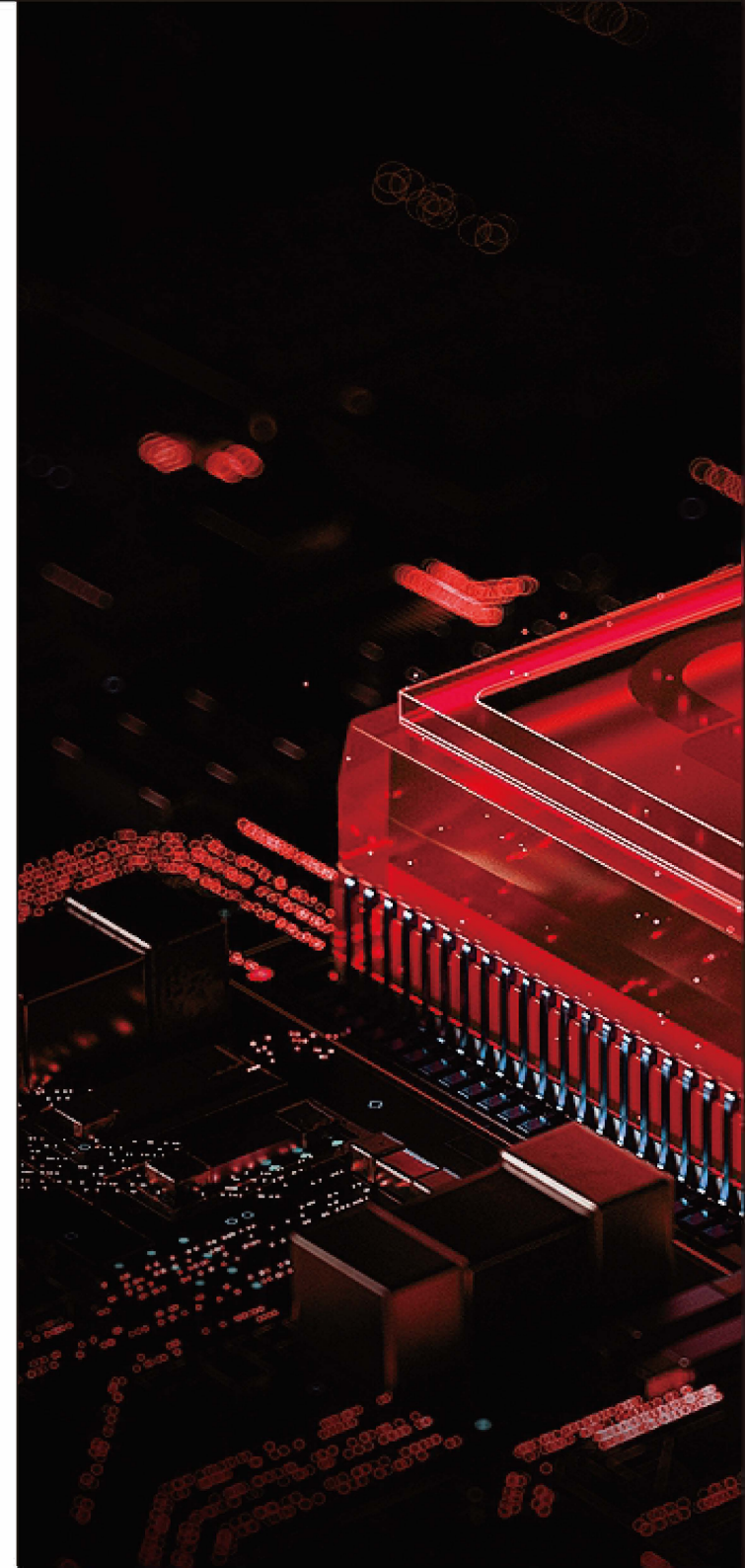
Low Cost

90% lower than
traditional FOG

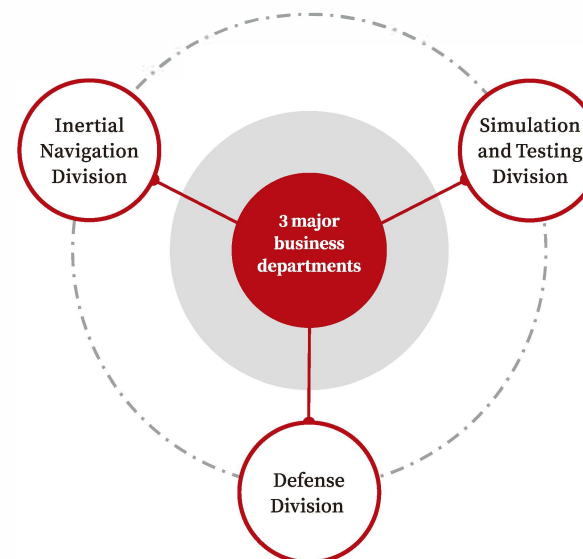


Small Size

50% smaller than
traditional FOG



BUSINESS ARCHITECTURE



PRODUCTION BASE

The core competitiveness lies in building "three major divisions, inertial navigation division, simulation and testing division and defense division.

The production lines are distributed in Shenzhen and Xi'an respectively, and Xi'an has China's advanced production conditions for silicon optical gyroscope devices, and has the ability to automatic mass production.

PRODUCTION ENVIRONMENT

Firepower technology has built clean rooms, electrical assembly production line, and environmental testing center that comply with the national "Clean Building Design Specification". It has complete precision measuring instruments and testing equipment, simulation testing systems, high and low temperature test chambers, vibration and shock test benches, precision optical indexing heads, functional centrifuges, mechanical testing rooms, anechoic chambers, multi axis turntables and other instruments and testing equipment to ensure product quality.





FIBER OPTIC INERTIAL DEVICE

- > Micro-nano integrated fiber optic gyroscope series
- > Close-loop fiber optic gyroscope series
- > High Precision Fiber Optic Gyro Inertial Navigation System

01

01

MFOG-24/091

Micro-nano integrated fiber optic gyroscope series

> **Product features:** Volume breaks the industry limit, zero bias repeatability, 2.0 °/h

> **Typical applications:**

1. Photoelectric pod, high-precision PTZ
2. Unmanned forklifts and large robots
3. Unmanned driving



PROJECT	UNIT	MFOG-24A	MFOG-091D	MFOG-091A
Measuring range	°/s	-300~+300	-300~+300	-300~+300
Zero bias stability	°/h(10s, 1σ)	≤2.5	≤2	≤2
Random walk coefficient	°/√h	0.04	0.03	0.04
Scale factor	/	7mv/°/s	3600LSB/°/s	7mv/°/s
Start time	s	≤1	≤2	≤1
Bandwidth	Hz	300	300	
Power supply	V	5±0.15	5±0.15	
Power	W	≤1	≤1.5	≤1
Operating temperature	°C	-45~+70	-45~+70	
Storage temperature	°C	-55~+85	-55~+85	
Vibration	Hz, g ² /Hz	20~2000,0.04	20~2000,0.04	
Impact	g,ms	30,11	30,11	
Output mode	/	Analog voltage	Rs422	Analog voltage
Connector	/	soldering pin/ pad	soldering pin/ pad	
Overall dimensions	mm	Φ24*40	Φ24*52	
Weight	g	≤30	≤30	

MFOG-103PT/095/910

Micro-nano integrated fiber optic gyroscope series

> **Product features:** simple structure, no moving parts, no wear parts, impact resistance, fast start, small size, light weight, high reliability

> **Typical applications:**

1. Photoelectric pod, high-precision PTZ
2. Unmanned forklifts and large robots
3. Unmanned driving
4. Control and measurement of motion carriers

01

PROJECT	UNIT	MFOG-103PT	MFOG-095	MFOG-910A	MFOG-910B
Measuring range	°/s	±350	±370	±240	
Zero bias stability	°/h(10s, 1σ)	≤1	≤1.5	≤0.8	
Zero-bias repeatability	°/h(1σ)	≤1	≤1.5	≤0.8	
Random walk coefficient	°/√h	≤0.02	≥450	≤0.02	
Scale factor	/	6±0.6	11±1.5	47±5	8±1
Start time	s			≤2	
Bandwidth	Hz	≥1000	≥450	≥300	
Power supply	V	5+0.25	5+0.25	5±0.25, ±12	5±0.25
Power	W	≤1	≤1	≤1	≤1
Operating temperature	°C	-45~+70			
Storage temperature	°C	-55~+85			
Vibration	Hz, g ² /Hz	20~2000, 0.04			
Impact	g.ms	≥1500	≥1500	30,11	30,11
Output mode	/	Analog voltage			
Connector	/	soldering pin /soldering pad			
Overall dimensions	mm	60 * 60 * 17	60 * 35 * 25.5	82*82*19.5	



01

MFOG-40 SERIES

Micro-nano integrated fiber optic gyroscope series

> Product features: Low cost, small size, high accuracy, zero bias stability better than 0.5°/h

> Typical applications:

1. Attitude Heading Reference System (AHRS), Position Orientation System (POS)
2. High-precision Photoelectric pod
3. Unmanned driving



PROJECT	UNIT	MFOG-40A	MFOG-40D
Measuring range	°/s	±300~±500(optional)	
Zero bias stability	°/h(10s, 1σ)	≤1	≤0.5
Zero-bias repeatability at full temperature	°/h(1σ)	≤2	≤1
Random walk coefficient	°/√h	0.02	0.015
Scale factor nonlinearity	ppm	500	300
Scale factor repeatability	ppm	300	
Scale factor asymmetry	ppm	300	
Start time	s	≤2	
Bandwidth	Hz	300	
Power supply	V	5±0.15	
Power	W	≤1.5	
Operating temperature	°C	-45~+70	
Storage temperature	°C	-55~+85	
Vibration	Hz, g ² /Hz	20~2000,0.04	
Impact	g,ms	30,11	
Data refresh rate	Hz	2000(Customizable)	
Baud rate	bps	921600(Customizable)	
Output mode	/	RS-422	
Connector	/	J30J-9TJL(Customizable)	
Overall dimensions	mm	Φ40*20	
Weight	g	Aluminum alloy shell ≤ 45, permalloy shell ≤ 75	

F50A

Close-loop Fiber Optic Gyroscope

>Product features:

Digital closed-loop mode, zero bias stability $0.5^{\circ} \sim 1^{\circ} / h$, small size $\phi 50mm \times 38mm$, lightweight $\leq 160 g$

>Typical applications:

1. Small inertial navigation and seeker
2. Servo tracking, photoelectric hoisting, unmanned aerial vehicle, unmanned ship

01



PROJECT	UNIT	F50A
Measuring range	$^{\circ}/s$	± 900
Zero bias stability	$^{\circ}/h, 10s$	0.1
Zero-bias repeatability	$^{\circ}/h$	0.1
Random walk coefficient	$^{\circ}/\sqrt{h}$	0.01
Scale factor nonlinearity	ppm	50
Scale factor repeatability	ppm	50
Scale factor asymmetry	ppm	50
Start time	S	5
Bandwidth	Hz	200
Power supply	V	+5
Power	W	4
Operating temperature	$^{\circ}C$	-40~+70
Storage temperature	$^{\circ}C$	-50~+70
Vibration	Hz, g^2/Hz	20~2000,0.06
Impact	g,ms	30,11
Baud rate	Bps	230400
Output mode	/	RS-422
Connector	/	Lead wires
Overall dimensions	mm	50x50x36
Installation dimensions	mm	41x41

01

FOG-60 SERIES

Close-loop fiber optic gyroscope series

> **Product features:** Digital closed-loop mode, zero bias stability $0.2^{\circ} \sim 0.8^{\circ}/h$, small size $\phi 60mm * 32mm$

> **Typical applications:**

1. Servo tracking, medium precision inertial navigation, platform stabilization
2. High-speed rail detection, photoelectric hoisting, mobile communication



PROJECT	UNIT	F60A	F60B	F60C	F60D
Measuring range	$^{\circ}/s$	$\pm 400 \sim \pm 800$ (optional)			
Zero bias stability	$^{\circ}/h, 10s$	≤ 0.05	≤ 0.1	≤ 0.3	≤ 1
Zero-bias repeatability	$^{\circ}/h$	≤ 0.05	≤ 0.1	≤ 0.3	≤ 1
Random walk coefficient	$^{\circ}/\sqrt{h}$	< 0.006	< 0.01	< 0.03	< 0.1
Scale factor nonlinearity	ppm	≤ 50	≤ 60	≤ 70	≤ 80
Scale factor repeatability	ppm	≤ 50	≤ 60	≤ 70	≤ 80
Scale factor asymmetry	ppm	≤ 50	≤ 60	≤ 70	≤ 80
Start time	s	≤ 1			
Bandwidth	Hz	500			
Power supply	V	$\pm 5 \pm 0.15$			
Power	W	≤ 6			
Operating temperature	$^{\circ}C$	$-40 \sim +70$			
Storage temperature	$^{\circ}C$	$-55 \sim +85$			
Vibration	Hz, g^2/Hz	20 ~ 2000, 0.06			
Impact	g,ms	30, 11			
Baud rate	bps	921600(Customizable)			
Output mode	/	RS-422			
Connector	/	J30J-15TJL/(Customizable)			
Overall dimensions	mm	60*60*32			
Installation dimensions	mm	52*52			

FOG-70 SERIES

Close-loop fiber optic gyroscope series

> **Product features:** Digital closed-loop mode, zero bias stability 0.05°~0.1°/h, weight ≤ 220g

> **Typical applications:**

1. Servo tracking, medium precision inertial navigation, platform stabilization
2. High-speed rail detection, photoelectric hoisting, mobile communication

01

PROJECT	UNIT	F70A	F70B	F70C	F70D
Measuring range	°/s	±400~±800(optional)			
Zero bias stability	°/h,10s	≤ 0.05	≤ 0.1	≤ 0.2	≤ 0.5
Zero-bias repeatability	°/h	≤ 0.05	≤ 0.1	≤ 0.2	≤ 0.5
Random walk coefficient	°/√h	≤ 0.005	≤ 0.01	≤ 0.02	≤ 0.05
Scale factor nonlinearity	ppm	≤ 50	≤ 60	≤ 60	≤ 80
Scale factor repeatability	ppm	≤ 50	≤ 60	≤ 60	≤ 80
Scale factor asymmetry	ppm	≤ 50	≤ 60	≤ 60	≤ 80
Start time	s	≤ 1			
Bandwidth	Hz	500			
Power supply	V	±5±0.15			
Power	W	≤ 6			
Operating temperature	°C	-40~+70			
Storage temperature	°C	-55~+85			
Vibration	Hz, g ² /Hz	20 ~ 2000, 0.06			
Impact	g,ms	30,11			
Baud rate	bps	921600(Customizable)			
Output mode	/	RS-422			
Connector	/	J30J-15TJL/(Customizable)			
Overall dimensions	mm	70*70*30			
Installation dimensions	mm	62*62			



01

FOG-98 SERIES

Close-loop fiber optic gyroscope series

> Product features:

Digital closed-loop mode, bias stability $0.007^{\circ} \sim 0.01/h$, high precision, weight ≤ 550 g

> Typical applications:

Precision northseeking, high precision inertial navigation system, vehicle positioning and orientation



PROJECT	UNIT	F98A	F98B	F98C	F98D
Measuring range	$^{\circ}/s$	$\pm 400 \sim \pm 800$ (optional)			
Zero bias stability	$^{\circ}/h, 10s$	≤ 0.005	≤ 0.01	≤ 0.02	≤ 0.05
Zero-bias repeatability	$^{\circ}/h$	≤ 0.005	≤ 0.01	≤ 0.02	≤ 0.05
Random walk coefficient	$^{\circ}/\sqrt{h}$	≤ 0.0005	≤ 0.001	≤ 0.002	≤ 0.005
Scale factor nonlinearity	ppm	≤ 20	≤ 30	≤ 40	≤ 50
Scale factor repeatability	ppm	≤ 20	≤ 30	≤ 40	≤ 50
Scale factor asymmetry	ppm	≤ 20	≤ 30	≤ 40	≤ 50
Start time	s	≤ 1			
Bandwidth	Hz	200			
Power supply	V	$\pm 5 \pm 0.15$			
Power	W	2.5			
Operating temperature	$^{\circ}C$	$-40 \sim +70$			
Storage temperature	$^{\circ}C$	$-55 \sim +85$			
Vibration	Hz, g^2/Hz	20~2000, 0.06			
Impact	g,ms	30,11			
Baud rate	bps	921600(Customizable)			
Output mode	/	RS-422			
Connector	/	J30J-15TJL/(Customizable)			
Overall dimensions	mm	98*98*33.5			
Installation dimensions	mm	80*80			

FOG-120 SERIES

Close-loop fiber optic gyroscope series

> **Product features:**

Quick start technology----minimal activation time, no external calibration required

Optimal wavelength ----- with the same structure, size, and cost, sensitivity is increased by 50%

Noise isolation and compression-----significantly reduce angle random walk

Auto-tracking technique----improve dynamic range of gyroscope.

> **Typical applications:**

Aerospace, integrated navigation system, inertial platform stabilization, vehicle navigation

PROJECT	UNIT	F120A	F120B	F120C	F120D
Measuring range	°/s	±400~±1000(optional)			
Zero bias stability	°/h,10s	≤ 0.003	≤ 0.008	≤ 0.01	≤ 0.03
Zero-bias repeatability	°/h	≤0.003	≤ 0.008	≤0.01	≤0.03
Random walk coefficient	°/√h	≤0.0004	≤0.0008	≤0.001	≤0.003
Scale factor nonlinearity	ppm	≤5	≤10	≤20	≤ 30
Scale factor repeatability	ppm	≤5	≤10	≤20	≤30
Scale factor asymmetry	ppm	≤5	≤10	≤20	≤30
Start time	s	≤1			
Bandwidth	Hz	>200			
Power supply	V	±5±0.15			
Power	W	≤6			
Operating temperature	°C	-40~+70			
Storage temperature	°C	-55~+85			
Vibration	Hz, g ² /Hz	20~2000,0.06			
Impact	g,ms	30,11			
Baud rate	bps	921600(Customizable)			
Output mode	/	RS-422			
Connector	/	J30J-15TJL/(Customizable)			
Overall dimensions	mm	120*120*39.5			
Installation dimensions	mm				



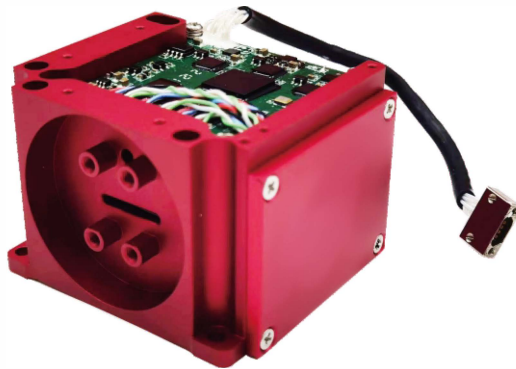
01

TG-40

Three-axis integrated fiber optic gyroscope series

> **Product features:** it consists of an optical angular velocity sensing unit and a signal detection unit to provide the angular increment of the gyro information and internal temperature information

> **Typical applications:** High precision inertial navigation system, positioning and orientation system, servo stabilization system and other applications



PROJECT	UNIT	TG-40M	TG-40
Measuring range	°/s	-500~+500	
Zero bias stability	°/h,10s	0.3	0.1
Zero-bias repeatability	°/h	0.3	0.1
Random walk coefficient	°/√h	0.02	0.01
Scale factor nonlinearity	ppm	20	20
Scale factor repeatability	ppm	10	10
Scale factor asymmetry	ppm	20	20
Start time	s	3	
Bandwidth	Hz	500	
Power supply	V	±5±0.15	
Power	W	4	
Operating temperature	°C	-40~+70	
Storage temperature	°C	-55~+85	
Vibration	Hz, g ² /Hz	20 ~2000,0 .06	
Impact	g,ms	30,11	
Baud rate	bps	921600(Customizable)	
Output mode	/	RS-422	
Connector	/	J30J-15TJL/(Customizable)	
Overall dimensions	mm	71.5*70.2*45	
Installation dimensions	mm	58*53*52.5*44.5	

STG-70H/75/90H

Three-in-one Fiber Optic Gyroscope Series

> **Product features:** It consists of an optical sensing meter head unit and a circuit box, providing external three-axis angular increment information and internal temperature information.

> **Typical applications:** Strapdown inertial navigation/inertial measurement system, positioning and orientation system, high-precision control platform and other application directions

01

PROJECT	UNIT	STG-70H	STG-75	STG-90H
Measuring range	°/s	±300		
Zero bias stability	°/h,10s	0.03	0.02	0.01
Zero-bias repeatability	°/h	0.01	0.008	0.003
Random walk coefficient	°/√h	0.002	0.001	0.0005
Scale factor nonlinearity	ppm	5	5	5
Scale factor repeatability	ppm	2	2	2
Scale factor asymmetry	ppm	5	5	5
Start time	s	≤1		
Bandwidth	Hz	>200		
Power supply	V	±5±0.15		
Power	W	4.5		
Operating temperature	°C	-40~+70		
Storage temperature	°C	-55~+85		
Vibration	Hz, g ² /Hz	20 ~2000,0.06		
Impact	g,ms	30,11		
Baud rate	bps	921600(Customizable)		
Output mode	/	RS-422		
Connector	/	J30J-15TJL/(Customizable)		
Overall dimensions	mm	Provide the size of the circuit box and the sensor head, see the manual for details, and the customer can design the support table body by himself		
Installation dimensions	mm			



01

MF-103 /MF-102 SERIES

High-precision north finder commercial grade (type A, B), industrial grade (type A, B)

> **Product features:** commercial-grade products with rich features ,built-in explosion-proof battery, easy to carry/Industrial -grade products are small in size, light in weight and low in power consumption;

> **Typical applications:**

1. Vehicle, initial alignment and direction control;
2. Provide accurate azimuth datum in tunnel construction, mining, geodetic survey and other projects;



PROJECT	UNIT	COMMERCIAL GRADE MF-103A	COMMERCIAL GRADE MF-103B	INDUSTRIAL GRADE MF-102A	INDUSTRIAL GRADE MF-102B
Communication mode		Screen display/mobile phone APP/upper computer software RS422/RS485		RS422/RS232	
Connector		J30JM-9ZKP	J30JM-9ZKP	J30JM-15ZKP	J30JM-15ZKP
Power consumption(with laser indication)	W	≤3	≤3	\	\
Power consumption(without laser indication)	W	≤1.2	≤1.2	≤1	≤1
Power supply	V	Standby for 18h with explosion-proof battery		DC9V~26V	DC9V~26V
Operating temperature	°C	0~+40	0~+40	- 40~+60	- 40~+60
North seeking time	min	≤3			
North seeking accuracy	°	±0.5	±1	±0.5	±1
Pitch accuracy	°	±0.1	±0.5	±0.1	±0.5
Roll angle accuracy	°	±0.1	±0.5	±0.1	±0.5
Tilt adaptability	°	±15			
Altitude measurement	m	include	include	\	\
Overall dimensions	mm	135*135*85		60*60*60	
Installation dimensions	mm	119*119		46*53	
Weight	g	≤1500	≤1500	≤400	≤400
Heading angle tracking measurement accuracy		0.5°(5min)			
Measurement accuracy of pitch angle tracking		0.1°(5min)			
Roll Angle Tracking Measurement Accuracy		0.1°(5min)			
Optional configuration		Ma Certified, Intrinsically Safe		Ma certified, flameproof Implementation standards: GB/T3836.1-2021 GB/T3836.2-2021	
IP rating		Ip55		Ip65	

01

IMU-300 SERIES

High-precision inertial measurement unit (Type A, Type B)

> **Product features:** Built-in multi-mode satellite navigation system can output high-precision IMU information acquisition synchronization signal. Selectable accelerometer measurement range, with redundant computing resources available for customer secondary development. The technical status of the shock absorber is optional.

> **Typical applications:**

1. Medium and large robots, platform stabilization
2. Intelligent tunneling machines, coal mining machines, transportation, large-scale bridge immersed tube docking, etc

PARAMETER		UNIT	IMU-300A	IMU-300B
Gyroscope	Measuring range	°/s	-500~+500	
	Random walk coefficient	°/√ h	≤0.0015	≤0.002
	Zero bias stability at room temperature	°/h (10s, 1σ)	≤0.01	≤0.015
	Zero bias stability at full temperature	°/h (10s, 1σ)	≤0.015	≤0.025
	Normal-temperature zero-bias repeatability	°/h (1σ)	≤0.01	≤0.015
	Zero-bias repeatability at full temperature	°/h (1σ)	≤0.015	≤0.02
	Scale factor nonlinearity	ppm	≤10	≤15
	Scale factor repeatability	ppm (1σ)	≤5	≤10
	Gyro start time	s	≤5	
Gyro bandwidth	Hz	≥300		
Accelerometer	Measuring range	g	-20~+20	
	Zero bias stability at full temperature	ug (10s, 1σ)	≤50	
	Zero-bias repeatability at full temperature	ug (1σ)	≤80	
	Starting time	s	≤5	
1. Environmental parameters				
	Operating temperature	°C	-40~+60	
	Storage temperature	°C	-45~+75	
	Vibration	Hz, g ² /Hz	20~2000, 0.04	
	Impact	g, ms	20, 11, half sine	
2. Electrical parameters				
	Power supply	V	+18~+36(DC)	
	Steady-state power	W	≤25	
	Data interface	/	RS-422/CAN/network port	
	Data refresh rate	Hz	≤200(settable)	
3. Physical parameters				
	Overall dimensions	mm	178*178*134.5	
	Installation dimensions	mm	162*162(4*Φ6.5)	
	Weight	kg	≤4.6	



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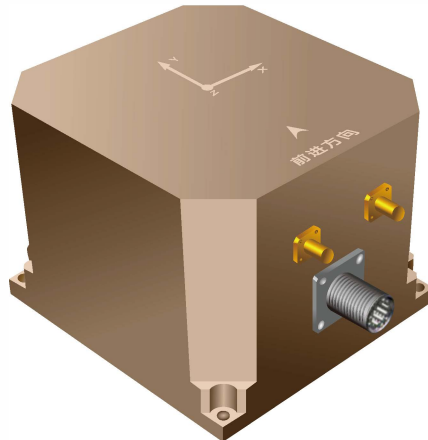
IMU-200 SERIES

High-precision inertial measurement unit (Type A, Type B)

> **Product features:** Built-in multi-mode satellite navigation system can output high-precision IMU information acquisition synchronization signal. Selectable accelerometer measurement range, with redundant computing resources available for customer secondary development. The technical status of the shock absorber is optional.

> **Typical applications:**

1. Medium and large robots, platform stabilization
2. Intelligent tunneling machines, coal mining machines, transportation, large-scale bridge immersed tube docking, etc



PARAMETER		UNIT	IMU-200A	IMU-200B
Gyroscope	Measuring range	°/s	-500~+500	
	Random walk coefficient	°/√ h	≤0.0015	≤0.002
	Zero bias stability at room temperature	°/h (10s, 1σ)	≤0.03	≤0.05
	Zero bias stability at full temperature	°/h (10s, 1σ)	≤0.05	≤0.08
	Normal-temperature zero-bias repeatability	°/h (1σ)	≤0.02	≤0.03
	Zero-bias repeatability at full temperature	°/h (1σ)	≤0.03	≤0.05
	Scale factor nonlinearity	ppm	≤10	≤30
	Scale factor repeatability	ppm (1σ)	≤10	≤30
	Gyro start time	s	≤5	
	Gyro bandwidth	Hz	≥300	
Accelerometer	Measuring range	g	-20~+20	
	Zero bias stability at full temperature	ug (10s, 1σ)	≤50	
	Zero-bias repeatability at full temperature	ug (1σ)	≤80	
	Starting time	s	≤5	
1. Environmental parameters				
	Operating temperature	°C	-40~+60	
	Storage temperature	°C	-45~+75	
	Vibration	Hz, g ² /Hz	20~2000, 0.04	
	Impact	g, ms	20, 11, half sine	
2. Electrical parameters				
	Power supply	V	+18~+36(DC)	
	Steady-state power	W	≤25	
	Data interface	/	RS-422/CAN/network port	
	Data refresh rate	Hz	≤200(settable)	
3. Physical parameters				
	Overall dimensions	mm	140*130*105	
	Installation dimensions	mm	120.5*130.5(4*05.5)	
	Weight	kg	≤4.0	

IMU-150 SERIES

High-precision inertial measurement unit (Type A, Type B)

> **Product features:** Built-in multi-mode satellite navigation system can output high-precision IMU information acquisition synchronization signal. Selectable accelerometer measurement range, with redundant computing resources available for customer secondary development. Lightweight, low power, built-in high precision crystal oscillator, time synchronization error within 1ppm. The technical status of the shock absorber is optional.

> **Typical applications:**

1. Mapping and underwater robot
2. Track detection and pipeline detection
3. High-precision agricultural machinery operation

PARAMETER		UNIT	IMU-150A	IMU-150B
Gyroscope	Measuring range	°/s	-500~+500	
	Random walk coefficient	°/√h	0.02	0.02
	Zero bias stability at room temperature	°/h (10s, 1σ)	≤0.1	≤0.2
	Zero bias stability at full temperature	°/h (10s, 1σ)	≤0.15	≤0.3
	Normal-temperature zero-bias repeatability	°/h (1σ)	≤0.1	≤0.2
	Zero-bias repeatability at full temperature	°/h (1σ)	≤0.15	≤0.3
	Scale factor nonlinearity	ppm	≤20	≤30
	Scale factor repeatability	ppm (1σ)	≤20	≤30
	Gyro start time	s	≤5	
Gyro bandwidth	Hz	≥300		
Accelerometer	Measuring range	g	-20~+20	
	Zero bias stability at full temperature	ug (10s, 1σ)	≤100	
	Zero-bias repeatability at full temperature	ug (1σ)	≤100	
	Starting time	s	≤5	
1. Environmental parameters				
Operating temperature		°C	-40~+60	
Storage temperature		°C	-45~+75	
Vibration		Hz, g ² /Hz	20~2000, 0.04	
Impact		g, ms	20, 11, half sine	
2. Electrical parameters				
Power supply		V	+9~+36(DC)	
Steady-state power		W	≤9	
Data interface		/	RS-422/CAN	
Data refresh rate		Hz	≤200(settable)	
3. Physical parameters				
Overall dimensions		mm	78*78*80	
Installation dimensions		mm	69.5*69.5(4*Φ4.5)	
Weight		kg	≤0.8	

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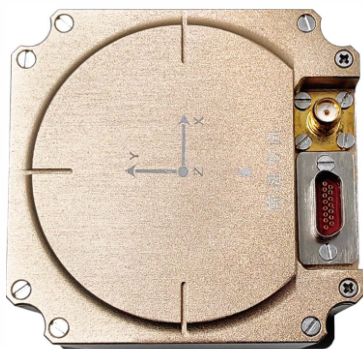
IMU-100 SERIES

High-precision inertial measurement unit (Type A, Type B)

> **Product features:** Wide measurement range, built-in multi-mode satellite navigation system, angular rate, linear acceleration, synchronization signal acquisition. Selectable accelerometer measurement range, built-in high precision crystal oscillator, time synchronization error within 1ppm. Support secondary development, the technical status of the shock absorber is optional.

> **Typical applications:**

1. Power inspection, mapping, robot
2. Platform stabilization, transportation, etc.



PARAMETER		UNIT	IMU-100A	IMU-100B
Gyroscope	Measuring range	°/s	-300~+300	
	Random walk coefficient	°/√h	0.03	0.08
	Zero bias stability at room temperature	°/h (10s, 1σ)	≤0.8	≤1.5
	Zero bias stability at full temperature	°/h (10s, 1σ)	≤1	≤3
	Normal-temperature zero-bias repeatability	°/h (1σ)	≤0.8	≤1.5
	Zero-bias repeatability at full temperature	°/h (1σ)	≤1	≤3
	Scale factor nonlinearity	ppm	≤300	
	Scale factor repeatability	ppm (1σ)	≤300	
	Gyro start time	s	≤5	
	Gyro bandwidth	Hz	≥300	
Accelerometer	Measuring range	g	-20~+20	
	Zero bias stability at full temperature	ug (10s, 1σ)	≤100	
	Zero-bias repeatability at full temperature	ug (1σ)	≤100	
	Starting time	s	≤5	
1. Environmental parameters				
Operating temperature		°C	-40~+60	
Storage temperature		°C	-45~+75	
Vibration		Hz, g ² /Hz	20~2000, 0.04	
Impact		g, ms	20, 11, half sine	
2. Electrical parameters				
Power supply		V	+9~+36(DC)	
Steady-state power		W	≤6	
Data interface		/	RS-422/CAN	
Data refresh rate		Hz	≤200(settable)	
3. Physical parameters				
Overall dimensions		mm	68*71*60	
Installation dimensions		mm	61*63.5(4*Φ4.6)	
Weight		kg	≤0.51	

INS-300 SERIES

High-precision fog GNSS/INS integrated inertial navigation system (Type A, Type B)

> **Product features:** high precision, gyro accuracy 0.008 (°)/h ~ 0.015 (0)/h (10s, 1σ); gyro measurement range, ± 500 (°)/s, accelerometer measurement range ± 20g, built-in multi-mode Satellite navigation system, the technical status of the shock absorber is optional.

> **Typical applications:**

1. High-precision positioning and orientation
2. High-speed rail inspection vehicle, coal mine intelligent roadheader, coal mining machine, digital map, 3D city modeling, etc.

PARAMETER	UNIT	INS-300A	INS-300B
Satellite navigation signal is valid			
Self-north-seeking heading accuracy	°	≤0.03/cosL, (1σ) (L is the local latitude)	≤0.06/cosL, (1σ) (L is the local latitude)
Azimuth measurement accuracy	°	≤0.02, (1σ)	≤0.03, (1σ)
Accuracy of attitude angle measurement	°	≤0.01, (1σ)	≤0.02, (1σ)
Speed accuracy	m/s	≤0.03	
Position accuracy	m	≤2m (single point)/RTK2cm (CEP)	
Satellite navigation signal loss Effect			
Satellite navigation signal failure	°	≤0.02, 1h (peak-to-peak value)	≤0.04, 1h (peak-to-peak value)
Accuracy of attitude angle maintenance	°	≤0.02, 1h (peak-to-peak value)	≤0.02, 1h (peak-to-peak value)
Inertial horizontal position accuracy (airborne)	n mile	1.0(50%CEP, 1h)	1.2(50%CEP, 1h)
Inertial horizontal position accuracy (on-board)	m	≤200(RMS, 1h)	≤300(RMS, 1h)
Inertial horizontal position accuracy (shipboard)	m	≤300(RMS, 1h)	≤500(RMS, 1h)
Horizontal position accuracy of inertial/DVL combination	m	0.2D%(D is mileage)	0.3D%(D is mileage)
Inertial/odometer combination horizontal position accuracy	m	0.1D%(D is mileage)	0.15D%(D is mileage)
System characteristics			
North-seeking mode	Estimate latitude, shake base(GPS or odometer available)		
Navigation mode	Pure Inertial, GPS Combination, Odometer Combination, Altimeter Combination, DVL Combination		
1. Environmental parameters			
Operating temperature	°C	-40~+60	
Storage temperature	°C	-45~+75	
Vibration	Hz, g ² /Hz	20~2000, 0.04	
Impact	g, ms	20, 11, half sine	
2. Electrical parameters			
Power supply	V	+18~+36 (DC)	
Steady-state power	W	≤25	
Data interface	/	RS-422/CAN/network port	
Data refresh rate	Hz	≤200(settable)	
3. Physical parameters			
Overall dimensions	mm	178*178*134.5	
Installation dimensions	mm	162*162(4*Φ6.5)	
Weight	kg	≤4.6	

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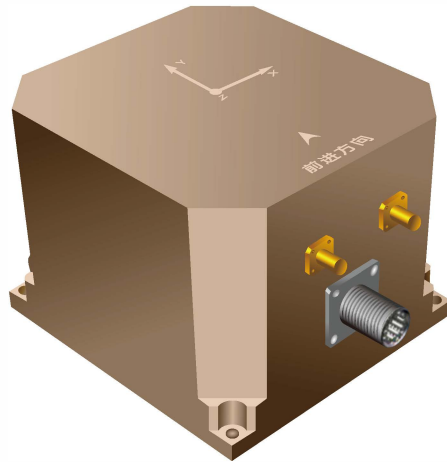
INS-200 SERIES

High-precision fog GNSS/INS integrated inertial navigation system (Type A, Type B)

> **Product features:** high precision, gyro accuracy 0.025 (°)/h ~ 0.04 (°)/h (10s, 1σ); gyro measurement range, ± 500 (°)/s, accelerometer measurement range ± 20g, built-in multi-mode Satellite navigation system, the technical status of the shock absorber is optional.

> **Typical applications:**

1. High-precision positioning and orientation
2. High-speed rail inspection vehicle, coal mine intelligent roadheader, coal mining machine digital map, 3D city modeling.



PARAMETER	UNIT	INS-200A	INS-200B
Satellite navigation signal is valid			
Self-north-seeking heading accuracy	°	≤0.1/cosL, (1σ) (L is the local latitude)	≤0.15/cosL, (1σ) (L is the local latitude)
Azimuth measurement accuracy	°	≤0.06, (1σ)	≤0.08, (1σ)
Accuracy of attitude angle measurement	°	≤0.03, (1σ)	≤0.03, (1σ)
Speed accuracy	m/s	≤0.03	
Position accuracy	m	≤2m(single point)/RTK2cm (CEP)	
Satellite navigation signal loss Effect			
Azimuth hold accuracy	°	≤0.06, 1h(peak-to-peak value)	≤0.1, 1h(peak-to-peak value)
Accuracy of attitude angle maintenance	°	≤0.03, 1h(peak-to-peak value)	≤0.04, 1h(peak-to-peak value)
Inertial horizontal position accuracy (airborne)	m	≤1000(RMS, 20min)	≤2000(RMS, 20min)
Inertial/odometer combination horizontal position accuracy		≤0.25D%(D is mileage)	≤0.4D%(D is mileage)
System characteristics			
North-seeking mode	Estimate latitude, shake base(GPS or odometer available)		
Navigation mode	Pure inertia, GPS combination, odometer combination, altimeter combination		
1. Environmental parameters			
Operating temperature	°C	-40~+60	
Storage temperature	°C	-45~+75	
Vibration	Hz, g ² /Hz	20~2000, 0.04	
Impact	g, ms	20, 11, half sine	
2. Electrical parameters			
Power supply	V	+18~+36 (DC)	
Steady-state power	W	≤25	
Data interface	/	RS-422/CAN/ Network	
Data refresh rate	Hz	≤200(settable)	
3. Physical parameters			
Overall dimensions	mm	178*178*134.5	
Installation dimensions	mm	162*162(4*Φ6.5)	
Weight	kg	≤4.6	

INS-150SERIES

High-precision fog GNSS/INS integrated inertial navigation system (Type A, Type B)

> **Product features:** high precision, gyro precision 0.08 (°)/h ~ 0.15 (°)/h (10s, 1σ); gyro measurement range, ± 500 (°)/s, accelerometer measurement range ± 20 g, optional built-in multi-mode satellite navigation system, optional technical status with shock absorber

> **Typical applications:**

1. High-precision positioning and orientation
2. High-speed rail inspection vehicle, coal mine intelligent roadheader, coal mining machine, digital map, 3D city modeling.

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PARAMETER	UNIT	INS-150A	INS-150B
Satellite navigation signal is valid			
Self-north-seeking heading accuracy	°	≤0.3/cosL, (1σ) (L is the local latitude)	≤0.45/cosL, (1σ) (L is the local latitude)
Azimuth measurement accuracy	°	≤0.06, (1σ)	≤0.08, (1σ)
Accuracy of attitude angle measurement	°	≤0.03, (1σ)	≤0.04, (1σ)
Speed accuracy	m/s	≤0.03	
Position accuracy	m	≤2m(single point)/RTK2cm (CEP)	
Satellite navigation signal loss Effect			
Azimuth hold accuracy	°	≤0.1(1σ,1h)	≤0.15(1σ,1h)
Accuracy of attitude angle maintenance	°	≤0.05,1h(1σ,1h)	≤0.08(1σ,1h)
Inertial/odometer combination horizontal position accuracy	m	≤0.6D%(D is mileage)	≤0.9D%(D is mileage)
System characteristics			
North-seeking mode	Estimate latitude, shake base(GPS or odometer available)		
Navigation mode	Pure inertia, GPS combination, odometer combination, altimeter combination		
1. Environmental parameters			
Operating temperature	°C	-40~+60	
Storage temperature	°C	-45~+75	
Vibration	Hz, g ² /Hz	20~2000,0.04	
Impact	g,ms	20,11, half sine	
2. Electrical parameters			
Power supply	V	+9~+36 (DC)	
Steady-state power	W	≤9	
Data interface	/	RS-422/CAN/Network	
Data refresh rate	Hz	≤200 (settable)	
3. Physical parameters			
Overall dimensions	mm	78*78*80	
Installation dimensions	mm	69.5*69.5(4*Φ4.5)	
Weight	kg	≤0.8	

INS-100 SERIES

Micro-nano integrated fiber optic gyroscope GNSS/INS integrated inertial navigation system (type A, type B)

> **Product features:** ultra-small size, lightweight, accelerometer measurement range $\pm 20g$, gyro accuracy $0.5 (^{\circ})/h \sim 1.5 (^{\circ})/h$ (10s, 1σ) high reliability, long life, built-in multi-mode satellite navigation system, optional technical status with shock absorber

> **Typical applications:**

1. Attitude/azimuth reference system, multi-beam attitude sensing
2. Navigation control of high-speed rail inspection vehicle
3. Stabilization platform, pod, attitude stabilization, mobile communication , AHRS, pipeline survey, etc.



PARAMETER	UNIT	INS-100A	INS-100B
Satellite navigation signal is valid			
Self-north-seeking heading accuracy	$^{\circ}$	$\leq 1.5/\cos L, (1\sigma)$ (L is the local latitude)	$\leq 2.5/\cos L, (1\sigma)$ (L is the local latitude)
Azimuth measurement accuracy	$^{\circ}$	$\leq 0.2, (1\sigma)$	$\leq 0.3, (1\sigma)$
Accuracy of attitude angle measurement	$^{\circ}$	$\leq 0.07, (1\sigma)$	$\leq 0.1, (1\sigma)$
Speed accuracy	m/s	≤ 0.03	
Position accuracy	m	$\leq 2m(\text{single point})/\text{RTK}2cm$ (CEP)	
Satellite navigation signal loss Effect			
Azimuth hold accuracy	$^{\circ}$	$\leq 0.8(1\sigma, 1h)$	$\leq 1.5(1\sigma, 1h)$
Accuracy of attitude angle maintenance	$^{\circ}$	$\leq 0.3(1\sigma, 1h)$	$\leq 0.5(1\sigma, 1h)$
Pure inertial horizontal position accuracy	m	20(RMS, 100s)	40(RMS, 100s)
System measurement range			
Azimuth measurement range	$^{\circ}$	0~360	
Attitude angle measurement range	g	-90~+90	
Bandwidth	Hz	300	
1. Environmental parameters			
Operating temperature	$^{\circ}C$	-40~+60	
Storage temperature	$^{\circ}C$	-45~+75	
Vibration	Hz, g^2/Hz	20~2000, 0.04	
Impact	g, ms	20, 11, half sine	
2. Electrical parameters			
Power supply	V	+9~+36(DC)	
Steady-state power	W	≤ 6	
Data interface	/	RS-422/CAN/Network	
Data refresh rate	Hz	$\leq 200(\text{settable})$	
3. Physical parameters			
Overall dimensions	mm	68*71*60	
Installation dimensions	mm	61*63.5(4* Φ 4.6)	
Weight	kg	≤ 0.51	

INS 500 FIBER OPTIC INTEGRATED NAVIGATION SYSTEM

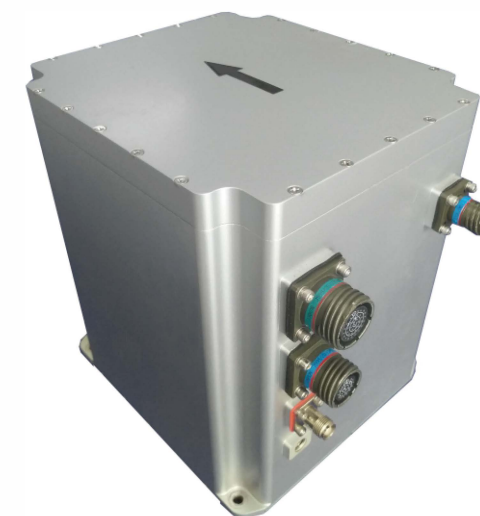
> **Product features:** It is realized by multi-sensor fusion and navigation calculation algorithm, and provides high precision navigation attitude, speed, degree, position and other information to meet the requirements of high-precision measurement and control.

> **Typical applications:**

Reference inertial navigation, marine compass, vehicle-mounted positioning and orientation, high precision mobile measurement, high precision stable platform

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PROJECT	TEST CONDITIONS	A0 INDICATOR	B0 INDICATOR
Positioning accuracy	GNSS Valid, Single Point	1.2m (RMS)	1.2m (RMS)
	GNSS Valid, RTK	2cm+1ppm (RMS)	2cm+1ppm (RMS)
	Position holding (GNSS failure)	1.5nm/h (50%CEP), 5nm/2h (50%CEP)	0.8nm/h (CEP), 3.0nm/3h (CEP)
Heading accuracy	Self-north seeking accuracy	0.1° × sec (Lati), Lati is latitude (RMS), 10 min	0.06° × sec (Lati), 5min alignment of stationary base; 0.03° × sec (Lati), 10 min alignment of stationary base; Where Lati denotes the latitude (RMS).
	Heading holding (GNSS failure)	0.05°/h (RMS), 0.1°/2h (RMS)	0.02°/h (RMS), 0.05°/3h (RMS)
Attitude accuracy	GNSS is valid	0.03° (RMS)	0.01° (RMS)
	Attitude holding (GNSS failure)	0.02°/h (RMS), 0.06°/2h (RMS)	0.01°/h (RMS), 0.03°/3h (RMS)
Speed accuracy	GNSS valid, single point L1/L2	0.1m/s (RMS)	0.1m/s (RMS)
	Speed holding (GNSS failure)	2m/s/h (RMS), 5m/s/2h (RMS)	0.8m/s/h (RMS), 3m/s/3h (RMS)
Optical fiber Gyroscope	Measuring range	±400°/s	±400°/s
	Zero bias stability	≤0.02°/h	≤0.01°/h
Accelerometer	Measuring range	±20g	±20g
	Zero bias stability	≤50μg (10 s average)	≤20μg (10 s average)
Communication interface	Rs422	6-channel baud rate: 9.6 kbps ~ 921.6 kbps, default: 115.2k bps Frequency up to 1000Hz (raw data), default 200Hz	
	Rs232	Baud rate of channel 1: 9.6 kbps ~ 921.6 kbps, default: 115.2k bps Frequency up to 1000Hz (raw data), default 200Hz	
Electrical characteristics	Voltage	24~36VDC	
	Power consumption	≤30W	
Structural characteristics	Size	199mm × 180mm × 219.5mm	
	Weight	6.5kg	≤7.5kg (non-aviation) ≤6.5kg (optional for aviation)
Use environment	Operating temperature	-40°C~+60°C	
	Storage temperature	-45°C~+65°C	
	Vibration (with shock absorption)	5~2000Hz, 6.06g	
	Shock (with shock absorption)	30g, 11ms	
Reliability	Life span	>15years	
	Continuous working time	>24h	



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INS 600A-B0 INTEGRATED NAVIGATION SYSTEM

> **Product features:** It has the function of shaking base/moving base alignment, self-seeking north function and multi-sensor information fusion integrated navigation, and long time accuracy maintenance without satellite/external information assistance.

> **Typical applications:** underwater equipment, mobile measurement, high-precision stable platform, etc.



PROJECT	TEST CONDITIONS	INDICATOR
Positioning accuracy	GNSS Valid, Single Point	Better than satellite positioning accuracy
	GNSS Valid, RTK	Better than satellite positioning accuracy
	Pure inertial horizontal positioning holding ①	4nm/60min(CEP) 1nm/30min(CEP) 200m/6min(CEP)
Heading accuracy	Dual antenna	0.2 °/L (L = baseline length) (RMS)
	Heading holding	005°/30min(RMS),0.1°/h(RMS)①
	Self-north seeking accuracy	0.3 ° SecL, alignment 15 min
Attitude accuracy	GNSS is valid	0.05°(RMS)
	Attitude holding (GNSS failure)	0.05°/30min(RMS),0.1°/h(RMS)①
Gyroscope	Measuring range	±400°/s
	Zero bias stability	≤0.3°/h②
Accelerometer	Measuring range	±16g
	Zero bias stability	≤100μg②
Physical dimensions and electrical characteristics	Voltage	10-36VDC
	Power consumption	≤9W
	Interface	See the electrical interface description section of this document for details.
	Size	110mm × 94mm × 94mm (L, W, H)
Environmental characteristics	Weight	≤1kg
	Operating temperature	-40°C+65°C
	Storage temperature	-45°C+70°C
	Vibration	202000Hz,6.06g③
	Impact	30g,11ms③
	Life span	> 15 years
Continuous working time	>24h	

Note: ① Valid alignment; ② Average in 10s; ③ With shock absorption.

MEMS INERTIAL DEVICES

- > MEMS Gyroscopes
- > MEMS Inertial Measurement Unit
- > MEMS Inertial Navigation Systems

02

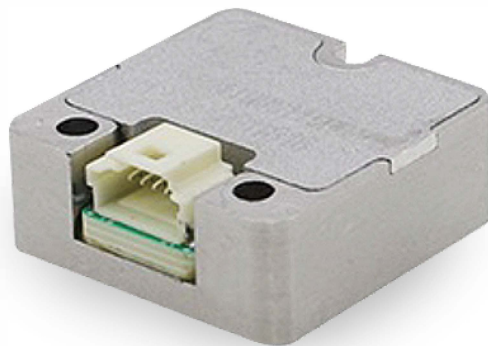
02

MEMS MG115 TRI-AXIS GYROSCOPE

> **Product features:** Low vibration rectification error, low power consumption, low delay, impact resistance, high precision, low noise, good repeatability, full compensation, small size, light weight, easy to install.

> **Typical applications:**

Electro-optical pod, high-speed rail, oil exploration, stabilization platform



PARAMETER		TEST CONDITIONS	UNIT	MINIMUM VALUE	TYPICAL VALUE	MAXIMUM VALUE
Gyroscope	Dynamic measuring range		°/s		250~500	
	Zero bias stability	Allan variance	°/h		4	
		10 s avg (-400+ 80 C constant temperature)	°/h		8	
	Zero bias	Zero bias range	°/s		±0.15	
		Zero-bias variation over full temperature range	°/s		±0.2	
	Scale factor	Scale factor accuracy		%	0.15	
Scale factor nonlinearity			%FS	0.02		
	Bandwidth		Hz	80		
Accelerometer	Dynamic measuring range	This function is optional.				
Communication interface	1-way UART	Baud rate	Kbps		115.2	460.8
	Sampling frequency	UART	Hz		200	1000
Electrical characteristics	Voltage		V	4.5	5	5.5
	Power consumption		W			0.35
	Ripple	P-P	mV			20
Structural characteristics	Size		mm		22.4*22.4*9.5	
	Weight		g		16	
Use environment	Operating temperature		°C	-40		80
	Storage temperature		°C	-45		85
	Vibration				20~2000Hz, 3g	
	Impact				1000g, 0.5ms	
Reliability	MTBF		h		20000	
	Continuous working time		h		120	
The zero deviation of the whole temperature change process is calculated, the temperature change rate is ≤1°C/min, and the temperature range is -40 °C ~ + 80 °C						

MEMS THREE-AXIS GYROSCOPE

> **Product features:** Low vibration rectification error, small size, light weight, easy installation, full compensation, high precision, low noise, good repeatability, low power consumption, low delay, impact resistance.

> **Typical applications:**

Inertial navigation, electro-optical pod, high-speed rail, oil exploration, stabilized platform

02

	PARAMETER	UNIT	MG3-1A
Gyroscope	Measuring range (customizable)	°/s	±400
	Zero bias stability(@ Allan Variance)	°/h	1
	Zero bias stability (1s smooth, 1σ, room temperature)	°/h	10
	Zero bias stability (10 s smooth, 1σ, room temperature)	°/h	5
	Zero-bias error over full temperature range	°/h	20
	Random walk	°/√h	0.2
	Zero-bias repeatability	°/h	10
	Zero bias acceleration sensitivity	°/h/g	1
	Resolution	°/h	2
	Scale factor nonlinearity	ppm	100
	Scale factor repeatability	ppm	100
	Cross coupling	%	0.1
Bandwidth	Hz	125	
Electrical parameters	Voltage	V	5
	Power consumption	W	2
	Ripple	mV	100
	Operating temperature	°C	-45~85
	Storage temperature	°C	-55~105
	Vibration	--	10~2000Hz, 6.06g
	Impact	-	1000g,0.1ms
	Weight	g	52±5



02

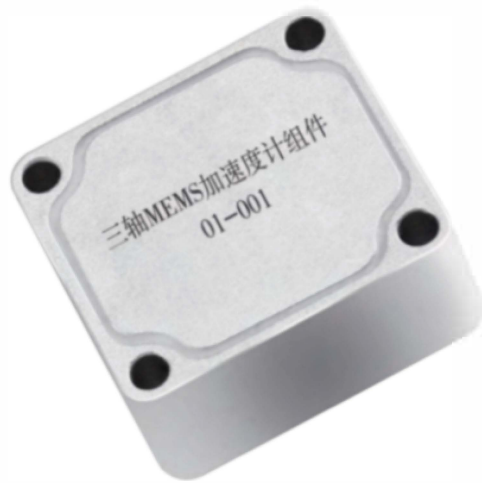
MEMS THREE-AXIS GYROSCOPE

> Product features:

Low vibration rectification error, small size, light weight, easy installation, full compensation, high precision, low noise, good repeatability, low power consumption, low delay, impact resistance.

> Typical applications:

inertial navigation, electro-optical pod, high-speed rail, oil exploration, stabilized platform



PARAMETER (TYPICAL VALUE)	UNIT	BASIC TYPE	MG2-2 A	MG2-2 B	MG2-2 C
Measuring range	°/s	±400	±400	±400	±300
Zero offset	°/h	15	10	5	8
Zero-bias instability (@ Allan variance)	°/h	0.3	0.1	0.05	0.2
Zero-bias stability(10 s smooth, 10, room temperature)	°/h	3	1	0.4	1
Zero-bias repeatability	°/h	3	1	0.3	0.5
Zero-bias error over full temperature range	°/h	20	10	2	5
Random walk	°/√ h	0.15	0.05	0.02	0.03
Zero bias acceleration sensitivity	°/h/g	2	2	2	2
Resolution	°/h	2	1	0.5	1
Output Noise (Half Peak)	°/s	0.3	0.25	0.15	0.2
Bandwidth	Hz	250	250	150	400
Scale factor nonlinearity	ppm	100	100	100	100
Scale factor repeatability	ppm	100	100	100	100
Cross coupling	%	0.1			
Startup stabilization time	s	< 1			
Data update rate	Hz	2000			
Voltage	V	+5±0.25			
Starting current	mA	<120			
Steady-state power consumption	W	< 0.4			
Ripple	mV	100			
Operating temperature	°C	-45~85			
Storage temperature	°C	-55~105			
Weight	g	50			
Size	mm	22*20*10.2			
Interface	—	RS-422			

MEMS MG2-1 DUAL-AXIS GYROSCOPE

> **Product features:** Low vibration rectification error, low power consumption, low delay, impact resistance, high precision, low noise, good repeatability, full compensation, small size, light weight, easy installation.

> **Typical applications:**

Electro-optical pod, high-speed rail, oil exploration, stabilization platform, inertial navigation

02

PARAMETER (TYPICAL VALUE)	UNIT	BASIC TYPE	TYPE A (X, Z)	TYPE B (X, Z)	TYPE C (X, Z)
Measuring range	°/s	±400	±400	±400	±300
Zero offset	°/h	15	10	5	8
Zero-bias instability (@ Allan variance)	°/h	0.3	0.1	0.05	0.2
Zero-bias stability (10 s smooth, 10, room temperature)	°/h	3	3	0.4	1
Zero-bias repeatability	°/h	3	3	0.3	0.5
Zero-bias error over full temperature range	°/h	20	20	2	5
Random walk	°/√h	0.15	0.05	0.02	0.03
Zero bias acceleration sensitivity	°/h/g	2	2	2	2
Resolution	°/h	2	1	0.5	1
Output Noise (Half Peak)	°/s	0.3	0.25	0.15	0.2
Bandwidth	Hz	250	250	150	400
Scale factor nonlinearity	ppm	100	100	100	100
Scale factor repeatability	ppm	100	100	100	100
Cross coupling	%	0.1			
Startup stabilization time	s	< 1			
Data update rate	Hz	2000			
Voltage	V	+5±0.25			
Starting current	mA	<200			
Steady-state power consumption	W	< 0.5			
Ripple	mV	100			
Operating temperature	°C	-45~85			
Storage temperature	°C	-55~105			
Weight	g	50			
Size	mm	21.5*21.5*30			
Interface	—	RS-422			

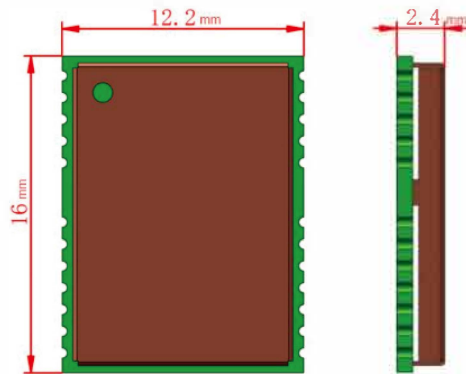


02

MULTI-SYSTEM DUAL-FREQUENCY POINT HIGH-PRECISION GNSS MODULE

NAV3310SAB multi-system dual-frequency high-precision GNSS module, based on MIKAG3335at chip, supports BDS/GPS/GLONASS/Galileo/OzsS signal reception, fully supports the new generation of Beidou global satellite signals and built-in RTK algorithm. It can provide high-quality observation data and position, speed and time.

Information, applicable to IOT devices and vehicle terminals with high requirements for positioning accuracy and power consumption.



Mechanical properties	
Mechanical dimension (mm)	16*12.2*2.4
Encapsulation	LCC 24Pin
Weight, g	1
Temperature range	
Operating temperature	-40°C~+85°0
Storage temperature	-40°C~+90°0
GNSS characteristics	
Supported frequency bands	GPS/OZSS: L1 C/A; L5、Galileo: E1; E5a、BeiDou: B1I: B2A、GLONASS:L1、 NAVIC
Function	PVT positioning/RTK positioning/GNSS raw data
Number of channels	Channel 135
Position accuracy	Single point positioning: ≤ 1m CEP RTK: <0.02m + 1ppm CEP (room temperature, open environment, signal power -130dBm)
Speed accuracy	≤ 0.1 m/s CEP
TTF	Cold start: < 28 s Warm start: < 20 s Hot start: ≤ 2 recaptures: < 2 s (preliminary data)
Sensitivity	Capture (Cold Start): -148 dBm Tracking: -166 dBm Recapture: -158 dBm (Preliminary Data)
Dynamic performance	Maximum altitude: 18000 m Maximum speed: 500m/s Maximum acceleration: 4.0 G
Maximum update ratio	GNSS raw data: 1Hz PVT: 1Hz RTK: 1Hz
Interface	
UART	Adjustable baud rate: 9600 ~ 921600 bps Default baud rate: 115200 bps
Agreement	
Supported protocols	NMEA 0183/RTCM 3.x
External antenna interface	
Antenna type	Active antenna
Antenna power supply	Externally provided
Electrical characteristics	
Supply voltage range	2.8 V to 4.3 V, 3.3 V recommended
Power consumption (capture)	30mA. @ VCC=3.3 V
Power Consumption (Sleep)	340uA. @ VCC=3.3 V
Power consumption (RTC)	60uA. @ VCC=3.3V

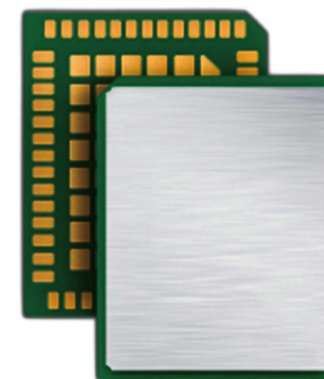
02

NAV3120 FULL-FREQUENCY HIGH-PRECISION POSITIONING MODULE

Product advantages:

- Manufactured strictly accordance with IATF16949: 2016 automotive industry quality management system standard
- Support multiple GNSS constellations of BDS/GPS/GLONASS/Galileo/QZSS
- Support full-system full-frequency point on-chip RTK positioning and dual-antenna directional calculation
- Support INS integrated navigation

Basic characteristics	
Operating Voltage	3.0 V~3.6 V, 3.3 V recommended
Operating Temperature	-40°C~+105°C
Power Consumption	115mA@3.3V
Size	17mm*22mm*3.1mm(LGA 54PIN)
Weight	About 2 grams
GNSS characteristics	
Number Of Channels	1040
Frequency Band	GPS/QZSS: L1 C/A;L1C;L2C;L5 BDS: B11;B1C;B21;B2a;B2b;B31 GAL: E1;E5a;E5b GLO: G1;G2 PPP*:L-Band;B2b;L6;E6
Ttff	Cold start:27 s Hot start:1s RTK convergence:< 5S
Single Point Positioning (rms)	Level: 1.5m Elevation: 2.5m(static open sky)
Rtk Positioning(rms)	Level:1 cm + 1ppm Elevation:1.5cm+1ppm(static opensky)
Directional Accuracy (rms)	0.2°/m baseline *
Speed Measurement Accuracy E(rms)	0.03m/s
Timing Accuracy(rms)	20ns
Position Estimation Accuracy(10)	8%* Driving distance (1km/120s)
Dead-reckoning Accuracy(10)	≤0.5*(60s)*
Data output	
Data Protocol	Nmea0183/RTCM3/Asensing
Output Frequency	RTK(20Hz) INS(200Hz)
IMU characteristics	
Gyro Scale Factorerror	5%
Angular Random Walk	0.21°/vh
Gyro Range	±4000°/s
Scale Factor Error Ofaddition Table	5%
Speed Random Walk	0.036m/svh
Accelerometer Range	±16g
Interface characteristics	
Uart	X4 Baud rate:9600921600 bps Default: 460800 bps
Other	CAN x1*/PPS x2/SP1 x1/12C x1
Certification	
RoHS	

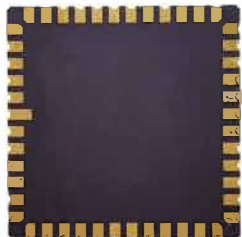


02

MEMS GYROSCOPE CHIP

IMU is an inertial measurement unit based on micromachining technology (MEMS).

(IMU) with built-in high-performance MEMS sensors. Has that advantage of high reliability, high environment adaptability and the like.



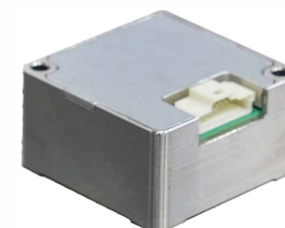
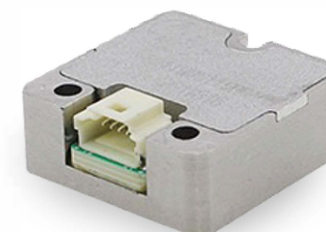
PARAMETER		UNIT	MGZ332HC-P1	MGZ332HC-P5	MGZ318HC-A1	MGZ221HC-A4	MGZ330HC-01	MGZ332HC-E1	MGZ330HC-A1
Performance	Range	deg/s	400	400	400	400	400	400	400
	Output accuracy	bits				24bit			
	Data output rate	Hz	12K	12K	12K	12K	12K	2K	2K
	Delay	ms	<3	<1.5	<1.5	<1.5	<1	<50	<6
	Phase delay	deg	《90deg	《90deg	《90deg	《90deg	《90deg		《90deg
	Bandwidth	Hz	≥90	≥180	≥180	≥200	300	12	≥50
	Scale factor	lsb/deg/s	20000	20000	16000	16000	20000	80000	80000
	Scale factor repeatability	ppm	<20	<20	<20	<20	<100	<100	<100
	Temperature drift of scale factor	ppm	100	100	100	100	<300	<300	<300
	Scale factor nonlinearity	ppm	100	100	150	150	<300	<300	<300
	Zero bias stability	deg/hr	0.05	0.05	0.1	0.5	<0.1	<0.02	<0.02
	Zero bias stability	deg/hr	<0.5	<0.5	<1	<5	<1	<0.1	<0.1
	Zero bias stability	deg/hr	<1.5	<1.5	<3	<15	<3	<0.3	<0.3
	Angular random walk	°/√h	<0.025	<0.025	<0.05	<0.25	<0.05	<0.005	<0.005
	Zero bias temperature drift	deg/Hr	<5	<5	<10	<30	<10	3	5
	Zero bias temperature drift	deg/Hr	<0.5	<0.5	<1	<10	<1	<0.3	<0.5
	Zero-bias repeatability	deg/hr	<0.5	<0.5	<0.5	<3	<0.3	<0.1	<0.1
	Broadband noise	deg/s	<0.15	<0.15	<0.35	<0.4	<0.25	<0.005	<0.015
	G value sensitivity	°/hr/g	<1	<1	<1	<3	<1	<1	<1
	Vibration rectification error	°/hr/g (rms)	<1	<1	<1	<3	<1	<1	<1
Power-on time	S				750m				
Drive shaft frequency	HZ				10.5k-13.5k				
Environmental suitability	Impact (electrified)		500g, 1ms						
	Shock resistance (uncharged)		10000g, 10ms						
	Vibration (electrification)		18 grms, screening spectrum						
	Operating temperature		Minus 40 degrees Celsius 85 degrees Celsius						
	Storage temperature		Minus 55 degrees Celsius 125 degrees Celsius						
	Supply voltage		5±0.25V						
	Electric current		45ma						

MEMS INERTIAL MEASUREMENT UNIT

The IMU has high reliability and strong environmental adaptability, and by matching different software, it can be widely used in intelligent driving, seeker, mobile communication, mapping, stable platform and other fields.

02

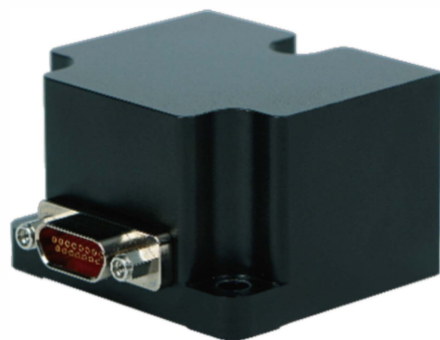
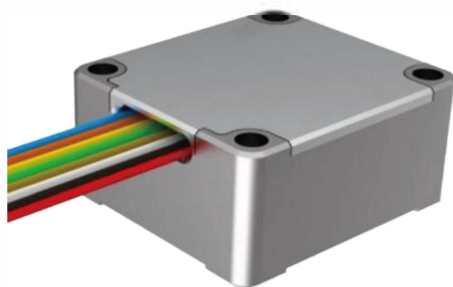
PARAMETER		TEST CONDITIONS	IMU305	IMU103	IMU109	UNIT
Gyroscope	Dynamic measuring range		500	500	250/500	°/s
	Zero bias stability	Allan variance	2	1	3/4	°/h
		10 s average (-40 °C ~ +80 °C, constant temperature)	4	2.5	5/7	°/h
	Zero bias	Zero bias range	±0.02	±0.02	±0.1	°/s
		Zero-bias variation over full temperature range	±0.01	±0.01	±0.1	°/s
	Scale factor	Scale factor accuracy	0.2	0.15	0.15	%
Scale factor nonlinearity		0.02	0.005	0.015	%FS	
Bandwidth		80 / 150	80 / 150	80 / 150	Hz	
Accelerometer	Dynamic measuring range		4 / 16	16	4 / 16	g
	Zero bias stability	Allan variance	0.065	0.02	0.055 / 0.06	mg
		10 s average (-40 °C ~ +80 °C, constant temperature)	0.03	0.035	0.1 / 0.12	mg
	Zero bias	Zero bias range	±0.6	±0.75	±1.5	mg
		Zero bias change in full temperature range, peak-to-peak value	±3	±1	±1.5	mg
	Scale factor	Scale factor accuracy	0.1	0.2	0.3	%
Scale factor nonlinearity		0.02	0.03	0.03	%FS	
Bandwidth		80 / 150	80 / 150	80 / 150	Hz	
Posture	Roll & Pitch Accuracy		0.1° optional	-	-	°
Posture	Precision		-	-	-	°
Magnetometer	Resolution		-	-	-	
Output Interface		Uart TTL	Uart TTL	Uart TTL	Uart TTL	
		200~1000	200~1000	200~1000	200~1000	Hz
Electrical characteristics	Voltage		5			V
	Power consumption		0.35	1.5		W
Structural characteristics	Size		22.4*22.4*9.5	30*30*16	22.4*22.4*10.54	mm
	Weight		16	40	20	g
Use environment	Operating temperature		-40~+80			°C
	Storage temperature		-45~+85			°C
	Vibration		20~2000Hz, 6g			
	Impact		1000g, 0.5ms			
Reliability	MTBF		20000			h
	Continuous working time		120			h
The zero deviation of the whole temperature change process is calculated, the temperature change rate is ≤1 °C/min, and the temperature range is -40 °C ~ +80 °C						



02

MEMS INERTIAL MEASUREMENT UNIT

IMU has high reliability and strong environmental adaptability. By matching different software, it can be widely used in intelligent driving, industrial automatization system, intelligent navigation, mobile communication, mapping, stable platform and other fields.



PARAMETER		TEST CONDITIONS	IMU123	IMU563	UNIT
Gyroscope	Dynamic measuring range		500	250/500	°/s
	Zero bias stability	Allan variance	1.8	4	°/h
		10 s average (-40 °C ~ +80 °C, constant temperature)	3.5	6	°/h
	Zero bias	Zero bias range	±0.06	±0.07	°/s
		Zero-bias variation over full temperature range	±0.1	±0.3	°/s
	Scale factor	Scale factor accuracy	0.15	0.15	%
Accelerometer	Bandwidth	Scale factor nonlinearity	0.015	0.015	%FS
			150	80 / 150	Hz
	Dynamic measuring range		16 / 200	4 / 16	g
	Zero bias stability	Allan variance	0.03	0.065	mg
		10 s average (-40 °C ~ +80 °C, constant temperature)	0.1	0.12	mg
	Zero bias	Zero bias range	±1.5	±3	mg
Zero bias change in full temperature range, peak-to-peak value		±1.5	±6	mg	
Scale factor	Scale factor accuracy	0.3	0.3	%	
	Scale factor nonlinearity	0.03	0.03	%FS	
Bandwidth		100	80 / 150	Hz	
Posture	Roll & Pitch Accuracy		0.1(@±80)	0.1° optional	°
Heading	Precision		1	1	°
Magnetometer	Resolution		-	0.1(@2Gauss)	Gauss
Output interface		Uart TTL	Rs422	RS422/232/CAN	Hz
		200~1000	200~1000	200~1000	
Electrical characteristics	Voltage			9 V-24V/5V	V
	Power consumption			0.35	W
Structural characteristics	Size		22*20*10.3	44.8*38.6*28	mm
	Weight		35	16	g
Use environment	Operating temperature			-40~+80	°C
	Storage temperature			-45~+85	°C
	Vibration			20~2000Hz, 6g	
	Impact			1000g, 0.5ms	
Reliability	MTBF			20000	h
	Continuous working time			120	h

The zero deviation of the whole temperature change process is calculated, the temperature change rate is ≤1°C/min, and the temperature range is -40 °C ~ +80 °C

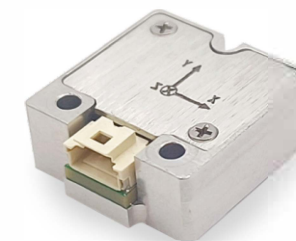
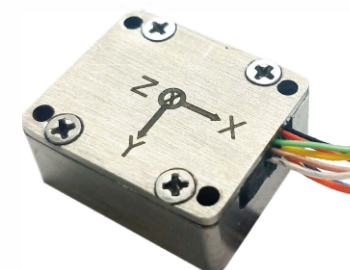
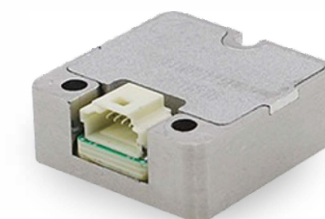
MEMS INERTIAL MEASUREMENT UNIT

IMU has high reliability and strong environmental adaptability. By matching different software, it can be widely used in intelligent driving, intelligent navigation and guidance. Lead, mobile communication, mapping, stable platform and other fields.

02

PARAMETER		TEST CONDITIONS	IMU115	IMU200B	IMU200G	UNIT
Gyroscope	Dynamic measuring range		250/500	2000	500	°/s
	Zero bias stability	Allan variance	4	3.8	2	°/h
		10 s average (-40 °C ~ +80 °C, constant temperature)	6	16	10	°/h
	Zero bias	Zero bias range	±0.2	±0.3	±0.1	°/s
		Zero-bias variation over full temperature range	±0.3	±0.04	±0.05	°/s
	Scale factor	Scale factor accuracy	0.2	0.4	0.2	%
Scale factor nonlinearity		0.02	0.04	0.02	%FS	
Bandwidth		150	200	200	Hz	
Accelerometer	Dynamic measuring range		4/16	200	16	g
	Zero bias stability	Allan variance	0.065	0.1	0.1	mg
		10 s average (-40 °C ~ +80 °C, constant temperature)	0.12	0.5	0.5	mg
	Zero bias	Zero bias range	±3	±5	±5	mg
		Zero bias change in full temperature range, peak-to-peak value	±6	±1	±1	mg
	Scale factor	Scale factor accuracy	0.3	3	0.3	%
Scale factor nonlinearity		0.03	0.3	0.02	%FS	
Bandwidth		150	200	200	Hz	
Posture	Roll & Pitch Accuracy		-	-	-	°
Heading	Precision		-	-	-	°
Magnetometer	Resolution		-	-	-	Gauss
Output interface		Uart TTL	Uart TTL	Rs422	Uart TTL	
		200~1000	200~1000	*500~1000	200~1000	Hz
Electrical characteristics	Voltage		5	5	5	V
	Power consumption		0.35	0.8	0.35	W
Structural characteristics	Size		22.4*22.4*9.5	25*21*11.5	22.4*22.4*9.5	mm
	Weight		16	16	16	g
Use environment	Operating temperature		-40~+80	-40~+80	-40~+80	°C
	Storage temperature		-45~+85	-45~+85	-45~+85	°C
	Vibration		20~2000Hz, 6g	20~2000Hz, 6g	20~2000Hz, 6g	
	Impact		1000g, 0.5ms	1000g, 0.5ms	1000g, 0.5ms	
Reliability	MTBF		20000	20000	20000	h
	Continuous working time		120	120	120	h

The zero deviation of the whole temperature change process is calculated, the temperature change rate is ≤1°C/min, and the temperature range is -40 °C ~ +80 °C



02

MEMS INERTIAL MEASUREMENT UNIT 16488

IMU is an inertial measurement unit based on micro-machining technology (MEMS). With built-in high-performance mems sensors. High reliability, strong environmental adaptability and the like.



PARAMETER		TEST CONDITIONS	16488C	16488D	16488HB	16488HA	UNIT
Gyroscope	Dynamic measuring range		±450 / ±2000	±500	±450	±500	°/s
	Zero-bias instability	Allan variance, better than	2	1	0.8	0.3	°/h
	Zero bias stability	1s smooth, RMS, better than	20	7	16	10	°/h
	Zero bias in full temperature range	-40°C~85°C,10s smoothing, rms	0.02	0.007	0.07	0.005	°/s
	Random walk	1σ	0.26	0.13	0.2	0.15	°/√h
	Zero-bias repeatability	1σ	20	5	15	10	°/h
	Output noise	No filtering, RMS	0.135	0.02	0.06	0.05	°/s
	Scale factor repeatability	1σ	0.1	0.01	0.03	0.01	%
	Scale factor nonlinearity	FS=450 °/s	0.01	0.005	0.02	0.01	%FS
	Bandwidth (-3dB)		330	150 / 280	200	250	Hz
Cross coupling		0.1	0.05	0.1	0.1	%	
Accelerometer	Dynamic measuring range	Configurable (Max ± 40)	±20 / ±40	±16	±16	±20	g
	Zero bias stability	Allan variance	0.07	0.018	0.015	0.02	mg
	Zero bias in full temperature range	-40°C~85°C,10s smoothing, RMS	5	0.3	0.05	1	mg
	Random walk	1σ	0.029	0.015	0.02	0.029	m/s/√h
	Zero-bias repeatability	1σ	16	1	0.5	1	mg
	Output noise	No filtering, RMS	1	0.2	0.25	0.5	mg
	Scale factor repeatability		0.1	0.04	0.1	0.1	%
	Scale factor nonlinearity	1σFS=10g	0.1	0.04	0.1	0.1	%FS
Magnetometer	Dynamic measuring range		±2.5	±2	±2.5	±2	gauss
	Sensitivity		0.1	0.1	0.1	0.1	mgauss/LSB
	Nonlinearity		0.5	0.5	0.5	0.5	%FS
Barometer	Pressure range		300~1100	300~1100	300~1100	300~1100	mbar
	Sensitivity		6.1 × 10 ⁻⁷	6.1 × 10 ⁻⁷	6.1 × 10 ⁻⁷	6.1 × 10 ⁻⁷	mbar/LSB
	Zero bias		4.5	4.5	4.5	4.5	mbar
	Relative error		2.5	2.5	2.5	2.5	mbar
Communication interface	Nonlinearity		0.1	0.1	0.1	0.1	%FS
	1-way SPI	Enter the clock frequency	15	15	15	15	MHz
Electrical characteristics	Voltage	Direct current	3.3 (or 5) ± 10%	3.3 (or 5) ± 10%	3.3 (or 5) ± 10%	3.3 (or 5) ± 10%	V
	Power consumption		0.6	1	1	1	W
	Weight		48±2	50±2	48±2	48±2	g
Use environment	Operating temperature	Scalable	-45~+85	-45~+85	-40~+85	-40~+85	°C
	Storage temperature		-55~+85	-55~+85	-55~+85	-55~+85	°C
	Vibration		10~2000Hz, 6.06g	10~2000Hz, 6.06g	10~2000Hz, 6.06g	10~2000Hz, 6.06g	
	Impact		5000g, 0.1ms	2000g, 0.1ms	1000g, 0.1ms	1000g, 0.1ms	

MEMS INERTIAL MEASUREMENT UNIT

IMU6/HG4930C

IMU is an inertial measurement Unit based on micro-machining technology with built-in high-performance MEMS sensors. High reliability, strong environmental adaptability and the like.

02



PARAMETER		UNIT	-1	1A	1B	1C	-1F	
Gyroscope	Measuring range (customizable)	°/s	±400	±400	±400	±2000	±300	
	Zero offset	°/h	15	10	5	30	3	
	Zero-bias instability (@ Allan Variance)	°/h	0.3	0.1	0.05	1	0.05	
	Zero bias stability (1s smooth, 1σ, room temperature)	°/h	3	2	0.4	6	0.2	
	Zero-bias repeatability	°/h	3	1	0.3	3	0.2	
	Zero-bias error over full temperature range	°/h	20	10	2	30	1	
	Random walk	°/√h	0.15	0.05	0.02	0.3	0.02	
	Zero bias acceleration sensitivity	°/h/g	2	2	2	2	1	
	Resolution	°/h	2	1	0.5	5	2	
	Output noise (half peak value)	°/s	0.3	0.25	0.15	0.45	0.03	
	Bandwidth	Hz	125					
	Scale factor nonlinearity	ppm	100					
	Scale factor repeatability	ppm	100					
	Cross coupling	%	0.1					
Accelerometer	Measuring range (customizable)	g	±10		±40	±80	±10	
	Zero-bias stability (10s, 1σ, room temperature)	mg	0.05		0.2	1	0.05	
	Zero-bias repeatability	mg	0.2		1	0.5	0.3	
	Zero-bias error over full temperature range	mg	2		2	5	1	
	Resolution	mg	0.1		0.1	0.1	0.1	
	Bandwidth	Hz	125				100	
	Scale factor repeatability	ppm	500					
	Scale factor nonlinearity	ppm	500					
Cross coupling	%	0.1						
Inclinometer	Range	g	±1.7 (this function is optional)					
Electrical parameters	Startup stabilization time	s	IMU6-1: 0.5; HG4930C: 1					
	Data update rate	Hz	IMU6-1: 500; HG4930C: 600					
	Operating voltage	V	5±0.5					
	Power consumption	W	IMU6-1: ≤1.5; HG4930C: ≤2					
	Ripple	mV	100					
	Weight	g	IMU6-1: ≤58; HG4930C: ≤120					
	Size	mm	IMU6-1: 44.8*38.6*20; HG4930C: ø64.78*35.6					
Interface		RS422						

02

MINS100E-B0 INTEGRATED NAVIGATION SYSTEM

> Product features:

Built-in high-performance MEMS gyroscope and accelerometer, which can receive internal GNSS data, realize multi-sensor fusion and The integrated navigation algorithm has the ability of short-term inertial navigation when GNSS is invalid.

> Typical applications:

Mobile communication, mapping, Seekers and stabilized platforms.



PROJECT		METRICS (RMS)	REMARK
Heading accuracy	Dual GNSS	0.1°	2m baseline
	Single GNSS	0.2°	Need to maneuver
	Post-processing	0.03°	Optional
	Maintain accuracy	0.2°/min	GNSS failure
Attitude accuracy	GNSS is valid	0.1°	Single-point L1/L2, RTK
	Inertial/odometer combination	0.1°	Optional
	Post-processing	0.02°	Optional
	Maintain accuracy	0.2°/min	GNSS failure
	V-G mode	2°	GNSS failure time unlimited, no acceleration
Horizontal positioning accuracy	GNSS is valid	1.2m	Singlepoint L1/L2
		2cm+1ppm	RTK
	Inertial/odometer combination	2‰D(D for mileage, CEP)	Optional
	Post-processing	1cm+1ppm	Optional
Gyroscope	GNSS failure	20m	Fail for 60s
	GNSS is valid	0.1m/s	Single-point L1/L2, RTK
	Inertial/odometer combination	0.1m/s(RMS)	Optional
	Inertial/DVL combination	0.2m/s(RMS)	Optional
Accelerometer	Measuring range	±450°/s	
	Zero bias stability	2°/h	Allan variance
	Measuring range	±16g	Customizable 200 g
Satellite card	Zero bias stability	30μg	Allan variance
	Cold start	30 seconds	Open environment
	Hot start	5 seconds	Open environment
	Type of receiver	BDS B1I/B2I/B3I GPS L1C/A/L2P (Y)/L2C/L5 GLONASS G1/G2 Galileo E1/E5a/E5b QZSS L1/L2/L5	
Communication interface	RS232	Route 2	
	RS422	Route 1	
	CAN	Route 1	
Electrical characteristics	Voltage	9~36VDC	
	Power consumption	≤3W	
	Ripple	100 mV	P-P
Structural characteristics	Size	80 mm×53 mm×23mm	
	Weight	≤150g	

MINS100C-CO INTEGRATED NAVIGATION SYSTEM

> **Product features:** Carry out integrated navigation by using the satellite navigation information received internally, and output the pitch, roll, heading, position, speed, time, etc.

> **Typical applications:**
Mapping, seeker and stable platform, etc.

02

PROJECT		METRICS (RMS)	REMARK
Heading accuracy	Dual GNSS	0.05°	2m baseline
	Single GNSS	0.1°	Need to maneuver
	Maintain accuracy	≤0.04°	GNSS fails for 2min
Attitude accuracy	GNSS is valid	0.05°(RMS)	
	Maintain accuracy	≤0.03°(RMS)	GNSS fails for 2min
Horizontal positioning accuracy	GNSS is valid	2cm+1ppm(RMS, RTK)	
		1.2m (RMS)	Single point positioning
	Maintain accuracy	9.5m	GNSS fails for 2min
Horizontal velocity accuracy	GNSS is valid	0.1m/s	RMS, single point L1/L2
Gyroscope	Measuring range	±400°/s	
	Zero bias stability	≤0.1°/h	
Accelerometer	Measuring range	±10g	10 s average
	Zero bias stability	≤5μg	10 s average
Communication interface	RS232	Route 1	
	RS422	Route 1	
	CAN	Route 1	
Electrical characteristics	Voltage	5~36VDC	
	Power consumption	≤8W	
	Ripple	100 mV	P-P
Structural characteristics	Size	80 mm×60mm×31mm	
	Weight	≤150g	
Use environment	Operating temperature	-40°C~+70°C	
	Storage temperature	-45°C~+75°C	
	Vibration	20~2000Hz, 6.06g	
	Impact	1000g, 0.5ms	
Reliability	MTBF	>20000h	
	Continuous working time	>120h	





QUARTZ ACCELEROMETER

- > 1. Angle measurement
- > 2. Vibration measurement
- > 3. Ship

03

QUARTZACCELEROMETER

> Quartz flexible accelerometer series is a high-precision inertial navigation class accelerometer with excellent long-term stability, repeatability, start-up performance, environmental adaptability and high reliability. It can be used for both static and dynamic testing, and it is also a standard vibration sensor.

03



PARAMETERS	ACC1-01	ACC1-02	ACC1-03	UNIT
Range	±50			g
Threshold /Resolution	1	2	3	μg
Bias k0/k1	≤±1	≤±3	≤±5	mg
Scale factor kl	1.05~ 1.30			mA/g
Class II nonlinearity coefficient k2/k1	≤±10	≤±15	≤±20	μg/g ²
0g 4 hours short time stability	≤10	≤10	≤15	μg
1g 4 hours short time stability	≤10	≤10	≤15	ppm
Bias drift Sigma k0(1σ , one month)	≤10	≤20	≤30	μg
Repeatability of scale factor Sigma kl/kl(1σ,one month)	≤15	≤30	≤50	ppm
Class II nonlinearity Coefficient repeatability k2/k1(1σ , one month)	≤±10	≤±20	≤±30	μg/g ²
Bias thermal coefficient	≤±10	≤±30	≤±50	μg/°C
Scale factor thermal coefficient	≤±10	≤±30	≤±50	ppm/°C
Noise (sample resistance 840Ω)	≤5	≤8.4	≤8.4	mv
Natural Frequency	400~800			Hz
Bandwidth	800~2500			Hz
Vibration	6g			Hz
Shock	100g			8ms, 1/2sin
Temperature range(Operating)	-55~+85			°C
Temperature range(saved)	-60~+120			°C
Power	±12~±15			V
Consume current	≤±20			mA
Temp. sensor	PT1000/AD590			Optional
Size	Φ25.4*30			mm
Weight	≤80			g

03

QUARTZ ACCELEROMETER

> Quartz flexible accelerometer series is a high-precision inertial navigation class accelerometer with excellent long-term stability, repeatability, start-up performance, environmental adaptability and high reliability. It can be used for both static and dynamic testing, and it is also a standard vibration sensor.



PARAMETERS	ACC2-01	ACC2-02	ACC2-03	UNIT
Range	±70			g
Threshold /Resolution	2	3		μg
Bias k0/k1	≤±3	≤±3	≤±5	mg
Scale factor kl	0.8~ 1.2			mA/g
Class II nonlinearity coefficient k2/k1	≤±10	≤±15	≤±20	μg /g ²
0g 4 hours short time stability	≤10	≤15	≤20	μg
1g 4 hours short time stability	≤10	≤15	≤20	ppm
Bias drift Sigma k0(1σ , one month)	≤10	≤20	≤30	μg
Repeatability of scale factor Sigma kl/kl(1σ,one month)	≤15	≤30	≤50	ppm
Class II nonlinearity Coefficient repeatability k2 /k1(1σ , one month)	≤±10	≤±20	≤±30	μg /g ²
Bias thermal coefficient	≤±10	≤±30	≤±50	μg /°C
Scale factor thermal coefficient	≤±10	≤±30	≤±50	ppm /°C
Noise (sample resistance 840Ω)	≤5	≤5	≤5	mv
Natural Frequency	400~800			Hz
Bandwidth	800~2500			Hz
Vibration	6g			Hz
Shock	100g			8ms, 1/2sin
Temperature range(Operating)	-55~+85			°C
Temperature range(saved)	-60~+120			°C
Power	±12~±15			V
Consume current	≤±20			mA
Temp. sensor	PT1000/AD590			Optional
Size	Φ25.4*30			mm
Weight	≤80			g

QUARTZACCELEROMETER

>ACC3 series quartz flexible accelerometer is a miniaturized, high-precision inertial navigation class accelerometer for a large number of applications. The product has excellent long-term stability, repeatability, start-up performance, environmental adaptability and high reliability, which can be used for static and dynamic testing. It is also a standard vibration sensor .

03

PARAMETERS	ACC3-01	ACC3-02	ACC3-03	UNIT
Range	±60			g
Threshold /Resolution	5	5	5	μg
Bias k0/k1	≤±5	≤±5	≤±5	mg
Scale factor k1	1.0±0.2	1.0±0.2	0.6±0.2	mA/g
Class II nonlinearity coefficient k2/k1	≤±20	≤±30	≤±20	μg/g ²
0g 4 hours short time stability	≤10	≤20	≤20	μg
1g 4 hours short time stability	≤10	≤20	≤20	ppm
Bias drift Sigma k0(1σ , one month)	≤15	≤50	≤50	μg
Repeatability of scale factor Sigma k1/k1(1σ,one month)	≤15	≤50	≤50	ppm
Class II nonlinearity Coefficient repeatability k2/k1(1σ , one month)	≤±20	≤±30	≤±30	μg/g ²
Bias thermal coefficient	≤±15	≤±50	≤±50	μg/°C
Scale factor thermal coefficient	≤±15	≤±80	≤±50	ppm/°C
Noise (sample resistance 840Ω)	≤5	≤8.4	≤8.4	mv
Natural Frequency	350~800			Hz
Bandwidth	800~2500			Hz
Vibration	10g			Hz
Shock	150g			8ms, 1/2sin
Temperature range(Operating)	-55~+85			°C
Temperature range(saved)	-60~+120			°C
Power	±12~±15			V
Consume current	≤±20			mA
Temp. sensor	PT1000/AD590			Optional
Size	Φ18.2*23			mm
Weight	≤30			g



03

QUARTZ ACCELEROMETER

>ACC4 series quartz flexible accelerometer is a high temperature and anti-vibration accelerometer, the product adopt unique high temperature design, packaging process and special circuit, product output current is proportional to the measured acceleration, the user can calculate the appropriate sampling resistance, achieve high precision output, and according to the user demand built-in temperature sensor, used for the partial value and scale factor compensation, reduce the influence of environmental temperature.



PARAMETERS	ACC4-01	ACC4-02	ACC4-03	UNIT
Range	±30			g
Threshold /Resolution	10	15	15	µg
Bias k0/k1	≤±10	≤±10	≤±10	mg
Scale factor k1	1.1~ 1.3			mA/g
One-month composite repeatability	<50	<200	<200	µg
Temperature sensitivity	<50	<100	<100	µg/°C
One-month composite, repeatability	<80	<150	<150	ppm
Temperature sensitivity	<100	<200	<200	ppm
Axis misalignment	<1500	<1500	<1500	µrad
Vibration rectification	<30	<100	<100	µg/g 2rms
Shock (g)/0.5ms, 1/2sin	500 g	1000 g	1000 g	g/ms
Operating temperature range	-55~+96	-55~+155	-55~+180	°C
Vibration peak sine	25			g
Intrinsic noise	<3000			µg-rms
Bandwidth	>300			Hz
Quiescent current per supply	<20			mA
Quiescent power @ ±15VDC	<480			mW
Input voltage	±13~±18			V
Weight	<55			g
Diameter below mounting surface	Φ25			mm
Height-bottom to mounting surface	<21.5			mm
Case material	300 series stainless steel			

QUARTZ ACCELEROMETER

>ACC5 series quartz flexible accelerometer is a middle grade precision accelerometer with unique structural size (short) design. The product has excellent long-term stability, repeatability, dynamic response performance, good vibration and impact resistance and high reliability. It can be used for static and dynamic testing, and is also a standard vibration sensor .

03

PARAMETERS	ACC5-01	ACC5-02	ACC5-03	UNIT
Range	±50			g
Threshold /Resolution	5	5	5	µg
Bias k0/k1	≤±5	≤±7	≤±10	mg
Scale factor k1	1.1~ 1.3			mA/g
Class II non-linearity coefficient k2/k1	≤±20	≤±20	≤±20	µg /g ²
Bias drift Sigma k0(1σ , one month)	≤30	≤50	≤80	µg
Repeatability of scale factor Sigma k1/k1(1σ,one month)	≤50	≤80	≤100	ppm
Class II non-linearity Coefficient repeatability k2/k1(1σ , one month)	≤±20	≤±20	≤±20	µg /g ²
Bias thermal coefficient	≤±20	≤±20	≤±20	µg /°C
Scale factor thermal coefficient	≤±40	≤±50	≤±80	ppm
Noise (sample resistance 840Ω)	≤5	≤5	≤5	mv
Bandwidth	>300			Hz
Vibration Rectification	<30			µg/g ² rms
Vibration	20g			Hz
Shock	250g			4.5ms
Install error	<1500			µrad
Temperature range(Operating)	-55~+96			°C
Power	±13~±18			V
Consume current	<20			mA
Temp. sensor	PT1000/AD590			Optional
Size	Φ25*25			mm
Weight	≤55			g



03

QUARTZ ACCELEROMETER

ACC6 series quartz flexible accelerometer is a small, high temperature resistant seismic type accelerometer. The product has excellent repeatability, starting performance, high temperature seismic resistance and high reliability characteristics, which can be used for both static testing and dynamic testing, and is also a standard vibration sensor.



PARAMETERS	ACC6-01	ACC6-02	UNIT
Range	±30		g
Threshold /Resolution	30		μg
Bias k0/k1	≤±20		mg
Scale factor k1	1.9~2.1		mA/g
Class II nonlinearity coefficient k2/k1	≤±20	≤±50	μg /g ²
Bias drift Sigma k0(1σ , one month)	≤150	≤220	μg
Stability of scale factor Sigma k1/k1(1σ,one month)	≤150	≤220	ppm
Class II nonlinearity Coefficient repeatability k2/k1(1σ , one month)	≤±40	≤±50	μg /g ²
Bias thermal coefficient	≤±80	≤±150	μg /°C
Scale factor thermal coefficient	≤±100	≤±200	pp/°C
Noise (sample resistance 840Ω)	≤8	≤8.4	mv
Natural Frequency	350~800		Hz
Bandwidth	800~2500		Hz
Vibration	25g		Hz
Shock	1000g		0.5m, 1/2sin
Temperature range(Operating)	-40~+150	-40~+180	°C
Temperature range(saved)	-60~+180	-60~+200	°C
Power	±12~±15		V
Consume current	±20		mA
Temp. sensor	PT1000/AD590		Optional
Size	Φ18.2*16		mm
Weight	≤25		g



SOLUTIONS

- > Intelligent Coal Mine Fully Mechanized Mining & Drilling Application
 - > Underwater scientific robotics
- > Driverless vehicle and driverless automatic driving application
 - > UAV for mapping Applications

04

APPLICATION OF FULLY MECHANIZED MINING AND DRILLING IN INTELLIGENT COAL MINE

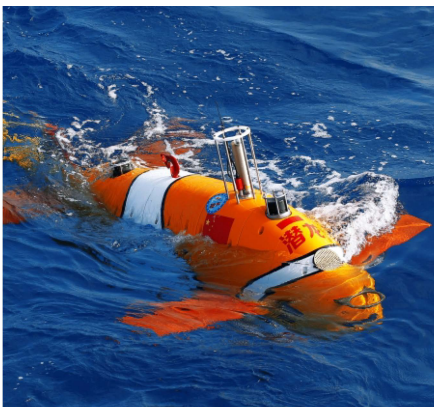


With the rapid development of coal mining technology and equipment, the fully mechanized mining face has experienced mechanization, automation and intelligent mining. The mechanization degree of large-scale coal mines in China has reached 95%, and has entered the stage of intellectualization. The intelligent system of fully mechanized mining is based on the electro-hydraulic control system of hydraulic support. By improving the perception, transmission and intelligent control capabilities, the intelligent system of fully mechanized mining is realized.

The goal of adaptive control is to realize unmanned coal mining.

The low-cost north finder developed by Firepower can be applied to the scene of coal caving directional drilling rig to accurately control the azimuth of the drill bit and achieve precise operation. The small north finder has also been applied to the mining intrinsically safe drilling rig opening orientation instrument, which is a new type of portable instrument for intelligent measurement of drilling rig attitude. The instrument uses a high precision fiber optic gyroscope to measure the azimuth and The inclination angle is used to select the opening position for the drilling rig for accurate positioning.

Underwater scientific robotics



Navigation of underwater vehicle means that the mobile robot gets the state of itself with the help of sensors and completes the autonomous movement process from the initial position to the target position. Navigation technology is the core of AUV. The robot navigation board can be equipped with GPS receiver, three-axis compass, three-axis accelerometer, and built-in navigation algorithm, so that the robot can navigate accurately. In addition, the task data can be transmitted back to the base station through the wireless communication module for operation processing.

UNMANNED VEHICLE AND UNMANNED AUTOMATIC DRIVING APPLICATION

Automatic driving vehicle uses inertial, GNSS, laser radar, millimeter wave radar and other sensors to perceive the surrounding environment of the vehicle and its own posture and position, and controls the steering and speed of the vehicle according to the road and obstacle information obtained by perception, so that the vehicle can be safely and reliably on the road or in the prescribed area (Airport, port, park, etc.) Driving, automatic driving is a kind of intelligent automobile. Car driving mode, also known as mobile robot, mainly depends on the car. Intelligent driving instrument based on computer system is used to realize unmanned driving.



UNMANNED AERIAL VEHICLES (UAV) FOR MAPPING

UAV flight control system is its "brain", including sensors, airborne computers and servo actuation equipment, to achieve attitude stabilization, mission management and emergency control. It is mainly composed of gyroscope, acceleration sensor, air pressure sensor, ultrasonic sensor, GPS module, etc. It is used to automatically maintain the normal flight attitude of the aircraft. The IMU is used for attitude detection and measurement and transmitting data to the main control processor

MCU controls the stable operation of the aircraft through the flight algorithm.



Widely used scenarios

Ship-borne takeoff

Floating on the sea

Water-proof flying with the ship


0 hook diameter flight

Small hook flight

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