



SPECIFICATIONS

Item No.: AH106B

Description: MEMS Mini Attitude and Heading Reference System

Version: Ver.03

production standard reference

- enterprise quality system standard: ISO9001:2008 (approval No.:128101)
- inclinometer production standard: GB/T 191 SJ 20873-2003 inclinometer, level sensor general standard
- inclinometer calibration standard: JJF1119-2004 electric level sensor calibration standard
- gyroscope&accelerometer test standard: QJ 2318-92 gyroscope&accelerometer test method
- software development reference standard: GJB 2786A-2009 military software general requirements
- products environment test standard: JB150
- electromagnetic interference test standard: GB/T 1762
- version: Ver.03
- revising version: 2015.6.25



AHRS

Introduction

AH106B is MEMS inertial measure unit composed of three axis MEMS gyroscope(measure the three directions absolute angular rate of carrier), three axis accelerometer(measure the three directions linear acceleration). It output analog signal, the signal goes through 24digit A/D enhancement, sampling and analog-digital conversion, enters CPU.The aquisition CPU transmits the original code to compensation calculation CUP through serial port. The gyroscope signal is pulse signal, it enter compensation calculation CUP without conversion. The compensation calculation CUP processes calculation first, and temperature compensation, scale factor compensation, gyroscope bias&Incremental calibration bias correction, installation bias compensation, non-linearity compensation, then the angular rate and acceleration data in motion coordinate of carrier are output at last. Digital version AH106B adopts serial port directly, RS232, RS485, RS422 are available. Analog version AH106B output 0-5v or 4-20mA after digit-analog conversion of calibrated data.

Main features

- Output three axis linear acceleration, gyroscope
- high speed output
- long service life, high stability
- 24 digit A/D sampling
- compact and light design
- DC+9~36V power supplier
- full temp. Compensation
- Pure dynamic inertial measurement
- high cost-effective
- High performance in anti-impact, anti-shock, waterproof
- digital/analog type available
- wide working temperature

Application

- UAV posture control
- Agricultural machinery control
- Truck - mounted satellite
- 3D Virtual Reality
- Camera Pan&Tilt
- vessel posture calculation
- Communication vehicle radar
- Industrial Manipulator
- Ships electronic compass bias compensation
- GPS combo
- underwater robot
- RC Helicopter
- robot



Technical index of accelerometer

Index suitable for single, dual and triple axis				
Measure range	±2	±08	±40	g
Bias calibration	<2	<5	<10	mg
Measure axis	X,Y,Z	X,Y,Z	X,Y,Z	axis
Output signal	0-5V; 4-20mA; RS232; RS485; RS422 available			
Annual bias stability[2]	1.5 (<5)	7.5 (<25)	22 (<75)	Mg typical value(max value)
power-up/power-off repeatability	<10	<10	<20	mg(max value)
Power-up stability time	<25	<25	<25	ms
Bias temperature coefficient[3]	0.1	0.5	1.5	mg/°C typical value
	±0.4	±2	±6	mg/°C max value
Resolution/threshold value (@ 1Hz)	< 1	< 5	< 15	mg(max value)
Non-linearity	<0.1	<0.5	<0.6	% FS (max value)
	<0.02	<0.09	<0.27	g(max value)
bandwidth[4]	0~≥400	0~≥400	0~≥400	Hz
resonance frequency	1.6	6.7	6.7	kHz
Output speed (digital version)	5Hz、15Hz、35Hz、50Hz、100Hz、300Hz (settable)			
Unless special description, all parameters testified under condition ±20°C (±68°F) and 12VDC.				

Technical index of gyroscope

Index suitable for single, dual and triple axis				
Measure range	±50	±150	±300	°/s
Measure axis	X、Y、Z(optional)	X、Y、Z(optional)	X、Y、Z (optional)	
analog acquisition bandwidth	>2000	>2000	>2000	Hz
Output signal	0-5V; 4-20mA; RS232; RS485; RS422 optional			
Resolution	0.1	0.1	0.2	°/s
Non-linearity	0.1	0.1	0.1	% of FS
Temperature drift	< ±0.1	< ±0.1	< ±0.1	°/sec, /°C
Start-up time	5	5	5	ms
Power-up stability time	<25	<25	<25	ms
Output speed (digital version)	5、1z、35、50、100、300 settable			Hz

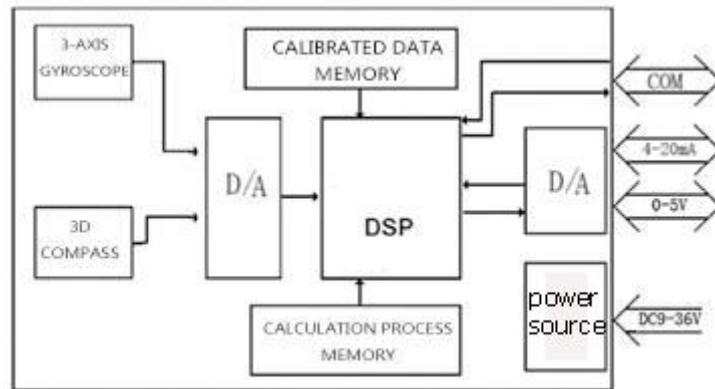
AH106B -MEMS Inertial Measure Unit

Unless special description, all parameters testified under condition $\pm 20^{\circ}\text{C}$ ($\pm 68^{\circ}\text{F}$) and 12VDC.

Working condition requirements

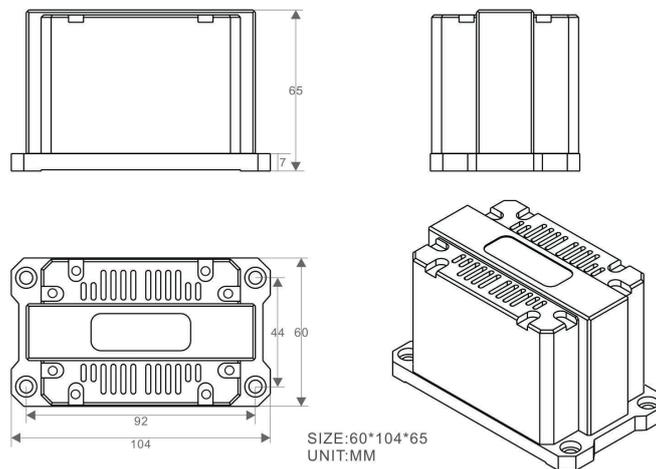
Power supply voltage	DC 9~36V
Working current	<60mA
insulation resistance	≥ 100 mega-ohm
Anti-impact	200g pk, 2ms, $\frac{1}{2}$ sine
Anti-shock	10grms、10~1000Hz
waterproof	IP67 (air plug) IP68 (direct lead)
Connector	8 pin air plug, 1m cable (analog version) 5 pin air plug, 1m cable (RS232/RS485) 8 pin air plug, 1m cable (RS422)
Screw	4*M5
weight	<250g(exclude cable)
Working temperature	-40 $^{\circ}\text{C}$ ~ +85 $^{\circ}\text{C}$
Storage temperature	-55 $^{\circ}\text{C}$ ~ +100 $^{\circ}\text{C}$
Low air pressure	1.9 $\times 10^4$ Pa;
RH	95% (25 $^{\circ}\text{C}$) , shall not lower than 30% within operation temperature
salt-mist, mycete	Fit GJB1060
MTBF	≥ 50000 hours/time
credence	0.7
reliability	R ≥ 0.994
electromagnetic compatibility	electromagnetic compatibility design and test refer to GJB151A-1997 <i>military equipment and subsystem EMI&sensibility requirement</i> and JB1389-1992 <i>system EMC requirement</i> , and relative design rule, CE102, CS101, CS106, CS114, CS115, CS116, RE102, RS103 specifically.

Working Principle



Shell Size Chart

structural rigidity, aperture coupling reduce and electromagnetic shielding are achieved by whole cutting process. The shell groove design makes it beauty, lighter and better heat dissipation(natural cooling, no need of additional cooling equipment) without compromise of structural rigidity, outline drawing as below:



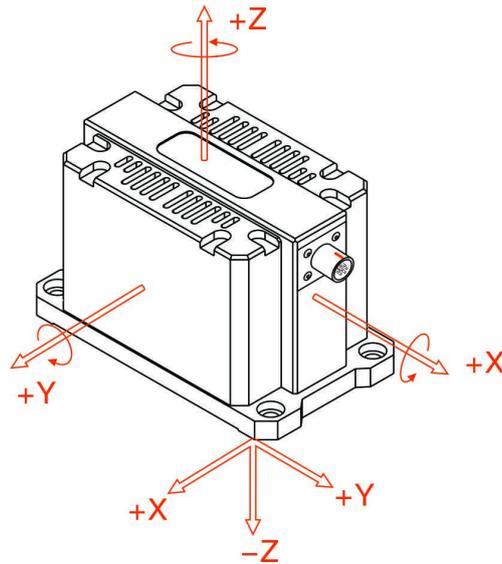
Size : L104mm *W60mm *H65mm

Installation precautions

Make sure correct installation, wrong installation may cause error, pay attention to one surface, two lines:

- 1) The Sensor mounting surface and the measured surface must be fixed closely, smoothly, stable, if mounting surface uneven likely to cause the sensor to measure the angle error.
- 2) The sensor axis and the measured axis must be parallel, the two axes do not produce the angle as much as possible.

Measuring direction



Electrical Connection

pin assignment	Lead color	0-5V	4-20mA	Lead color	RS232 RS485	Lead color	RS422
1	brown	DC 9-36V	DC 9-36V	black	GND	Red	DC9~36V
2	black	GND	GND	white	RXD/D+	Orange	TXD+
3	green	X acceleration	X acceleration	blue	TXD/D-	yellow	RXD-
4	yellow	Y acceleration	Y acceleration	brown	DC 9-36V	blue	RXD+
5	Grey	Z acceleration	Z acceleration	Grey		purple	TXD-
6	pink	X gyro	X gyro			black	GND
7	blue	Y gyro	Y gyro				
8	white	Z gyro	Z gyro				

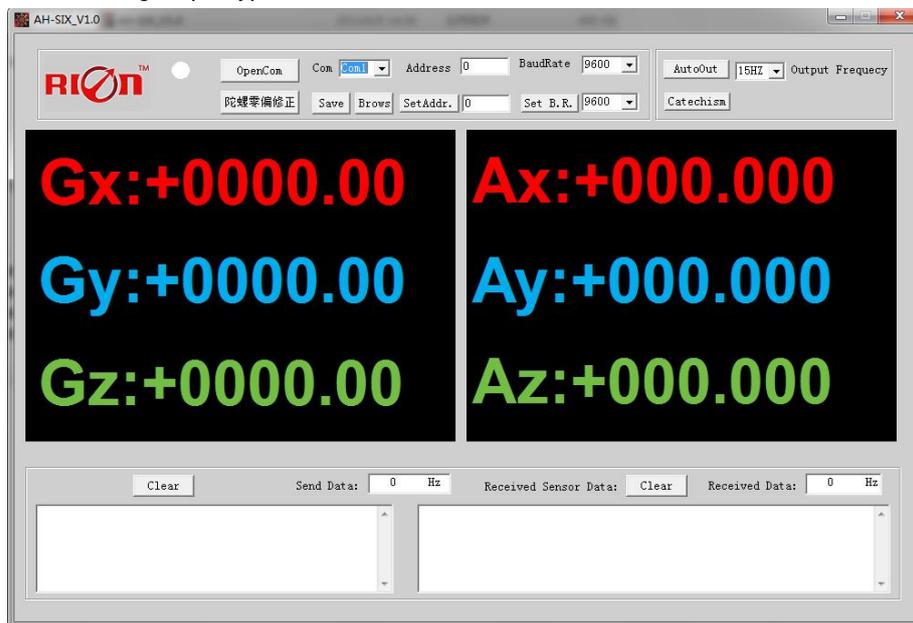
RION's products software debug

AH106B would be equipped with professional RION's serial port debug software. The software. In convenience of debug and demonstration, it is designed inspired by INS software experience, software engineering, promoting the reliability, efficiency, stability of product. It is easy to maintain, test. It is used

AH106B -MEMS Inertial Measure Unit

VC language. User could download from Rion's website or find universal version in other professional websites.

(analog output type do not need the software)



Open/Close: Open and close COM port;

Com: Select the the device corresponding to the COM port

Address: Fill in the sensor current address code, the factory default is 00

Set Address: Set the sensor address code input box on the right to enter the desired address code, click Set Addr button

Save Data: Save the data, click here data can be synchronized Save angle data, the file is stored by default in the C: ---- COMDATA file

Set Zero: Set relative zero, the sensor current angle is 00.00 degrees

Cancel Zero: Unset the relative zero, to restore the sensor to the factory absolute zero;

Baud Rate: Select the sense baud rate , the factory default is 9600;

Set Baud Rate: Set the sensor baud rate, on the right of the selection box to select corresponding baud rate then click SetB.R. button;

Auto Output: Switch the sensor to automatically output mode, in the automatic output mode can be filled with different output frequency in Hz;

Catechism: The sensor switch to answer pattern, such as choosing the answer type, must input "send command" (command, please refer to the specification) on the left of "Send Command" input box, but also can fill in the transmit frequency in the Send Data, the unit Hz;

Mag. Dec.: Magnetic declination setting, in the right box directly enter the local magnetic declination, click "Mag.Dec." Button to confirm .

Calibration: compass calibration forum

Start: Start calibration

AH106B -MEMS Inertial Measure Unit

Stop: Stop the calibration (Click this button, keep the compass shaking state to avoid incorrect calibration of the acquisition)

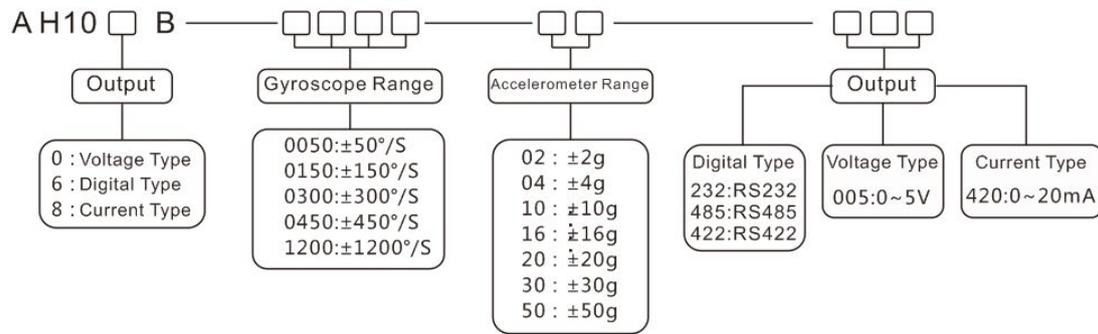
Save: stop calibration and save data. (Specific calibration method please refer to this specification calibration description)

Note: after install the RION's debugging software, if can not open, please operate by the following steps (please appear to the administrator status to operate):

Copy these three files mscomm.srg、mscomm32.ocx、mscomm32.dep from the folder to C:/Windows/system32 path below。

Click "Start" –"run" --regsvr32 mscomm32.ocx, You are prompted to install successful dialog。

Model choose instruction



Product Protocol

(8 bits date, 1 bit stop, No check, Default baud rate 115200)

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain	Check sum (1byte)
68					

Date format: hexadecimal

Identifier: Fixed68

Data length: From data length to check sum (including check sum) length

Address code: Accumulating module address, Default :00

Date domain will be changed according to the content and length of command word

Check sum: Data length、Address code、Command word and data domain sum,No carry.

command word analysis

Desc.	Meaning/Example	Description
0X04	Meanwhile read angle command E.g: 68 04 00 04 08	Data domain(obyte) No Data domain command
0X84	sensor response: Eg: 68 18 00 84 01 23 86 10 03 76 00 00 18 12 48 98 10 10 96 00 09 75 10 78 95	Data domain (18byte) ,adopt BCD compressed code 68 16 00 84: is fixed data domain 01 23 86:3 characters means X axis angular rate, +123.86°/s 10 03 76:3 characters means Y axis angular rate, -3.76°/s 00 00 18:3 characters means Z axis angular rate, +0.18°/s 12 48 98:3 characters means X axis acceleration, -24.898 G 10 10 96:3 characters means Y axis acceleration, -1.096 G 00 09 75:3 characters means Z axis acceleration, -0.975 G

AH106B -MEMS Inertial Measure Unit

		<p>10 78: 2 characters means sensor internal temperature, -7.8 C°</p> <p>95: packet single byte accumulated check sum</p> <p>1-9 byte in data domain indicate X,Y,Z data of gyroscope, the first byte high 4 digit is data sign bit, 1 indicates positive, 0 indicates negative, the follow are hundreds, tens, units, tenths, percentile. Take the second couple data as an example 10 03 76, the first byte high four bit is 1, so data symbol is negative.</p> <p>10-19 byte of data domain indicates angular data of X,Y,Z axis, sign bit is the same with gyroscope, the follow are tens, units, tenths, percentile, thousands(note, there is no percentile for accelerometer). 20-21 byte indicate the internal temperature of sensor, first byte high four bit is sign bit, the follow are tens, units, tenths. The last byte of whole packet is check sum byte, it indicate the accumulation sum from the positive second byte to the last but one byte.</p> <p>The above example is 18+00+84.....+10+78=95</p>
0X0B	<p>Setting communication rate E.g: 68 05 00 0B 03 13</p> <p>The command setting is effective after power off then restart (power off with save function)</p>	<p>Data domain (1byte)</p> <p>Baud rate: default :9600</p> <p>00 means 2400</p> <p>01 means 4800</p> <p>02 means 9600</p> <p>03 means 19200</p> <p>04 means 38400</p> <p>05 means 115200</p>
0X8B	<p>Sensor answer reply command E.G:68 05 00 8B 90</p>	<p>Data domain (1byte)</p> <p>Data domain in the number means the sensor response results</p> <p>00 Success FF Failure</p>
0X28	<p>set angular rate as zero Meanwhile set three axis output angular rate as zero Eg: 68 04 00 28 2C</p>	<p>Data domain (obyte)</p> <p>none</p>
0X28	<p>sensor response command Eg: 68 05 00 A8 00 AD</p>	<p>Data domain (1byte)</p> <p>Number in data domain means the response result of sensor</p> <p>00 success set</p> <p>FF failure set</p>
0X0c	<p>set automatic output frequency Eg: 68 05 00 0c 05 16</p> <p>Set automatic output as 50Hz,the command of power off storage</p>	<p>Data domain (1byte)</p> <p>Question&answer mode: 00,sensor would output a single packet when receiving inquiry(all equipment parameter must be proceeded under the mode)</p> <p>Automatic output mode: output packet, x,y,z angle and rate automatically after power on,</p> <p>01 5Hz Data Rate</p> <p>02 15Hz Data Rate</p> <p>03 25Hz Data Rate</p> <p>05 50Hz Data Rate</p> <p>Default value 00, question&answer mode</p>

AH106B -MEMS Inertial Measure Unit

oX8B	sensor response command Eg: 68 05 00 8c 91	Data domain (1byte) Number in data domain means the responding result of sensor 00 success FF failure
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Core component model selection

High speed processor, AD and other key components are imported industrial components of high performance and stability. Processor use ST company's chip as the compensation calculation unit, it is 32 digit processor with Cortex™-M3 core which is used in our other mature products for its high frequency, quick calculation and stability. A/D is TI company's industry chip processing 16 ways 24 digit A/D data acquisition and conversion. It is high precision, fast acquisition. SPI receive the A/D data to achieve the smooth filter, temperature compensation, scale factor compensation, zero compensation and installation error compensation.

Electromagnetic Compatibility

The three elements of electromagnetic interference are interference source, interference sensitive circuit and coupling paths, the solutions are:

- 1, twisted pair transmission pulse signal.
- 2, avoid common GND between bigger current and smaller current, separate signal GDN and shell GDN.
- 3, Adopt suitable filter.

Maintenance

First, basic level, user replace outer wire or standard connector.

Second, factory deal level, send it back to factory to fix and test.

- Products design meets the safety requirements described in GJB/457Z---2001 as below:
- Shell bonding resistance meets requirements described in GJB358-1987-3.4.2, ensuring reliable grounding;
- Shape design avoids edges and corners.
- There are warning sign and notice to prevent improper operation
- With error proof function to prevent man made mistake when installation
- When out of order, the fault message would output through bus line in convenience of prompt redress action

It is adopted mature, testified and reliable printed circuit board

Production reference standard

GJB 150.2A-2009 military equipment environment testing, the second part: low pressure(height) testing

GJB 150.3A-2009 military equipment environment testing, the third part: high temperature testing

GJB 150.4A-2009 military equipment environment testing, the fourth part: low temperature testing

GJB 150.5A-2009 military equipment environment testing, the fifth part: temperature impact testing

GJB 150.9A-2009 military equipment environment testing, the ninth part: damp heat testing

GJB 150.15A-2009 military equipment environment testing, the fifteenth part: acceleration testing

AH106B -MEMS Inertial Measure Unit

GJB 150.16A-2009 military equipment environment testing, the sixteenth part: vibration testing

GJB 150.18A-2009 military equipment environment testing, the eighteenth part: impact testing

GJB 1406A-2005 quality guarantee outline requirements

GJB 813-1990 reliable model establishment and estimate

GJB 1909A-2009 equipment reliable maintenance requirements

GJB 1310A-2004 design review

GJB 1269A-2000 process review

GJB 907A-2006 products quality review

GJB 1710A-2004 trial-produce and production readiness inspection

GJBZ 1391-2006 failure mode, effect and hazard analysis guide

GJBZ 106A-2005 engineering standard outline guide

GJBZ 114A-2005 product standardization outline guide

QJ 1890-1990 printed circuit board design and connection standard

QJ 908A-1998 electrical products aging test method

QJ 1408A-1998 spaceflight products reliability requirements

QJ 3183-2003 spaceflight products quality zero implementation guide



note: visit www.rion-tech.net for more information

The logo features the word 'RION' in a bold, white, sans-serif font. The letter 'O' is replaced by a stylized white circle with an arrow pointing upwards and to the right. A 'TM' trademark symbol is positioned to the upper right of the 'N'.

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✓ 三维电子罗盘 ✓ 加速度计 ✓ 航姿参考系统 ✓ 寻北仪

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