SPECIFICATIONS

Model：IMU520

Description：Inertial Measure Unit

Production standard reference

●enterprise quality system standard：ISO9001:2008 standard（certificate sign：128101）

●Inclinometer production standard：GB/T 191 SJ 20873-2003

●Inclinometer calibration standard：JJF1119-2004

●Gyroscope accelerometer test standard：QJ 2318-92

●Software development standard：GJB 2786A-2009

●Product environment test standard：GJB150

●EMI test standard：GB/T 17626

●Version：Ver.01

Introduction

IMU520 is a reliable solid inertial measure unit. The built-in three axis silicon gyroscope and three axis silicon accelerometer calibrated precisely by three axis turntable make its function qualified for kinds of working condition. Data fusion is realized by built-in DSP extending kalman filter, providing precise carrier posture and sensor data in real-time.

Main Feature

●high performance under vibration condition.
●precise calibration of gyroscope zero point, zero temperature coefficient, sensitivity, sensitivity temperature coefficient, orthogonality error, acceleration effect, accelerometer zero, zero temperature coefficient, sensitivity, sensitivity temperature coefficient and orthogonality error.
●500Hz fast calculation, 128kSPS high speed synchronous sampling ensure motion calculation in detail, inhibition aliasing, promote signal-noise ratio.
●data packet max speed 250Hz, RS232 interface.
●low power consumption: typical 0.25A(12V).

Application

●mini-UAV
●platform stability and aiming
●satellite communication on the move
●posture monitor

Installation axial

IMU520 adopts NED coordinate(XYZ-north east ground), right hand system. When X positive direction point to the front of carrier, the angle rotate X is roll angle, the angle rotate Y is pitch angle, the angle rotate Z is heading angle.

Connection definition

Table 1~4 pin connector signal definition

Pin Number	Function
1	Power anode, 12V(red)
2	Power ground(black)
3	RS-232 data sending(green)
4	RS-232 data receiving(white)

Dimension
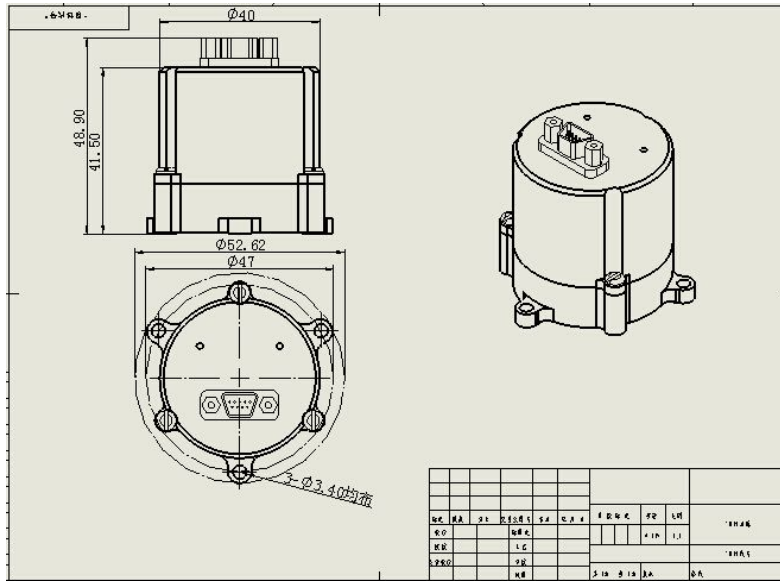
Using and installation

1. Power is 12v+/-1v DC, ripple<50mV, current at least 0.5A, if power noise is relatively big and power cable is long, filter or external voltage regulator is recommended.
2. IMU is fixed on carrier by M3 semi-circle screw, looseness during operation would affect the measure accuracy.
3. IMU should be keep static within 15 seconds after power on till there is data output, self-detect finish and initial alignment. IMU will postpone data output till initial alignment finish.
4. Please install it on the gravity center as possible.
5. Avoid strong vibration, temperature change(like install it close to motor) as possible. Use vibration damper when necessary.
6. Align IMU coordinate with carrier coordinate as possible.

Working mode and data packet format

IMU520 work mode: vertical gyroscope(VG). Output roll, pitch, gyroscope angular speed and acceleration after kalman filter correction.

Need IMU520 work at VG mode, could use serial port output command:

Table 2 VG mode command

Byte No.	Content	Description
1	0xBD	First header byte
2	0xDB	Second header byte
3	0x65	Attitude (with Heave and Sensor) Output command byte
4	0x03	Checksum: Byte-wise XOR of byte 1 to 3.

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Data packet format:

Table 3 data packet format

Byte No.	Content	Description
0	0xBD	First header byte
1	0xDB	Second header byte
2	Status	0x04
3	Roll	LSB of Roll
4		MSB of Roll
5	Pitch	LSB of Pitch
6		MSB of Pitch
7	Yaw	LSB of Yaw
8		MSB of Yaw
9	DEBUG0	LSB of DEBUG0
10		MSB of DEBUG0
11	DEBUG1	LSB of DEBUG1
12		MSB of DEBUG1
13	GX	LSB of x-axis gyroscope
14		MSB of x-axis gyroscope
15	GY	LSB of y-axis gyroscope
16		MSB of y-axis gyroscope
17	GZ	LSB of z-axis gyroscope
18		MSB of z-axis gyroscope
19	AX	LSB of x-axis accelerometer
20		MSB of x-axis accelerometer
21	AY	LSB of y-axis accelerometer
22		MSB of y-axis accelerometer
23	AZ	LSB of z-axis accelerometer
24		MSB of z-axis accelerometer
25	Temp	LSB of temperature sensor
26		MSB of temperature sensor
27	Timestamp	LSB of timestamp
28		Mid1 of timestamp
29		Mid2 of timestamp
30		MSB of timestamp
31	Info	LSB of INFO
32		MSB of INFO
33	Checksum	Byte-wise XOR of byte 0 to 32

Angle is 16bit, integer with sign (int16), multiply by coefficient 360/32768 to convert to degree.

Angle is 16bit, integer with sign (int16), multiply by coefficient GRange/32768 to convert to degree/second.

Acceleration is 16bit, integer with sign (int16), multiply by coefficient ARange/32768 to convert to g.

Angle is 16bit, integer with sign (int16), multiply by coefficient ARange/32768 to convert to g.

Sensor temperature is 16bit, integer with sign (int16), multiply by coefficient 200/32768 to convert to Celsius degree.

Timestamp is the internal time from power on to current, 32 bit integer with no sign(unit 32), unit ms.

Info is status word, definition as below:

Table 4 Info definition

15	14	13	12
Model2	Model1	Model0	SW ver2
11	**10**	**9**	**8**
SW ver1	SW ver0	HW ver1	HW ver0
7	**6**	**5**	**4**
GRange2	GRange1	GRange0	ARange1
3	**2**	**1**	**0**
ARange0	Sys warning	Sys Err	Over range Err

Model <2..0>

000 IMU800

001 IMU610

010 WS601

011 MiniIMU

1xx Future models

SW ver <2..0> Software main version

HW ver<1..0> Hardware main version

GRange<2..0> Gyro measurement range

000 75deg/s

001 150deg/s

010 200deg/s

011 300deg/s

100 573deg/s

101 900deg/s

ARange<1..0>

00 2g

01 3g

10 5g

11 12g

Sys warning: non-fatal error happens, such as sending speed exceed serial port limit speed, full serial port receiving buffer zone, sending result exceeds int16 range etc. When warning lifted, the warning will disappear in 1 second.

Sys Err: gross error happens, self-detection failure, sensor failure, initialization failure and so on, the flag bit do not disappear.

Sensor Saturation warning: sensor exceeds limit warning, 1s later it will disappear if not over any more.

IMU Assistant software

IMU 610 Assistant software is used to debug, configure IMU520 as pic 3 below:

Pic 3 IMU610 assistant

1 software installation

1. Installation setup.exe
2. If need, system will hint update the newest version of windows .netframework.

2 software using

1. Serial port on the upper left is to choose serial port baud rate and serial port number, open serial port. Default baud rate is 57600bps。
2. Under default binary system data format, right-mid section Artificial Horizon card could display Artificial Horizon posture, heading display amitzh(gyroscope integration or magnetic heading), VR Data on the upper right display value.
3. Default mode is binary system operation, vertical gyroscope gyroscope mode attitude and Sensor data 0x65。
4. If need 2D AHRS mode, click AHRS MODE (2D compass).(IMU520 has no that work mode)
5. If need revise baud rate or data speed, could choose under binary system mode or configure in text mode.
   Under different baud rate and mode, the highest data speed allowed is different. The calculation was as below:
   Allowed highest speed=baud rate/10/byte number of each data packet
   Eg: under VG and AHRS mode, 57600bps baud rate allows the highest data speed is 100Hz, while 115200bps baud rate allows the highest speed is 250Hz.
6. If need to calibrate compass(2D), click calibrate compass 2D under binary system format, rotate at least one round within 60s in carrier horizontal level or close to horizontal level and far away from magnetic interference. It will calibrate automatically after the 60 seconds.
7. If need to save working status set, click save configs.
8. Print Error log could print internal the last 16 error or warning.
9. To save data to file, click save at Log data to file.
10. Upgrade firmware: press ASCII to enter ASCII mode, click upgrade on the right, choos LDR

file to begin upgrade. Please be noted that do not plug out, restart or power off if error occurs and upgrading is interrupted during upgrading, user should re-click upgrade to re-start upgrading.

IMU520 parameter index

attribute	index	remark
heading		
Range (°)	±180	
Accuracy (°)	< 2°	With compass or GPS assist
Resolution (°)	0.01	
attitude		
Range: roll, pitch (°)	±180	
Dynamic accuracy (°)	<0.3°	Helicopter suspend or hover
Resolution (°)	0.01	
Angular speed		
range: roll, pitch, yaw (°/sec)	±300	Standard configure
	±900	High range configure
Zero absolute error(°/sec)	< 0.15deg/s	No kalman filter within operating temperature zone
	<0.02 deg/s	With kalman filter
Zero instability(°/hr)	6	Typical Allen variance, high accuracy optional
resolution (°/sec)	0.01	
ARW (°/√hr)	<0.28	
acceleration		
Range: X,Y,Z(g)	±6g	
Bias stability (mg)	<5mg	operating temperature zone, high accuracy optional
Resolution (mg)	<1mg	
bandwidth		
sensor bandwidth	90Hz	With internal filter, software could adjust
Working environment		
power on impact	200g@6ms	
Non-power on impact	10000g@0.3ms	
anti-shock	6g rms	20Hz-2kHz, random
Working temperature	-40°C ~85°C	
Protection grade	N/A	
Electrical interface		
input voltage (DC V)	5-13	Clamping voltage>15.0V
Size (mm)	φ40×40	
Weight (g)	70	
Interface type	4 Pin	

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