High precision gyroscope module JY-901 Series

User Manual

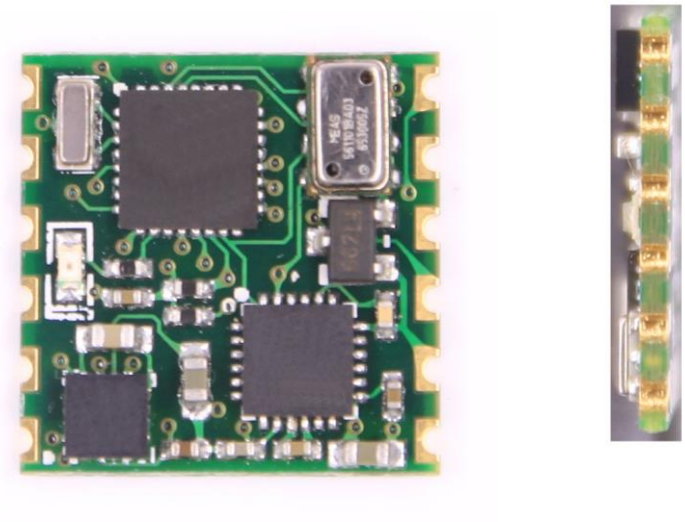
1 Product Description

1) JY-901 series module integrates high-precision gyroscopes, accelerometers, geomagnetic sensor, high-performance microprocessors and advanced dynamics solver and dynamic Kalman filter algorithm to quickly solve the current real-time movement of the module attitude .
2) The use of advanced digital filtering technology, can effectively reduce the measurement noise and improve measurement accuracy.
3) Integrates gesture solver, with dynamic Kalman filter algorithm, can get the accurate attitude in dynamic environment, attitude measurement precision is up to 0.01 degrees with high stability, performance is even better than some professional inclinometers!
4) Integrate voltage stabilization circuit, working voltage is 3v ~ 6v, pin level compatible 3.3V and 5V embedded system .
5) Supports serial port and IIC interfaces. Serial port rate is adjustable from 2400bps ~ 921600 bps , IIC interface supports full 400K rate.
6) Highest 200Hz output data rate. The output data and rate can be adjusted.
7) The 4-way expansion ports can configured as analog input, digital input, digital output, PWM output function.
8) With GPS connectivity. Acceptable in line with NMEA-0183 standard serial GPS data form GPS-IMU navigation unit.
9) Stamp hole gold plating PCB design, can be embedded in the user's PCB board.
10) 4layer PCB technology, thinner, smaller, and more reliable.

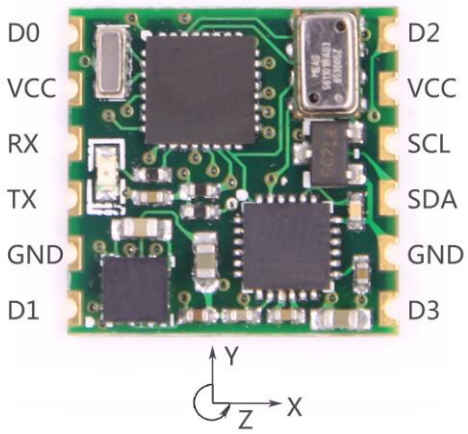
Technical Indicator

1) Input voltage: 3V-6V
2) Consumption current: <40mA
3) Volume: 15.24mm X 15.24mm X 2mm
4) Pad pitch: up and down 100mil (2.54mm), left and right 600mil (15.24mm)
5) Measuring dimensions: Acceleration: 3D Angular Velocity: 3D Attitude angle: 3D Magnetic field：3D Atmospheric pressure:1D GPS:1D
6) Range: Acceleration: ±16g, angular velocity: ±2000 °/ s.
7) Resolution: Acceleration: 6.1e-5g, Angular velocity: 7.6e-3 °/ s.
8) Stability: Acceleration: 0.01g, angular speed 0.05 °/ s.
9) Attitude stabilization measurement: 0.01 °.

10) Data output: time, acceleration, angular velocity, angle, field, port status, pressure (JY-901B), height (JY-901B), latitude and longitude (to be connected to GPS), ground speed (to be connected to GPS).
11) The data output frequency 0.1Hz to 200Hz.
12) Data Interface:
Serial (TTL level, baud rate support 2400,4800,9600,19200,38400,57600, 115200,230400,460800,921600), I2C (IIC maximum support high speed 400K)
13) Expansion port functions: analog input (0 ~ VCC), digital input, digital output, PWM output (period 1us-65535us, resolution 1us)
14) Provide single-chip analytical sample code.



2 Pin Description



Name	Function
VCC	Power，3.3V or 5V Input
RX	Serial data input ， TTL level
TX	Serial data output ， TTL level
GND	GND
SCL	I2C Clock line
SDA	I2C Data line
D0	Extended port 0
D1	Extended port 1
D2	Extended port 2
D3	Extended port 3

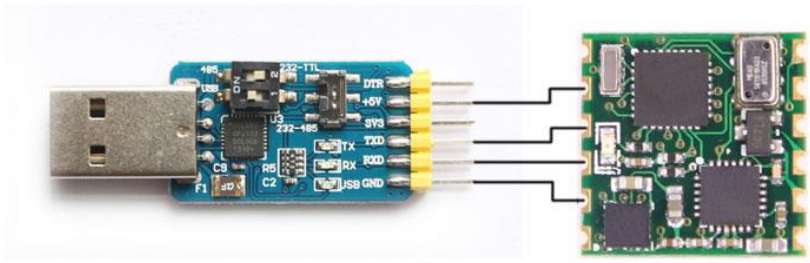
As shown in the figure above, the coordinates of the module are indicated, and the right is the X axis, the upper is Y axis, the Z axis is perpendicular to the surface of the paper to yourself. The direction of rotation is defined by the right hand rule, that is, the thumb of the right hand is pointed to the axial direction, and the four is the direction of the bending of the right hand.

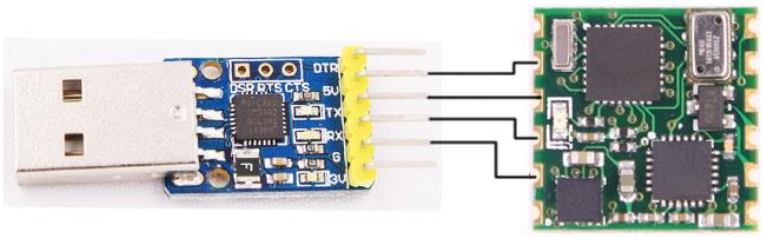
3 Hardware connection method

3.1 Connect to PC

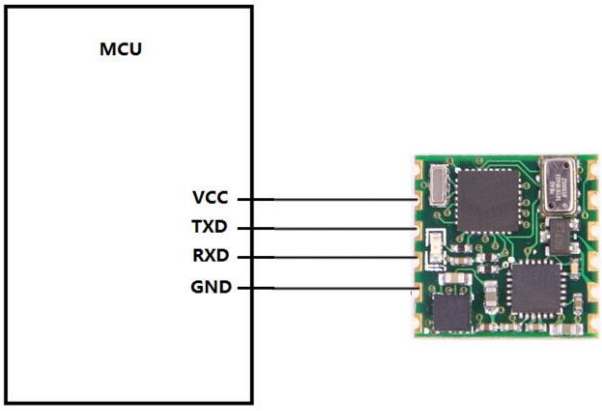
USB to TTL tool connect to JY-901 module：USB to TTL tool:+5V，TXD，RXD，GND are respectively connected JY901 module :VCC，RX，TX，GND。Note TXD and RXD should be crossover。

(Notice：The switch of Six serial interface module needs to be configed as the following figure when connecting to 6050 module)





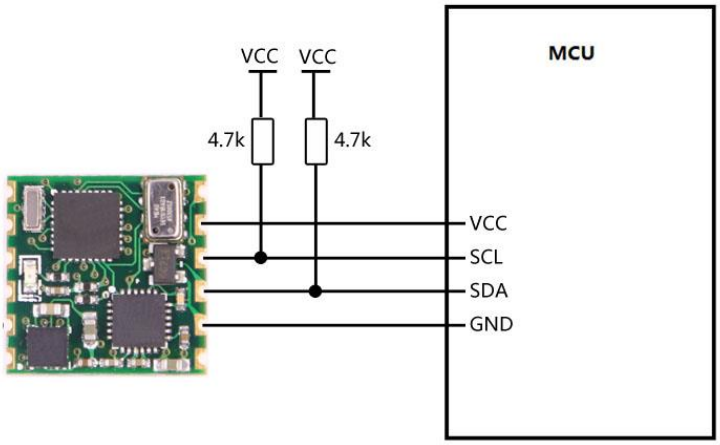
3.2 Connected to MCU



3.3 IIC Connection

JY-901 modules can be connected through the IIC interface to MCU, connection method as

shown below. Note that, in order to connect several modules on IIC bus, module IIC bus is open-drain output, MCU need a 4.7K resistor pulled to VCC when connecting the module.

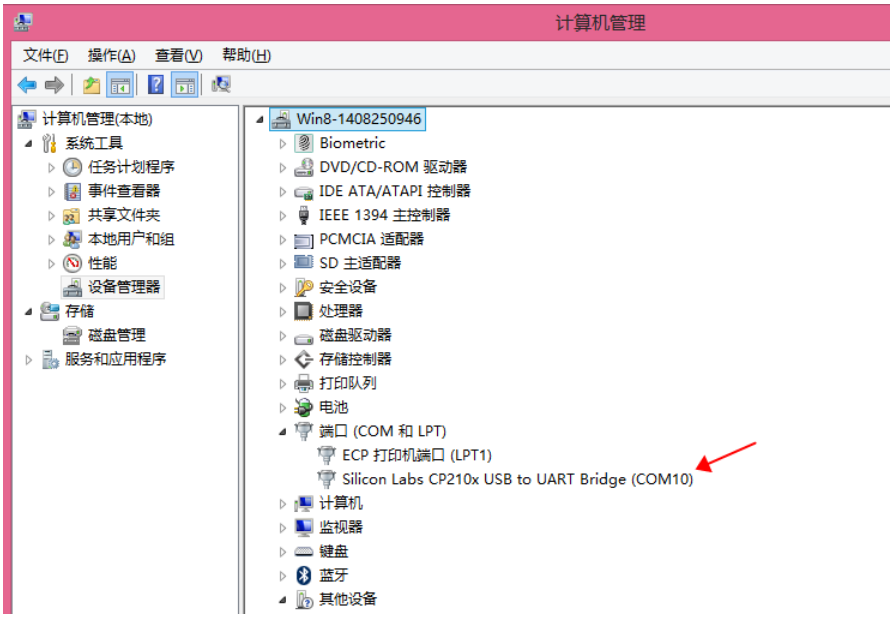


4 Software Operation

4.1 Installation USB-TTL module driver

First, the module is connected via USB-TTL module to the computer, install the USB-TTL module driver.

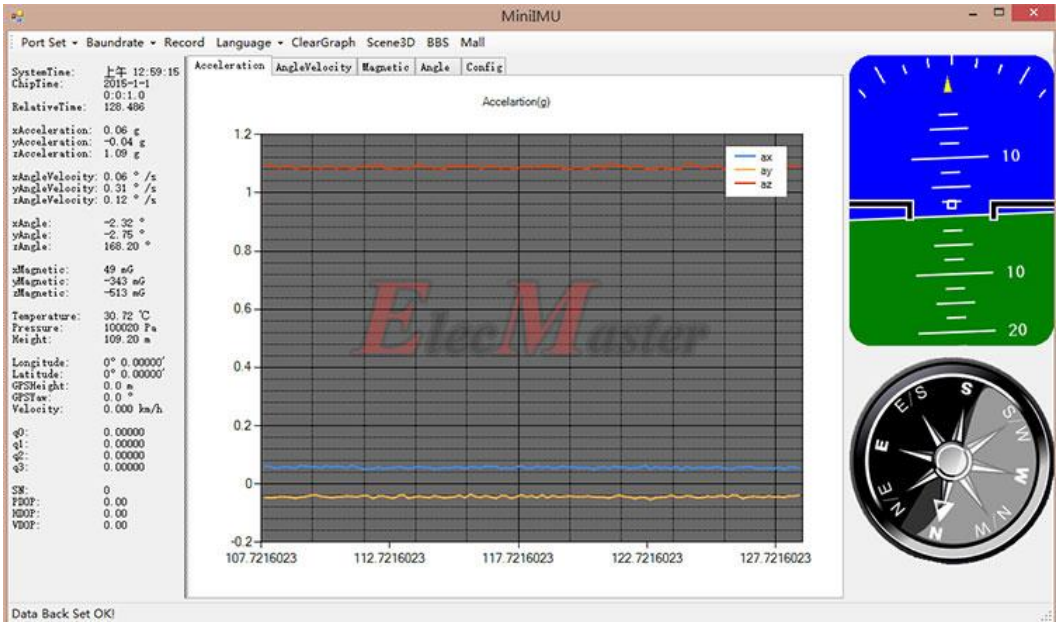
After installing the USB-TTL module driver, and then Device Manager can query corresponding serial number, as below figure shows:



4.2 Open PC program of JY901

Open the PC software, first click on the baud rate menu, select the baud rate module, the

default setting is 9600. Then click Serial port Settings menu, select the Port number the same as the USB-TTL module which query in 2.2. As shown below.



After you open the serial port, if there was no data of the image, check wiring is correct, then confirm the baud rate is set correctly, if you forget the module baud rate is the number, you can click on the menu baud -> Auto. The software will automatically search the baud rate , Prerequisite for automatic search module ,the output rate should be greater than 5Hz, if the rate is too low, the automatic detection module will not work.If it like this, you can try to set the module to the factory settings.

Click the record button, the software can record data to a text file, click on the record button, and when finish recording ,need to click the stop , the file will be written to the hard disk, the file path to the root directory of the PC program of JY-901 module,the file name is the start time.

Click on the language menu, you can switch the language between Chinese and English

Click clear diagram button, you can clear the data displayed in the chart. When collecting this data with the previous data collection interval for a long time, the chart will update slower, then you can click on the clear button, It will become faster.

Click the three-dimensional buttons, call up the three-dimensional display screen, displaying three-dimensional posture of the module. After starting the three-dimensional model, the default interface is full screen, and to change back to the window mode, you can press the [F] key, if you can not switch, press ctrl + Space to change the input method to English,then press [F]key.

4.3 Module calibration

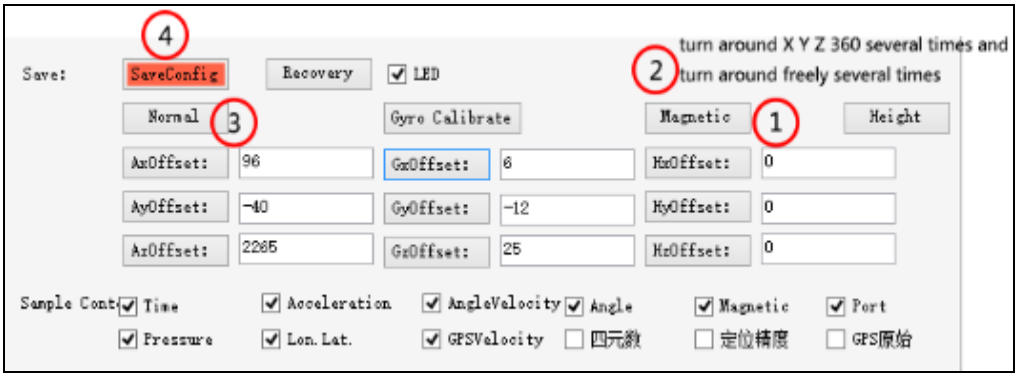
First, the module needs to be calibrated. Calibration module includes a gyroscope calibration, Magnetic calibration and height set to 0.

Gyroscope calibration measurement is used to remove the gyroscope bias. When the module is still, if the angular speed is not near 0 °/ s, then need to calibrate the gyro. Click the Settings tab, and enter the settings page. Click on "Gyro calibration" button, when GXOFFSET, GYOFFSET, GZOFFSET are stable, then click on "normal" button to complete the calibration. Then click the "Save Config" button to save the bias data to the module's internal FLASH in order to Power-down save. Then at the stationary state, the gyro output will return to 0 °/ s vicinity.

The calibration value of the gyroscope can be set up manually, and the corresponding value is filled in the GxOffset GyOffset GzOffset.

It should be noted that the calibration process is not applied to acceleration. Normally it is no need . Advanced users can manually use set bias acceleration. It is the same as gyro calibration method .

Magnetic field sensor calibration for the removal of bias. Generally there will be magnetic error in the when manufactured, if not calibration, measurement errors will bring great impact on angle measurement accuracy. During calibration, first connect the module and the computer, the module is placed in a place where far away from magnetic interference, then open the PC software. Click the Settings tab, and enter the settings page. Click on "magnetic" button, rotate around X-axis 360 °several times, and then turn around the Y-axis 360 °several times, and then turn around the Z-axis 360 °several times, then freely rotate a few times, when HxOffset, HyOffset, HzOffset are still, and then click on "normal " button to complete the calibration. Then click the "Save Config" button to save the bias data to the module's internal FLASH in order to power-down save. Thereafter, the angle will be accurate.



Calibration of the magnetic field can also be manually set, after input value, click on the

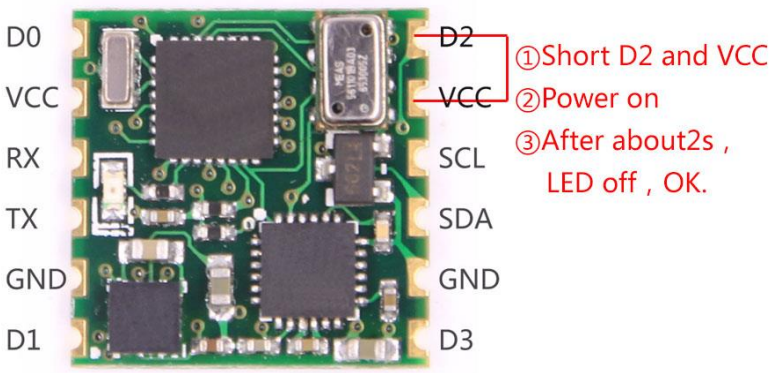
button on HxOffset to set the X axis magnetic bias, empathy click HyOffset can set the Y-axis magnetic bias.

Zero height is the height of module which can be setted to 0. JY-901B type has the function .The height of the output is calculated based on the pressure,so it is only for reference. height set to 0 operation is the current barometric pressure value as a zero height calculation.

4.4 Restore factory settings

There are two methods, short circuit method and instruction methods.。

Short Circuit Method : D2 pin are short to VCC pin, then power on the module, the module LED lights long bright, lasts about two seconds, LED light is off, complete restore factory settings operation.



Instruction method : JY-901 module connected to a PC via USB-TTL module , click the Settings tab, click “Recovery”. After restore the factory settings ,need to restart the module again. (This method requires advance knowledge to know baud rate of the module, if the baud rate does not match the command will not take effect, try using a short-circuit recovery method)

4.5 Setting output content

Data output can be customized according to user needs, click on the Settings tab which needs to be output. After the setup is complete, click the Save Configuration button, otherwise settings will be lost after power-down content.

When power on, the time of the module is January 1, 2015 0: 0: 0. If you connect the GPS module, the time of the module is the GPS time. Note that GPS time is eight hours later than Beijing.

Pressure data is only equipped in JY-901B-type with pressure sensors.

When connect to GPS module successfully, and D1 expansion port function module setted to GPSRX , the PC program can get the latitude and longitude and ground speed information..

4.6 Set return rate

The default return rate is 10Hz, the return rate can reach up to 200Hz. To save the settings when power down, need to click Save Configuration button . if the output data is too much, at the same time communication baud rate is too low, it could not transfer so much data, the module will automatically change the output frequency.

4.7 Set baud rate

Module supports multiple baud, 9600 default. Change baud rate only when the module connect to PC program successfully, choose the baud rate and Click “Change” button.

Note: After changing the baud rate, the module does not immediately take effect, need to re-power and then it will take effect.

4.8 Set IIC address

The module's IIC address is 0x50, which can be changed by software. Change the IIC address only when the module connect to PC program successfully, and enter the new 16 hexadecimal IIC address and click the “change” button.

Note: The IIC address of the module will not be changed immediately, and it will take effect when the module restart.

4.9 Set the GPS baud rate

The default GPS baud rate is 9600. Change the IIC address only when the module connect to PC program successfully, and choose the GPS baud rate in the drop box and click the “change” button.

Note: The GPS baud rate of the module will not be changed immediately, and it will take effect when the module restart.

4.10 Set Extended port

The JY-901 module has 4 multiple function expansion ports, which can be set to different functions according to the need. Set extended port only when the module connect to PC program successfully.

The extended port supports analog input mode, digital input mode, digital output mode, PWM output mode. D1 port also supports GPSRX mode, port state by default is analog input mode.

Analog input mode is used to measure the analog voltage on the port, such as a potentiometer or a sensor, etc.

Formula is As follows:

$U=DxStatus/4096*U_{vcc}$

Uvcc is the power supply voltage of the module, because the module has LDO, if the module power supply voltage is greater than 3.5V, Uvcc is 3.3V. If the module supply voltage is less than 3.5V, Uvcc equal to the supply voltage minus 0.2V。

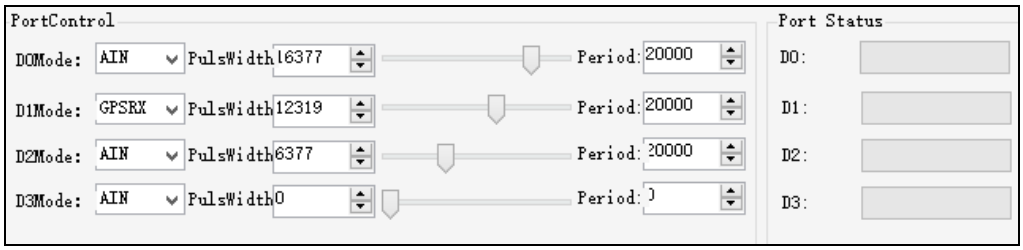
For digital input mode，if the voltage is high，DxStatus=1，else，DxStatus=0。

For digital output mode:

Voltage is high， DxStatus=1。

Voltage is low， DxStatus=0。

PWM output mode is used for the output of the PWM wave, the cycle and the high level width can be adjusted, the unit is us. In the PWM output mode, the port state data is used to indicate the high level of the PWM, the unit us.



4.11 Set LED

In some special cases, the user may not need to make the module's LED lights flashing, you can turn off the LED lamp by clicking on the LED button. For power saving settings, click the save configuration button.

5 Serial communication protocol

Level: TTL level (non RS232 level, if the module is wrong to the RS232 level may cause damage to the module)

Baud rate: 2400, 4800, 9600 (default), 19200 38400, 57600, 115200, 230400, 460800, 921600, stop bit and parity bit 0

5.1 Module to PC program:

5.1.1 Time output：

0x55	0x50	YY	MM	DD	hh	mm	ss	msL	msH	SUM

YY：Year，20YY Year

MM：Month

DD：Day

hh：hour

mm：minute

ss：Second

ms：Millisecond

Millisecond calculate formula：

ms=((msH<<8)|msL)

Sum=0x55+0x51+YY+MM+DD+hh+mm+ss+ms+TL

5.1.2 Acceleration output：

0x55	0x51	AxL	AxH	AyL	AyH	AzL	AzH	TL	TH	SUM

Calculate formula：

a_x=((AxH<<8)|AxL)/32768*16g(g is Gravity acceleration，9.8m/s^2)

a_y=((AyH<<8)|AyL)/32768*16g(g is Gravity acceleration，9.8m/s^2)

a_z=((AzH<<8)|AzL)/32768*16g(g is Gravity acceleration，9.8m/s^2)

Temperature calculated formular：

T=((TH<<8)|TL) /100 ℃

Checksum：

Sum=0x55+0x51+AxH+AxL+AyH+AyL+AzH+AzL+TH+TL

Note：

1、 the data is transmitted in accordance with the 16 hexadecimal, not ASCII code

2、 Each data is transmitted in a low byte and a high byte, and the two is combined into a short type of symbol. Such as X axis acceleration data Ax, where AxL is the low byte, AxH is high byte.

The conversion method is as follows:

Assuming Data is the actual data, DataH for its high byte, DataL for its low byte part, then: Data= ((short) DataH<<8) |DataL. Here we must pay attention to that force the DataH to be converted into a symbol of the short type of data and then after shift 8 bit, and the type of Data is also a symbol of the short type, so it can show a negative.

5.1.3 Angular velocity output：

0x55	0x52	wxL	wxH	wyL	wyH	wzL	wzH	TL	TH	SUM

Calculated formular：

w_x=((wxH<<8)|wxL)/32768*2000(°/s)

w_y=((wyH<<8)|wyL)/32768*2000(°/s)

w_z=((wzH<<8)|wzL)/32768*2000(°/s)

Temperature calculated formular：

T=((TH<<8)|TL) /100 ℃

Checksum：

Sum=0x55+0x52+wxH+wxL+wyH+wyL+wzH+wzL+TH+TL

5.1.4 Angle Output：

0x55	0x53	RollL	RollH	PitchL	PitchH	YawL	YawH	TL	TH	SUM

Calculated formular：

Roll（x axis）Roll=((RollH<<8)|RollL)/32768*180(°)

Pitch（y axis）Pitch=((PitchH<<8)|PitchL)/32768*180(°)

Yaw（z axis）Yaw=((YawH<<8)|YawL)/32768*180(°)

Temperature calculated formular：

T=((TH<<8)|TL) /100 ℃

Checksum：

Sum=0x55+0x53+RollH+RollL+PitchH+PitchL+YawH+YawL+TH+TL

Note：

1. Attitude angle use the coordinate system for the Northeast sky coordinate system, the X axis is East,the Y axis is North, Z axis toward sky. Euler coordinate system rotation sequence defined attitude is z-y-x, first rotates around the Z axis. Then, around the Y axis, and then around the X axis.
2. In fact, the rotation sequence is Z-Y-X, the range of pitch angle (Y axis) is only ±90

degrees, when the pitch angle (Y axis) is bigger than 90 degrees and the pitch angle (Y axis) will become less than 90 degrees. At the same time, the Roll Angle(X axis) will become larger than 180 degree. Please search on Google about more information of Euler angle and attitude information.

3. Since the three axis are coupled, the angle will be independent only when the angle is small. It will be dependent of the three angle when the angle is large when the attitude angle change, such as when the X axis close to 90 degrees, even if the attitude angle around the X axis, Y axis angle will have a big change, which is the inherent characteristics of the Euler angle

5.1.5 Magnetic output：

0x55	0x54	HxL	HxH	HyL	HyH	HzL	HzH	TL	TH	SUM

Calculated formular：

Magnetic（x axis）Hx=((HxH<<8)| HxL)

Magnetic（y axis）Hy=((HyH <<8)| HyL)

Magnetic（z axis）Hz =((HzH<<8)| HzL)

Temperature calculated formular：

T=((TH<<8)|TL) /100 ℃

Checksum：

Sum=0x55+0x53+HxH+HxL+HyH+HyL+HzH+HzL+TH+TL

5.1.6 Data output port status：

0x55	0x55	D0L	D0H	D1L	D1H	D2L	D2H	D3L	D3H	SUM

Calculated formular：

D0 = (D0H<<8)| D0L

D1 = (D1H<<8)| D1L

D2 = (D2H<<8)| D2L

D3 = (D3H<<8)| D3L

Note：

Analog input port mode:

U=DxStatus/1024*U_{vcc}

Uvcc is the power supply voltage of the module, because the module has LDO, if the module power supply voltage is greater than 3.5V, Uvcc is 3.3V. If the module supply voltage is less than 3.5V, Uvcc equal to the supply voltage minus 0.2V

Digital input mode:

Voltage level is high, the data is 1,

Voltage level is low, the data is 0.

Digital output mode:

Output is high，the data is 1。

Output is low，the data is 0。

PWM output mode:

When the port is set to PWM output mode, port status data indicates high level width , the unit is us.

5.1.7 Atmospheric pressure and Height output：

0x55	0x56	P0	P1	P2	P3	H0	H1	H2	H3	SUM

Calculated formular：

Atmospheric pressure P = ((P3<<24)| (P2<<16)| (P1<<8)| P0 （Pa）

Height H = ((H3<<24)| (H2<<16)| (H1<<8)| H0 （cm）

Checksum：

Sum=0x55+0x54+P0+P1+P2+P3+H0+H1+H2+H3

5.1.8 Longitude and Latitude Output：

0x55	0x57	Lon0	Lon 1	Lon 2	Lon 3	Lat0	Lat 1	Lat 2	Lat 3	SUM

Calculated formular：

Longitude Lon = ((Lon 3<<24)| (Lon 2<<16)| (Lon 1<<8)| Lon 0

In NMEA0183 standard , GPS output format is ddmm.mmmmm (dd for the degree, mm.mmmmm is after decimal point), JY-901 removed output decimal point, so the degree of longitude can be calculated:

dd=Lon/100000000;

mm.mmmmm=(Lon%10000000)/100000；(% calculate Remainder)

Latitude Lat = ((Lat 3<<24)| (Lat 2<<16)| (Lat 1<<8)| Lat 0 （cm）

In NMEA0183 standard , GPS output format is ddmm.mmmmm (dd for the degree, mm.mmmmm is after decimal point), JY-901 removed output decimal point, so the degree of longitude can be calculated:

dd=Lat/100000000;

mm.mmmmm=(Lat%10000000)/100000；(% calculate Remainder)

Checksum：

Sum=0x55+0x54+ Lon 0+ Lon 1+ Lon 2+ Lon 3+ Lat 0+ Lat 1+ Lat 2+ Lat 3

5.1.9 Ground speed output：

0x55	0x58	GPSHeightL	GPSHeightH	GPSYawL	GPSYawH
GPSV0	GPSV 1	GPSV 2	GPSV 3	SUM	

Calculated formular：

GPSHeight = ((GPSHeightH<<8)| GPSHeightL)/10 （m）

GPSYaw =((GPSYawH <<8)| GPSYawL)/10 （°）

GPSV = (((Lat 3<<24)| (Lat 2<<16)| (Lat 1<<8)| Lat 0)/1000（km/h）

Checksum：

Sum=0x55+0x54+ GPSHeightL + GPSHeightH + GPSYawL + GPSYawH + GPSV0+ GPSV 1+ GPSV 2+ GPSV 3

5.1.10 Quaternion：

0x55	0x59	Q0L	Q0H	Q1L	Q1H	Q2L	Q2H	Q3L	Q3H	SUM

Calculated formular：

Q0=((Q0H<<8)|Q0L)/32768

Q1=((Q1H<<8)|Q1L)/32768

Q2=((Q2H<<8)|Q2L)/32768

Q3=((Q3H<<8)|Q3L)/32768

Checksum：

Sum=0x55+0x59+Q0L+Q0H+Q1L +Q1H +Q2L+Q2H+Q3L+Q3H

5.1.11 Satellite positioning accuracy output：

0x55	0x59	SNL	SNH	PDOPL	PDOPH	HDOPL	HDOPH	VDOPL	VDOPH	SUM

Calculated formular：

Satellite quantity：SN=((SNH<<8)|SNL)

Location positioning accuracy：PDOP=((PDOPH<<8)|PDOPL)/32768

Horizontal positioning accuracy：HDOP=((HDOPH<<8)| HDOPL)/32768

Vertical positioning accuracy：VDOP=((VDOPH<<8)| VDOPL)/32768

Checksum：

Sum=0x55+0x59+ SNL + SNH + PDOPL + PDOPH + HDOPL + HDOPH + VDOPL + VDOPH

5.2 PC program to Module

Note：

1. Default settings using the serial port, baud rate 9600, frame rate 10Hz. configurations can be powered down save, so only configured once on the line.
2. Format

0xFF	0xAA	Address	DataL	DataH

5.2.1 Register Address table

Address	Symbol	Meaning
0x00	SAVE	Save
0x01	CALSW	Calibration
0x02	RSW	Return data content
0x03	RATE	Return data Speed
0x04	BAUD	Baud rate
0x05	AXOFFSET	X axis Acceleration bias
0x06	AYOFFSET	Y axis Acceleration bias
0x07	AZOFFSET	Z axis Acceleration bias
0x08	GXOFFSET	X axis angular velocity bias
0x09	GYOFFSET	Y axis angular velocity bias
0x0a	GZOFFSET	Z axis angular velocity bias
0x0b	HXOFFSET	X axis Magnetic bias
0x0c	HYOFFSET	Y axis Magnetic bias
0x0d	HZOFFSET	Z axis Magnetic bias
0x0e	D0MODE	D0 mode

0x0f	D1MODE	D1 mode
0x10	D2MODE	D2 mode
0x11	D3MODE	D3 mode
0x12	D0PWMH	D0PWM High-level width
0x13	D1PWMH	D1PWM High-level width
0x14	D2PWMH	D2PWM High-level width
0x15	D3PWMH	D3PWM High-level width
0x16	D0PWMT	D0PWM Period
0x17	D1PWMT	D1PWM Period
0x18	D2PWMT	D2PWM Period
0x19	D3PWMT	D3PWM Period
0x1a	IICADDR	IIC address
0x1b	LEDOFF	Turn off LED
0x1c	GPSBAUD	GPS baud rate
0x30	YYMM	Year、Month
0x31	DDHH	Day、Hour
0x32	MMSS	Minute、Second
0x33	MS	Millisecond
0x34	AX	X axis Acceleration
0x35	AY	Y axis Acceleration
0x36	AZ	Z axis Acceleration
0x37	GX	X axis angular velocity
0x38	GY	Y axis angular velocity
0x39	GZ	Z axis angular velocity
0x3a	HX	X axis Magnetic
0x3b	HY	Y axis Magnetic
0x3c	HZ	Z axis Magnetic
0x3d	Roll	X axis Angle
0x3e	Pitch	Y axis Angle
0x3f	Yaw	Z axis Angle
0x40	TEMP	Temperature
0x41	D0Status	D0Status
0x42	D1Status	D1Status
0x43	D2Status	D2Status
0x44	D3Status	D3Status
0x45	PressureL	Pressure Low Byte
0x46	PressureH	Pressure High Byte
0x47	HeightL	Height Low Byte
0x48	HeightH	Height High Byte
0x49	LonL	Longitude Low Byte
0x4a	LonH	Longitude High Byte
0x4b	LatL	Latitude Low Byte
0x4c	LatH	Latitude High Byte

0x4d	GPSHeight	GPS Height
0x4e	GPSYaw	GPS Yaw
0x4f	GPSVL	GPS speed Low byte
0x50	GPSVH	GPS speed High byte
0x51	Q0	Quaternion Q0
0x52	Q1	Quaternion Q1
0x53	Q2	Quaternion Q2
0x54	Q3	Quaternion Q3

5.2.2 Save Configuration

0xFF	0xAA	0x00	SAVE	0x00

SAVE：Save

0：Save current configuration

1：set to default setting

5.2.3 Set carlibration

0xFF	0xAA	0x01	CALSW	0x00

CALSW：Set calibration mode

0：Exit calibration mode

1：Enter Gyroscope and Accelerometer calibration mode

2：Enter magnetic calibration mode

3：Set height to 0

5.2.4 Set return content

0xFF	0xAA	0x02	RSW	0x00

RSW byte definition

byte	7	6	5	4	3	2	1	0
Name	0x57 pack	0x56 pack	0x55 pack	0x54 pack	0x53 pack	0x52 pack	0x51 pack	0x50 pack
default	0	0	0	1	1	1	1	0

0x50 pack：time pack

0：Not output

1：Output

0x51 pack：Acceleration pack

0：Not output

1：Output

0x52 pack：Angular velocity pack

0：Not output

1：Output

0x53 pack：Angle Pack

0：Not output

1：Output

0x54 pack：Magnetic Pack

0：Not output

1：Output

0x54 pack：Atmospheric pressure &Height Pack

0：Not output

1：Output

0x55 pack：Longitude and Latitude Output Pack

0：Not output

1：Output

0x56 pack：GPS speed Pack

0：Not output

1：Output

0x57 pack：Port status pack

0：Not output

1：Output

5.2.5 Set return rate

0xFF	0xAA	0x03	RATE	0x00

RATE：return rate

0x01：0.1Hz

0x02：0.5Hz

0x03：1Hz

0x04：2Hz

0x05：5Hz

0x06：10Hz（default）

0x07：20Hz

0x08：50Hz

0x09：100Hz

0x0a：200Hz

0x0b：Single

0x0c：Not output

After the setup is complete , need to click save,and re-power the module to take effect.

5.2.6 Set baud rate

0xFF	0xAA	0x04	BAUD	0x00

BAUD：

0x00：2400

0x01：4800

0x02：9600（default）

0x03：19200

0x04：38400

0x05：57600
0x06：115200
0x07：230400
0x08：460800
0x09：921600

5.2.7 Set X axis Acceleration bias

0xFF	0xAA	0x05	AXOFFSETL	AXOFFSETH

AXOFFSETL：X axis Acceleration bias low byte
AXOFFSETH：X axis Acceleration bias high byte
AXOFFSET= (AXOFFSETH <<8) | AXOFFSETL
Note：When set the acceleration bias, the output equal the value of the acceleration sensor output value minus the bias value

5.2.8 Set Y axis Acceleration bias

0xFF	0xAA	0x06	AYOFFSETL	AYOFFSETH

AYOFFSETL：Y axis Acceleration bias low byte
AYOFFSETH：Y axis Acceleration bias high byte
AYOFFSET= (AYOFFSETH <<8) | AYOFFSETL
Note：When set the acceleration bias, the output equal the value of the acceleration sensor output value minus the bias value.

5.2.9 Set Z axis Acceleration bias

0xFF	0xAA	0x07	AZOFFSETL	AZOFFSETH

AZOFFSETL：Z axis Acceleration bias low byte
AZOFFSETH：Z axis Acceleration bias high byte
AZOFFSET= (AZOFFSETH <<8) | AZOFFSETL
Note：When set the acceleration bias, the output equal the value of the acceleration sensor output value minus the bias value.

5.2.10 Set X axis Angular velocity bias

0xFF	0xAA	0x08	GXOFFSETL	GXOFFSETH

GXOFFSETL：Set X axis Angular velocity bias low byte
GXOFFSETH：Set Y axis Angular velocity bias high byte
GXOFFSET= (GXOFFSETH <<8) | GXOFFSETL
Note：When set the Angular velocity bias, the output equal the value of the sensor output value minus the bias value.

5.2.11 Set Y axis Angular velocity bias

0xFF	0xAA	0x09	GYOFFSETL	GYOFFSETH

GYOFFSETL：Set X axis Angular velocity bias low byte

GYOFFSETH：Set X axis Angular velocity bias high byte

GYOFFSET= (GYOFFSETH <<8) | GYOFFSETL

Note：When set the Angular velocity bias, the output equal the value of the sensor output value minus the bias value.

5.2.12 Set Y axis Angular velocity bias

0xFF	0xAA	0x0a	GXOFFSETL	GXOFFSETH

GZOFFSETL：Set Z axis Angular velocity bias low byte

GZOFFSETH：Set Z axis Angular velocity bias low byte

GZOFFSET= (GZOFFSETH <<8) | GZOFFSETL

Note：When set the Angular velocity bias, the output equal the value of the sensor output value minus the bias value.

5.2.13 Set X axis magnetic bias

0xFF	0xAA	0x0b	HXOFFSETL	HXOFFSETH

HXOFFSETL：Set X axis magnetic bias low byte

HXOFFSETH：Set X axis magnetic bias high byte

HXOFFSET= (HXOFFSETH <<8) | HXOFFSETL

Note：When set the magnetic bias, the output equal the value of the sensor output value minus the bias value.

5.2.14 Set Y axis magnetic bias

0xFF	0xAA	0x0c	HXOFFSETL	HXOFFSETH

HXOFFSETL：Set Y axis magnetic bias low byte

HXOFFSETH：Set Y axis magnetic bias high byte

HXOFFSET= (HXOFFSETH <<8) | HXOFFSETL

Note：When set the magnetic bias, the output equal the value of the sensor output value minus the bias value.

5.2.15 Set Z axis magnetic bias

0xFF	0xAA	0x0d	HXOFFSETL	HXOFFSETH

HXOFFSETL：Set Y axis magnetic bias low byte

HXOFFSETH：Set Z axis magnetic bias high byte

HXOFFSET= (HXOFFSETH <<8) | HXOFFSETL

Note：When set the magnetic bias, the output equal the value of the sensor output value minus the bias value.

5.2.16 Set port D0 mode

0xFF	0xAA	0x0e	D0MODE	0x00

D0MODE：

0x00：Analog Input（default）

0x01：Digital Input

0x02：Digital Output high

0x03：Digital Output low

0x04：PWM Output

5.2.17 Set port D1 mode

0xFF	0xAA	0x0f	D1MODE	0x00

D1MODE：

0x00：Analog Input（default）

0x01：Digital Input

0x02：Digital Output high

0x03：Digital Output low

0x04：PWM Output

0x05：Connect to TX of GPS

5.2.18 Set port D2 mode

0xFF	0xAA	0x10	D2MODE	0x00

D2MODE：

0x00：Analog Input（default）

0x01：Digital Input

0x02：Digital Output high

0x03：Digital Output low

0x04：PWM Output

5.2.19 Set port D3 mode

0xFF	0xAA	0x11	D3MODE	0x00

D3MODE：

0x00：Analog Input（default）

0x01：Digital Input

0x02：Digital Output high

0x03：Digital Output low

0x04：PWM Output

5.2.20 Set the PWM width of Port D0

0xFF	0xAA	0x12	D0PWMHL	D0PWMHH

D0PWMHL：the PWM width of Port D0 low byte

D0PWMHH：the PWM width of Port D0 high byte

D0PWMH = (D0PWMHH<<8) | D0PWMHL

Note: The unit of PWM high-level width and period is us, such as high-level width is 1500us, just set D0PWMH 1500.

5.2.21 Set the PWM width of Port D1

0xFF	0xAA	0x13	D1PWMHL	D1PWMHL

D1PWMHL：the PWM width of Port D1 low byte

D1PWMHH：the PWM width of Port D1 high byte

D1PWMH = (D1PWMHH<<8) | D1PWMHL

Note: The unit of PWM high-level width and period is us, such as high-level width is 1500us, just set D0PWMH 1500.

5.2.22 Set the PWM width of Port D2

0xFF	0xAA	0x14	D2PWMHL	D2PWMHL

D2PWMHL：the PWM width of Port D2 low byte

D2PWMHH：the PWM width of Port D2 high byte

D2PWMH = (D2PWMHH<<8) | D2PWMHL

Note: The unit of PWM high-level width and period is us, such as high-level width is 1500us, just set D0PWMH 1500.

5.2.23 Set the PWM width of Port D3

0xFF	0xAA	0x15	D3PWMHL	D3PWMHL

D3PWMHL：the PWM width of Port D3 low byte

D3PWMHH：the PWM width of Port D3 low byte

D3PWMH = (D3PWMHH<<8) | D3PWMHL

Note: The unit of PWM high-level width and period is us, such as high-level width is 1500us, just set D0PWMH 1500.

5.2.24 Set period of Port D0

0xFF	0xAA	0x16	D0PWMTL	D0PWMTH

D0PWMTL：PWM period of Port D0 low byte

D0PWMTH：PWM period of Port D0 high byte

D0PWMT = (D0PWMTH<<8) | D0PWMTL

Note: The unit of PWM high-level width and period is us, such as high-level width is 1500us, just set D0PWMH 1500.Period is 20000us, just set D0PWMT 20000.

5.2.25 Set period of Port D1

0xFF	0xAA	0x17	D1PWMTH	D1PWMTL

D1PWMTL：PWM period of Port D1 low byte

D1PWMTH：PWM period of Port D1 high byte

D1PWMT = (D1PWMTH<<8) | D1PWMTL

Note: The unit of PWM high-level width and period is us, such as high-level width is 1500us, just set D0PWMH 1500.Period is 20000us, just set D0PWMT 20000.

5.2.26 Set period of Port D2

0xFF	0xAA	0x18	D2PWMTH	D2PWMTL

D2PWMTL：PWM period of Port D2 low byte

D2PWMTH：PWM period of Port D2 high byte

D2PWMT = (D2PWMTH<<8) | D2PWMTL

Note: The unit of PWM high-level width and period is us, such as high-level width is 1500us, just set D0PWMH 1500.Period is 20000us, just set D0PWMT 20000.

5.2.27 Set period of Port D3

0xFF	0xAA	0x19	D3PWMTH	D3PWMTL

D3PWMTL：PWM period of Port D3 low byte

D3PWMTH：PWM period of Port D3 high byte

D3PWMT = (D3PWMTH<<8) | D3PWMTL

Note: The unit of PWM high-level width and period is us, such as high-level width is 1500us, just set D0PWMH 1500.Period is 20000us, just set D0PWMT 20000.

5.2.28 Set IIC Address

0xFF	0xAA	0x1a	IICADDR	0x00

IICADDR：

IIC address of the module, default is 0x50. IIC address using 7bit address, can not exceed the maximum 0x7f. After the setup is complete , need to click save, and re-power the module to take effect.

5.2.29 Set LED

0xFF	0xAA	0x1b	LEDOFF	0x00

LEDOFF：

0x01：Turn off LED

0x00：Turn on LED

5.2.30 Set GPS baud

0xFF	0xAA	0x1c	GPSBAUD	0x00

GPSBAUD：

0x00：2400

0x01：4800

0x02：9600（default）

0x03：19200

0x04：38400
0x05：57600
0x06：115200
0x07：230400
0x08：460800
0x09：921600

After the setup is complete , need to click save, and re-power the module to take effect.

6 IIC Communication protocol：

JY-901 module can be fully accessed through IIC, the maximum IIC communication speed support 400khz, slave module address is 7bit, default address is 0x50, you can change the command through the serial port or the methods of IIC writing address ways. Many GY-901 modules can be connect to IIC bus at the same time, The precondition is that the module has the different IIC address.

IIC protocol module using the register address accessible way. The length of each address are 16bits, two bytes. The register address is defined in the following table:

RegAddr	Symbol	Meaning
0x00	SAVE	Save
0x01	CALSW	Calibration
0x02	RSW	Return data content
0x03	RATE	Return data Speed
0x04	BAUD	Baud rate
0x05	AXOFFSET	X axis Acceleration bias
0x06	AYOFFSET	Y axis Acceleration bias
0x07	AZOFFSET	Z axis Acceleration bias
0x08	GXOFFSET	X axis angular velocity bias
0x09	GYOFFSET	Y axis angular velocity bias
0x0a	GZOFFSET	Z axis angular velocity bias
0x0b	HXOFFSET	X axis Magnetic bias
0x0c	HYOFFSET	Y axis Magnetic bias
0x0d	HZOFFSET	Z axis Magnetic bias
0x0e	D0MODE	D0 mode
0x0f	D1MODE	D1 mode
0x10	D2MODE	D2 mode
0x11	D3MODE	D3 mode
0x12	D0PWMH	D0PWM High-level width
0x13	D1PWMH	D1PWM High-level width
0x14	D2PWMH	D2PWM High-level width
0x15	D3PWMH	D3PWM High-level width
0x16	D0PWMT	D0PWM Period
0x17	D1PWMT	D1PWM Period
0x18	D2PWMT	D2PWM Period

0x19	D3PWMT	D3PWM Period
0x1a	IICADDR	IIC address
0x1b	LEDOFF	Turn off LED
0x1c	GPSBAUD	GPS baud rate
0x30	YYMM	Year、Month
0x31	DDHH	Day、Hour
0x32	MMSS	Minute、Second
0x33	MS	Millisecond
0x34	AX	X axis Acceleration
0x35	AY	Y axis Acceleration
0x36	AZ	Z axis Acceleration
0x37	GX	X axis angular velocity
0x38	GY	Y axis angular velocity
0x39	GZ	Z axis angular velocity
0x3a	HX	X axis Magnetic
0x3b	HY	Y axis Magnetic
0x3c	HZ	Z axis Magnetic
0x3d	Roll	X axis Angle
0x3e	Pitch	Y axis Angle
0x3f	Yaw	Z axis Angle
0x40	TEMP	Temperature
0x41	D0Status	D0Status
0x42	D1Status	D1Status
0x43	D2Status	D2Status
0x44	D3Status	D3Status
0x45	PressureL	Pressure Low Byte
0x46	PressureH	Pressure High Byte
0x47	HeightL	Height Low Byte
0x48	HeightH	Height High Byte
0x49	LonL	Longitude Low Byte
0x4a	LonH	Longitude High Byte
0x4b	LatL	Latitude Low Byte
0x4c	LatH	Latitude High Byte
0x4d	GPSHeight	GPS Height
0x4e	GPSYaw	GPS Yaw
0x4f	GPSVL	GPS speed Low byte
0x50	GPSVH	GPS speed High byte
0x51	Q0	Quaternion Q0
0x52	Q1	Quaternion Q1
0x53	Q2	Quaternion Q2
0x54	Q3	Quaternion Q3

6.1 IIC write the module

When IIC write the module, the format is as below:

IICAddr<<1	RegAddr	Data1L	Data1H	Data2L	Data2H	……

First IIC host sends a Start signal to JY-901 module, then write IICAddr to register address and then write RegAddr , write the Data1L Data1H Data2L Data2H …. Sequentially, , when the last data has been written, the host sends a stop signal to the module to release the IIC bus.

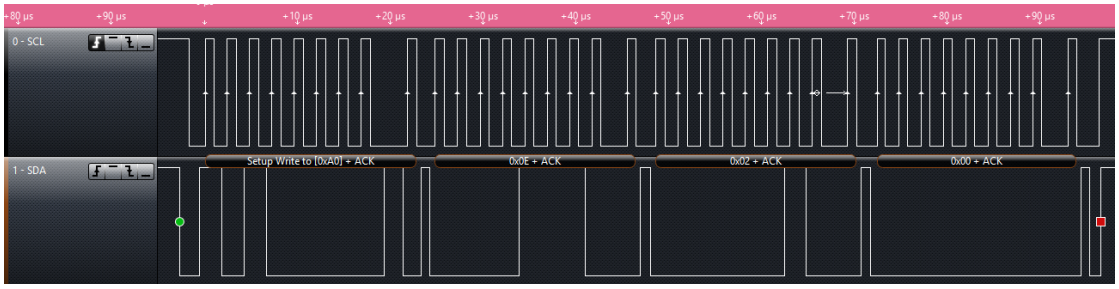
When finish writing the data, the register will be updated and module will execute the order. At the same time, the address of the module will add 1 automatically . The address Pointer will point to next address. So it can be written Continuously

For example:

Set D0 as Digital output high

RegAddr :0x0e DataL:0x02 DataH:0x00

Logic Analyzer captures waveforms as shown below:



Register set up by the module approach is consistent with the serial protocol, please refer 5.2

6.2 IIC read the module

IIC read the module, the format is as follow

IICAddr<<1	RegAddr	(IICAddr<<1)|1	Data1L	Data1H	Data2L	Data2H	……

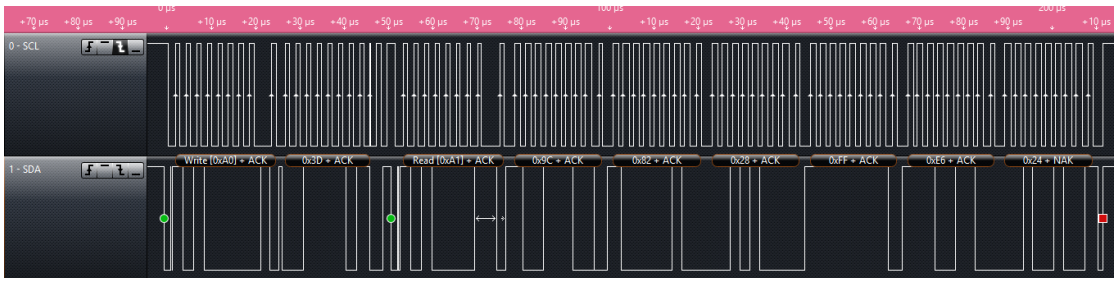
First IIC host sends a Start signal to JY-901 module， then write IICAddr to register address, then IIC host sends a read signal(IICAddr<<1)|1) to JY-901 module, if the IIC address is 0x50(default),then the host send 0xa0

Thereafter the module will export the data follow the rule: low byte first, high byte Sequentially. The host will make SDA bus low after receiving each byte, and sends a response signal to the module .After the specified number of data has been received completely, the host stop sending response signal back to the module, then the module will stop export data.The host send a stop signal to end this operation.

For example:

Read the Angle of the module，

RedAddr: 0x3d，read 6 bytes continuously, the logic analyzer captures waveforms as shown below:



Start reading out data from 0x3d,the data is 0x9C, 0x82,0x28,0xFF, 0xE6,0x24. That means X-axis angle is 0x829C, Y-axis angle is 0xFF28, Z-axis angle is 0x24E6. According to section 5.1.4 , X axis angle is -176.33 °, Y-axis angle is -1.19 °, Z-axis angle is 51.89 °