电应普
BEST SENSOR

DATASHEET

Product model：DYP-L07A-V1.0

1. Production introduction

1.1 Overview

The L07A-module is an ultrasonic level sensor designed for liquid level height detection applications., focus on designing for problems on the current market ultrasonic sensor module large blind spot, large measurement angle, long response time, poor installation adaptability and other problems .
The L07 module has a series of advantages like small blind spot, small measurement angle, short response time, high installation adaptability, dust and waterproof, long life and high reliability. L07A-module, hereinafter referred to as "module".

1.2 Functional summary

- The product shell is made of food-grade materials;
- Wide voltage power supply, working voltage 3.3~12V;
- 1.5cm standard blind area (the minimum product blind area can be 0.8cm);
- Any value within the range of 30cm to 300cm can be set as the farthest range through instructions;
- A variety of output modes are available, including UART automatic/controlled, PWM controlled, switching TTL level, RS485, IIC, etc.;
- The default baud rate is 115200, which can be modified to 4800, 9600, 14400, 19200, 38400, 57600, and 76800;
- ms-level response time, data output time as fast as 13ms;
- 6 algorithm modes can be set, with built-in liquid level sloshing filtration, small step filtration, high sensitivity and other modes to suit different application scenarios;
- 9 signal levels can be set to meet the needs of different ranges and angles;
- Built-in noise reduction function, supports 5-level noise reduction level settings, suitable for battery power supply, short/long distance USB power supply, switching power supply and loud noise power supply;
- Waterproof structural design, waterproof grade IP67;
- Strong installation adaptability, simple, stable and reliable installation method;
- Extra-wide temperature design, operating temperature -25℃ to +65℃;
- Electrostatic protection design, input and output interfaces are equipped with electrostatic protection devices, complying with IEC61000-4-2 standards.

1.3 Advantages

- •Food grade housing
- •Wide supply voltage
- •Small Dead Band
- •Output interface is optional

- •Support range modification
- •Support baud rate modification
- •Support address modification
- •Supports algorithm mode setting
- •Support signal level setting
- •Support power noise reduction level Settings
- •High waterproof rating
- •Small size, easy to install
- •Wide operating temperature
- •Strong anti-static performance
- •High measurement accuracy
- •Stable and reliable measurement data

1.4.Applications

- •Top-mounted level detection
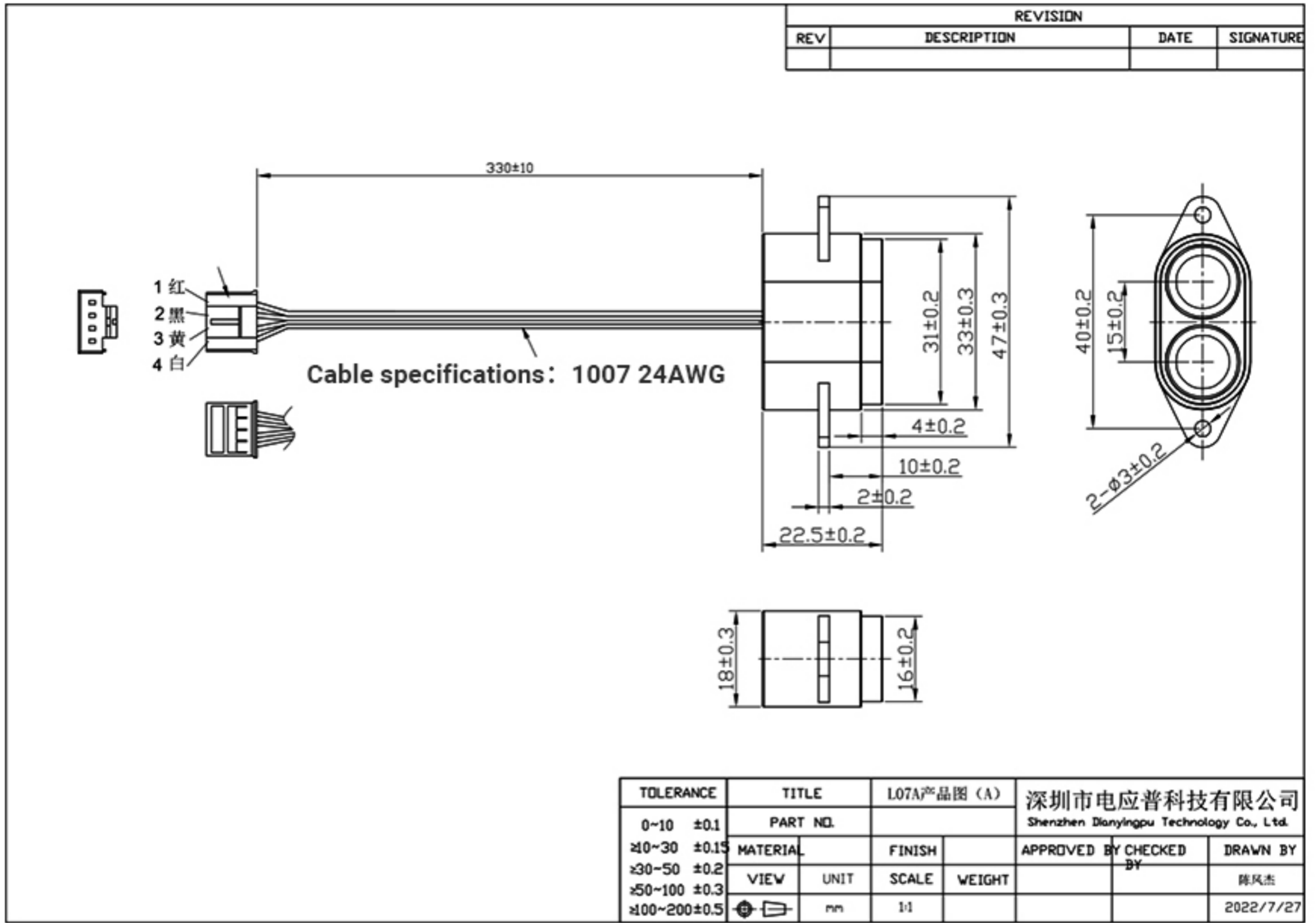
1.5.Module Specification

Item	UART auto	UART controlled	Switch	IIC	RS485	PWM	Unit	Remarks
Working voltage	3.3～12V							
Standby current	-	≤5	-	-	-	≤5	uA	(1)
Average working current	≤9			≤10		≤9	mA	(2)
Dead Band	≤1.5						cm	
Measuring range of flat object	1.5～200						cm	(3)
Response time	≥2000	8～42	≥2000	8～42	15～230	＜8	ms	(3)

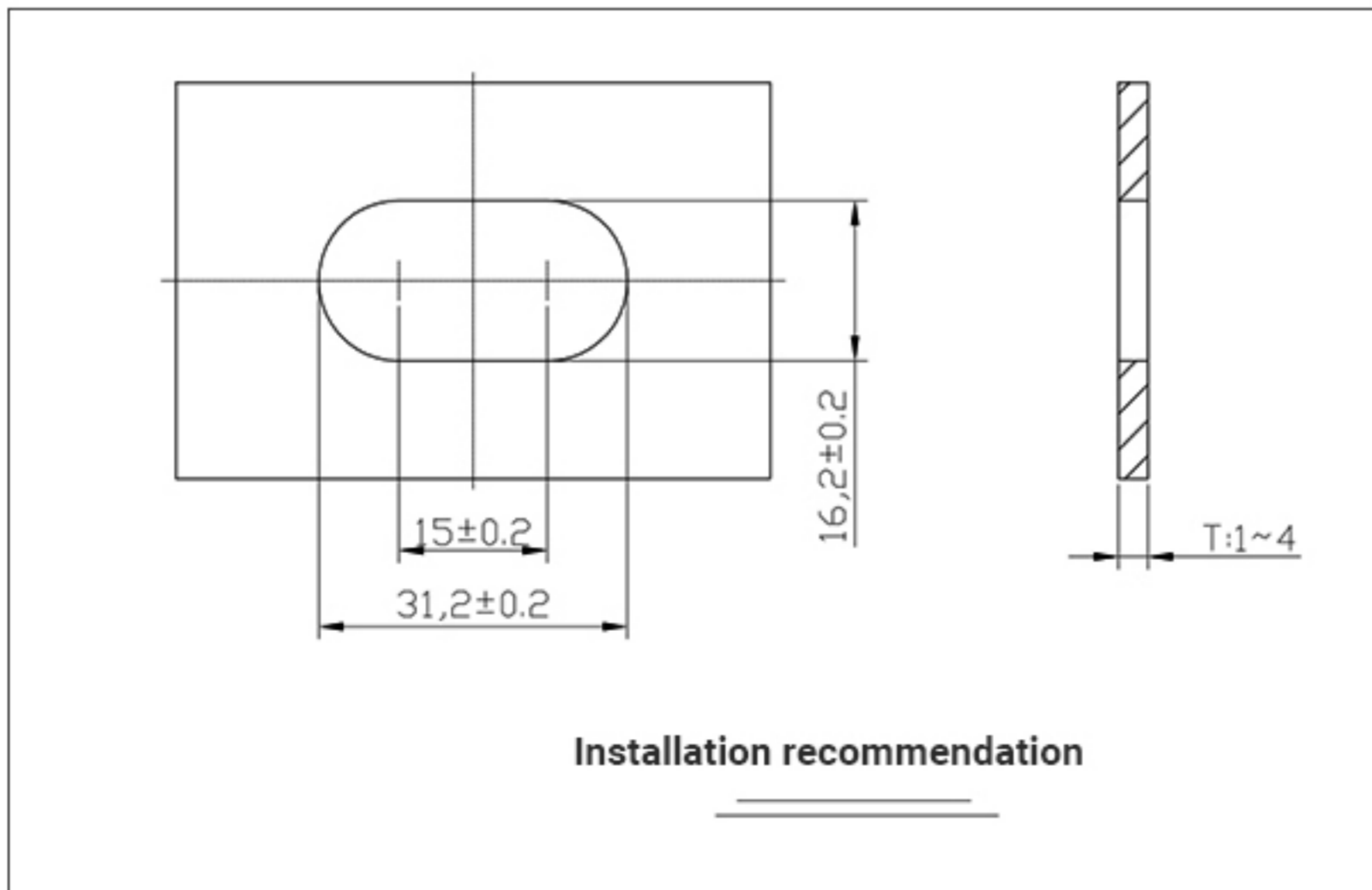| Power on working time	≤650				ms	
Operating cycle	100	Controlled	100	Controlled	ms	
Output interface	Auto	Controlled	Auto	Controlled	-	
Accuracy	0.5+(S*0.3%)			1+(S*0.5%)	cm	(3)
Temperature compen-sation	Support				-	
Beam Angle	10～50				°	(5)

Remarks： (1)The module exceeds 5S does not receive the control instruction will enter a low power consumption dormant state, when the power consumption current is the standby power consumption current;

(2)Typical data obtained by testing with temperature 25°C, humidity 65% RH, power supply 12V, and 100ms working cycle;

(3)The temperature is 25°C, the humidity is 65% RH, the measured object is a 50cm×60cm flat carton, and the transducer should be as vertical as possible. S represents the measurement distance;

(4)The output response time is 0.5~3m range test, the shorter the range, the faster the response time.

(5)Test data for single-angle modules,The measured object is the reference data obtained from the test of φ 75mm×100cm white PVC pipe with a distance of 100cm.

1.6.Mechanical characteristics

Product structure size：

REVISION			
REV	DESCRIPTION	DATE	SIGNATURE

330±10

1 红
2 黑
3 黄
4 白

Cable specifications：1007 24AWG

31±0.2
33±0.3
47±0.3

40±0.2
15±0.2

2-Φ3±0.2

4±0.2
10±0.2
2±0.2
22.5±0.2

18±0.3
16±0.2

TOLERANCE		TITLE	L07A产品图（A）	深圳市电应普科技有限公司			
0~10	±0.1	PART NO.		Shenzhen Dianyingpu Technology Co., Ltd.			
≥10~30	±0.15	MATERIAL		FINISH		APPROVED BY	CHECKED BY	DRAWN BY
≥30~50	±0.2							
≥50~100	±0.3	VIEW	UNIT	SCALE	WEIGHT			陈风杰
≥100~200	±0.5	⊕ ⊟	mm	1:1				2022/7/27

Recommendations of installing the opening：

16.2±0.2

15±0.2
31.2±0.2

T:1~4

Installation recommendation

1.7.Pin Definition

Pin No.	Mark	Description	Remark
1	VCC	Power input	
2	GND	GND	
3	RX/B	Function PIN	(1)
4	TX/A	Function PIN	(1)

Remarks: (1) Lead wire, pin function and output mode of product model correspond one-to-one, and cannot coexist with other output modes.

2.Limit parameters

2.1.Environment

Item	Minimum value	Typical value	Maximum	Unit	Remark
Storage temperature	-30	25	80	℃	
Storage Humidity		65%	90%	RH	(1)
Operating temperature	-25	25	65	℃	
Operating Humidity		65%	80%	RH	(1)

Remark:
1.a. Environment temperature is 0-39℃, max humidity is 90%(Non-condensation)
b.Environment is 40-50℃, max humidity is the highest at current temperature in nature

2.2.Electronics

Parameter	Specification			Unit	Remarks
	Minimum	Typical value	Maximum		
Operating voltage	3.3	5	12	V	
Peak current			150	mA	
Input ripple			50	mV	Peak to peak
Input noise			100	mV	Peak to peak
ESD			±4K/±8K	V	(1)

Remarks: (1) The connecting leads and pins conform to the IEC61000-4-2 standard

3. Output Interface

3.1 UART Auto Output

3.1.1 Pin Definition

PIN #	PIN name	PIN description	Remarks
1	VCC	Power input	
2	GND	Ground	
3	RX	UART input	(1)
4	TX	UART output	(1)

Remarks:
(1) Lead wire, pin function and output mode of product model correspond one-to-one, and cannot coexist with other output modes.

3.1.2 Communication instruction

The module works automatically at 100ms cycle,and the algorithm mode of the module can be set by writing the 0x228 register of the modbus protocol, among which algorithm modes 0, 4, and 5 are real-time value output, and algorithm modes 1, 2, and 3 are processing value output. Real-time value output, the response time is 100ms; the processed value output data is more stable, and the response time is ≥2s. The default mod works in Algorithm Mode 1.

When there is co-channel interference in the detection environment, output 0xFFFE data as a reminder, and output 0xFFFD when no object is detected.

Remarks: Please read the 0x228 registration part of "3.6.3 Modbus registration" for detailed description of the algorithm mode.

UART	Data Bit	Stop Bit	Parity Bit	Baud Rate
TTL Level	8	1	No	9600bps

3.1.3 UART Output format

Frame data	Description	Byte
Frame header	0XFF 0XFF	1byte
Data_H	High8 distance value	1byte
Data_L	Low8 distance value	1byte
SUM	Parity sum	1byte

Note：According to the parameter values of the modbus register 0x0209, the data output units are different, mm or us units.

3.1.4 Example

Frame header	Data_H	Data_L	SUM
0XFF	0X07	0XA1	0XA7

Remark: Parity sum only remain low8 value.

SUM =(start bit+ Data_H+ Data_L)&0x00FF

=(0XFF + 0X07 + 0XA1)&0x00FF

=0XA7

Distance value= Data_H*256+ Data_L=0X07A1；

Convert to decimal equal to 1953

Means current measurement distance value is 1953mm

When the parameter value of modbus register 0x0209 is 0x00, the unit is mm, indicates that the currently measured distance value is 1953 mm;

When the parameter value of modbus register 0x0209 is 0x01, the unit is us, indicates that the currently measured distance echo time value is 1953us, divide this value by 5.75 to get a distance value in mm units =1953/5.75≈340mm。

3.2 UART Controlled Output

3.2.1 Pin Definition

Pin No.	Mark	Description	Remark
1	VCC	Power input	
2	GND	GND	
3	RX	Trigger input	(1)
4	TX	UART output	(1)

Remarks: The pin function corresponds to the output mode selected before ordering, and cannot coexist with the functions of other output modes.

3.2.2 Instruction

When the trigger input lead "RX" receives a trigger pulse with a falling edge or any serial port data, the falling edge will trigger the module to work once, and the output lead "TX" will output one measurement data. The trigger cycle of the module must be greater than 150ms.

When the trigger pulse of the "RX" foot is not received for more than 5 seconds, the module goes dormant with the lowest power consumption. When the "RX" trigger pulse is received while dormant, it awakens the work immediately, but the response time increases by 12ms than when not dormant. Module write modbus protocol register 0x228 can set the algorithm mode, the default algorithm mode 0, when the module is set to the algorithm mode 1, 2, 3, the working mode from the original controlled working mode to the 100ms cycle automatic working mode, but does not automatically output measurement data. When "RX" receives the falling edge, it outputs the latest measured data processed.

Output 0xFFFE data as a prompt when the detection environment has the same frequency interference, and output 0xFFFD when the object is not detected.

Note: For a detailed description of the algorithm mode, read the 0x228 register section of "3.6.3 Modbus Register".

UART	Data Bit	Stop Bit	Parity Bit	Baud Rate
TTL Level	8	1	no	9600bps

3.2.3 Timing Diagram
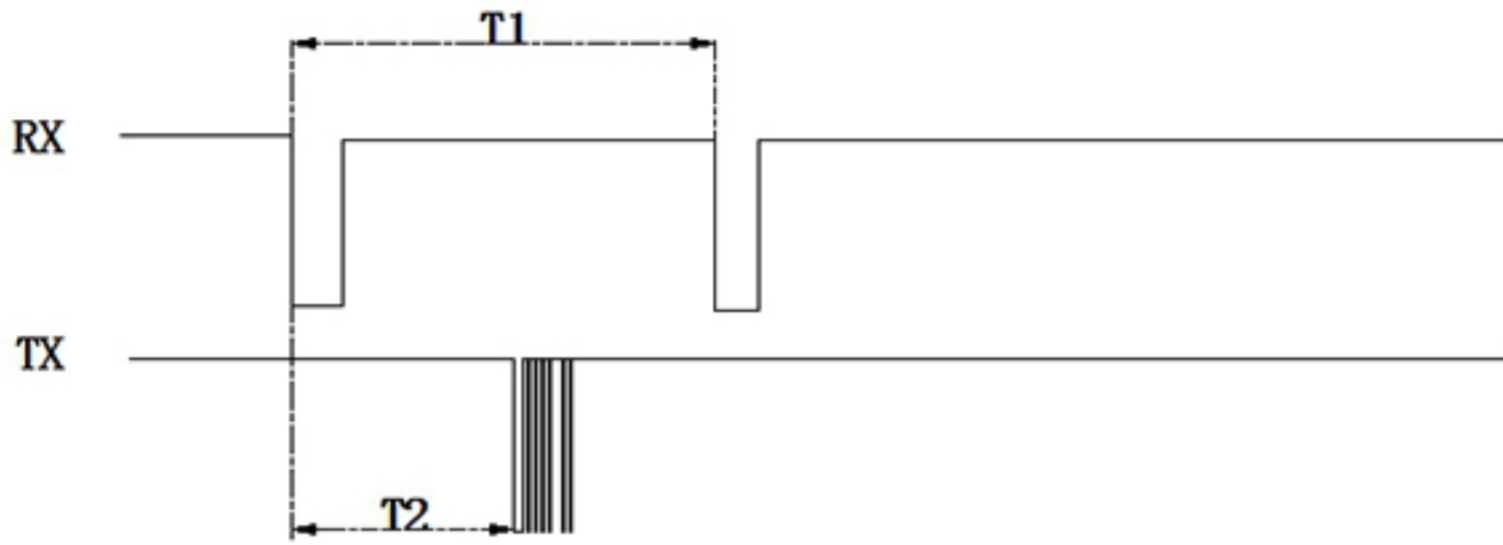
Note: T1 > T2+15ms; T2=8 ~ 42ms; Module operation was measured in algorithm mode 0, and without sleep.

3.2.4 UART Output Format

Frame data	Description	Byte
Frame header	0XFF 0XFF	1Byte
Data_H	High8 distance value	1Byte
Data_L	Low8 distance value	1Byte
SUM	Communication checksum	1Byte

3.2.5 UART Example

Frame header	Data_H	Data_L	SUM
0XFF	0X07	0XA1	0XA7

Remark:

Parity sum only remain low8 value.

SUM =(start bit+ Data_H+ Data_L)&0x00FF

=(0XFF + 0X07 + 0XA1)&0x00FF

=0XA7

Distance value= Data_H*256+ Data_L=0X07A1;

Convert to decimal equal to 1953

Means current measurement distance value is 1953mm

When the parameter value of modbus register 0x0209 is 0x00, the unit is mm, indicates that the currently measured distance value is 1953 mm;

When the parameter value of modbus register 0x0209 is 0x01, the unit is us, indicates that the currently measured distance echo time value is 1953us, divide this value by 5.75 to get a distance value in mm units =1953/5.75≈340mm.

3.3 PWM Output description

UART controlled、 =only supports the serial port Modbus protocol within 500ms. UART Auto does not have this limitation, sustainable communication after power-up.

3.3.1 Pin Definition

Pin No.	Mark	Description	Remark
1	VCC	Power input	
2	GND	GND	
3	RX	Trigger input	(1)
4	TX	PWM Output leads	(1)

Remarks: (1) The output modes of leads, pin functions and product models correspond one to one and cannot coexist with the output modes of other products.

3.3.2 PWM Trigger description

When the trigger input lead "RX" receives a trigger pulse with a falling edge, the falling edge will trigger the module to work once, and the output lead "TX" will output a TTL level PWM high-level pulse width signal. If the module does not When an object is detected, the output lead "TX" will output a fixed pulse width of approximately 13ms (maximum range).

When the trigger pulse of the "RX" pin is not received for more than 5 seconds, the module will enter the sleep state with the lowest power consumption. When the "RX" trigger pulse is received during sleep, it will wake up immediately, but the response time will be 12ms longer than when not sleeping.

The module can set the algorithm mode by writing the 0x228 register of the modbus protocol. The default algorithm mode is 0. When the module is set to algorithm mode 1, 2, or 3, the working mode changes from the original controlled working mode to the automatic working mode with a cycle of 100ms. , but does not automatically output the PWM high-level pulse width signal. When "RX" receives the falling edge, it outputs the most recently processed PWM high-level pulse width signal.

Note: For detailed description of algorithm mode, please read the 0x228 register part of "3.6.3 Modbus Register".

3.3.3 Timing diagram
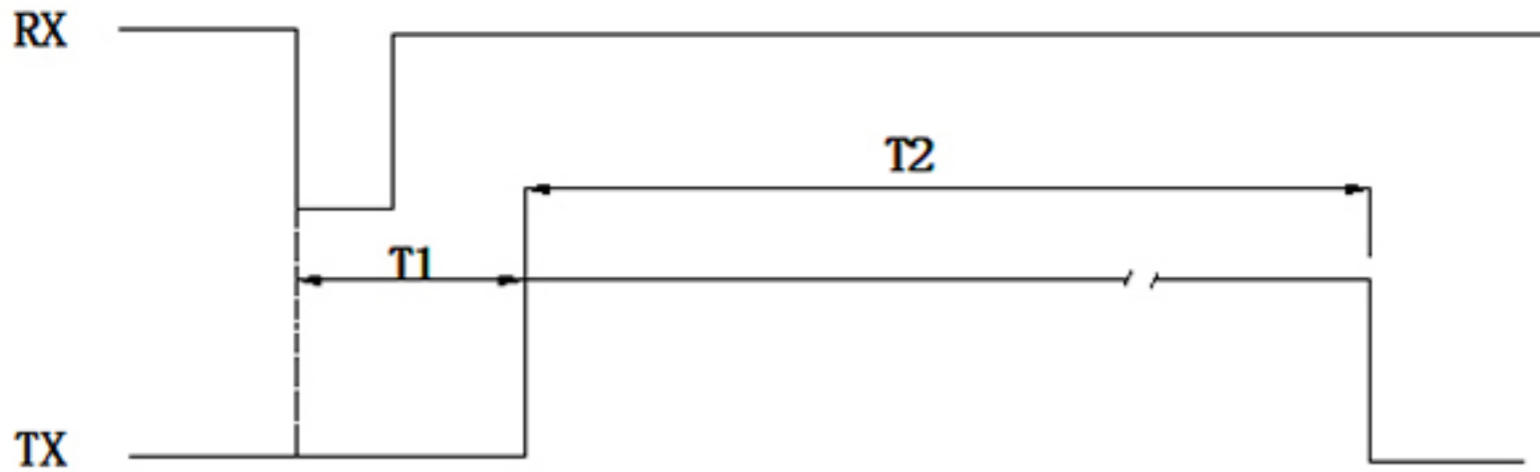
Note: T1=5~8ms (measured in non-sleep mode);
T2=0.18~13ms (PWM high-level pulse width time, measured at a range of 2 meters and algorithm mode 0);
When co-channel interference is detected, a pulse width of about 10us is output.

3.3.4 Calculation

Formula: S=T*V/2 (S is the distance value, T is the PWM high-level pulse width time, and V is the propagation speed of sound in the air).
The speed of sound V at normal temperature is 348M/S, and the formula can be simplified to get S= T/57.5 (at this time, the unit of distance S is centimeters and the unit of time T is microseconds).
Example: When the PWM high-level pulse width time T3 of the output lead "TX" is 10000us,
Obtain S= T/57.5=10000/57.5≈173.9(cm), which means the current measured distance value is 173.9cm.

3.4 Switch output description

3.4.1 Output lead definition

Pin No.	Mark	Description	Remark
1	VCC	Power input	
2	GND	GND	
3	RX	Processing value and real-time value output selection lead, communication receiving line	(1)
4	TX	Switch output lead	(1)

Remarks: (1) The lead function corresponds to the output mode of the product model one-to-one and cannot coexist with the output modes of other products.

3.4.2 Work description

The module will set a threshold value when it leaves the factory. The default is 1 meter. The module performs distance measurement approximately every 100ms. When the distance value of the detected target is less than the set threshold value, the "TX" lead outputs a high level (3.3V); the current detected distance value is greater than the set threshold value, and the "TX" lead outputs low level (0V); when the module works in algorithm modes 1, 2, and 3, it outputs according to the processing value, and the data is more stable , response time ≥ 2s, holding time ≥ 2s; when the module works in algorithm mode 0, 4, 5, it outputs according to the real-time value, the response time is 0.3s, and the delay time is 0.5s; in order to improve stability, the module defaults Works in algorithm mode 1, processing value output. The threshold value and output polarity parameters can be set. For example, when the output polarity is positive output (0x01), when the distance value of the detected target is less than the set threshold value, the output is high level, and the currently detected distance value is greater than Set the threshold value and output low level. When the output is negative (0x00), the level logic is reversed. (Note: The TX lead of the module only outputs high and low level signals and has no driving capability. If there are special requirements that require modifying the threshold value or other settings, special instructions are required when purchasing)

3.4.3 Set threshold value and output polarity

(1) Communication line connection
Connect the RX and TX of the module leads to the TXD and RXD of the host respectively for serial communication.

(2) Communication serial port settings

UART	Data Bit	Stop Bit	Parity	Baud Rate
TTL Level	8	1	no	115200bps

The setting is only valid when the module is powered on (within 500ms after powering on), with an interval of 100 ms. Repeat the command until the module responds.

(3) Modify the threshold data format
The user computer is the host device, and this module is the slave device.
Host sends:

Name	Frame header	Command code	Threshold value high	Threshold value low	Checksum
Byte	Fixed 0XFB	Fixed 0X05	1 byte	1 byte	1 byte

The slave responds:

Name	Frame header	Command code	Threshold value high	Threshold value low	Status bit	Checksum
Byte	Fixed 0XFB	Fixed 0X85	1 byte	1 byte	Set successfully: 0X00	1 byte

Remarks: Checksum = (frame header + command code + high bit of threshold value + low bit of threshold value + status bit) & 0x00FF

Example 1:

Host: FB 05 03 E8 EB (checksum=(0XFB+0X05+0X03+0XE8)&0X00FF=0XEB)

Slave: FB 85 03 E8 00 6B

Indicates that the setting is successful and the switching distance is set to 1000mm.

Threshold value setting range: 30~3000mm.

(4) Modify the switching polarity data format

The user computer is the host device, and this module is the slave device.

Host sends:

Name	Frame header	Command code	Reserve	Output polarity	Checksum
Byte	Fixed 0XFB	Fixed 0X06	0X00	0x00: Negative output, low level output when less than the threshold value;	1 byte

The slave responds:

Name	Frame header	Command code	Reserve	Output polarity	Status bit	Checksum
Byte	Fixed 0XFB	Fixed 0X86	0X00	Set successfully: 0X00	Set successfully: 0X00 Setting failed: 0X01	1 byte

Remarks: Note: Checksum = (frame header + command code + output polarity + status bit) & 0x00FF

Example 1:

Host: FB 06 00 01 02 (checksum=(0XFB+0X06+0X00+0X01)&0X00FF=0X02)

Slave: FB 86 00 01 00 82

The description is set to 0X01 successfully. When the module detects an object, the "TX" lead outputs high level and the "RX" lead outputs low level.

Example 2:

Host: FB 06 00 00 01 (checksum=(0XFB+0X06+0X00+0X00)&0X00FF=0X01)

Slave: FB 86 00 00 00 81

Indicates that the setting is successful. Set the module so that when an object is detected, the "TX" lead outputs a low level and the "RX" lead outputs a high level.

3.5 Modbus protocol description

UART controlled、=only supports the serial port Modbus protocol within 500ms. UART Auto does not have this limitation, sustainable communication after power-up.

3.5.1 Modbus Protocol specification

Mode	Parity	Sensor Address	Read function code	Write the function code
Modbus-RTU	CRC-16/MODBUS	Setable, default 0x01	0x03	0x06

3.5.2 Modbus protocol format

Sensor module as slave. Customer device as master.

Master request(Read):

Name	Device address	Function code0x03	Register address	Registers qty	CRC16 Parity
Length(Byte)	1	1	2	2	2

Slave response(read)：

Name	Address	Function code0x03	Response byte	Data zone	CRC16 Parity
Length(Byte)	1	1	1	N	2

Master request(write)

Name	Device address	Function code 0x06	Register address	Data field	CRC16 Parity
Length(Byte)	1	1	2	2	2

Master request(write)

Name	Device address	Function code 0x06	Register address	Data field	CRC16 Parity
Length(Byte)	1	1	2	2	2

3.5.3Modbus Register

Register data for high bytes in front and low bytes in back.

(1)Modbus register table 1

Authority	address	function	Data type	Instruction
Read-only	0x0100	Processing value	Unsigned int, 16bit	Start raging after receiving instruction, output distance value after the algorithm processing unit: mm, response time is about 100~230ms(difference according to range)
Read-only	0x0101	Real-time value	Unsigned int, 16bit	After receiving the instruction, the module starts raging once, and outputs the real-time distance value, unit: mm, response time is about 15~140ms(difference according to range)
Read-only	0x0102	Temperature	Signed int, 16bit	Unit：0.1℃，Resolution：0.5℃，response time is about 15~50ms(difference according to range)
Read-only	0x010A	Echo time	Unsigned int, 16bit	After receiving the instruction, the module starts raging once, and outputs the real-time echo time, unit: us, this value is divided by 5.75 to obtain a distance value in mm unit, response time is about 5~40ms(difference according to range)

Note :The response time is measured in 0.5~3 meters, shorter the range and faster the response time

(2)0x0100/0x0101/0x010A register, output 0xFFFE data to indicate when the detection environment has the same frequency interference, output 0xFFFD when the object is not detected.

(2)Modbus register table 2

Authority	address	function	Data type	Instruction
Read-write	0x0200	Slave address	Unsigned int，16bit	Range: 0x01～0xFE(default 0x01), 0xFF is the broadcast address
Read-write	0x0201	Baud rate	Unsigned int，16bit	Serial port baud rate(default 115200), unit: bps , effective immediately after setting, baud rate corresponding to register value is as follows: 0x0002:4800, 0x0003:9600, 0x0004:14400, 0x0005:19200, 0x0006:38400, 0x0007:57600, 0x0008:76800, 0x0009:115200
Read-write	0x0208	Signal level	Unsigned int，16bit	The signal level can be set to level 1 ~ 9 (default level 5); The larger the grade, the larger the detection Angle, the more sensitive the induction, and the farther the measurement range. Level 1: Measuring range approx. 50cm L 2: Measuring range approx. 80cm L 3: Measuring range approx. 110cm L 4: Measuring range approx. 170cm L 5: Measuring range approx. 200cm L 6: Measuring range approx. 210cm L 7: Measuring range approx. 260cm L 8: Measuring range approx. 280cm L 9: Measuring range approx. 300cm Note: 1, the measurement range can be measured at 25℃, humidity 65%RH, the measured object is 50cm×60cm flat carton, the transducer should be as vertical as possible to the measured object 2, the size of the detection Angle between the various levels, please refer to the "4 effective detection range reference chart"
Read-write	0x0209	Output distance value data units	Unsigned int，16bit	Controlled / automatic output protocol distance value unit,0x00-mm, 0x01-us(This value is divided by 5.75 to obtain a distance value in mm units), Effective only for the UART Auto and UART controlled modes

Read-write	0x021A	Power noise reduction level	Unsigned int, 16bit	The power noise reduction level is 1~ 5 (the default is 1) to be suitable for different power supply scenarios; The higher the level, the greater the noise suppression, and the overall angle will also be affected, the higher the level, the more affected. Description of the different levels: 1-Suitable for battery-powered occasions; 2-Suitable for occasions with a certain high-frequency noise like USB power supply; 3-Suitable for longer distance USB power supply occasions; 4-Suitable for the occasion of switching power supply; 5-Suitable for switching power supply, environmental interference complex occasions, generally not recommended to use;
Read-write	0x021F	Range	Unsigned int, 16bit	Setting range: 300mm~3000mm Default: 2000mm Note: The maximum measurable range depends on the Angle grade. The smaller the Angle grade, the shorter the maximum measurable range
Read-write	0x0228	Algorithm mode	Unsigned int, 16bit	Algorithm mode selection: 0: real time value 1: Liquid level sloshing filtration grade 1 2: Liquid level sloshing filtration grade 2 3: Liquid level sloshing filtration grade 3 4: Small step filtering mode 5: High sensitivity mode UART Auto default value: 1 UART Controlled default value: 0 Note: 1, Set to 1~3 mode, controlled mode sensor will be forced to automatic measurement, controlled output, distance value to processing value, response time ≥ 2S; 2, Algorithm mode 5 has the highest sensitivity, the largest Angle, and the blind area is about 8~11cm, which is suitable for the scene with foam on the surface

(3) The influence of baud rate on communication time

Serial	Baud rate	Communication time
1	4800	16ms
2	9600	8ms
3	14400	5.6ms
4	19200	4ms
5	38400	2.4ms
6	57600	1.6ms
7	76800	0.8ms
8	115200	0.6ms

Note：The higher the baud rate, the shorter the communication time.

3.5.4 Modbus sample

Example 1：read the processing data
Host：01 03 01 00 00 01 85 F6
Slave：01 03 02 02 F2 38 A1
instruction：The sensor address is 0x01, The processing distance value is 0x02F2, Convert to a decimal into 754mm。

Example2：read the real-time data
Host：01 03 01 01 00 01 D4 36
Slave：01 03 02 02 EF F8 A8
instruction：The sensor address is 0x01, The real-time distance value is 0x02EF, Convert to a decimal into 751mm。

Example3：read the temperature data
Host：01 03 01 02 00 01 24 36
Slave：01 03 02 01 2C B8 09
instruction：The sensor address is 0x01, The real-time temperature value is 0x012C, Convert to a decimal into 30.0℃。

Example 4：modify the slave address
Host：01 06 02 00 00 05 48 71
Slave：01 06 02 00 00 05 48 71
instruction：The sensor address was modified from 0x01 to 0x05.

Example 5：read the baud rate
Host：01 03 02 01 00 01 D4 72
Slave：01 03 02 00 03 F8 45
instruction：Read the port rate, the read baud rate is：9600bps

Example 6：set the baud rate
Host：01 06 02 01 00 03 99 B3
Slave：01 06 02 01 00 03 99 B3
instruction：set the baud rate to 9600bps

3.6 IIC Output description

3.6.1 Output lead definition

Pin No.	Mark	Description	Remark
1	VCC	Power input	
2	GND	GND	
3	RX	IC clock line SCK	(1)
4	TX	IIC data line SDA	(1)

3.6.2 IIC Module parameters

This module is a slave device and supports multiple parallel connections. The communication lines SDA and SCK need to be connected externally by the user with pull-up resistors. The recommended size range is: 3K ~ 10K.

Communication level: equal to VCC

Communication rate: 10~100kbit/s

Broadcast address: 0x00

Default address: 0xE8

The 8-bit slave address expressed in this article is obtained by shifting the 7-bit address to the left by one bit. For example, the 7-bit address corresponding to 0xE8 is expressed as 0x74.

Users can modify the address to any of 20 addresses: 0xD0, 0xD2, 0xD4, 0xD6, 0xD8, 0xDA, 0xDC, 0xDE, 0xE0, 0xE2, 0xE4, 0xE6, 0xE8, 0xEA, 0xEC, 0xEE, 0xF8, 0xFA, 0xFC, 0xFE.
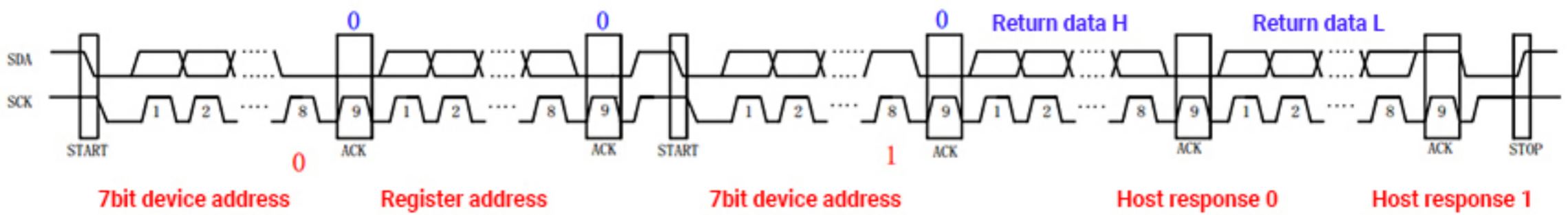
3.6.3 IIC Timing diagram

（1） Read 1 byte of data

Note: The blue part above the timing is the signal generated by the slave, and the red part below the timing is the signal generated by the master.
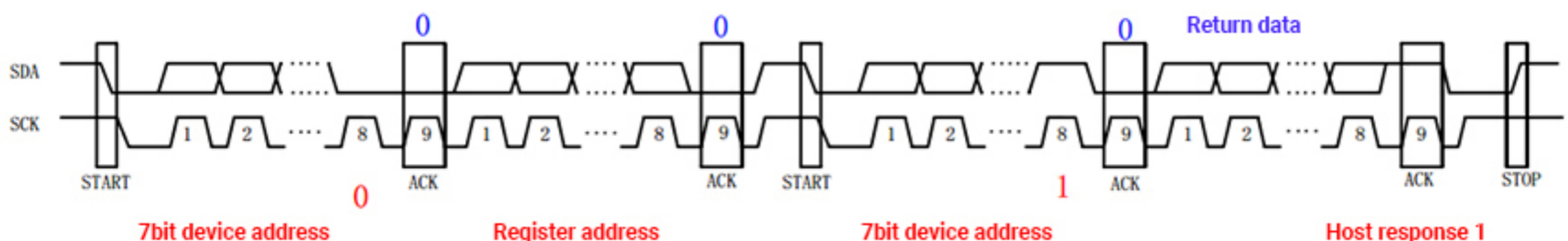
（2）**Read 2 bytes of data, with the high eight bits in front and the low eight bits in the back.**

（3）**Write 1 byte of data**

3.6.4 IIC Register

The register data is high byte first and low byte last.

(1) IIC Register table 1

Authority	Register	function	Data type	Instruction
Rread only	0x00 ~0x01	Program version identifier	Unsigned int, 16bit	Module software version number identification
Rread only	0x02~ 0x03	Distance value	Unsigned int, 16bit	Output the real-time distance value, and determine the output unit according to the trigger command. The data has mm and us units; When there is co-channel interference in the detection environment, it outputs 0xFFFE data as a prompt. When no object is detected, it outputs 0xFFFD. If it is read prematurely, it will respond with 0xFFFF to prompt that the ranging has not been completed. It is recommended that after triggering ranging, delay for a corresponding length of time before reading the distance value.
Read-write	0x05	Slave address	Unsigned int, 8bit	8-bit slave device address, default 0xE8, 0x00 is the broadcast address; Can be written to any of the 20 addresses: 0xD0, 0xD2, 0xD4, 0xD6, 0xD8, 0xDA, 0xDC, 0xDE, 0xE0, 0xE2, 0xE4, 0xE6, 0xE8, 0xEA, 0xEC, 0xEE, 0xF8, 0xFA, 0xFC, 0xFE

Read-write	0x06	Power supply noise reduction level	Unsigned int, 8bit	Power supply noise reduction level (default is 1), suitable for different power supply scenarios; the higher the level, the greater the noise suppression, and at the same time, the measured object with a smaller signal may not be detected. Description of different levels: 1-Suitable for battery-powered occasions; 2-Suitable for USB power supply and other occasions with certain high-frequency noise; 3-Suitable for long-distance USB power supply situations; 4-Suitable for switching power supply situations; 5- Suitable for switching power supply and complex environmental interference situations, generally not recommended
Read-write	0x07	Signal level	Unsigned int, 8bit	The signal level can be set from 1 to 9 (default is level 5); the greater the level, the larger the detection angle, the more sensitive the induction, and the farther the measurable range. Level 1: measurable range is about 50cm Level 2: measurable range is about 80cm Level 3: measurable range is about 110cm Level 4: measurable range is about 170cm Level 5: measurable range is about 200cm Level 6: measurable range is about 210cm Level 7: measurable range is about 260cm Level 8: measurable range is about 280cm Level 9: measurable range is about 300cm Note: 1. The measurable range is measured when the temperature is 25°C, the humidity is 65% RH, the measured object is a 50cm×60cm flat carton, and the transducer must be as vertical as possible to the measured object. 2. For the relationship between the detection angles of each level, please refer to "4 Effective Detection Range Reference Chart"

Read-write	0x09	Algorithm pattern	Unsigned int, 8bit	Algorithm mode selection: 0: real-time value 1: Liquid surface shaking filtration level 1 2: Liquid surface shaking filtration level 2 3: Liquid surface shaking filtration level 3 4: Small step filtering mode 5: High sensitivity mode UART automatic, switching value Default: 1 UART controlled, PWM, RS485, IIC Default: 0 Note: 1. After setting to mode 1~3, the sensor will be forced to change to automatic measurement and controlled output, and the distance value will become a processing value. The response time is ≥2S. The bus can directly read the 0x02~0x03 registers to obtain the distance value or echo. Time value, writing the corresponding trigger measurement instruction to the 0X10 register can switch between reading the distance value or the echo time value; 2. Algorithm mode 5 has the highest sensitivity, the largest angle, and a blind area of about 8~11cm. It is suitable for scenes with foam on the surface. 3. The PWM mode is set to mode 1~5 to change the processing value output. The distance value is obtained after the measurement is completed, and then the PWM signal is output.
Rread only	0x0A ~0x0B	Temper-ature	Signed int, 16 bits	Unit: 0.1℃, resolution: 0.5℃, can be read after triggering ranging
Write only	0x10	Command control	Unsigned int, 8bit/8bit	Please see the explanation in Table 2

（2）IIC Register table 2, control instructions

Authority	Command	Function	Instruction

Write only	Measuring range	Trigger ranging once	Write the measurement range to trigger the sensor measurement, the range is: 0x03~0x23, the unit is 100mm, representing the range of 300mm~3000mm, and the distance value in mm unit is returned; The measurement takes 15~110ms; Note: Please read the distance value after the ranging is completed. Reading the 0x02 register too early will result in a response of 0xFFFF.
Write only	Measuring range +0x64	Trigger ranging once	Write the measurement range to trigger the sensor measurement, the range is: 0x67~0x87, the unit is 100mm, which represents the range of 300mm~3000mm. The echo time value in us unit is returned. Divide by 5.75 to get the distance value in mm unit; Note: 1. The measurement takes 15~110ms; please read the distance value after the ranging is completed. Reading the 0x02 register too early will result in a response of 0xFFFF; 2. 0x67 = 0x03 + 0x64, indicating that the measurement range is 300mm, and the echo time is returned; 0x87 = 0x23 + 0x64, indicating that the measurement range is 3500mm, and the echo time is returned;
Write only	0x5A+0xA5	Restart sensor	The slave machine restarts immediately after receiving the command

3.6.5 Communication examples

Example 1: Read the module software version number. The operation steps are:

Address (write)	0x00	Address(read)	0x00	0x01

The module is identified by the software version number 0x0001.

Example 2: The trigger module measures distance according to the 2-meter range and reads the real-time distance value. The operation steps are as follows.
① Send trigger ranging command:

Address (write)	0x10	0x14

② Delay wait 50ms
③ Read the distance value:

Address (write)	0x02	Address(read)	0x04	0xE9

The real-time distance value is 0x04E9, which is converted to decimal 1257mm.

Example 3: The host modifies the module IIC address. The operation steps are:

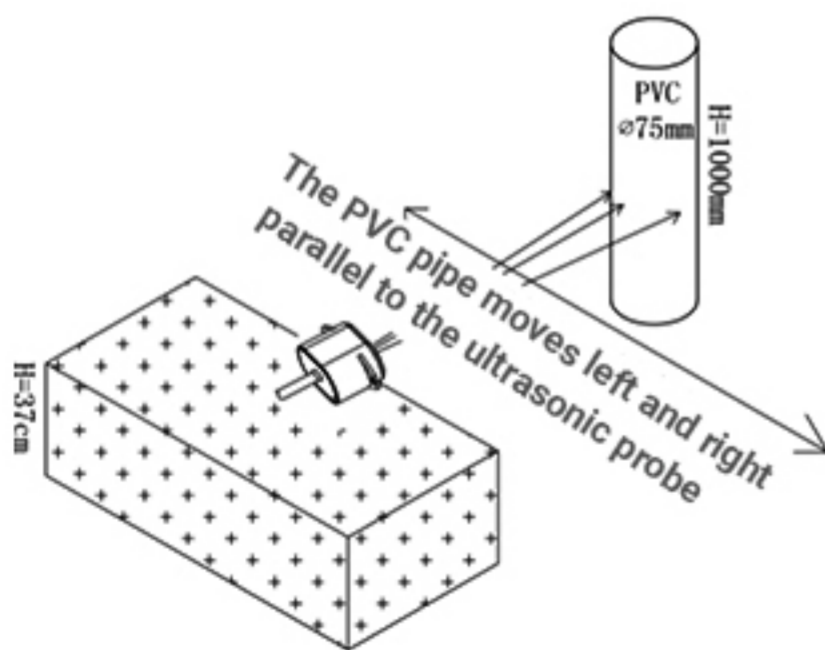| Original address 0xE8 (write)	0x05	New address 0xD0

Example 4: Modify the module signal level. The operation steps are:

Address (write)	0x07	0x04

Modify the module signal level to level 4.

4. Beam Pattern

The tested object is a white cylindrical tube made of PVC material, with a height of 100cm and a diameter of 7.5cm.
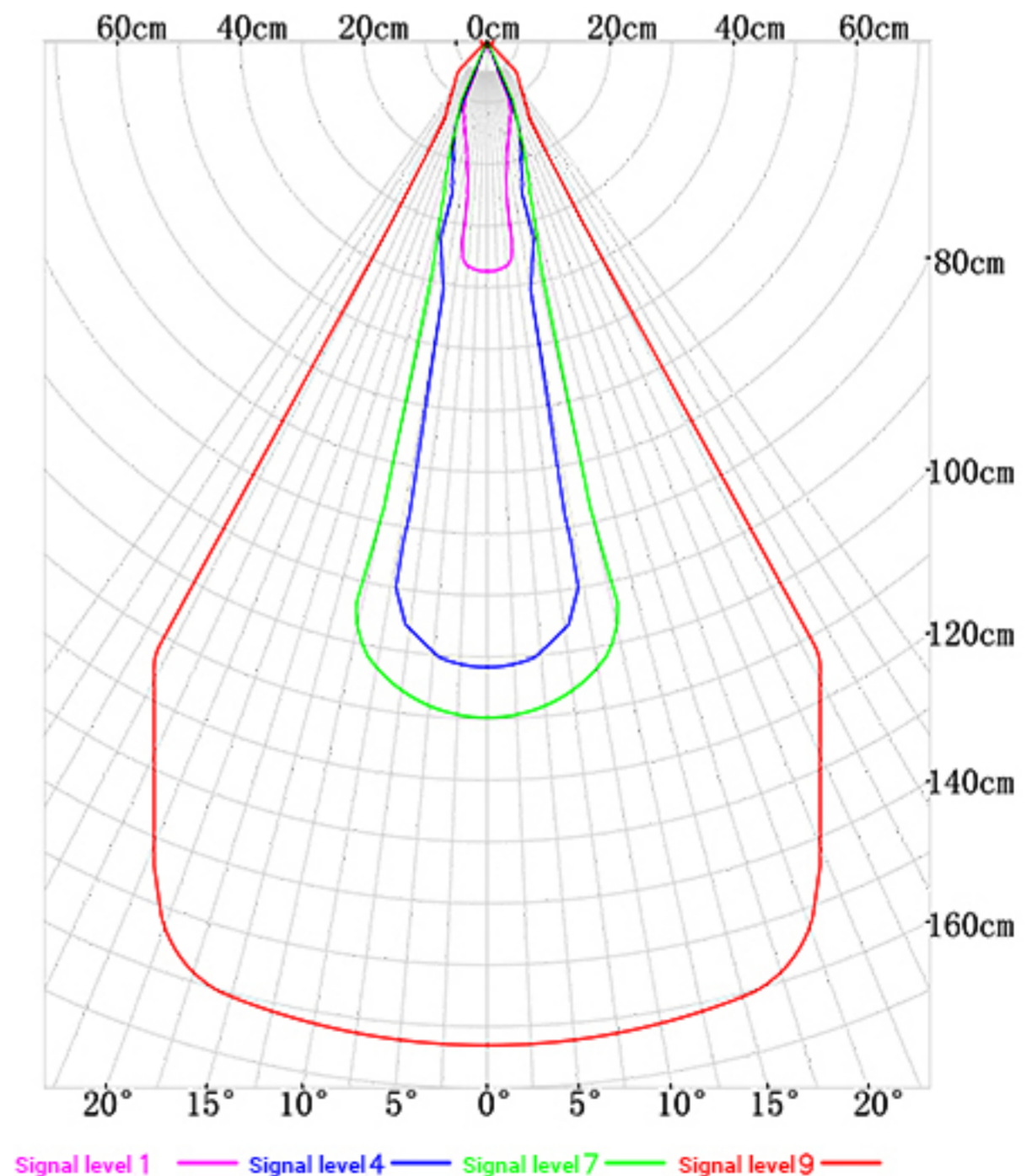
5 .Sensor Selection Instruction

There are nine output interface for you choose, If there are special requirements that need to modify the response time, angle, communication agreement, etc., please contact us

No.	L07A Model No.	Ouput put
1	DYP-L07AYYUW-V1.0	UART auto
2	DYP-L07AYYTW-V1.0	UART controlled
3	DYP-L07AYYMW-V1.0	PWM pulse width
4	DYP-L07AYYGDW-V1.0	Switch output
5	DYP-L07AYYCW-V1.0	IIC
6	DYP-L07AYY4W-V1.0	RS485

6.Installation Suggestions

1.When installing the sensor, ensure that the transmitting surface of the transducer is parallel to the measured plane, so as to ensure that the sound waves emitted vertically to the surface of the measured object return with maximum energy to ensure maximum range stability and reliability;

2. In front of the sensor, it should be noted that except for the measured object, other objects should avoid the sensor testing range;

3. There is steam at the site of use and installation, and water droplets are easy to adhere to the surface of the probe, so try to avoid the influence of water droplets;

4. The installation and fixation of the sensor needs to avoid structural deformation, metal or other resonance, and avoid resistance components such as (elbows, valves, variable diameters);

7.Matters needing attention

1. The company reserves the right to change this document and update the functions without notice;
2. Please pay attention to the structural tolerances when designing. Unreasonable structural design may cause transient abnormalities in module functions;

3. Please pay attention to the evaluation of electromagnetic compatibility when designing. Unreasonable system design may cause abnormal module function;

4. When the boundary application of the product limit parameter is involved, you can contact our FAE to confirm the relevant precautions.

5. The response time and same-frequency interference of this product are configured in common scenarios, and can be improved in special scenarios. You can contact our FAE to communicate with related matters.

8. Packaging specification

1. The default is DYP's conventional packaging method;

2. Packaging materials can be customized according to customer IQC related standards;

3. The container transportation method needs to adopt the staggered consolidation method, and at the same time, the outer edge of the single stack needs to be wrapped with a reinforced gusset to provide sufficient support.