DATASHEET

Product Model: DYP-L04-V1.0

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1.Production introduction

1.1.Overview

The L04 module is an ultrasonic underwater obstacle avoidance sensor designed based on underwater application, with a series of advantages like small size, small blind spot, high accuracy and good waterproof performance. It supports modbus protocol and is available in two different ranges, angles and blind zones for users with different requirements.

L04 module, hereinafter referred to as "module".

1.2.Product features

- Wide supply voltage, operating voltage 5~24V
- Operating temperature-15℃ to 55℃
- Waterproof grade IP68
- Small size
- Blind zone minimum 2cm
- Range of 2 cm to 300 cm and 5 cm to 600 cm are optional
- Output interface UART and RS485 optional
- Support the module address, angle, and baud rate modification
- Electrostatic protection design, in accordance with the IEC 61000-4-2 standard

1.3.Scope of application

- Underwater robot obstacle avoidance and automatic control
- Underwater ranging

1.4.Basic parameters

Parameters	L041MTW	L041M4W	L042MTW	L042M4W	Unit	Remarks
Working voltage	5~24V				V	DC
Standby current	≤1	-	≤1	-	mA	(1)
Average working current	≤7	≤8	≤7	≤8	mA	(1)

Dead band	5		2		cm	
Flat object range	5~600		2~300		cm	
Output response time	14	26	10	22	ms	(2)
Power working hours	≤1				s	
Working period	Controlled				-	
Connection type	UART Controlled	RS485	UART Controlled	RS485		
Measurement accuracy within 2m	±(0.5+S*0.5%)				cm	(3)
Measurement accuracy over 2m	±(1+S*1%)				cm	(3)
Temperature compensation	Compensate				-	
Angle	8~16		5~10		°	(4)

Remarks：

(1)Typical data obtained from a 500ms duty cycle test with12V supply;

(2)Response time measured at 115200 baud rate.

(3)Data obtained when the module is stationary at 30cm underwater, at 25℃, with a calm water surface and no current, S indicates the current distance.

(4)The module was tested at 0.7m underwater at 30cm, at 25℃, with a calm water surface and no current, using φ75mm×100cm white PVC pipe.

1.5.Mechanical characteristics

(1)Product structure size

5±0.3

11.2±0.3

③ ②

1000±30

PVC wire stripping 30±5

①

ø19±0.2

ø28±0.5

Tail dip tin 3～5

M19x1.5

34±0.5

1. black pvc 4 lead cable 2464 26AWG 80oC 300V OD=4±0.2mm

2.waterproof O ring: OD=26MM ID=20.2 *1.5MM/White
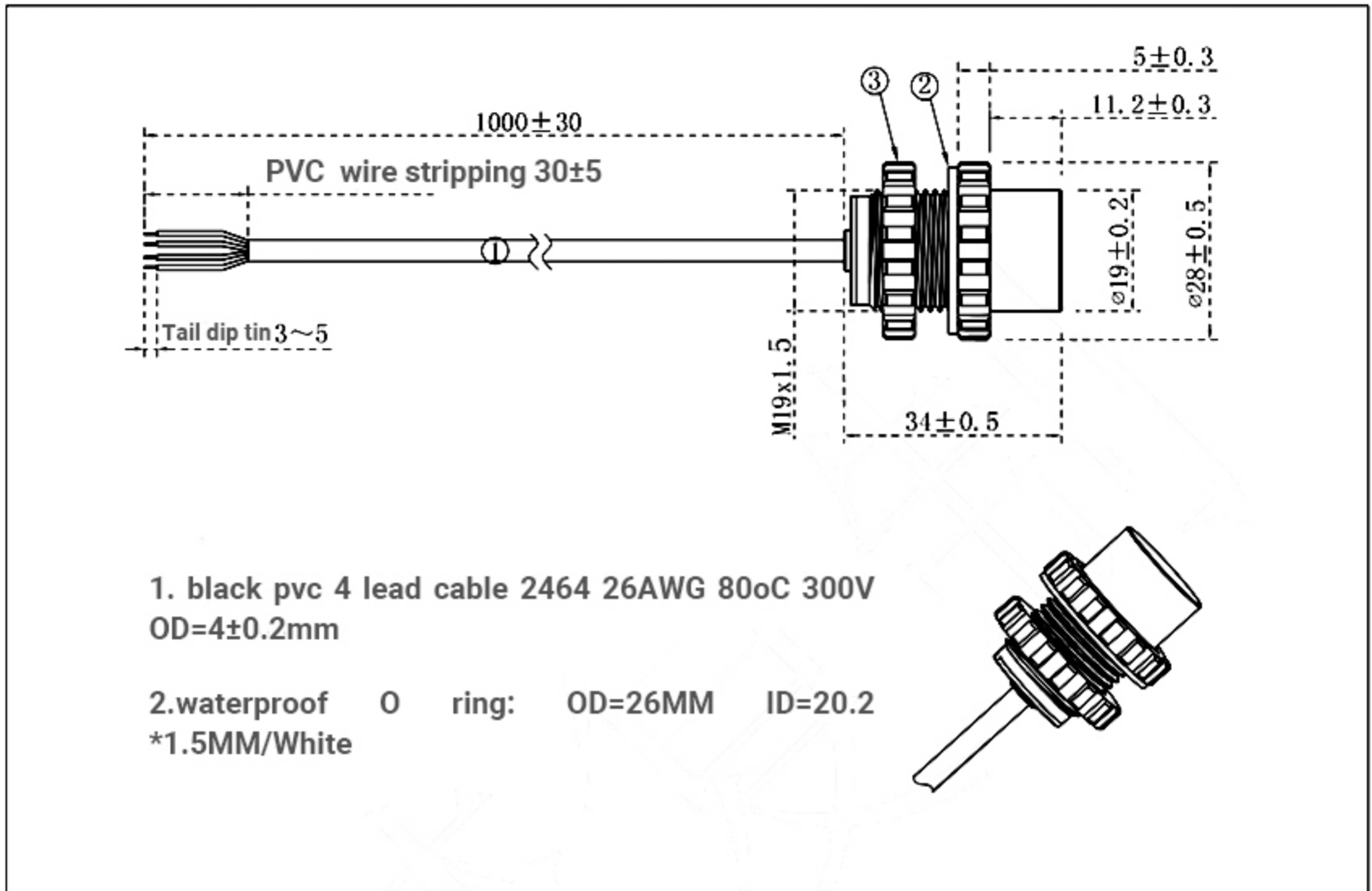
(2)Recommendations of installing the opening:

ø19.5~ø22

T:1~5
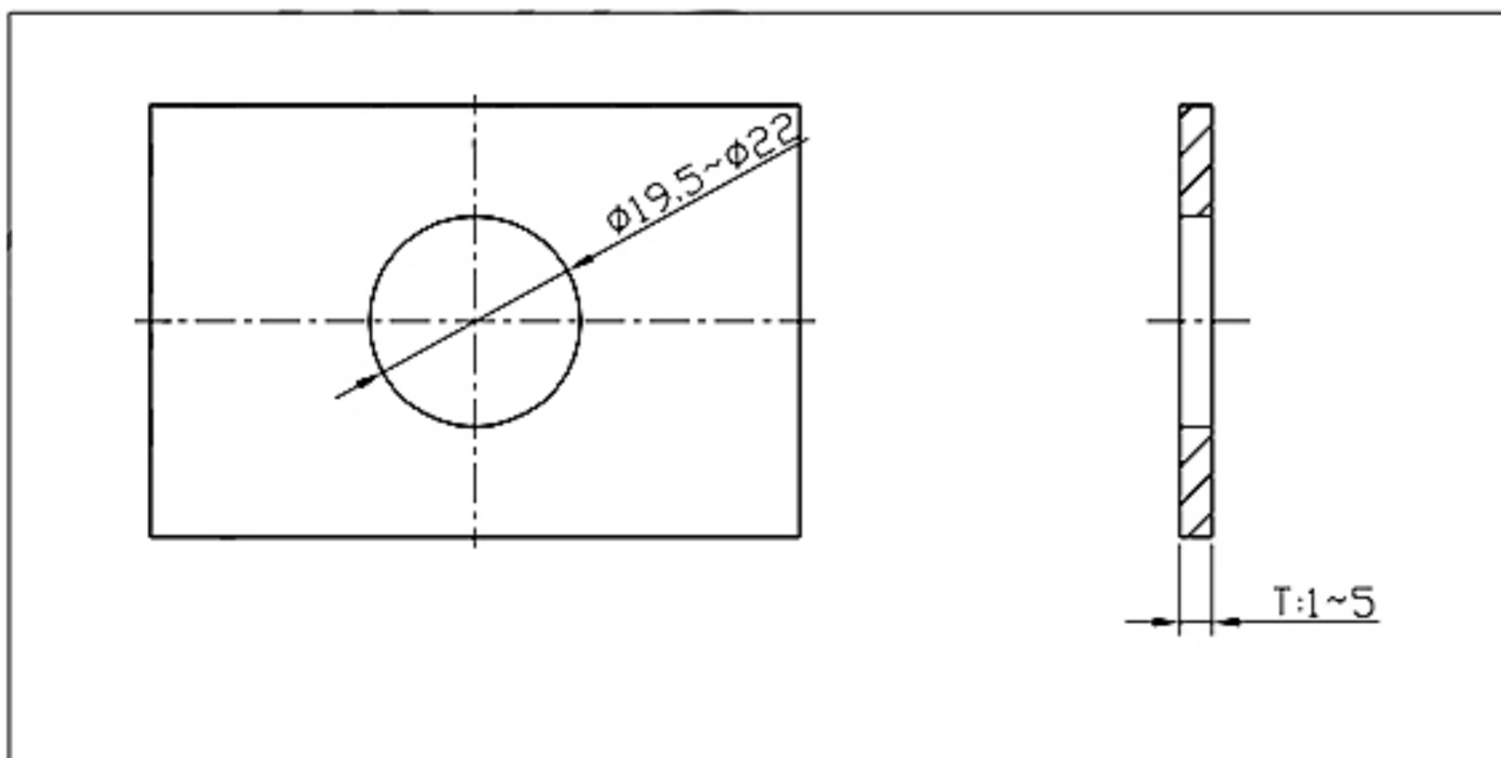
1.6.Interface definition

1 Red
2 Black
3 Yellow
4 White

PIN #	Lead name	Lead description	Remarks
1	VCC	Power input lead	Red
2	GND	Power supply lead	Black
3	RX/B	Function lead	Yellow (1)
4	TX/A	Function lead	White (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.Rated environment conditions

Item	Minimum	Typical value	Maximum	Unit	Remark
storage temperature	-25	25	80	℃	
Storage humidity	-	65%	90%	RH	(1)
Operating temperature	-15	25	50	℃	
Operating humidity	-	-	-	RH	(1)

Remark: (1) a. When the ambient temperature is 0-39°C, the maximum humidity is 90% (non-condensing)

2.2.Rated electrical conditions

Parameter	Specification			Unit	Remark
	Minimum	Typical value	Maximum		
Operating voltage	5.0	12	24	V	
Peak current	-	-	70	mA	Peak to peak
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; contact static ±4KV, air static ±8KV.

3.Output format

3.1.UART controlled output description

3.1.1.Output pin definition

PIN #	PIN name	PIN description	Remarks
1	VCC	Power input lead	
2	GND	Ground	
3	RX	Trigger input leads	(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 description

Interface	Baud rate	Data bit	Stop bit	Parity check
TTL level	115200bps	8	1	No

3.1.3.Timing diagram
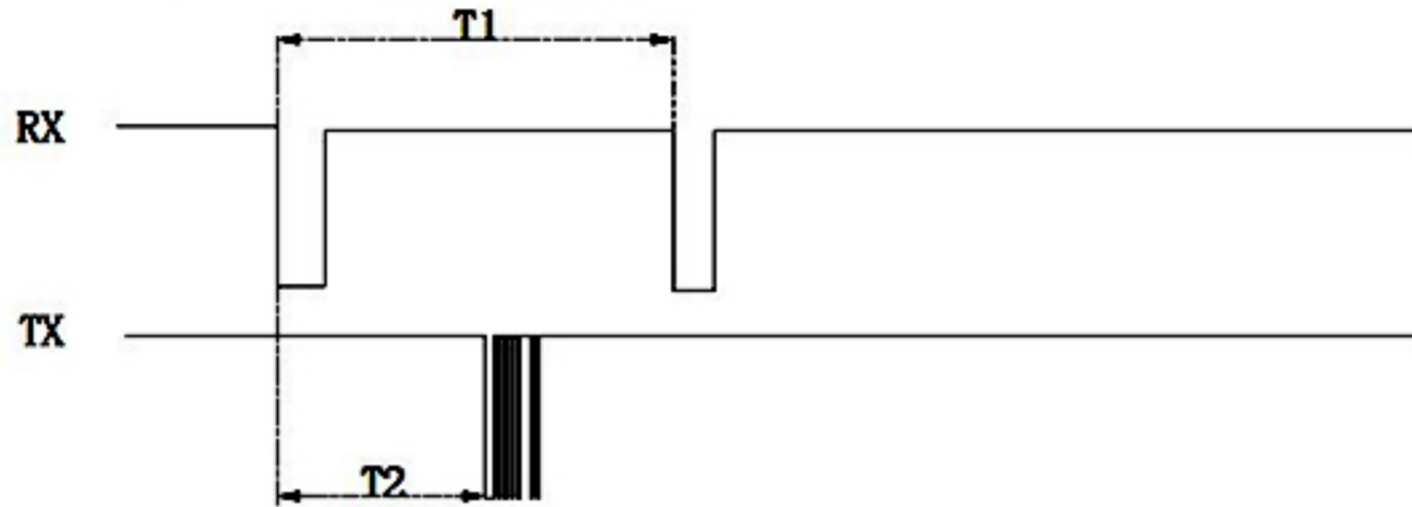
Note: DYP-L041MTW-V1.0: T1 >= 19ms; T2≈13ms
DYP-L042MTW-V1.0: T1 >= 14ms; T2≈9ms

3.1.4.UART output format

Serial	Output data	Description	Remarks
1	0XFF	Frame head, fixed to 0XFF	
2	0X01	Data high bits	
3	0X10	Data low 8 bits	
4	0X29	Communication checksum	①

①： The checksum is equal to the sum of all data and the lower byte of the data is taken

3.1.5.UART output example

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

SUM =(Frame header+ Data_H+ Data_L)&0x00FF

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

=0XA7；

Converted to decimal is equal to 1953；

3.2.RS485 output description

3.2.1. RS485 output lead definition

PIN #	PIN name	PIN description	Remarks
1	VCC	Power input lead	
2	GND	Ground	
3	B	485Communication anti-phase terminal	(1)
4	A	485 Communication in the same terminal	(1)

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

3.2.2.RS485 interface parameters

Interface	Baud rate	Data bit	Stop bit	Parity check
RS485	115200	8	1	No

3.2.3.RS485 interface protocol

Adopt the Modbus protocol, please refer to the "Modbus protocol specification" chapter.

3.3.Modbus protocol description

3.3.1.The Modbus protocol parameters

Model	Check	Sensor address	Read the function code	Write the function code
Modbus-RTU	CRC-16/MODBUS	Setable, default 0x01	0x03	0x06

3.3.2.The Modbus protocol format

The user machine is the host machine equipment, and this module is the slave equipment.
Host sent(read)

Name	Device address	Function code 0x03	Register address	Register number	CRC16 check
Length (Byte)	1	1	2	2	2

Slave response(read)：

Name	Device address	Function code 0x03	Return bytes number	Data field	CRC16 check
Length (Byte)	1	1	1	N	2

Host sent(write)：

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

Slave response(write)：

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

3.3.3.The Modbus register

(1)Modbus register table 1

Status	Register address	Register function	Data type	Instruction
Read-only	0x0100	Processing value	Unsigned int, 16bit	Start raging after receiving instruction, Output the distance value after multiple measurements and processed using the algorithm, unit: mm, response time 101～121ms
Read-only	0x0101	Real-time value	Unsigned int, 16 bits	After receiving the instruction, the module starts raging, and outputs the real-time distance value, unit: mm, response time 22～26ms
Read only	0x0102	Tempera-ture	Signed int, 16bit	Unit：0.1℃，Resolution：0.1℃，response time is about 15ms
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, 16 bits	default 0x09.115200bps; 0x01-2400, 0x02-4800, 0x03-9600, 0x04-14400, 0x05-19200, 0x06-38400, 0x07-57600, 0x08-76800, 0x09-115200

Read-write	0x0208	Angle level	Unsigned int, 16bit	The angle level can be set to level 1~4, default level 2; the larger the level, the more sensitive the induction.
Read-write	0x021A	Power noise reduction level	Unsigned int, 16bit	The power noise reduction level is 1 to 5 ,the default is 3; 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, and the higher the level, the smaller the angle.

Note :

1.Register data for high bytes in front and low bytes after.

2.The instruction reading time must be longer than the instruction response time to ensure the integrity of the data frame sending and receiving.

3.When increasing the Angle level and reducing the noise reduction level of the power supply, ensure that the noise of the use environment is small enough and will not affect the normal measurement.

(2)Effect of baud rate on single-packet communication duration

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 port rate, the shorter the single-packet communication time.

3.3.4.Modbus communication example

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: 05 06 02 01 00 01 19 F6
Slave: 05 06 02 01 00 01 19 F6
instruction: The sensor address is 0x05, and the baud rate is modified to 0x01, that is, 2400 bps.

Example 6: Modify Angle Level
Host: 01 06 02 08 00 03 49 B1
Slave: 01 06 02 08 00 03 49 B1
instruction: The sensor address is 0x01, and the angle is modified to level 3

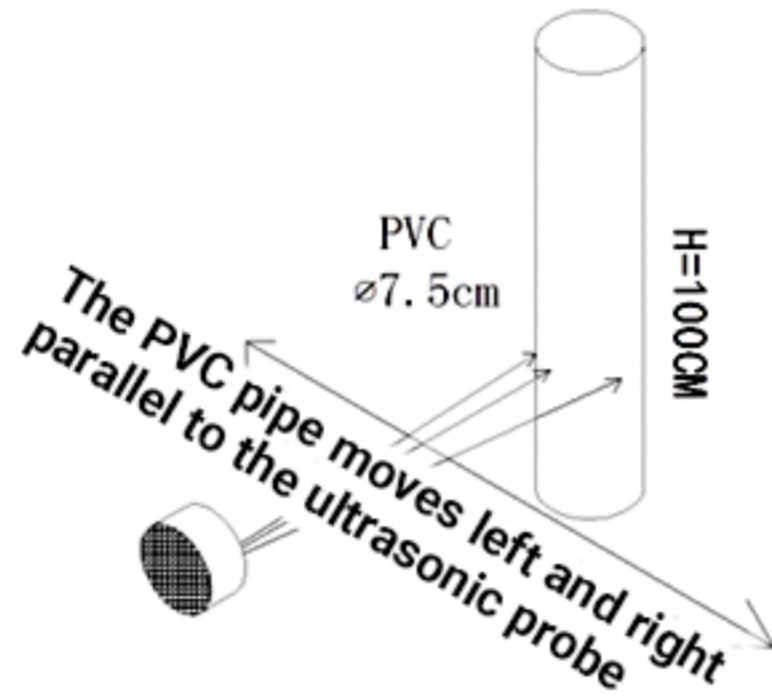Example 7: Modify the power supply noise reduction level
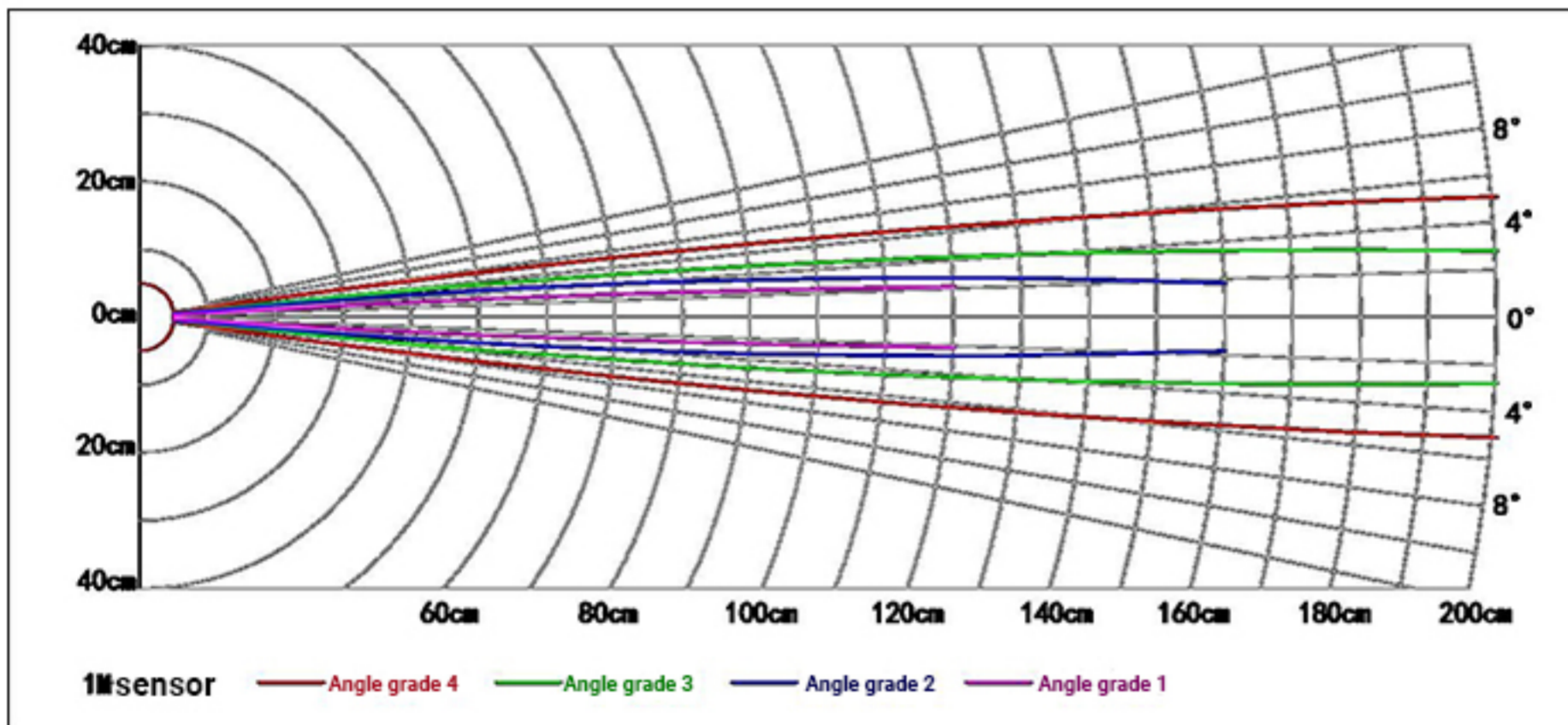Host: 01 06 02 1A 00 02 28 74
Slave: 01 06 02 1A 00 02 28 74
instruction: The sensor address is 0x01, and the power noise reduction is modified to level 2.
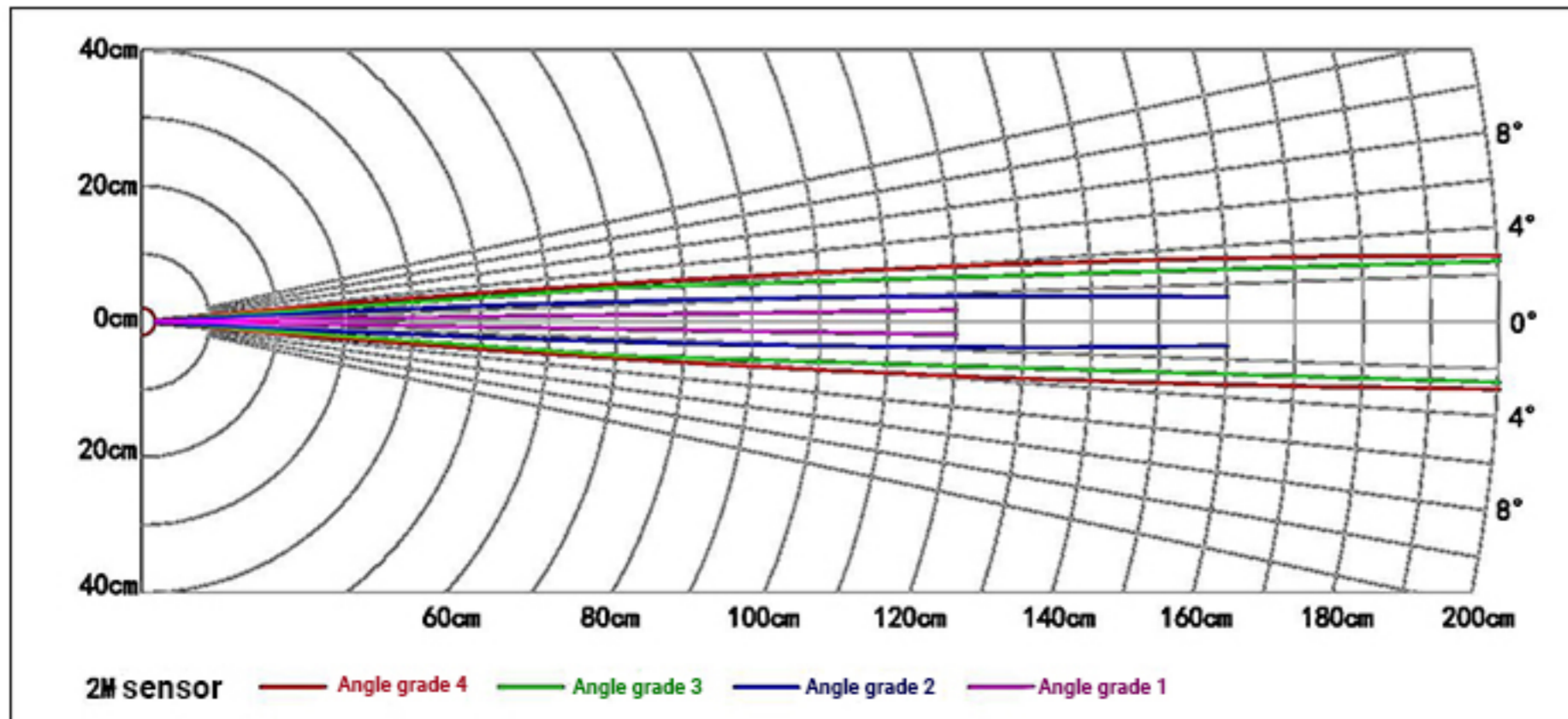
4.Reference of effective detection range

(1) Data obtained in pools with length 2.5m * width 1.5m and water depth of 30cm.

Effective detection range of DYP-L041MTW-V1.0 and DYP-L041M4W-V1.0

Effective detection range of DYP-L042MTW-V1.0 and DYP-L042M4W-V1.0

5.Model selection description

Module name	Product module	Function point name	Remarks
L04-module	DYP-L042MTW-V1.0	UART Controlled output	Range 2 ~ 300 cm
	DYP-L042M4W-V1.0	RS485 Controlled output	Range 2 ~ 300 cm
	DYP-L041MTW-V1.0	UART Controlled output	Range 5 ~ 600 cm
	DYP-L041M4W-V1.0	RS485 Controlled output	Range 5 ~ 600 cm

6.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.

7.Packaging specification

1. The default is Dianyingpu'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.