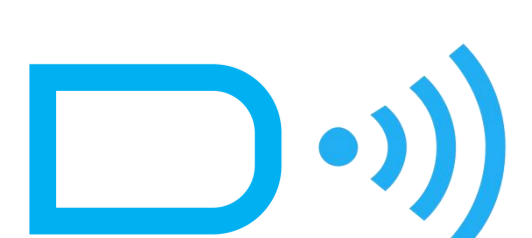


**DYP**  
Smart Sensor



# A25 SERIES SENSOR MODULE

DATASHEET



<https://dypsensoren.alibaba.com/>

SHENZHEN DIANYINGPU TECHNOLOGY Co.,LTD.



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# 1. Product introduction

## 1.1 Overview

A25-module is an ultrasonic obstacle avoidance sensor designed based on robot automatic control application, which is designed for the current market for ultrasonic sensor module with large blind spot, large measuring angle, long response time, poor installation adaptability and other problems.

A25-module has a series of advantages, such as small blind spot, small measuring angle, short response time, filtering the interference of the same frequency, small size, high mounting adaptability, dustproof and waterproof, long life, high reliability and so on.

Combined with our self-developed heterodyne acoustic wave processing technology, which can identify and filter heterodyne acoustic waves, the output data is more stable and reliable, which makes the A25-module reduce the probability of ultrasonic homodyne interference to a certain extent, and meets the user's needs for the application of complex environments in the field of robotic automatic control.

A25-module is hereinafter referred to as "module".

## 1.2 Functional Summary

- Wide voltage supply, working voltage: 3.3~12V;
- 3cm standard blind spot;
- The furthest range can be set, a total 3-level range of 50cm, 150cm and 200cm can be set through instructions;
- Multiple output modes are available, UART auto/controlled. Although the output modes are different, the function is exactly the same.
- Default baud rate is 115200, can support to modify to 4800, 9600, 14400, 19200, 38400, 57600, 76800;
- Ms-level response time, data output time can up to 8ms fastest;
- Built-in noise reduction function which can support the 5-grade noise reduction level setting, suitable for battery power supply, short and long distance USB power supply, switch power supply and large noise power supply;
- Intelligent acoustic wave processing technology, built-in intelligent algorithms to filter interfering acoustic waves; it can identify the interfering acoustic waves and automatically perform filtering, and the correct rate is increased by 70% in the same frequency interference environment at 1 meter;
- Waterproof structure design, waterproof rating IP67;
- Highly adaptable for installation, easy to install, solid and reliable;



- Ultra-wide temperature design, operating temperature -15°C to +60°C;
- Electrostatic protection design, input and output interfaces add electrostatic protection devices, in line with IEC61000-4-2 standard.

## 1.3 Product advantages

- Wide supply voltage
- Small blind spot
- Output method selectable
- Supports range modification
- Supports baud rate modification
- Supports address modification
- Supports angle setting
- Supports power supply noise reduction level setting
- Effectively reduce the probability of same frequency interference
- High waterproof rating
- Compact size and easy installation
- Wide operating temperature
- Strong anti-static
- High measurement accuracy
- Stable and reliable measurement data

## 1.4 Scope of application

- Robot obstacle avoidance and automatic control
- Horizontal ranging
- Parking Management System
- Object proximity and presence detection

## 1.5 Basic parameters

Parameters	UART Auto	UART Controlled	Unit	Note
Operating voltage	3.3~12V		V	DC
Standby Current	/	6	uA	(1)



Average operating current	≤10	≤10	mA	(2)
Blind spot distance	≤3		cm	
Plane object range	3~200		cm	(3)
Output Response Time	15~140	≤40	ms	(4)
Power-up operating time	≤50		ms	
Working cycle	100	control	ms	
Output method	Automatic	Controlled	-	
Measurement at room temperature accurate	1+(S*0.5%)		cm	(3)
Temperature compensation	Compensate		-	
Flat Mode Angle	Level: 40~60		°	(5)
	Vertical: 80~110		°	(6)
Lawn pattern angle	Level: 20~40		°	(5)
	Vertical: 45~75		°	(6)

### Remarks :

(1) The module will enter the low-power sleep state if it does not receive the control command for more than 3S, and the power consumption current at this time is the standby power consumption current;

Note: The communication level between TX and RX pins of the module is 3.3V, if the communication level between TX and RX pins of the user is more than 3.3V, it will affect the low power sleep state current;

(2) Typical data obtained from temperature 25° C, humidity 65% RH, power supply 5V, 100ms duty cycle test;

(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 0.5~5 meter range test, the shorter the range, the faster the response time.

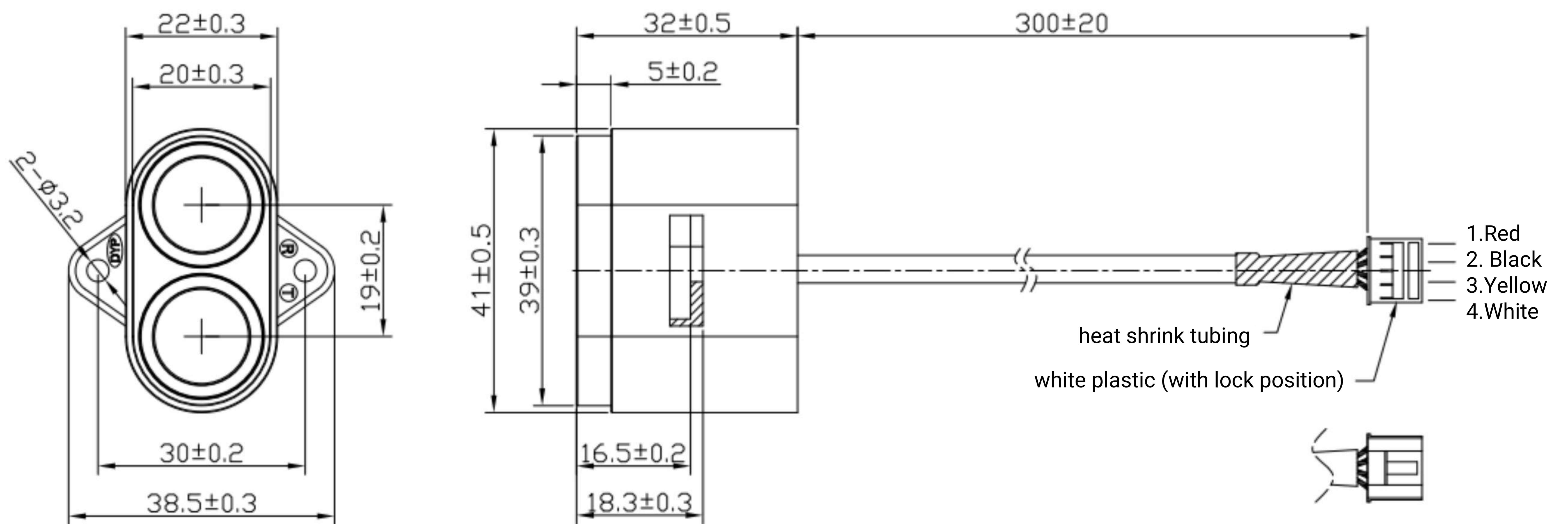
(5) The centre line of the two probes of the dual-angle module is horizontally arranged with the ground to test the object to be tested for the φ7.5 × 100cm white PVC pipe. The reference data is obtained from the test at a distance of 100cm with a default angle class of 4 in flat mode, and at a distance of 60cm with a default angle class of 4 in lawn mode;



(6) The centre line of the two probes of the dual-angle module is vertically arranged with the ground to test the object to be tested for the  $\phi 7.5 \times 100\text{cm}$  white PVC pipe. The reference data is obtained from the test at a distance of 100cm with a default angle class of 4 in flat mode, and at a distance of 60cm with a default angle class of 4 in lawn mode;

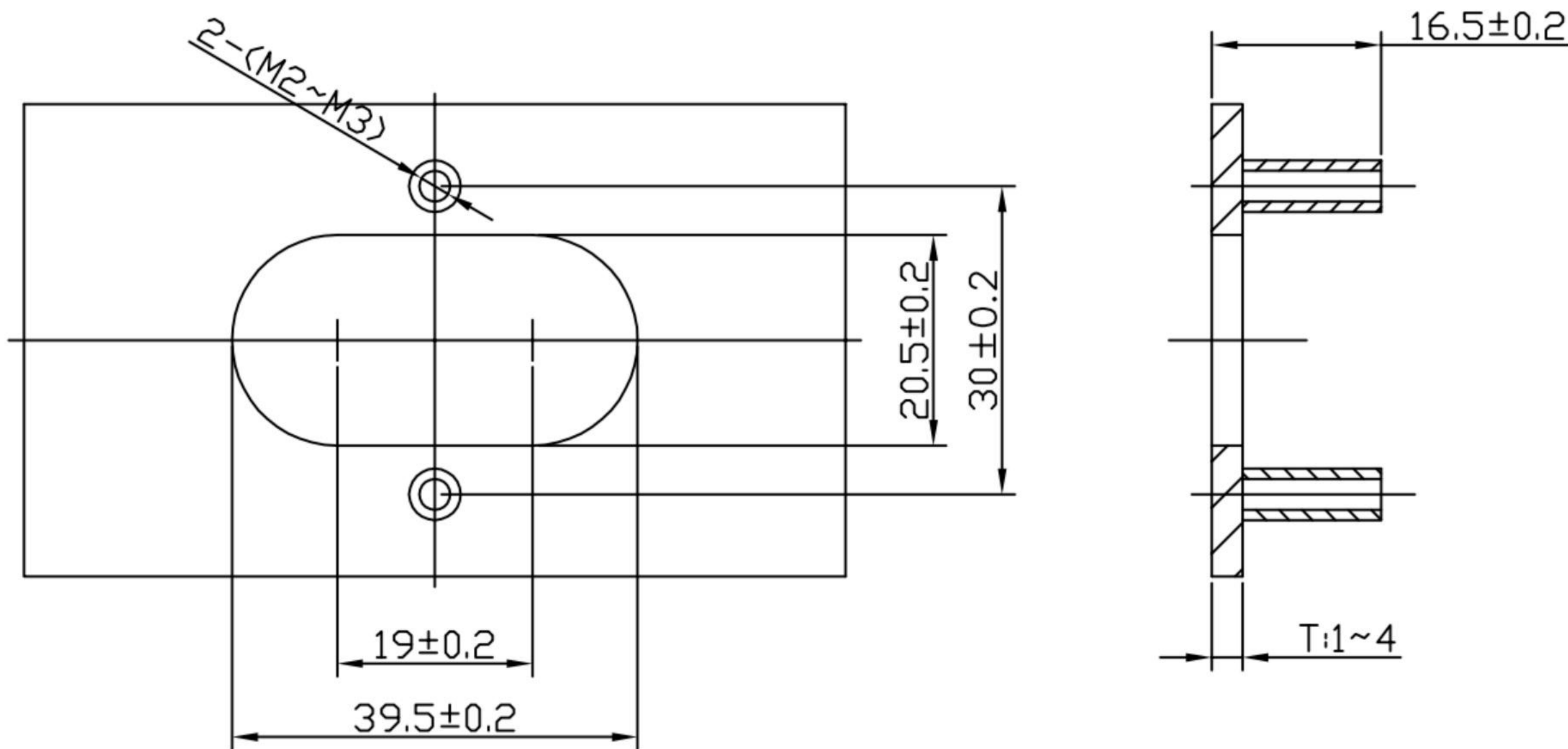
## 1.6 Mechanical characteristics

Product structure size (mm-inch) :

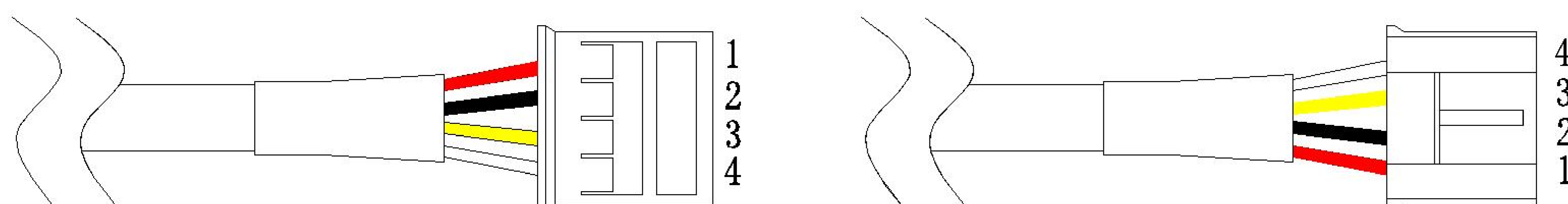


wire specification: blackPVC 2464 26AWG 4 cores wire(Red;Black;Yellow;White) unshielded OD:4.0mm

Installation Opening Suggestions:



## 1.7 Interface Definitions





PIN #	PIN name	PIN description	Remarks
1	VCC	Power Input PIN	
2	GND	Power Ground PIN	
3	RX	Functional PIN	(1)
4	TX	Functional 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. The average communication power is 0V~5V.

## 2.Limit parameters

### 2.1.Rated environment conditions

Item	Minimum	Typical value	Maximum	Unit	Remark
Storage temperature	-25	25	70	°C	
Storage humidity		65%	90%	RH	(1)
Operating temperature	-15	25	60	°C	
Operating humidity		90%	80%	RH	(1)

Remarks:

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

b. When the ambient temperature is 40-50° C, the highest humidity is the highest humidity in nature at the current temperature (no condensation)

## 2.2. Rated electrical conditions

Parameter	Specification			Unit	Remarks
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			$\pm 4K/\pm 15K$	V	(1)

Remarks: (1) Connection leads and pins are in accordance with IEC61000-4-2.

## 3. Output Modes

### 3.1. UART Automatic Output Description

#### 3.1.1 UART Automatic Output Description

Pin number	Pin name	Pin Description	note
1	VCC	Power Input	
2	GND	Power Ground	
3	RX	Processed and real-time value output selection	(1)
4	TX	UART Output	(1)

Remarks: (1) Lead wire, pin function and output method of product models correspond to each other, and cannot co-exist with other output methods.

#### 3.1.2 UART Communication Description

When the serial Modbus configuration register 0x0502 is 1, the module outputs according to the processed value, the data is more stable, and the response time is 100-140ms; when the configuration register 0x0502 is 0 (default), the response time is 15-30ms.

Outputs 0xFFE1 data as a reminder when too much electromagnetic interference exists in the detection environment, and outputs 0xFFFFD when no object can be detected.



UART	Data Bit	Stop Bit	Parity Check	Baud
TTL level	8	1	No	115200bps

### 3.1.3 UART Output Format

Frame Data	Clarification	Byte
Frame header	Fixed to 0XFF	1 byte
Data_H	Higher 8 bits of distance data	1 byte
Data_L	Lower 8 bits of distance data	1 byte
SUM	Communication checksum	1 byte

Note: Depending on the parameter value of modbus register 0x0209, there is a difference in data output units, mm or us units.

### 3.1.4 UART Output Example

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

Note: The checksum retains only the lower 8 bits of the accumulated value;

$$\text{SUM} = (\text{Frame Header} + \text{Data}_H + \text{Data}_L) \& 0x00FF$$

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

$$= 0XA7;$$

$$\text{Distance value} = \text{Data}_H * 256 + \text{Data}_L = 0X07A1;$$

Converted to decimal equals 1953;

When the parameter value of modbus register 0x0209 is 0x00 in mm, it means that the current measured distance value is 1953 mm;

When the parameter value of modbus register 0x0209 is 0x01, the unit is us, it means that the current measured distance echo time value is 1953us, and this value is divided by 5.75 to get the distance value in mm unit = 1953/5.75≈340mm.



## 3.2 UART Controlled Output Description

### 3.2.1 Definition of Output Pins

Pin Number	Pin Name	Pin Description	note
1	VCC	Power Input	
2	GND	Power Ground	
3	RX	Trigger Input	(1)
4	TX	UART Output	(1)

Remarks: (1) Lead wire, pin function and output method of product models correspond to each other, and cannot co-exist with other output methods.

### 3.2.2 UART Communication Description

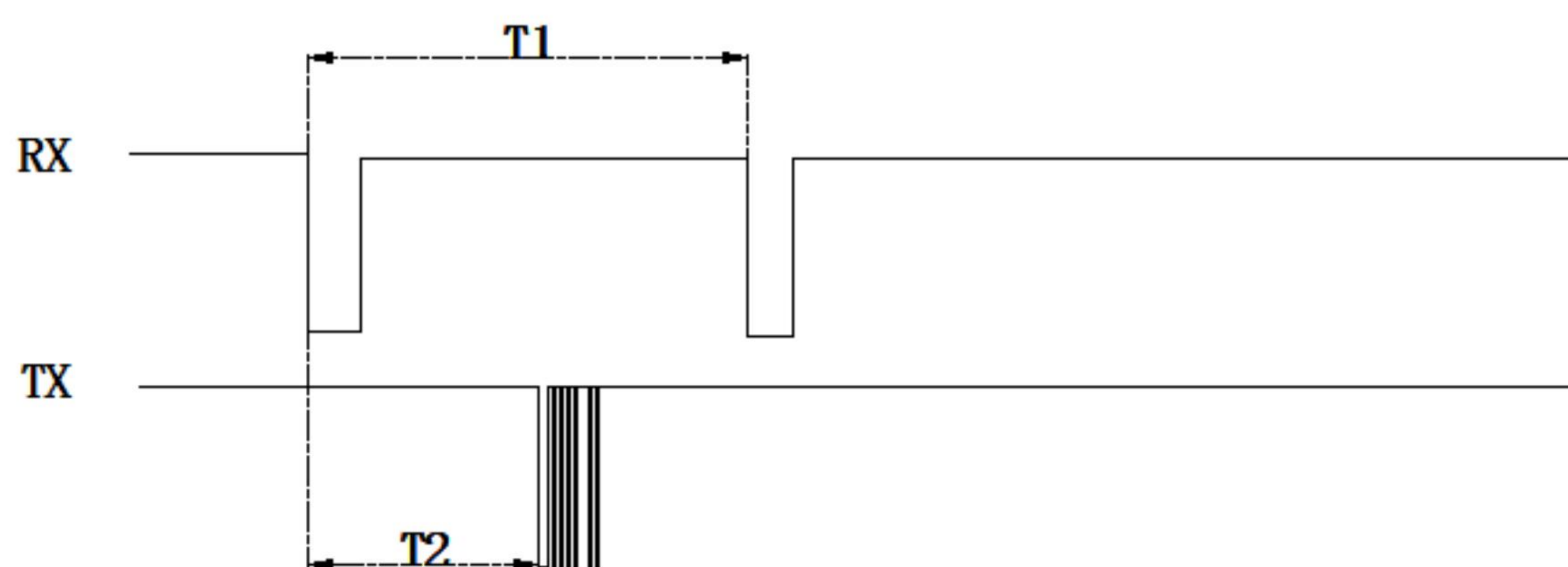
When the trigger input lead "RX" receives a trigger pulse with a falling edge or any serial data, the falling edge will trigger the module to work once, and the output lead "TX" will output the measurement data once, the trigger period of the module must be more than 55ms.

When no trigger pulse is received from the "RX" pin for more than 1 second, the module will enter into sleep state with the lowest power consumption. When the module receives the "RX" trigger pulse when it is sleeping, it will wake up immediately, but the response time will be 12ms longer than when it is not sleeping.

Outputs 0xFFE1 data as a reminder when too much electromagnetic interference exists in the detection environment, and outputs 0xFFFFD when no object can be detected.

UART	Data Bit	Stop Bit	Parity Check	Baud
TTL level	8	1	No	115200bps

### 3.2.3 Timing Diagrams



Note:  $T1 > T2 + 15ms$ ;  $T2 = 10$  to  $40ms$ ; measured in undormant mode.



### 3.2.4 UART Output Format

Frame Data	Instructions	Byte
header	Fixed to 0XFF	1 byte
Data_H	Higher 8 bits of distance data	1 byte
Data_L	Lower 8 bits of distance data	1 byte
SUM	Communications checksum	1 byte

### 3.2.5 UART Output Example

Header	Data_H	Data_L	SUM
0XFF	0X07	0XA1	0XA7

Note: The checksum retains only the lower 8 bits of the accumulated value;

$$\text{SUM} = (\text{Frame Header} + \text{Data}_H + \text{Data}_L) \& 0x00FF$$

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

$$= 0XA7;$$

$$\text{Distance value} = \text{Data}_H * 256 + \text{Data}_L = 0X07A1;$$

Converted to decimal equals 1953;

When the parameter value of modbus register 0x0209 is 0x00, the unit is mm, which means the current measured distance value is 1953mm;

When the parameter value of modbus register 0x0209 is 0x01, the unit is us, it means that the current measured distance echo time value is 1953us, and this value is divided by 5.75 to get the distance value in mm unit = 1953/5.75≈340mm.

## 3.3 Modbus Protocol Description

### 3.3.1 Modbus Protocol Parameters

Paradigm	Calibration	Sensor Address	Read Function Codes	Write Function Code
Modbus-RTU	CRC-16/MODBUS	Settable, default 0x01	0x03	0x06



### 3.3.2 Modbus Protocol Format

The user machine is the master device and this module is the slave device.

Host Transmit (Read):

Name	Device Address	Function Code 0x03	Register Address	Number of Registers	CRC16 Check
Length (Byte)	1	1	2	2	2

Respond (read) from the machine:

Name	Device Address	Function Code 0x03	Return bytes number	Data field	CRC16 Check
Length (Byte)	1	1	1	N	2

Host Send (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 Modbus Registers

The register data is the high byte first and the low byte second.

(1) Modbus register table 1

Authority	Address	Function	Data Type	Instructions
Read-only	0x0100	Processing value	Unsigned int, 16bit	Start ranging after receiving instruction, output distance value after the algorithm processing unit: mm, response time is about 100~300ms(varying with different ranges)
Read-only	0x0101	Real-time value	Unsigned int, 16bit	After receiving the instruction, the module starts ranging once, and outputs the real-time distance value, unit: mm, response time is about 15~40ms(varying with different ranges)



Read-only	0x0102	Temperature	Signed int, 16bit	Unit: 0.1°C, Resolution: 0.5°C, Response time about 50~100ms (varying ranges)
Read-only	0x010A	Echo time	Unsigned int, 16bit	After receiving the instruction, the module starts ranging 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 10~40ms(varying with different ranges)
Read-only	0x01E0	abnormal state	Unsigned int, 16bit	0x0000 : No exception status 0xFFE2 : Blind zone too large 0xFFE4 : NTC shorted or soldered. 0xFFE5 : Temperature too high 0xFFE6 : Temperature too low

Note:(1)Response time is obtained from 0.5 to 2 metres range test, the shorter the range, the faster the response time.

(2) 0x0100/0x0101/0x010A register, outputs 0xFFE1 data as a reminder when there is too much electromagnetic interference in the detection environment, and outputs 0xFFFFD when no object can be detected.

(2) Modbus register table 2

Authority	Address	Function	Data Type	Instruction
Read-write	0x0200	Slave Address	Unsigned int, 16bit	Range: 0x01 to 0xFE (default 0x01), 0xFF is the broadcast address
Read-write	0x0201	Baud rate	Unsigned int, 16bit	The serial port baud rate (default 115200), unit: bps, takes effect immediately after setting, and the baud rate corresponding to the register value is as follows: 0x0002:4800, 0x0003:9600, 0x0004:14400, 0x0005:19200, 0x0006:38400, 0x0007:57600, 0x0008:76800, 0x0009:115200



Read-write	0x0208	Flat Mode Detection Angle Rating	Unsigned int, 16bit	<p>The angle level can be set from 1 to 4 (default level 4); the larger the level, the larger the detection angle and the more sensitive the sensing, and vice versa, the smaller the level.</p> <p>1-Horizontal angle of approx. 25° , vertical angle of approx. 50°                  2-Horizontal angle of approx. 30° , vertical angle of approx. 65°                  3-Horizontal angle of approx. 45° , vertical angle of approx. 75°                  4-Horizontal angle approx. 50° , Vertical angle approx. 95</p>
Read-write	0x0208	Lawn Pattern Detection Angle Rating	Unsigned int, 16bit	<p>The angle level can be set from 1 to 4 (default level 4); the larger the level, the larger the detection angle and the more sensitive the sensing, and vice versa, the smaller the level.</p> <p>1 - Horizontal angle approx. 10° , vertical angle approx. 30°                  2 - Horizontal angle of approx. 20° , vertical angle of approx. 40°                  3 - Horizontal angle of approx. 20° , vertical angle of approx. 45°                  4-Horizontal angle approx. 30° , vertical angle approx. 60°</p>
Read-write	0x0209	Output distance value data unit	Unsigned int, 16bit	Controlled/Auto output protocol distance value units, 0x00-mm, 0x01-us (divide this value by 5.75 to get the distance value in mm), only available for UART Auto and UART Controlled modes
Read-write	0x021A	Power Supply Noise Reduction Rating	Unsigned int, 16bit	<p>The power supply noise reduction level is divided into 1 to 5 levels (default 1) to apply to different power supply scenarios; the higher the level, the greater the noise suppression, while the overall angle will be affected, the higher the level the more the angle is affected by the situation. Description of different levels:</p> <p>1 - Suitable for battery-powered applications;                  2 - Suitable for USB power supply and other occasions where there is a certain amount of high-frequency noise;                  3 - Suitable for longer distance USB power supply;                  4- Suitable for the occasion of switching power supply;                  5-Suitable for switching power supply, environmental interference complex occasions, generally not recommended to use</p>



Read-write	0x021F	Range Rating	Unsigned int, 16bit	Ranging range class 1 to 3 (default is 3), Range scope: 1-about 50cm, response time 10-15ms for real-time values and 100-150ms for processed values; 2-about 150cm, response time 15-20ms for real-time values and 100-200ms for processed values; 3-about 200cm, response time 20-40ms for real-time values and 100-250ms for processed values;
Read-write	0x0308	Detection Mode	Unsigned int, 16bit	There are 2 types of detection modes: 0x01: Lawn mode for lawn mowing robots or underwater robots 0x00: Flat mode, regular horizontal detection of large angles (default)
Read-write	0x0502	Data Model	Unsigned int, 16bit	Setting the output data as real-time or processed values (automatic mode only) 0x00: Real-time value (default) 0x01: Processed value

(3) Impact of baud rate on single packet communication duration

No.	Baud	Communication Time	Remark
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 single packet communication time.



### 3.3.4 Example of Modbus Communication

Example 1: Reading processed value data

Mainframe: 01 03 01 00 00 01 85 F6

Slave: 01 03 02 02 F2 38 A1

Note: The sensor address is 0x01, and the processed distance value is 0x02F2, which is converted to decimal 754mm.

Example 2: Reading real-time value data

Mainframe: 01 03 01 01 00 01 D4 36

Slave: 01 03 02 02 EF F8 A8

Description: The sensor address is 0x01 and the real-time distance value is 0x02EF, which is converted a decimal into 751mm.

Example 3: Reading temperature value data

Mainframe: 01 03 01 02 00 01 24 36

Slave: 01 03 02 01 2C B8 09

Note: The sensor address is 0x01 and the real-time temperature value is 0x012C, which is converted to 30.0° C in decimal.

Example 4: Modifying the Slave Address

Mainframe: 01 06 02 00 00 05 48 71

Slave: 01 06 02 00 00 05 48 71

Note: The sensor address is changed from 0x01 to 0x05.

Example 5: Reading Baud Rate

Mainframe: 01 03 02 01 00 01 D4 72

Slave: 01 03 02 00 03 F8 45

Description: Read the baud rate, the baud rate read is: 9600bps

Example 6: Setting the Baud Rate

Mainframe: 01 06 02 01 00 03 99 B3

Slave: 01 06 02 01 00 03 99 B3

Description: Set the baud rate to 9600bps.

Example 7: Accessing Illegal Registers

Mainframe: 01 03 FF FF 00 01 84 2E

Slave: 01 82 02 C1 61

Explanation: 0x82 means that the operation register 0xFFFF is illegal

Example 8: Illegal register setting range

Mainframe: 01 06 02 01 00 FF 99 F2

Slave: 01 81 00 40 50

Explanation: 0x81 indicates that the baud rate setting range is illegal.

## 4. Module Selection Explanation

The output format of this series of distance measuring module is divided into two, users can choose the corresponding model according to the actual application.

If there are special requirements for modification of response time, angle, communication protocol, etc., you need to communicate with our FAE engineers when purchasing.

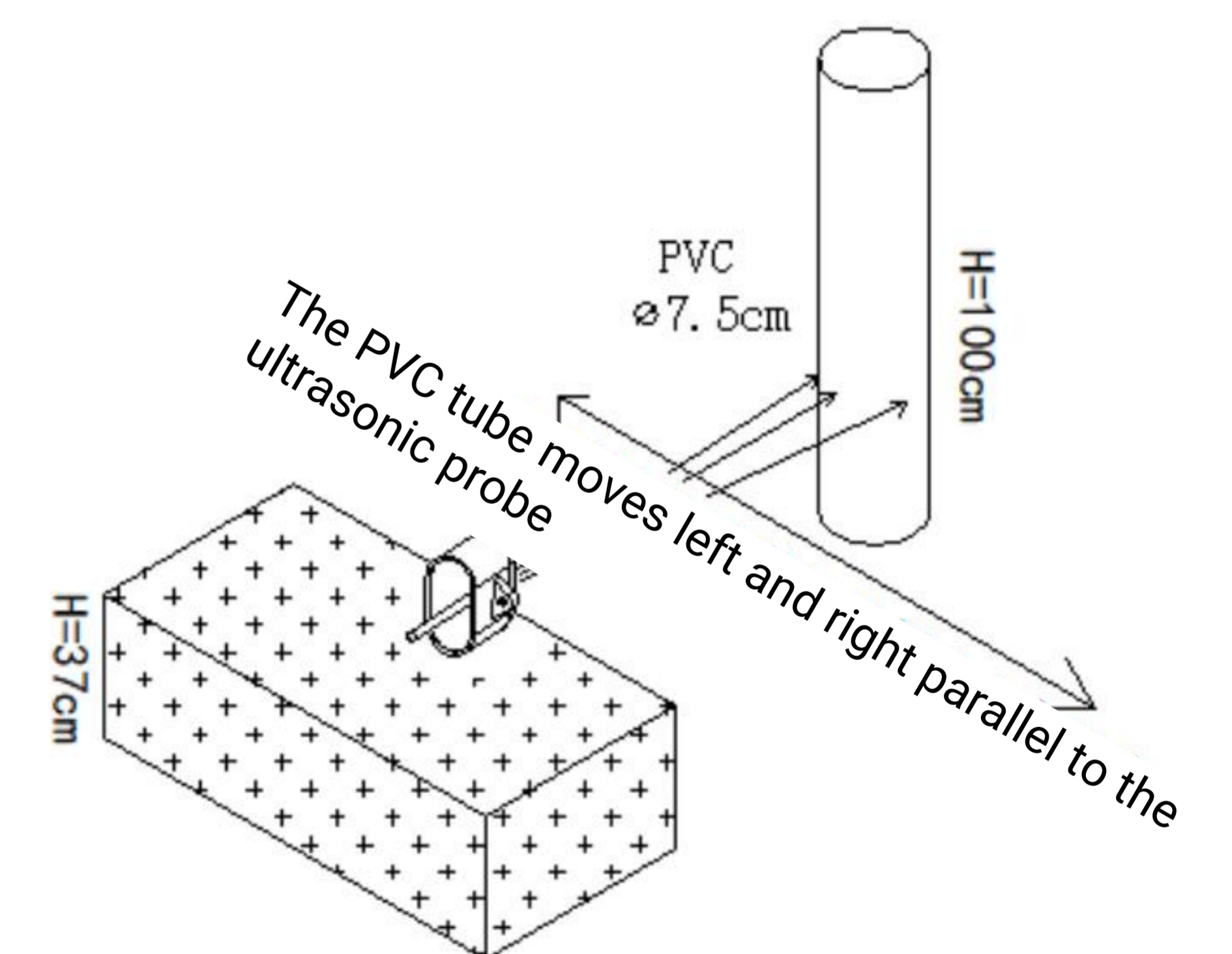
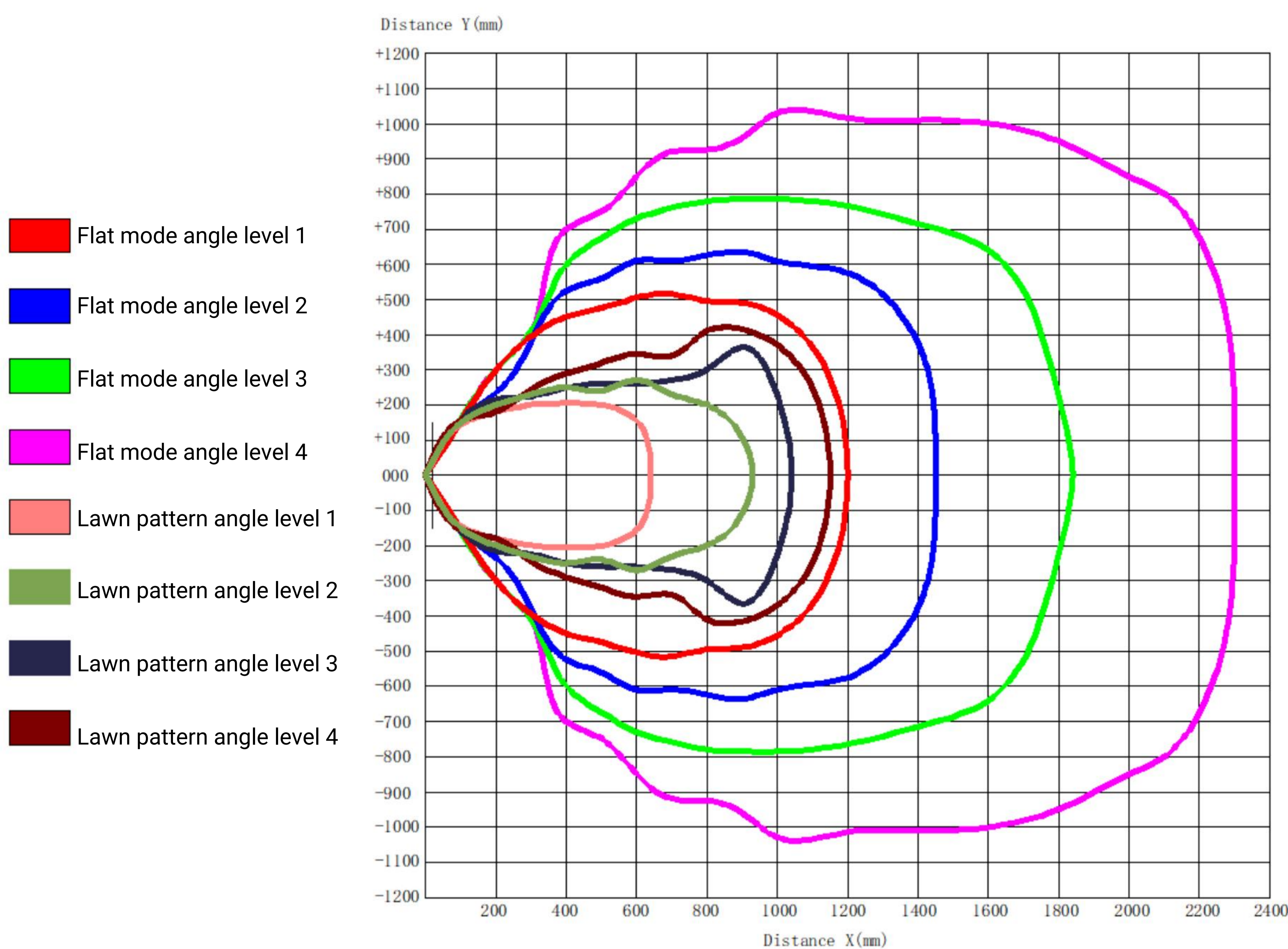


No.	A25 Series Model	Output Method	Remark
1	DYP-A25YYUW-V1.0	UART Auto	
2	DYP-A25YYTW-V1.0	UART controlled	

## 5. Reference diagram of the effective detection range

### 5.1 Vertical angle: The centre line of the two probes is arranged perpendicular to the ground.

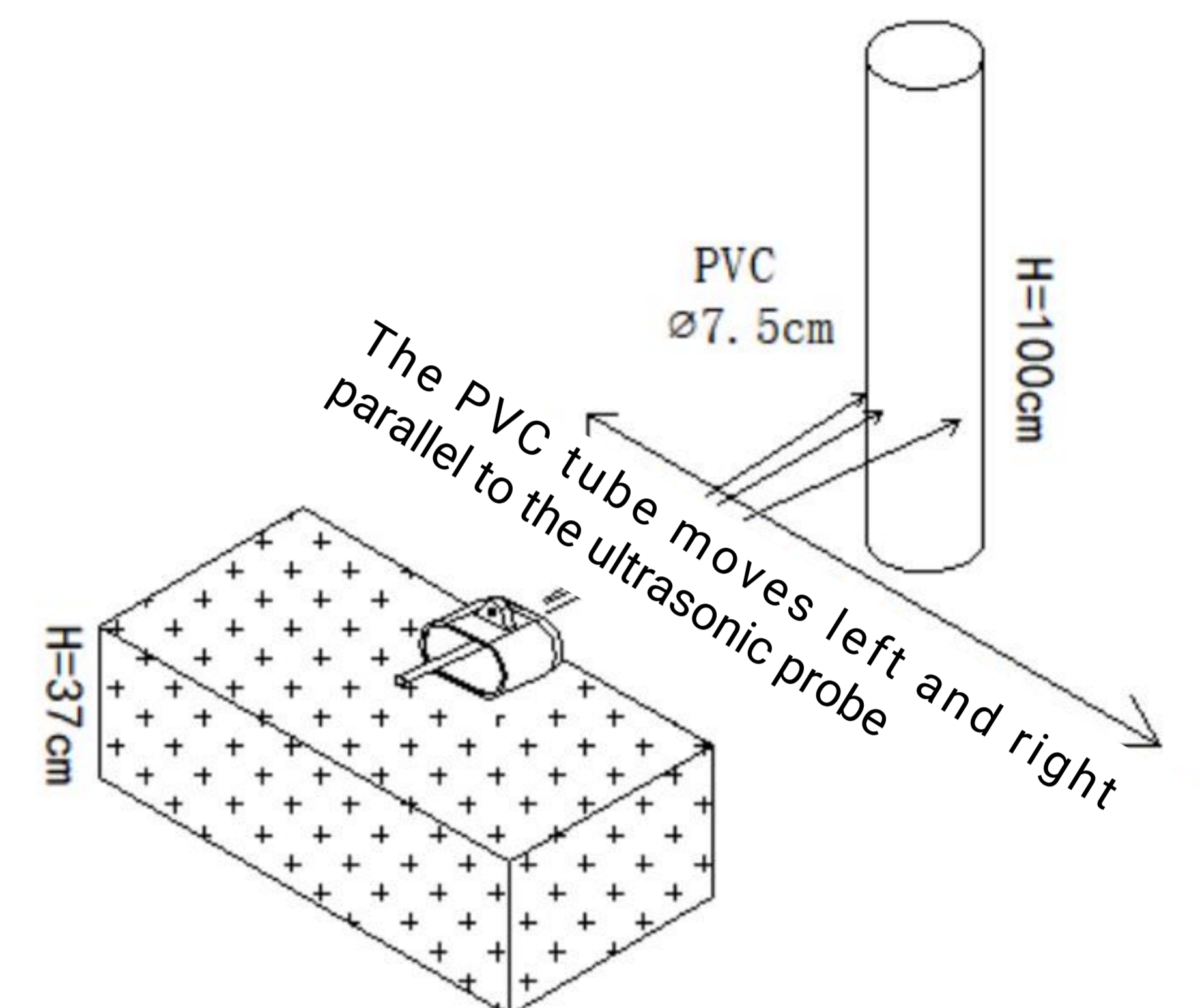
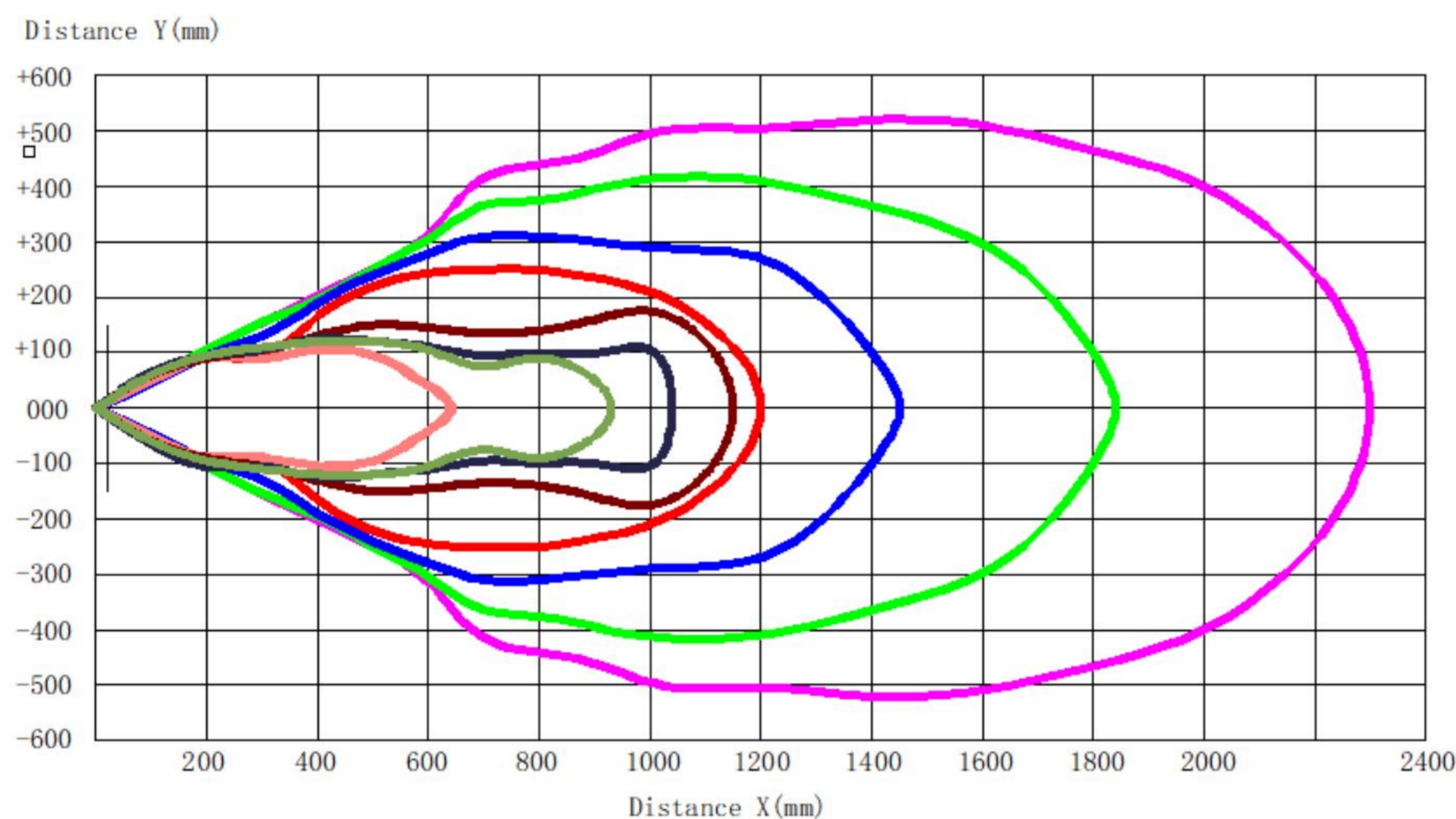
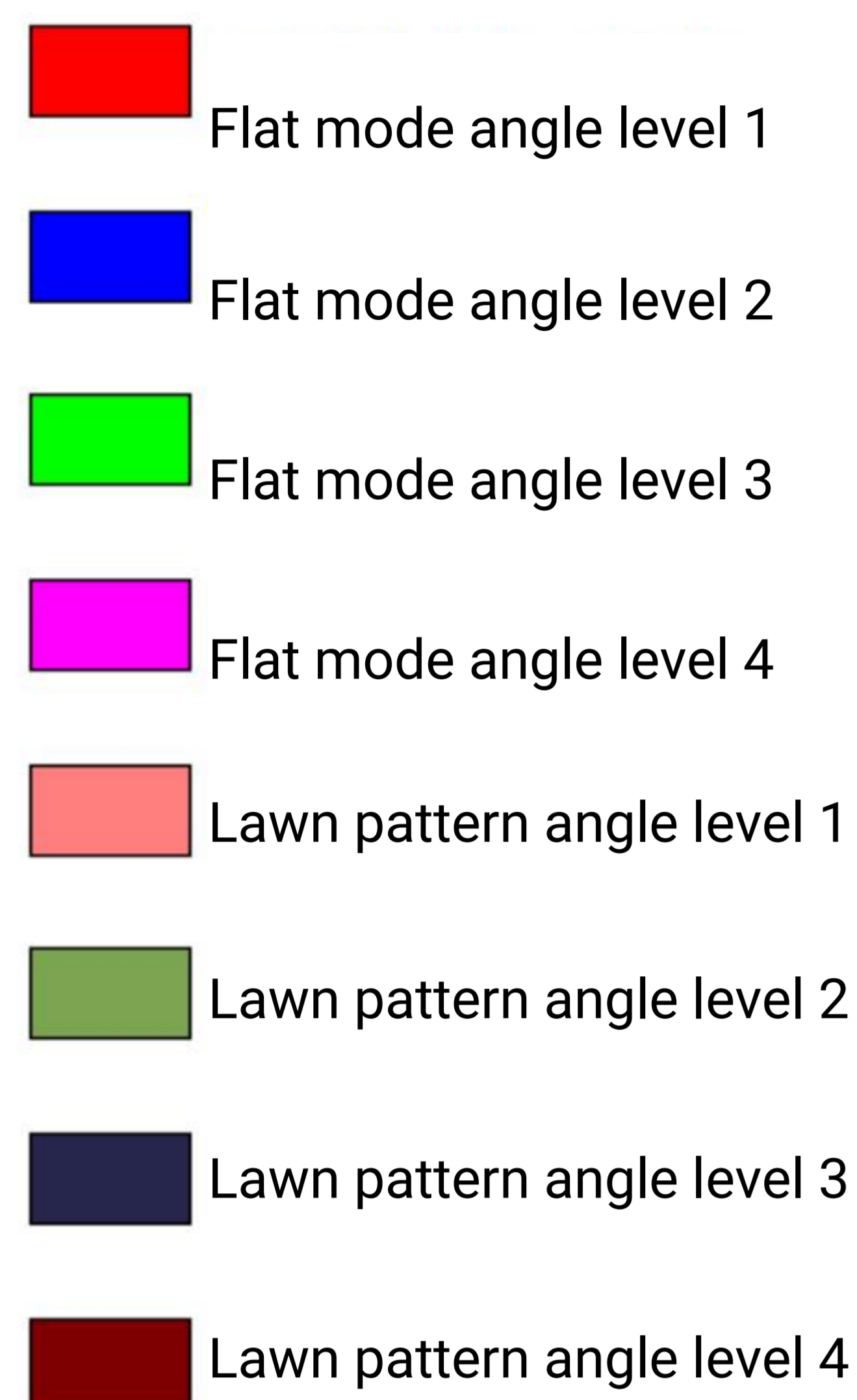
(1) The object under test was a white cylindrical tube made of PVC with a height of 100cm and a diameter of 7.5cm.





## 5.2 Horizontal angle: The centre line of the two probes is arranged horizontally with the ground.

(1)The object under test was a white cylindrical tube made of PVC with a height of 100cm and a diameter of 7.5cm.



## 6. Installation Recommendations

1. When installing the transducer, make sure that the transducer's emitting surface and the plane to be measured are parallel, so as to ensure that the sound waves emitted vertically to the surface of the object to be measured return with the maximum energy, in order to ensure the stability and reliability of the maximum range;
2. Please note that objects in front of the sensor other than the object to be measured are to be kept out of the sensor's test range;
3. In the use and installation site there will be steam, easy to have water droplets attached to the surface of the probe, please try to avoid the effect of water droplets or water junction;
4. Sensor mounting needs to avoid structural deformation, metal or other resonance, avoid resistance components (such as elbows, valves, reducers).

## 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 tolerance when designing, unreasonable structural design may cause transient abnormality of module functions;
3. Please pay attention to the electromagnetic compatibility assessment when designing, unreasonable system design may cause abnormal module function;
4. Contact our FAE to confirm the relevant precautions when applying to the boundary of product limit parameters;
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 Specifications

- 1.Defaults to DYP's regular packaging method;
- 2.Packaging materials can be customized according to customer IQC related standards;
- 3.The container transport mode should adopt staggered consolidation mode, and at the same time, it should use film wrapping with reinforced corner boards at the outer edge of a single stack to provide sufficient support.