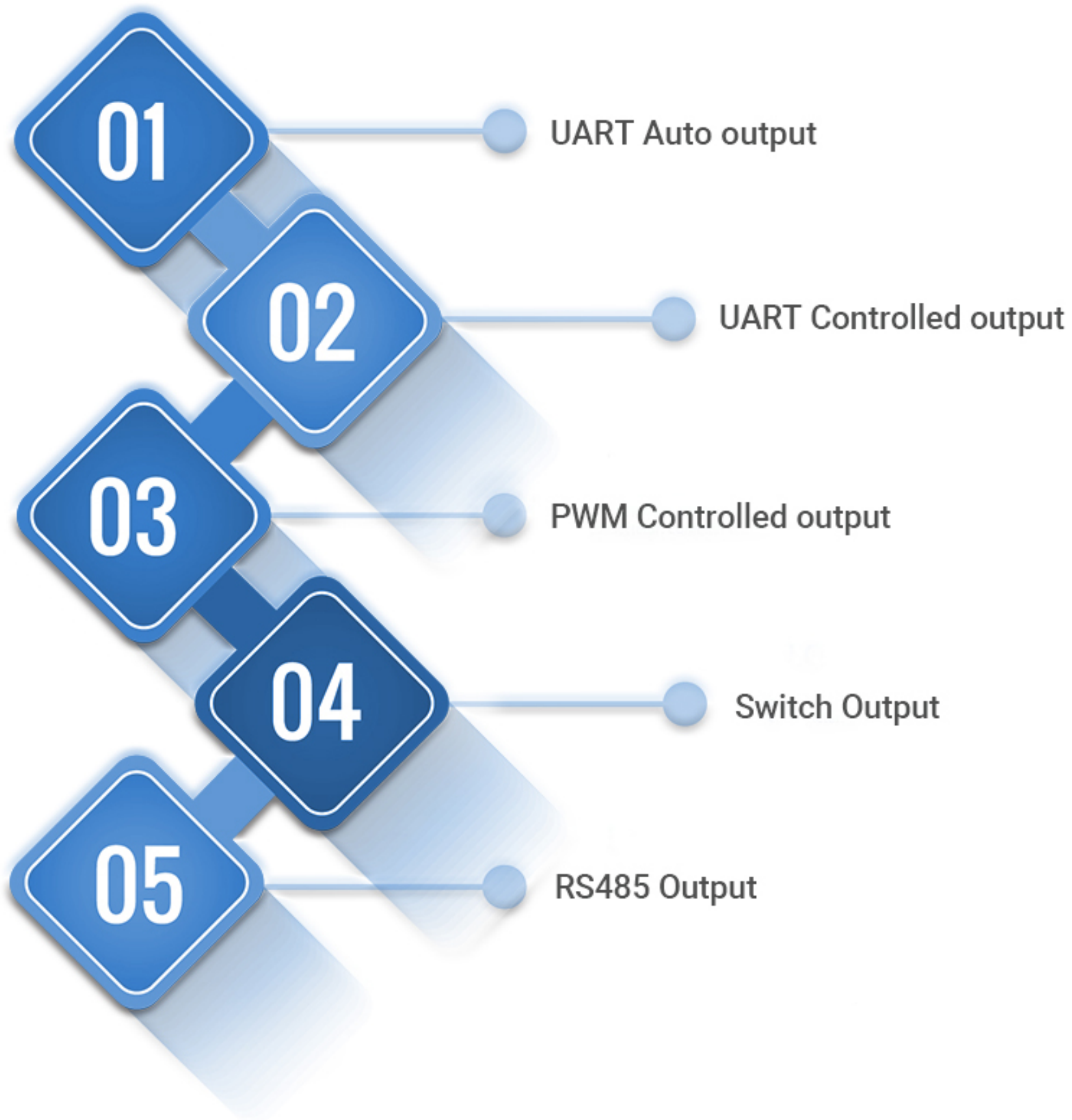


# A13 Module Output Interface



## 1. UART Auto

UART auto output mode outputs measured distance value(Hexadecimal) according to UART communication format. This mode does not require an external trigger signal, automatic measurement by every 100ms.Pin(TX) output distance value, only one I/O port is needed

### (1) Pin definition

Pin No.	Mark	Pin Description	Remark
③	RX	Processed value or Real time value output	
④	TX	UART output	

Remark: The output high-level voltage of RX TX is 3V,the max allowable input voltage is 5V.

### (2) UART Instruction

When the pin(RX)is suspended or the input high level, the module outputs processed value, and the data is more stable. The response time of the A13 series is 1.5s~2.5s, and the time of A13B series is 0.3s~0.5s. When the pin(RX)is input low level, the module outputs real-time value. Response time of A13 series is 500ms, and the time of the A13B series is 100ms.

Interface	Data Bit	Stop Bit	Parity Bit	Baud Rate
TTL level	8	1	No	9600bps

Note: The real-time value or processed value output is judged when powered on. Re-power on to switch.

### (3) UART Output format

Data Frame	Description	Byte
Start Bit	0XFF 0XFF	1byte
Data_H	High8 distance value	1byte
Data_L	Low8 distance value	1byte
SUM	Parity sum	1byte

#### (4) Example

Start Bit	Data_H	Data_L	SUM
0XFF	0X07	0XA1	0XA7

Remark: Parity sum only remain low8 value.

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

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

$$= 0XA7$$

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

Convert to decimal equal to 1953

Means current measurement distance value is 1953mm

## 2. UART Controlled Output

UART controlled mode outputs measured distance value(Hexadecimal) according to UART communication format. When pin(RX) receives a falling edge pulse, the module will perform a measurement, measured distance value output through pin(TX) after completed. Such output method can set measuring cycle to drop power consumption. Recommend for battery power supply use.

#### (1) Pin definition

Pin No.	Mark	Pin Description	Remark
③	RX	Trigger Signal input	
④	TX	UART output	

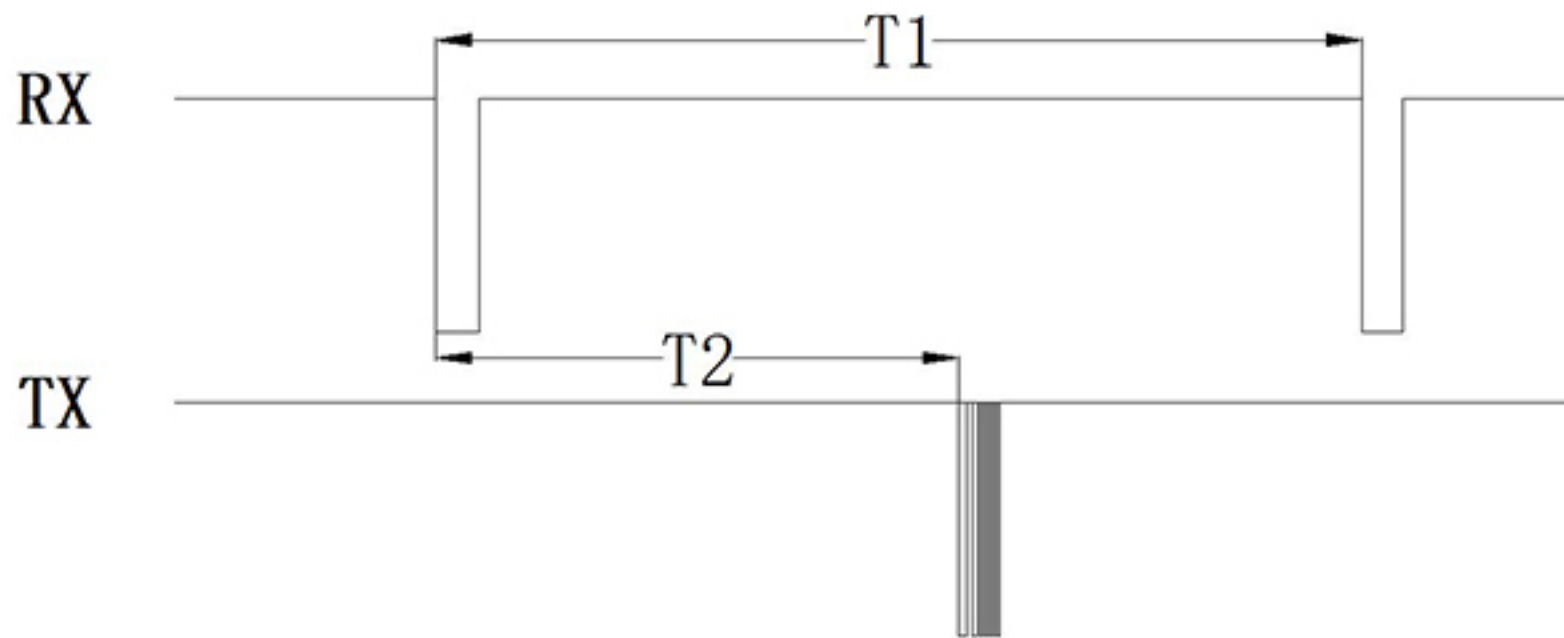
Remark: The output high-level voltage of RX TX is 3V, the max allowable input voltage is 5V.

#### (2) Instruction

The module will perform a distance detection after Pin(RX) receives a falling edge pulse. Pin(TX) will output a TTL level after detection is completed. The trigger period of the module must be greater than 500ms of A13 series, greater than 60ms for A13B series.

Interface	Data Bit	Stop Bit	Parity Bit	Baud Rate
TTL level	8	1	No	9600bps



**(3) Timing Diagram**

Remark: A13 Series  $T1 > 500\text{ms}$ ,  $T2 \approx 380\text{ms}$ ; A13B Series:  $T1 > 60\text{ms}$ ,  $T2 \approx 31\text{ms}$

**(4) UART Output Format**

Data Frame	Description	Byte
Start Bit	0XFF 0XFF	1byte
Data_H	High8 distance value	1byte
Data_L	Low8 distance value	1byte
SUM	Parity sum	1byte

**(5) Example**

Start Bit	Data_H	Data_L	SUM
0XFF	0X07	0XA1	0XA7

Remark: Parity sum only remain low8 value.

$$\text{SUM} = (\text{Start bit} + \text{Data\_H} + \text{Data\_L}) \& 0\text{x}00\text{FF}$$

$$= (0\text{XFF} + 0\text{X}07 + 0\text{XA}1) \& 0\text{x}00\text{FF}$$

$$= 0\text{XA}7$$

$$\text{Distance value} = \text{Data\_H} * 256 + \text{Data\_L} = 0\text{X}07\text{A}1$$

Convert to decimal equal to 1953

Means current measurement distance value is 1953mm

### 3. PWM output

PWM output interface is simple and flexible, can be connected to digital or analog circuits to realize distance measurement.

#### (1) Pin Definition

Pin No.	Mark	Pin Description	Remark
③	RX	Trigger Signal input	
④	TX	PWM value output	

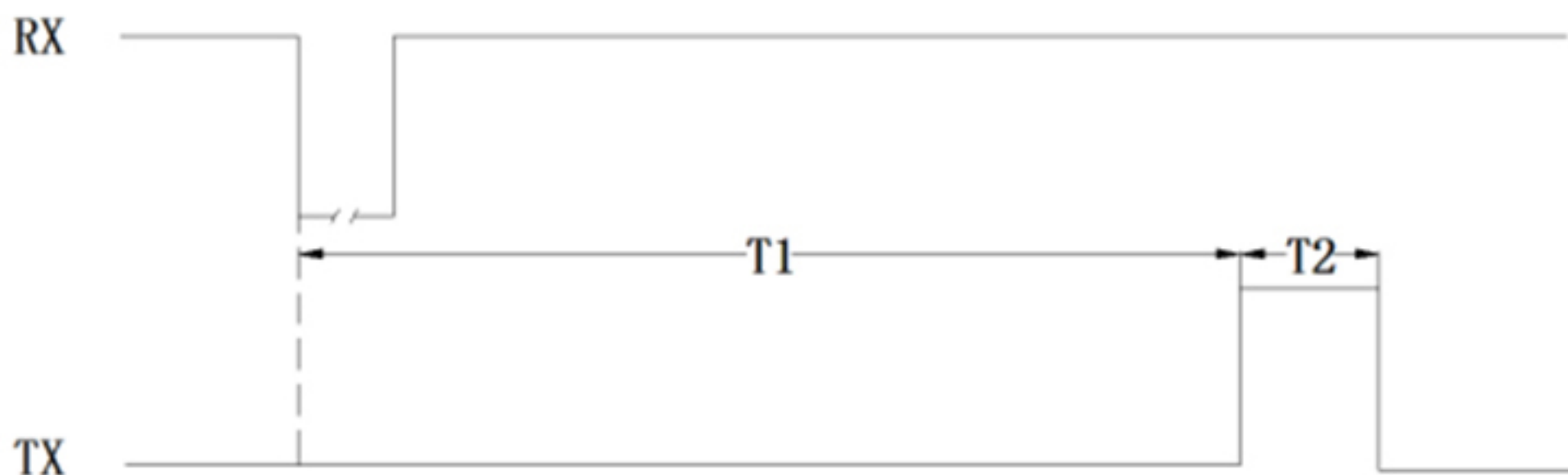
Remark: The output high-level voltage of RX TX is 3V, the max allowable input voltage is 5V.

#### (2) Instruction

When Pin(RX) receives a falling edge pulse, the module start measurement, and then converts to a high-level pulse width output through pin(TX).

The high level duration of the Pin(TX) of the module corresponds to the distance between the detection target and the module. The trigger cycle of the module must be greater than 500ms for the A13 series, and greater than 60ms for the A13B series. If the module does not detect an object, Pin(TX) will output a fixed pulse width about 25ms.

#### (3) Timing Diagram



Remark: A13Series: T1≈380ms, T2=1.4~25ms. A13BSeries: T1≈30ms, T2=1.4~25ms

#### (4) Formula

Formula:  $S = T \cdot V / 2$  (S is the distance value, T is duration time of PWM high-level pulse width, the V is sound travel speed in the air). V is directly calculated at speed of 348m/S at room temperature. The simplified formula is  $S = T / 57.5$  (unit of S in centimeters and us of time T)

For example: The duration time(T3) of PWM high-level pulse width is 10000us, the  $S = T / 57.5 = 10000 / 57.5 \approx 173.9$ (cm), means 173.9cm distance value.

## 4. Switch Output

The switch output interface is simple, the distance can be measured only by simple analog or digital circuit.

### (1) Pin Definition

Pin No.	Mark	Pin Description	Remark
③	RX	Processed value or Real time value output	
④	TX	Switch positive output	

Remark: The output high-level voltage of RX TX is 3V, the max allowable input voltage is 5V.

### (2) Instruction

Factory setting a thresholds of 1 meter as default of this module. The module performs distance measurement. When the distance value less than 1 meter, the Pin(TX) output high level, the current detected distance value is greater than 1 meter, pin(TX) output low level.

In order to improve stability, the factory defaults that when the distance value of the target is detected 3 times in a row is less than the set thresholds, it is determined that the detected target distance is less than the set thresholds. The distance value of the target detected 5 times in a row is greater than the set thresholds. It is determined that the detected target distance is greater than the set threshold value.

The Pin(TX) of the module only outputs high and low level signals without driving capability

In order to improve the stability, when pin(RX) is suspended or input high level, the module outputs processed value. The response time of A13 series is 7.5s and the reversed time is 12.5s, and the response time of A13B series is 1.5s, reversed time is 2.5s;

when pin(RX) input low level, the module outputs real-time value, the response time of A13 series is 1.5s, delay 7.5s, the response time of A13B series is 0.3s, and reversed time is 0.5s. The pin(TX) only outputs high and low level signals and has no drive capability. If there are special requirements that need to modify the threshold or other settings, Pls contact us before ordering.

### (3) Threshold value Setting

In order to allow users to flexibly adjust the threshold value, the module adds the function of modifying the threshold value through serial interface commands. Receive new threshold value of distance set through pin(RX), pin(TX) returns to the new threshold value after finished.

Interface	Data Bit	Stop Bit	Parity Bit	Baud Rate
TTL level	8	1	No	9600bps



#### (4) Threshold value format

Data Frame	Description	Byte
Start Bit	0XFF 0XFF	1byte
Data_H	High8 distance value	1byte
Data_L	Low8 distance value	1byte
SUM	Parity sum	1byte

#### (5) Example

Start Bit	Data_H	Data_L	SUM
0XFF	0X05	0XDC	0XDB

Remark: Parity sum only remain low8 value.

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

$= (0XFA + 0X05 + 0XDC) \& 0x00FF$

$= 0XDB$

$\text{Distance Value} = \text{Data\_H} * 256 + \text{Data\_L} = 0X05DC$

Convert to decimal equal to 1500

Means the setting threshold value is 1500mm

## 5. RS485 Output

### (1) Pin Definition

Pin No.	Mark	Pin Description	Remark
③	RX	RS485 A	
④	TX	RS485 B	

### (2) Adopt standard MODBUS protocol, support 0X03 and 0X06 function code

Interface	Data Bit	Stop Bit	Parity Bit	Baud Rate
RS485	8	1	No	9600bps

## Output data format

No.	Output data	Description	Remark
1	0X01	Address, default 0X01	①
2	0X03	Function Code	
3	0X02	Effective data	
4	0X07	Data high byte	
5	0XA1	Data low byte	
6	0X7B	CRC high byte	②
7	0XCC	CRC low byte	②
① Module address: The default is 0X01, the address range can be set to 0X01~0XFE, 0XFF is the broadcast address. ② CRC-16 Parity/MODBUS			

## MODBUS Register address

No.	Register Address	Description	Access	Remark
1	0X0102	Distance value, mm unit	Read only	
2	0X0103	Module address	Read-write	①
① Module address: The default is 0X01, the address range can be set to 0X01~0XFE, 0XFF is the broadcast address				

## (3) Parameter query and configuration instruction

## 1. Distance value

Code: 01 03 01 02 00 01 24 36

Description:

① If it returns: 01 03 02 07 A1 7B CC, the red bold part 07A1 is the returned distance data, 07A1



is converted to decimal 1953. the distance value is 1953mm.

- ② **Note:** The module query time must be greater than 100ms.

## 2. Check module address

Code: FF 03 01 03 00 01 60 28

Description:

- ① 0XFF is the general broadcast address, and the current module address can also be used instead.
- ② If it returns: FF 03 02 00 02 10 51, the red bold part 02 is the current module address.

## 3. Configure module address

Code:01 06 01 03 00 03 38 37

Description:

If it returns: 01 06 01 03 00 03 38 37, 01 is the module address before setting, and the red bold part 03 is the module address after setting.