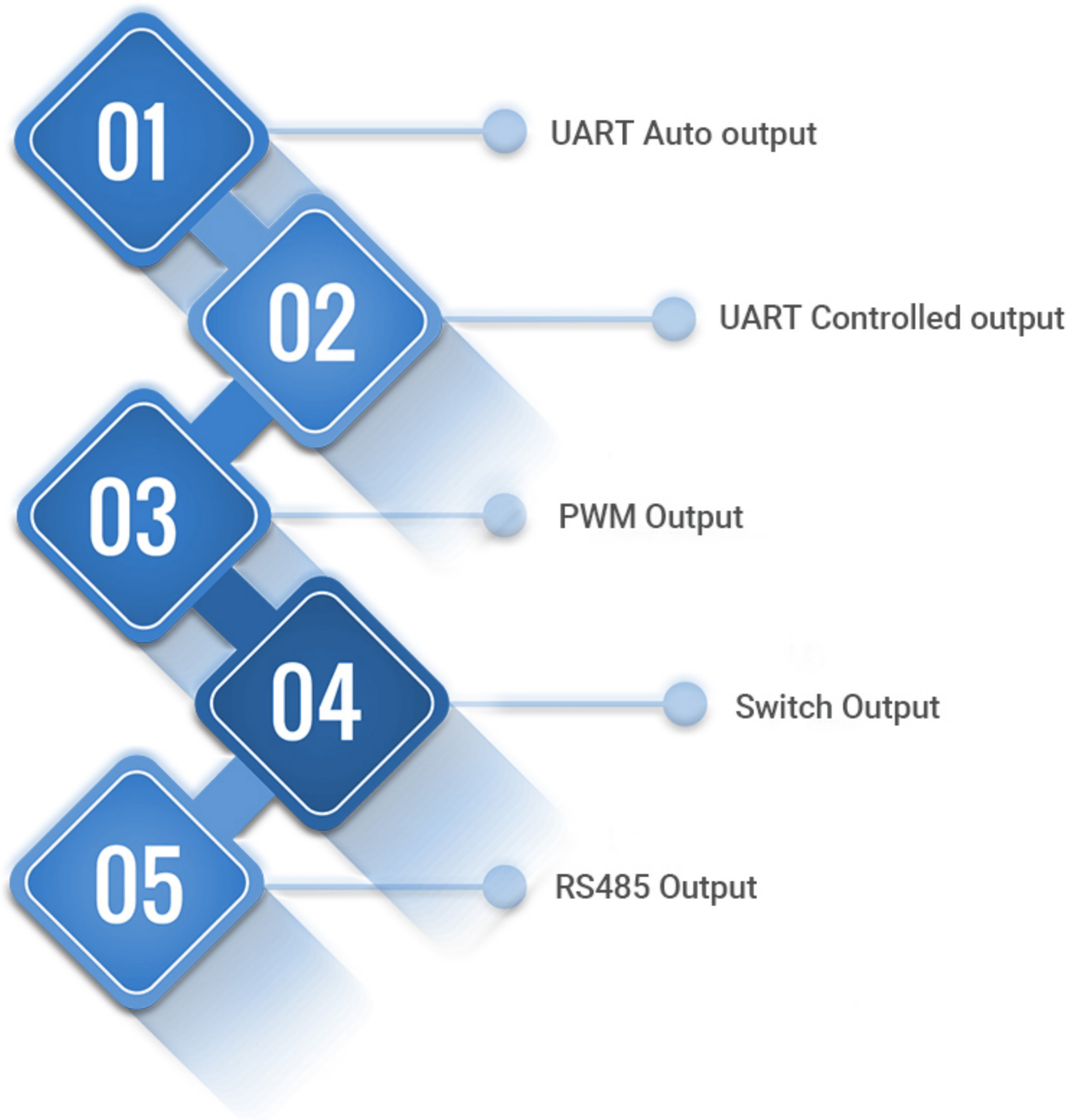


A02 Module Output Interface



1. UART Auto Output

(1) Pin definition

Pin No.	Mark	Pin description	Remark
①	VCC	Power input	
②	GND	GND	
③	RX	Processed value or Real time value output	(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

(2) Communication 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 is 100~500ms. When the pin(RX) is input low level, the module outputs real-time value. Response time of is 100ms.

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

(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.

$$\text{SUM} = (\text{start bit} + \text{Data_H} + \text{Data_L}) \& 0x00FF$$

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

$$= 0XA7$$

$$\text{Distance value} = \text{Data_H} * 256 + \text{Data_L} = 0X07A1;$$

Convert to decimal equal to 1953

Means current measurement distance value is 1953mm

2. UART Controlled Output

(1) Pin Definition

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

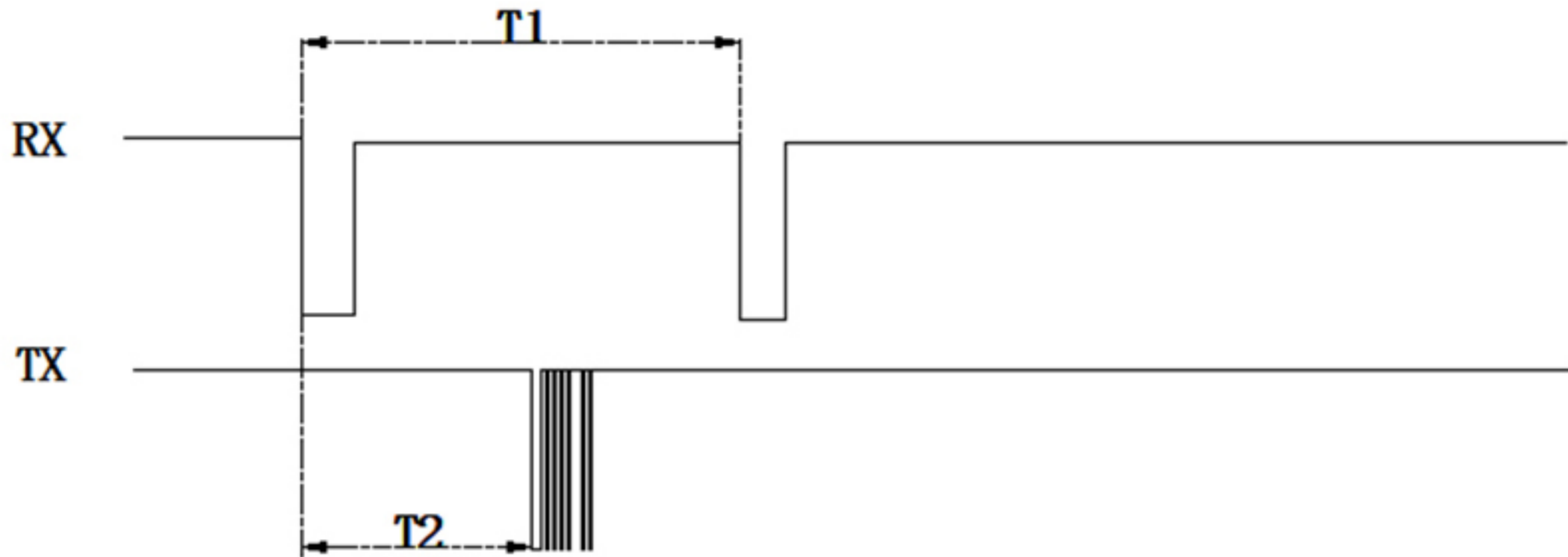
Remarks: The pin function corresponds to the output mode selected before ordering, and cannot coexist with the functions of other output modes.

(2) UART Communication instruction

The module will perform a distance detection after Pin(RX) receives a falling edge pulse or any one serial interface data. Pin(TX) will output a TTL level after detection is completed. The trigger period of the module must be greater than 70ms.

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

(3) Timing Diagram



Remark: T1 >70ms T2=45~60ms

(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.

$$\text{SUM} = (\text{start bit} + \text{Data_H} + \text{Data_L}) \& 0x00FF$$

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

$$= 0XA7$$

$$\text{Distance value} = \text{Data_H} * 256 + \text{Data_L} = 0X07A1;$$

Convert to decimal equal to 1953

Means current measurement distance value is 1953mm

3. PWM Output

(1) Pin Definition

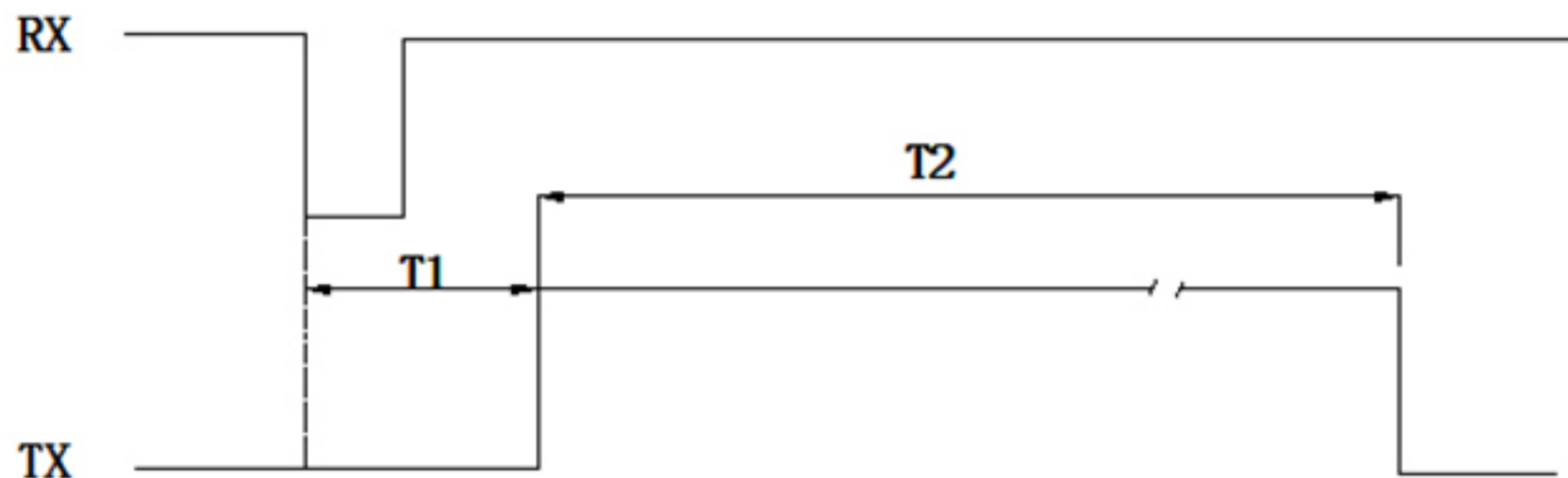
Pin No.	Mark	Pin description	Remark
①	VCC	Power input	
②	GND	GND	
③	RX	Trigger input	(1)
④	TX	PWM output	(1)

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

(2) Instruction

When pin(RX) receives a trigger falling edge pulse, the module will start detecting, Pin(TX) will output a TTL level PWM high-level pulse width signal once. The period must be greater than 70ms. If the module does not detect an object, pin(TX) will output a fixed pulse width of about 35ms.

(3) Timing Diagram



Remark: T1=10~17ms; Flat object T2=0.18~35ms(PWM High level pulse width timing)

(4) Formula

Formula: $S = T \cdot V / 2$ (S is the distance value, T is duration time of PWM high-level pulse width, V is sound travel speed in the air)

Because of internal temperature compensation, 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 T 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

(1) Pin Definition

Pin No.	Mark	Pin description	Remark
①	VCC	Power input	
②	GND	GND	
③	RX	Switch negative output	(1)
④	TX	Switch positive output	(1)

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

(2) Instruction

Factory setting a thresholds of 1.5 meter. The module performs distance measurement every 100ms. When the distance value less than threshold, the Pin(TX) output high level, Pin(RX) output low level. When the value greater than threshold, pin(TX) output low level and Pin(RX) output high 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

5. RS485 Output

(1) Pin definition

Pin No.	Mark	Pin description	Remark
①	VCC	Power input	
②	GND	GND	
③	B	RS485 Inverting input	(1)
④	A	RS485 Non-inverting input	(1)

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

(2) RS485 interface specification

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

(3) RS485 Modbus Protocol specification

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

(4) RS485 Modbus protocol format

Sensor module as slave. Customer device as master.

Master request(Read):

Name	Address	Function code 0x03	Register address	Registers qty	CRC16 Parity
(Byte) Length(Byte)	1	1	2	2	2

Slave response(Read):

Name	Address	Function code 0x03	Response byte	Data zone	CRC16 Parity
(Byte) Length(Byte)	1	1	1	N	2

Master request(write):

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

Slave response(write):

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

(5) RS485 Modbus Register

Status	Register Address	Register Function	Type of Data	Description	Remark
Read-only	0x0100	Processing value	Unsigned, 16bit	Start the distance measurement after receiving the command code, output distance value which processed by the algorithm. unit mm, response time is 500ms.	
Read-only	0x0101	Real-time value	Unsigned, 16bit	Start the distance measurement after receiving the command code, output real time value. Unit is mm, response time is about 100ms.	
Read-only	0x0102	Temperature	Unsigned, 16bit	Unit is 0.1°C, resolution is 0.5°C, response time is about 100ms	
Read-only	0x0200	Slave address	Unsigned, 16bit	Range: 0x01~0xFE, default 0x01, 0xFF is broadcast address	

Remarks: The register data is the high byte first and the low byte last.

(6) RS485 Modbus Example

Example 1: Read processing value data

Master:01 03 01 00 00 01 85 F6

Slave: 01 03 02 02 F2 38 A1

Description: The sensor address is 0x01, processing distance value is 0x02F2, converts to decimal is equal to 754mm.

Example 2: Read real time distance value

Master:01 03 01 01 00 01 D4 36

Slave:01 03 02 02 EF F8 A8

Description:The sensor address is 0x01, real time value is 0x02EF, converts to decimal is equal to 751mm.

Example: Read temperature data

Master: 01 03 01 02 00 01 24 36

Slave: 01 03 02 01 2C B8 09

Description: The sensor address is 0x01, real temperature is 0x012C, converts to decimal is equal to 30.0°C.

Example 4: Modify slave address

Master:01 06 02 00 00 05 48 71

Slave:01 06 02 00 00 05 48 71

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