A12 Module Output Interface

01 — PWM Output

02 — UART Auto output

03 — UART Controlled output

04 — Switch Output

05 — RS485 Output
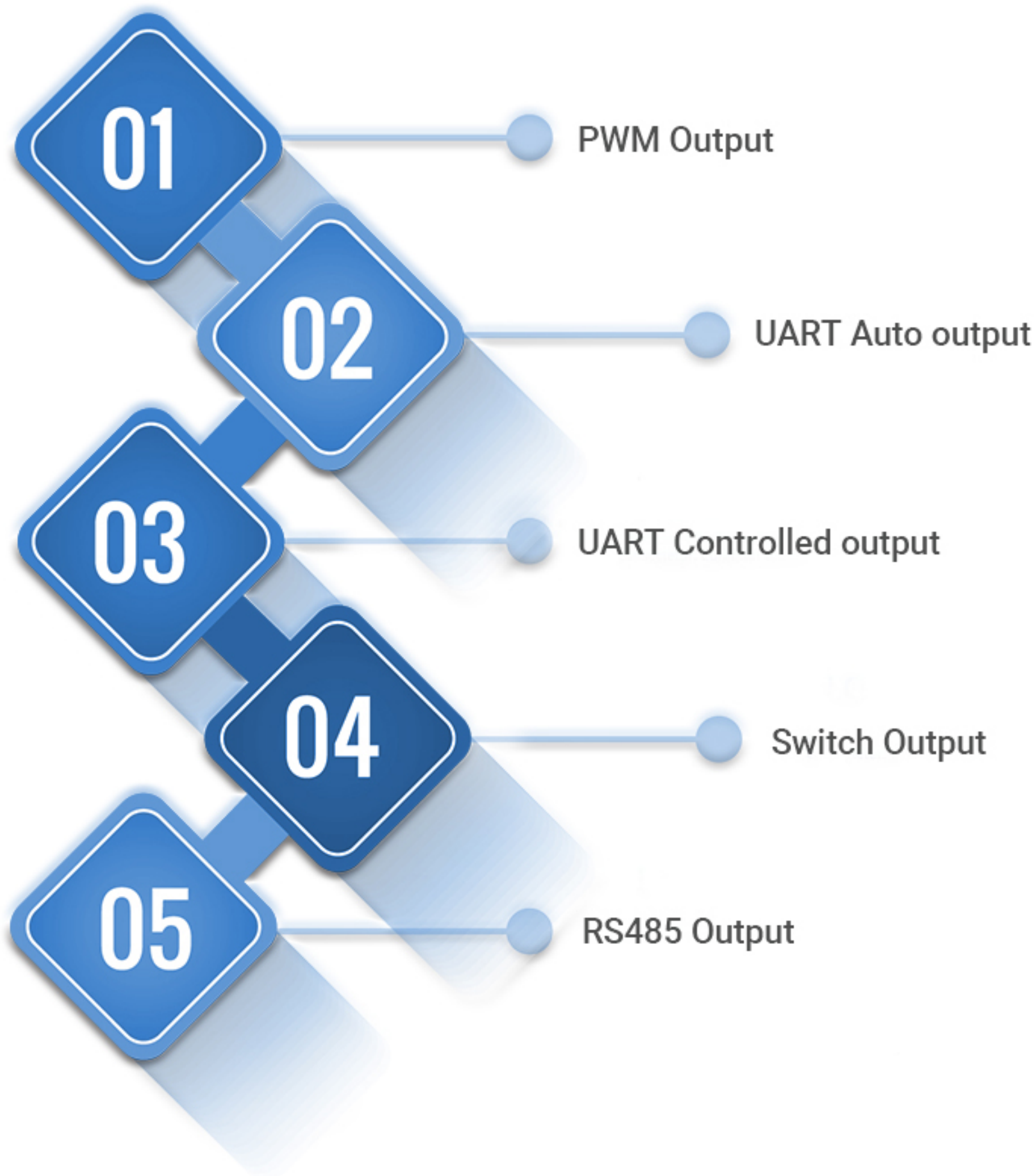
1. PWM Output

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 85ms. If the module does not detect an object, Pin(TX) will output a fixed pulse width about 32ms.

(3) Timing Diagram
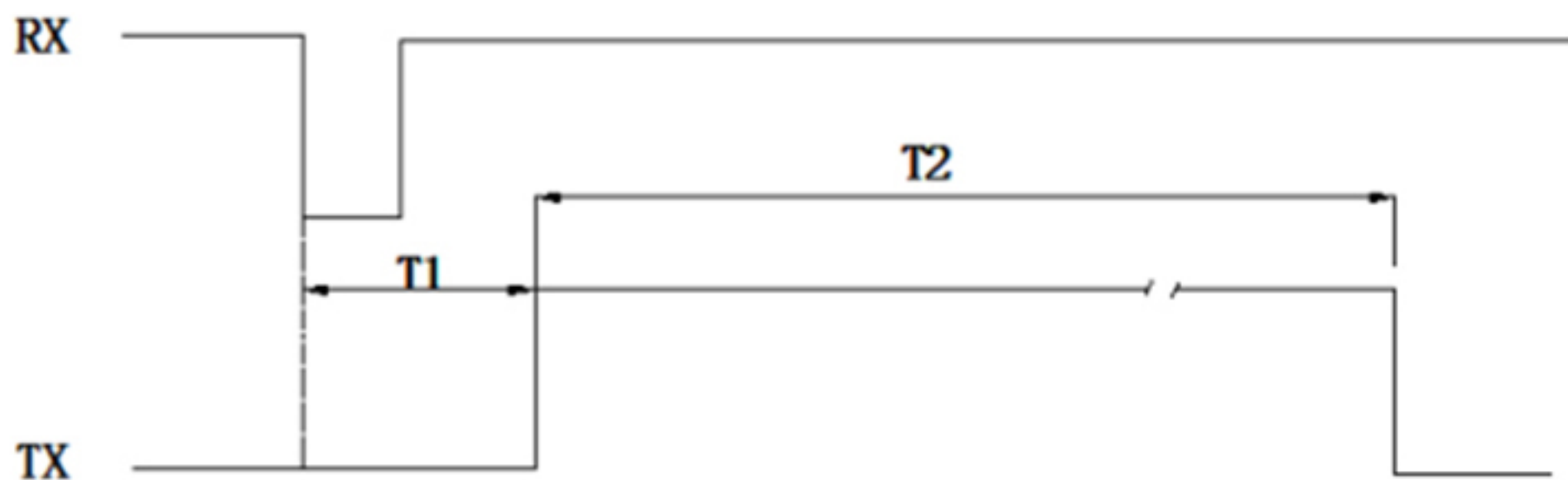
Remark: T1=12～16ms；T2=1.4～32ms(Duration of high level PWM)

(4) Formula

Formula: S=T*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≈173.9(cm), means 173.9cm distance value.

2. 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 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.

Interface	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.

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

3. 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) UART Communication 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 85ms.

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

(3) Timing Diagram
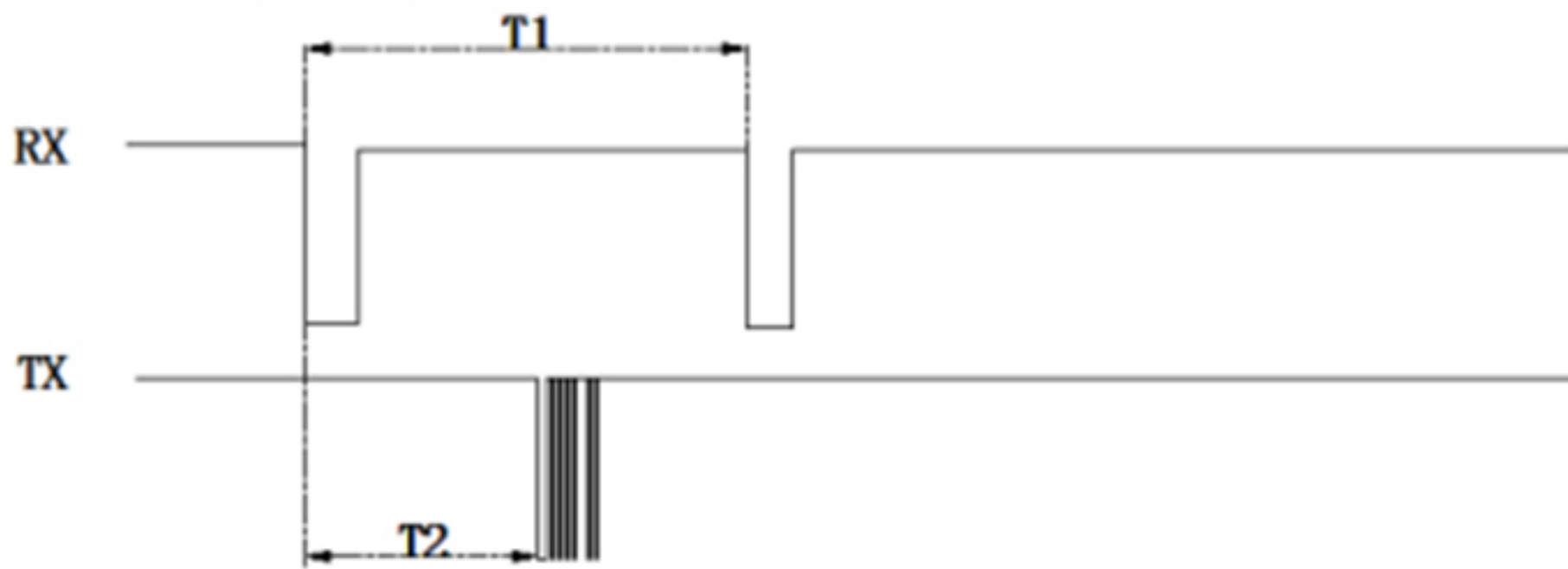
Remark:T1 ＞85ms； T2=40～45ms。

(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

Data_H	Data_L	SUM
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

4. Switch Output

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

(1) Pin Definition

Pin No.	Mark	Pin Description	Remark
③	RX	Switch negative output	
④	TX	Output/Switch 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 every 100ms. 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

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) Serial interface 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.

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

(4) Threshold value format

Sensor module as slave. Customer device as master.

Master request

Name	Start Bit	Command Code	Threshold high value	Threshold low value	Parity Sum
Length(Byte)	0XFB	0X05	1 Byte	1 Byte	1 Byte

Slave response

Name	Start Bit	Command Code	Threshold high value	Threshold low value	Status Bit	Parity Sum
Byte	0XFB	0X85	1 Byte	1 Byte	Success:0X00 Fail:0X01	1 Byte

Remark: Parity Sum=(Start Bit+Command code+Threshold high value+Threshold low value+status)&0x00FF

Master: FB 05 03 E8 EB(Parity Sum=(0XFB+0X05+0X03+0XE8)&0X00FF=0XEB)

Slave: FB 85 03 E8 00 6B

Setting successes,Switch distance is 1000mm

The threshold ranging 25-500cm

(5) Switch polarity data format

Sensor module as slave. Customer device as master.

Master request

Name	Start Bit	Command Code	Reserved	Output Polarity	Parity Sum
Byte	0XFB	0X06	0X00	High level:0X01 Low Level:0X00	1 Byte

Slave response

Name	Start Bit	Command Code	Reserved	Output Polarity	Status Bit	Parity Sum
Byte	0XFB	0X06	0X00	1 Byte	Success:0X00 Fail:0X01	1 Byte

Remark: Parity Sum=(Start Bit+command code+output polarity+status Bit)&0x00FF

Example 1:

Master:FB 06 00 01 02 （Parity Sum=(0XFB+0X06+0X00+0X01)&0X00FF=0X02）

Slave: FB 86 00 01 00 82

Setting successes, Pin(TX) output high level when module detect an object.

Example 2:

Master:FB 06 00 00 01 （Parity Sum=(0XFB+0X06+0X00+0X00)&0X00FF=0X01）

Slave:FB 86 00 00 00 81

Setting successes, Pin(TX) output low level when module detect an object.

5. RS485 Output

(1) Pin Definition

Pin No.	Mark	Pin Description	Remark
③	B	RS485-B	
④	A	RS485-A	

(2) RS485 interface specification

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

(3) Modus Protocol specification

The module supports Modbus protocol in RS485 mode, which is convenient for users to read data and set parameters

Mode	Parity	Sensor Address	Read function cod	Write function code
Modbus-RTU	CRC-16/MODBUS	Default 0x01, settable	0x03	0x06

(4) Modbus protocol format

Sensor module as slave. Customer device as master.

Master request(Read)

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

Slave response(Read)

Name	Device Address	Function code 0x03	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 zone	CRC16 Parity
Length(Byte)	1	1	2	2	2

Slave response(write)

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

(5) Modbus Register

Status	Register Address	Register Function	Type of Data	Description	Remark
Read-only	0x0100	Processing value	Unsigned 16bit	100ms Measurement start after received command, output distance value after multiple measurements filtering process. Unit mm, 500ms response time	
Read-only	0x0101	Real-time value	Unsigned 16bit	The module start measuring after received command, directly output real time value, unit mm 100ms response time.	
Read-only	0x0102	Temperature	Unsigned	Unit is 0.1℃, 100ms response time	

Read-write	0x0200	Slaver address	Unsigned 16bit	Range:0x00~0xFE, default 0x01, 0xFF as the broadcast address	

Note.:

Register data is high byte first and low byte last.

(6) Example

Example 1: Read processed value data

        Master:01 03 01 00 00 01 85 F6

        Slave=:01 03 02 02 F2 38 A1

        Instruction: Sensor address is 0x01, process distance value is 0x02F2, convert to decimal is 754mm.

Example 2: Read real time value data

        Master：01 03 01 01 00 01 D4 36

        Slave=：01 03 02 02 EF F8 A8

        Instruction： Sensor address is0x01， real time distance value is 0x02EF,convert to decimal is 751mm