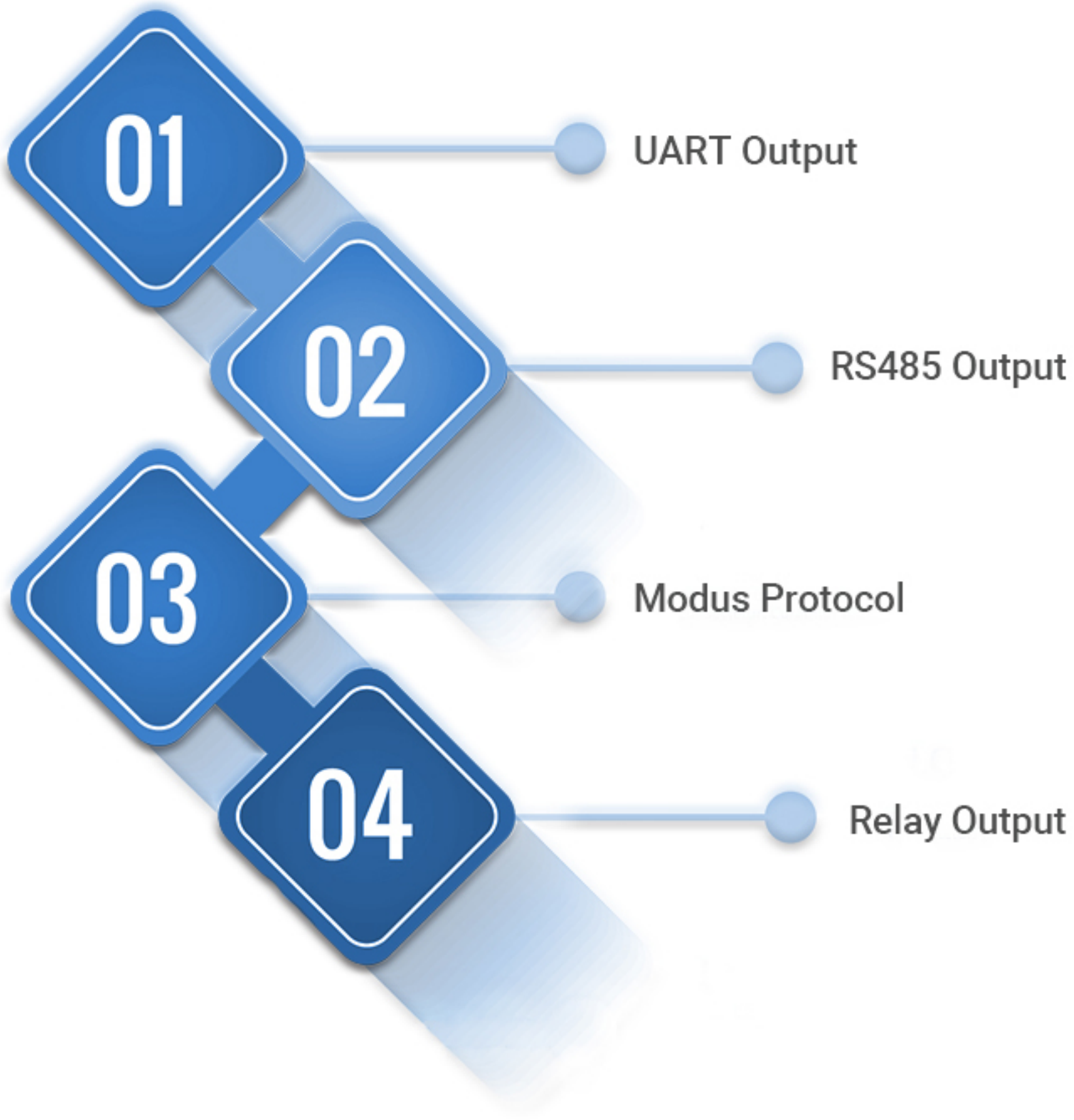
A05 Module Output Interface



1. UART Output

(1) UART instruction

Default output of the module is UART automatic output mode, which supports Modbus protocol controlled output at the same time. After receiving the Modbus command, it will switch to the controlled mode. For the communication format, please refer to the following description.

Under UART automatic output mode, the level of the RX input pin will be read and recorded within one second of power-on. When the RX pin is floating or input high level, the module will output according to the processed value, and the data will be more stable , The response time is 300～1500ms. When the RX pin input low level is recorded, the module outputs according to the real-time value, and the response time is about 300ms. (When using real-time value output, it is recommended to connect the RX input pin to low level before supplying power to the module)

UART	Data Bit	Stop Bit	Parity Bit	Baud Rate
TTL Level	8	1		9600bps

(2) UART output format

Frame data	Description	Byte
Start Bit	0XFF	One Byte
Data_1H	High 8 bit distance value of No.1 probe	One Byte
Data_1L	Low 8 bit distance value of No.1 probe	One Byte
Data_2H	High 8 bit distance value of No.2 probe	One Byte
Data_2L	Low 8 bit distance value of No.2 probe	One Byte
Data_3H	High 8 bit distance value of No.3 probe	One Byte
Data_3L	Low 8 bit distance value of No.3 probe	One Byte
Data_4H	High 8 bit distance value of No.4 probe	One Byte
Data_4L	Low 8 bit distance value of No.4 probe	One Byte
SUM	Parity Sum	One Byte

(3) Example

0XFF	Data_1H	Data_1L	Data_2H	Data_2L	Data_3H	Data_3L	Data_4H	Data_4L	SUM
	0X03	0XE8	0X07	0XD0	0X07	0XA1	0X0D	0XEA	0X60

Remark: Parity sum only remain low8 value.

SUM =(Start Bit+ Data_1H+ Data_1L+ Data_2H+ Data_2L+ Data_3H+ Data_3L+ Data_4H+ Data_4L)&0x00FF

=(0XFF + 0X03 + 0XE8 + 0X07 + 0XD0 + 0X07 + 0XA1 + 0X0D + 0XEA)&0x00FF

=0X60

Distance value of No1. Probe=Data_1H*256+ Data_1L=0X03E8

Converts to decimal is equal to 1000, means current measurement distance value is mm.

Distance value of No.2 Probe=Data_2H*256+ Data_2L=0X07D0

Converts to decimal is equal to 2000, means current measurement distance value is mm.

Distance value of No.3 Probe= Data_3H*256+ Data_3L=0X07A1

Converts to decimal is equal to 1953, means current measurement distance value is mm.

Distance value of No.4 Probe= Data_4H*256+ Data_4L=0X0DEA

Converts to decimal is equal to 3562, means current measurement distance value is mm.

2. RS485 Output

(1) Communication spec

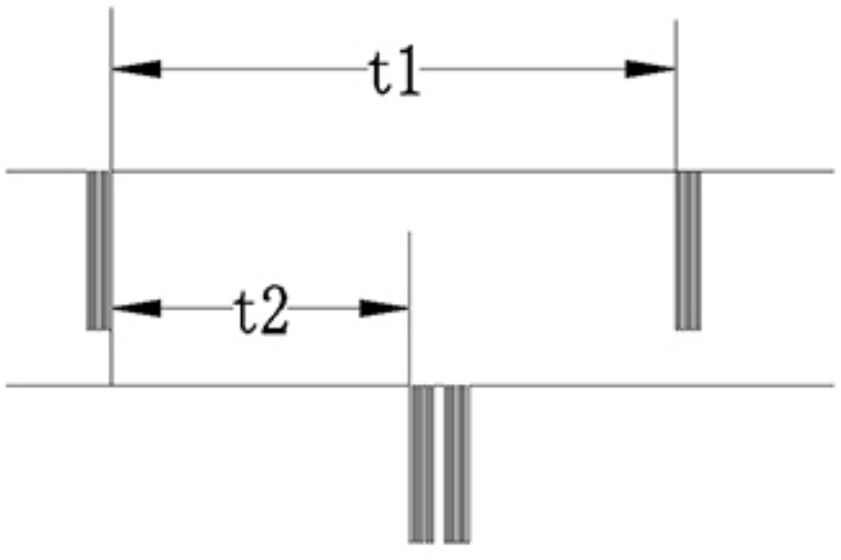
	Type of interface	Start Bit	Data Bit	Stop bit	Parity	Baud Rate
RS485 interface	Half Duplex	1	8	1	NO	9600bps

(2) Scope of application

This product can communicate with any host device with RS485 communication interface supporting DYP protocol. This interface supports Modbus protocol at the same time, and the communication format is described later.

(3) DYP Protocol

1. Timing Diagram



Remark: Control command code is 0X01, t1≥250ms t2=200~210ms

When the command code is 0X10~0X13, t1≥100ms t2=65 ~75ms

2. Command code, Frame format

Control behavior	Command code	Remark
Perform measurement of all probes	0X01	Send command cycle required≥250ms
Perform measurement of No. 1 probe	0X10	Send command cycle required≥100ms
Perform measurement of No. 2 probe	0X11	
Perform measurement of No. 3 probe	0X12	
Perform measurement of No. 4 probe	0X13	
Modify sensor address	0X03	
Broadcast address	0XFF	

Frame data	Description	Byte
Start Bit	0X55	1 Byte
Start Bit	0XAA	1 Byte
Address	Range:0X01~0XFE, default is 0X01	1 Byte
Control Bit	Command code	1 Byte

Data_1H	High 8 bit distance value of No.1 probe	1 Byte
Data_1L	Low 8 bit distance value of No.1 probe	1 Byte
Data_2H	High 8 bit distance value of No.2 probe	1 Byte
Data_2L	Low 8 bit distance value of No.2 probe	1 Byte
Data_3H	High 8 bit distance value of No.3 probe	1 Byte
Data_3L	Low 8 bit distance value of No.3 probe	1 Byte
Data_4H	High 8 bit distance value of No.4 probe	1 Byte
Data_4L	Low 8 bit distance value of No.4 probe	1 Byte
SUM	Parity Sum	1 Byte

3. All probes perform distance measurement

Command Code: 0X01

	Start Bit		Address	Command code	Data	
Master request	0X55	0XAA	0X01	0X01	N/A	N/A
Slave response	0X55	0XAA	0X01	0X01	Data_1H	Data_1H

	Data						Parity Sum
Master Request	N/A	N/A	N/A	N/A	N/A	N/A	Checksum
Slave response	Data_2H	Data_2H	Data_3H	Data_3L	Data_4H	Data_4L	Checksum

Example:

Module address 0X01, the master request

0X55 0XAA 0X01 0X01 checksum

Checksum=(Start Bit+address+command code)&0x00ff

=(0x55+0xaa+0x01+0x01) &0x00ff

=0x01

The return command of the ultrasonic module is

0X55 0XAA 0X01 0X01 0X03 0XE8 0X07 0XD0 0X07 0XA1 0X0D 0XEA checksum

Checksum=(Start Bit+address+command code+data)&0X00FF

=(0X55 + 0XAA + 0X01+ 0X01 + 0X03 + 0XE8 + 0X07 + 0XD0 + 0X07 + 0XA1 + 0X0D + 0XEA)&0X00FF

=0X60

Distance value of No1. Probe=Data_1H*256+ Data_1L=0X03E8

Converts to decimal is equal to 1000, means current measured distance value is 1000mm.

Distance value of No2. Probe=Data_2H*256+ Data_2L=0X07D0

Converts to decimal is equal to 2000, means current measured distance value is 2000mm.

Distance value of No3. Probe=Data_3H*256+ Data_3L=0X07A1

Converts to decimal is equal to 1953, means current measured distance value is 1953mm.

Distance value of No4. Probe= Data_4H*256+ Data_4L=0X0DEA

Converts to decimal is equal to 3562, means current measured distance value is 3562 mm.

4. Single probe perform distance measurement

Command code: 0X10～0X13

	Start bit		Address	Command	Data		Parity Sum
Master Request	0X55	0XAA	0X01	0X10	N/A	N/A	Checksum
Slave response	0X55	0XAA	0X01	0X10	Data_H	Data_L	Checksum

Example:

The ultrasonic module address is 0X01, master request

0X55 0XAA 0X01 0X10 checksum

Checksum=(Start Bit+address+command code)&0X00FF

=(0X55+0XAA+0X01+0X10) &0X00FF

=0X10

The return command of the ultrasonic module is

0X55 0XAA 0X01 0X10 0X07 0XA1 checksum

Checksum=(start bit+address+command code+data)&0X00FF

=(0X55+0XAA+0X01+0X10+0X07+0XA1) &0X00FF

=0XB8

Distance value of No.1 probe= Data_H*256+ Data_L=0X07A1

Coverts to decimal is equal to 1953, means current measured distance value is 1953mm.

5. Modify Address

Command Code: 0X03 (ADD:Address to be changed)

	Start bit		Address	Command	Data		Parity Sum
	0X55	0XAA	ADD	0X10	N/A	N/A	Checksum
Slave response	0X55	0XAA	ADD	0X10	Data_H	Data_L	Checksum

Example:

The default address of ultrasonic module is 0X01, if want change to 0X05, the master send

0X55 0XAA 0X05 0X03 checksum

Checksum=(Start bit+address+command code+data)&0X00FF

=(0X55+0XAA+0X05+0X03) &0X00FF

=0X07

The return command of the ultrasonic module is

0X55 0XAA 0X05 0X03 checksum

Checksum=(Start bit+user address+command code+data)&0X00FF

=(0X55+0XAA+0X05+0X03) &0X00FF

=0X07

3. Modbus Protocol

This protocol function is valid when the module is UART or RS485 output.

(1) Modbus protocol specification

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

(2) 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

(3) Modbus Register

Status	Register Address	Register Function	Type of Data	Description	Remark
Read-only	0x0106, 0x0010	No.1 probe distance value	Unsigned, 16bit	No.1 probe perform a measurement after received command code, output real time value, m m unit, response time about 100ms	Support read multiple probes value

Read-only	0x0107, 0x0011	No.2 probe distance value	Unsigned, 16bit	No.2 probe perform a measurement after received command code, output real time value, m m unit, response time about 100ms	Support read multiple probes value
Read-only	0x0108, 0x0012	No.3 probe distance value	Unsigned, 16bit	No.3 probe perform a measurement after received command code, output real time value, m m unit, response time about 100ms	Support read multiple probes value
Read-only	0x0109, 0x0013	No.3 probe distance value	Unsigned, 16bit	No.4 probe perform a measurement after received command code, output real time value, m m unit, response time about 100ms	
Read-write	0x0200	Slave address	Unsigned, 16bit	Range:0x00~0xFE, default 0x01, 0xFF as the broadcast address	

Remark:

(1) Registers 0x0106～0x0108 support continuous backward reading of multiple probe data, but only up to 0x0109; at this time, longer response time will be required. For example, if 3 data are read to 0x0106, the measurement values of probe 1, probe 2 and probe 3 will be returned.

(2) Registers 0x0010～0x0013 have the same function as 0x0106～0x0108.

(4) Example

1. Read

Example 1:Read measured distance value of No.1 probe

Master：01 03 01 06 00 01 65 F7

Slave：01 03 02 01 3C B9 C5

Description: The sensor address is 0x01, Real time distance value of No.1 probe is 0x013C=316mm

Example 2:Read measured distance value of No.2 probe

Master：01 03 01 07 00 01 34 37

Slave：01 03 02 09 1B FE 1F

Description: The sensor address is 0x01, Real time distance value of No.2 probe is 0x091B=2331mm

Example 3:Read measured distance value of No. 2 No.3 No.4 probes

Master：01 03 01 07 00 03 B5 F6

Slave：01 03 06 00 FA 02 93 09 7A 8F 47

Description: The sensor address is 0x01, Real time value of No.2 probe is 0x00FA=250mm, No.3 is 0x0293=659mm, No.4 is 0x097A=2426mm

2. Write

Example 1: 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 changed from 0x01 to 0x05.

4. Relay output

(1) Replay Description

When measuring the distance of an object, if current four probes have one probe or more than one probe which detection distance value is less than set threshold, then the relay is closed, the normally closed end and the common end are not conducting, the normally open end and the common end. In order to improve stability, the factory default relay pull-in and cut-off time will be maintained for 1 second.

(2) Threshold value setting

Step 1: First evaluate the threshold distance value that needs to be set, and place the sensing flat object or baffle at the position of the sensing threshold distance value.

Example: To set the threshold distance value to 3 meters, place a flat baffle at 3 meters. The baffle is flat, and the environment is wide enough to ensure accuracy.

Step 2: Align the No. 4 probe of the module with a flat object or baffle, press and hold the button (more than 3 seconds), when the LED is on, it indicates that the setting is successful, you can release the button, and the module will reset the current measurement The distance value is saved as the threshold distance. If the LED is flashing quickly, it means that the setting has failed and the module threshold will not change.

If you need to reset, repeat the above steps.

Note: 1. Factory default threshold is 100cm, and the threshold setting range is 25~450cm.

2. When the 4# interface is not connected with a probe or the probe cannot measure an object, the setting will fail.

3. This function is only valid when the module is a relay output.