

**Four wire ultrasonic level gauge**

**MODBUS communication protocol**

## RS485 communication protocol

Using MODBUS RTU protocol and half duplex master-slave response mode for communication.

When the host sends a request data frame, it is recommended to have an interval of at least 1 second between two data frames.

### 1. Communication parameters

Transfer rate	9600
Start bit length	1 bit
Data bit length	8 bit
Stop bit length	1 bit
Parity check	no
Error verification method	CRC-16 cyclic redundancy check (check polynomial 0xA001)

### 2. Function code 0x03 (Read register) Data frame

Function instruction 3 can read data from a single register or read data from multiple registers consecutively.

Host Request							
Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Slave address	Function code	Start register address high byte	Start register address low byte	Read register amounts high byte	Read register amounts low byte	CRC check low byte	CRC check high byte

Slave Response					
Byte 1	Byte 2	Byte 3	Byte 4- Byte 4+N-1	Byte N+4	Byte N+5
Slave address	Function code	Register data bytes total amounts (N)	N data bytes (high order first)	CRC check low byte	CRC check high byte

### 3. Register definition

Attribute	Address	Register length	Explanation
R	0000H	2 byte	Liquid level value H
R	0001H	2 byte	Measuring distance L
R	0002H	2 byte	Installation height

R	0003H	2 byte	Temperature value
R	0004H	2 byte	Relay status
R	0005H	2 byte	Blind area
R	0006H	2 byte	High high limit (AHH) control value
R	0007H	2 byte	High high limit (AHH) return difference
R	0008H	2 byte	High limit (AH) control value
R	0009H	2 byte	High limit (AH) return difference
R	000AH	2 byte	Low limit (AL) control value
R	000BH	2 byte	Low limit (AL) return difference
R	000CH	2 byte	Low low limit (ALL) control value
R	000DH	2 byte	Low low limit (ALL) return difference
R	000EH	2 byte	4mA corresponding value
R	000FH	2 byte	20mA corresponding value

**NOTES:**

1. All data are stored in integer form, for example, if the current level value is 2.098 meters, then the data in register 0002H is the integer 2098. if the temperature value is 20.0°C, then the data in register 0005H is the integer 200.

2. The lower 4 bits of the status register correspond to the status of the relay, BIT3 corresponds to AHH, BIT2 corresponds to AH, BIT1 corresponds to AL, and BIT0 corresponds to ALL. 1 means closed and 0 means disconnected. If the value of register 0004H is 000AH, it means that AHH and AL relays are closed and AH and ALL relays are open.

3. Error reply data frame

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Slave address	0X80+ function code	0x01 (illicit function) 0x02 (illicit data address) 0x03 (illicit data)	CRC16 (L)	CRC16 (H)

No answer for mismatched addresses, wrong CRC check sums. If a full frame of data is not received after the timeout, the previously received bytes will be ignored.

Example: Read the current level value of the slave (address 01).

The address of the register where the level value is stored is 0000H.

Host sends:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Slave address	Function code	Start register address high byte	Start register address low byte	Read register amounts high byte	Read register amounts low byte	CRC check low byte	CRC check high byte
0x01	0x03	0x00	0x00	0x00	0x01	0x84	0x0A

Slave responses:

Assuming a level value of 1.400 meters for the #01 slave, the slave replies:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte7
Slave address	Function code	Data bytes amounts	Register high byte	Register low byte	CRC check low byte	CRC check high byte
0x01	0x03	0x02	0x05	0x78	0xBB	0x36

Liquid level value =  $(0x05 \ll 8 + 0x78) = 1400$ , that is 1.400m