![ideabytes IoT logo]

# IBI-A-TH485
# RS485 Temperature and humidity Sensor
# User Manual v1.2



- Stainless steel strainer
- Quality probe
- Wiring
- Mounting holes
- Standard one meter lead
- Waterproof terminal

![ideabytes IoT logo]
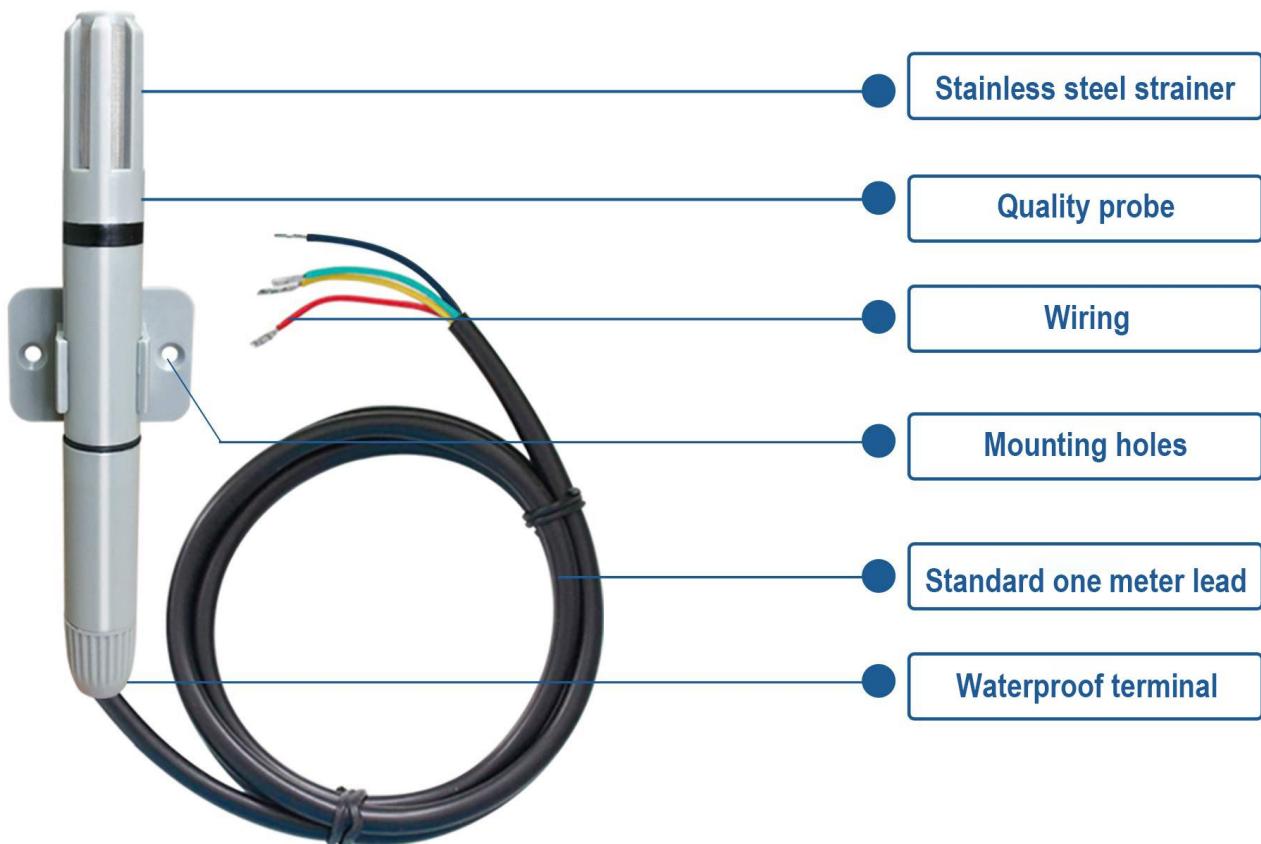
# 1 Overview

The IBI-TH485 temperature and humidity sensor is designed based on the RS-485 communication interface, compatible with the standard Modbus-RTU protocol, and can be connected to the Modbus network to achieve temperature and humidity measurement and monitoring.

The IBI-TH485 sensitive element uses SHT30, a newly designed CMOSens chip, an improved capacitive humidity sensor element and a standard energy gap temperature sensor element. Its performance has been greatly improved or even exceeds the previous generation of sensors (SHT1x and SHT7x). ) Reliability level to make its performance in high humidity environments more stable.

IBI-TH485 adopts the DIP switch to set the address, which avoids the need to set the address with the upper computer in advance. It is simple and convenient to maintain and replace.

IBI-TH485 has excellent long-term stability, low latency, low power consumption, strong resistance to chemical pollution and excellent repeatability. It is used for accurate temperature and humidity relative measurement in HVAC, communication equipment rooms, warehouse buildings, and automatic control applications. The ideal solution for humidity.

# 2 Features

■ Low power consumption
■ Fully calibrated
■ High precision and good consistency
■ Long-term stability, low drift
■ Humidity full range temperature compensation
■ Standard Modbus-RTU protocol
■ Strong interface defense capability and stable communication

# 3 Application areas

Generally used in indoor clean environment, such as：
■ HVAC
■ Building automation
■ Laboratory, hospital, library
■ Storage and production facilities in the pharmaceutical, paper, food and electronics industries

# 4 Technical Data

## 4.1 Power supply

| Supply voltage | DC 5～24V |
|---|---|
| Current | 5mA |

## 4.2 RS-485 interface

| Transmission rate | Optional 4800bps / 9600bps / 19200bps |
|---|---|

## 4.3 Transmission distance

The standard maximum transmission distance is about 1200 meters depending on the use environment, transmission material and transmission rate

| Number of theoretical nodes | 32 |
|---|---|

## 4.4 Temperature parameter

| Sensing element | SHT30 |
|---|---|
| Measuring range | -30～70℃ |
| Resolution | 0.1℃ |
| Measurement accuracy | ±0.3℃(0~60℃); ±0.5°C for other range |

## 4.5 Humidity parameters

| Sensing element | SHT3X |
|---|---|
| Working range | 5～95%RH |
| Resolution | 0.1%RH |
| Measurement Accuracy | ±2%(10%~90%RH); ±5% for other range |
| Hysteresis | ＜±0.8%RH |
| Response time | About 8s (from 33%RH to 75%RH, in flowing air) |
| Long-term stability | ＜±0.25%RH/year (under no pollution） |

## 4.6 Environmental conditions

| working environment | -30～70℃/ 5～95%RH(Non-condensing） |
|---|---|
| Storage environment | -30～70℃/ 5～95%RH(Non-condensing） |

## 4.7 Lead description

| Lead | Label | Function description |
|---|---|---|
| Green | B- | RS485 interface B- |
| Yellow | A+ | RS485interface A+ |
| Black | GND | Public ground (connect to the negative end of the power supply when DC power is supplied) |
| Red | V+ | Power supply positive (connect to the positive end of the power supply when DC power is supplied) |

## 4.8 Schematic diagram of connection with PC
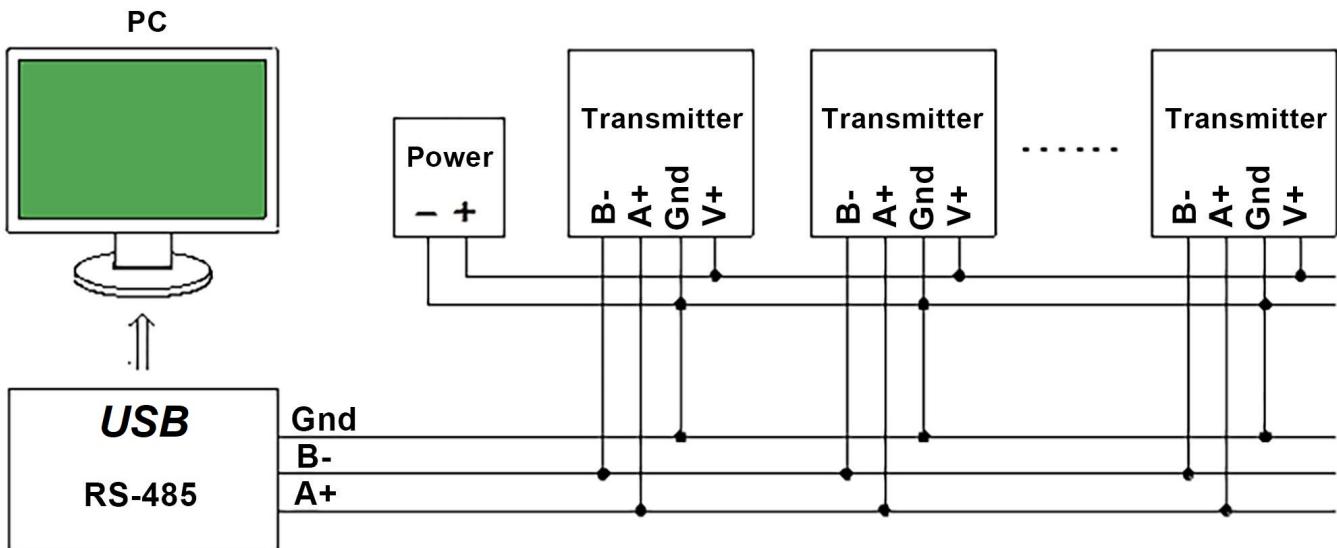
Note:

When setting up a RS485 network, pay attention to the RS485 grounding treatment to eliminate the common mode voltage. Suggest to connect the common ground of each sensor together, and then connect it to the ground wire of the RS-485 transceiver.

To connect, you can use the shielding layer of the shielded wire as the ground wire.

# 5 DIP switch and address code



**Dialing Diagram:**

Note: The above picture is a schematic diagram of the DIP switch. The DIP switch has 8 DIP positions. The corresponding numbers from 1 to 8 are 128, 64, 32, 16, 8, 4, 2, 1, and these values are added together as the address code. As shown in the figure above, bits 1, 3, and 4 are in the ON position, so the address code is 128+32+16=176, that is, the address code is 176
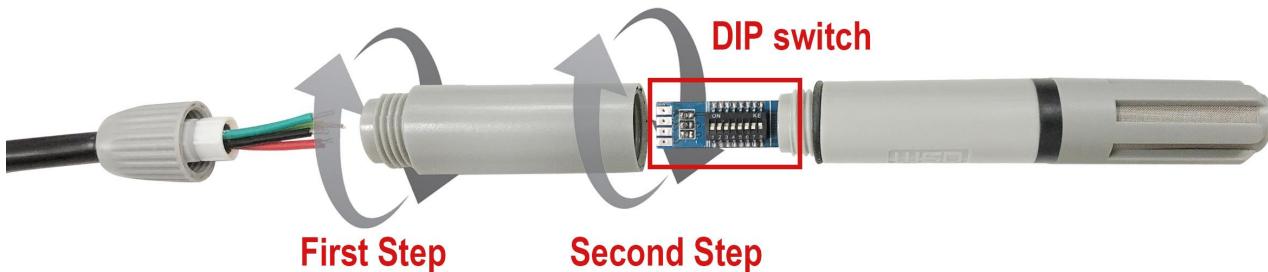


The above figure is a schematic diagram of the correct steps to open the DIP switch, please follow the above steps to open the DIP switch to set the address

Note:
You can specify when ordering, we will preset it for you.

# 6 Protocol

For the Modbus-RTU protocol, please refer to the relevant information, here it is only a brief introduction of device.

## 6.1 Data frame format

| Start bit | Data bit | Parity bit | Stop bit |
|-----------|----------|------------|----------|
| 1 | 8 | 0 | 1 |

Note:
The above is the default format of the sensor. If you need other formats, please specify when ordering.

## 6.2 RTU message frame format

IBI-TH485 follows the RTU information frame protocol. In order to ensure the integrity of the information

frame, a pause time of 3.5 characters or more is required at the beginning and end of each information frame (T1-T2-T3-T4, this time can be based on the wave Calculated by special rate), each byte of the information frame needs to be transmitted continuously. If there is a pause time greater than 1.5 characters, the sensor will treat it as invalid information and will not respond.

## 6.3 Information frame format

| Start | address | function code | Data area | CRC check | end |
|-------|---------|---------------|-----------|-----------|-----|
| T1-T2-T3-T4 | 1byte | 1byte | N byte | 2byte | T1-T2-T3-T4 |

## 6.4 Register definition

| Register Address | Meaning | Description | Read and write |
|------------------|---------|-------------|----------------|
| 0 | Temperature | The unit is 0.1 degree, MSB First, complement format, 7FFF H means the sensor is abnormal | Read only |
| 1 | Relative humidity | The unit is 0.1%, MSB First,complement format, 7FFF H means the sensor is abnormal | Read only |
| 2 | Reserved 1 | | Read only |
| 3 | Reserved 2 | | Read only |
| 4 | Address code | Set by DIP switch | Read only |
| 5 | Baud rate | Support 4800、9600、19200 | Can read and write |
| 6 | Hardware version | | Read only |
| 7 | Software version | | Read only |

## 6.5 Address setting

You can specify when ordering, we will preset it for you, or you can modify it by yourself through the dial switch

## 6.6 Baud rate setting

You can specify when ordering, we will preset it for you, or you can modify it by yourself through the serial port assistant.
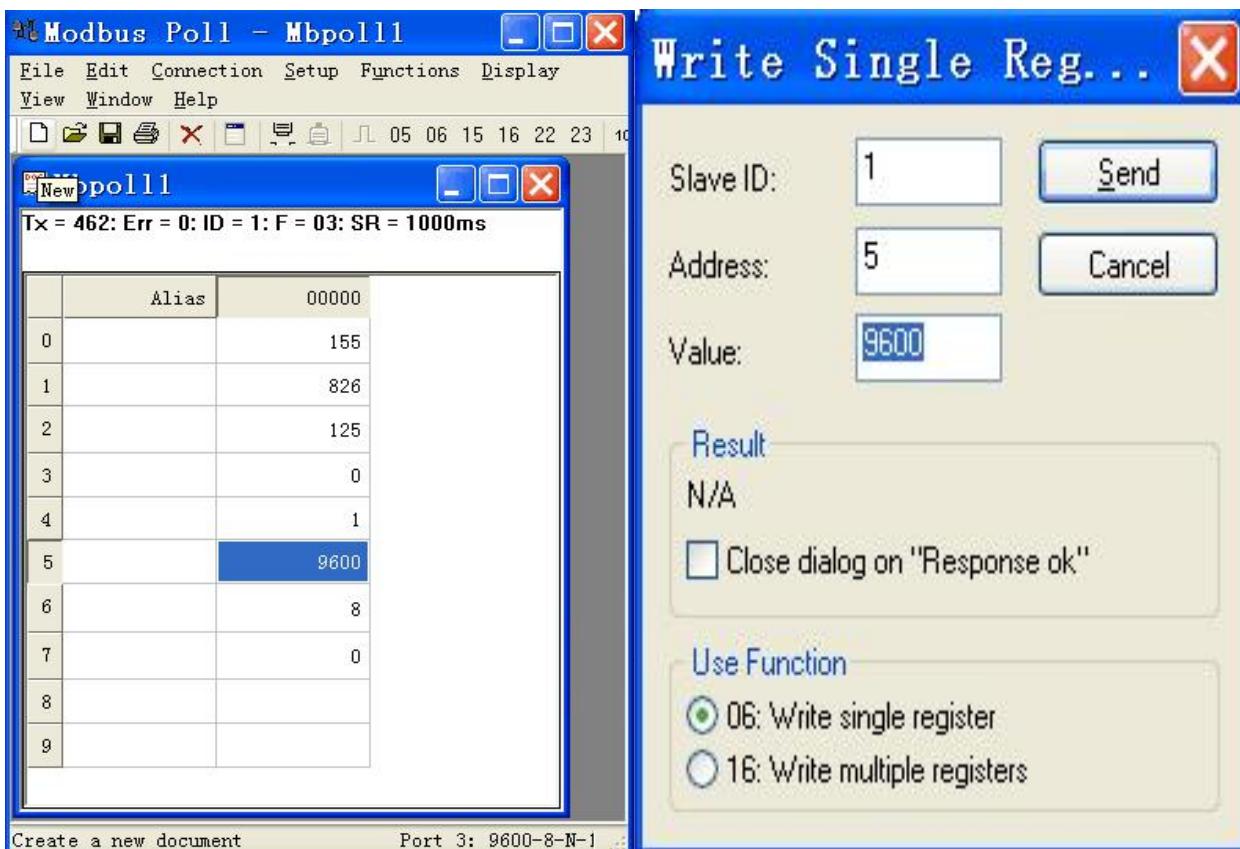
## 6.7 Host reads sensor information (function code 03)

The sensor allows the host to use the function code 03 to read the temperature and humidity measurement value of the sensor and other information. The information frame format of the 03 code is as follows：

**Host request information frame**

| Field Description | Example |
|---|---|
| Slave address | 01 |
| Function code | 03 |
| Register address high byte | 00 |
| Register address low byte | 00 |
| High byte of query quantity | 00 |
| Low byte of query quantity | 08 |
| CRC check code low byte | 44 |
| CRC check code high byte | 0C |

**Sensor response information frame**

| Field Description | Example |
|---|---|
| Slave address | 01 |
| Function code | 03 |
| Return the number of bytes | 10 |
| Temperature data high byte | 00 |
| Temperature data low byte | FA |
| Humidity data high byte | 02 |
| Low byte of humidity data | 58 |
| 1 high byte reserved | 00 |
| 1 low byte reserved | 00 |
| 2 high byte reserved | 00 |
| 2 low byte reserved | 00 |
| Address code high byte | 00 |
| Address code low byte | 01 |
| Baud rate high byte | 25 |

| Baud rate low byte | 80 |
|---|---|
| Hardware version high byte | 06 |
| Hardware version low byte | 00 |
| Software version high byte | 00 |
| Software version low byte | 0A |
| CRC check code low byte | D4 |
| CRC check code high byte | 64 |

## Data analysis

Temperature = 00FAH = 250 / 10 = 25.0℃；

Humidity = 0258H = 600 / 10 = 60.0%RH；

Reserved 1 = 0000H;

Reserved 2 = 0000H;

Address code = 0001H = 1;

Baud rate = 2580H = 9600;

Hardware version = 0600H;

Software version = 000AH = 10 = V1.0;

Note! If users only want to read the temperature and humidity or other registers, they only need to read the corresponding registers.

## 6.8 Host setting sensor information (function code 06)

This machine can currently set the baud rate (register address is 0005H), and the message frame format is as follows:

### Host request information frame

| Field description | Example |
|---|---|
| Slave address | 01 |
| Function code | 06 |
| Register address high byte | 00 |
| Register address low byte | 05 |
| Set value high byte | 25 |
| Set value low byte | 80 |
| CRC check code low byte | 82 |
| CRC check code high byte | FB |

### Sensor response information frame

| Field description | Example |
|---|---|
| Slave address | 01 |
| Function code | 06 |
| Register address high byte | 00 |
| Register address low byte | 05 |
| Set value high byte | 25 |
| Set value low byte | 80 |
| CRC check code low byte | 82 |
| CRC check code high byte | FB |

## Data analysis: Set the baud rate to 9600

## 6.9 Abnormal response

When the host sends request information to the sensor, various errors may occur. At this time, the sensor sets the highest position of the function code to 1, and then returns an error code. The host can determine whether an error has occurred by detecting whether the highest bit of the function code is 1.

## Return format

| Slave address | Function code | error code | CRC check |
|:---:|:---:|:---:|:---:|
| 1 byte | 1 byte | 1 byte | 2 byte |

## Error code

01：Illegal function code
02：Illegal data address
03:  Illegal data value

## 6.10 CRC check code

RTU mode uses CRC-16 check, the check code occupies 2 bytes, if the check code is wrong, the sensor will ignore the host's request and not respond.

The calculation method of CRC-16 check code is as follows:
① Preset a 16-bit register as hexadecimal FFFF, call this register CRC register;
② XOR the first 8-bit binary data (the first byte of the information frame) with the lower 8 bits of the 16-bit CRC register, and place the result in the CRC register;
③ Shift the content of the CRC register one bit to the right (toward the low bit) and fill the highest bit

with 0, check the right shift out position after shift;
④ If the shifted out bit is 0, repeat step ③ (shift one bit to the right again), if the shifted out bit is 1, the CRC register is XORed with the polynomial A001 (1010 0000 0000 0001);
⑤ Repeat steps ③ and ④ until the right shift is 8 times, so that the entire 8-bit data has been processed;
⑥ Repeat steps ② to step ⑤ to process the next byte of the message frame;
⑦ After calculating all the bytes of the information frame according to the above steps, the content of the CRC register obtained is: 16-bit CRC check code.

# 7 Dimensions (unit: mm)