



# HWR-380MOil Characterisation Sensor user manual

(v1.0.1)



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## Representations

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This manual explains the instructions related to the use of the HWR-380M Oil Characterisation Sensor (hereinafter all referred to as the HWR-380M) and consists of the following four sections:

1. test tools;
2. configuration connections;
3. communication protocols;
4. test instructions.

## 1 Test Tools

### 1.1 Hardware Tools

- ① PC with USB interface;
- ② HWR-380M sensor;
- ③ Test oil sample;
- ④ M8 6-core cable;
- ⑤ USB-RS485 converter;
- ⑥ +24V DC regulated power supply.

### 1.2 Software tool

- ① USB-RS485 Converter Driver



PL2303\_Prolific\_DriverInstaller\_v110.rar

- ② serial communications software



ModbusPoll6.3.rar

If users need, related software can be obtained from our technical staff.

## 2 Configuring Connections

### 2.1 Installation of serial drivers and serial communication software

It is recommended that you close the antivirus software on your computer before installing the software, otherwise it may report errors or lose files and cause the installation to fail.

#### 2.1.1 Installing the serial port driver

Users should install the corresponding driver according to the serial port communication software used. After the driver is installed, you can check the installation result under Computer->Management->Device Manager->Port Directory, and the interface after successful installation is shown in Figure 1:

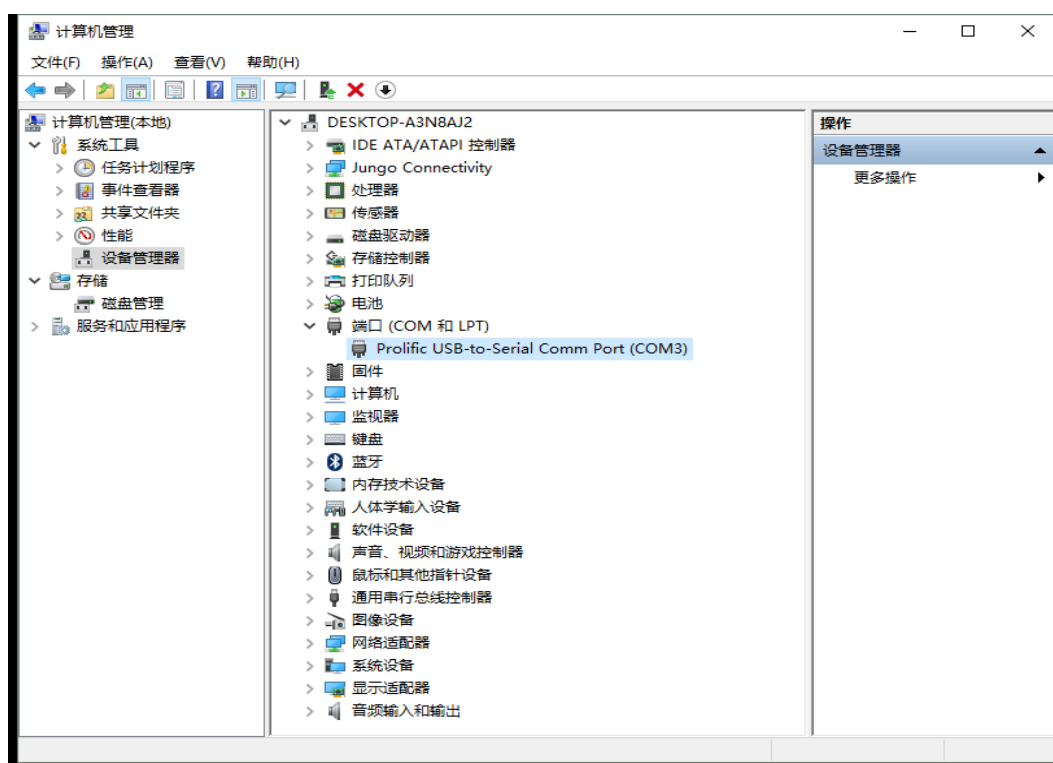


Figure 1 Serial Driver Installation Successful Interface

## 2.1.2 Installation of serial communication software

Follow the Modbus Poll software prompts for installation and setup.

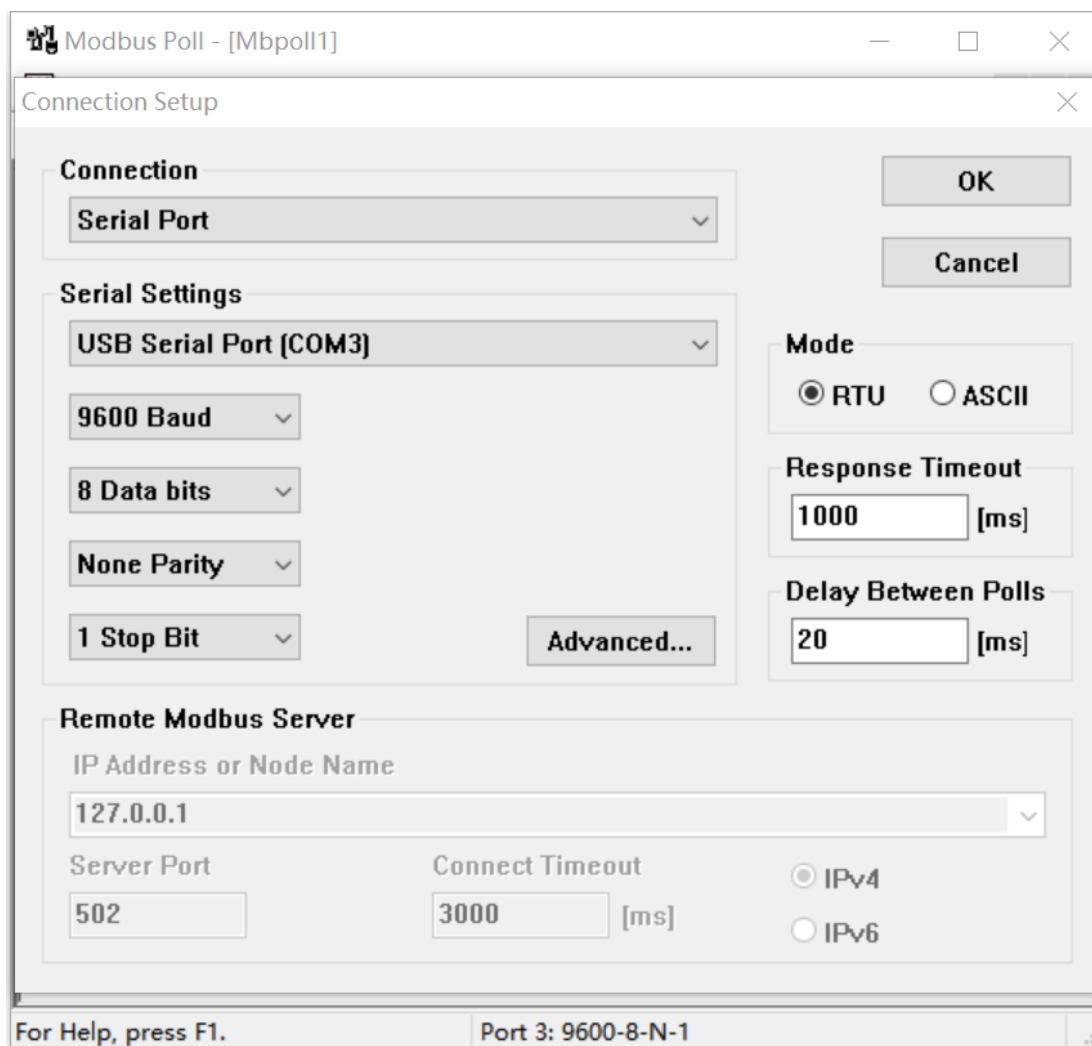


Figure 2 Modbus Poll Software Serial Port Settings

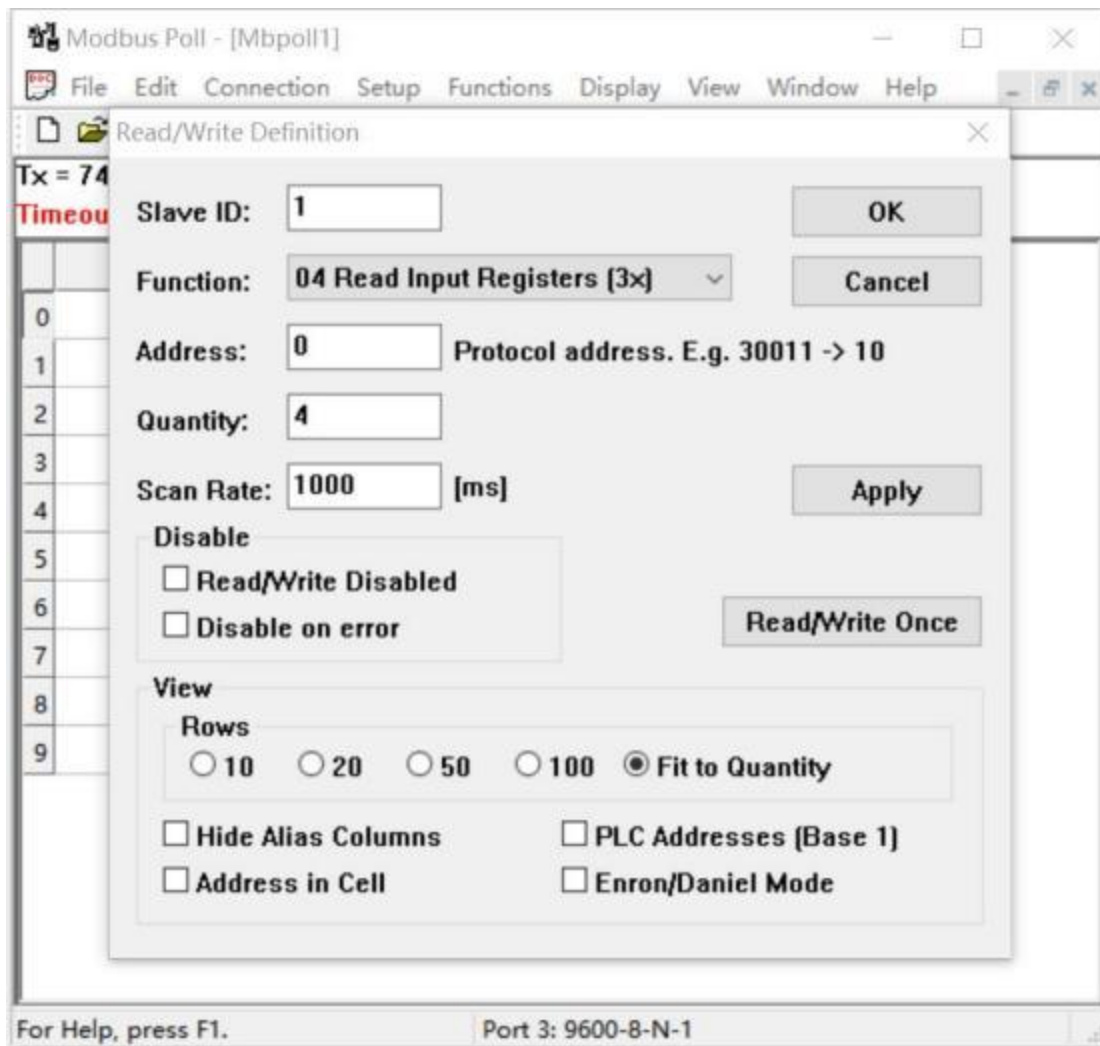


Figure 3 Modbus Poll Software Read/Write Settings

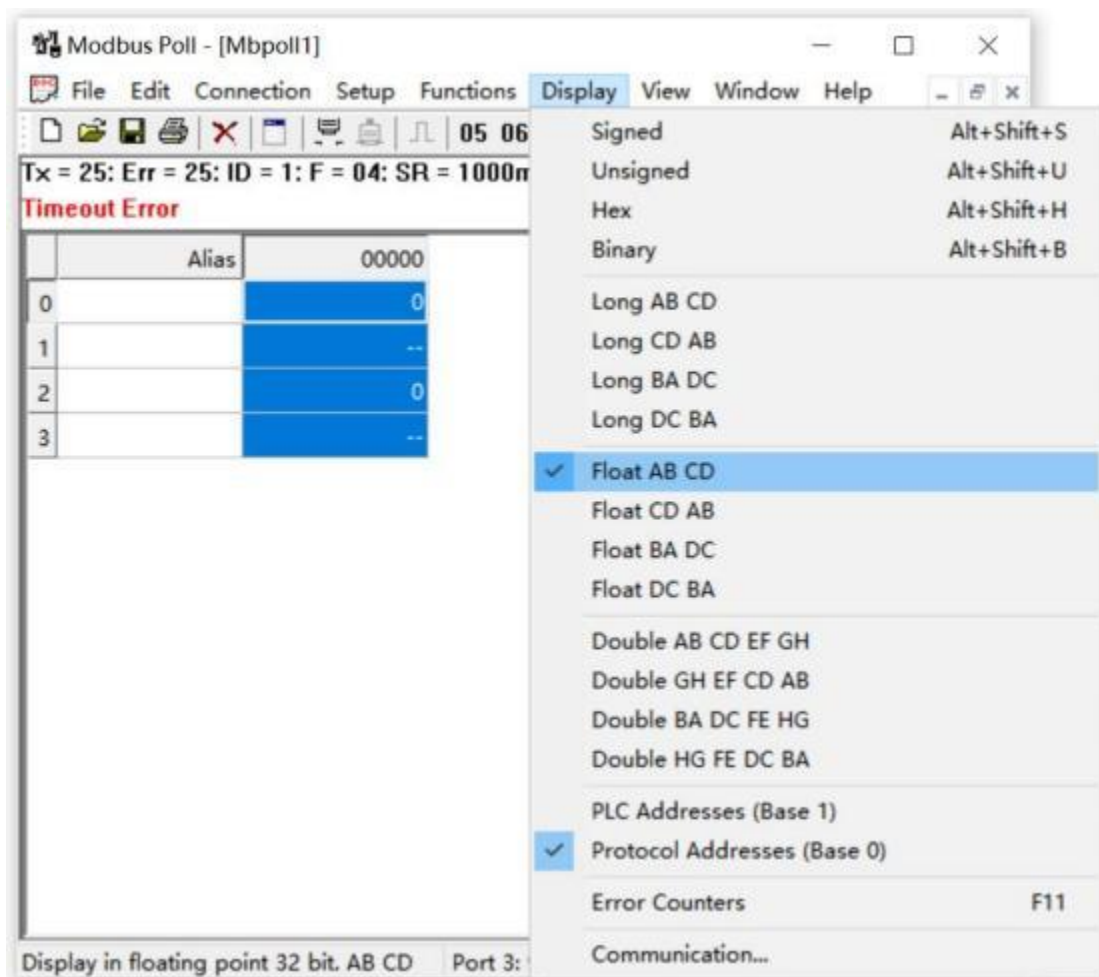


Figure 4 Modbus Poll Software Data Display Settings

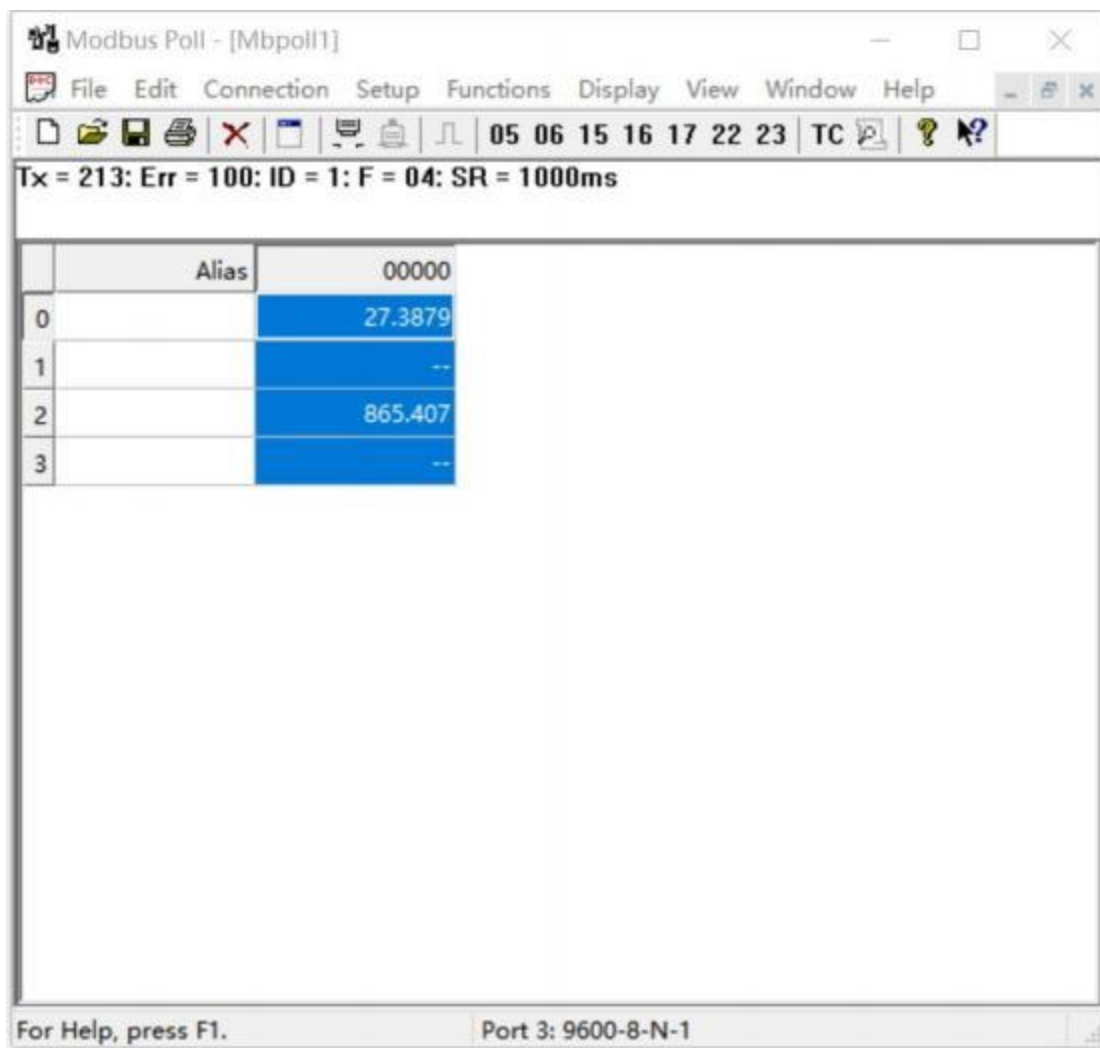


Figure 5 Modbus Poll Software Communication Interface

Fig. 5 shows the data that the temperature is 27.3879 °C, the oil condition is 865.407, the oil is in good condition.

## 2.2 Communication line connection

Connect the communication lines as shown in Figure 6. Measurement results can be read normally about 3 seconds after the power is turned on. Special attention should be paid to the fact that the HWR-380M probe must be completely submerged in the oil (no air bubbles at the probe's air holes) during testing or normal use, otherwise the measurement results will not be able to characterise the current condition of the oil sample.



Figure 6 Schematic diagram of communication line connection

### 3 Communication protocol

HWR-380M provides standard RS485 communication interface externally and uses Modbus RTU communication protocol to communicate with the host. In a complete online monitoring system, the master control device acts as the host and HWR-380M acts as the slave. Each communication handshake is always an access request from the host and a response from the slave.

Use specification standard: ‘GB/T19582-2008 Industrial Automation Network Specification Based on Modbus Protocol’.

#### 3.1 Data format

##### 3.1.1 Data frame format

HWR-30M sends each byte (frame) format fully comply with the GB/T19582-2008 standard MODBUS communication protocol, function code support read, write, batch write and so on. The CRC check:  $(CRC-16/MODBUS \times 16 + x_{15} + x_2 + 1)$  starts from ‘address code’ to ‘data’. The data frame contains start bit, information bit and stop bit, a total of 10 bits, as shown in Figure 7.

Frame format (10-bit):

start bit	D0	D1	D2	D3	D4	D5	D6	D7	stop bit
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Figure 7 Data frame format

The specific definitions are as follows:

Bit 1: start bit ( ‘0’ is valid);

Bits 2 to 9: information bits;

Bit 10: stop bit ( ‘1’ valid);

##### 3.1.2 Message format

The format of each message received and sent by the system is as follows:

—address

—Function code

—Data number

—Data 1

—...

—Data n

—CRC16 calibration

## 3.2 Communication parameters

### 3.2.1 Serial port settings

parametric	causality
baud	9600
data bit	8 place
parity check	uncalibrated
stop bit	1 place

Table 1 Serial Port Settings

### 3.2.2 Modbus function code

function code	define
04 (0x04)	Read Input Register
06 (0x06)	Write Single Register
16 (0x10)	Write multiple registers

Table 2 Modbus function codes

### 3.2.3 Modbus operable register

No.	starting address	function code	word length	Stored content	clarification
1	0x0000	04	2	temp	data type : float ABCD ; unit: °C
2	0x0002		2	oil condition	data type : float ABCD ; unit: -
3	0x9000	0x04	1	address	data type : unsigned int
		0x06			

Note: float single-precision floating-point data, compliant with IEEE754 standard

Table 3 Modbus operable registers

### 3.3 Data retrieval

Example of reading HWR-380M data message [ HWR-380M address is 1, temperature 30.09571° C, oil condition 859.2796].

request		responsive	
domain name	(hexadecimal)	domain name	(hexadecimal)
address	01	address	01
function code	04	function code	04
data home address Hi	00	Number of data bytes	08
data home address Lo	00	temp	41
Number of data words Hi	00		F0
Number of data words Lo	04		C4
<b>CRC16 Lo</b>	F1		04
<b>CRC16 Hi</b>	C9	oil condition	44
			56
			D1
			E5
		<b>CRC16 Lo</b>	99
		<b>CRC16 Hi</b>	81

Table 4 Example of reading HWR-380M data message

### 3.4 Address Settings

The factory default address of HWR-380M is 1. The address setting range is 1 to 100, and 0 is the broadcast address.

#### 3.4.1 Enquiry Address

Example of a query address message [ HWR-380M current address is 1. ]

request		responsive	
domain name	(hexadecimal)	domain name	(hexadecimal)
broadcast address	00	broadcast address	00
function code	04	function code	04
start address Hi	90	Number of data bytes	02
start address Lo	00	current address Hi	00
Number of data words Hi	00	current address Lo	01
Number of data words Lo	01	CRC16 Lo	45
CRC16 Lo	1D	CRC16 Hi	30
CRC16 Hi	1B		

Table 5 Example of query HWR-380M address message

#### 3.4.2 Change address

Example of a Modify Address Message [ HWR-380M address changed from 1 to 2. ]

request		responsive	
domain name	(hexadecimal)	domain name	(hexadecimal)
current address	01	current address	01
function code	06	function code	06
data home address Hi	90	data home address Hi	90
data home address Lo	00	data home address Lo	00
Setting the address Hi	00	Setting the address Hi	00
Setting the address Lo	02	Setting the address Lo	02
CRC16 Lo	25	CRC16 Lo	25
CRC16 Hi	0B	CRC16 Hi	0B

Table 6 Example of Modifying the HWR-380M Address Message

## 4 Test Description

### 4.1 Wiring Definitions

The HWR-380M has an M8 1\*6 connector (male) on the end with the following interface definition:

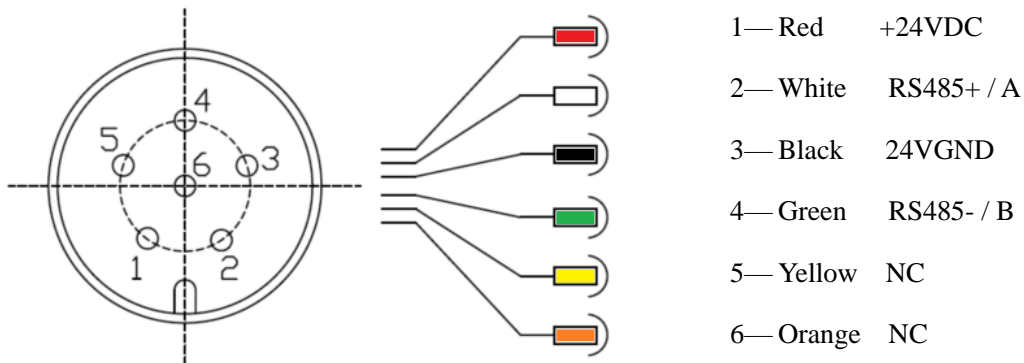


Figure 11 Connector Interface Definition

### 4.2 Test step

**Step 1:** Connect the test line according to Figure 6.

**Step 2:** Set up the communication software and test whether the whole line communication connection is normal. If it is normal, perform step 3; If not normal, double-check the line connection and troubleshoot the problem.

**Step 3:** Clean the HWR-380M probe with petroleum ether until there are no visible oil stains on the probe surface, and blow it dry with the instrument air source. this step must be performed before the HWR-380M is used.

**Step 4:** Use a 25mL or larger capacity measuring cup to take an appropriate amount of oil samples, the oil level to just submerge the HWR-380M mounting pipe threads as appropriate, the probe air hole parts can not have obvious air bubbles.

**Step 5:** Connect the HWR-380M, power on the test.