Quick Start Manual

ICON™ PROCESS CONTROLS Corrosion-Free Instrumentation Equipment

Read the user's manual carefully before starting to use the unit.
Producer reserves the right to implement changes without prior notice.

ProCon® — TB800 Series
Turbidity Controller

ICON PROCESS CONTROLS™ Corrosion-Free Instrumentation Equipment™

Features

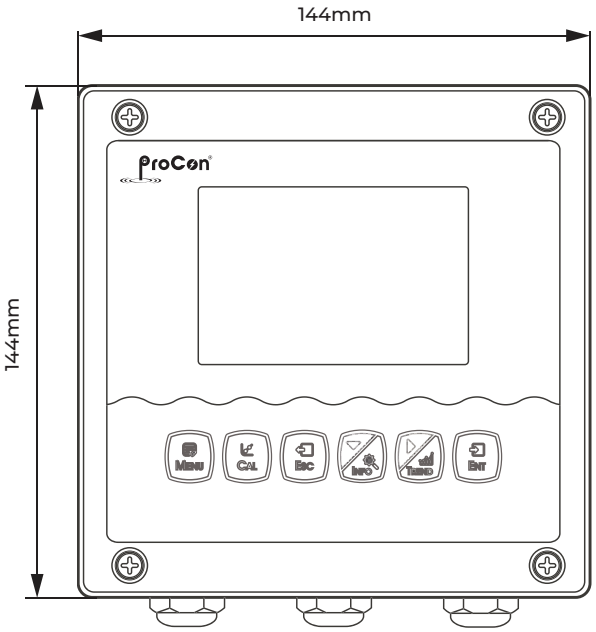
- Large Color LCD Display
- Data Recording/Trend Chart/Data Upload Function
- Multiple Automatic Calibration to Ensure the Accuracy
- Differential Signal Mode
- Three Relay Control Switches
- High & Low Alarm and Hysteresis Control
- 4-20mA | RS485 Multiple Output Modes
- Password Protection

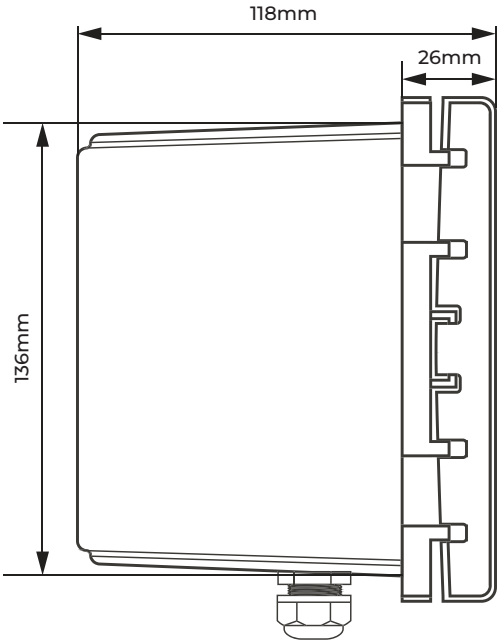
Technical Specifications

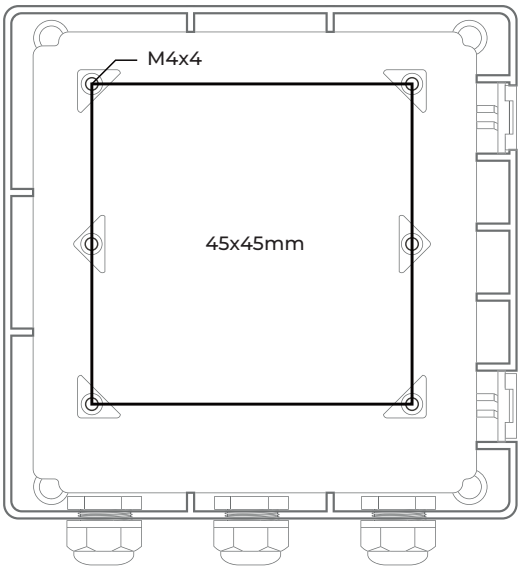
Measurement Range	0~99999NTU
Measurement Unit	NTU | mg/L
Resolution	0.001 | 0.01 | 0.1 | 1
Basic Error	±1% F.S
Temperature	14 ~ 302°F | -10 ~ 150.0°C
Temperature Resolution	0.1°C
Temperature Accuracy	±0.3°C
Temperature Compensation	Manual | Automatic
Current Output	4~20mA | 20~4mA | 0~20mA
Communication Output	RS485 MODBUS RTU
Relay Control Contacts	3 Group : 5A 250VAC, 5A 30VDC
Power Supply	9~36VDC | 85~265VAC* | Power Consumption ≤ 3W
Working Conditions	No strong magnetic field interference around except the geomagnetic field
Working Temperature	14 ~ 140°F | -10~60°C
Relative Humidity	≤90%
Waterproof Rating	IP65
Dimensions (mm)	144 x 144 x 118
Mounting	Panel | Wall Mount

* Optional

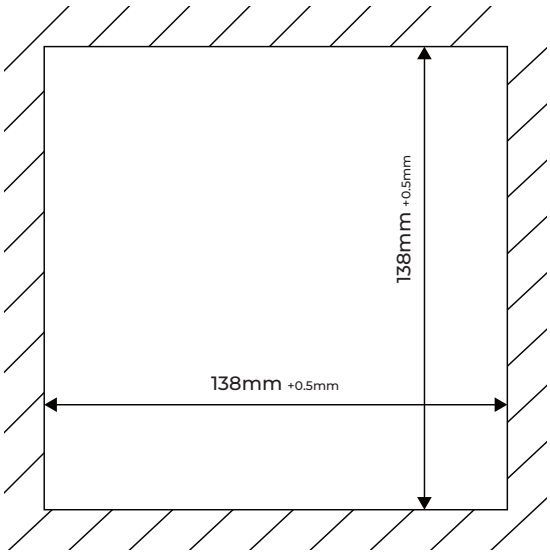
Dimensions





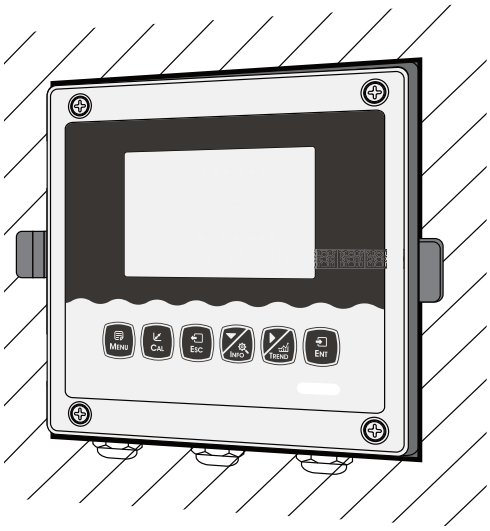


Back Fixed Hole Size



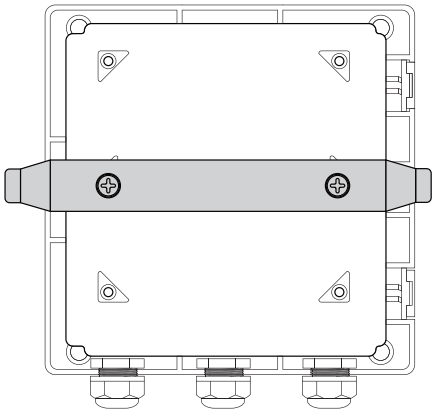
Embedded Mounting Cut-out Size

Cabinet Installation

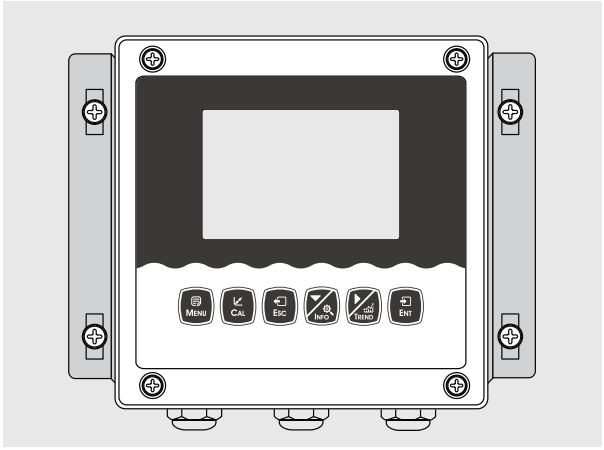


Schematic of Installation

a) Embedded in an open hole
b) Fix the instrument

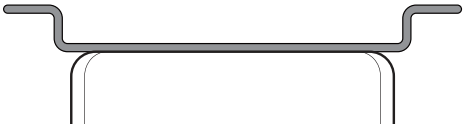


Wall Mount Installation

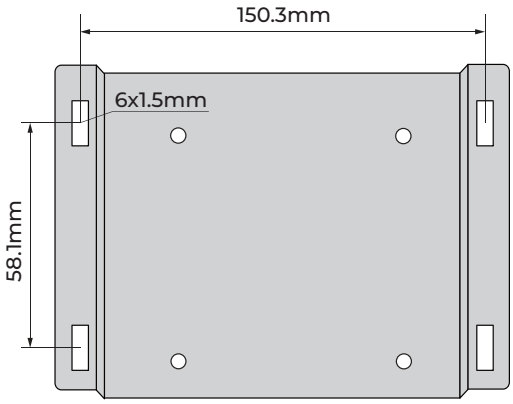


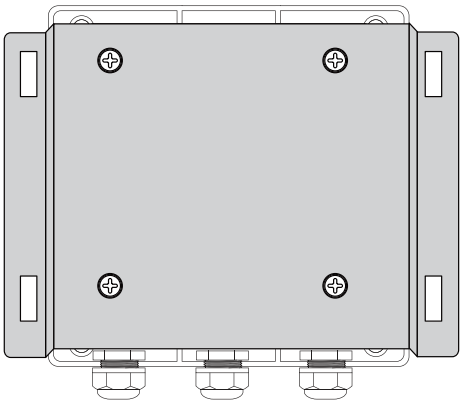
Schematic of Installation

a) Install a mounting bracket for the instrument
b) Wall screw fixation

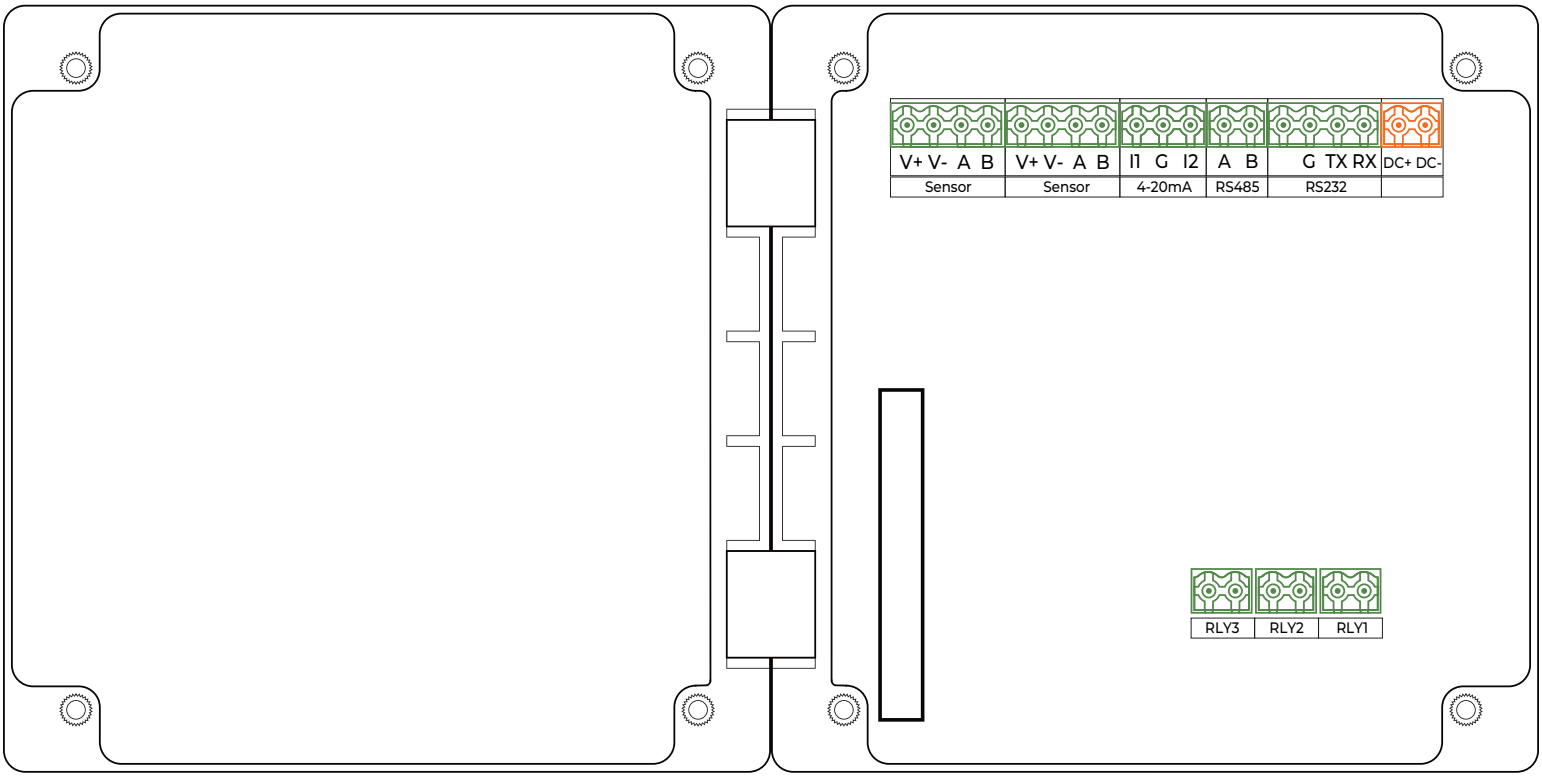


Top view of mounting bracket.
Pay attention to installation direction





Wiring



Terminal	Description
V+, V-, A1, B1	Sensor Input Channel 1
V+, V-, A2, B2	Sensor Input Channel 2
I1, G, I2	4-20mA Output
A, B	RS485 Communication Output
G, TX, RX	RS232 Communication Output (Data Upload)
DC+, DC-	DC Power Supply
RLY3, RLY2, RLY1	3 Sets of Relays

Electrical Connection

The connection between the instrument and the sensor: The power supply, output signal, relay alarm contact and the connection between the sensor and the instrument are all inside the instrument, and the wiring is as shown above. The length of the cable lead is usually 5-10 Meters. Insert the line with corresponding label or color wire on the sensor into the corresponding terminal inside the instrument and tighten it.

Keypad Description

Menu Setting Mode:
Press this key to loop
down the menu options

Confirm
Options

Enter Calibration Mode
Calibrated: Check Calibration Status
Recalibration: Press "ENT" Again

Menu Setting Mode:
Press this key to
rotate menu options

MENU CAL ESC INFO TREND ENT

Enter Menu Setting Mode |
Return Measurement |

Return to
Previous Menu

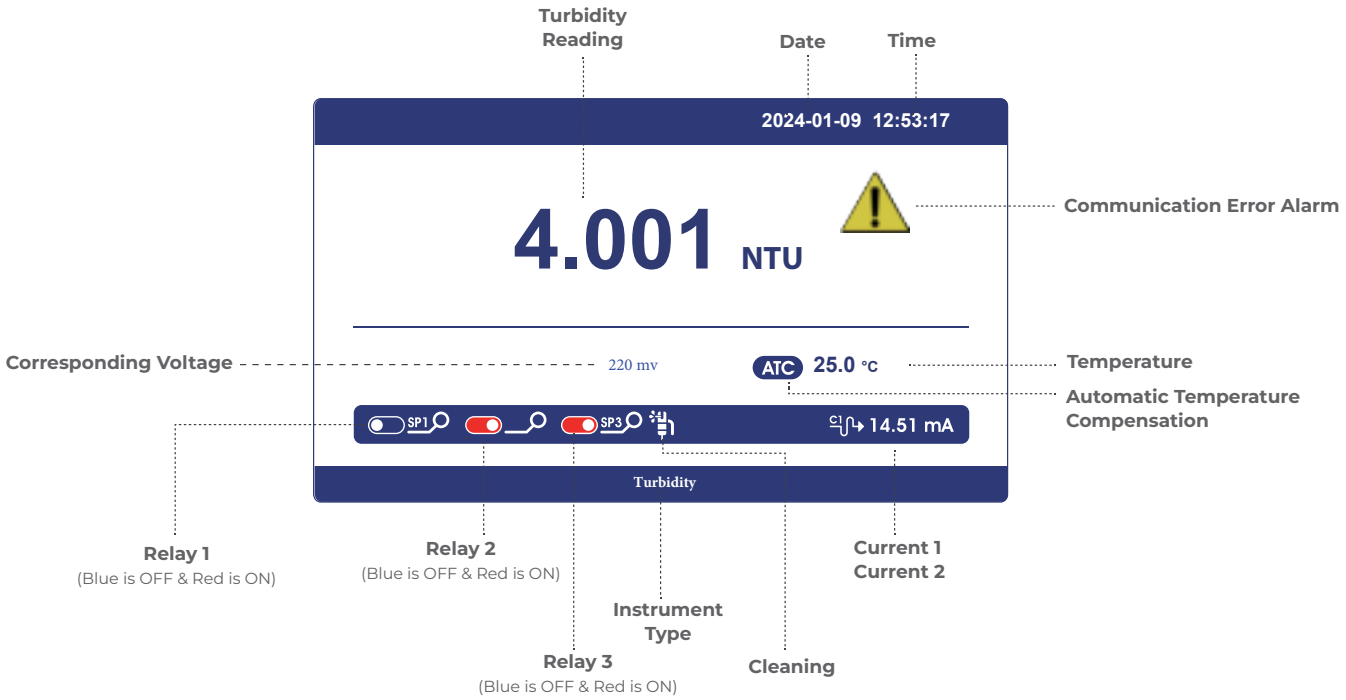
In Measurement Mode,
Press this key to display the trend chart

Keypad Operation

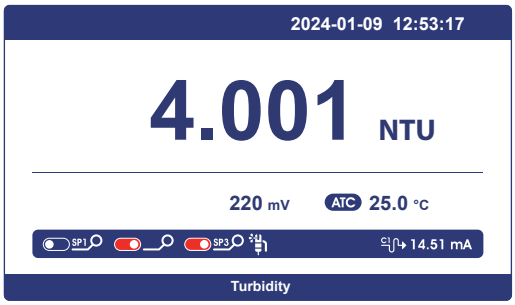
Short Press: Release the key immediately after pressing (Default to short presses if not specified above).
Long Press: Press the button for 3 seconds and then release it.

Display Descriptions

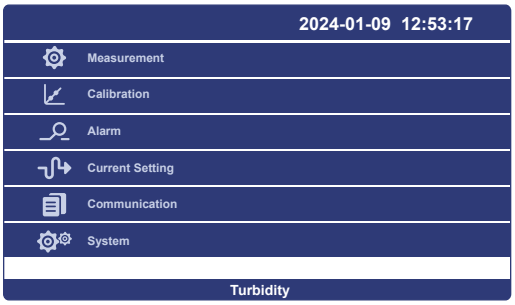
All pipe connections and electrical connections should be checked before use. After the power is switched on, the meter will display as follows.



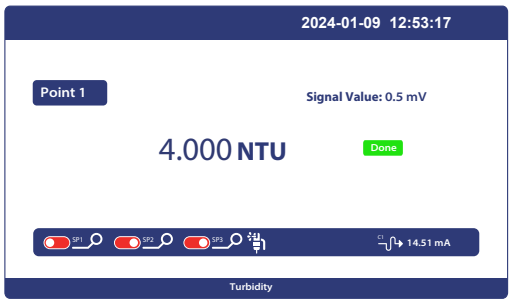
Measurement Mode



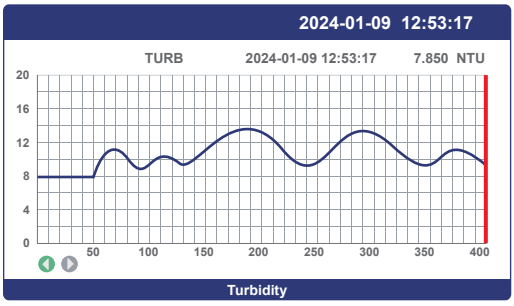
Setting Mode



Calibration Mode



Trend Chart Display



Menu Structure

Measurement	Sensor	Type	Turbidity (Default) | Suspended Solids
		Unit	NTU (Default)| mg/L
		Modbus Node	000001
		Scraping Time	000000 Min
		Manual Cleaning	
		Select Range	Range 1 | Range 2 | Range 3 | Automatic
	Temperature	Offset	32.0°F
		Input	Automatic
			Manual
			N/A
		Unit	°C
			°F (Default)
Calibration	Standard Solution Calibration	Point 1	
		Point 2	
		Point 3	
		Point 4	
		Point 5	
	Standard Solution Calibration Query	Voltage 1	
		Voltage 2	
		Voltage 3A	
		Voltage 3B	
		Voltage 4A	
		Voltage 4B	
		Voltage 5	
	On-site Calibration		
	On-site Query	Offset	0.000NTU
		Slope	1.000

Alarm	Relay 1	Channel	Main (Default)
			Temp
		Alarm Mode	Low Alarm
			High Alarm (Default)
		Status	Normally Open (Default)
			Normally Closed
		Limit Value	4000NTU
		Hysteresis	0.00NTU
	Relay 2	Channel	Main (Default)
			Temp
		Alarm Mode	Low Alarm (Default)
			High Alarm
		Status	Normally Open (Default)
			Normally Closed
		Limit Value	0.00NTU
		Hysteresis	0.00NTU
	Relay 3	Channel	Main
			Temp (Default)
		Alarm Mode	Low Alarm
			High Alarm (Default)
		Status	Normally Open (Default)
			Normally Closed
		Limit Value	122.0°F
		Hysteresis	32°F
	Auto Clean	Duration of Clean	000001 Min
		Off Time	000030Min
		Select Relay	Relay 1 | Relay 2 | Relay 3 | N/A (Default)
		Clean Mode	Hold (Default) | Real Time

Current Setting	Current 1	Channel	Main (Default)
			Temperature
		Output Type	4-20mA (Default)
			0-20mA
			20-4mA
		Upper Limit	4000NTU
		Lower Limit	0.00NTU
	Current 2	Channel	Main
			Temperature (Default)
		Output Type	4-20mA (Default)
			0-20mA
			20-4mA
		Upper Limit	212.0°F
		Lower Limit	32.0°F
Communication	Baud Rate	4800BPS	
		9600BPS	Default
		19200BPS	
	Parity Check	None Parity	Default
		Odd Parity	
		Even Parity	
	Stop Bit	1 Bit	Default
		2 Bit	
	Address	1 (Default)	1~247
System	Restore	No Password (Default)	Calibration Recovery
			Parameter Recovery
	Display	Display Rate	Low | Standard (Default) | Medium | High
		Back light	30 Sec | 5 min | 15 min | 30 min | Always On
	Set Time	Year / Month / Date	
		Hr : Min : Sec	
	Password	No Password (Default)	
	Series No.	0000045073	
	Version	6.2.36	
	Language	English	

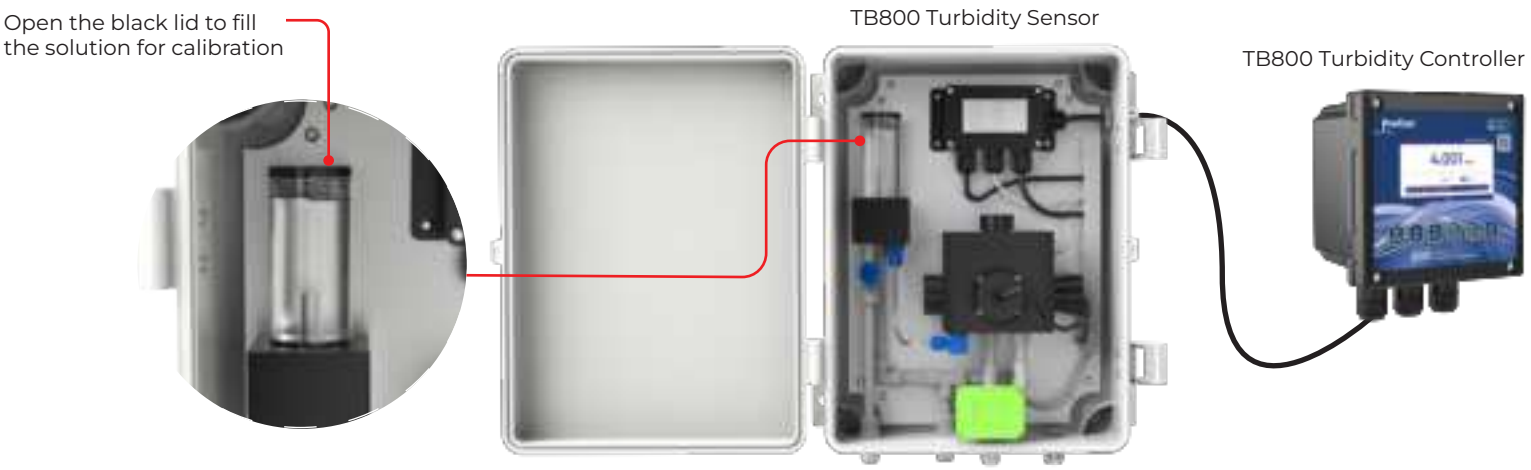
Maintenance	Current Calibration	Current 1 | 4mA	
		Current 1 | 20mA	
		Current 2 | 4mA	
		Current 2 | 20mA	
	Relay Test	Relay 1	On
		Relay 2	On
		Relay 3	On
Data Log	Data Recording Interval	7.5 s	
		1 min	
		5 min	
		10 min	
		60 min	
	Data Query	Query by number of data	

Menu Description

Measurement

Sensor	Type	Select "Turbidity"
	Unit	Select Unit
	Modbus Node	Sensor communication address. The address is preset in the factory. User can change according to the demand.
	Scraping Time	If the sensor comes with a scrap, you can set the scrap start time in this menu.
	Manual Cleaning	Click to enable the brush.
	Select Range	
Temperature	Offset	The user can compare the instrument's measured temperature with that of other standard instruments automatically. If a discrepancy is found, the "temperature offset" can be used for correction. For example, if the instrument measures 77°F and the standard instrument measures 76.64°F, enter "-0.36°F" as the offset. Then, press "Menu" to exit the editing interface and select "Save" to apply the correction.
	Input	You can choose from three temperature methods: "Auto," "Manual," and "None." **Auto:** The instrument automatically displays the temperature detected by the sensor. **Manual:** The user can manually input a temperature value. The system defaults to a compensation setting of 77°F. **None:** The instrument will not display a temperature value.
	Unit	The user can choose between two temperature units in the unit settings: Celsius (°C) or Fahrenheit (°F).

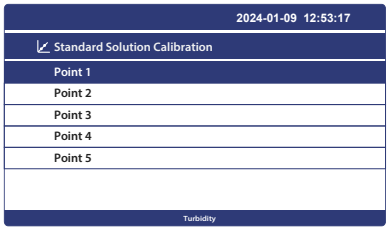
Filling Solution for Calibration (TB800 Turbidity Sensor)

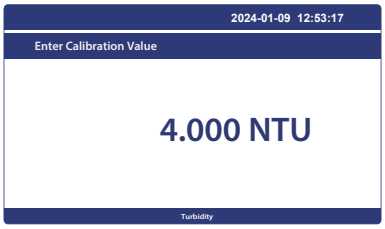


Calibration (Unit is Factory Calibrated)

Standard Solution Calibration

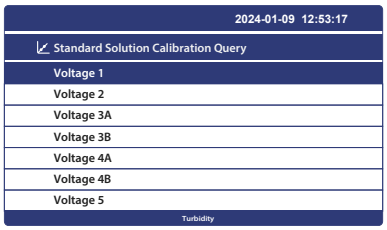
The standard solution calibration offers five points and allows calibration at any single point (minimum one point required). Press [**CAL**] to access the calibration menu (or navigate to calibration via the Main Menu) and select "Standard Solution Calibration." Choose a point, fill the flow cell with the known solution, and press [**ENT**]. Input the calibration value and press [**ENT**] again to initiate the calibration. Calibration will begin, and once it displays "**Done**," press [**ENT**] to save the settings.

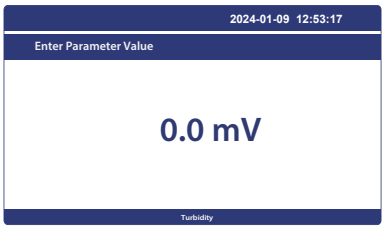




Standard Solution Calibration Query

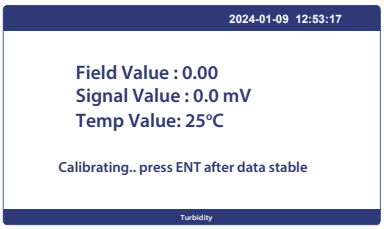
During calibration, the turbidity sensor measures the voltage at five different calibration points (Calibration Point 1 to Calibration Point 5). These voltage readings are used to create a calibration curve. This curve helps the sensor accurately convert voltage readings into corresponding turbidity values, allowing it to provide precise feedback on the water's turbidity.





On-site Calibration

Open the black lid of the flow cell and fill it with a solution of known concentration. Press [**CAL**] to enter calibration menu (or select calibration from main menu) and select on-site calibration. press [**ENT**] to begin calibration. Once calibration is complete, enter the data obtained from the laboratory or portable instrument. Press [**ENT**] again to display the slope value, then press [**ENT**] once more to exit.



On-site Calibration Query

Offset : Compare the measurement data from the controller with the data obtained from the laboratory or portable device. If discrepancies are found, use this function to adjust the error.
Example: If the instrument's automatic measurement is 12 and the user value is 11.8, enter "-0.2000" to correct it.

Slope : The slope value obtained from "On-site calibration" is stored in this setting, with the factory default set to 1.0000.

Alarm

Relay 1 | 2 | 3	Channel	Choose the data type for the relay output.
	Alarm Mode	Select Alarm Mode. High | Low
	Status	The relay status can be configured as either "normally open" or "normally closed." The factory default setting is "normally open.
	Limit Value	Users can set a "high limit value" & "low limit value" in this settings. The instrument will produce a tick sound when the measurement data exceeds the high or low limit.
	Hysteresis	Enter Hysteresis Value
	Example: To trigger an alarm when the main measurement value exceeds 10, follow these steps: Set the "Status" to "Normally Open," select "High Limit" under "Alarm Mode," and input 10 in the "Limit Value" setting. Once the measurement exceeds 10, the instrument will produce a sound, and the relay will activate. To maintain the alarm, connect an external alarm device.	
Auto Clean	Duration of Clean	For example, if the user wants to clean every three minutes for one minute, set the "duration" to "3" and the "off time" to "1" in minutes.
	Off Time	
	Select Relay	If the wire is connected to Relay 1, choose Relay 1.
	Clean Mode	Choose between "Hold" mode and "Real Time" mode. If "Hold" is selected, set the duration time (default is 5 seconds).

Current Settings (mA Output)

Current 1 | 2	Channel	Select the output "Main" Value or "Temp Value.
	Output Type	The Default Output Type is "4-20mA". The Upper Limit Value Corresponds to 20mA and the Lower Limit Value corresponds to 4mA.
	Upper Limit	Set the Upper Limit Value
	Lower Limit	Set the Lower Limit Value

Communication (MODBUS)

Baud Rate	The baud rate, check bit, and stop bit must match the settings required by the equipment at the customer's site to ensure successful data upload.
Parity Check	
Stop Bit	
Address	When uploading data from multiple instruments at the site, the network node setting helps users quickly and efficiently identify data sources. Up to 247 groups can be configured.

System

Restore	Calibration and parameter recovery can be performed in this setting.
Display	Display Rate : The display speed of the data on the screen can be adjusted, with the system offering four settings: "Low," "Standard," "Medium," and "High." The default setting is "Standard."
	Backlight : This feature adjusts the highlight duration of the instrument display.
Set Time	Set the Date and Time
Password	Change Password if required. Once the password is set, exit to measurement mode. To access the menu again, enter the password. If you wish to cancel the password, set it to "000000" in this settings, which is the default password.
Series No.	Users can access the product version information here.
Version	
Language	

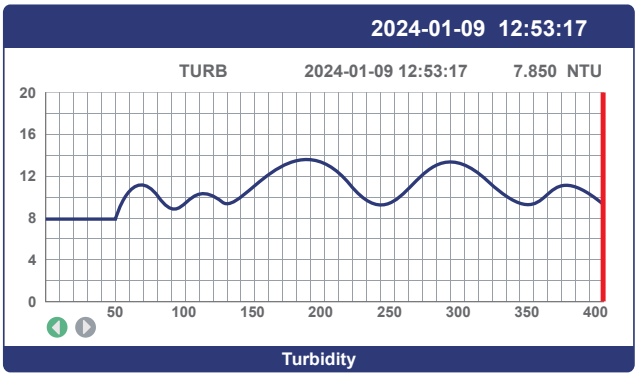
Maintenance

Current Calibration	**Example : Calibrating Current 1 (4 mA)** After connecting the "I1" (Current I/positive) and "G" (output current negative) terminals of the multimeter and the instrument, if the multimeter displays a current value of 3.98 mA, press the "up key" or "right key" at the Input Parameter Value until the multimeter shows the target value of 4 mA, completing the calibration. When testing the current, the multimeter should be connected to "I1" & "G." For a test current of 2 mA, connect the multimeter to "I2" & "G." Note: "I1" and "I2" are positive terminals, "G" is the negative sensor, and it serves as the common point for the output current. Important: Ensure that the multimeter has sufficient power. Insufficient power may cause deviations in current measurement data.
Relay Test	After selecting the appropriate relay, press [ENT] to hear the tick sound, indicating that the relay is functioning normally.

Graphic Trend (Trend Chart)

Data Log	Data Recording Interval	7.5 s	Store Data Every 7.5 Seconds
		1 min	Store Data Every 60 Seconds
		5 min	Store Data Every 300 Seconds
		10 min	Store Data Every 600 Seconds
		60 min	Store Data Every 3600 Seconds
	Data Query	Retrieve the history based on the amount of data stored in the controller	

Press the [▶/**TREND**] button in the measurement mode to view the trend chart of the saved data directly. Pressing the [**ESC**] button returns to the measurement screen. There are 480 sets of data record per page.



In the current screen, press the [**CAL**] key to move the data display line to the left and [▶/**TREND**] key to move towards right. Press [**INFO**] to change the chart display range.

Data Recording Interval : Users can select the recording interval here. Once selected, the instrument will save the data at the specified interval.

Data Query : Enter the number of records to query here, then press [ENT] to retrieve the historical data.

MODBUS RTU

The hardware version number of this document is V2.0; the software version number is V5.9 and above. This document describes the MODBUS RTU interface in details and the target object is a software programmer.

MODBUS Command Structure

Data format description in this document;
Binary display, suffix B, for example: 10001B - decimal display, without any prefix or suffix, for example: 256
Hexadecimal display, prefix 0x, for example: 0x2A
ASCII character or ASCII string display, for example: "YL0114010022"

Command Structure

The MODBUS application protocol defines the Simple Protocol Data Unit (PDU), which is independent of the underlying communication layer.

Fig.1 : MODBUS Protocol Data Unit

MODBUS protocol mapping on a specific bus or network introduces additional fields of protocol data units. The client that initiates the MODBUS exchange creates the MODBUS PDU, and then adds the domain to establish the correct communication PDU.

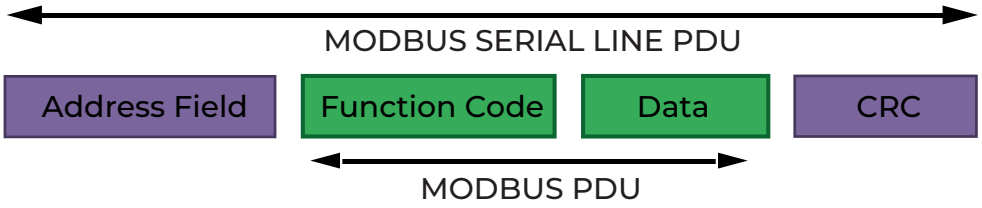


Fig.2 : MODBUS Architecture for Serial Communication

On the MODBUS serial line, the address domain contains only the slave instrument address. Tips: The device address range is 1...247
Set the device address of the slave in the address field of the request frame sent by the host. When the slave instrument responds, it places its instrument address in the address area of the response frame so that the master station knows which slave is responding.

Function codes indicate the type of operation performed by the server.
CRC domain is the result of the " redundancy check" calculation, which is executed according to the information content.

MODBUS RTU Transmission Mode

When the instrument uses RTU (Remote Terminal Unit) mode for MODBUS serial communication, each 8-bit byte of information contains two 4-bit hexadecimal characters. The main advantages of this mode are greater character density and better data throughput than the ASCII mode with the same baud rate. Each message must be transmitted as a continuous string.

The format of each byte in RTU mode (11 bits):

Coding system: 8-bit binary

Each 8-bit byte in a message contains two 4-bit hexadecimal characters (0-9, A-F)

Bits in each byte: 1 starting bit

8 data bits, the first minimum valid bits without parity check bits

2 stop bits

Baud rate: 9600 BPS

How characters are transmitted serially:

Each character or byte is sent in this order (from left to right) the least significant bit (LSB)... Maximum Significant Bit (MSB)

Start bit	1	2	3	4	5	6	7	8	Stop bit	Stop bit

Fig.3 : RTU Pattern Bit Sequence

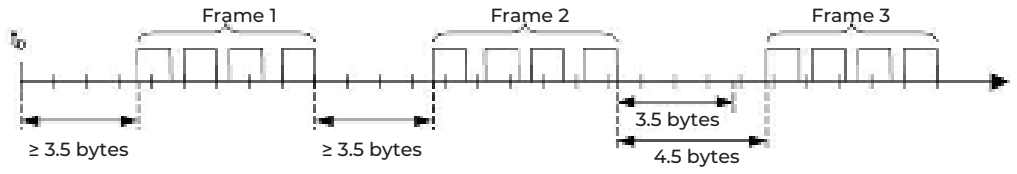
Check Domain Structure: Cyclic Redundancy Check (CRC16)

Structure description:

Slave Instrument	Address	Data	CRC
1 byte	1 byte	0...252 byte	2 byte
			CRC Low byte | CRC High byte

Fig.4 : RTU Information Structure

The maximum frame size of MODBUS is 256 bytes
MODBUS RTU Information Frame
In RTU mode, message frames are distinguished by idle intervals of at least 3.5 character times, which are called t3.5 in subsequent sections.



Starting	Address	Function code	Data	CRC	End
≥ 3.5 bytes	8	8	Nx8	16 bit	≥ 3.5 bytes

Fig.5 : RTU Message Frame

The entire message frame must be sent in a continuous character stream. When the pause time interval between two characters exceeds 1.5 characters, the information frame is considered incomplete and the receiver does not receive the information frame.

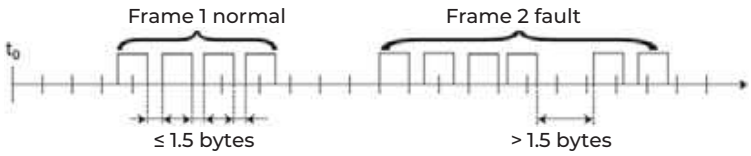


Fig.6 : MODBUS RTU CRC Check

The RTU mode contains an error-detection domain based on a cyclic redundancy check (CRC) algorithm that performs on all message contents. The CRC domain checks the contents of the entire message and performs this check regardless of whether the message has a random parity check. The CRC domain contains a 16-bit value consisting of two 8-bit bytes. CRC16 check is adopted. Low bytes precede, high bytes precede.

Implementation of MODBUS RTU in Instrument

According to the official MODBUS definition, the command starts with a 3.5 character interval triggering command, and the end of the command is also represented by a 3.5 character interval. The device address and MODBUS function code have 8 bits. The data string contains n*8 bits, and the data string contains the starting address of the register and the number of read/write registers. CRC check is 16 bits.

Value	Start	Device Address	Function	Data	Summary Check		End
	No Signal bytes during 3.5 Characters	1-247 1	Function Codes Confirming to MODBUS Specification	Data Confirming to MODBUS Specification	CRCL	CRCL	No Signal bytes during 3.5 characters
Byte	3.5		1	N	1	1	3.5

Fig.7 : MODBUS definition of Data Transmission

Instrument MODBUS RTU Function Code

The instrument only uses two MODBUS function codes:
0x03: Read-and-hold register
0x10: Write multiple registers

MODBUS Function Code 0x03: Read-and-hold Register
This function code is used to read the continuous block content of the holding register of the remote device. Request the PDU to specify the start register address and the number of registers. Address registers from zero. Therefore, the addressing register 1-16 is 0-15. The register data in the response information is packaged in two bytes per register. For each register, the first byte contains high bits and the second byte contains low bits.

Request:

Function Code	1 byte	0x03
Start Address	2 byte	0x0000....0xfffff
Read Register Number	2 byte	1...125

Fig.8 : Read and hold register request frame

Response:

Function Code	1 byte	0x03
Number of bytes	2 bytes	0x0000....0xfffff
Read Register Number	2 bytes	1...125

N = Register Number

Figure 9 : Read and hold register response frame

The following illustrates the request frame and response frame with the read and hold register 108-110 as an example. (The contents of register 108 are read-only, with two byte values of 0X022B, and the contents of register 109-110 are 0X0000 and 0X0064)

Request Frame		Response Frame	
Number Systems	(Hexadecimal)	Function Code	(Hexadecimal)
Function Code	0x03	Byte Count	0x03
Start Address (High byte)	0x00	Register Value (High Bytes) (108)	0x06
Start Address (Low byte)	0x6B	Register Value (Low Bytes) (108)	0x02
Number of Read Registers (High Bytes)	0x00	Register Value (High Bytes) (109)	0x2B
Number of Read Registers (Low Bytes)	0x00	Register Value (Low Bytes) (109)	0x00
		Register Value (High Bytes) (110)	0x00
		Register Value (Low Bytes) (110)	0x00
		Function Code	0x64

Figure 10 : Examples of read and hold register request and response frames

MODBUS Function Code 0x10 : Write Multiple Registers

This function code is used to write continuous registers to remote devices (1... 123 registers) block that specifies the value of the registers written in the request data frame. Data is packaged in two bytes per register. Response frame return function code, start address and number of registers written.

Request:

Function Code	1 byte	0x10
Start Address	2 byte	2 byte
Number of input registers	2 byte	2 byte
Number of bytes	1 byte	1 byte
Register Values	N x 2 byte	N x 2 byte

Fig.11 : Write Multiple Register Request Frames *N = Register Number

Response:

Function Code	1 byte	0x10
Start Address	2 byte	0x0000....0xffff
Register Number	2 byte	1...123(0x7B)

N = Register Number

Figure 12 : Write Multiple Register Response Frames

The request frame and response frame are illustrated below in two registers that write the values 0x000A and 0x0102 to the start address of 2.

Response Frame	(Hexadecimal)	Response Frame	(Hexadecimal)
Number Systems	0x10	Number Systems	0x10
Function Code	0x00	Function Code	0x00
Start Address (High byte)	0x01	Start Address (High byte)	0x01
Start Address (Low byte)	0x00	Start Address (Low byte)	0x00
Input Register Number (High bytes)	0x02	Input Register Number (High bytes)	0x02
Input Register Number (Low bytes)	0x04	Input Register Number (Low bytes)	
Number of bytes	0x00		
Register Value (High byte)	0x0A		
Register Value (Low byte)	0x01		
Register Value (High byte)	0x02		
Register Value (Low byte)			

Figure 13 : Examples of writing multiple register request and response frames

Data Format in Instrument

Floating Point

Definition: Floating point, conforming to IEEE 754 (single precision)

Description	Symbol	Index	Mantissa	SUM
Bit	31	30...23	22...0	22...0
Index Deviation	127			

Figure 14 : Floating Point Single Precision Definition (4 bytes, 2 MODBUS Registers)

Example: Compile decimal 17.625 to binary

Step 1:

Converting 17.625 in decimal form to a floating-point number in binary form, first finding the binary representation of the integer part

17decimal= 16 + 1 = $1\times2^4 + 0\times2^3 + 0\times2^2 + 0\times2^1 + 1\times2^0$

The binary representation of integer part 17 is 10001B

then the binary representation of decimal part is obtained

0.625= 0.5 + 0.125 = $1\times2^{-1} + 0\times2^{-2} + 1\times2^{-3}$

The binary representation of decimal part 0.625 is 0.101B.

So the binary floating point number of 17.625 in decimal form is 10001.101B

Step 2:

Shift to find the exponent.

Move 10001.101B to the left until there is only one decimal point, resulting in 1.0001101B, and

10001.101B = 1.0001101 B× 24 . So the exponential part is 4, plus 127, it becomes 131, and its binary representation is 10000011B.

Step 3:

Calculate the tail number

After removing 1 before the decimal point of 1.0001101B, the final number is 0001101B (because before the decimal point must be 1, so IEEE stipulates that only the decimal point behind can be recorded). For the important explanation of 23-bit mantissa, the first (i.e. hidden bit) is not compiled. Hidden bits are bits on the left side of the separator, which are usually set to 1 and suppressed.

Step 4:

Symbol bit definition

The sign bit of positive number is 0, and the sign bit of negative number is 1, so the sign bit of 17.625 is 0.

Step 5:

Convert to floating point number

1 bit symbol + 8 bit index + 23-bit mantissa

0 10000011 00011010000000000000000B (the hexadecimal system is shown as 0 x418d0000)

Reference code:

1. If the compiler used by the user has a library function that implements this function, the library function can be called directly, for example, using C language, then you can directly call the C library function memcpy to obtain an integer representation of the floating-point storage format in memory.

For example: float floatdata; // converted floating point number

void* outdata; memcpy(outdata,&floatdata,4);

Suppose floatdata = 17.625

If it is a small-end storage mode, after executing the above statement, the data stored in the address unit outdata is 0x00.

address unit (outdata + 1) stores data as 0x00

address unit (outdata + 2) stores data as 0x8D

address unit (outdata + 3) stores data as 0x41

If it is large-end storage mode, after executing the above statement, the data stored in outdata of address unit is 0x41

address unit (outdata + 1) stores data as 0x8D

address unit (outdata + 2) stores data as 0x00

address unit (outdata + 3) stores data as 0x00

2. If the compiler used by the user does not implement the library function of this function, the following functions can be used to achieve this function:

void memcpy(void *dest,void *src,int n)

{

char *pd = (char *)dest; char *ps = (char *)src;

for(int i=0;i<n;i++) *pd++ = *ps++;

}

And then make a call to the above memcpy(outdata,&floatdata,4);

Example: Compile binary floating-point number 0100 0010 0111 1011 0110 0110 0110 10B to decimal number

Step 1: Divide the binary floating-point number 0100 0010 0111 1011 0110 0110 0110B into symbol bit, exponential bit and mantissa bit.

0 10000100 11110110110011001100110B

1-bit sign + 8-bit index + 23-bit tail sign bit S: 0 denotes positive number

Index position E: $10000100B = 1\times2^7+0\times2^6+0\times2^5+0\times2^4 + 0\times2^3+1\times2^2+0\times2^1+0\times2^0$

$=128+0+0+0+0+4+0+0=132$

Mantissa bits M: 11110110110011001100110B =8087142

Step 2: Calculate the decimal number

$D = (-1)\times(1.0 + M/223)\times2E-127$

$= (-1)0\times(1.0 + 8087142/223)\times2132-127$

$= 1\times1.964062452316284\times32$

$= 62.85$

Reference Code:

float floatTOdecimal(long int byte0, long int byte1, long int byte2, long int byte3)

{

long int realbyte0,realbyte1,realbyte2,realbyte3; char S;

long int E,M;

float D; realbyte0 = byte3; realbyte1 = byte2; realbyte2 = byte1; realbyte3 = byte0;

```
if((realbyte0&0x80)==0)
{
S = 0;//positive number
}
else
{
 S = 1;//negative number
 }
E = ((realbyte0<<1)|(realbyte1&0x80)>>7)-127;
M = ((realbyte1&0x7f) << 16) | (realbyte2<< 8)| realbyte3;
D = pow(-1,S)*(1.0 + M/pow(2,23))* pow(2,E);
return D;
 }
```

Function description: parameters byte0, byte1, byte2, byte3 represent 4 bytes of binary floating point number.

The decimal number converted from the return value.

For example, the user sends the command to get the temperature value and dissolved oxygen value to the probe. The 4 bytes representing the temperature value in the received response frame are 0x00, 0x00, 0x8d and 0x41. Then the user can get the decimal number of the corresponding temperature value through the following call statement.

That is temperature = 17.625.

float temperature = floatTOdecimal(0x00, 0x00, 0x8d, 0x41)

Read Instruction Mode

The communication protocol uses MODBUS (RTU), and both the communication content and address can be customized based on customer requirements.
The default configuration is network address 1, baud rate 9600, no parity check, and 1 stop bit. Users can modify these settings.

Function Code 0x03:

This function allows the host to retrieve real-time measurement values from the slave device, which are defined as single-precision floating-point values (i.e., occupying two consecutive register addresses). The received order is abcd, and the analytical order is cdab. Different parameters are marked with distinct register addresses.
The communication register address is as follows:

0000-0001: Main Value | 0002-0003: Temperature Value

Communication Example:

Examples of function code 03 instructions:

Address = 1, Main Value = 7.00, Temp Value = 24.00

Host Send: 01 03 00 00 00 04 XX XX | Slave Reply: 01 03 08 00 00 40 E0 00 00 41 C0 XX XX

Note:

[01] Represents the instrument communication address;

[03] Represents function code 03;

[08] represents 16 bytes data;

[00 00 40 E0] = 7.00; | Main value ; Parse Order: 40 E0 00 00

[00 00 41 C0]= 24.00; | Temperature Value ; Parse Order: 41 C0 00 00

[XX XX] Represents the CRC 16 Check Code

Maintenance

According to the requirements of use, the installation position and working condition of the instrument are relatively complex. In order to ensure that the instrument is working normally, maintenance personnel should carry out regular maintenance on the instrument. Please pay attention to the following during maintenance:

Check the working environment of the instrument. If the temperature exceeds the rated range of the instrument, please take appropriate measures; otherwise, the instrument may be damaged or its service life may be reduced;

When cleaning the plastic body of the instrument, please use a soft cloth and a soft cleaner to clean.

Check to ensure the wiring on the terminal of the instrument is firm. Pay attention to disconnect the AC or DC power before removing the wiring cover.

Check to determine display data of the instrument is normal or not.

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