COD01
Self-cleaning COD transmitter
User Manual

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1.Product description

Chemical oxygen demand (COD) is an indicator to measure the content of reducing substances in water, and the reducing substances in water are mainly organic substances, so chemical oxygen demand (COD) is often used as an indicator to measure the content of organic substances in water. The larger the COD, the more serious the water body is polluted by organic matter.

This product is a device for measuring the chemical oxygen demand (COD) of a solution. It adopts the ultraviolet absorption method without chemical reagents; the internal self-cleaning system is integrated to effectively prevent biological adhesion; the built-in temperature transmitter has automatic temperature compensation function; Modulate the light signal to reduce visible light interference; with a turbidity measurement, effectively compensate the influence of turbidity on COD measurement. It can be widely used in water treatment, aquaculture, environmental monitoring and other industries.

1.1 Features

- COD measurement range 0~500mg/L, turbidity measurement range 0~200NTU。
- Using modulated optical signals to reduce visible light interference。
- Dual optical path measurement to compensate for the influence of turbidity on COD measurement。
- Internal integrated self-cleaning system to effectively prevent biological fouling。
- RS485 communication interface: MODBUS RTU communication protocol can be easily connected to the computer for monitoring and communication。
- ModBus communication address can be set, baud rate can be modified。
- The equipment adopts wide voltage power supply, DC 12~30V can be used。

1.2 Equipment technical parameters

powered by	DC 12~30V	
Power consumption	0.6W（normal）； 1.8w（When the self-cleaning system works）	
Communication Interface	RS485; standard MODBUS-RTU protocol; communication baud rate: default 4800	
Measurement principle	Dual wavelength UV absorption	
Measuring range	COD	Turbidity
	0~500mg/L equiv.KHP	0~200NTU
Measurement error	COD	Turbidity
	±5%FS equiv.KHP（25℃）	±5%FS（25℃）
Measurement	COD	Turbidity

resolution	0.1mg/L	0.1NTU
temperature resolution	0.1℃	
temperature error	±0.5℃	
Repeatability	±1%FS equiv.KHP（25℃）	
Response time	≤20sec	
Equipment working conditions	0~40℃	
waterproof level	IP68	
flow rate	<3m/s	
Pressure resistance	＜0.1MPa	
electrode wire length	Default 5m, can be customized	
shell material	Corrosion-resistant plastic, stainless steel	
Recommended Maintenance and Calibration Frequency	3 months	
Self-cleaning system life	18 months	

1.3 product model

COD01-				Self-cleaning COD transmitter
	N01-			RS485（Modbus-RTU protocol）
		2-		Second generation shell
			500	Range 0~ 500mg/L equiv.KHP

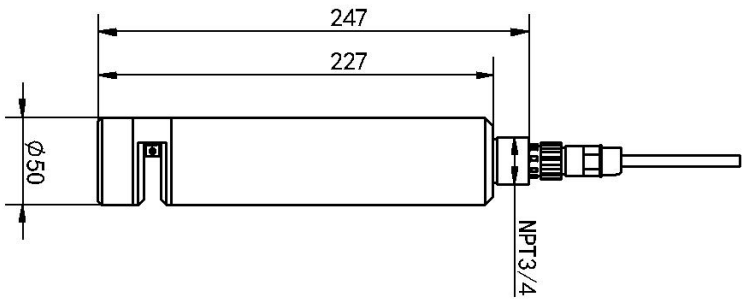
1.4 Product List

◆1 self-cleaning COD transmitter

◆5m cable

◆Certificate, Warranty Card, etc.

1.5 Equipment size



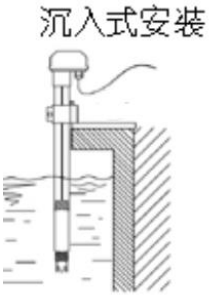
1.6 device installation

The device can be placed in any direction in the water, and the best placement direction is horizontal, which can reduce the impact of debris and foreign matter deposition in the water on the measurement.

When suspending the sensor, avoid the sensor hitting the wall or other water conservancy facilities due to water flow. If the water flow is fast, secure the sensor.

The equipment should be placed in the water without bubbles, and the depth of the installation equipment should not exceed 2 meters from the water surface. Considering the fluctuation of the water level, it is recommended to submerge the equipment below the minimum water level of 30cm.

With NPT3/4 thread, it can be used with our waterproof pipes. Thread the cable out of the pipe and screw the device into the waterproof pipe threads.



2. Equipment Instructions

2.1 Wiring Instructions

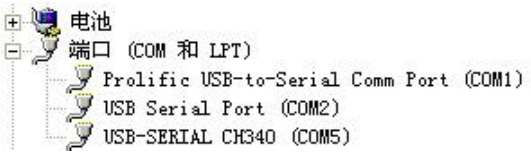
	illustrate	illustrate
power supply	brown	V+（10~30V DC）
	black	V-
communic ation	green	485-A
	blue	485-B

2.2 Parameter configuration description

Open the data package, select "Debugging Software"---"485 Parameter Configuration Software",turn up 

Just open it.

1) Select the correct COM port (check the COM port in "My Computer - Properties - Device Manager - Port"), the following figure lists the driver names of several different 485 converters.



2) Connect only one device and power it on, click the test baud rate of the software, the

software will test the baud rate and address of the current device, the default baud rate is 4800bit/s, and the default address is 0x01.

3) Modify the address and baud rate according to the needs of use, and at the same time, you can query the current functional status of the device.

4) If the test is unsuccessful, please re-check the equipment wiring and 485 driver installation.

2.3Calibration Instructions

2.3.1 Turbidity Calibration

1. Zero-point calibration: Take an appropriate amount of zero-turbidity solution in a beaker, place the transmitter vertically in the solution, and place the transmitter about 2cm away from the beaker. After the value is stable, perform zero-point calibration. Instructions refer to the register for details.

2. Slope calibration: Put the transmitter in the solution and place it in the 200NTU standard solution. After the value is stable, perform slope calibration. The instruction is detailed in the register.

2.3.2 COD calibration

1. KHP (Potassium hydrogen phthalate, C8H5KO4), CAS# 877-24-7 As a common stain in environmental research, it can be used for COD calibration.

2. Prepare standard solutions

①Accurately weigh 0.8503 g of KHP into a 1000 mL flask. Perfuse with distilled or deionized water until the highest mark. This solution is a COD solution with a concentration of 1000 mg/L.

②Put 200/300/400/500mL of this solution into a 1000mL flask, and then fill it with distilled water or deionized water to the highest scale. After shaking, the COD concentrations were 200/300/400/500 mg/L, respectively.

③ Store this concentrated standard solution (step 2.1) in a black glass bottle and store it at a low temperature to prevent its decomposition. Diluted standard solution (step

Step 2.2) needs to be used within 24 hours of preparation.

3. Calibration (5-point calibration)

①Put the transmitter into distilled water or deionized water, the transmitter electrode is submerged in the water for at least 2cm, and there are no air bubbles or obstructions blocking the light path. After the reading is stable, follow the instructions in the detailed register to perform zero calibration.

②Put the transmitter into the 200/300/400/500mg/L COD solution, respectively, and perform slope calibration according to the instructions in the detailed register after the reading is stable.

Note: When calibrating, first calibrate the turbidity, and then calibrate the COD.

WARNING: KHP is a carcinogenic risk, wear gloves when handling

2.4 Mod Bus Communication and register details

2.4.1Device Communication Basic Parameters

coding	8 bit binary
data bits	8 bits
parity bit	none
stop bit	1 person
error checking	CRC (Redundant Cyclic Code)
baud rate	Factory default is 4800bit/s

2.4.2Data Frame Format Definition

Adopt Modbus-RTU communication protocol, the format is as follows:

Initial structure ≥4 bytes of time

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error check = 16-bit CRC code

Time to end structure ≥ 4 bytes

Address code: It is the address of the transmitter, which is unique in the communication network (factory default 0x01).

Function code: the function instruction of the command sent by the host.

Data area: The data area is the specific communication data, pay attention to the high byte of the 16bits data first!

CRC code: two-byte check code.

2.4.3register address

register address	operate	illustrate
0x0000	0x03	COD value (mg/L; 16-bit unsigned integer, actual value*10)
0x0001	0x03	Temperature (℃; 16-bit signed integer, actual value*10)
0x0002	0x03	Turbidity (NTU; 16-bit unsigned integer, actual value*10)
0x0050	0x03/0x06	COD offset value (mg/L; 16-bit unsigned integer, actual value*10)
0x0051	0x03/0x06	Temperature offset value (℃; 16-bit signed integer, actual value*10)
0x0052	0x03/0x06	Turbidity offset value (NTU; 16-bit unsigned integer, actual value*10)
0x0060、0061	0x03/0x10	COD slope (float big endian)
0x0062、0063	0x03/0x10	Turbidity slope (float big endian)
0x0100、0101	0x10	COD calibration (Use 5-point calibration, write 0x0001 to 0x0100, write 0x000 to 0x0101, calibrate the zero point; write 0x0002-0x0005 to 0x0100, write the 2-5th point standard solution value*10 to 0x0101, calibrate the 2-5th point)
0x0120、0121	0x10	Turbidity Calibration (Use 2-point calibration, write 0x0001 to 0x012, write 0x000 to 0x0121, calibrate the zero point; write 0x0002 to 0x0120, write the 2nd point standard solution value*10 to 0x0121, calibrate the 2nd point)
0x1200	0x03/0x06	Cleaning interval (minutes; 6-6000 can be set, default 30)
0x1201	0x03/0x06	Number of cleaning laps (1 lap back and forth, 3 laps by default)

2.4.4Communication protocol example and explanation

Example 1: Read the current COD value, temperature and turbidity value of the device whose address is 01

send frame：

address code	function code	register address	register content	Check code low	Check code high
0x01	0x03	0x00 0x00	0x00 0x03	0x05	0xcb

Reply frame:

address code	function code	number of valid bytes	register content	Check code low	Check code high
0x01	0x03	0x06	0x00 0x0d 0x00 0xce 0x00 0x0e	0xec	0x8f

0x000d converted to decimal is 13, the value is 10 times the actual value, indicating that the COD concentration is 1.3mg/L

0x00ce converted to decimal is 206, the value is 10 times the actual value, indicating that the temperature is 20.6 ℃

0x000e converted to decimal is 14, the value is 10 times the actual value, which means the turbidity is 1.4ntu

Example 2: Setting the deviation value

Take setting the temperature deviation value as an example:

Sending frame: set a deviation value of 1° C to the device whose address code is 1

Writing 10 to the 0x0051 register translates to 000a in hex

address code	function code	register address	register content	Check code low	Check code high
0x01	0x06	0x00 0x51	0x00 0x0a	0x58	0x1c

Response frame: (according to the MODBUS standard, the response is a mirrored message of the delivered frame)

address code	function code	register address	register content	Check code low	Check code high
0x01	0x06	0x10 0x22	0x27 0x97	0x77	0x5e

Example 3: Setting the slope

Each output data value = (actual data - deviation value) * slope

Take the COD slope as an example:

If the standard solution of 200mg/L is measured and the value after the deviation value has been set is 150.0mg/L, then write 200/150=1.3333 to the 0x0060, 0x0061 registers... Convert to a floating-point big endian value of 3faaaaab

Send frame:

address code	function code	register address	register length	length in bytes	register content	Check code low	Check code high
0x01	0x10	0x00 0x60	0x00 0x02	0x04	0x3f 0xaa 0xaa 0xab	0xe6	0xac

Response frame: (according to the MODBUS standard, the response is a mirrored message of the delivered frame)

address code	function code	register address	register length	Check code low	Check code high
0x01	0x10	0x00 0x60	0x00 0x02	0x88	0x19

Example 4: COD calibration

Zero calibration:

After the sensor is in the 0-point standard solution, after the value is stable, use the 0x10 function code to write 0x0001 to the 0x0100 register, and write 0x0000 to the 0x0101 register to calibrate the 0 point

Send frame:

address code	function code	register address	register length	length in bytes	register content	Check code low	Check code high
0x01	0x10	0x01 0x00	0x00 0x02	0x04	0x00 0x01 0x00 0x00	0xaf	0xff

Response frame: (according to the MODBUS standard, the response is a mirrored message of the delivered frame)

function code	function code	register address	register length	Check code low	Check code high
0x01	0x10	0x01 0x00	0x00 0x02	0x40	0x34

The remaining 4 points of calibration:

Taking point 2 as an example, after the sensor is in the 200mg/L standard solution, after the value is stable, use the 0x10 function code to write 0x0002 to the 0x0100 register, and write 200*10=2000 to the 0x0101 register to convert it to hexadecimal as 0x07d0 for calibration.

Send frame:

address	function	register addre	register lengt	length in b	register content	Check code l	Check code h

code	code	ss	h	ytes		ow	igh
0x01	0x10	0x01 0x00	0x00 0x02	0x04	0x00 0x02 0x07 0xd0	0x5c	0x53

Response frame: (according to the MODBUS standard, the response is a mirrored message of the delivered frame)

address c ode	function code	register addr ess	register length	Check code lo w	Check code hig h
0x01	0x10	0x01 0x00	0x00 0x02	0x40	0x34

Example 5: Turbidity Calibration

After the sensor is in the 0-point standard solution, after the value is stable, use the 0x10 function code to write 0x0001 to the 0x0100 register, and write 0x0000 to the 0x0101 register to calibrate the 0 point

Send frame:

address code	function code	register addre ss	register lengt h	length in b ytes	register content	Check code l ow	Check code h igh
0x01	0x10	0x01 0x20	0x00 0x02	0x04	0x00 0x01 0x00 0x00	0x5e	0x4b

Response frame: (according to the MODBUS standard, the response is a mirrored message of the delivered frame)

address c ode	function code	register addr ess	register length	Check code lo w	Check code hig h
0x01	0x10	0x01 0x20	0x00 0x02	0x41	0xfe

After the sensor is stabilized in the 200ntu standard solution, use the 0x10 function code to write 0x0002 to the 0x0120 register, and write 200*10=2000 to the 0x0101 register to convert it to hexadecimal as 0x07d0 for calibration

Send frame:

address code	function code	register addre ss	register lengt h	length in b ytes	register content	Check code l ow	Check code h igh
0x01	0x10	0x01 0x20	0x00 0x02	0x04	0x00 0x02 0x07 0xd0	0x5e	0x4b

Response frame: (according to the MODBUS standard, the response is a mirrored message of the delivered frame)

address c ode	function code	register addr ess	register length	Check code lo w	Check code hig h

0x01	0x10	0x01 0x20	0x00 0x02	0x41	0xfe

3.Precautions and maintenance

- When the equipment has obvious failure, please do not open it to repair it by yourself, and contact us as soon as possible!
- The device contains sensitive optical components and electronic parts, make sure that the device is not subjected to severe mechanical impact.
- Try to avoid too tight or stress on the cables when installing the equipment.
- Avoid exposure of the device to sunlight.
- Please do not touch the measurement window with your hands.
- Avoid damage to the measurement window.
- When measuring and calibrating the device, avoid air bubbles adhering to the surface of the device, especially the measurement window.
- Avoid applying any mechanical stress directly to the device during use.
- Do not forcibly rotate the self-cleaning brush shaft.
- Regularly check the measuring window for attachments and scaling; it can be washed with tap water and wiped with a damp soft cloth. For some stubborn dirt, you can add some household detergent to tap water to clean it. Do not scratch the measurement window.
- Regularly check whether the self-cleaning brush is working properly and whether it is damaged.
- Periodically calibrate the equipment according to the actual situation.
- If the measured value is too high, too low or the value is continuously unstable, please check whether the measuring window of the transmitter is clean.
- The self-cleaning device has been used continuously for 18 months, and it needs to be returned to the factory to replace the dynamic sealing device (the actual time can be appropriately increased or decreased according to the actual frequency of self-cleaning).
- The equipment should be calibrated before each use. It is recommended to calibrate every 3 months for long-term use. The calibration frequency should be adjusted according to different application conditions (the degree of dirt in the application, the deposition of chemical substances, etc.).