Transmitter User Manual

COD SENSOR

COD-210

Foreword

Dear customers:

You are welcome to use our products!

To make you have a general understanding of our products and facilitate your use, we have specially configured this user manual for you. The content includes the characteristics of the product,

Size drawing, technical parameters, installation attention and cable definition, product calibration, maintenance and precautions, quality assurance, etc., are your essential guidelines when using this product.

Before using it, please read the user manual carefully, I believe it will be of great help to you to use the product effectively. In addition, in the process of use, if you have any problems, please call, letter consultation, we will be dedicated to your service.

Product Feature

COD-210 is a new UV254 COD sensor launched by our company. It utilizes the ultraviolet absorption method and incorporates years of industry application development experience. The sensor features a compact design, integrated self-cleaning function, and anti-corrosion surface treatment.With fast response and analysis speed, it requires no chemical reagents. Equipped with imported deep ultraviolet UV LED cold light sources, it ensures long service life for measurement. Additionally, the 550nm compensation light source effectively eliminates interference from turbidity and chromaticity, delivering higher reliability.

Features：

1.Digital sensor， Direct output Rs-485 digital signal, Support MODBUS/RTU

2.Double optical path measurement; 254nm and 550nm compensated light sources to eliminate the influence of turbidity and chromaticity

3.Imported UV254 LED cold light source， Long life and small drift; Filter design, low interference, stable

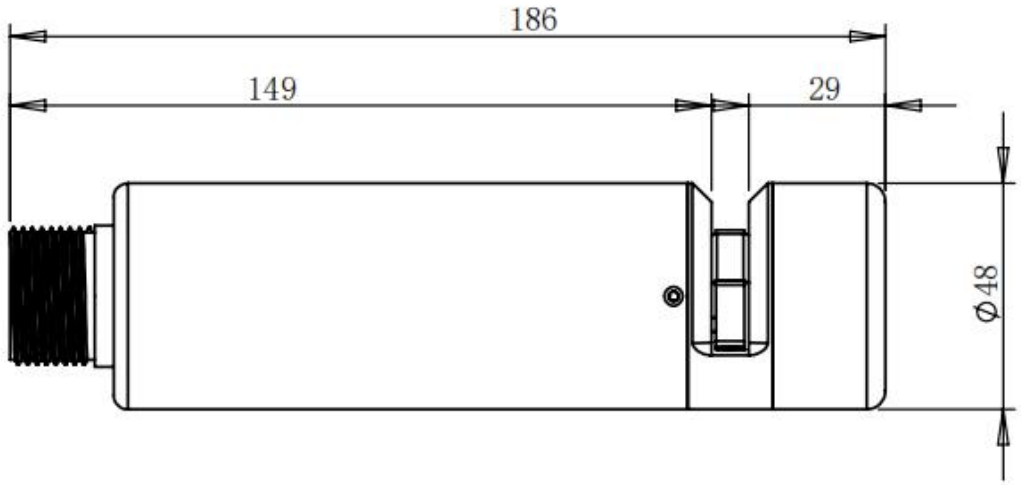
4.COD TOC turbidity and temperature can be measured without chemical reagent and sample digestion

5.Compact size, internal integrated automatic cleaning brush, effectively prevent biological attachment

6.The surface shall be treated with anti-corrosion spraying

7.Low power consumption sensor, internal circuit anti - interference design

Dimension



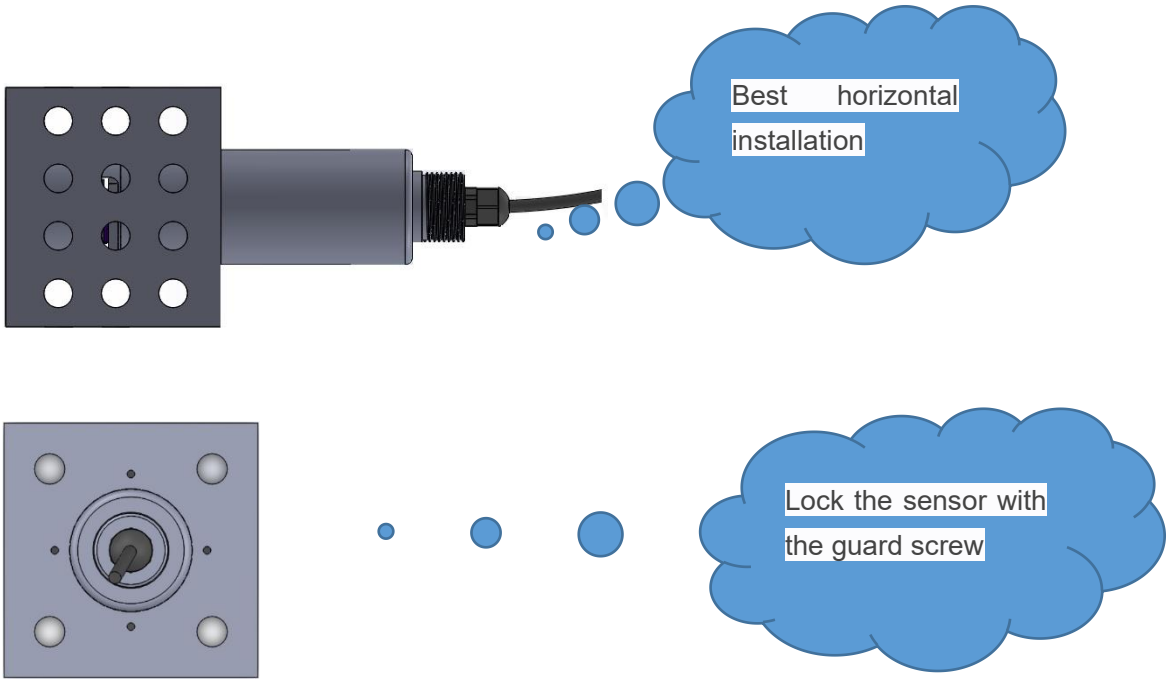
Technical Parameters

Name	Argument
Output signal	Rs-485 and MODBUS/RTU protocols are supported
Measurement method	UV 254 dual wavelength ultraviolet absorption method
COD range	0.3 ~ 100mg/L equiv. KHP 0.3 ~ 370mg/L equiv. KHP 0.3 ~ 500mg/L equiv. KHP
COD accuracy	±5%F.S. equiv. KHP
COD resolution	0.1mg/L equiv. KHP
Turbidity range	0 ~ 100NTU
Repeatability	±1%F.S. equiv. KHP
Working condition	0.1 ~ 50℃、<0.1MPa
Calibration mode	Two-point calibration
Response time	Ten seconds T90
Power source	12VDC±10%, 15mA; 200mA brush rotation
Dimension	Diameter 48mm; Length 186mm; Optional protective cover
Class of protection	IP68, water depth of 10m
Velocity of flow	Less than 3m/s
Service life	Sensor 3 years or more, brush system 18 months or more
Cable length	10m(default), customizable
Sensor housing material	316L, quartz glass
Maintenance and calibration frequency	Sensor 3 months, cleaning brush 6 months

Installation note and cable definition

1. Set Up

- Avoid collision during sensor installation; Avoid back and forth shaking during measurement. If the water flows rapidly in the monitoring area, the sensor shall be fixed .
- When the sensor is installed and measured, it must be installed laterally to avoid foreign matter deposition in the measurement and monitoring window, resulting in inaccurate measurement data.
- If the measuring area has a lot of sticks attached to it, which is easy to jam the rotating shaft of the cleaning brush and cause the sensor to be stuck, then the protective cover shall be selected for protection installation, as shown in the figure below.



- The sensor shall be installed with a depth of not more than 2m from the water surface; The sensor is immersed below 30cm.
- The sensor is installed in the area with slow flow and no bubbles.

Installation note and cable definition

2. Electrical Connection

- Brown line—power line（12VDC±10%）
- Black line—Ground wire（GND）
- Blue line—485A
- White line—485B
- Bare wire—Shielding Layer

Sensor cable： 4 line AWG-24 or AWG-26 shielded line.

OD：6.0-6.2mm；Bendable double stranded shielded cable

Calibration

1. Turbidity calibration

1.1 Zero point calibration: take an appropriate amount of zero turbidimetric solution from a beaker and place the sensor vertically in the solution. The sensor is about 2cm away from the beaker. After the value is stabilized for about 1 minute, zero-point calibration instructions shall be given in accordance with the appendix

1.2 Slope calibration: the sensor is placed in the solution in 100NTU standard solution, about 1 minute after the value stabilizes, the slope calibration instruction is carried out according to the appendix

2. COD Calibration

2.1 KHP(potassium hydrogen phthalate, C8H5KO4) , CAS# 877-24-7 as a common dye used in environmental research, it can be used for COD calibration。

2.2 Preparation of standard liquid

①Accurately weigh 0.8503g of KHP into a 1000mL flask. Filled with distilled or deionized water up to the highest scale. This liquor is 1000mg/L concentration COD liquor.

②Get 100 mL of the liquor into a 1000 mL flask and fill the flask up to the highest scale with distilled or deionized water. After mixing well, the COD concentration was 100mg/L.

③Store the concentrated standard solution in a black glass bottle (Step 2.1) and store it at a low temperature to prevent its decomposition and dilution (Step 2.2). Use within 24 hours after preparation

2.3 Calibration (Two calibration)

①Put the sensor into distilled water or deionized water. The sensor electrode is immersed in water for at least 2cm, and there is no bubble occlusion to block the light path. After the number shown is stable, perform zero calibration according to the command in the appendix。

②Put the sensor into the100mg/L COD solution, and conduct slope calibration according to the command in the appendix after the number shown is stable

Note: During calibration, turbidity should be calibrated first and COD should be calibrated again。

Warning: KHP has cancer risk, please wear gloves when operating

Maintenance and precautions

1. Maintain

- Measuring window: Check whether the measuring window is attached or not; Wipe the window with a wet dust-free cloth; If scale is difficult to wipe, use clean cloth with washing solution; Or use diluted hydrochloric acid to wipe. Use diluted hydrochloric acid to avoid direct contact with hands.
- Cleaning brush: prevent foreign matter from blocking the rotation stroke of the cleaning brush, ensure that there is no foreign matter blocking the rotation shaft; If there are more branches attached at the monitoring place, it is necessary to consider selecting a protective cover for protection installation. Contact the sales staff of the company for additional matching Cleaning brush: prevent foreign matter from blocking the rotation stroke of the cleaning brush, ensure that there is no foreign matter blocking the rotation shaft; If there are more branches attached at the monitoring place, it is necessary to consider selecting a protective cover for protection installation. Contact the sales staff of the company for additional matching.
- Outer surface of sensor: regularly clean the surface attachments, which can be cleaned with washing solution.
- Automatic cleaning continuous use for 18 months, need to return to the factory to replace the dynamic sealing device.

2. Notes

- Measurement window: the scratch measurement and monitoring window for sharp objects cannot be used; Avoid bubble attachment during monitoring and measurement.
- Automatic cleaning brush: do not forcibly rotate the cleaning brush spindle.
- Installation note: the sensor should be installed laterally to avoid foreign body deposition in the measurement and monitoring window; In the monitoring and measurement area, such as branches and other foreign bodies easily block to the rotating shaft, the protective cover should be selected as far as possible for protection installation

3. Others

Problems	Probable cause	solution
The interface cannot connect or does not display the measurement results	The cable connection is wrong	Check wiring mode
	Incorrect sensor address	Check the address for errors
The measured value is too high or too low or the value is continuously unstable	The sensor window is attached to the external object	Clean sensor window surface
	Sensor self-cleaning damage	Contact the after-sales

Quality and service

1. Quality assurance

Thank you for choosing our product!

Since its establishment, our company has been positioning product quality as the core of the company to participate in the market competition.

According to the product quality requirements, the company has established a strict quality inspection system. The company has strictly controlled and managed all the links related to product quality, established scientific inspection procedures, and quantified the inspection indicators, and assigned the responsibility to the people to ensure the company continuous and stable production of qualified products. The company strictly checks the raw materials, puts an end to the three products, selects the products of domestic and foreign famous brand manufacturers, establishes strict product process indicators, and establishes a good supply and demand relationship with the supplier.

Our company has established a regular staff quality training system, learn new knowledge and information of quality management, establish the quality awareness of each employee, standardize their own behavior, from a solder joint, a wire, to a whole machine to do meticulous, excellence. The quality inspection department has established standard inspection procedures, with advanced and perfect testing equipment and means, and strictly in accordance with the procedures of inspection, make every link of product quality testing, do not let a unqualified product leave the factory.

Our company provides the local after-sales service within one year from the sales date, but it does not include the damage caused by improper use. For maintenance or adjustment, please send it back, but the freight should be paid by yourself.

2. Accessories and Spare Parts

Explain	Quantity (pcs)
Sensor	1
Instructions	1
Certificate	1
Protective cover	1 (Optional)

Data communication

1.Modbus

Modbus protocol is a general communication protocol which has been widely used in today's industrial control field. Through this protocol, controllers can communicate with each other or with other devices via a network (such as Ethernet). Modbus protocol uses master-slave communication technology, that is, the master device actively queries and operates the slave device

A)The master sends a request to the slave

B)The request from the master device is analyzed and processed by the slave device, and the result is sent to the master device

C)If anything goes wrong, an exception function code is returned from the device

Modbus RTU Communication mode frame format

Device Address	**Function Code**	Data	CRC low byte	CRC high byte
8bit	8bit	n*8bit	8bit	8bit

- Use RTU mode, the message is sent at least to begin with a pause interval of 3.5 characters time transmission equipment is the first domain address bus network equipment continuously detect network, including pause when the first interval time domain (domain) to receive, every device decodes to determine whether to own after the last transmission character, a pause at least 3.5 characters time calibration for the end of the message of a new message can be started after the pause.
- The entire message frame must flow as a continuous stream. If there is a pause of more than 1.5 characters before the frame completes, the receiving device refreshes the incomplete message and assumes that the next byte is the address field of a new message.

2.Information frame format

The default data format of Modbus communication for this sensor is:

MODBUS-RTU	
Baud	9600（Default）
Device Address	1（Default）
data bits	8bits
Parity	nothing
stop bits	1bit

a) Function Code 03H: Read register value

The host sends

1	2	3	4	5	6	7	8
ADR	03H	Start register high byte	Start register low byte	High register number in bytes	Low register count	CRC low byte	CRC high type

1 byte ADR：Address code of the slave machine（=001~254）

2 byte 03H：Read register value function code

3、4 byte：Start address of the register to read

Read the FCC downlink meter，

5、6 byte：Number of registers to read

7、8 byte：CRC16 checksum from bytes 1 through 6

The host sends：

1	2	3	4、5	6、7		M-1、M	M+1	M+2
ADR	03H	Total bytes	data register1	data register2	……	data register M	CRC low byte	CRC high byte

1 byte ADR：Address code of the slave machine（=001~254）
2 byte 03H：Read register value function code
3 byte ：The total number of bytes from 4 to M(including 4 and M)
4 to M byte： data registers
M+1、M+2 byte：CRC16 checksum from byte 1 to M

When an error is received from the slave, send it back from the slave：

1	2	3	4	5
ADR	83H	information code	CRC low byte	CRC high byte

1 byte ADR：Address code of the slave machine（=001~254）
2 byte 83H：Error reading register value
3 byte information code：01 – Function code wrong
03 – SET DATA ERR
4、5 byte：CRC16 checksums from bytes 1 through 3

b) **Function Code**06H: Write a single register value

The host sends

1	2	3	4	5	6	7	8
ADR	06	Register	Register	High byte	Low byte	CRC Code	CRC Code

		high byte address	low byte address	of data	of data	the low byte	the high byte

When the slave receives correctly, the slave sends back：

1	2	3	4	5	6	7	8
ADR	06	Register high byte address	Register low byte address	High byte of data	Low byte of data	CRC Code the low byte	CRC Code the high byte

When the slave receives an error, the slave sends back：

1	2	3	4	5
ADR	86H	Error code information code	CRC Code the low byte	CRC Code the high byte

1 byte ADR：Address code of the slave machine（=001~254）

2 byte 86H：Write register value error function code

3 byte Error code information code：01 – Function code wrong

03 – SET DATA ERR

4、5 byte：CRC checksums from bytes 1 to 3

3.Data structure types

integer

unsigned short

The data consists of two integers

XXXX XXXX	XXXX XXXX
Byte1	Byte0

float

Float，IEEE 754(single precision)；

The data consists of 1 symbol bit, 8-bit exponent, and a 23-bit mantissa

XXXX XXXX		XXXX XXXX	XXXX XXXX	XXXX XXXX
Byte3		Byte2	Byte1	Byte0
sign bit	Exp Index place		F decimal place	

4.Register address

Register address

Register address	**Name**	**Read/ Write**	**Explanation**	**Number of registers (byte)**	**Data type**
0x0100	Temperature value	R	℃ value x10 （e.g :25.6 temperature display as 256, default 1 decimal。）	1 (2Byte)	unsigned short
0x0101	COD value	R	mg/L value x10(e.g:16.2mg/L of COD displayed as 162, the default is 1 decimal place)	1 (2Byte)	unsigned short
0x0102	TOC value	R	mg/L value x10(e.g: 22.3mg/L of TOC displayed as 223, the default is 1 decimal place)	1 (2Byte)	unsigned short
0X0105	turbidity value	R	NTU value x10 （e.g: the turbidity of 10NTU is 100, and the default is 1 decimal place。）	1 (2Byte)	unsigned short
0x0107	humidity measurement	R	%RH value x10 （For example :11.3% relative humidity display is 113, default 1 decimal）	1 (2Byte)	unsigned short
0x1000	temperature correction	R/W	Temperature calibration: write the data as the actual temperature value x10; The readout data is the temperature calibration offset x10	1 (2Byte)	unsigned short

0x1001	COD zero calibration	R/W	The calibration value data 0 written during the calibration in deionized water; The data read out is the zero offset （It can also be calibrated in 0-20mg/L of COD standard solution. The calibration way can take slope of calibration for reference.）	1 (2Byte)	unsigned short
0x1002	Zero Turbidity zero calibration	R/W	The calibration value data written in zero turbidity water is 0; The data read out is the zero offset	1 (2Byte)	unsigned short
0x1003	COD The slope of calibration	R/W	It can also be calibrated in 20-200mg/L of standard solution. The written calibration value is the value of the standard liquid concentration x10. The reading value is slope of calibration x1000.	1 (2Byte)	unsigned short
0x1004	Turbidity slope calibration	R/W	The calibration value data that can be written in the standard solution of 20-200NTU is the value of the standard solution concentration x10. The reading is going to be the slope x1000	1 (2Byte)	unsigned short
0x1100	sensing switch	W	Turn the sensor measurement function on or off. Turn off the measurement when the written data is 0; Turn on the measurement when the write data is 1. When the sensor is powered on, it is considered open by default	1 (2Byte)	unsigned short
0x2000	address sensor	R/W	The default is 1, and the data range is 1-127	1 (2Byte)	unsigned short
0x2003	Baud rate setting	R/W	Default is 9600 write 0 is 4800; Write 1 as 9600; Write 2 as 19200	1 (2Byte)	unsigned short

0x2020	Factory Reset	W	The calibration value is restored to the default value and the written data is 0. Note that the sensor needs to be calibrated again before it can be used after reset	1 (2Byte)	unsigned short
0x3000	Automatic cleaning interval setting	R/W	The default is 30 minutes and the data range is 6-6000 minutes	1 (2Byte)	unsigned short
0x3001	Automatic cleaning number setting	R/W	The default is 3 laps and the data range is 1~6 laps	1 (2Byte)	unsigned short

5.Example command

Default register:

a) **Change slave address:**

Address:0x2000

Number of registers: 1

Function Code: 0x06

Default sensor address: 01

Change the Modbus device address of the sensor and change the device address 01 to 06, as shown below:

Send instructions: 01 06 20 00 00 06 02 08

Response: 01 06 20 00 00 06 02 08;

Note: Change the address to 06, save after power off。

b) **Baud:**

Address: 0x2003

Number of registers: 1

Function Code：0x06

Default： 1（9600bps）

Support value：0-2（4800-19200bps）

Baud rate can be set to change the upper computer, after the change of baud rate, power off and save the Settings.

The baud rate supports 4800,9600,19200. The baud rate assigned for integer values is as follows:：

Integer	Baud
0	4800 bps
1	9600 bps
2	19200 bps

Send instructions：01 06 20 03 00 02 F3 CB

Response：01 06 20 03 00 02 F3 CB

Note：Change the baud rate to 19200bps, save when power is lost.

Function Register：

a) **PS-ON：**

Address：0x1100

Number of registers：1

Function Code：0x06

Power on defaults to the measurement state, write 0 to turn off the sensor measurement function, write 1 to turn on the sensor measurement.

Send instructions：01 06 11 00 00 01 4D 36

Response：01 06 11 00 00 01 4D 36；

Note：Set to start measuring when power on, save when power off.

b) **Temperature instruction：**

Address：0x0100

Number of registers：1

Function Code：0x03

Read sample values：19.2℃

Send instructions：01 03 01 00 00 01 85 F6

Response：01 03 02 00 C0 B8 14

Returns hexadecimal unsigned integer data， Temperature value=Integer/10,keep 1 decimal place.

c) **Measure COD value instruction：**

Address：0x0101

Number of registers：1

Function Code：0x03

Read sample values：30.0mg/L

Send instructions：01 03 01 01 00 01 D4 36

Response：01 03 02 01 2C B8 09

Register returns hexadecimal unsigned integer data，COD value=Integer/10,keep 1 decimal place.

d) **Read temperature and COD value instructions continuously：**

Address：0x0100

Number of registers：2

Function Code：0x03

Read sample values：19.2℃ and COD 30.0mg/L

Send instructions：01 03 01 00 00 02 C5 F7

Response：01 03 04 00 C0 01 2C FA 42

Register returns hexadecimal unsigned integer data， Temperature value=Integer/10,keep 1 decimal place.

Register returns hexadecimal unsigned integer data，COD=Integer/10,keep 1 decimal place

e) **Humidity measurement instruction：**

Address：0x0107

Number of registers：1

Function Code：0x03

Read sample values：relative humidity40%

Send instructions：01 03 01 07 00 01 34 37

Response：01 03 02 01 90 B9 B8

Register returns hexadecimal unsigned integer data， Humidity=Integer/10，keep 1 decimal place.

f) **Calibration instructions：**

temperature correction

Address：0x1000

Number of registers：1

Function Code：0x06

Calibration sample：Calibration at 25.8℃

Send instructions：01 06 10 00 01 02 0D 5B

Response：01 06 10 00 01 02 0D 5B

The sensor needs to be calibrated in a constant temperature environment without temperature fluctuation

COD zero calibration

Address：0x1001

Number of registers：1

Function Code：0x06

Calibration sample：Calibration in distilled or deionized water

Send instructions：01 06 10 01 00 00 DC CA

Response：01 06 10 01 00 00 DC CA

COD The slope of calibration

Address：0x1003

Number of registers：1

Function Code：0x06

Calibration sample： Calibrate in 100mg/L COD solution

Send instructions：01 06 10 04 03 E8 7D B4

Response：01 06 10 04 03 E8 7D B4

Turbidity Zero calibration

Address：0x1002

Number of registers：1

Function Code：0x06

Calibration sample：Calibration in zero turbidity deionized water

Send instructions：01 06 10 02 00 00 2C CA

Response：01 06 10 02 00 00 2C CA

Turbidity slope calibration

Address：0x1004

Number of registers：1

Function Code：0x06

Calibration sample：Calibration in 100NTU turbidity solution

Send instructions：01 06 10 03 03 E8 CC 75

Response：01 06 10 03 03 E8 CC 75

Automatic cleaning interval

Address：0x3000

Number of registers：1

Function Code：0x06

Calibration sample：The default cleaning interval is 30 minutes. Change the cleaning interval to 60 minutes

Send instructions：01 06 30 00 00 3C 86 DB

Response：01 06 30 00 00 3C 86 DB

Automatic cleaning winding number setting

Address：0x3001

Function Code：0x06

Calibration sample：The default number of cleaning turns is 3. Change the number of cleaning turns to 6

Send instructions：01 06 30 01 00 06 57 08

Response：01 06 30 01 00 06 57 0