



Inline Conductivity Sensor User Manual



User Notes

- Please read this manual carefully before use and keep it for future reference.
- Please follow the operating procedures and precautions in this manual.
- Upon receiving the instrument, carefully open the package and inspect the instrument and accessories for any damage during transportation. If any damage is found, notify the manufacturer and distributor immediately and keep the packaging for return shipment.
- If the instrument fails, do not repair it by yourself. Please contact the manufacturer's service department directly.

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I. Application Environment

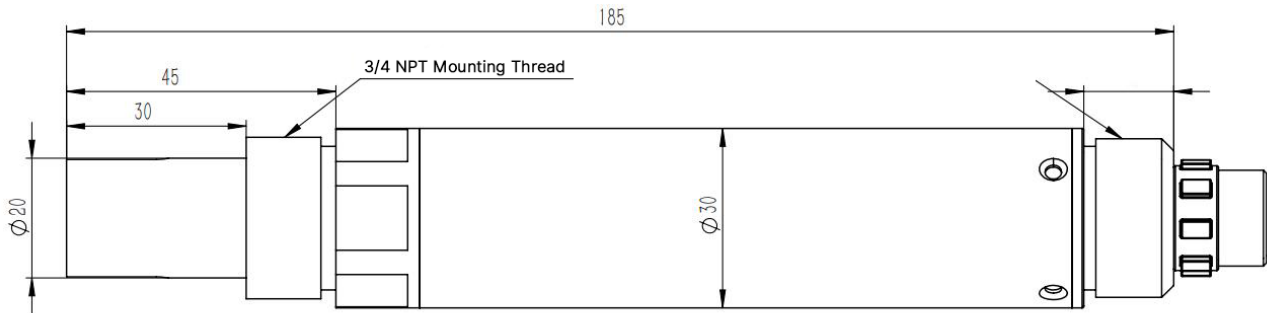
- Drinking water / surface water / various water supply / industrial water treatment
- Signal output: supports RS-485, Modbus RTU protocol, and 4-20 mA current output
- Convenient connection to third-party equipment such as PLC, DCS, industrial control computers, general controllers, paperless recorders, and touch screens.
- Immersion installation with 3/4 NPT thread, convenient for immersion installation or installation in pipes and tanks.
- IP68 protection; suitable for water depths up to 60 m.

II. Technical Performance and Specifications

1. Technical Parameters

Model	ATO-DDM-406-S	
Measurement principle	Contact electrode method	
Range and resolution	0-200 mS/cm	0.01 mS/cm
Accuracy	±1.5%	
Response time (T90)	<10 s	
Minimum detection limit	0.01 mS/cm (0-200 mS/cm)	
Calibration method	Two-point calibration	
Cleaning method	/	
Temperature compensation	Automatic temperature compensation (Pt1000)	
Output method	RS-485 (Modbus RTU), 4-20 mA	
Storage temperature	-5-65°C	
Operating conditions	0-45°C, ≤0.6 MPa	
Housing material	316L	
Installation method	Submersible installation, 3/4 NPT	
Power consumption	0.7 W @ 12 V	
Power supply	12-24 V DC	
Protection rating	IP68	

2. Dimensional Drawing



Note: The sensor connector is a male M16-5-core waterproof connector.

III. Installation and Electrical Connection

1. Installation

Note: During installation and testing, keep the sensor at least 2 cm from the bottom and side walls of the container.

2. Electrical Connection

The cable is a 5-core twisted-pair shielded cable. The wire sequence is defined as follows:

- Red wire - power positive (12-24 VDC)
- Black wire - power negative (GND)
- Blue wire - 485A
- White wire - 485B
- Yellow wire - current output (leave floating if unused)

Carefully check the wiring sequence before power-on to avoid unnecessary losses caused by incorrect wiring.

Wiring instructions:

Considering that the cable may be immersed in water (including seawater) for a long time or exposed to air, all wiring points must be waterproofed, and the user-side cable should have a certain level of corrosion resistance.

IV. Maintenance

1. Use and Maintenance

Conventional electrodes require periodic cleaning and calibration. The maintenance interval should be determined by the customer according to operating conditions. Cleaning method for conventional electrodes: remove attached matter with a soft brush (avoid scratching the electrode surface), rinse with distilled water, and then perform calibration.

2. Calibration

a) Zero Calibration

Rinse the sensor with distilled water and blot the liquid dry with filter paper. Power on the sensor and place it vertically in air for about 3 minutes. After the value stabilizes, perform zero calibration. See the appendix for calibration commands.

b) Slope Calibration

Place the sensor vertically in a standard solution (10% of full scale to full scale). Keep the sensor at least 2 cm from the bottom and side walls of the container, and then perform slope calibration. See the appendix for calibration commands.

V. Quality and Service

1. Quality Assurance

- The quality inspection department has standardized inspection procedures, advanced and complete testing equipment and methods, and strictly performs inspections according to the procedures. Products undergo a 72-hour aging test and stability test, and no unqualified product is allowed to leave the factory.
- The receiving party may directly return any product batch with a failure rate reaching 2%, and all costs incurred shall be borne by the supplier. The inspection standard refers to the product description provided by the supplier.
- Ensure supply quantity and shipping speed.

2. Accessories and Spare Parts

This product includes:

- 1 sensor
- 1 copy of the manual
- 1 certificate
- 1 cable (5 m)

3. After-sales Service Commitment

The company provides after-sales service for this instrument within one year from the date of sale, excluding damage caused by improper use. If repair or adjustment is required, please return the instrument at your own shipping cost. Ensure that the package is in good condition before return to avoid damage during transportation. The company will repair instrument damage free of charge.

Appendix Data Communication

1. Data Format

The default data format for Modbus communication is: 9600, n, 8, 1 (baud rate 9600 bps, 1 start bit, 8 data bits, no parity, 1 stop bit).

2. Information Frame Format (xx represents one byte)

a) Read Data Instruction Frame

02	03	xx	xx	xx	xx	xx	xx
Address	Function code	Register address		Number of registers			

CRC check code (low byte first)

b) Read Data Response Frame

02	03	xx	xx.....xx	xx	xx
Address	Function code	Bytes	Response data		

CRC check code (low byte first)

c) Write Data Instruction Frame

02	06	xx	xx	xx	xx	xx	xx
Address	Function code	Register address	Write data				

CRC check code (low byte first)

d) Write Data Response Frame (same as write data instruction frame)

02	06	xx	xx	xx	xx	xx	xx
Address	Function code	Register address	Write data				

CRC check code (low byte first)

3. Register Address

Register address	Name	Description	Regs. (bytes)	Access
40001 (0x0000)	Value + temp.	Four double-byte integers: measured value, decimal places of measured value, temperature value, and decimal places of temperature value.	4 (8 bytes)	Read
40081 (0x0050)	Value + temp.	Two single-precision floating-point numbers (CDAB): measured value and temperature value.	4 (8 bytes)	Read
44097 (0x1000)	Zero calibration	Calibrate in air. The written data is 0; the read data is the zero calibration offset.	1 (2 bytes)	Write/Read
44101 (0x1004)	Slope calibration	Calibrate in a known standard solution (10% of full scale to full scale). Write the actual standard solution value x100; read slope value x1000.	1 (2 bytes)	Write/Read
44113 (0x1010)	Temp. calibration	Calibrate in solution. Written data is actual temperature x10; read data is temperature calibration offset x10.	1 (2 bytes)	Write/Read
48195 (0x2002)	Sensor address	Default: 2. Data range: 1-254.	1 (2 bytes)	Write/Read
48196 (0x2003)	Baud rate	Default: 9600. 0--9600, 1--19200.	1 (2 bytes)	Write/Read

4. Command Example

a) Measurement Command:

Function: Read the conductivity and temperature values measured by the sensor; the unit of temperature is °C, and the unit of conductivity is mS/cm.

Request frame: 02 03 00 00 00 04 44 3A

Response frame: 02 03 08 00 D5 00 02 00 E7 00 01 16 69

Reading example:

Conductivity value	Temperature value
00 D5 00 02	00 E7 00 01

For example: Conductivity value 00 D5 indicates the hexadecimal conductivity reading; 00 02 indicates that the conductivity value has two decimal places (the decimal point depends on the range). Converted to decimal, the value is 2.13.

Temperature value 00 E7 indicates the hexadecimal temperature reading; 00 01 indicates that the temperature value has one decimal place. Converted to decimal, the value is 23.1.

Request frame: 02 03 00 50 00 04 44 2B

Response frame: 02 03 08 51 EC 40 08 CC CD 41 B8 02 21

Reading example:

Conductivity value	Temperature value
51 EC 40 08	CC CD 41 B8

For example: Conductivity value "51 EC 40 08" is parsed in CDAB order as 2.13.

Temperature value "CC CD 41 B8" is parsed in CDAB order as 23.1.

b) Calibration Command:

a) Zero Calibration

Function: Set the conductivity zero calibration value of the sensor; zero calibration is performed in air.

Request frame: 02 06 10 00 00 00 8D 39

Response frame: 02 06 10 00 00 00 8D 39

Slope Calibration

Function: Set the conductivity slope calibration value of the sensor. Calibration is performed in an 80 mS/cm standard solution, and the written data is based on the actual standard solution value.

Request frame: 02 06 10 04 1F 40 C5 38

Response frame: 02 06 10 04 1F 40 C5 38

c) Set Device ID Address:

Function: Set the sensor's Modbus device address.

Change the sensor address from 02 to 01. The example is as follows:

Request frame: 02 06 20 02 00 01 E2 39

Response frame: 02 06 20 02 00 01 E2 39

5. Error Response

If the sensor cannot correctly execute the host computer command, it will return information in the following format:

Definition	Address	Function code	CODE	CRC check
Data	ADDR	COM+80H	xx	CRC 16
Bytes	1	1	1	2

a) CODE: 01 - Function code error

03 - Data error

b) COM: Received function code