

OXYSERIES- Dissolved oxygen digital sensor

CLOUD

Support the Internet of Things
Base on RS-485
MODBUS partially compatible
Step onto Industrial 4.0



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1. Product introduction

The primary battery dissolved oxygen digital sensor is a new generation of intelligent water quality detection digital sensor independently developed by InStore-OXY Series. It can check, calibrate, maintain through mobile phone or computer. It's easy to maintenance, with high stability and good repeatability. Its' function it to test the DO value and temperature of liquid. It is widely used in waste water treatment, purified water, circulating water, boiler water and other systems as well as continuous monitoring of dissolved oxygen values in solutions such as electronics, aquaculture, food, printing and dyeing, electroplating, pharmaceutical, fermentation, chemical and Other farming and tap water.

1. Main feature

- ✧ This product is a DO digital sensor, which can directly output RS485 signal.
- ✧ The product has high precision, high stability and strong anti-interference ability.
- ✧ Automatic temperature compensation.
- ✧ No need for instrumentation, can directly connect to computers, PLCs and other devices with RS485/4-20mA signal interface for data acquisition and maintenance; it is convenient for users to integrate sensors into the industrial computer system such as PC system and IOT.
- ✧ Using the mobile APP to collect, debug and maintain the sensor through wired (OTG line and 485 to USB module) or wireless network (such as WIFI, GPRS and other wireless networks).
- ✧ The sensor can be set by RS485 communication, slave address and baud rate, online calibration, factory reset, 4-20mA output corresponding range (4-20mA is optional), proportional coefficient and incremental compensation.
- ✧ Two-point calibration method is used.
- ✧ Power off protection > 10 years.
- ◇ Power off protection > 10 years.

2. Technical indicators

- ✧ Measurement range: 0~20.0 mg/L, 1-100.0°C
- ✧ Precision: dissolved oxygen: $\pm 0.5\%$ FS, temperature: ± 0.3 ° C
- ✧ Stability: ≤ 0.1 mg/L 24h
- ✧ Temperature compensation: 0~60°C
- ✧ 485 interface: support IOT, (partially compatible with MODBUS protocol).
- ✧ Working conditions: ambient temperature is 0-60 ° C
- ✧ Input impedance: $\geq 1 \times 10^{12} \Omega$
- ✧ Output load: 4-20mA load $< 750 \Omega$ (optional)
- ✧ Working voltage: DC 5V
- ✧ Protection rating: IP68

Wiring Details

 → DC5V +

 → RS-485 B

 → RS-485 A

 → DC5V -

OXY-DO Digital Sensor Communication Protocol

MODBUS-RTU	
Baud rate	9600 (default)
Device No	1 (default)
Data bit	8 digits
odd-even calibration	NO
Stop bit	1 digits

Register Setting

Register name	Address	type of data	length	Read/Write	Instruction
Display value	R0	unsigned	1	R	(3 decimals)
temperature	R1	unsigned	1	R	(3 decimals)
4mA output display value	R2	unsigned	1	R	(3 decimals)
20mA output display value	R3	unsigned	1	R	(3 decimals)
Rang lower limit	R4	unsigned	1	R	Default to 0
Rang upper limit	R5	unsigned	1	R	Default 2000 (3 decimals)
Scale factor	R6	unsigned	1	R	(1 decimal)
Increment	R7	signed	1	R	(3 decimals)
Resolution	R8	signed	1	R	Default to 3
Slave address	R10	unsigned	1	R	Rang between 1-127
Baud rate	R11	unsigned	1	R	1200 2400 4800 9600 19200 38400 57600
Function call	R12	unsigned	1	W	Find parameter settings for more details
parameter1	R13	unsigned	1	W	Find parameter settings for more details
parameter2	R14	unsigned	1	W	Find parameter settings for more details
Manual temperature compensation value	R15	unsigned	1	R	(2 decimals)
Manual salinity compensation value	R16	unsigned	1	R	(2 decimals) g/kg
Atmospheric pressure compensation value	R17	unsigned	1	R	(2 decimals) kPa

4. MODBUS Instruction format:

This sensor is compatible with 0x03, 0x06, 0x10 function codes of MODBUS protocol.

0x03 Command Format:

Definition	Address	Function Code	Initial Address	Number of Register	CRC calibration
Data	ADDR	0x03	Rstart	Rnum	CRC 16
Number of Bytes	1	1	2	2	2

0x03 Return Format:

Definition	Address	Function Code	Number of Data	Data	CRC calibration
Data	ADDR	0x03	Rnum*2	Data	CRC 16
Number of Bytes	1	1	1	Rnum*2	2

0x06 Command Format:

Definition	Address	Function Code	Register Address	Data	CRC calibration
Data	ADDR	0x06	Raddr	Data	CRC 16
Number of Bytes	1	1	2	2	2

0x06 Return Format (same as command):

Definition	Address	Function Code	Register Address	Data	CRC calibration
Data	ADDR	0x06	Raddr	Data	CRC 16
Number of Bytes	1	1	2	2	2

0x10 Command Format:

Definition	Address	Function Code	Initial Address	Number of Register	Number of Data	Data	CRC calibration
Data	ADDR	0x10	0x000C	0x0003	0x06	Data	CRC 16
Number of Bytes	1	1	2	2	1	6	2

0x10 Return Format:

Definition	Address	Function Code	Initial Address	Number of Register	CRC calibration
Data	ADDR	0x10	0x000C	0x0003	CRC 16
Number of Bytes	1	1	2	2	2

4.1 Data reading :

This sensor data is read using the 0x03 function code of the MODBUS protocol.

Example:Reading DO value and temperature value

Send command: 01 03 00 00 00 02 C4 0B

Return: 01 03 04 1C 2D 08 6A EA 45

The data part is: 1C 2D 08 6A

DO Value: Data 0x1C2D, converted to decimal in 7213, PH value is 7.213, retaining 3 decimal places

Temperature Value: Data 0x086A, converted to decimal 2154, temperature value is 21.54, retain 2 decimal places.

5. Parameter adjustment:

1. This sensor parameter adjustment uses the 0x06 or 0x10 function code of the MODBUS protocol.

2, using 0x06 function code adjustment parameters are divided into 3 steps

- 1) Write parameter 1 to the R13 register
- 2) Write parameter 2 to the R14 register
- 3) Write the function number to the R12 register

3. Use the 0x10 function code, and write the function number, parameter 1, and parameter 2 to the three registers starting from R12. Equivalent to the step-by-step write effect.

4. When the function call is successful, the R12, R13, and R14 registers are all reset to 0. If the function call fails or the parameters are incorrect, the R14 register will display -1.

Function call parameter list

Function	Parameter 1	Parameter 2	Function number
Zero Calibration	Zero Conductivity*1000	1	1
Slope Calibration	0	2	1
Manual temperature compensation	Temperature value*100	0	2
Manual salinity compensation	Salinity value (g/kg)*100	1	2
Manual atmospheric pressure compensation	Atmospheric pressure (kPa)*100	2	2
Change the 4-20ma output range (need to be customized)	4mA Output representative value	20mA representative value	3
Change Correction Factor	Scale factor	Display value increment	5
Change slave configuration	New slave number	New baud rate	6
Restore Factory Setting	Password 20034	Arbitrary value	7

Example: DO value calibration (using 0x10 function code)

Zero calibration: The oxygen-free water DO value is 0 mg/L, $0*1000=0$. Therefore, the function number is 0x0001, parameter 1 is 0x0000, and parameter 2 is 0x0001.

The data part is: 00 01 00 00 00 01

Send command: 01 10 00 0C 00 03 06 00 01 00 00 00 01 DA BF

Return: 01 10 00 0C 00 03 40 0B

Slope calibration: The sensor automatically calculates the dissolved oxygen at the current temperature. The sensor is placed in the air without manual input. After the value is stable, the calibration is performed. Therefore, the function number is 0x0001, parameter 1 is 0x0000, and parameter 2 is 0x0002.

The data section is: 00 01 00 00 00 02

Send command: 01 10 00 0C 00 03 06 00 01 00 00 00 02 9A BE

Return: 01 10 00 0C 00 03 40 0B.

6. Comparison table of dissolved oxygen in the air

(Standard atmospheric pressure) :

Temp °C	DOmg/L	Temp °C	DOmg/L	Temp °C	DOmg/L
0	14.60	16	9.86	32	7.30
1	14.22	17	9.64	33	7.17
2	13.80	18	9.47	34	7.06
3	13.44	19	9.27	35	6.94
4	13.08	20	9.09	36	6.84
5	12.76	21	8.91	37	6.72
6	12.44	22	8.74	38	6.60
7	12.11	23	8.57	39	6.52
8	11.83	24	8.41	40	6.40
9	11.56	25	8.25	41	6.33
10	11.29	26	8.11	42	6.23
11	11.04	27	7.96	43	6.13
12	10.76	28	7.83	44	6.06
13	10.54	29	7.68	45	5.97
14	10.31	30	7.56	46	5.88
15	10.06	31	7.43	47	5.79

7. Precautions and maintenance

- 1) The electrode has been systematically calibrated before send out from factory; you can use it directly when you received it. If there is any doubt about the measured value, you can clean it up then put it in the air, compare the measuring range with *Comparison table of dissolved oxygen in the air*. If there are any deviations, please re-calibrate.
- 2) When calibration, use oxygen-free water to calibrate zero calibration (oxygen-free water preparation: saturated sodium sulfite solution), and put the sensor in the air to calibrate slope calibration.
- 3) Because changes in atmospheric pressure per 1 kPa will result in a change in dissolved oxygen of about 0.2 mg/L in air, therefore, the sensor must use function No 2 to compensate the atmospheric pressure before the slope calibration.
- 4) Because changes in salt content per 1 g/kg in water will result in a change in dissolved oxygen of about 0.3-0.8 mg/L in water, therefore, the sensor should use function No 2 for salinity compensation before the measurement.
- 5) The electrode should be cleaned regularly. The oxygen-permeable membrane should not be broken when disassembling and cleaning. The oxygen-permeable membrane on the electrode should not be wiped with filter paper to avoid damage to the oxygen-permeable membrane.
- 6) Keeping the electrode socket clean and dry, and ensure that the positive and negative poles and the voltage value correspond to the label before powering on.
- 7) Cleaning the electrode with deionized water before and after measurement. In order to ensure the measurement accuracy, after measuring in a viscous sample, the electrode needs to be washed with deionized water to remove the solvent.
- 8) The electrode usage period is about one year. After aging, the new electrode should be replaced in time.