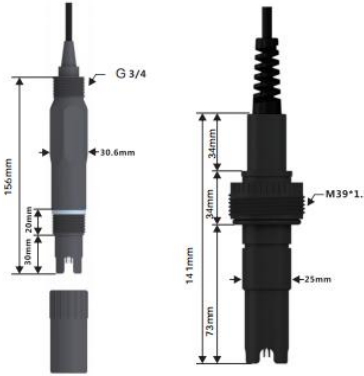


ORP Intelligent ORP Sensor Instruction Manuals and Communication Protocols

Technical Parameters

- Measuring range:-2000.... .2000mV
- Temperature measurement range:0.0... .70.0℃
- Slope:≥96%
- Housing material:PBT anti-corrosion, PC
- Liquid interface:polytetrafluoroethylene
- Connecting thread:G3/4,M39*1.5
- Signal cable length:5m(customized)
- Withstand pressure range:0...4bar
- Memristor:<500MQ
- Housing protection Grade: IP68
- Output:4.... .20mA or RS485

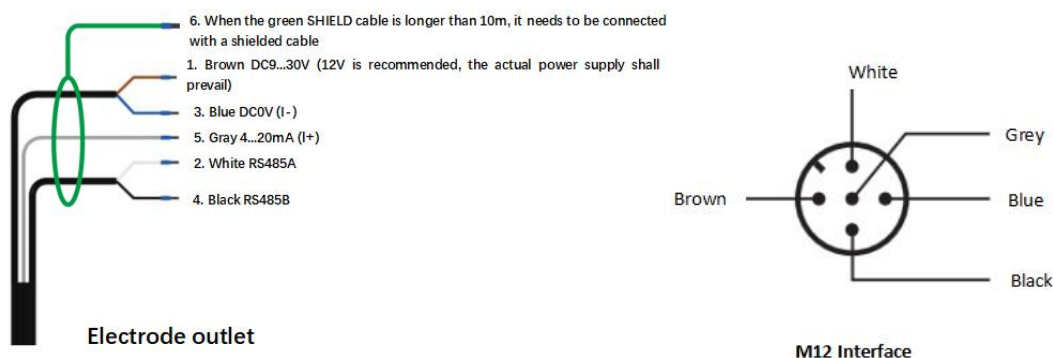


Pre-use Instructions

- Please study these instructions carefully before use.
- The instructions apply to the Smart ORP Series electrodes.
- Sensor sensitive membrane bulb is a perishable product, once damaged will not be able to be repaired.
- Before opening the package, please check whether there is any damage to the package. If the package is damaged, please do not open the package, but please contact the sales company, the nearest authorized agent or us directly. When the representative of the transporting arrives, please open the package together to check whether the electrodes are damaged or not, and it is recommended to take photos for evidence.
- If the package is intact but the electrode is damaged, please contact the sales company, the nearest authorized agent or us directly, and send the electrode with the original package back.
- Do not store electrodes in distilled or deionized water.
- Any dirt, adhesion or scale on the front of the electrode during measurement will cause inaccuracy or fluctuation of the measurement value, so it should be cleaned and calibrated in time.
- The contents of this manual are subject to change with the continuous improvement of the product, we will not give any notice in the manual, and we will not undertake the consequences thereof.

Wiring

- Follow the instructions carefully for wiring , incorrect wiring will result in complete damage to the product.
- It is strictly prohibited to supply power before all cables are connected to avoid danger. Before powering up the system, be sure to check all wiring carefully and make sure it is correct before powering up.

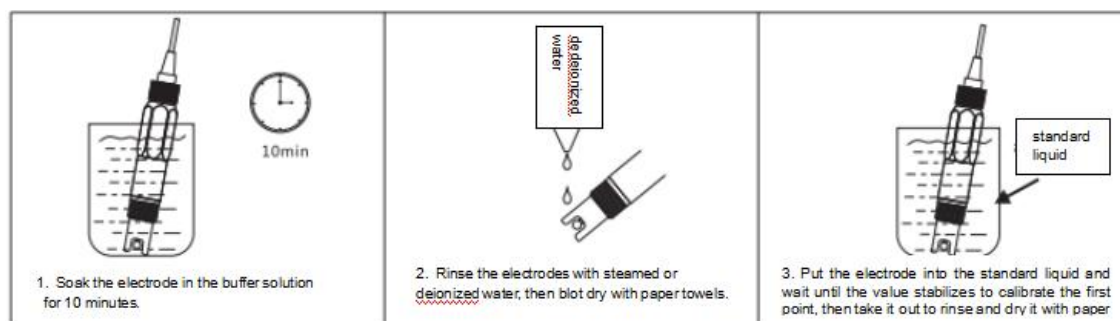


Electrode activation

- Electrodes need to be activated in 3 M KCL solution.
- Electrodes placed dry need to be activated before using.

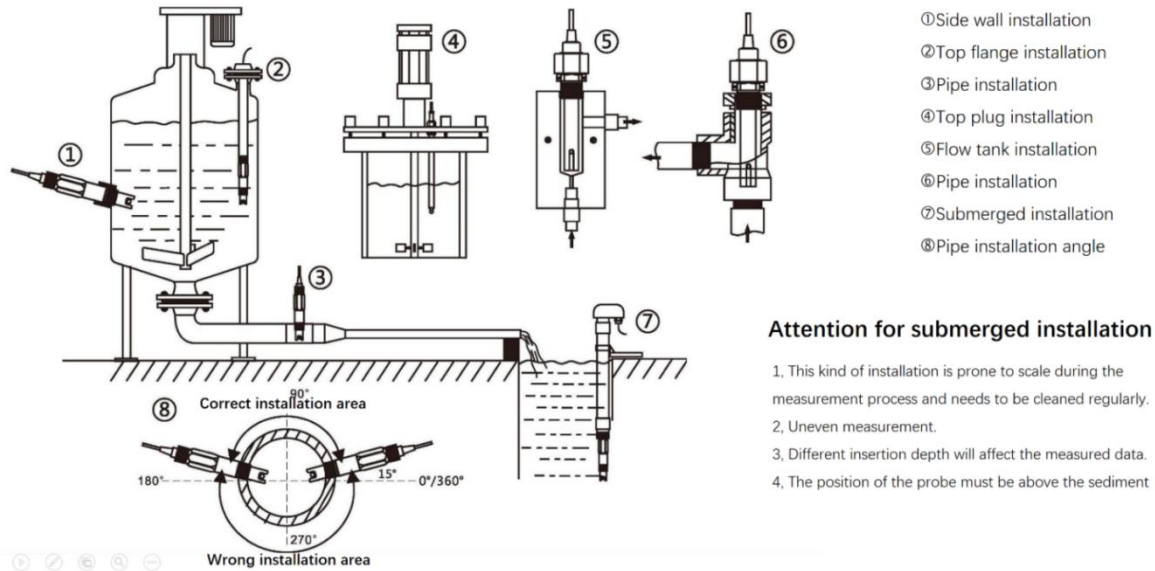
Electrode calibration

- It is recommended that the user calibrate the electrode before using.
- It is recommended that the standard solution be used for calibration.
- The electrode should be calibrated in fresh buffer.
- It is recommended that the user calibrates the electrode every 1 to 2 months.
- The calibration procedure is shown in the figure.



Electrode Installation

- ORP electrodes are generally recommended to be installed in a flow-through tank for more stable and accurate measurements.
- For pipe installation, 15° - 165° is the correct installation area, the rest is the wrong area.
- Installation method.



Electrode Communication

- Default Communication Instructions:

- Note: 1 . Data starting with 0x is represented in hexadecimal,
2 . The checksum is 16CRC with the low byte first and the high byte second.
3 . Float (floating point number) occupies four bytes.

- Factory Default Communication Parameters :

Factory Default Communication Parameters	
Baud rate for communication	9600(Default)
Number of data bits	8
Number of stop bits	1
Parity calibration bit	None
Address	1 (Default)

- The Upper computer sends format:

	Data Type	Definition	Remark
Integer	16-bit integer	Indicates that the high and low bytes of a word element are not reversed.	Example:0x 0032 to decimal number is 50.
Floating number	CDAB (3412)	Indicates that the high and low bytes of a double-byte component are reversed, but the high and low bytes of the word are not reversed.	Example:72 37 41 DB transfers to floating point, CDAB changes order to ABCD . The 41 DB 72 37 to floating point is 27.4.

- Function Code Description

- ✧ This product supports common function codes, such as 03, 06, 16 and so on.
- ✧ The output register uses 16 function codes for double-word data write operations or batch writing of multiple data.

03	Read single or multiple registers
06	Write Single register
16	Write multiple registers

➤ Read floating point number

- ✧ The Upper computer sends format

	Device ID Address	Function code	Register Starting Address		Number of registers		CRC16	
			High byte	Low byte	High byte	Low byte	Low byte	High byte
Example 1 Reading measured values	0x 01	0x 03	0x00	0x 01	0x 00	0x 02	0x 95	0x CB
Example 2 Reading the temperature value	0x 01	0x 03	0x 00	0x 03	0x 00	0x 02	0x 34	0x 0B

- ✧ Response format of the lower computer

	Device ID Address	Function code	Number of Byte	Register Starting Address				CRC16	
				C	D	A	B	Low byte	High byte
Example 1 Reading measured values	0x 01	0x 03	0x 04	0x 2C	0x 81	0x 40	0x 91	0x 52	0x E7
Example 2 Reading the temperature value	0x 01	0x 03	0x 04	0x 72	0x 37	0x 41	0xDB	0x 20	0x BE

Note: 72 37 41 DB to floating point, CDAB change order to ABCD, i.e. 41 DB 72 37 to floating point 27.4.

➤ Read an integer

- ✧ The Upper computer sends format

	Device ID Address	Function code	Register Starting Address		Number of registers		CRC16	
			High byte	Low byte	High byte	Low byte	Low byte	High byte
Example 1 Read Warning Status	0x 01	0x 03	0x 00	0x 07	0x 00	0x 01	0x 35	0x CB

- ✧ Response format of the lower computer

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	Device ID Address	Function code	Number of Byte	Write register data with hexadecimal floating point number		CRC16	
				A	B	Low byte	High byte
Example 1 Read Warning Status	0 x 01	0x 03	0x 02	0x 00	0x 00	0x B8	0x 44

- Write floating point number
- ✧ The Upper computer sends format

	Device ID Address	Function code	Register Starting Address		Number registers of		Number of Byte	Write register data with hexadecimal floating point				CRC16	
			High byte	Low byte	High byte	Low byte		C	D	A	B	Low byte	High byte
Example 1 Write measured value offset	0x 01	0x 10	0x 00	0x 12	0x 00	0x 02	0x 04	0x 00	0x 00	0x 3F	0x 80	0x 63	0x 2A

- ✧ Response format of the lower computer

	Device ID Address	Function code	Register Starting Address		Number of registers		CRC16	
			High byte	Low byte	High byte	Low byte	Low byte	High byte
Example 1 Write measured value offset	0x 01	0x 10	0x 00	0x 12	0x 00	0x 02	0x E1	0x CD

Note: Measured value offset 1.00, the floating point number 100 to hexadecimal number 0X3F800000, high and low transposition 0X00003F80 write 0x0012.

- Write an integer

- ✧ The Upper computer sends format

	Device ID Address	Function code	Register Starting Address		Write register data with hexadecimal floating point number		CRC16	
			High byte	Low byte	A	B	Low byte	High byte
Example 1 Write Device Address	0x 01	0x 06	0x 00	0x 19	0x 00	0x 02	0x D9	0x CC

- ✧ Response format of the lower computer

	Device ID Address	Function code	Register Starting Address		Write register data with hexadecimal floating point number		CRC1 6	
			High byte	Low byte	A	B	Low byte	High byte
Example 1 Device address return	0x 01	0x 06	0x 00	0x 19	0x 00	0x 02	0xD9	0x CC

Note: Change the local address 1 to address 2, and write the hexadecimal number 0x 00 02 into the 0x 00 19 memory.

Note: Measured value offset 1.00, the floating point number 1.00 to hexadecimal number 0X3F800000, high and low transposition 0X00003F80 write 0x0012.

➤ Calibration instructions

✧ Before calibration

Before calibration, write the ORP calibration value to the sensor. If the calibration is 86mV, write the data 86mV to the 0x30 register. Send command: 0110 00 30 00 02 04 00 00 42 AC C0 66

✧ Starting calibration

The electrode is cleaned and wiped dry and put into the calibration liquid, send the instruction 01 03 00 66 00 016415, read the measured AD value in register 0x66, after the measured AD value is stable, write the instruction to confirm the calibration to register 0x3F send the instruction: 0106 00 3F 00 FF F9 86, end of calibration.

➤ Description of the address

Measured value	0x 00 00	Float	2	R	Measurement storage location
Temperature measurement value	0x 00 03	Float	2	R	Measured temperature storage location
Current output value	0x 00 05	Float	2	R	Current output based on PH/ORP measurements
Warning	0x 00 07	Integer	1	R	00:Normal 01:Measurement exceeds upper limit; 02:Measurement exceeds lower Limit 03:Temperature exceeds upper limit; 04:Temperature exceeds lower limit
Measurement mode	0x 00 08	Integer	1	R/W	00: PH ; 01: ORP
Measurement upper limit	0x 00 0A	Float	2	R/W	Measurement value upper limit (20mA corresponding value)
Measurement lower limit	0x 00 0C	Float	2	R/W	Measurement value lower limit (4mA corresponding value)
Temperature upper limit	0x 00 0E	Float	2	R/W	Temperature value upper value
Temperature lower limit	0x 00 10	Float	2	R/W	Temperature value lower value
Measured value offset	0x 00 12	Float	2	R/W	Corrected measured values
Temperature offset	0x 00 14	Float	2	R/W	Corrected Temperature offset
Damping factor	0x 00 16	Integer	1	R/W	0-10
Device address	0x 00 19	Integer	1	R/W	1-255
Baud rate	0x 00 1A	Integer	1	R/W	0=2400, 1=4800,2=9600,3=19200,4=38400
Restore the factory	0x 00 1B	Integer	1	W	
ORP calibration value	0x 00 30	Float	2	R/W	
Calibration Slope	0x 0034	Integer	2	R	-0.1984

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First Point Calibration Fluid	0x00 36	Integer	1	R/W	0=7.00,1=6.86
Second Point Calibration Fluid	0x 00 38	Integer	1	R/W	0=1.68, 1=4.01, 2=9.18,3=10.1, 4=12.45
Manual temperature	0x 00 3A	Float	2	R/W	25℃
Zero calibration	0x 00 3E	Integer	1	W	
Slope Correction	0x 00 3f	Integer	1	W	
Measure ADC	0x 00 66	Integer	1	R	

➤ Examples of Common Instruction Sets

	Function	Send Command	Return Command	Remark
1	Read Measured value	01 03 00 01 00 02 95 CB	01 03 04 2C 81 40 91 52 E7	The 2C814091 for serial number 40912C81 and transfers to floating point is 4.53.
2	Read temperature measured value	01 03 00 03 00 02 34 0B	01 03 04 72 37 41 DB 20 BE	The 723741DB for serial number 41DB7237 transfers to floating point is 27.4.
3	Read current output value	01 03 00 05 00 02 D4 05	01 03 04 00 00 41 40 CB 93	The 00004140 for serial number 41400000 and transfers to floating point is 12.00.
4	Read Warning	01 03 00 07 00 01 35 CB	01 03 02 00 00 B8 44	The 0000 is current status.
5	Write Measurement mode	01 06 00 08 00 01 C9 C8	01 06 00 08 00 01 C9 C8	Set to ORP mode.
6	Write Measurement upper limit	01 10 00 0A 00 02 04 00 00 41 20 42 58	01 10 00 0A 00 02 61 CA	The measurement upper limit is 10.00.
7	Write Measurement lower limit	01 10 00 0C 00 02 04 00 00 3F 08 0E 3A	01 10 00 0C 00 02 81 C8	The measurement lower limit is 1.00.
8	Write Temperature upper limit	01 10 00 0E 00 02 04 00 00 42 C8 43 15	01 10 00 0E 00 02 20 0B	The temperature upper limit is 100.00.
9	Write Temperature lower limit	01 10 00 10 00 02 04 00 00 40 A0 C3 1B	01 10 00 10 00 02 40 0D	The temperature lower limit is 5.00.
10	Write Measured value offset	01 10 00 12 00 02 04 00 00 3F 80 63 2A	01 10 00 12 00 02 E1 CD	Set to 1.00.
11	Write Temperature offset	01 10 00 14 00 02 04 00 00 3F 80 E3 00		Set to 1.00.
12	Write Damping factor	01 06 00 16 00 01 A9 CE	01 06 00 16 00 01 A9 CE	Set to 1.
13	Write Device address	01 06 00 19 00 02 D9 CC	01 06 00 19 00 02 D9 CC	Set to 2.
14	Write Baud rate	01 06 00 1A 00 00 A8 0D	01 06 00 1A 00 00 A8 0D	Set to 2400.
15	Write Restore the factory	01 06 00 1B 00 FF B9 8D	01 06 00 1B 00 FF B9 8D	Send it once to restore factory default.
16	Write ORP calibration value	01 10 00 30 00 02 04 00 00 42 AC C0 66	01 10 00 30 00 02 41 C7	Write to ORP standard fluid value 86mV.
17	Read Calibration Slope	01 03 00 34 00 02 85 C5	01 03 04 CC CD 3E 4C 45 09	The CC3E4C for serial number 3E4CCD and transfers to floating point is 0.2.
18	Write Zero Point Calibration Fluid	01 06 00 36 00 01 A8 04	01 06 00 36 00 01 A8 04	Set to 6.86.
19	Write Slope Calibration Fluid	01 06 00 38 00 02 C9 C7	01 06 00 38 00 02 C9 C7	Set to 9.18.
20	Write Manual temperature	01 10 00 3a 00 02 04 00	01 10 00 3A 00 02 61 C5	Set to 20.0.

		00 41 A0 40 EC		
21	Write Zero Correction	01 06 00 3E 00 FF A8 46	01 06 00 3E 00 FF A8 46	Confirmation of corrected zero point
22	Write Slope Correction	01 06 00 3F 00 FF F9 86	01 06 00 3F 00 FF F9 86	Confirmation of corrected slope.
23	Read Measure AD	01 03 00 66 00 01 64 15	01 03 02 2E E0 A4 6C	2EE0 transfers to integer is 12000.

Maintenance and Storage

- After rinsing the electrodes only absorb the water with a soft paper towel and do not rub the measuring end. When storing the electrode, you must screw on the protective sleeve, which must contain a soaking solution to ensure that the measuring end of the electrode is moist.
- When you find white potassium chloride crystals accumulating on the electrode, this salty substance will not affect the use, just rinse the electrode with distilled water and then vacuum it up.
- Must keep the cable connector clean, no moisture or water.
- The electrodes should not be stored dry for a long period of time, or when there is a dry medium attached to the surface, and the electrodes should be activated in a suitable preservation solution before they are used, if they are stored dry.

Trouble Shooting

- If the measurement is not accurate, the main reason is that the state of the conductivity electrode has changed, so it is necessary to check whether the electrode is in good condition. Generally, it is scaling, clogging, etc. It should be maintained or replaced in time.
- If the displayed value is too large, too small or no change, please check whether the electrode connection cable or electrode measurement appearance is intact.
- Modbus troubleshooting:

Issues	Possible Reasons	Solutions
Modbus unresponsive	Baud rate or stop bits do not match the Modbus master device settings.	Verify that the settings match the Modbus master device , and verify that the Modbus master device parity is set to None.
	RS232 or RS485 cable is failed.	Cable replacement/repair
	There is no network offset and termination , or the network offset and termination is not appropriate.	Check the termination or offset settings of all network devices . Only the endpoints of the network should have termination turned on, and only one point on the network should provide an offset.
	The slave address is incorrect or the slave address is the same as the address of another bus device.	Verify that all addresses are unique and between 1 and 247.
Modbus responses abnormally	Registers are not supported	Verify that the registers are supported.
	Incorrect data type	Verify that the requested register data type matches the Modbus master request. For example, it is not possible to use 2-byte integer data to access some floating point type data. When requesting a floating point data (2 registers/4 bytes), both registers must be requested at the same time

Warranty and Maintenance

- The company from the time of purchase of customers on the instrumentation sensor has a one-year warranty, as long as the warranty period is not caused by improper use of non-human damage, please prepaid freight will be properly packaged instrumentation shipped back to you free of charge to repair, the company will be based on the actual instrumentation of the damage to analyze the cause, beyond the conditions of the warranty, you need to charge the cost of repairs.
- Any reason for repair must be approved by our customer service department before returning, after the application is approved, please return the repair card with the repaired goods, the returned goods must be carefully packed to avoid damage during transportation and insured, our company will not be responsible for any damage caused by the lost or shoddy packing of the returned goods.