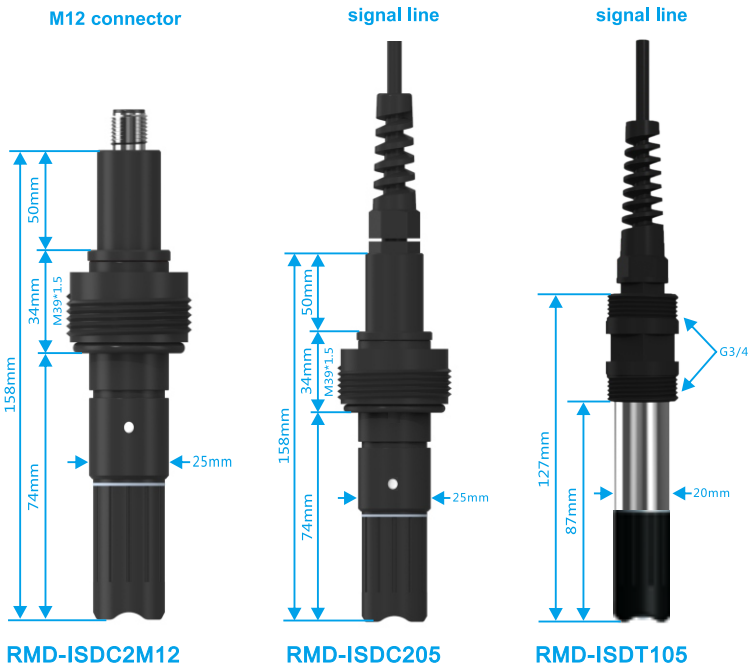
1. Technical data

Measuring range	0...20mg/L
Resolution	0.01mg/L
Accuracy	±2%FS
Temperature range	0...60.0℃
Power supply	DC9-30V(Recommend 12V)
Output signal	RS485;4...20mA
Shell material	ABS, PC+stainless steel
Pressure range	0...2bar
Medium flow rate	15...30L/h
Pipe thread	M39*1.5, G3/4
Cable length	5m or customized
Sensitivity	±0.05% of range
Protection grade	IP68



2. Before use

2.1 Please read this instruction carefully before use.

2.2 The membrane head is a fragile, it cannot be repaired if it is damaged.

2.3 Before using the sensor, the protective cover should be gently removed, put the sensor in the solution to be tested for polarization for more than 6 hours (see Section 5 for polarization method).

2.4 The measurement would be inaccurate or fluctuating if no electrolyte in the membrane head.

2.5 After adding membrane head with electrolyte, if the sensor is stored in air for more than 30 minutes, the measurements would be inaccurate and fluctuation.

2.6 In the measurement process, if there is dirt, adhesive or encrust on the membrane head, the measured value would be inaccurate or fluctuate. The membrane head should be cleaned and calibrated in time.

2.7 If there are bubbles in the membrane head, the measured value will be inaccurate or fluctuate.

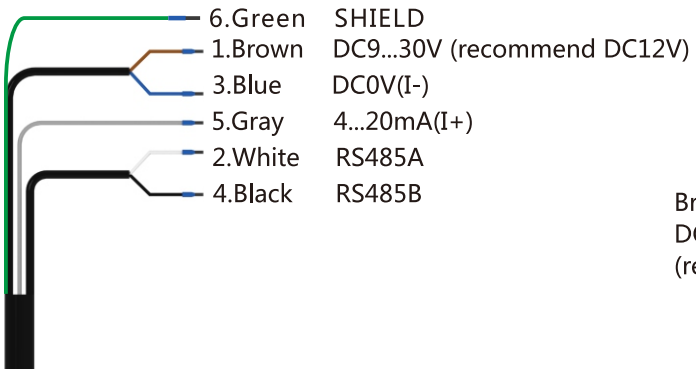
2.8 Privately extend, cutting short, jointing and forcefully pulling signal line etc., will result in inaccurate or unsteady measurement.

3. Sensor wiring

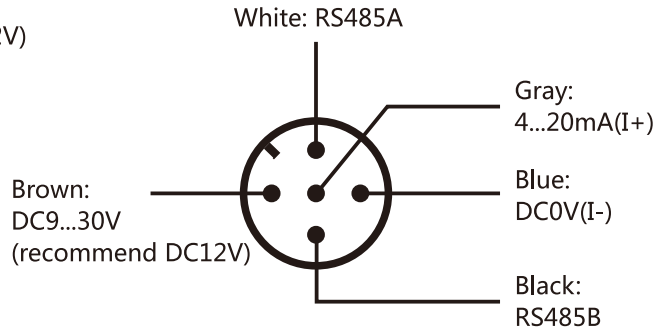
3.1 Please follow the instructions carefully, the wrong wiring will damage the product completely.

3.2 Please carefully check all the wiring in the system and confirm that the wiring is complete right before switch on the power.

3.3 Note: RS485A line and RS485B line are strictly forbidden to contact with the power supply line, otherwise the communication of the sensor will be permanently damaged.



Sensor outlet



M12 connector

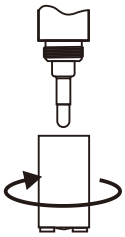
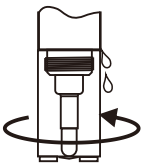
4.Add electrolyte and replace the membrane head

4.1 The new membrane head is added with electrolyte, and users are recommended to check before use.

4.2 It is recommended that the user should replace the electrolyte every three months, but the actual operation should be subject to the specific use of the measured medium and sensor.

4.3 If the sensor signal is abnormal (long response time, mechanical damage, too large in zero oxygen water, too large or too small in air, etc.), the membrane head needs to be replaced, the normal oxygen membrane is replaced every 6 to 12 months, the toughened oxygen membrane is replaced every 18 to 24 months.

4.4 The procedure for replacing the membrane head and adding electrolyte is shown below:

		
Disconnect the power supply, turn counterclockwise, remove the membrane head smoothly, and pour the dissolved oxygen electrolyte inside the membrane head to the waste solution pool.	Tilt the membrane head, and the electrolyte bottle is vertically downward. Gently squeeze the electrolyte bottle, so that the electrolyte slowly drips into the membrane head until it is full.	Slowly rotate the membrane head clockwise onto the inner core of the sensor until the liquid beads flow out. Repeat 3 times of tightening and loosening to completely burst the bubbles and make the membrane head close to the sensor cathode.

5. Sensor polarization

5.1 Polarization method : Put the sensor into the solution to be tested, connect the power supply. After the power is turned on, the polarization starts.

5.2 The sensor need to be polarized in the following cases.

☞When the sensor is first used, it will polarize for more than 6 hours ;

☞Replace the membrane head or electrolyte, it will polarize for more than 6 hours;

☞If the sensor is disconnected from the power line. See the table below for polarization time.

	Power-off time t1 (minute)	Minimum polarization time t2 (minute)
1	t1≤5	2*t1
2	5＜t1≤15	4*t1
3	15＜t1≤30	6*t1
4	t1＞30	360

6. Sensor calibration

6.1 The sensor has been calibrated before shipment, the user can directly use it. Online monitoring of the measured medium should keep a constant flow rate , flow rate range 15...30L/h.

6.2 The calibration of dissolved oxygen sensor is performed by zero oxygen calibration and full scale calibration, Before the calibration, ensure that the sensor has polarized for more than 6 hours.

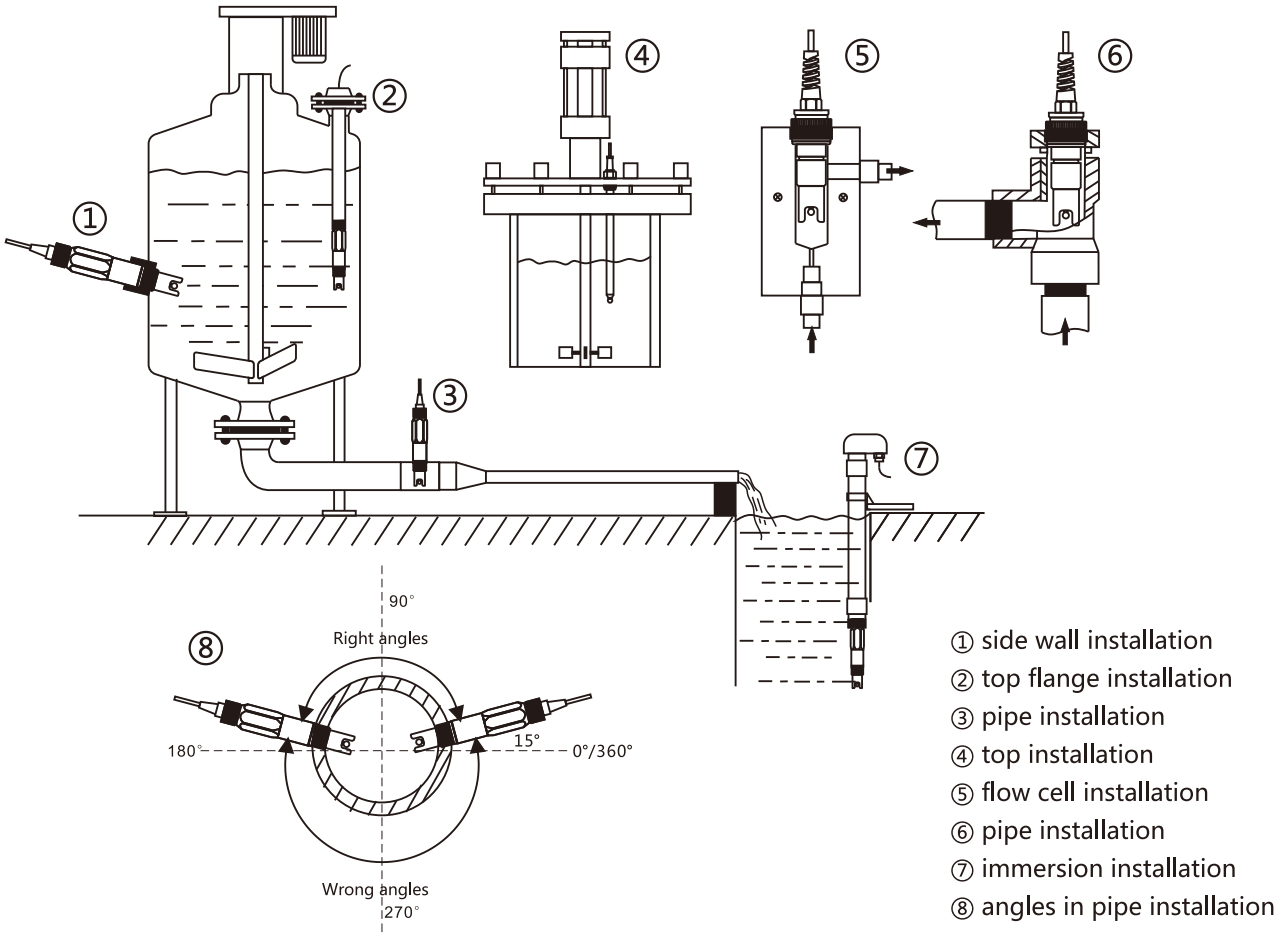
6.3 It is recommended that the user calibrate the sensor every 1 to 2 months.

7. Sensor installation

7.1 The DO sensor is recommended to be installed in the flow cell for more stable and accurate measurement.

7.2 If installing sensor in the pipe, the right angle should be 15°~165°.

7.3 Installation method.



① side wall installation
② top flange installation
③ pipe installation
④ top installation
⑤ flow cell installation
⑥ pipe installation
⑦ immersion installation
⑧ angles in pipe installation

Pay attention to the immersion installation:

1. In this installation, there will be dirt on the sensor frequently, it needs to be cleaned regularly.
2. Measuring value is not stable.
3. Different insertion depths will affect the measured value.
4. The position of the sensor must be above the sediment.

8. Sensor communication

8.0 Default communication instructions:

Note: 1. Data starting at 0x represents hexadecimal;

2. The check code is 16CRC, the low byte is in the front and the high byte is in the back;

3. Floating point number occupy four bytes;

8.1 Communication description (factory default):

Factory default	
Baud rate	9600(default)
Data bit	8
Stop bit	1
Check bit	no
Address	1 (default)

8.2 Host computer transmission format:

	Data type	Description	Remarks
Integer	16 bit integer	The high and low bytes of the word component are not reversed	Example: 0x 0032 to decimal number is 50
Floating point number	(CDAB) 3412	The high-low word of the double-byte component is reversed, but the high-low byte of the word is not reversed.	Example: 72 37 41 DB transfer to floating point number, CDAB change order is ABCD, ie 41 DB 72 37 transfer to floating point is 27.4

8.3 Function code description

8.3.1 This product supports 03,06,16 and other common function codes

8.3.2 The output register uses 16 function codes when writing double word data or writing multiple data in batches

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

8.4 Read floating point number

8.4.1 Host computer transmission format:

	ID address	Function code	Register start address		Qty of registers		CRC16	
			High byte	Low byte	High byte	Low byte	Low byte	High byte
Example 1 Read measured value	0x 01	0x 03	0x 00	0x 01	0x 00	0x 02	0x 95	0x CB
Example 2 Read Temp value	0x 01	0x 03	0x 00	0x 03	0x 00	0x 02	0x 34	0x 0B

8.4.2 Slave computer response format:

	ID address	Function code	Qty of registers	Read register data in hexadecimal floating point number				CRC16	
				C	D	A	B	Low byte	High byte
Example 1 Measured value return	0x 01	0x 03	0x 04	0x 2C	0x 81	0x 40	0x 91	0x 52	0x E7
Example 2 Temp value return	0x 01	0x 03	0x 04	0x 72	0x 37	0x 41	0x DB	0x 20	0x 8E

Note: 72 37 41 DB transfer to floating point number, CDAB change order is ABCD, ie 41 DB 72 37 transfer to floating point is 27.4

8.5 Read integer

8.5.1 Host computer transmission format:

	ID address	Function code	Register start address		Qty 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

8.5.2 Slave computer response format:

	ID address	Function code	Qty of registers	Read register data in hexadecimal integer		CRC16	
				A	B	Low byte	High byte
Example 1 Warning status return	0x 01	0x 03	0x 02	0x 00	0x 00	0x B8	0x 44

8.6 Write floating point number

8.6.1 Host computer transmission format:

	ID address	Function code	Register start address		Qty of registers		Qty of bytes	Write register data in hexadecimal floating point number				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

8.6.2 Slave computer response format:

	ID address	Function code	Register start address		Qty of registers		CRC16	
			High byte	Low byte	High byte	Low byte	Low byte	High byte
Example 1 Measured value offset return	0x 01	0x 10	0x 00	0x 12	0x 00	0x 02	0x E1	0x CD

Note: the measured value is offset by 1.00, floating point number 1.00 converts to hexadecimal 0X3F800000, transpose the high and low positions 0X00003F80 and write 0X0012.

8.7 Write integer

8.7.1 Host computer transmission format:

	ID address	Function code	Register start address		Write register data in hexadecimal integer		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

8.7.2 Slave computer response format:

	ID address	Function code	Register start address		Write register data in hexadecimal integer		CRC16	
			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	0x D9	0x CC

Note: change the local computer address 1 to address 2 and write the hexadecimal number 0x 00 02 into register 0x 00 19.

8.8 Calibrating instructions

8.8.1 The first point Zero calibration:

The sensor is cleaned, dried and put in a 0 mg/L solution (ie, anhydrous sodium sulfite solution);

Send command: 01 03 00 66 00 01 64 15;

After the measured AD value is stable, read the AD value in the 0x66 register;

Write the instruction to confirm the calibration to the 0x 3E register;

Send command: 01 06 00 3E 00 FF A8 46.

8.8.2 The second point Slope calibration:

The sensor is cleaned and dried ,and put in saturated air (ie 100%);

Send command: 01 03 00 66 00 01 64 15;

After the measured AD value is stable, read the AD value in the 0x66 register;

Write the instruction to confirm the calibration to the 0x 3F register;

Send command: 01 06 00 3F 00 FF F9 86;

This product can be calibrated at 1 point or 2 points;

If the first point is not calibrated, directly calibrate the second point.

End of calibration

8.9 Address description

Name	Hosting number	Data type	Length	Read/write	Description
Measurements	0X 00 01	floating point	2	read	Storage location for measured value
Temperature measurement	0X 00 03	floating point	2	read	Storage location for measured temperature
Current output value	0X 00 05	floating point	2	read	Output current based on DO measurements
Warning	0X 00 07	Integer	1	read	01: Measurement exceeds the upper limit; 02: Measurement exceeds the lower limit 03: Temperature exceeds the upper limit; 04: Temperature exceeds the lower limit
Measurement mode	0X 00 08	Integer	1	read/write	00: % 01: mg/L
Upper limit of measurement	0X 00 0A	floating point	2	read/write	Default value 200%;Upper limit of measured value (20mA corresponding value)
Lower limit of measurement	0X 00 0C	floating point	2	read/write	Default value 0;Lower limit of measurement value (4mA corresponding value)
Upper temperature limit	0X 00 0E	floating point	2	read/write	Default value 60℃;Upper temperature limit
Lower temperature limit	0X 00 10	floating point	2	read/write	Default value 0℃;Lower temperature limit
Measured value offset	0X 00 12	floating point	2	read/write	Default value 0; adjust measurement
Temperature offset	0X 00 14	floating point	2	read/write	Default value 0; adjust temperature value
Damping coefficient	0X 00 16	Integer	1	read/write	Default value 0; 0-10
Device address	0X 00 19	Integer	1	read/write	Default value 01; 1-255
Baud rate	0X 00 1A	Integer	1	read/write	Default value 9600; 0=2400，1=4800，2=9600 3=19200，4=38400
Restore default	0X 00 1B	Integer	1	write	
Pressure compensation	0X 00 24	floating point	2	read/write	1013mbar
Salinity compensation	0X 00 2C	floating point	2	read/write	0.0ppt
Calibration slope	0X 00 22	Integer	2	read	-0.1984
Manual temperature	0X 00 3A	floating point	2	read/write	25℃
Zero calibration	0X 00 3E	Integer	1	write	
Slope calibration	0X 00 3F	Integer	1	write	
Measuring AD	0X 00 66	Integer	1	read	

8.10 Common instruction examples

	Function	Send command	Return command	Remarks
1	Read measured value	01 03 00 01 00 02 95 CB	01 03 04 2C 81 40 91 52 E7	The 2C814091 change order is 40912C81 and its floating point is 4.53
2	Read temperature measurement	01 03 00 03 00 02 34 0B	01 03 04 72 37 41 DB 20 8E	The 723741DB change order is 41DB7237and its floating point is 27.4
3	Read current output value	01 03 00 05 00 02 D4 0A	01 03 04 00 00 41 40 CB 93	The 00004140 change order is 41400000 and its floating point is 12.00
4	Read warning	01 03 00 07 00 01 35 CB	01 03 02 00 00 B8 44	0000 is the current state
5	Write measurement mode	01 06 00 08 00 01 C9 C8	01 06 00 08 00 01 C9 C8	Set to mg/L mode
6	Write upper limit of measurement	01 10 00 0A 00 02 04 00 00 41 20 42 58	01 10 00 0A 00 02 61 CA	The upper measurement limit is set to 10.00
7	Write lower limit of measurement	01 10 00 0C 00 02 04 00 00 3F 80 E3 AA	01 10 00 0C 00 02 81 CB	The lower measurement limit is set to 1.00
8	Write upper temperature limit	01 10 00 0E 00 02 04 00 00 42 C8 43 15	01 10 00 0E 00 02 20 0B	The upper temperature limit is set to 100.00
9	Write lower temperature limit	01 10 00 10 00 02 04 00 00 40 A0 C3 1B	01 10 00 10 00 02 40 0D	The lower temperature limit is set to 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	01 10 00 14 00 02 01 CC	Set to 1.00
12	Write damping coefficient	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 default	01 06 00 1B 00 FF B9 8D	01 06 00 1B 00 FF B9 8D	Factory default values are restored after sent
16	Write pressure compensation	01 10 00 2C 00 02 04 00 00 44 7A 43 01	01 10 00 2C 00 02 80 01	Pressure compensation written to 1000 mbar
17	Read calibration slope	01 03 00 22 00 02 64 01	01 03 04 CC CD 3E 4C 45 09	The CCCD3E4C change order is 3E4CCCD and its floating point is 0.2
18	Write salinity compensation	01 10 00 24 00 02 04 CC CD 3E 4C 4F 7E	01 10 00 24 00 02 01 C3	Salinity compensation written to 0.2ppt
19	Write manual temperature	01 10 00 3A 00 02 04 00 00 41 A0 40 EC	01 10 00 3A 00 02 61 C5	Set to 20.0
20	Write zero calibration	01 06 00 3E 00 FF A8 46	01 06 00 3E 00 FF A8 46	Confirm calibration zero
21	Write slope calibration	01 06 00 3F 00 FF F9 86	01 06 00 3F 00 FF F9 86	Confirm calibration slope
22	Read measuring AD	01 03 00 66 00 01 64 15	01 03 02 2E E0 A4 6C	2EE0 turns to integer 12000

9. Maintenance and storage

9.1 The sensor should be cleaned regularly with deionized water. The oxygen-permeable membrane should not be broken when disassembling and rinsing the sensor. The oxygen-permeable membrane on the sensor should not be wiped with filter paper or sandpaper.

9.2 If the membrane head is fouled and clogged, the electrolyte is dry, lack or to be contaminated, it should be stopped using and the membrane head should be removed and cleaned.

9.3 After cleaning the sensor, replacing the membrane head, adding electrolyte, after long-term storage, it needs to be polarized and calibrated before use.

9.4 The cable connector must be kept clean, dry, free from moisture, water, acids, alkalis or salts, etc.

9.5 If no water flow or sensor is stopped using for short period on site, the sensor should be taken out, cleaned and covered with protective sleeve containing water for preservation; When the sensor is not used for a long time, drain the electrolyte, thoroughly clean the anode and the cathode with deionized water at 30°C~40°C, dry it and put on the protective cover. Place it in a dry place for storage at room temperature.

10. Troubleshooting

10.1 If the measurement is not accurate, mostly because the condition of dissolved oxygen sensor has changed, so it is necessary to check whether the dissolved oxygen sensor is in good condition. The dissolved oxygen sensor is not easy to damage, generally the membrane head would be damaged or fouled, electrolyte would be polluted or lack, user needs to replace the membrane head , add or change electrolyte.

10.2 Modbus troubleshooting:

Problem	Possible reason	Solution
Modbus no response	The baud rate, or stop bit does not match the Modbus master settings	Verify that the Settings match the Modbus master device Settings, and verify that the Modbus master device parity check is set to None
	Rs232 or RS485 cable is faulty	Replace/repair cables
	No network offsets and terminations, or network offsets and terminations are not suitable.	Check the termination or offset Settings for all network devices. Only the endpoints of the network should be turned on and terminated, and there should be only a point on the network to 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 are between 1 and 247.
Modbus abnormal response	Register not supported	Verify that the register is supported
	Incorrect data type	Verify that the requested register data type matches the Modbus master device request; for example, you cannot access a floating point data using 2-byte integer data.When a floating point data (2 registers /4 bytes) is requested, two registers must be requested at the same time.

11. Warranty

The sensor has a one year warranty period. As long as the damage is caused by improper use of non-human within the warranty period, please prepaid freight, pack the sensor and ship it back, we will repair it for you free of charge. We will analyze the reasons for the damage of the sensor, if the damage exceeds the warranty conditions, we need to charge the repair fee.