



SENSECAP

RS485 Oxygen Concentration O₂ Sensor User Manual

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1 Introduction

The RS485 Oxygen Concentration O₂ Sensor with RS485 Modbus-RTU interface is a compact and accurate tool for monitoring ambient oxygen partial pressure, oxygen concentration, temperature, and barometric pressure. It uses luminescence-quenching optical technology instead of an electrochemical sensing principle and integrates an SST® O₂ sensor with a service life of more than two years. With its small size, high accuracy, excellent stability, wall-mounting installation, reverse power protection, built-in surge protection, and TVS/ESD protection, the RS485 Oxygen Concentration O₂ Sensor is suitable for scientific research, air-conditioning and ventilation control, routine weather monitoring, environmental monitoring, and applications requiring long cable runs or multiple sensors.

Features

- Integrated with SST® O₂ sensor with lifetime > 2 years
- Luminescence-based optical technology, NOT electrochemical
- Digital Output RS485 (Modbus-RTU) with built-in surge protection
- Small size with high accuracy and excellent stability, maintenance-free
- Wall mounting installation
- Reverse power protection and Built-in TVS/ESD protection
- Excellent price-performance ratio

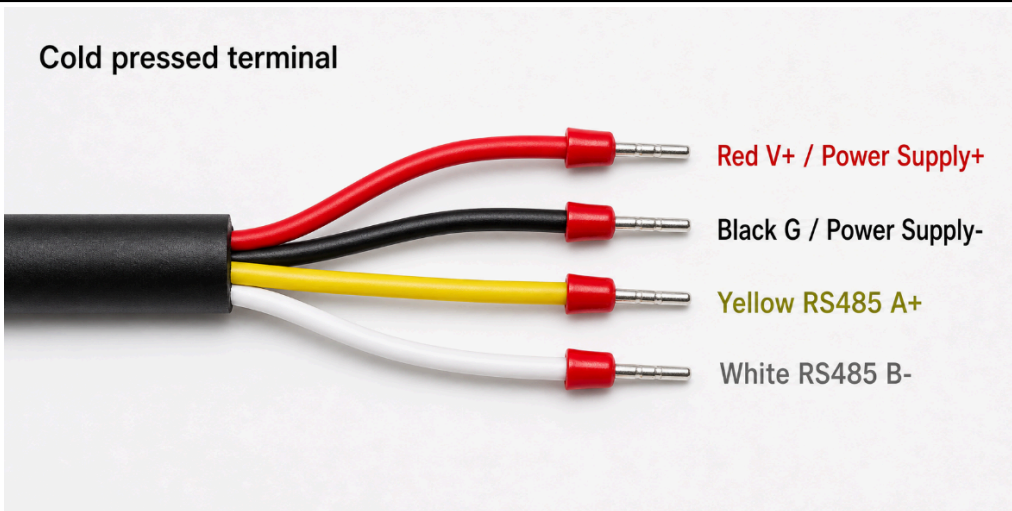
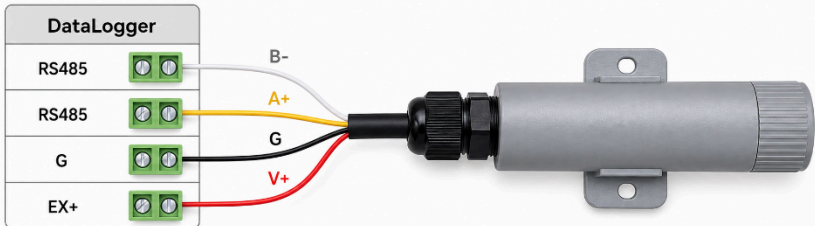
Applications

- Science research
- Air conditioning and ventilation control
- Home and Industrial Environmental Monitoring
- Indoor Plant Growth Room Monitoring

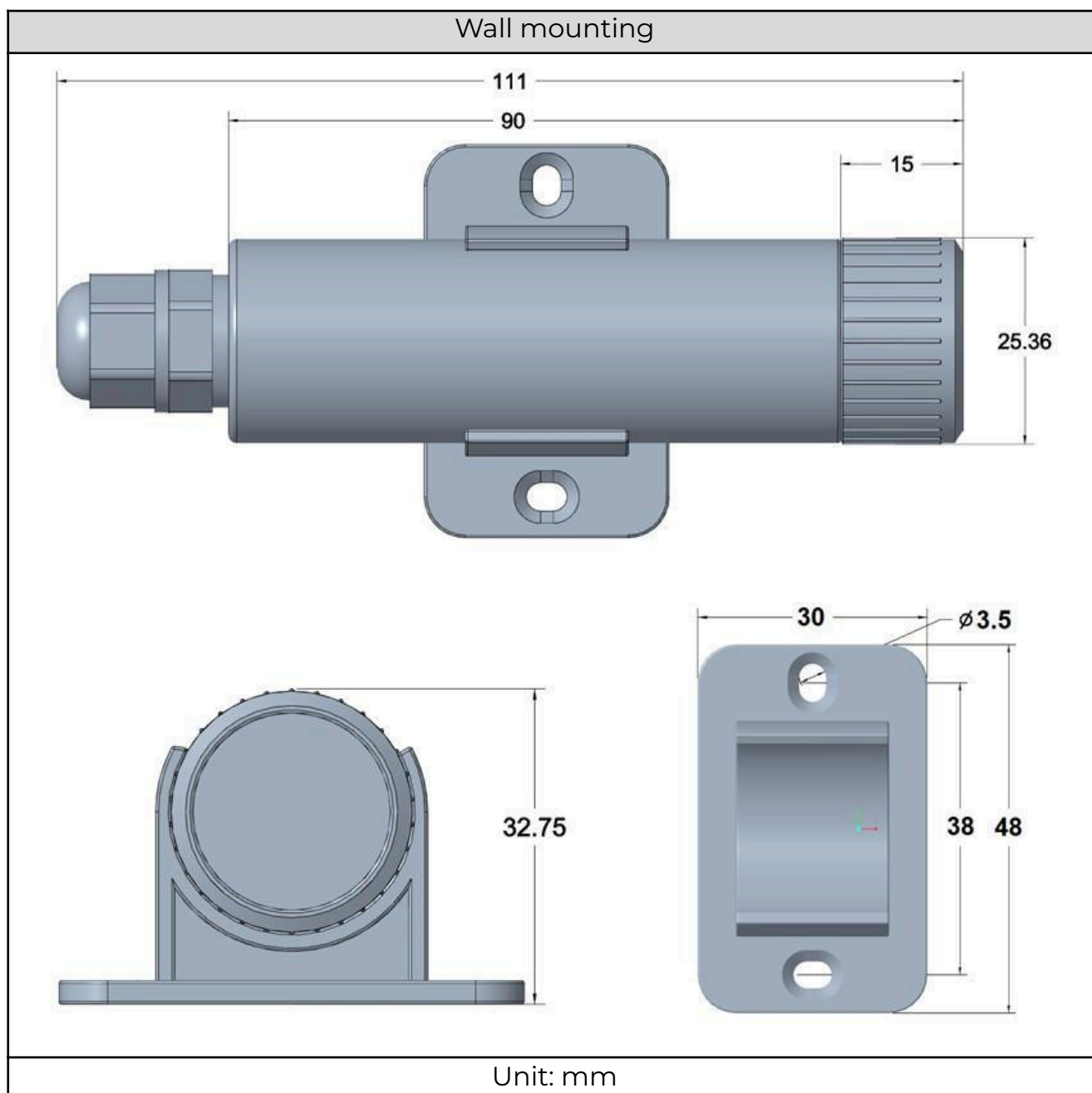
2 Specifications

Oxygen Partial Pressure	
Range	0-300 mbar
Accuracy	<2% FS
Resolution	0.1 mbar
Oxygen Concentration	
Range	0-25%
Accuracy	Determined by the accuracy of oxygen partial pressure and barometric pressure
Resolution	0.01%
Temperature Measurement	
Range	-10-60°C
Accuracy	±2°C
Resolution	0.1°C
Barometric Pressure Measurement	
Range	500-1200 mbar
Accuracy	±5 mbar
Resolution	1 mbar
General Parameters	
Sensor Description	RS485 Oxygen Concentration O2 Sensor
Output Interface	RS485, Modbus-RTU
Default Serial Communication	Slave address: 1; baud rate: 9600 bps; data bits: 8; stop bits: 1;
Power Supply	9-28 V DC
Power Consumption	Average Current: <10mA @12V DC Measuring Current : <20mA @12V DC, measurement interval 1000ms
Operating Temperature	10-45°C
Operating Humidity	0-95%, non-condensing
IP Rating	IP50
Cable Length	2 meters
Installation	Wall mounting
Dimensions	Sensor body: 111 * 25.5 mm (Length * Diameter)

3 Wiring Diagrams

Type	Wiring diagram
RS485 Interface	Cold pressed terminal  Red V+ / Power Supply+ Black G / Power Supply- Yellow RS485 A+ White RS485 B-
Connections	Wiring Diagram  DataLogger RS485 RS485 G EX+ B- A+ G V+

4 Dimensions



5 RS485 Communication

5.1 Modbus Protocol

Modbus Protocol is widely used to establish master-slave communication between intelligent devices or sensors. A MODBUS message sent from a master

to a slave contains the address of the slave, the function code (e.g., 'read register' or 'write register'), the data, and a checksum (LRC or CRC).

The sensor has an RS-485 interface with Modbus protocol. The default serial communication settings are slave address 1, Modbus RTU, 9600bps, 8 data bits, and 1 stop bit. All communication settings can be changed with a Modbus command and take effect after re-powering the sensor.

The following Modbus function codes are supported by the sensor.

Modbus Function Code 0x03: used for reading a holding register.

Modbus Function Code 0x04: used for reading an input register.

Modbus Function Code 0x06: used for writing a single holding register.

Modbus Function Code 0x10: used for writing multiple holding registers.

5.2 Modbus Register

Parameters	Register Addr. (HEX/DEC)	Data Type	Modbus Function Code(DEC)	Range and Comments	Default Value
Oxygen partial pressure (Calibrated)	0x0000/0	INT16 RO	3/4	0-30000 (0-300.00mbar)	N/A
Temperature (Calibrated)	0x0001/1	INT16 RO	3/4	-4000-12500 (-40.00-125.00°C) -4000-25700 (-40.00-257.00°F)	N/A
Barometric (Calibrated)	0x0002/2	INT16 RO	3/4	5000-12000 (500.0-1200.0 mbar)	N/A
Oxygen concentration (Calibrated)	0x0003/3	INT16 RO	3/4	0-2500 (00.00-25.00 %)	N/A
RESERVED	0x0004/4	INT16 RO	3/4	Reserved	0
RESERVED	0x0005/5	INT16 RO	3/4	Reserved	0
RESERVED	0x0006/6	INT16 RO	3/4	Reserved	0
RESERVED	0x0007 /7	INT16 RO	3/4	Reserved	0
RESERVED	0x0008 /8	INT16 RO	3/4	Reserved	0
RESERVED	0x0009 /9	INT16 RO	3/4	Reserved	0
RESERVED	0x000A /10	INT16 RO	3/4	Reserved	0

RESERVED	0x000B /11	INT16 RO	3/4	Reserved	0
RESERVED	0x000C /12	INT16 RO	3/4	Reserved	0
RESERVED	0x000D /13	INT16 RO	3/4	Reserved	0
RESERVED	0x000E /14	INT16 RO	3/4	Reserved	0
RESERVED	0x000F /15	INT16 RO	3/4	Reserved	0
Oxygen partial pressure (Original)	0x0010 /16	UINT16 RO	3/4	0-30000 (0-300.00mbar)	N/A
Temperature (Original)	0x0011 /17	INT16 RO	3/4	-4000-12500 (-40.00-125.00 °C) ; -4000-25700 (-40.00-257.00°F)	N/A
Barometric (Original)	0x0012 /18	INT16 RO	3/4	5000-12000 (500.0-1200.0 mbar)	N/A
Oxygen concentration (Original)	0x0013 /19	INT16 RO	3/4	0-2500 (00.00-25.00 %)	N/A
RESERVED	0x0014 /20	INT16 RO	3/4	Reserved	0
RESERVED	0x0015 /21	INT16 RO	3/4	Reserved	0
RESERVED	0x0016 /22	INT16 RO	3/4	Reserved	0
RESERVED	0x0017 /23	INT16 RO	3/4	Reserved	0
RESERVED	0x0018 /24	INT16 RO	3/4	Reserved	0
RESERVED	0x0019 /25	INT16 RO	3/4	Reserved	0
RESERVED	0x001A /26	INT16 RO	3/4	Reserved	0
RESERVED	0x001B /27	INT16 RO	3/4	Reserved	0
RESERVED	0x001C /28	INT16 RO	3/4	Reserved	0
RESERVED	0x001D /29	INT16 RO	3/4	Reserved	0
RESERVED	0x001E /30	INT16 RO	3/4	Reserved	0

RESERVED	0x001F /31	INT16 RO	3/4	Reserved	0
Temperature Unit TEMPUNIT	0x0020 /32	UINT16 R/W	3/6/16	0: °C 1: °F	0
Temperature Offset TOFFSET	0x0021 /33	INT16 R/W	3/6/16	-1000~1000 (-10.00~10.00°C/°F)	0
Oxygen Partial Pressure Offset O2OFFSET	0x0022 /34	INT16 R/W	3/6/16	-1000~1000 (-10.00~10.00mbar)	0
Barometric Offset BAROOFFSET	0x0023 /35	INT16 R/W	3/6/16	-1000~1000 (-10.00~10.00mbar)	0
Floating Point Register Byte Order FLOATBYTEORDE R	0x0024 /36	INT16 R/W	3/6/16	Configure floating point register byte order. 0: Big-endian[ABCD] 1: Little-endian[DCBA] 2: Big-endian byte swap [BADC] 3: Little-endian byte swap[CDAB]	3
Modbus Slave Address ADDRESS	0x0200 /512	UINT16 R/W	3/6/16	0-255	1
RS485 baudrate BAUDRATE	0x0201 /513	UINT16 R/W	3/6/16	0-5 0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps	3: 9600bps
RS485 Protocol PROTOCOL	0x0202 /514	UINT16 R/W	3/6/16	0 0: Modbus RTU	0: Modbus RTU
RS485 parity PARITY	0x0203 /515	UINT16 R/W	3/6/16	0-2 0: NONE 1: EVEN 2: ODD	0: NONE
RS485 data bits DATABITS	0x0204 /516	UINT16 R/W	3/6/16	1 1: 8 bits	1: 8 bits
RS485 Stopbits STOPBITS	0x0205 /517	UINT16 R/W	3/6/16	0-1 0: 1 stopbit 1: 2 stopbits	0: 1 stopbit

Reserved RESERVED	0x0206 /518	UINT16 R/W	3/6/16	Reserved	0
Reserved RESERVED	0x0207 /519	UINT16 R/W	3/6/16	Reserved	0
User Defined Serial Number USERSN	0x0220 /544 0x0221 /545 0x0222 /546 0x0223 /547	UINT16 R/W	3/16	0x0000000000000000 000- 0xFFFFFFFFFFFFFFF FF Those four registers should be read/write in one command.	N/A
Oxygen partial pressure(Calibrat ed)_FLOAT	0x1000 /4096	FLOAT RO	3/4	0-30000 (0-300.00mbar)	N/A
Temperature(Cali brated)_FLOAT	0x1002 /4098	FLOAT RO	3/4	-4000-12500 (-40.00-125.00 °C) ; -4000-25700 (-40.00-257.00°F)	N/A
Barometric(Calibr ated)_FLOAT	0x1004 /4100	FLOAT RO	3/4	5000-12000 (500.0-1200.0 mbar)	N/A
Oxygen concentration(Cal ibrated)_FLOAT	0x1006 /4102	FLOAT RO	3/4	0-2500 (00.00-25.00 %)	N/A
RESERVED_FLOA T	0x1008 /4104	FLOAT RO	3/4	Reserved	0
RESERVED_FLOA T	0x100A /4106	FLOAT RO	3/4	Reserved	0
RESERVED_FLOA T	0x100C /4108	FLOAT RO	3/4	Reserved	0
RESERVED_FLOA T	0x100E /4110	FLOAT RO	3/4	Reserved	0
RESERVED_FLOA T	0x1010 /4112	FLOAT RO	3/4	Reserved	0
RESERVED_FLOA T	0x1012 /4114	FLOAT RO	3/4	Reserved	0
RESERVED_FLOA T	0x1014 /4116	FLOAT RO	3/4	Reserved	0
RESERVED_FLOA T	0x1016 /4118	FLOAT RO	3/4	Reserved	0
RESERVED_FLOA T	0x1018 /4120	FLOAT RO	3/4	Reserved	0
RESERVED_FLOA T	0x101A /4122	FLOAT RO	3/4	Reserved	0

RESERVED_FLOAT	0x101C /4124	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x101E /4126	FLOAT RO	3/4	Reserved	0
Oxygen partial pressure(Original)_FLOAT	0x1020 /4128	FLOAT RO	3/4	0-30000 (0-300.00mbar)	N/A
Temperature(Original)_FLOAT	0x1022 /4130	FLOAT RO	3/4	-4000-12500 (-40.00-125.00 °C) ; -4000-25700 (-40.00-257.00°F)	N/A
Barometric(Original)_FLOAT	0x1024 /4132	FLOAT RO	3/4	5000-12000 (500.0-1200.0 mbar)	N/A
Oxygen concentration(Original)_FLOAT	0x1026 /4134	FLOAT RO	3/4	0-2500 (00.00-25.00 %)	N/A
RESERVED_FLOAT	0x1028 /4136	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x102A /4138	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x102C /4140	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x102E /4142	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x1030 /4144	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x1032 /4146	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x1034 /4148	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x1036 /4150	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x1038 /4152	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x103A /4154	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x103C /4156	FLOAT RO	3/4	Reserved	0
RESERVED_FLOAT	0x103E /4158	FLOAT RO	3/4	Reserved	0

UINT16: 16-bit unsigned integer

INT16: 16-bit signed integer

RO: Register is Read Only

R/W: Register is Read/Write

HEX: Hexadecimal (data with 0x/0X prefix)

DEC: Decimal

FLOAT: Floating point register; the byte order is configured by the "Floating Point Register Byte Order, FLOATBYTEORDER" register. Please refer to "Modbus Register Detail Description" for more details.

The register value will be set as follows when there is a sensor error:

Error Value	Register	Error Condition
-32768	Oxygen partial pressure value	sensor broken
-32768	Temperature value	sensor broken
-32768	Barometric value	sensor broken
-32768	Oxygen concentration value	sensor broken

5.3 Modbus Register Detail Description

O2MBAR_CALIBED: Oxygen partial pressure(Calibrated), INT16 O2MBAR: Oxygen partial pressure(Original), INT16		
Range	0-30000 mapping to 0-300.00mbar	Default: N/A
Parameter Save	N/A	

Note: Oxygen partial pressure measurement value

O2MBAR_CALIBED_FLOAT: Oxygen partial pressure(Calibrated), FLOAT O2MBAR_FLOAT: Oxygen partial pressure(Original), FLOAT		
Range	0-300.00mbar	Default: N/A
Parameter Save	N/A	

Note: Oxygen partial pressure measurement value. The byte order is configured by the "Floating Point Register Byte Order, FLOATBYTEORDER" register.

TEMPEATURE_CALIBED: Temperature(Calibrated), INT16 TEMPERATURE: Temperature(Original), INT16		
Range	-4000-12500 mapping to -40.00-125.00 (Temperature Unit set to °C); -4000-25700 mapping to -40.00-257.00 (Temperature Unit set to °F)	Default: N/A
Parameter Save	N/A	

Note: Temperature measurement value

TEMPEATURE_CALIBED_FLOAT: Temperature(Calibrated), FLOAT		
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TEMPERATURE_FLOAT: Temperature(Original), FLOAT		
Range	-40.00-125.00 (Temperature Unit set to °C); -40.00-257.00 (Temperature Unit set to °F)	Default: N/A
Parameter Save	N/A	

Note: Temperature measurement value. The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

BARO_CALIBED: Barometric(Calibrated), INT16 BARO: Barometric(Original), INT16		
Range	5000-12000 mapping to 500.0-1200.0 mbar	Default: N/A
Parameter Save	N/A	

Note: Barometric measurement value

BARO_CALIBED_FLOAT: Barometric(Calibrated), FLOAT BARO_FLOAT: Barometric(Original), FLOAT		
Range	500.0-1200.0 mbar	Default: N/A
Parameter Save	N/A	

Note: Barometric measurement value. The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

O2PERCENT_CALIBED: Oxygen concentration(Calibrated), INT16 O2PERCENT: Oxygen concentration(Original), INT16		
Range	0-2500 mapping to 00.00-25.00 %	Default: N/A
Parameter Save	N/A	

Note: Oxygen concentration measurement value

O2PERCENT_CALIBED_FLOAT: Oxygen concentration(Calibrated), FLOAT O2PERCENT_FLOAT: Oxygen concentration(Original), FLOAT		
Range	00.00-25.00 mapping to 00.00-25.00%	Default: N/A
Parameter Save	N/A	

Note: Oxygen concentration measurement value. The byte order is configured by the “Floating Point Register Byte Order, FLOATBYTEORDER” register.

TEMPUNIT: Temperature Unit		
Range	0: °C 1: °F	Default: 0
Parameter Save	YES	

Note: Temperature Unit.

O2OFFSET: Oxygen partial pressure offset, INT16		
Range	-1000~1000 mapping to -10.00~10.00mbar	Default: 0
Parameter Save	YES	

Note: Oxygen partial pressure offset value

$O2MBAR_CALIBED = GAS + O2OFFSET;$

$O2MBAR_CALIBED_FLOAT = GAS_FLOAT + O2OFFSET/100.00;$

TOFFSET: Temperature Offset, INT16		
Range	-1000~1000 mapping to -10.00~10.00°C	Default: 0
Parameter Save	YES	

Note: Temperature Offset.

$TEMPRATURE_CALIBED = TEMPRATURE + TOFFSET;$

$TEMPRATURE_CALIBED_FLOAT = TEMPRATURE_FLOAT + TOFFSET / 100.00;$

BAROOFFSET: Barometric Offset, INT16		
Range	-1000~1000 mapping to -10.00~10.00mbar	Default: 0
Parameter Save	YES	

Note: Barometric Offset.

$BARO_CALIBED = BARO + BAROOFFSET/10.00;$

$BARO_CALIBED_FLOAT = BARO_FLOAT + BAROOFFSET / 100.00;$

FLOATBYTEORDER: Floating Point Register Byte Order, INT16		
Range	0: Big-endian [ABCD] 1: Little-endian[DCBA] 2: Big-endian byte swap [BADC] 3: Little-endian byte swap[CDAB]	Default: 3
Parameter Save	YES	

Note: Configure floating point register byte order.

Example: The 123456.00 in IEC754 is 0x47F12000 (A=47, B=F1, C=20, D=00), then

0: Big-endian [ABCD]

1: Little-endian[DCBA]

2: Big-endian byte swap [BADC]

3: Little-endian byte swap[CDAB]

SLAVEADDRESS: Modbus Slave Address, UINT16		
Data Range	0-255	Default: 1
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

BAUDRATE: Serial Comm Baudrate, UINT16		
Data Range	0-5 0:1200bps 1:2400bps 2:4800bps 3:9600bps 4:19200bps 5:38400bps	Default: 3
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

PROTOCOL: Serial Comm Protocol, UINT16		
Data Range	0 0:Modbus RTU	Default: 0
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

PARITY: Serial Comm Parity, UINT16		
Data Range	0-2 0:NONE 1:EVEN 2:ODD	Default: 0
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

DATABITS: Serial Comm Databits, UINT16		
Data Range	1 1:8 databits	Default: 1
Parameter Storage	YES	

Note: Please restart the sensor after configuration for the settings to take effect.

STOPBITS: Serial Comm Stopbits, UINT16		
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Data Range	0-1 0:1 stop bit 1:2 stop bits	Default: 0
Parameter Storage	YES	

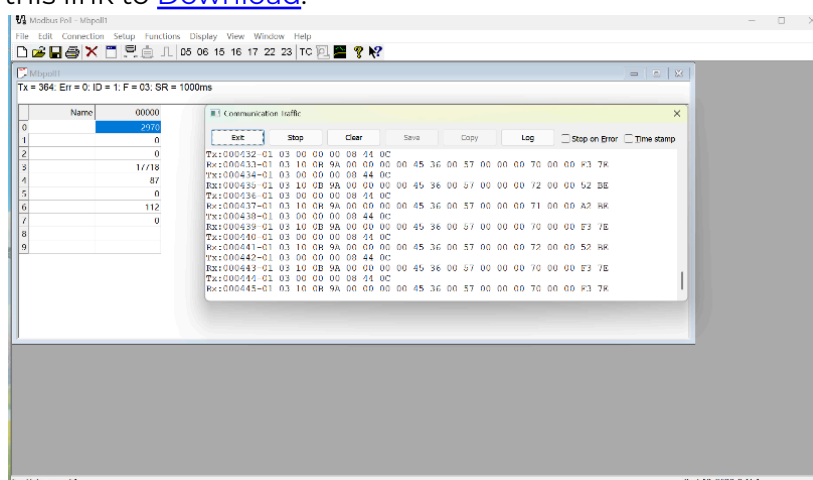
Note: Please restart the sensor after configuration for the settings to take effect.

USER_SN--- User Serial Number		
Data Range	0x0000000000000000-0xFFFFFFFFFFFFFFFF User Serial Number. These four registers should be read and written together from the start address 0x0220 with quantity 4.	Default: N/A
Parameter Storage	YES	

5.4 Software Configuration Utility

Software: Modbus Poll

You can use the software listed below to try reading/ writing the register of the sensor. Click this link to [Download](#).



5.5 Command Example

5.5.1 Modify the Slave Address

Default Registers	1
Change Slave Address	05
Address	0x0200 (512)

Number of Registers	1
Function Code	0x06
Default Sensor Address	01

To change the Modbus device address of the sensor from 01 to 05, use the following command:

Example:

Send Command	01 06 02 00 00 05 48 71
Response	01 06 02 00 00 05 48 71

Note: The address is changed to 05 and saved after power-off

5.5.2 Modify the Baud Rate

Address	0x0201 (513)
Number of Registers	1
Function Code	0x06
Default Value	3 (9600bps)
Supported Values	0-5 (1200-38400bps)

The baud rate can be set via the upper computer and takes effect after re-powering the sensor. The baud rate is saved after power-off.

The integer values map to baud rates as follows:

Integer value	Baud Rate
0	1200bps
1	2400bps
2	4800bps
3	9600bps
4	19200bps
5	38400bps

Example:

Send Command	05 06 02 01 00 02 59 F7
Response	05 06 02 01 00 02 59 F7

Note: The baud rate is changed to 4800bps and saved after power-off

6 FAQs

Question:

When multiple sensors are tested together, the values are inconsistent.

- (1) When multiple sensors are tested together, the sensing part of the sensor needs to be very close, and the data is read and compared after the gas is evenly diffused.
- (2) The accuracy of the sensor itself may cause the sensor output to be inconsistent, but the data are within the accuracy range.

Question:

The oxygen partial pressure or oxygen concentration has been changing and unstable since power-on.

- (1) The oxygen concentration depends on the oxygen partial pressure and barometric, any changes in these factors can impact the final concentration.
- (2) If the sensor is taken out of the package or placed in a new measurement environment, a certain gas concentration balance time is required, which depends on the flow of the ambient gas.
- (3) The concentration of oxygen in the room changes with breathing or ventilation.
- (4) The sensor can be placed in a sealed environment and tested after the concentration equalizes.

7 Document version

Version	Date	Description	Editor
V1.0		First Version	Zhai Chenyang