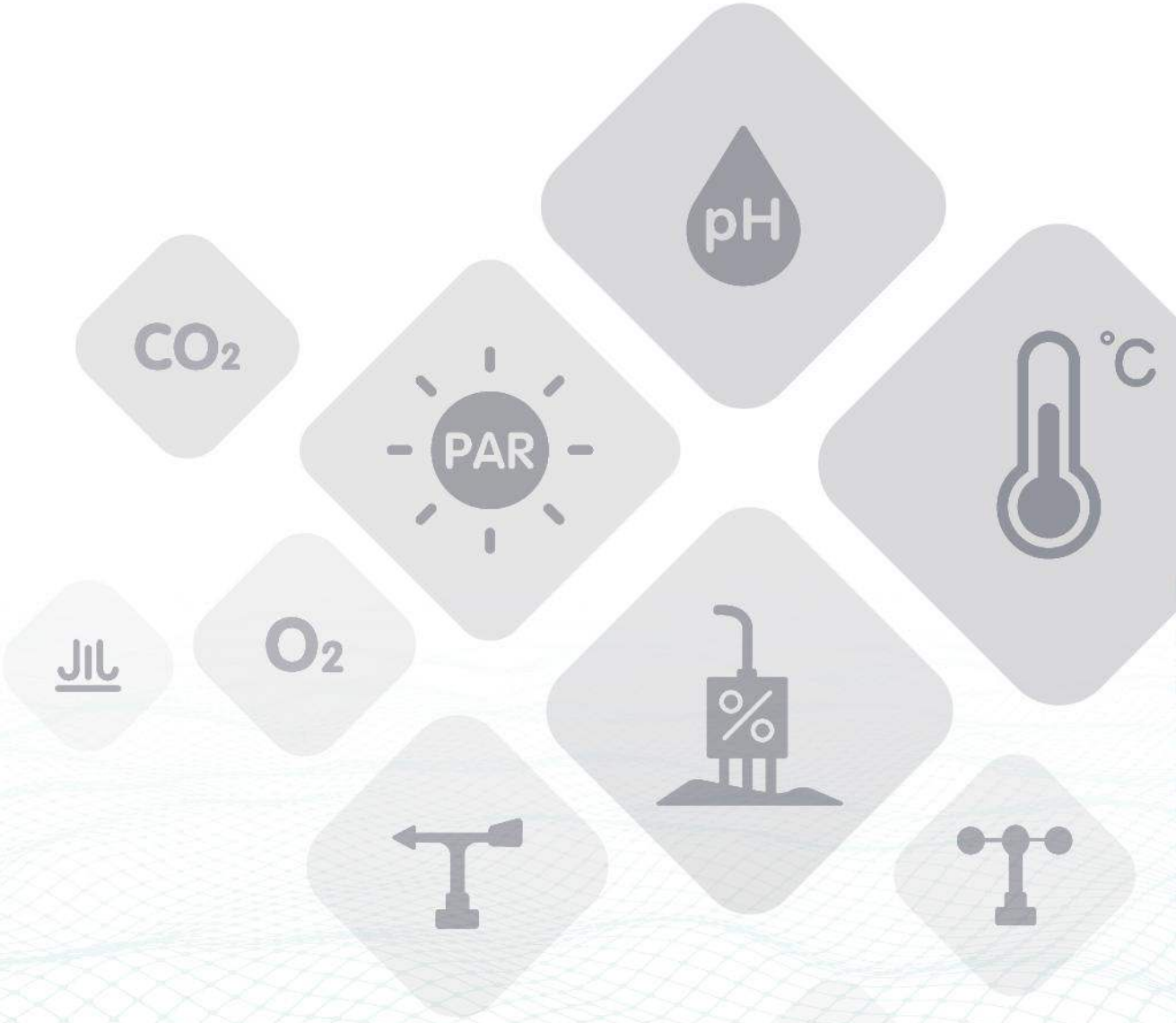
SENSECAP

# Liquid EC & TDS Sensor

## User Manual

**Version： v1.2**



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# 1 Customer Support

Thank you very much for your order. Our success comes from the continuous faith in the excellence of our products and services, something we are committed to and would never sacrifice. Our customer service, especially in the after sales phase, guarantees the satisfaction of our clients. In line with this strategy, we appreciate that you can share with us your feedback at any time for our improvement, be it positive or negative, so if we can serve you better in anyway, please do inform us.

### Need Technical Support?

Check out our Forum where is the base of our Technical Support Team. We tend to share our technical support at our Forum where the whole community can access it, but you may also email us at **sensecap@seeed.cc** for technical help.

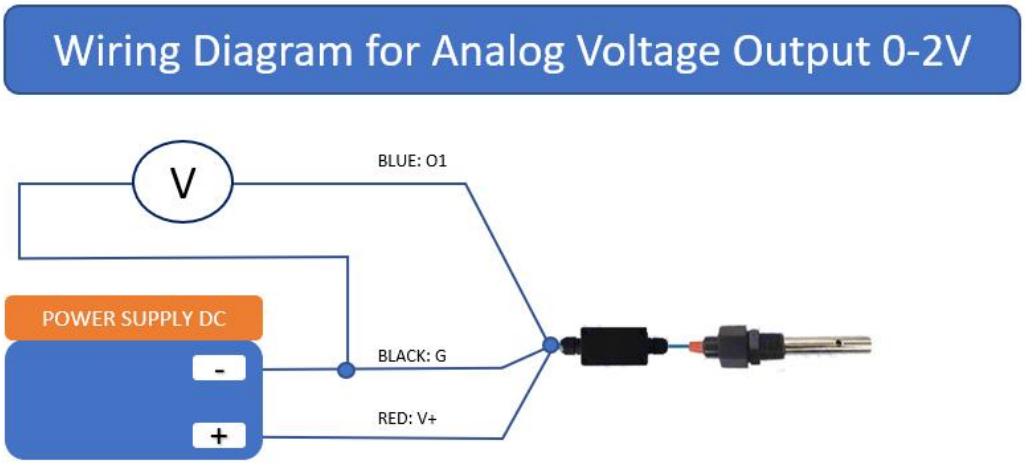
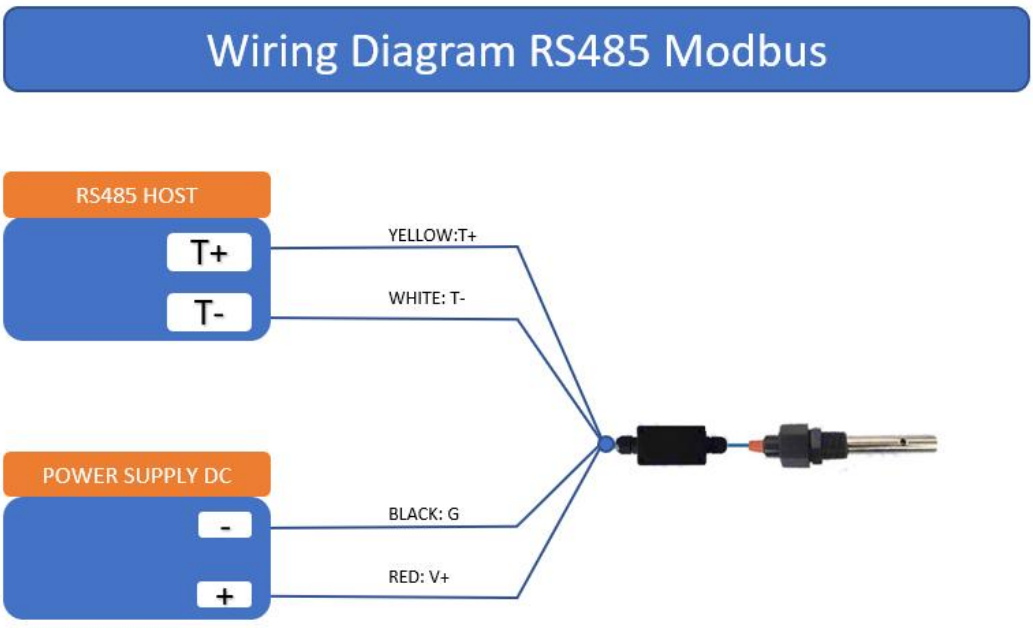
# 2 Introduction

S-EC-01 measures Conductivity, Salinity, TDS with temperature compensation. The output signal can be RS485 or Analog Voltage. The sensor is applicable for industrial, water processing, sewerage system, irrigation, smart agriculture etc.

- Conductivity, Salinity and TDS measurement with temperature compensation
- With ABS or Stainless steel electrode
- Output Interface with RS485, Voltage
- High accuracy with excellent stability
- Reverse power protection and Built-in TVS/ESD protection

| Specifications | | |
|---|---|---|
| **Output Interface** | Analog Voltage 0-2V<br>(Output resistance ~0ohm) | RS485 Modbus-RTU |
| **Power Supply** | 3.9-30V/DC | 3.9-30V/DC |
| **Power Consumption(Idle)** | 40mA@24V DC | 40mA@24V DC |
| **Power Consumption(Max)** | 80mA@24V DC | 80mA@24V DC |
| **Start-up time** | < 2 seconds | |
| **EC Measurement** | Isolated Sensor Input, Range: 0-20000us/cm<br>Resolution: 0-10000us/cm, 10us/cm; 100000-20000us/cm, 50us/cm<br>Accuracy: 0-10000us/cm, ±3%; 10000-20000us/cm, ±5%<br>EC temperature compensation: 0-50°C | |
| **Temperature Measurement** | Range: -40~80°C, Resolution:0.1°C, Accuracy:±0.5°C | |
| **IP Ratings** | Electrode:IP68; Transmitter:IP65 | |
| **Operating Temperature** | -40~85°C | |
| **Installation** | Electrode:1/2"NPT screw threads; Transmitter: Mounting hole | |
| **Cable Length** | Power and Signal Cable:2 meters or Customize; Electrode Cable:10 meters | |
| **Dimension** | Electrode:1/2"NPT screw threads; Transmitter:128*70*42mm | |

# 3 Wiring diagrams

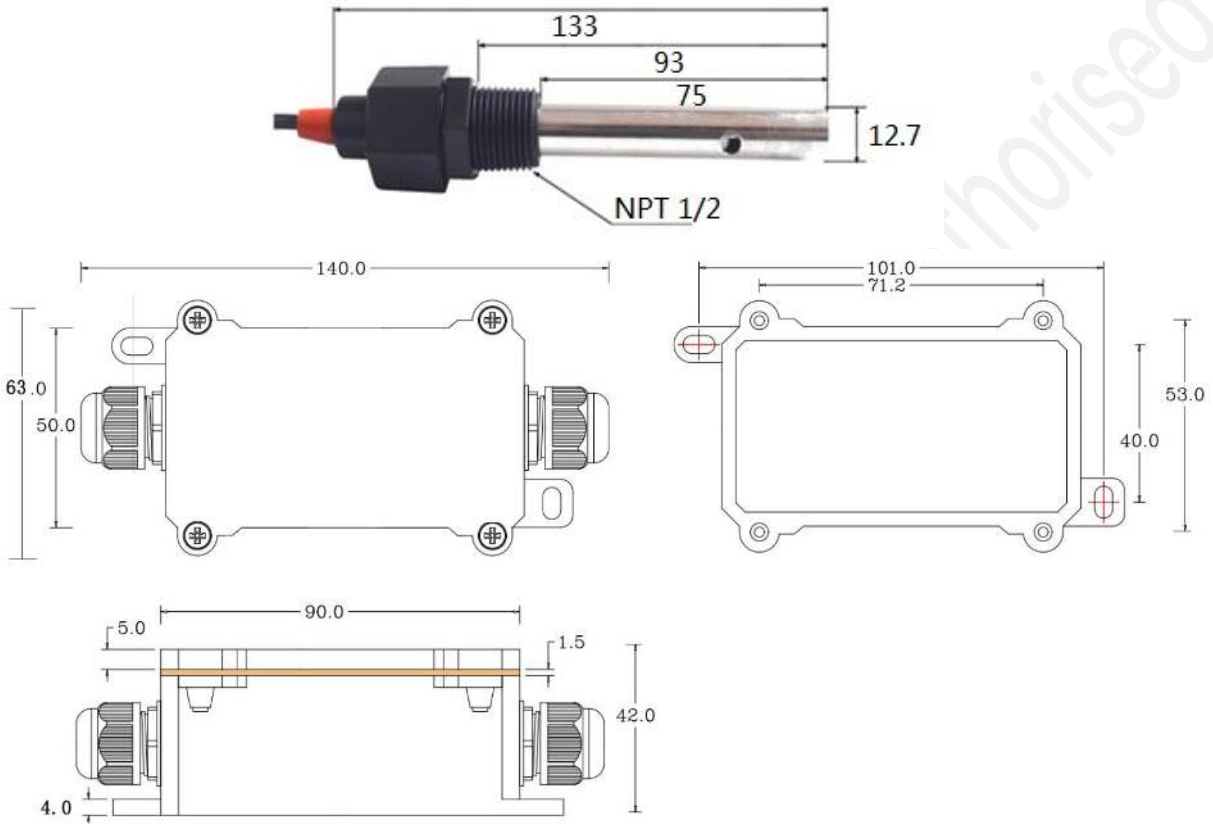
| Type | Wiring diagram |
|---|---|
| **Analog Voltage Output** | Red (V+): Power Supply +<br>Black (GND): Power Supply -<br>Blue (O1): Analog Output<br>  |
| **RS485 Modbus** | Red (V+): Power Supply +<br>Black (GND): Power Supply -<br>Yellow (T+): RS485+/A/T+<br>White (T-): RS485-/B/T-<br>  <br>ALL RS485 communication parameters (Modbus Slave Address, baud rate, parity, data bits, |

| | |
|---|---|
| | stop bits) are set in internal register and can be saved when power down, the default setting is ADDRESS=1, BAUDRATE=9600bps, PARITY=NONE, DATABITS= 8bits, STOPBITS=1bit;<br>Sometimes you may FORGET the communication settings. In this case, you can open the shield module and press the SW1-SET button at least 3 seconds, then all the communication parameters reset to default setting, then communicating with the sensor using the default setting to set your desired settings.<br>**Please re-power up the sensor to make the settings effective.** |

# 4 Dimension and Ordering Infomation

## 4.1 Dimension

Electrode(mm)




Unit: mm

***Note**: Do not put the Transmitter into the liquid.

# 5 Installation , On board buttons and Calibration

## 5.1 Installation

1/2"NPT screw threads installation. Please refer to the dimensions.

## 5.2 Installation Guide

Should following the common requirements for conductivity electrode installation.

## 5.3 On board buttons

There are 3 buttons on the transmitter board.

| Button | Functionality | Comment |
|---|---|---|
| SW1-SET | 1) Enter into EC calibration<br>2) Exit EC calibration<br>3) Reset to factory settings | 1) Long press for more than 3 seconds to restore the factory settings.<br>2) Short press to enter into the EC calibration.<br>3) Short press to exit the EC calibration. |
| SW2-CALL | EC calibration for 1413us/cm(1.413ds/m) | In EC calibration mode, Immerse the electrode in 1413us/cm solution for a while and short press the button to perform the auto calibration. |
| SW3-CALH | EC calibration for 12880us/cm(12.88ds/m) | In EC calibration mode, Immerse the electrode in 12880us/cm solution for a while and short press the button to perform the auto calibration. |

## 5.4 Restore Factory Settings

Long press SW1-SET button for more than 3 seconds to restore the factory settings. You can restore the factory settings in following cases:

1） EC Calibration failed and EC value is incorrect.
2) Can not communicate with sensor due to forgetting the communication parameters.

## 5.5 Calibration

When performing the EC calibration, you should guarantee the temperature of the standard EC calibration solution is around 25°C. And wait for a while for temperature and EC equilibrium after immersing the sensor into the standard solution.

### 5.5.1 Perform EC calibration by on board buttons

1） Short press SW1-SET button and enter into the EC calibration mode, then the led indicator flash two times every second, Note that communication is not available in calibration mode.
2） In EC calibration mode, Immerse the electrode in 1413us/cm solution for a while and short press the SW2-CALL button to perform the auto calibration.
3） In EC calibration mode, Immerse the electrode in 12880us/cm solution for a while and short press the button to perform the auto calibration.
4） Short press SW1-SET button to exit the EC calibration mode
5） Verify the sensor output.

### 5.5.2 Perform EC calibration by command

1） Immerse the electrode in 1413us/cm solution for a while and then write 0xFFFF to modbus register 0x0030 (ECCALIB_1413 EC calibration point for 1413us/cm) to perform auto calibration.
2） Immerse the electrode in 12880us/cm solution for a while and then write 0xFFFF to modbus register 0x0031 (ECCALIB_12880 EC calibration point for 12880us/cm) to perform auto calibration.
3） Verify the sensor output.

# 6 Output Signal Conversion

| Output Interface | Parameters Range | Conversion Formula |
|---|---|---|
| **Analog Voltage Output 0-2V** | EC range: 0-2000us/cm | EC=1000*VOLTAGE. When VOLTAGE=0.3V, then EC=1000*0.3=300us/cm |
| | EC range: 0-5000us/cm | EC=2500*VOLTAGE. When VOLTAGE=0.3V, then EC=2500*0.3=750us/cm. |
| | EC range: 0-10000us/cm | EC=5000*VOLTAGE. When VOLTAGE=0.3V, then EC=5000*0.3=1500us/cm. |
| | EC range: 0-20000us/cm | EC=10000*VOLTAGE. When VOLTAGE=0.3V, then EC=10000*0.3=3000us/cm. |
| **RS485 Modbus-RTU** | EC range: All | EC=(REGISTER VALUE).When REGISTER VALUE=1568, then EC= 1568us/cm. |

NOTE: The unit of VOLTAGE is (V).

NOTE: VWC is Volumetric Water Content, EC is Electrical Conductivity.

# 7 RS485 Modbus Protocol

## 7.1 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 check sum (LRC or CRC).

The sensor is RS485 interface with Modbus protocol. The default serial communication settings is slave address 1, modbus rtu, 9600bps, 8 databits and 1 stop bit. All communication settings can be changed with modbus command, and take effective after re-power up the sensor.

Following modbus function code are supported by sensor.

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

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

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

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

## 7.2 Modbus Register

| Parameters | Register Addr. (HEX/DEC) | Data Type | Modbus Function Code(DEC) | Range and Comments | Default Value |
|---|---|---|---|---|---|
| TEMPRATURE | 0x0000 /0 | INT16 RO | 3/4 | -4000-8000 for -40.00~80.00°C. | N/A |
| RESERVED | 0x0001 /1 | UINT16 RO | 3/4 | 0 | 0 |
| EC-Electrical Conductivity | 0x0002 /2 | UINT16 RO | 3/4 | 0-20000 for 0-20000us/cm | N/A |
| SALINITY | 0x0003 /3 | UINT16 RO | 3/4 | 0-20000 for 0-20000mg/L | N/A |
| TDS | 0x0004 /4 | UINT16 RO | 3/4 | 0-20000 for 0-20000mg/L | N/A |
| RESERVED | 0x0005 /5 | UINT16 RO | 3/4 | 0 | 0 |
| RESERVED | 0x0006 /6 | UINT16 RO | 3/4 | 0 | 0 |
| RESERVED | 0x0007 /7 | UINT16 | 3/4 | 0 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| | | RO | | | |
| ECRAWAD | 0x0008 /8 | UINT16<br>RO | 3/4 | 0-4000 | N/A |
| RESERVED | 0x0009 /9 | UINT16<br>RO | 3/4 | 0 | 0 |
| | | | | | |
| TEMPCOMPENSATEEN | 0x0020 /32 | UINT16<br>R/W | 3/6/16 | 0: External Temperature Sensor<br>1: Onboard temperature sensor<br>2: Disabled | 0 |
| RESERVED | 0x0021 /33 | UINT16<br>R/W | 3/6/16 | N/A | 0 |
| ECTEMPCOFF | 0x0022 /34 | UINT16<br>R/W | 3/6/16 | 0-100 for 0.0%-10.0% | 20(2%) |
| SALINITYCOFF | 0x0023 /35 | UINT16<br>R/W | 3/6/16 | 0-100 for 0.00-1.00 | 55(0.55) |
| TDSCOFF | 0x0024 /36 | UINT16<br>R/W | 3/6/16 | 0-100 for 0.00-1.00 | 50(0.5) |
| ELECTRODECONSTANT | 0x0025 /37 | UINT16<br>R/W | 3/6/16 | 500-1500 for 0.500-1.500 | 1000(1.000) |
| | | | | | |
| ECCALIB_1413<br>EC calibration point for 1413us/cm | 0x0030 /48 | UINT16<br>R/W | 3/6/16 | Immerse the electrode in 1413us/cm solution for a while and write 0xFFFF into the register to perform the auto calibration. | 223 |
| ECCALIB_12880<br>EC calibration point for 12880us/cm | 0x0031 /49 | UINT16<br>R/W | 3/6/16 | Immerse the electrode in 12880us/cm solution for a while and write 0xFFFF into the register to perform the auto calibration. | 1851 |
| | | | | | |
| SLAVEADDRESS | 0x0200 /512 | UINT16<br>R/W | 3/6/16 | 0-255 | 1 or 30 |
| BAUDRATE | 0x0201 /513 | UINT16<br>R/W | 3/6/16 | 0-6<br>0:1200bps<br>1:2400bps<br>2:4800bps<br>3:9600bps<br>4:19200bps<br>5:38400bps | 3:9600bps |

| | | | | | |
|---|---|---|---|---|---|
| PROTOCOL | 0x0202 /514 | UINT16 R/W | 3/6/16 | 0-1<br>0:Modbus RTU<br>1:Modbus ASCii | 0:Modbus RTU |
| PARITY | 0x0203 /515 | UINT16 R/W | 3/6/16 | 0-2<br>0:None<br>1:Even<br>2:Odd | 0:None Parity |
| DATABITS | 0x0204 /516 | UINT16 R/W | 3/6/16 | 1<br>1:8 databits | 1:8 databits |
| STOPBITS | 0x0205 /517 | UINT16 R/W | 3/6/16 | 0-1<br>0:1 stopbit<br>1:2 stopbits | 0:1 stopbit |
| RESPONSEDELAY | 0x0206 /518 | UINT16 R/W | 3/6/16 | 0-255 for 0-2550 milliseconds | 0 |
| ACTIVEOUTPUTINTERVAL | 0x0207 /519 | UINT16 R/W | 3/6/16 | 0-255 for 0-255 seconds. | 0 |

NOTE: UINT16:16 bit unsigned integer, INT16:16bit signed integer

NOTE: RO: Register is Read Only, R/W: Register is Read/Write

NOTE: HEX is Hexadecimal (data with 0x/0X prefix), DEC is Decimal

## 7.3 Modbus Register Detail Descripton

| **TEMPERATURE** | | |
|---|---|---|
| Data Range | -4000-8000 For -40.00~80.00°C | Default: N/A |
| Power Down Save | N/A | |

Note:Temperature value (Binary complement).

Example:When REGISTER = 0x0702 (HEX format), then VALUE=(0x07*256+0x02)/100=17.94°C.When REGISTER=FF05H (HEX format),then VALUE=((0xFF*256+0x05)-0xFFFF-0x01)/100 =(0xFF05-0xFFFF-0x01)/100=-2.51°C.

| **EC ---Electrical Conductivity** | | |
|---|---|---|
| Data Range | 0-20000 For 0-20000us/cm | Default: N/A |
| Power Down Save | N/A | |

Note:Electrical Conductivity.

Example:When REGISTER = 0x0702 (HEX format), then VALUE=(0x07*256+0x02)=1794us/cm

| **SALINITY--- Salinity** |
|---|

| | | |
|---|---|---|
| Data Range | 0-20000 For 0-20000mg/L | Default: N/A |
| Power Down Save | N/A | |

Note:**SALINITY**

Example:When REGISTER = 0x0702 (HEX format), then VALUE=(0x07*256+0x02)=1794mg/L, Salinity is derived by EC, SALINITY=EC* SALINITYCOFF, in which SALINITYCOFF is a coefficient, please refer to SALINITYCOFF.

| **TDS---Total Dissolved Solid** | | |
|---|---|---|
| Data Range | 0-20000 For 0-20000mg/L | Default: N/A |
| Power Down Save | N/A | |

Note:Total Dissolved Solid

Example:When REGISTER = 0x0702 (HEX format), then VALUE=(0x07*256+0x02)=1794mg/L, TDS is derived by EC, TDS=EC* TDSCOFF, in which TDSCOFF is a coefficient, please refer to TDSCOFF.

| **ECRAWAD** | | |
|---|---|---|
| Data Range | 0-4000 | Default: N/A |
| Power Down Save | N/A | |

Note: Conductivity raw AD value

Example:When REGISTER = 0x0702 (HEX format), then VALUE=(0x07*256+0x02)=1794

| **TEMPCOMPENSATEEN** | | |
|---|---|---|
| Data Range | 0: External Temperature Sensor<br>1: Onboard temperature sensor<br>2: Disabled | 0 |
| Power Down Save | YES | |

Note: Temperature compensation

| **ECTEMPCOFF---EC Temperature Compensation Coefficient** | | |
|---|---|---|
| Data Range | 0-100 for 0.0%-10.0% | Default: 20(2%) |
| Power Down Save | YES | |

Note:EC Temperature Compensation Coefficient

| **SALINITYCOFF---Salinity Coefficient** | | |
|---|---|---|
| Data Range | 0-100 for 0.00-1.00 | Default: 55(0.55) |

| | | |
|---|---|---|
| Power Down Save | YES | |

Note:Salinity Coefficient.

| **TDSCOFF---TDS Coefficient** | | |
|---|---|---|
| Data Range | 0-100 for 0.00-1.00 | Default: 50(0.50) |
| Power Down Save | YES | |

Note:TDS Coefficient.

| **ELECTRODECONSTANT** | | |
|---|---|---|
| Data Range | 500-1500 for 0.500-1.500 | Default: 1000(1.000) |
| Power Down Save | YES | |

Note: Electrode constant provided by the electrode manufactor

| **SLAVEADDRESS --- Modbus Slave Address** | | |
|---|---|---|
| Data Range | 0-255 | Default: 1 or 30 |
| Power Down Save | YES | |

Note: Please re-power on the sensor to take effective after set.

| **BAUDRATE --- Serial Comm Baudrate** | | |
|---|---|---|
| Data Range | **0-5**<br>**0:**1200bps<br>**1:**2400bps<br>**2:**4800bps<br>**3:**9600bps<br>**4:**19200bps<br>**5:**38400bps | Default: 3 |
| Power Down Save | YES | |

Note: Please re-power on the sensor to take effective after set.

| **PROTOCOL --- Serial Comm Protocol** | | |
|---|---|---|
| Data Range | 0-1<br>0:Modbus RTU<br>1:Modbus ASCii | Default: 0 |
| Power Down Save | YES | |

Note: Please re-power on the sensor to take effective after set.

| **PARITY --- Serial Comm Parity** | | |
|---|---|---|
| Data Range | 0-2<br>0:NONE<br>1:EVEN<br>2:ODD | Default: 0 |
| Power Down Save | YES | |

Note: Please re-power on the sensor to take effective after set.

| **DATABITS --- Serial Comm Databits** | | |
|---|---|---|
| Data Range | 1<br>1:8 databits | Default: 1 |
| Power Down Save | YES | |

Note: Please re-power on the sensor to take effective after set.

| **STOPBITS --- Serial Comm Stopbits** | | |
|---|---|---|
| Data Range | 0-1<br>0:1 stopbit<br>1:2 stopbits | Default: 0 |
| Power Down Save | YES | |

Note: Please re-power on the sensor to take effective after set.

| **RESPONSEDELAY --- Serial Comm Response Delay** | | |
|---|---|---|
| Data Range | 0-255 for 0-2550 milliseconds, 0 for disabled | Default: 0 |
| Power Down Save | YES | |

Note: Please re-power on the sensor to take effective after set.

Note: Sensor will delay a period before response to master request command.

Example: When set to 5 and receive a request from master device, then sensor will delay 5*10ms=50ms, then response to master.

| **ACTIVEOUTPUTINTERVAL --- Serial Comm Active Output Interval time** | | |
|---|---|---|
| Data Range | 0-255 for 0-255 seconds, 0 for disabled | Default: 0 |
| Power Down Save | YES | |

Note: Please re-power on the sensor to take effective after set.

Note: Sensor will output the data actively without any master request command.

Note:Only ONE sensor should be on RS485 network, or there will be data collision and corrupt the data on line.

Note:Refer to SETTING mode to exit the Active Output Mode.

Example: When set to 5 then sensor will output the data every 5 seconds without any master request command.

## 7.4 Modbus Function Code

For description below, data started with 0X/0x means that it's in HEX format.

### 7.4.1 Function Code 3 Protocol Example

**Master Request: AA 03 RRRR NNNN CCCC**

| | | |
|---|---|---|
| AA | 1 byte | Slave Address,0-255 |
| 0x03 | 1 byte | Function Code 3 |
| RRRR | 2 byte | Starting Register Addr |
| NNNN | 2 byte | Quantity of Register to read |
| CCCC | 2 byte | CRC CHECKSUM |

**Slave Response: AA 03 MM VV0 VV1 VV2 VV3… CCCC**

| | | |
|---|---|---|
| AA | 1 byte | Slave Address,0-255 |
| 0x03 | 1 byte | Function Code 3 |
| MM | 1 byte | Register Data Byte Count |
| VV0,VV1 | 2 byte | Register Value (High8bits first) |
| VV2,VV3 | 2 byte | Register Value (High8bits first) |
| … | … | Register Value (High8bits first) |
| **CCCC** | 2 byte | CRC CHECKSUM |

**Example: Read register 0x0200-0x0201,that is slave address and baudrate.**

**Master Request:01 03 0200 0002 C5B3**

| | | |
|---|---|---|
| Slave Addr. | 1 byte | 0x01 |
| Function Code | 1 byte | 0x03 |
| Starting Register Addr. | 2 byte | 0x0200 |

| | | |
|---|---|---|
| Quantity of Register to read | 2 byte | 0x0002 |
| Checksum | 2 byte | 0xC5B3 |

**Slave Response:01 03 04 00 01 00 03 EB F2**

| | | |
|---|---|---|
| Slave Addr. | 1 byte | 0x01 |
| Function Code | 1 byte | 0x03 |
| Register Data Byte Count | 1 byte | 0x04 |
| Register Value: Address | 2 byte | 0x00(HIGH 8 Bits) |
| | | 0x01(LOW8 Bits) |
| Register Value: Baudrate | 2 byte | 0x00(HIGH 8 Bits) |
| | | 0x03(LOW8 Bits) |
| Checksum | 2 byte | 0xEBF2 |

## 7.4.2 Function Code 4 Protocol Example

**Master Request: AA 04 RRRR NNNN CCCC**

| | | |
|---|---|---|
| AA | 1 byte | Slave Address,0-255 |
| 0x04 | 1 byte | Function Code 4 |
| RRRR | 2 byte | Starting Register Addr |
| NNNN | 2 byte | Quantity of Register to read |
| CCCC | 2 byte | CRC CHECKSUM |

**Slave Response: AA 04 MM VV0 VV1 VV2 VV3… CCCC**

| | | |
|---|---|---|
| AA | 1 byte | Slave Address,0-255 |
| 0x04 | 1 byte | Function Code 4 |
| MM | 1 byte | Register Data Byte Count |
| VV0,VV1 | 2 byte | Register Value (High8bits first) |
| VV2,VV3 | 2 byte | Register Value (High8bits first) |
| … | … | Register Value (High8bits first) |
| **CCCC** | 2 byte | CRC CHECKSUM |

**Example: Read register 0x0000-0x0002,that is temperature, reserved, and EC.**

**Master Request:01 04 0000 0003 B00B**

| | | |
|---|---|---|
| Slave Addr. | 1 byte | 0x01 |
| Function Code | 1 byte | 0x04 |
| Starting Register Addr. | 2 byte | 0x0000 |
| Quantity of Register to read | 2 byte | 0x0003 |
| Checksum | 2 byte | 0xB00B |

**Slave Response: 01 04 06 08 16 00 00 05 78 2B 6A**

| | | |
|---|---|---|
| Slave Addr. | 1 byte | 0x01 |
| Function Code | 1 byte | 0x04 |
| Register Data Byte Count | 1 byte | 0x06 |
| Register Value: Temperature | 2 byte | 0x08(HIGH 8 Bits) |
| | | 0x16(LOW8 Bits) |
| Register Value: Reserved | 2 byte | 0x00(HIGH 8 Bits) |
| | | 0x00(LOW8 Bits) |
| Register Value: EC | 2 byte | 0x05(HIGH 8 Bits) |
| | | 0x78(LOW8 Bits) |
| Checksum | 2 byte | 0xD257 |

Temperature =(0x08*256+0x 16)/100=2070/100=20.70 °C
EC=0x05*256+0x78=5*256+120 =1400 us/cm

## 7.4.3 Function Code 6 Protocol Example

**Master Request: AA 06 RRRR VVVV CCCC**

| | | |
|---|---|---|
| AA | 1 byte | Slave Address,0-255 |
| 0x06 | 1 byte | Function Code 6 |
| RRRR | 2 byte | Register Addr (High8bits first) |
| VVVV | 2 byte | Register Value (High8bits first) |
| CCCC | 2 byte | CRC CHECKSUM |

**Slave Response: AA 06 RRRR VVVV CCCC**

| | | |
|---|---|---|
| AA | 1 byte | Slave Address,0-255 |
| 0x06 | 1 byte | Function Code 6 |
| RRRR | 2 byte | Register Addr (High8bits first) |
| VVVV | 2 byte | Register Value (High8bits first) |
| CCCC | 2 byte | CRC CHECKSUM |

**Example: Write Register 0x0020,that is set temperature compensation**

**Request: 01 06 0020 0000 8800**

| | | |
|---|---|---|
| Slave Addr. | 1 byte | 0x01 |
| Function Code | 1 byte | 0x06 |
| Register Addr. | 2 byte | 0x0020 (High8bits first) |
| Register Value | 2 byte | 0x0000 (High8bits first) |
| Checksum | 2 byte | 0x8800 |

**Response:01 06 0021 0001 1800**

| | | |
|---|---|---|
| Slave Addr. | 1 byte | 0x01 |
| Function Code | 1 byte | 0x06 |
| Register Addr. | 2 byte | 0x0020 (High8bits first) |
| Register Value | 2 byte | 0x0000 (High8bits first) |
| Checksum | 2 byte | 0x8800 |

### 7.4.4 Function Code 16 Protocol Example

**Master Request: AA 10 RRRR NNNN MM VVVV1 VVVV2 …CCCC**

| | | |
|---|---|---|
| AA | 1 byte | Slave Address,0-255 |
| 0x10 | 1 byte | Function Code 0x10 |
| RRRR | 2 byte | Starting Register Addr |
| NNNN | 2 byte | Quantity of Register to write |
| MM | 1 byte | Register Data Byte Count |
| VVVV1 | 2 byte | Register Value(High8bits first) |
| VVVV2 | 2 byte | Register Value(High8bits first) |
| … | … | Register Value(High8bits first) |
| CCCC | 2 byte | CRC CHECKSUM |

**Slave Response: AA 10 RRRR NNNN CCCC**

| | | |
|---|---|---|
| AA | 1 byte | Slave Address,0-255 |
| 0x10 | 1 byte | Function Code 0x10 |
| RRRR | 2 byte | Starting Register Addr |
| NNNN | 2 byte | Quantity of Register to write |
| **CCCC** | 2 byte | CRC CHECKSUM |

**Example: Write Register 0x0200-0x0201,that is set slave address to 1,and baudrate to 19200bp.**

**Master Request:01 10 0200 0002 04 0001 0004 BACC**

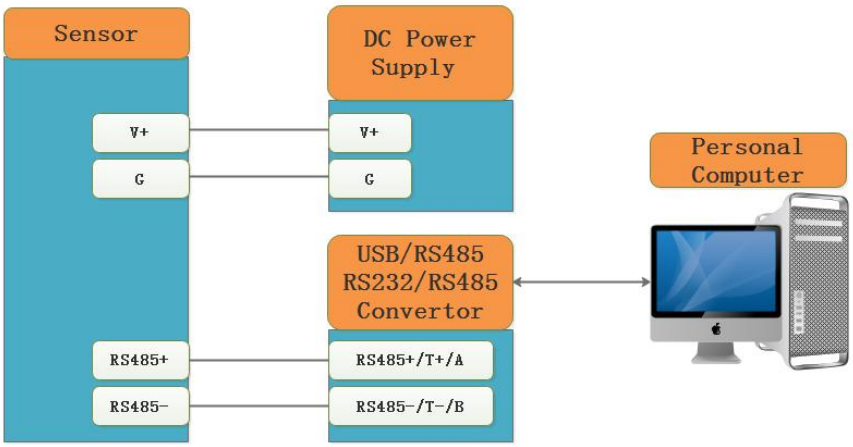
| | | |
|---|---|---|
| 0x01 | 1 byte | Slave Addr. |
| 0x10(HEX) | 1 byte | Function Code 0x10 |
| 0x0200 | 2 byte | Starting Register Addr |
| 0x0002 | 2 byte | Quantity of Register to write |
| 0x04 | 1 byte | Register Data Byte Count |
| 0x0001 | 2 byte | Register Value: Slave Address 1 |
| 0x0004 | 2 byte | Register Value: Baudrate 19200bps |
| 0xBACC | 2 byte | CRC CHECKSUM |

**Salve Response:01 10 0200 0002 4070**

| | | |
|---|---|---|
| 0x01 | 1 byte | Slave Addr. |
| 0x10(HEX) | 1 byte | Function Code 0x10 |
| 0x0200 | 2 byte | Starting Register Addr(High8bits first) |
| 0x0002 | 2 byte | Quantity of Register to write(High8bits first) |
| 0x4070 | 2 byte | CRC CHECKSUM |

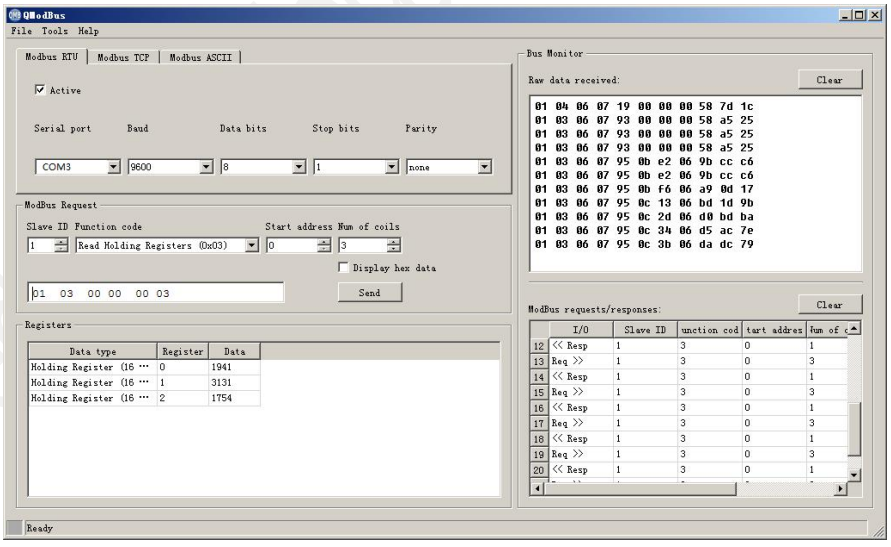
# 8 Software Configuration Utility

## 8.1 Hardware Setup




## 8.2 Universal Modbus Comm Utility

You can use software listed below to try reading/writing the register of sensor, https://github.com/ed-chemnitz/qmodbus/releases





# 9 Document version

| Version | Date | Description | Editor |
|---|---|---|---|
| V1.0 | | First Version | |
| V1.1 | 11/18/22 | Add Note in Chapter 4 | Yvonne.Meng |
| V1.2 | 01/29/23 | Delete the SensorOneSet Configuration Utility in Chapter 5 and 8 | Yvonne.Meng |
| | 06/26/23 | Modify Electrode Cable:10 meters | Yvonne.Meng |