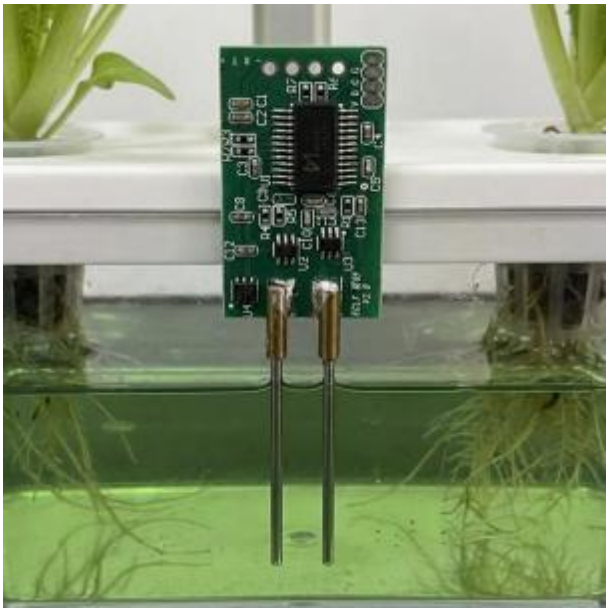
Electrical Conductivity, Level, and Temperature Sensor Product Overview

The ECLT (Electrical Conductivity, Level, and Temperature sensor) integrates the high-frequency differential capacitance sensing SoC chip MCP61 with embedded algorithms to measure electrical conductivity (EC), temperature, and liquid level within a container.Typically mounted at the bottom of a container, the sensor monitors water quality and low-level alerts. It features high sensitivity, precise measurement, low power consumption, and ease of use. Applications include drinking water purification, nutrient solution quality testing for plants and animals, and multi-parameter monitoring of liquid level and temperature.

Left: Electrical Conductivity,Level and Temperature Sensor Module(ECLT PCBA)
Right: Electrical Conductivity,Level and Temperature Sensor(ECLT)



Application Diagram

1. Technical Specifications

EC Range: 0 mS/cm to 40 mS/cm

Accuracy Error: <3% (calibrated against standard salt solutions)

Typical Temperature Accuracy: ±0.5°C

Operating Temperature Range: 0°C to 80°C

Operating Voltage: 2V to 5.5V

Interface: UART

Interface cable length: 50cm

Waterproof rating: IP67

Dimensions:

Module: 27*15*3mm (L*W*H)

Sensor: 50*24*10 mm (L*W*H)

Sensor weight: 15g

2. Interface/Wire Sequence Specifications

Refer to the table below for module interface details.

Interface Name	Silkscreen	Description
Communication Interface	R	Connects to host computer TX
	T	Connected to host computer RX
Power Interface	-	Power ground
	+	Power positive, 2V to 5.5V supply

Refer to the table below for detailed sensor wire sequence specifications.

	Wire Color	Description
Power Supply	Red	Power Positive (DC 2V~5.5V)
	Black	Power Negative
Communication	Yellow	TX
	Green/Blue	RX

3. Communication Protocol

3.1 Basic Communication Parameters

The basic parameters for serial communication are shown in the table below.

Encoding	8-bit binary
Data Bits	8 bits
Parity Bit	None
Stop bit	1 bit
Error Checking	CRC-16/MODBUS (Cyclic Redundancy Check)
Baud Rate	9600 bps

3.2 Wake-Up Instructions

In the low-power version, to trigger the module's measurement and data acquisition functions, the host must send two measurement commands: the first is

a wake-up command, followed by a query or configuration command. These two commands must be sent at least 200ms apart to ensure the module successfully wakes up for testing.

Read Timing Specification:

- Send 8F ------ Wake-up command
- Wait 200ms ------ Wait for internal clock stabilization
- Send Inquiry Frame 01 03 00 12 00 03 A5 CE ------Query capacitance, Vbe, water immersion alarm status
- Wait 500ms to receive response frame

3.3 Data Frame Format Definition

Using Modbus-RTU communication protocol, format as follows:

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error Check = 16-bit CRC code (low byte first)

Address Code: Represents the sensor's address, which is unique within the communication network (factory default: 0x01).

Function Code: Indicates the command function sent by the host. Function code 0x03 reads register data; function code 0x06 writes a single register.

Data Area: Contains the specific communication data. Note that for 16-bit data, the high byte is transmitted first.

CRC Code: Two-byte checksum, with the low byte first and the high byte second.

Host Inquiry Frame Structure

Address Code	Function Code	Register Start Address	Register Length	Checksum Low Bit	High-order parity bit
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Slave Response Frame Structure

Address Code	Function code	Number of Valid Bytes	First Data Area	...	Nth Data Field	Checksum Low Byte	High-order parity bit
1 byte	1 byte	1 byte	2 bytes	...	2 bytes	1 byte	1 byte

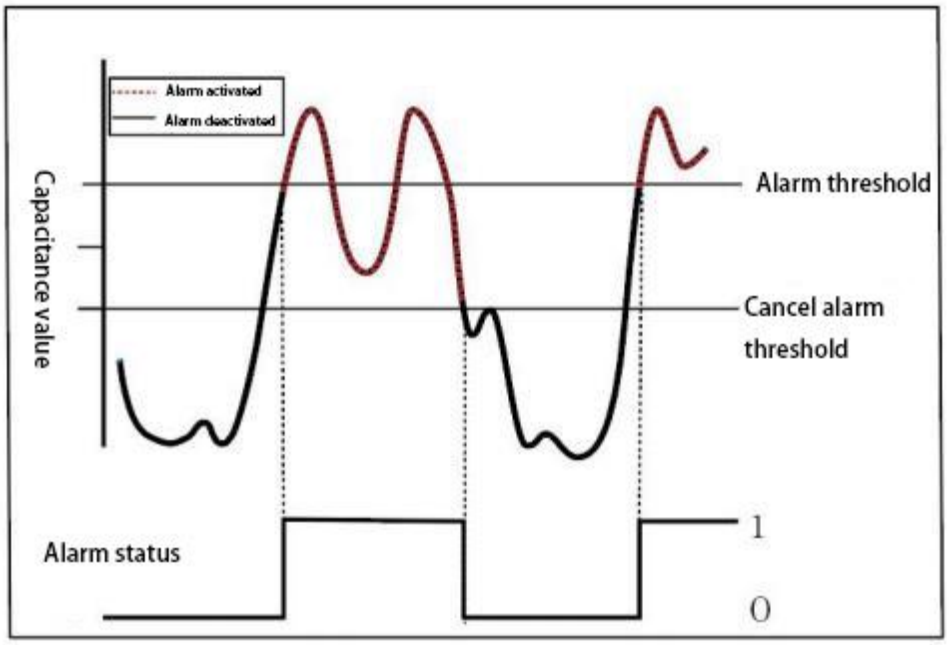
3.4 Register Definitions

Register Start Address	Data Length Unit is 2 Bytes	Content	Description	Operation
0001 H	1	Device ID	Unsigned integer, 1–252	Read/ Write
0002 H	1	485 Node Address	Unsigned integer, 1–252	Read-only
0003 H	1	Liquid Level Alarm Capacitance Threshold	Unsigned integer, 0 to 65535 (scaled up by 100), Unit: pF	Read/ Write
0004 H	1	Liquid level alarm release capacitance threshold	Unsigned integer, 0~65535 (scaled up by 100), Unit: pF	Read/ Write
0005 H	1	No-load calibration capacitance value C0	Unsigned integer, 0~65535 (scaled up by 100), Unit: pF	Read/ Write
0006 H	1	Capacitance difference Cd	Signed Integer -32768 to 32767 (scaled up by 100), unit: pF	Read/ Write

0007 H	1	Calibration Command	Unsigned integer, 0~1	Read/ Write
0008	5		Reserved	
H~000BH				
000CH	1	Capacitor	Unsigned integer, 0 to 65535 (scaled up by 100), unit: pF	Read-only
000EH	1	Liquid level alarm status	Unsigned integer, 0~1	Read-only
000FH	1	Temperature	Signed number (scaled by 10), -70.0 to 150.0°C	Read-only
0010H	1	TDS	Unsigned integer, 0 to 65535 (multiplied by 10), unit: PPM	Read-only
0011H	1	Conductivity	Unsigned integer, 0~65535 (multiplied by 10), unit: μS/cm	Read-only
0012H	1	Conductivity	Unsigned integer, 0~65535 (multiplied by 10), unit: μS	Read-only
0013H~0015H	1		Reserved	
0020H	1	Hardware Version Number	The upper 8 bytes represent the major version number; the lower 8 bytes represent the minor version number. Example: 2.A is stored as 0x2A.	Read-only

0021H	1	Firmware Version Number	The upper 8 bytes represent the major version number; the lower 8 bytes represent the minor version number. Example: 0.1 is	Read-only
			stored as 0x01.	
0030H~0035H	6	Device ID	Unique device ID number 64-bit	Read-only

3.5 Alarm Threshold Specifications



Alarm Threshold Configuration Guide

As shown in the figure above, we can set alarm thresholds and cancel alarm thresholds using corresponding commands. When the measured capacitance value exceeds the alarm threshold, the alarm status bit will be set to 1. If the capacitance value falls below the alarm threshold but does not reach the alarm cancellation threshold, the alarm status will remain active. Only when the measured capacitance value falls below the alarm cancellation threshold will the alarm status bit be reset to 0.

Note: Capacitance difference Cd = C (real-time capacitance value collected during calibration) - C0 (no-load calibration capacitance value C0).

3.6 Communication Protocol Example

3.6.1 Reading Capacitance and Liquid Level Alarm Status for Sensor Address 0x01

Query Frame

Example: 01 03 00 12 00 03 A5 CE Query 2 words (4 bytes) of data from Node 1, starting at address 0x0012

Address Code	Function Code	Start Address	Data Length Unit is 2 bytes	Checksum Low Bit	High-order parity bit
0x01	0x03	0x00 0x12	0x00 0x02	0x64	0x0E

Response Frame

For example, when reading a capacitance of 7.5 pF, the liquid level alarm status is: 0x00 indicates no water, 0x01 indicates water present

Address Code	Function code	Valid Byte Count	Capacitance	Liquid Level Alarm Status	Low-order parity bit	High-order check digit
0x01	0x03	0x04	0x1D 0x4C	0x00 0x00	0x3D	0x88

Note: 1. Capacitance: Capacitance value acquired by Channel 1

0x1D4C (hexadecimal) = 7500 = > Capacitance = 7.5 pF

2. Liquid level alarm status: 0x01 indicates water present, 0x00 indicates no water

3.6.2 Modifying Capacitance Alarm Threshold

Modify the liquid level alarm threshold to 8pF

Note: Only one sensor can be connected to the bus when modifying the address Setup.

Frame

Address Code	Function Code	Start Address	Alarm Threshold	Low-order parity bit	High-order parity bit
0x01	0x06	0x00 0x03	0x1F 0x40	0x70	0x0A

Response Frame

Address Code	Function Code	Start Address	Alarm Threshold	Checksum Low Bit	High-order parity bit
0x01	0x06	0x00 0x03	0x1F 0x40	0x70	0x0A

3.6.3 Initial Calibration Capacitance Value

Perform a no-load calibration on the sensor

Note: Only one sensor may be connected to the bus when modifying the address. Factory calibration is pre-set by default.

Set Frame

Address Code	Function Code	Start Address	Calibration Status	Checksum Low Bit	High-order parity bit
0x01	0x06	0x00 0x07	0x00 0x01	0xF9	0xCB

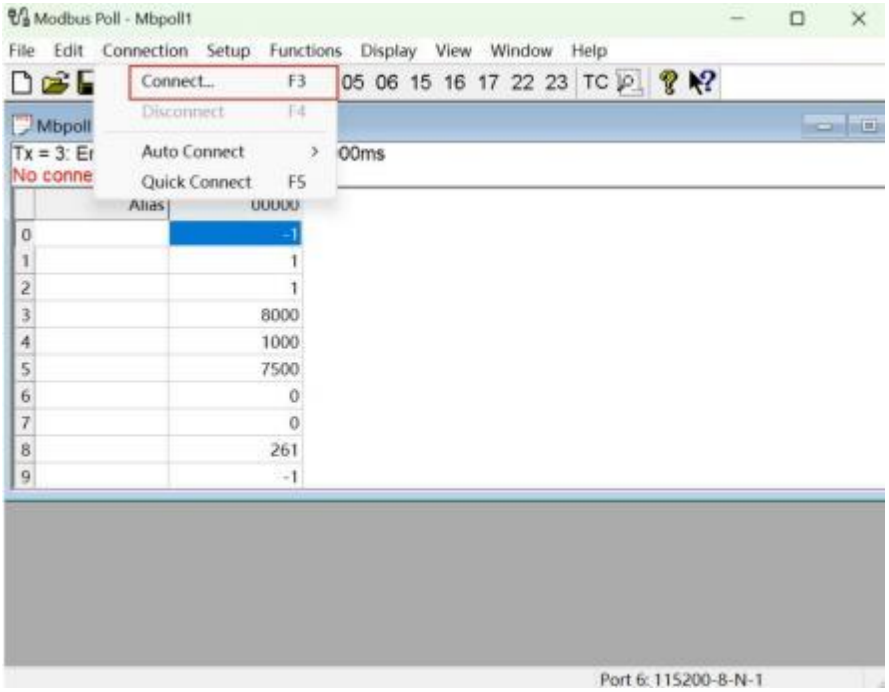
Response Frame

Address Code	Function Code	Start Address	Calibration Status	Checksum Low Bit	High-order parity bit
0x01	0x06	0x00 0x07	0x00 0x01	0xF9	0xCB

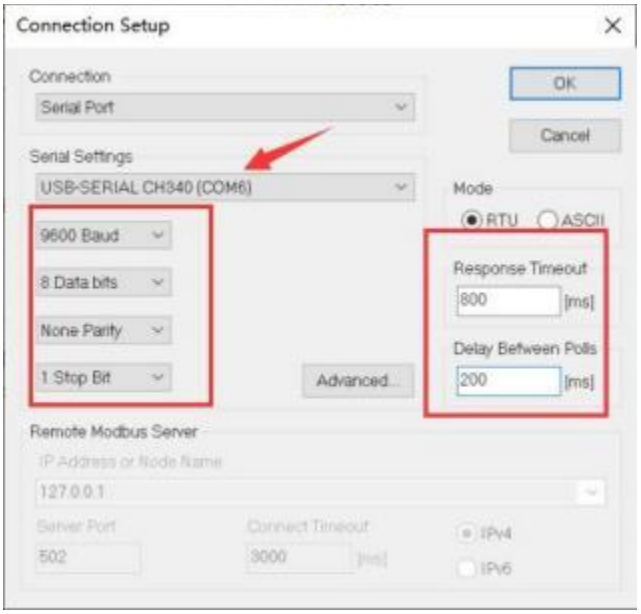
4. Modbus Poll Usage Instructions

4.1 Serial Port Parameter Configuration and Connection Instructions

Click "Connection". In the pop-up serial port window, select the corresponding port number, baud rate, and other information.

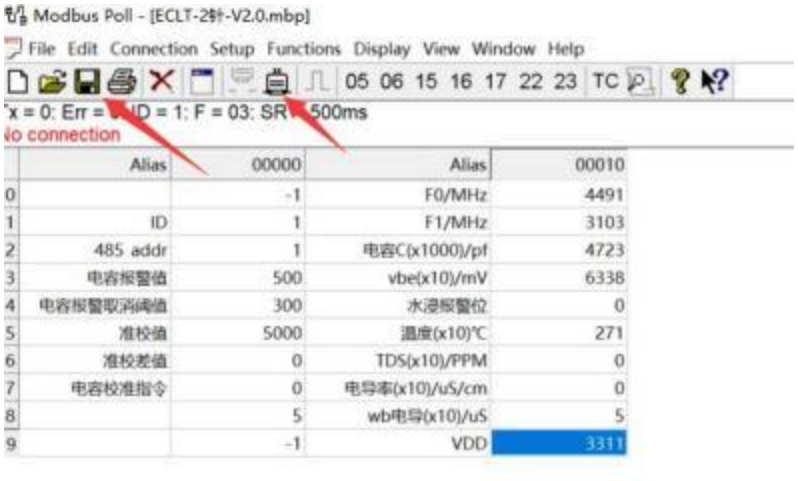


Modbus Poll Connection Diagram



Serial Port Parameter Configuration Reference Diagram

Open the ECLT-2-Pin-V2.0.mbp file and click "Connect" to view real-time data from the corresponding sensors.

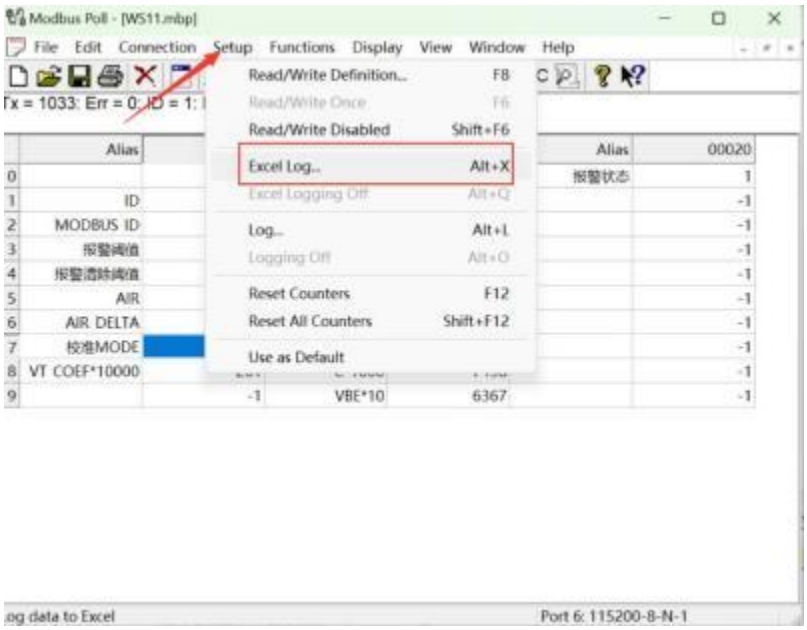


Opening mbp file diagram

4.2 Saving Log Data

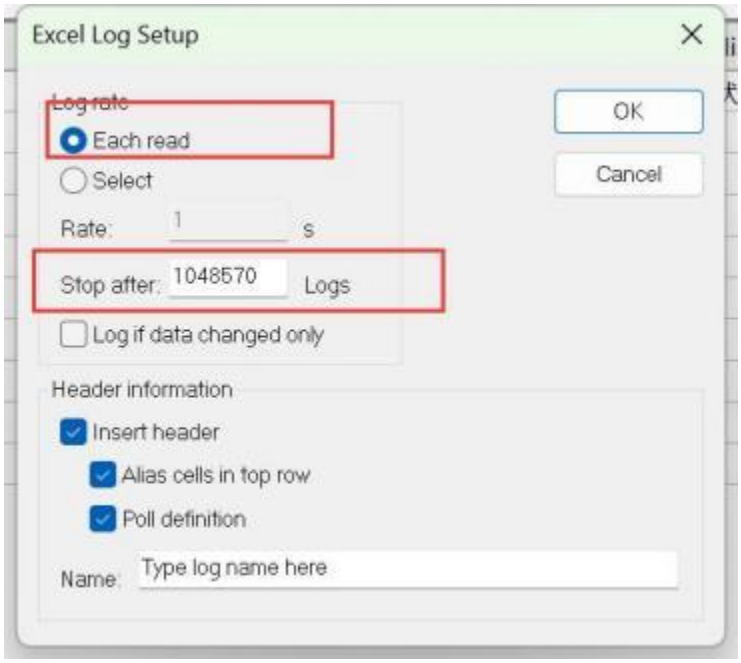
To save test data, follow these steps:

a. Click "Setup" → "Excel Log".



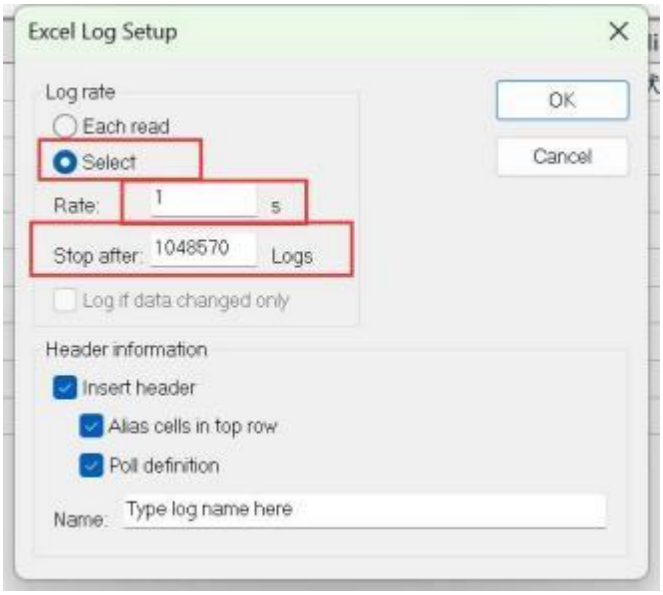
Save log diagram

b. In the pop-up window, if you select "Each read," enter "1048570" in the "stop after" field. This will log data after each update and stop logging after 1048570 entries.



Save Settings Diagram

If you select "Select," choose 1s under "Rate" to record data once every second. Additionally, recording will stop after 1,048,570 data points are collected.



Settings Save Diagram

Finally, click "OK" to begin recording data in Excel.