

## Digital Conductivity Sensor



## 1. Overview

The AGRINOVO-EC-100 is a digital water conductivity sensor capable of measuring Electrical Conductivity (EC), Total Dissolved Solids (TDS), and temperature. It integrates internal signal conditioning, linearization, temperature compensation, and digital communication.

### Key Features

- EC measurement ( $\mu\text{S}/\text{cm}$ )
- TDS derived ( $\text{EC} \div 2$ )
- Temperature compensation
- Accuracy:  $\pm 1.0\%$  FS
- Multiple electrode constants
- Slope/intercept calibration
- RS485 Modbus-RTU
- Low power:  $\leq 0.5\text{W}$

### Applications

- Agricultural irrigation
- Hydroponics
- Aquaculture
- Water quality monitoring

### EC–TDS Conversion

- $\text{EC} = 2 \times \text{TDS}$
- $\text{TDS} = \text{EC} \div 2$

## 2. Specifications

| Parameter          | Specification      |
|--------------------|--------------------|
| Accuracy           | $\pm 1.0\%$ FS     |
| Temp Compensation  | 0–60°C (automatic) |
| Power Consumption  | $\leq 0.5\text{W}$ |
| Supply Voltage     | 7–24 VDC           |
| Operating Humidity | $\leq 85\%$ RH     |

## Electrode Constants and Ranges

| K Value               | EC Range         | TDS Range     | Resolution |
|-----------------------|------------------|---------------|------------|
| 0.1 cm <sup>-1</sup>  | 0.2–200 µS/cm    | 0.1–100 ppm   | 0.01       |
| 1.0 cm <sup>-1</sup>  | 2–10,000 µS/cm   | 1–5,000 ppm   | 1          |
| 10.0 cm <sup>-1</sup> | 20–100,000 µS/cm | 10–50,000 ppm | 1          |

### 3. Wiring

| Wire Color | Function | Description             |
|------------|----------|-------------------------|
| Red        | V+       | Power Supply (7–24V DC) |
| Black      | GND      | Power Ground            |
| Yellow     | RS485-A  | Data+                   |
| Green      | RS485-B  | Data-                   |

### 4. Communication Settings

| Parameter       | Value      |
|-----------------|------------|
| Protocol        | Modbus-RTU |
| Baud Rate       | 9600 bps   |
| Data Bits       | 8          |
| Parity          | None       |
| Stop Bits       | 1          |
| Default Address | 0x01       |

## 5. Register Map

### Measurement Registers (Function 0x03)

| Address | Description             | Scaling                                |
|---------|-------------------------|--|
| 0x0000  | Electrical Conductivity | Direct ( $\mu\text{S}/\text{cm}$ )     |
| 0x0001  | Temperature             | Value $\div$ 10 ( $^{\circ}\text{C}$ ) |

### Configuration Registers (Function 0x06)

| Address | Description        | Range/Notes                          |
|---------|--------------------|--------------------------------------|
| 0x0004  | Slope (Gain)       | Value $\times$ 1000 (default: 1000)  |
| 0x000B  | Intercept (Offset) | $\mu\text{S}/\text{cm}$ (default: 0) |
| 0x0050  | Slave Address      | 0x01–0xFE                            |

## 6. Reading Data

Read 2 registers from 0x0000:

```
Request: 01 03 00 00 00 02 C4 0B  
Response: 01 03 04 02 AE 01 64 5C 91
```

### Decoding:

| Register    | Hex    | Decimal | Scaling   | Result  |
|-------------|--------|---------|-----------|---|
| EC          | 0x02AE | 686     | Direct    | <b>686 <math>\mu\text{S}/\text{cm}</math></b> |
| Temperature | 0x0164 | 356     | $\div$ 10 | <b>35.6<math>^{\circ}\text{C}</math></b>      |

**TDS Calculation:**  $\text{TDS} = 686 \div 2 = 343 \text{ ppm}$

## 7. Address Configuration

### Change Address (0x01 → 0x02)

Request: 01 06 00 50 00 02 08 1A

Response: 01 06 00 50 00 02 08 1A

### Broadcast Discovery

Use address 0xFE with only one device connected.

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## 8. Calibration

### Set Slope (1.200)

Slope = 1200 ( $1.200 \times 1000$ ) = 0x04B0

01 06 00 04 04 B0 CB 7F

### Set Intercept (10 $\mu$ S/cm)

01 06 00 0B 00 0A 78 0F

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## 9. Installation Notes

### Sensor Placement

- Stable water flow, no bubbles
- Fully submerged tip
- Correct flow orientation

### Electrical

- Separate RS485 from power lines
- Shielded twisted pair cable
- Proper bus termination