

Digital Corrosion Rate Electrode Sensor (LPR / EIS)



1. Overview

The AGRINOVO-FSL-100 is a smart corrosion rate electrode that combines Linear Polarization Resistance (LPR) and Electrochemical Impedance Spectroscopy (EIS) techniques. It measures both pitting corrosion and average corrosion rate in real time, with dual output via RS485 Modbus-RTU and 4–20mA. Built with 316L stainless steel and IP68 protection, it is designed for harsh industrial and environmental monitoring applications.

Key Features

- LPR + EIS combined measurement
- Range: 0–0.25 / 0–0.5 / 0–1 / 0–5 mm/a
- Resolution: 0.0001 mm/a
- Dual output: RS485 + 4–20mA
- 316L stainless steel, IP68
- Wide supply: 7–30 VDC, <0.2W
- Low drift: $\leq 0.3\%$ FS/24h
- Anti-polarization technology

Applications

- Industrial cooling water corrosion monitoring
 - Wastewater treatment pipeline assessment
 - Environmental corrosion monitoring
 - Process water quality control
 - Infrastructure integrity monitoring
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2. Specifications

Parameter	Specification
Measurement Principle	LPR + EIS
Range	0–0.25 / 0–0.5 / 0–1 / 0–5 mm/a (configurable)
Resolution	0.0001 mm/a
Repeatability	±0.001 mm/a
Response Time	50s
Drift	≤0.3% FS / 24h
Output	RS485 Modbus-RTU + 4–20mA
Supply Voltage	7–30 VDC
Power Consumption	<0.2W
Operating Temp	0–75°C
Protection	IP68
Housing Material	316L Stainless Steel
Mounting Thread	1" NPT
Cable Length	5m (standard)

3. Wiring

RS485 Mode (4 wires)

Wire Color	Function	Description
Red	V+	Power Supply (7–30V DC)
Blue	GND	Power Ground
Yellow	RS485-A	Data+
Green	RS485-B	Data–

4–20mA Mode (3 wires)

Wire Color	Function	Description
Red	V+	Power Supply (7–30V DC)
Blue	GND	Power Ground
Black	4–20mA+	Analog Current Output

RS485 + 4–20mA Mode (5 wires)

Use all five wires: Red (V+), Blue (GND), Yellow (485-A), Green (485-B), Black (4–20mA+).

4. Communication Settings

Parameter	Value
Protocol	Modbus-RTU
Baud Rate	9600 bps (configurable: 2400/4800/9600/19200/38400/43000)
Data Bits	8
Parity	None
Stop Bits	1
Default Address	0x09

Note: For communication distances exceeding 100m, reduce baud rate to 4800 or 2400 for stability.

5. Register Map

All measurement values are IEEE-754 float32, each occupying 2 registers. Read via function 0x03.

Measurement Registers (Function 0x03 – Read Only)

Address	PLC Address	Description	Range	Data Type
0x0000– 0x0001	40001	Corrosion Rate	0–5 mm/a	Float32
0x0002– 0x0003	40003	Polarization Voltage	–1250– 1250 mV	Float32
0x0004– 0x0005	40005	Reserved	–	Float32
0x0006– 0x0007	40007	Current Step	–	Float32
0x0010– 0x0011	40017	Temperature Correction	–	Float32
0x0012– 0x0013	40019	Baud Rate	–	Float32
0x0014– 0x0015	40021	Slave Address	–	Float32
0x0016– 0x0017	40023	Filter Time (seconds)	–	Float32
0x0018– 0x0019	40025	Electrode Sensitivity	–	Float32
0x001A– 0x001B	40027	Measurement Time	–	Float32
0x001C– 0x001D	40029	Model	–	Float32
0x001E– 0x001F	40031	Software Version	–	Float32
0x0020– 0x0021	40033	4–20mA High Point	–	Float32

Configuration Registers (Read/Write)

Address	PLC Address	Description	Data Type	Values
0x0008–0x0009	40009	Corrosion Coefficient	Float32 (0x10)	R/W
0x0012	40019	Set Baud Rate	Signed (0x06)	2400/4800/9600/19200/38400/43000
0x0014	40021	Set Slave Address	Signed (0x06)	1–254
0x0016	40023	Trigger Measurement	Signed (0x06)	Write 1 (wait 0–3s)
0x0018	40025	Set Filter Seconds	Signed (0x06)	Seconds
0x001A	40027	Set Compensation Mode	Signed (0x06)	0=Auto, 1=Manual
0x0032	40051	Float Byte Order	Signed (0x06)	0=Normal, 1=Reversed
0x0064	40101	Restore Defaults	Signed (0x06)	Write 1
0x270F	41000	Restore Baud & Address	Signed (0x06)	Write 1

6. Reading Data

Read corrosion rate, polarization voltage, and reserved value

Read 6 registers from 0x0000 (3 float32 values):

```
Request: 09 03 00 00 00 06 C4 80
```

```
Response: 09 03 0C [Float1: 4 bytes] [Float2: 4 bytes] [Float3: 4 bytes] [CRC]
```

Decoding:

Registers	Description	Example
0x0000–0x0001	Corrosion Rate	0.1280 mm/a
0x0002–0x0003	Polarization Voltage	xxx.x mV
0x0004–0x0005	Reserved	—

Float byte order: Default is normal order. Can be switched to reversed via register 0x0032.

7. Address Configuration

Change Slave Address (0x09 → 0x02)

Write to register 0x0014 (40021) using function 0x06:

```
09 06 00 14 00 02 [CRC]
```

Change Baud Rate (9600 → 19200)

Write to register 0x0012 (40019) using function 0x06:

```
09 06 00 12 4B 00 [CRC]
```

Supported baud rates: 2400, 4800, 9600, 19200, 38400, 43000.

Restore Baud Rate and Address to Defaults

Write 1 to register 0x270F (41000):

```
09 06 27 0F 00 01 [CRC]
```

8. Calibration

Calibration is performed via the companion PC software (USB-485 adapter required).

Software Calibration Features

- Set calibration standard value
- Adjust corrosion coefficient (K factor) via register 0x0008
- Set low-range K and high-range K coefficients
- Configure 4–20mA high point and correction coefficient

Trigger Immediate Measurement

Write 1 to register 0x0016 (40023). Result available after 0–3 seconds:

```
09 06 00 16 00 01 [CRC]
```

9. Factory Reset

Restore All Defaults

Write 1 to register 0x0064 (40101):

```
09 06 00 64 00 01 [CRC]
```

Restore Only Baud Rate and Address

Write 1 to register 0x270F (41000):

```
09 06 27 0F 00 01 [CRC]
```

10. Installation Notes

Placement

- Mount using 1” NPT pipe thread
- Install both electrode tips into the sensor body
- Water flow direction should be perpendicular to the gap between the two electrodes
- Ensure electrodes are fully submerged

Maintenance

- Soak electrode in water for 15 minutes before first use
- Clean electrode tips before measurement; remove oil with cloth, detergent, or dilute acid
- For carbon steel electrodes, inspect regularly and replace if heavily corroded
- Store in dry environment when not in use