

Digital Dissolved CO₂ Sensor



1. Overview

The AGRINOVO-CO2-100 is a digital dissolved carbon dioxide sensor for water quality monitoring. It measures dissolved CO₂ concentration and temperature through an ion-selective electrode, with isolated power and built-in protection for stable operation in demanding environments. The corrosion-resistant PPS body and 3/4" threaded fittings make installation straightforward.

Key Features

- CO₂: 0.2-2200 ppm (configurable to 20000)
- Temperature: -10 to 110°C
- Accuracy: ±5% FS
- Resolution: 0.01 ppm
- RS485 Modbus-RTU
- 32-bit float (IEEE-754)
- Isolated supply (2500 Vrms)
- 9-27 VDC power

Applications

- Aquaculture (RAS, shrimp, fish)
 - Water quality assessment
 - Process water monitoring
 - Environmental monitoring
-

2. Specifications

Parameter	Specification
CO ₂ Range	0.2-2200 ppm (configurable to 20000 ppm)
Resolution	0.01 ppm
Accuracy	±5% FS
Temperature Range	-10 to 110°C
Temperature Accuracy	±0.5°C
Temperature Compensation	Automatic (NTC10K) or manual
Working pH Range	4.8-5.2
Supply Voltage	9-27 VDC
Power Consumption	≤0.5W
Isolation	2500 Vrms
Housing	PPS, NPT 3/4" front and back thread
Dimensions	Ø30 mm, 220 mm length

3. Wiring

Color	Function	Description
Red	V+	Power Supply (9-27V DC)
Black	GND	Power Ground
Yellow	RS485-A	Data+ (T/R+)
White	RS485-B	Data- (T/R-)

4. Communication Settings

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

Data Format

- **Type:** 32-bit Single Precision Float (IEEE-754)
- **Byte Order:** Word-swapped, big-endian within each word

Each measurement spans two registers. Assemble the float from the second register (high word) followed by the first register (low word). Supported baud rates: 1200, 2400, 4800, 9600, 19200.

5. Register Map

Measurement Registers (Function 0x03, float32)

Address (Hex)	Description	Range	Unit
0x0000-0x0001	CO ₂ Concentration	0-20000	ppm
0x0002-0x0003	Electrode Signal	-750 to 750	mV
0x0008-0x0009	Temperature	-10 to 110	°C

Parameter Registers (Function 0x03 read / 0x06 write)

Address (Hex)	Description	Range / Values	Default
0x0019	Calibration Status	Bitfield (read)	-
0x001C	Electrode Efficiency	70.0-130.0% ($\div 10$)	100.0%
0x001D	Calibrated Points	0-5	0
0x001E	Device Address	1-247 (255 = broadcast)	1
0x001F	Baud Rate	0:1200 1:2400 2:4800 3:9600 4:19200	3 (9600)
0x0020	Temp Comp Type	0: Manual, 1: Automatic	1
0x0021	Temp Setpoint / Offset	-10.0 to 110.0°C ($\times 10$)	25.0°C / 0.0°C
0x0023	Ion Valence	0: Unset, 1: Monovalent, 2: Divalent	-

Information Registers (Function 0x03 read)

Address (Hex)	Description	Notes
0x0040	Work Mode	0x0010 Measure, 0x0050 Setup, 0x0060 Calibration
0x0043	Calibration Status / Operation	Read status, write standard code
0x0045	Model Number	0x1210
0x0046	Software Version	BCD
0x0047	Hardware Version	BCD
0x0048-0x0049	Serial Number	BCD

6. Reading Data

Read CO₂ + Electrode Signal + Temperature

Read 10 registers from 0x0000:

```
Request: 01 03 00 00 00 0A C5 CD
Response: 01 03 14 00 00 41 20 33 33 42 C8 00 00 00 00
          00 00 00 00 E3 E8 41 C7 [CRC]
```

Decoding (word-swapped float32):

Value	Registers	Reordered	Result
CO ₂	00 00 / 41 20	41 20 00 00	10.00 ppm
Electrode Signal	33 33 / 42 C8	42 C8 33 33	100.1 mV
Temperature	E3 E8 / 41 C7	41 C7 E3 E8	25.0°C

7. Address Configuration

Change Address (0x01 → 0x02)

Write to register 0x001E:

```
01 06 00 1E 00 02 68 0D
```

Note: Communication will be lost until reconnecting with the new address.

Broadcast Discovery

Use address 255 (0xFF) with only one device connected.

8. Calibration

The sensor supports up to 5 calibration points. Calibration is performed over RS485 by placing the electrode in a standard solution and writing the matching standard code to the calibration register (0x0043).

Standard Solution Codes

Standard	Code
0.1 ppm	0x0002
1 ppm	0x0004
10 ppm	0x0008
100 ppm	0x0010
1000 ppm	0x0020

Calibration Procedure

1. Place the electrode in the standard solution.
2. Write the standard code to register 0x0043. Example (1 ppm point):

```
01 06 00 43 00 04 79 DD
```

1. Poll register 0x0043 to read calibration status:

Value	Meaning
0	Success (returned to measurement mode)
1	In progress (wait and re-read)
2	Incorrect standard solution value
3	Signal unstable or out of range after 180s
4	Sensor performance out of allowed range

1. Repeat for additional points.

Clear Calibration

Write 0x7FFF to register 0x0043 to clear all calibration data.

Factory Reset

Enter setup mode, then restore defaults:

```
01 06 00 40 00 50 88 22 (enter setup mode)
01 06 00 41 7F FF B9 AE (restore defaults and restart)
```

9. Installation Notes

Placement

- Mount via 3/4" threaded fitting
- Keep electrode tip immersed
- Maintain sample pH 4.8-5.2 for valid readings
- Avoid air bubbles and high-flow zones

Maintenance

- Recalibrate periodically against standards
- Keep electrode clean
- Store per electrode storage guidance