

SIGNUX COA01

Water quality — RS485



DESCRIPTION

Integrated conductivity transmitter for continuous monitoring of water and aqueous solutions. Electrode and electronics in a single IP68 body, RS485 Modbus RTU output, automatic temperature compensation and salinity and TDS conversion. Two cell constants: $k = 1$ for $1\text{--}2000\text{ }\mu\text{S/cm}$ and $k = 10$ for $10\text{--}20000\text{ }\mu\text{S/cm}$. $7\text{--}30\text{ V DC}$.

This product adopts an integrated design, the structure is lighter and simpler, and the use is more convenient. Waterproof grade IP68. It can be widely used in continuous monitoring of the conductivity value of aqueous solutions such as section water quality, aquaculture, sewage treatment, environmental protection, pharmaceuticals, food and tap water.

FEATURES

- Maximum range of conductivity measurement: $1\text{--}20000\text{ }\mu\text{S/cm}$
- Temperature measurement range: $-20\text{--}60$
- Waterproof grade: IP68
- Salinity and TDS included: Besides conductivity and temperature, the probe reports salinity and total dissolved solids in ppm, ready to use.
- RS485 communication interface: communication address can be set, baud rate can be modified
- The equipment adopts wide voltage power supply: $\text{DC } 7\text{--}30\text{V}$ can be used

AT A GLANCE

Measures	Conductivity · Temperature · Salinity · TDS
Output	RS485
Protection	IP68
Operating	$-20\text{ to }+60\text{ }^{\circ}\text{C}$

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1 Introduction

The SX-COA01 is an integrated conductivity transmitter for aqueous solutions. Electrode, temperature sensor and electronics share one body, so the probe connects directly to an RS485 bus with Modbus RTU protocol and reports conductivity, temperature, salinity and total dissolved solids.

Temperature compensation is automatic: the conductivity read is referred to a reference temperature (25 °C by default) with an adjustable coefficient. Two cell constants are available, $k = 1$ for 1-2000 $\mu\text{S}/\text{cm}$ and $k = 10$ for 10-20000 $\mu\text{S}/\text{cm}$.

Typical applications: surface water quality, aquaculture, wastewater treatment, environmental monitoring, pharmaceutical and food processes, drinking water.

- Conductivity up to 20000 $\mu\text{S}/\text{cm}$; temperature -20 to +60 °C with 0.1 °C resolution
- One-piece design, light and simple, easy to install
- IP68 protection rating, pressure-rated to 0.6 MPa
- Salinity and TDS conversion on board
- RS485 interface with Modbus RTU protocol, easy to connect to a PLC, datalogger or computer
- Configurable Modbus address and baud rate
- Wide supply voltage range: 7-30 V DC

SPECIFICATIONS

Power supply	7-30 V DC
Power consumption	0.4 W
Communication interface	RS485, Modbus RTU 4800 baud by default (1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 selectable)
Conductivity range	$k = 1$: 1-2000 $\mu\text{S}/\text{cm}$, resolution 0.1 $\mu\text{S}/\text{cm}$ $k = 10$: 10-20000 $\mu\text{S}/\text{cm}$, resolution 1 $\mu\text{S}/\text{cm}$
Conductivity accuracy	$\pm 1\%$ FS
Temperature range	-20 to +60 °C, resolution 0.1 °C
Temperature accuracy	± 0.5 °C
Temperature compensation	-20 to +60 °C, referred to 25 °C by default; coefficient 0.02 by default
Salinity range	0-11476 ppm
TDS range	0-13400 ppm
Operating conditions	Ambient -20 to +60 °C
Protection rating	IP68
Pressure resistance	0.6 MPa
Cable length	5 m by default (other lengths on request)



2 Wiring

The probe is supplied with a four-core cable with bare ends.

FUNCTION	WIRE COLOUR	DESCRIPTION
Power supply	Brown	Power supply positive (7-30 V DC)
Power supply	Black	Power supply negative (GND)
Communication	Yellow	RS485 A
Communication	Blue	RS485 B

3 Dimensions and ordering information

3.1 Dimensions

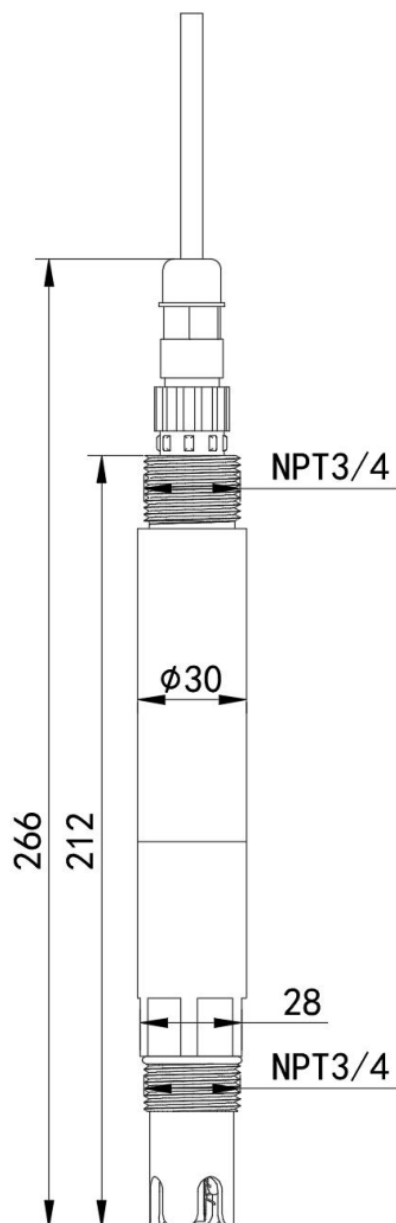


Fig. 3.1.1 · Overall length 266 mm, body 212 mm, diameter 30 mm, electrode window 28 mm, NPT 3/4" thread at both ends

3.2 Ordering information

The order code states the cell constant. It cannot be changed afterwards: choose it from the conductivity to be measured.

ORDER CODE	CELL CONSTANT	RANGE	RESOLUTION
SX-COA01-1	k = 1	1-2000 $\mu\text{S/cm}$	0.1 $\mu\text{S/cm}$
SX-COA01-10	k = 10	10-20000 $\mu\text{S/cm}$	1 $\mu\text{S/cm}$

- One integrated conductivity transmitter
- 5 m cable (or the length ordered)

4 Safety, care and installation

4.1 Installation

- Submerged installation: run the cable through a rigid waterproof pipe and screw the pipe onto the upper NPT 3/4" thread of the probe, sealing the thread with PTFE tape. The top of the probe and the cable must stay dry.
- Pipe installation: screw the probe into the pipe or tee through its NPT 3/4" thread.
- Keep the electrode fully immersed and away from air bubbles. Do not exceed 0.6 MPa or 60 °C.
- Wire A to A and B to B; swapped wires are the most common cause of a probe that does not answer.

4.2 Care and maintenance

- The probe needs no routine maintenance. If it fails, do not open it: contact SIGNUX.
- An electrode that has been stored dry must be soaked in distilled water for several hours before use, to reactivate it. An electrode in frequent use may be stored in distilled water.
- Cleaning: organic deposits come off with warm water and detergent, or with alcohol. Calcium and magnesium scale is best removed with 10 % citric acid. Clean the electrode poles only chemically or by shaking them in water: wiping them destroys the platinum black coating.
- Calibrate before each campaign of use and, in continuous use, every three months. Adjust the frequency to the fouling and chemical deposits of the application.

5 Calibration

Calibration is done over RS485, from the SIGNUX tool or from any Modbus master, with registers 0x0110 and 0x0111 written together with function code 16.

Rinse the electrode, immerse it in a standard solution of known conductivity, shake it gently to speed up the response and let it settle. When the reading is stable, write 0x0004 to register 0x0110 and the conductivity of the standard to register 0x0111, multiplied by 10 for the $k = 1$ probe (1-2000 $\mu\text{S}/\text{cm}$) or as it is for the $k = 10$ probe (10-20000 $\mu\text{S}/\text{cm}$). Example 3 in the Modbus chapter shows the exact frame.

Two related settings can also be adjusted: the temperature compensation coefficient (registers 0x0052-0x0053, 0.02 by default) for solutions with a different temperature coefficient, and the cell constant (registers 0x0054-0x0055). Both are 32-bit floating-point values, high word first. Small corrections to the reading can be made with the offsets in 0x0050 (temperature) and 0x0051 (conductivity).

6 Modbus RS485 protocol

6.1 Communication parameters

Encoding	8-bit binary
Data bits	8
Parity	None
Stop bits	1
Error check	CRC (cyclic redundancy check)
Baud rate	4800 bit/s by default (1200 to 115200 configurable)
Device address	1 (0x01) by default

6.2 Frame format

Silence before the frame	≥ 4 byte times
Address code	1 byte: the address of the transmitter, unique on the bus (factory default 0x01)
Function code	1 byte: the operation requested by the master
Data area	N bytes: register addresses, counts and values, high byte first
Error check	16-bit CRC, low byte first
Silence after the frame	≥ 4 byte times

All 16-bit values are sent high byte first. The 32-bit floating-point registers (compensation coefficient and cell constant) are big-endian: high word in the lower address.

6.3 Modbus registers

REGISTER ADDRESS	FUNCTION CODES (DEC)	DESCRIPTION
0x0000	3 / 4	Conductivity. UINT16: 10 times the value on the k = 1 probe (1-2000 µS/cm), the value itself on the k = 10 probe (10-20000 µS/cm)
0x0001	3 / 4	Temperature (°C). INT16: 10 times the value
0x0002	3 / 4	Salinity (ppm). UINT16
0x0003	3 / 4	TDS (ppm). UINT16
0x0050	3 / 4 / 6 / 16	Temperature offset. INT16, 10 times the value
0x0051	3 / 4 / 6 / 16	Conductivity offset. UINT16, same scaling as 0x0000
0x0052 / 0x0053	3 / 16	Temperature compensation coefficient. 32-bit float, big-endian (0.02 by default)
0x0054 / 0x0055	3 / 16	Cell constant. 32-bit float, big-endian
0x0110 / 0x0111	16	Calibration: write 0x0004 to 0x0110 and the standard value to 0x0111 (same scaling as 0x0000), in one frame
0x07D0	3 / 4 / 6 / 16	Device address: 1-254 (UINT16, factory default 1)
0x07D1	3 / 4 / 6 / 16	Baud rate: 0 = 2400, 1 = 4800, 2 = 9600, 3 = 19200, 4 = 38400, 5 = 57600, 6 = 115200, 7 = 1200 (factory default 1 = 4800)

UINT16: 16-bit unsigned integer

INT16: 16-bit signed integer

7 Communication examples

EXAMPLE 1: READ CONDUCTIVITY AND TEMPERATURE

send frame

MASTER REQUEST: 01 03 0000 0002 C4 0B

Slave address	1 byte	0x01
Function code	1 byte	0x03
Start register	2 bytes	0x0000
Number of registers	2 bytes	0x0002
CRC	2 bytes	0xC4 0x0B

Response frame: (For example, a device with a range of 0~2000µs/cm reads a conductivity value of 1000µs/cm and a temperature of 26.5°C)

SLAVE RESPONSE: 01 03 04 2710 0109 30 D4

Slave address	1 byte	0x01
Function code	1 byte	0x03
Number of data bytes	1 byte	0x04
Conductivity	2 bytes	0x2710
Temperature	2 bytes	0x0109
CRC	2 bytes	0x30 0xD4

Conductivity calculation: 2710 (hex) = 10000 => Conductivity = 1000.0 µs/cm

Temperature calculation: 109H (hexadecimal)=265=>temperature=26.5

EXAMPLE 2: SET THE CONDUCTIVITY OFFSET

Perform numerical correction on the deviation value of the current conductivity value setting of the device whose address is 01

Sending frame: (if the current range is 0~2000µs/cm, the output conductivity value is 990, to correct the value to 1000, the difference is 1000-990=10, and the expansion is 10 times to 100=>64H (ten Hexadecimal), the register content is written 00 64)

MASTER REQUEST: 01 06 0050 0064 88 30

Slave address	1 byte	0x01
Function code	1 byte	0x06
Register address	2 bytes	0x0050
Register content	2 bytes	0x0064
CRC	2 bytes	0x88 0x30

Response frame: (according to the MODBUS standard, the response is a mirrored message of the delivered frame)

SLAVE RESPONSE: 01 06 0050 0064 88 30

Slave address	1 byte	0x01
Function code	1 byte	0x06
Register address	2 bytes	0x0050
Register content	2 bytes	0x0064
CRC	2 bytes	0x88 0x30

EXAMPLE 3: CALIBRATE WITH A 1413 US/CM STANDARD

Use the standard solution of 1413µs/ms to calibrate the device with the address 01 ranging from 1 to 2000

Sending frame: write 00 04 to 0110H and 0111H respectively, and convert 1413*10 into hexadecimal to 37 32

MASTER REQUEST: 01 10 0110 0002 04 00043732 29 17

Slave address	1 byte	0x01
Function code	1 byte	0x10
Register address	2 bytes	0x0110
Register length	2 bytes	0x0002
Length in bytes	1 bytes	0x04
Register content	4 bytes	0x00 0x04 0x37 0x32
CRC	2 bytes	0x29 0x17

Response frame: (according to the MODBUS standard, the response is a mirrored message of the delivered frame)

SLAVE RESPONSE: 01 10 0120 0002 41 FE |||

Slave address	1 byte	0x01
Function code	1 byte	0x10
Register address	2 bytes	0x0120
Register lengtht	2 bytes	0x0002
CRC	2 bytes	0x41 0xfe