

SIGNUX PHA01

Water quality — RS485



DESCRIPTION

Integrated pH transmitter for water and aqueous solutions, with automatic or manual temperature compensation and RS485 Modbus RTU output.

The SX-PHA01 measures pH and temperature in the same body. Electrode, reference and electronics are one piece, so there is no separate transmitter and no junction box: four wires go straight onto an RS485 bus speaking Modbus RTU.

The pH reading arrives temperature-compensated. The probe compensates automatically from its own temperature sensor, or against a fixed temperature if manual compensation is switched on, which is what you want when the process sits at a known temperature and the reading should not chase it. Both the switch and the fixed value are registers, so it is decided over the bus.

The reference uses a double salt bridge, which is what lets it keep working in dirty water — sewage, aquaculture, process effluent — where a single junction clogs and the reading drifts. The electrode is a consumable: it ages, loses sensitivity and is replaced, and it must never be stored dry.

FEATURES

- Compensates either way: Automatically, from its own temperature reading, or against a fixed temperature written over the bus. Both are registers: no jumper, nothing to open.
- Double salt bridge: The reference is built to last in dirty water — sewage, aquaculture, process effluent — where a single junction clogs and the reading drifts away.
- Calibrated over the bus, two points: No buttons and no screwdriver: two standard buffers written to a register pair. For general use, 4.01 and 9.18.
- One-piece housing: NPT 3/4 thread at both ends and the electronics inside the same body: it mounts submerged from a rigid tube or through the side of a pipe, with no separate enclosure and no wiring in between.

AT A GLANCE

Measures	pH · Temperature
Output	RS485
Protection	IP68
Operating	0 to +60 °C

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1 Introduction

The SX-PHA01 is an integrated pH transmitter for aqueous solutions. Electrode, reference, temperature sensor and electronics share one body, so the probe connects directly to an RS485 bus with Modbus RTU protocol and reports pH and temperature.

The pH value arrives temperature-compensated: automatically, from the probe own temperature reading, or against a fixed temperature when manual compensation is switched on. The reference uses a double salt bridge, which resists fouling better than a single junction in sewage, aquaculture and process water.

- pH from 0 to 14.00, resolution 0.01 pH
- Temperature from 0 to +60 °C, resolution 0.1 °C
- One-piece design, light and simple to install
- Double salt bridge reference, with stronger resistance to fouling
- IP68 protection rating
- Automatic or manual temperature compensation, switchable over the bus
- RS485 interface with Modbus RTU protocol
- Modbus address and baud rate configurable
- Wide supply range, 7 to 30 V DC

Power supply	7-30 V DC
Power consumption	.3 W
Communication interface	RS485, Modbus RTU 4800 baud by default (1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 selectable)
pH range	0 to 14.00 pH, resolution 0.01 pH
pH accuracy	±0.15 pH
Repeatability	±0.02 pH
Temperature range	0 to +60 °C, resolution 0.1 °C
Temperature accuracy	±0.5 °C
Temperature compensation	Automatic or manual; the manual value is 25 °C by default
Operating conditions	Ambient 0 to +60 °C
Protection rating	IP68
Pressure resistance	.6 MPa
Cable length	5 m by default (other lengths on request)
Electrode life	About one year

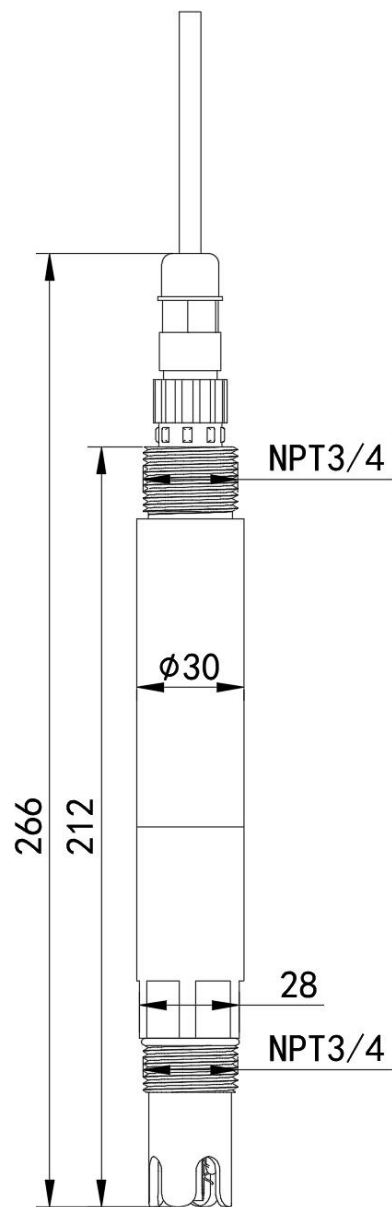
2 Wiring

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

Do not take the colours for granted from memory: not every water probe follows the same convention.

3 Dimensions, model and what is in the box



Dimensions in mm. The thread is NPT 3/4 at both ends.

The model code says how the cable ends. It is chosen when ordering and does not change afterwards.

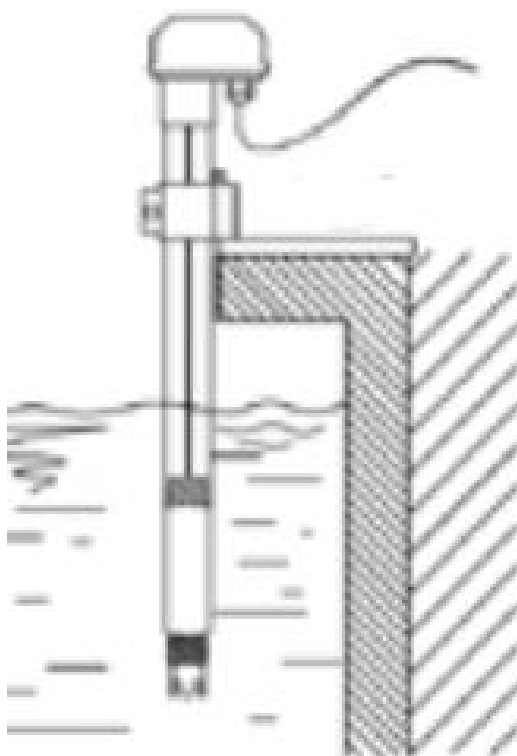
CODE	MEANING
SX-PHA01	pH transmitter with RS485 Modbus RTU output
M10 · PT	With an M10 connector, or with bare wires

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

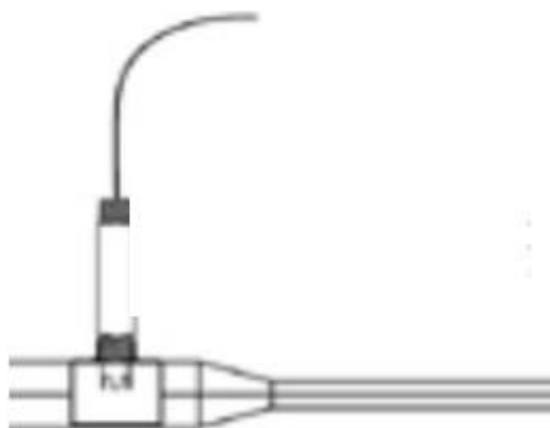
4 Safety, care and installation

4.1 Installation

- Submerged installation: run the cable through a rigid waterproof pipe and screw the pipe onto the 3/4 in thread on top 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 through its 3/4 in thread.
- Before the first measurement, unscrew the protective bottle, pull the electrode out and rinse it with pure water.
- Shake the air bubbles off the glass bulb before measuring: a bubble against the bulb changes the reading.
- Stir the solution, then let the probe settle before reading.



Submerged installation: the probe hangs from a rigid waterproof pipe.



Pipe installation: screwed into the side of the pipe, tilted upwards.

4.2 Care and maintenance

- The equipment needs no routine maintenance. If it fails, do not open it: contact SIGNUX.
- The electrode must never be stored dry. The protective bottle holds a soaking solution that keeps the glass bulb and the liquid junction active; keep the tip in it whenever the probe is not in service.
- Soaking solution: dissolve one sachet of pH 4.00 buffer in 250 ml of pure water and add 56 g of analytical grade potassium chloride, warming and stirring until it dissolves. A 3.3 M potassium chloride solution also works: 25 g of analytical grade potassium chloride in 100 ml of pure water.
- The glass bulb must not touch anything hard. Any knock or scrape destroys the electrode.
- Rinse the electrode with deionised water before and after every measurement.
- An electrode that has been in service a long time goes passive: the slope drops, the response slows down and the reading stops being accurate. Soak the bulb in 0.1 M dilute hydrochloric acid for 24 hours, then in 3.3 M potassium chloride for another 24 hours.
- The electrode lasts about a year. It is a consumable: replace it when it ages.
- Calibrate before each use, and at least every three months in continuous service. Dirty or chemically loaded water calls for calibrating more often.

4.2.1 Cleaning a fouled electrode

Fouling of the glass bulb or a blocked liquid junction also makes the electrode go passive. The cleaner depends on what has fouled it.

CONTAMINANT	CLEANER
Inorganic metal oxides	Dilute acid, under 1 M
Organic oils	Dilute detergent, weakly alkaline
Resins and polymers	Alcohol, acetone or ether
Protein and blood deposits	Acid enzyme solution
Pigments	Dilute bleach or hydrogen peroxide

If the electrode is badly passivated and 0.1 M hydrochloric acid does not recover it, the bulb can be dipped in 4 % hydrofluoric acid for three to five seconds, rinsed with pure water and then soaked in 3.3 M potassium chloride for 24 hours. Hydrofluoric acid is dangerous: this is a last resort, for a laboratory, not for the field.

5 Calibration

Calibration is done over RS485, with two standard buffers, writing registers 0x0120 and 0x0121 together with function code 16. There are no buttons on the probe.

MEASURING IN	BUFFERS
Acid solutions	.01 and 6.86
Alkaline solutions	.86 and 9.18
General use	.01 and 9.18

Work at about 25 °C. Rinse the electrode, immerse it in the buffer with the lower pH and let the reading settle. Then write 0x0001 to register 0x0120 and the buffer value multiplied by 100 to register 0x0121, in a single frame: that fixes the first point.

Rinse the electrode again and blot the water off with a paper towel or a soft cloth, without touching the glass bulb. Immerse it in the buffer with the higher pH, let it settle, and write 0x0002 to 0x0120 and its value multiplied by 100 to 0x0121. The calibration is then complete. Examples 3 and 4 in the Modbus chapter show the exact frames.

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
Error check	2 bytes: CRC
Silence after the frame	≥ 4 byte times

All 16-bit values are sent high byte first.

6.3 Modbus registers

REGISTER ADDRESS	FUNCTION CODES (DEC)	DESCRIPTION
0x0000	3 / 4	pH. UINT16, 100 times the value
0x0001	3 / 4	Temperature (°C). INT16, 10 times the value
0x0050	3 / 4 / 6	pH offset. INT16, 100 times the value
0x0051	3 / 4 / 6	Temperature offset (°C). INT16, 10 times the value
0x0060	3 / 4 / 6	Manual compensation: 1 on, 0 off
0x0061	3 / 4 / 6	Manual compensation temperature (°C). INT16, 10 times the value
0x0120 / 0x0121	16	Electrode calibration: the two registers are written together, 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

The pH register is scaled by 100 because the resolution is 0.01 pH. Other pH probes, such as soil ones, scale by 10: reading this one with that scale gives values ten times too large.

6.4 Communication examples

6.4.1 Example 1: read pH and temperature

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

Slave address	1 byte	0x01
Function code	1 byte	0x03
Number of data bytes	1 byte	0x04
pH	2 bytes	0x0316
Temperature	2 bytes	0x0109
CRC	2 bytes	0xB8 0xBE

0x0316 is 790 in decimal, so the pH is $790 / 100 = 7.90$. 0x0109 is 265, so the temperature is $265 / 10 = 26.5$ °C.

6.4.2 Example 2: set the pH offset

The probe reads 7.90 and the reading should be 8.00. The correction is $8.00 - 7.90 = 0.10$ pH, which is 10 in register units (100 times the value), that is 0x000A. It is written to register 0x0050 with function code 06.

Slave address	1 byte	0x01
Function code	1 byte	0x06
Register address	2 bytes	0x0050
Value	2 bytes	0x000A
CRC	2 bytes	0x09 0xDC

The response is a copy of the request.

6.4.3 Example 3: calibrate the first point with a 4.01 buffer

$4.01 \times 100 = 401 = 0x0191$. Registers 0x0120 and 0x0121 are written together with function code 16: 0x0001 to the first and 0x0191 to the second.

Slave address	1 byte	0x01
Function code	1 byte	0x10
Start register	2 bytes	0x0120
Number of registers	2 bytes	0x0002
Number of bytes	1 byte	0x04
0x0120 · point	2 bytes	0x0001
0x0121 · buffer value	2 bytes	0x0191
CRC	2 bytes	0x6D 0xDB

Slave address	1 byte	0x01
Function code	1 byte	0x10

Start register	2 bytes	0x0120
Number of registers	2 bytes	0x0002
CRC	2 bytes	0x41 0xFE

6.4.4 Example 4: calibrate the second point with a 9.18 buffer

$9.18 \times 100 = 918 = 0x0396$. Same two registers, with 0x0002 as the point number.

Slave address	1 byte	0x01
Function code	1 byte	0x10
Start register	2 bytes	0x0120
Number of registers	2 bytes	0x0002
Number of bytes	1 byte	0x04
$0x0120 \cdot \text{point}$	2 bytes	0x0002
$0x0121 \cdot \text{buffer value}$	2 bytes	0x0396
CRC	2 bytes	0xDD 0x79