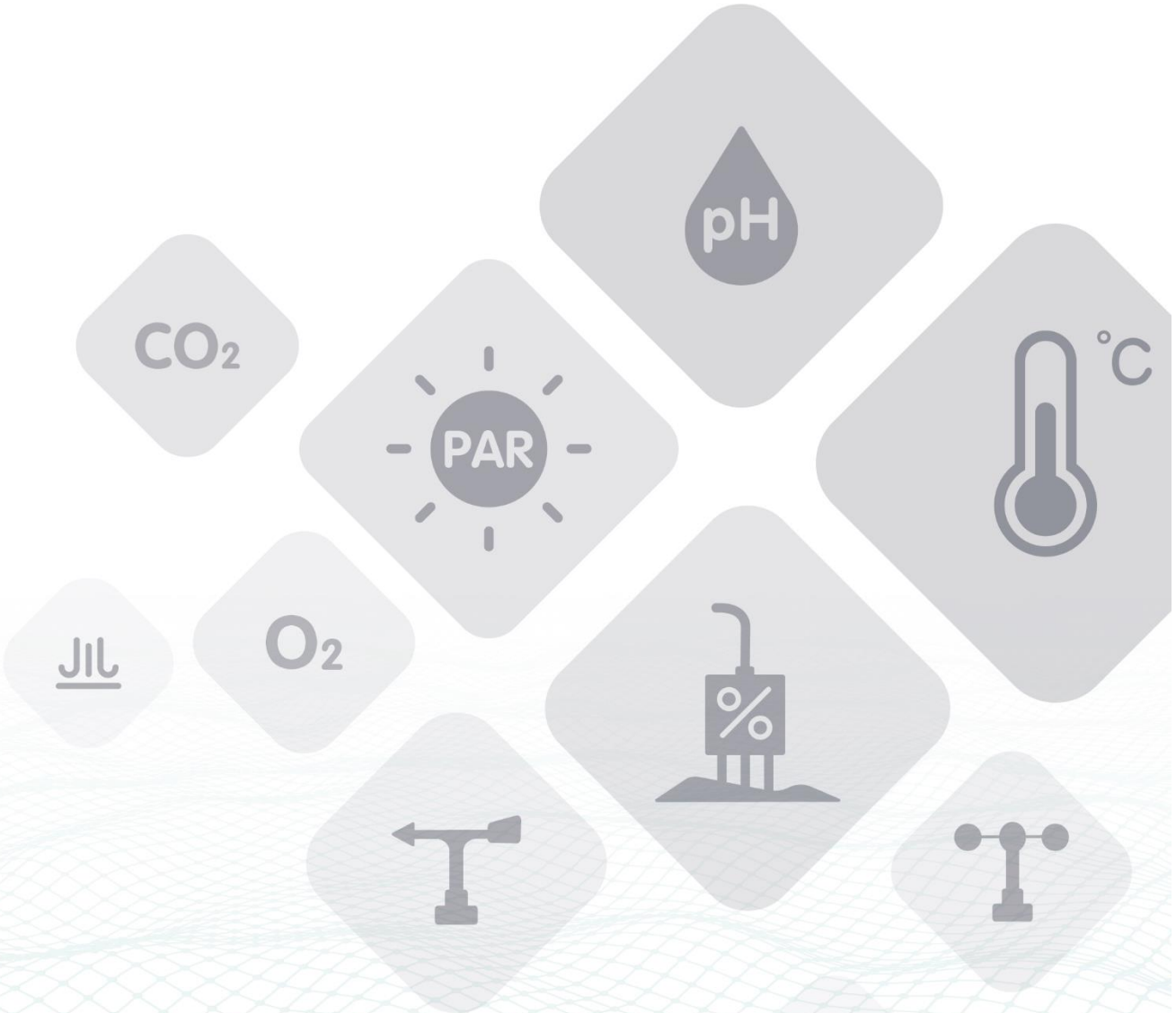
SENSECAP

RS485 & 4-20mA Current pH Sensor

User Manual

Product Model: S-pH-01

Version: V1.0



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1 Introduction

S-pH-01 soil PH sensor solves the shortcomings of traditional soil PH that need to be equipped with professional display instruments, cumbersome calibration, difficult integration, high power consumption, high price, and difficult to carry. Can be widely used in agricultural irrigation, flower gardening, grassland pasture, soil speed measurement, plant cultivation, scientific experiments and other fields. S-PH-01 consumes low power and provides long-term, uninterrupted monitoring.

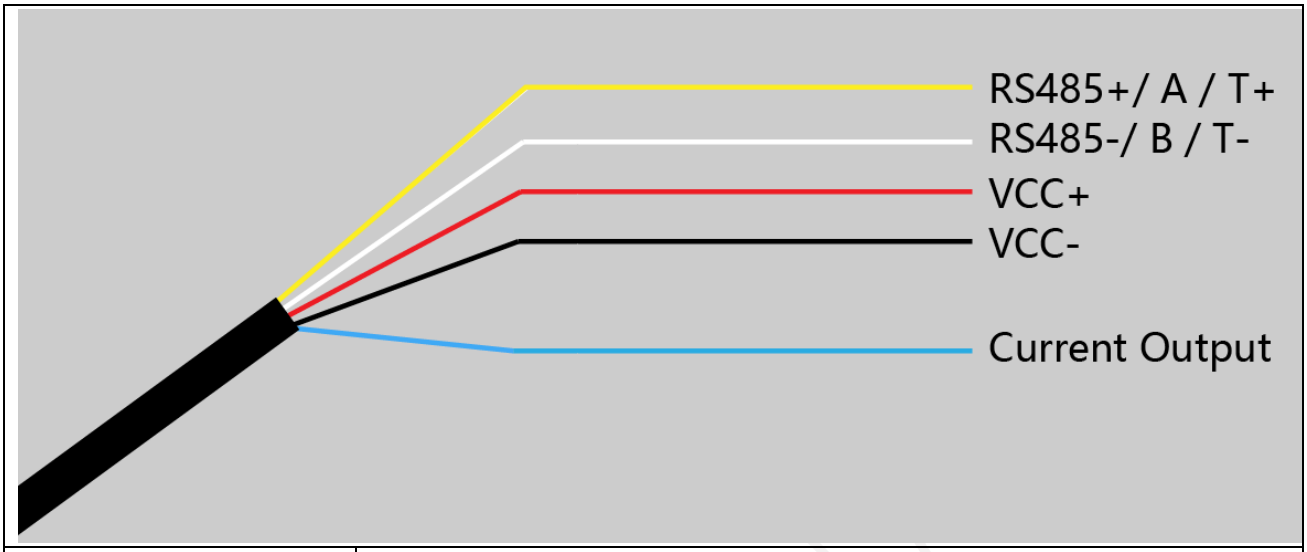
Features:

- The new soil pH sensor realizes real-time monitoring of soil PH online.
- It adopts international advanced solid dielectric and large-area polytetrafluoroethylene liquid junction, which is not easy to block and maintenance-free.
- Waterproof and sealed, high integration, small size, low power consumption, easy to carry, can be used outdoors.
- High precision, fast response, good interchangeability and reliable performance.
- Complete protection circuit and multiple signal output interfaces are available.

2 Specifications

pH	
Range	0 to 14 pH
Accuracy	±0.1 pH
Resolution	0.01 pH
General Parameters	
Product Model	S-pH-01
Interface	RS-485
Protocol	MODBUS-RTU RS485
Power Supply	3.6 ~ 30V DC
Current Consumption	Max 6mA @24V DC
IP Rating	IP65
Cable Length	5 meters
Operating Temperature	-40 ~ 85℃
Installation	All buried or probe into all of the measured medium
Device Weight	400g

3 Wiring and Output



Yellow	RS485+/A/T+
White	RS485-/B/T-
Red	VCC+, power supply
Black	VCC-, power ground
Blue	Current Output

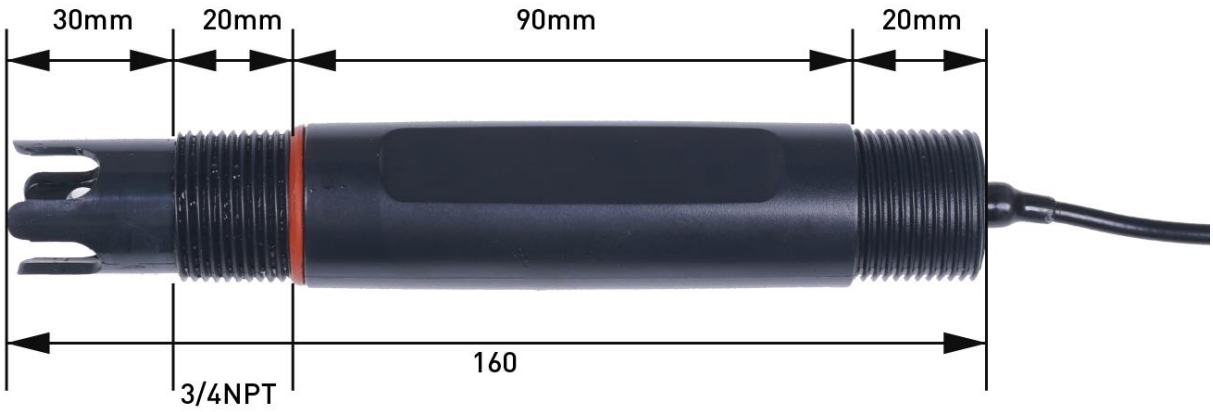
Sensor configuration parameters such as Modbus address, baud rate, parity bit, communication protocol, etc. are stored in the EEPROM (Power Down Storage Device) inside the module. Sometimes the specific configuration of these parameters is forgotten and communication with the module is not possible. In order to prevent this problem, the module has a button. After pressing for three seconds, the internal indicator of the module is off. When the button is released, all parameters of the module are restored to the following factory settings:

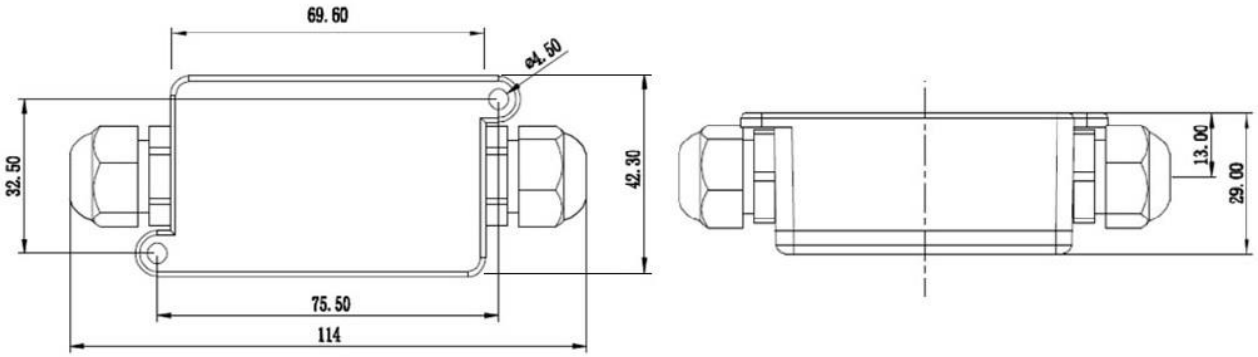
1. Modbus address is 1
2. Communication configuration is 9600, N, 8, 1 (9600bps, no parity, 8 data bits, one stop bit)

The communication protocol is Modbus-RTU

Output Mode	Range	Calculation
Current Output	pH: 0 ~ 14 pH	pH = 14 * (current value - 4) /16 if current value=12mA, pH = 14*(12-4)/16=7
MODBUS RS485	pH: 0~ 14 pH	pH = pH register value / 100
	Temperature: -40 ~80℃	pH = temperature register value / 100

4 Dimensions





5 Installation

5.1 Installation method

The sensor measures the pH of the water or the pH of the soil. When the sensor is shipped from the factory, the probe position has a transparent protective cover, and the built-in protective liquid protects the probe. When using it, please remove the protective cover first. Under normal circumstances, the pH value in the air is between 6.2 and 7.8.

When measuring the pH of the solution, the sensor has a 3/4 NPT pipe thread for fixed installation.
When measuring the pH value of the soil, insert the probe part vertically into the soil. After burying the sensor, pour a certain amount of water around the soil to be tested, wait a few minutes, and wait until the water is immersed in the probe to read the data. Normal conditions Under the soil, the soil is neutral, the pH value is about 7, the soil in different places, the actual pH value will be different, it should be determined according to the actual situation.

5.2 Precautions

In order to ensure that the electrode correctly measures the pH value in the pipeline, it should avoid the occurrence of air bubbles between the measuring cells and cause data misalignment. Do not use live wiring. After the wiring is checked, it can be energized. Do not arbitrarily change the components or wires that have been soldered at the factory. The sensor is a precision device. Please do not disassemble it when using it. Touch the sensor surface with sharp objects or corrosive liquid to avoid damage to the product.

5.3 Maintenance

The input end of the instrument (measuring electrode socket) must be kept dry and clean to prevent dust and moisture from entering; avoid immersing the electrode in the protein solution and acidic fluoride solution for a long time to avoid contact with the silicone oil; after long-term use of the electrode, the electrode can be Soak the lower end in 4% HF solution (hydrofluoric acid) for 3~5 seconds, then wash it with distilled water, then soak it with 0.1mol/L hydrochloric acid to renew the electrode; in order to make the measurement more accurate, the electrode should be calibrated frequently. And cleaned with distilled water; the transmitter should be placed in a dry environment or control box to avoid leakage or measurement error caused by water droplets splashing or damp.

6 Modbus Communication Protocol

6.1 Serial communication parameters

Modbus is a serial communication protocol. It is the standard for communication instruments in a variety of instrumentation and smart sensors. It has a wide range of applications in smart sensors. The Modbus protocol is a master-slave architecture protocol. There is a master node, and other nodes that use the Modbus protocol to participate in communication are slave nodes. Each slave has a unique device address. The sensor has an RS485 interface and supports the Modbus protocol. The factory default value of communication parameters is: baud rate 9600bps, one start bit, 8 data bits, no parity, one stop bit. The communication protocol is the Modbus RTU protocol. The communication parameters can be changed by the setting program or Modbus command. After the communication parameters are changed, the sensor needs to be powered on again to take effect.

6.2 Modbus Register

Parameter	Register address (HEX / DEC)	Parameter Type	Modbus Function number	Parameter range and description	Defaults
Temperature value TEMPRATURE	0x0000 /0	INT16 Read only	3/4	-4000-8000 corresponds to -40.00~80.00 °C.	N/A
PH value PHVALUE	0x0001 /1	UINT16 Read only	3/4	0-1400 corresponds to 0.00-14.00	N/A
PH calibration AD value PHCALIBRAWAD	0x0002 /2	UINT16 Read only	3/4	-2000~2000 corresponds to -2000~2000	N/A
Temperature compensation enable TEMPCOMPENSATEEN	0x0020 /32	UINT16 Read and write	3/6/16	0: Turn on temperature compensation 1: Turn off temperature compensation	0
PH calibration point 0 (pH = 4.01) PHCALIBRAWAD0	0x0030 /48	UINT16 Read and write	3/6/16	-2000~2000 corresponds to -2000~2000	N/A
PH calibration point 1 (pH = 7.00) PHCALIBRAWAD1	0x0031 /49	UINT16 Read and write	3/6/16	-2000~2000 corresponds to -2000~2000	N/A
PH calibration point 2 (pH = 10.01) PHCALIBRAWAD2	0x0032 /50	UINT16 Read and write	3/6/16	-2000~2000 corresponds to -2000~2000	N/A
Modbus slave address (ADDRESS)	0x0200 /512	UINT16 Read and write	3/6/16	0-255	1
Serial communication baud rate (BAUDRATE)	0x0201 /513	UINT16 Read and write	3/6/16	0-6 0:1200bps 1:2400bps 2:4800bps 3:9600bps 4:19200bps 5:38400bps	3:9600bps
Serial communication protocol (PROTOCOL)	0x0202 /514	UINT16 Read and write	3/6/16	0~1 0: Modbus RTU	0: Modbus

				1: Modbus ASCII	RTU
Serial communication check digit (PARITY)	0x0203 /515	UINT16 Read and write	3/6/16	0-2 0: No parity 1: Even parity 2: Odd parity	0: No parity
Serial communication data bits (DATABITS)	0x0204 /516	UINT16 Read and write	3/6/16	1 1: 8 data bits	1: 8 data bits
Serial communication stop bit (STOPBITS)	0x0205 /517	UINT16 Read and write	3/6/16	0-1 0: 1 stop bit 1:2 stop bit	0: 1 stop bit
Serial communication delay response (RESPONSEDELAY)	0x0206 /518	UINT16 Read and write	3/6/16	0-250 corresponds to 0-2500 milliseconds After the sensor receives the host request command, it delays for a period of time and then responds. The delay time is the set value *10 milliseconds. This feature is disabled when set to 0.	0
Serial communication active output time interval (ACTIVEOUTPUTINTERVAL)	0x0207 /519	UINT16 Read and write	3/6/16	0-250 corresponds to 0-250 seconds The host does not require a request, and the sensor automatically sends data at regular intervals. The time interval is the set value *1 second. This feature is disabled when set to 0.	0

6.3 Detail of Modbus Register

TEMPERATURE --- Temperature value		
Parameter range	-4000 ~ 8000 corresponds to -40.00 ~ 80.00°C	Default: none
Parameter storage	None	
Meaning: Temperature measurement value, negative number is represented by complement code. Example: If the returned value is 0702H (hexadecimal, original code), the first byte high byte is 07H, the second byte low byte is 02H, then the temperature measurement value is (07H*256+02H) /100=17.94 degrees Celsius. If the returned value is FF05H (hexadecimal, complement), the first byte high byte is FFH, the second byte low byte is 05H, then the temperature measurement value is ((FFH*256+05H)- FFFFH-1H)/100 = (FF05H-FFFFH-1H) / 100 = -2.51 degrees Celsius.		

PHVALUE --- PH value		
Parameter range	0-1400 corresponds to 0-14.00	Default: None
Parameter storage	None	
Meaning: PH value Example: If the returned value is 02BCH (hexadecimal), the first byte high byte is 02H, the second byte low byte is BCH, then the measured value is (02H*256+BCH)/100=(2*256+188)/100 =7.00. Represents a PH of 7.00		

PHCALIBRAWAD --- PH calibration AD value		
Parameter range	-2000 ~ 2000 corresponds to -2000 ~ 2000	Default: None
Parameter storage	None	
Significance: The AD value is used for PH calibration. Example: If the returned value is 02BCH (hexadecimal), the first byte high byte is 02H, the second byte low byte is BCH, then the measured value is (02H*256+BCH)=(2* 256+188) =700.		

TEMPCOMPENSATEEN --- Temperature compensation enable		
Parameter range	0：Turn on temperature compensation 1：Turn off temperature compensation	Default: None

Parameter storage	None	
Meaning: PH temperature compensation is enabled.		

PHCALIBRAWAD0 --- PH calibration point 0 (pH = 4.01)		
Parameter range	-2000~2000 corresponds to -2000~2000	Default: None
Parameter storage	None	
Significance: Put the pH probe into the pH calibration AD value after stabilization in a standard buffer of pH = 4.01. Example: If the returned value is FF24H (hexadecimal, 16-bit signed integer, negative number is represented by two's complement), the first byte high byte is FFH, the second byte low byte is 24H, then measurement The value is -(FFFFH-FF24H+1H)=-00DCH=-(00H*256+DCH)=-(0*256+220)=-220.		

PHCALIBRAWAD1 --- PH calibration point 1 (pH = 7.00)		
Parameter range	-2000~2000 corresponds to -2000~2000	Default: None
Parameter storage	None	
Significance: Put the pH probe into the pH calibration AD value after stabilization in a standard buffer of pH = 7.00. Example: If the returned value is 0000H (hexadecimal, 16-bit signed integer, negative number is represented by two's complement), the first byte high byte is 00H, the second byte low byte is 00H, then measurement The value is 0000H==(00H*256+00H)=(0*256+0) =0.		

PHCALIBRAWAD2 --- PH calibration point 0 (pH = 7.01)		
Parameter range	-2000~2000 corresponds to -2000~2000	Default: None
Parameter storage	None	
Significance: Put the pH probe into the pH calibration AD value after stabilization in a standard buffer of pH = 7.01. Example: If the returned value is 00DCH (hexadecimal, 16-bit signed integer, negative number is represented by two's complement), the first byte high byte is 00H, and the second byte low byte is DCH, then measurement The value is =(00H*256+DCH)=(0*256+220)=220.		

SLAVEADDR --- Modbus slave address		
Parameter range	0-255	Default: 1
Parameter storage	Store now	
Modbus address, can be set to 0-255. When the address dial switch external to the module is set to address 0, the contents of this register are used as the slave address. After the configuration, you need to power on again or use the RST command to restart the module to make this address take effect. Use this command to modify the module address without setting up the chassis.		

BAUDRATE --- Serial communication baud rate		
Parameter range	0-5 0:1200bps 1:2400bps 2:4800bps 3:9600bps 4:19200bps 5:38400bps	Default: 3
Parameter storage	Store now	

PROTOCOL --- Serial communication protocol		
Parameter range	0~1 0: Modbus RTU 1: Modbus ASCII	Default:0
Parameter storage	Store now	

PARITY --- Serial communication check digit		
Parameter range	0-2 0: No parity 1: Even parity 2: Odd parity	Default:0
Parameter storage	Store now	

DATABITS --- Serial communication data bit		
Parameter range	1 1: 8 data bits	Default:1，Only supports 8 data bits, others are invalid
Parameter storage	Store now	

STOPBITS --- Serial communication stop bit		
Parameter range	0-1 0: 1 stop bit 1:2 stop bit	Default:0
Parameter storage	Store now	

RESPONSEDELAY --- Serial communication delay response		
Parameter range	0-255	Default:0
Parameter storage	Store now	
The serial communication delay response is used when the host sends a request command, the module delays (RESPONSEDELAY*10) milliseconds, and then returns the response data to the host. For example, if RESPONSEDELAY=5 is set, then the module delays 5*10=50 ms to respond to the host request. When set to 0, it responds immediately without delay. This command is mainly used when the host is slow to switch from the RS485 transmission state to the receiving state.		

ACTIVEOUTPUTINTERVAL --- Serial communication active output time interval		
Parameter range	0-255	Default:0
Parameter storage	Store now	
The serial communication active output time interval is used when the host does not need to send a request command, the module actively outputs the response data, and the output interval is ACTIVEOUTPUTINTERVAL seconds. For example, if ACTIVEOUTPUTINTERVAL=5 is set, the module outputs data according to the set communication protocol every 5 seconds. When set to 0, the active output is invalid, and the host can respond after receiving the request. This command is mainly used in the case of wireless transmission such as GPRS, where the terminal node needs to send data actively. Note: When set to active output data, only one module can be connected to the RS485 bus to avoid bus data conflicts.		