Soil PH and temperature 2 in 1 sensor AgCl type Introduce

Type: SPHA-RD-01

1. Product Introduce

The new soil PH sensor, based on the latest research results, is developed using solid AgCl reference electrode and pure metal PH sensitive electrode. It has the characteristics of high measurement accuracy and long-term stable signal, which can replace glass electrodes. In addition, the isolation circuit design is suitable for burying in soil for long-term online measurement.

The PH sensor has temperature compensation inside, which can realize the pH value stabilization within a certain temperature range.

It has multi-directional protection functions for power lines, ground lines, and signal lines to prevent damage caused by reverse connection and wrong connection.

2. Product Features

1. Easy measurement

Soil PH testing is no longer limited to laboratories and professionals, and can be measured by inserting into the soil.

2. Low measurement cost

Compared with traditional laboratory measurement, this product has low cost, fewer steps, no reagents required, and unlimited testing times.

3. High precision

High accuracy, fast speed, can reach accuracy within 0.25, increase stability.

4. Portable measurement

Convenient to carry, can be read by inserting the soil, can grasp the soil condition at any time, make the soil fertility balanced, and reach the suitable growth environment of the plant.

3. Product Parameter

1. Technical Parameters

※Working voltage: /L: 2 ~ 5V (Max 6V)

※Working voltage: 5 ~ 24V (Max 26.7V)

※Quiet current: measured peak value <50mA, average <2mA.

※Response time: 2 ~ 15 seconds (adaptive)

※Measurement stabilization time: 30 minutes to 24 hours

※Protection level: IP68

※Working temperature range: -10℃ ~ 70℃,

※Cable length: standard 3.5 meters (2464-5C)

2. Measurement parameter (PH)

※Measurement range: 3-10

※Output signal: RS-485/RS-232/UART, MODBUS-RTU protocol

＊Measurement accuracy: <0.25

＊Exchange accuracy: <0.25

＊Re-test error: <0.2

＊Temperature compensation range: 0-50℃

3. Measurement parameter (temperature)

＊Measuring range: -40℃～85℃

＊Output signal: RS-485/UART, MODBUS-RTU protocol

＊Measurement accuracy: <±0.4℃（10℃～40℃), <±0.6℃（other)

＊Interchangeability: <0.5℃（-10℃～70℃）

＊Re-test error: <0.1℃

4. Product size

4. Connection diagram

Wire colour	Interface
Red	Power positive
Black	Power negative
Yellow	RS485A
White	RS485B

5. Measurement methods

1. Preparation before measurement

It should be placed in pure water for 24 hours to activate before being placed for more than 7 days. If it is not activated, it should be pre-buried in the soil for at least 24 hours to ensure measurement accuracy.

2. Quick measurement method

Select a place where the soil is relatively soft and moist, and pave the surface soil according to the required measurement depth. It is best to wet the measurement point with distilled water, purified water or rainwater to form a slurry, pick out the rocks, and then Insert the probe into the soil gently and slowly, remember not to use excessive force, make sure that the probe does not touch hard objects such as

rocks, and do not shake back and forth when inserting. After inserting, pile up the soil to cover the sensor body and fix it, after stabilizing for a period of time, the PH can be measured.

3. Buried measurement method

Dig a pit of appropriate diameter vertically to the depth as required for measurement, then bury the sensor at the bottom of the pit according to the rapid measurement method, and then fill and compact the pit. After stabilizing for a period of time, you can perform continuous measurement and recording for several days, months or even longer.

4. Precautions

1. The PH-sensitive electrode metal is very brittle and has low strength. Avoid force and impact. After being buried in the soil for a long time (3 months to half a year), the electrodes need to be cleaned. They can be lightly polished with high-grade sandpaper, or washed with 5% hydrochloric acid and soaked for a few minutes. The metal turns silver as bright as new, and then rinsed with pure water.

2. The non-metallic probe of the reference electrode is relatively thin, and the strength is not high, so force and impact should be avoided.

3. When the reference electrode is not in use, it should be kept moist.

4. Do not touch oily substances between the two electrodes to avoid oil film covering and blocking the electrical circuit.

5. The sensor's protection grade is IP68, so the entire sensor can be soaked in water.

6. RS485 Communication protocol

1. Communication parameter setting

1.The RS-485 interface is a physical interface, and the communication line is generally bus type, and all communication stations are connected to the 485 bus. The communication protocol adopts the MODBUS-RTU protocol, which is a master-slave protocol. There is a master station and multiple slave stations on a bus. The communication parameters between each station must be consistent, including baud rate, data bits, and parity. Check mode and number of stop bits. The station address of each slave station must be different, otherwise it will cause the slave station response conflict.

2. Brief description of MODBUS-RTU protocol

1. The function code is the description: the content of the second byte sent by the host, among which the 03 and 04 function codes are to read the register value; the 06 function code is to write a single register; the 16 function code is to write multiple registers; the 17 function code is to read Get the device ID. No response to other function codes.

2. Acronym description: TT: module address, address range 1-255; SS: register start address, 2 bytes, high byte first; NN: number of registers (NN≤8), 2 bytes, high byte First; MM: number of bytes, 1 byte; RR: register address, a group of 2 bytes, high byte first; VV: register value, a group of 2 bytes, high byte first; CRC: CRC Check code;? ? :version number

1) 03, 04 function codes, read single (or multiple) registers (read up to 8 registers at a time)

Host request: TT 03 SS SS NN NN CRC1 CRC2, 8 bytes,

Slave response: TT 03 MM VV VV. . . CRC1 CRC2, up to 21 bytes

2) 06 function code, write a single register

Host request: FF 06 RR RR VV VV CRC1 CRC2, 8 bytes

Slave response: FF 06 RR RR VV VV CRC1 CRC2, 8 bytes

3) 16 (0X10) function code, write multiple registers

Host request: FF 10 SS SS NN NN MM VV VV .. .. CRC1 CRC2, up to 9+16=25 bytes

Slave response: FF 10 SS SS NN NN CRC1 CRC2, 8 bytes

4) 17 (0X11) function code, read the device ID

Host request: TT 11 CRC1 CRC2, 4 bytes

Slave response: TT 11 0B "SMTS-II-485??" CRC1 CRC2, 19 bytes

3. For example:

To get the sensor PH value in the address 01:

Host sends: 01 03 00 00 00 03 05 CB

The meaning of the data:

01-sensor address 01;

03-function code;

0000-register starting address;

0003-read 3 registers

05 CB-CRC code

Sensor response: 01 03 06 02 B7 00 46 00 FE B4 D8

The meaning of the data:

01-station address 01;

03-function code;

06-byte number;

02B7- converted to decimal is 695, divided by 100 is equal to 6.95, indicating that the PH value is 6.95;

046- converted to decimal is 70, divided If 10 is equal to 7.0, the PH value is 7.0;

00FE- converted to decimal is 254, divided by 10 is equal to 25.4, which means the temperature is

25.4°C.

B4 D8-CRC check code

Note: The FE is the broadcast address (universal address), if you forget the present sensor address,

you can use the broadcast address FE to obtain the value:

FE 03 00 00 00 04 50 06 to obtain sensor PH value.

4. Example of setting address

For example, change the sensor address from 01 to 02, need send the following instruction:

Host send: 01 06 02 00 00 02 09 B3

The meaning of the data:

01-present sensor address 01;

06-function code;

0200-register address;

0002-set new address 02

09 B3-CRC check code.

If success, it will feedback: 01 06 02 00 00 02 09 B3

Note: If you forget the present sensor address value, you can check the sensor address by the following instruction:

Host sends: FE 03 02 00 00 01 91 BD

If feedback: FE 03 02 00 01 6D 90

It mean the sensor address is 01.

3. Register address

Register address:	Register address HEX:	Content	Read& Write	Value range	Applicable function code	Numerical meaning
00	00	High resolution PH value	Read only	0~1400	3/4	0.00-14.00，Resolution 0.01
01	01	Low resolution PH value	read only	0~140	3/4	0.0~14.0，Resolution 0.1
02	02	Temperature	read only	-400~800	3/4	-40.0℃~80.0℃
03	03	PH electrode millivolt value	read only	-20000~+20000	3/4	0 ~ ±2000.0mV
04	04	Reserve	read only	0	3/4	
05	05	Reserve	read only	0	3/4	
06	06	High resolution PH value	read only	100-1400	3/4	PH1.00~PH14.00
10	0A	User calibration	Read & Write	0,4,6,9,15	3/4/6/16	
13	0D	Low resolution PH value	read only	10-140	3/4	PH1.0~PH14.0
512	0X200	Sensor address	Read & Write	1-255	3/4/6/16	Factory set to 254
513	0X201	Baud rate	Read & Write	0-5	3/4/6/16	0-1200 1-2400 2-4800

514	0X202	Parity check	Read & Write	0,1,2	3/4/6/16	3-9600, default 4-19200 5-38400
515	0X203	Stop bit	Read & Write	0,1	3/4/6/16	0-no check, default 1- odd parity 2-even parity
						0-1 stop bit, default 1-2 stop bits
523	0X20B	Product serial number 1	read only	0-65535	3/4	Reserved
524	0X20C	Product series number 2	read only	0-65535	3/4	Reserved

Note: Serial communication is a fixed 8-bit data bit.

4. Calibration instruction

This sensor supports user calibration, but it is limited to the calibration of three PH standard solutions of 4.00, 6.86, and 9.18, which are available on the market. Before calibration, clean the electrode and put it in the PH standard solution. Observe that the signal is stable. The immersion time of the newly cleaned electrode may take up to 24 hours to stabilize. When the signal is stable, the calibration can be performed. When calibrating, write a calibration command to register 10, see the following table:

For example, for the sensor address of the 01, the calibration as following:

PH standard solution	Value written to register 10	Write command data string	Reading value after calibration of register 10
4.00	4	01 06 00 0A 00 04 A8 0B	41
6.86	6	01 06 00 0A 00 06 29 CA	61
9.18	9	01 06 00 0A 00 09 69 CE	91
Restore factory value	15	01 06 00 0A 00 0E 28 0C	151