Product Description

The 8-in-1 Soil Composite Sensor is a multi-parameter sensor that integrates temperature and humidity, PH, NPK and other parameters. By measuring the dielectric constant of soil, it can directly and stably reflect the real moisture content of various soils. It is suitable for soil moisture monitoring, scientific experiment, water-saving irrigation, greenhouse, flowers and vegetables, grass pasture, soil quick test, plant culture, sewage treatment, fine agriculture and other occasions. The sensor's input power supply, sensing probe, signal output three parts are completely isolated, safe and reliable, beautiful appearance, easy to install, the probe is made of stainless steel, corrosion resistance, stable performance.

Technical Parameters

8-in-1 Soil Composite Sensor	
Supply Voltage	DC 5-24V
Power Consumption	15mA@12V DC
Output	RS485
Baud rate	9600bps
Range and Accuracy	Temperature range: -40-80℃
	Temperature accuracy: ±0.5℃
	Moisture range: 0%-100%
	Moisture accuracy: ±5%
	Conductivity range: 0-10000us/cm
	Conductivity Accuracy: ±10%
	NPK range: 0-2000mg/Kg
	Accuracy of NPK: ±2%
	PH range: 0-10pH
	PH precision: ±1pH
	Salt range: 0-5500mg/L
	Salt precision: ±10%
Working Environment	-40~80℃
Sealing Material	Black epoxy resin
Material	Five-pin design, probe material for the solid stainless steel three, hollow stainless steel, a zinc alloy, the sensor total length 138 ± 1mm, width 45mm ± 1mm, thickness 15 ± 1mm, sensor probe length 65mm ± 1mm, diameter 3 ± 0.2mm

Product Features

- integrates multi-parameter, one machine multi-measurement
- Stable signal, high precision
- Wide measuring range, good linearity
- corrosion-resistant, waterproof, safe and reliable
- Convenient installation, easy to use, long transmission distance
- Low power consumption, can be a long time without interruption detection

Remark：Soil NPK sensor actually measures the electrical conductivity of the soil. The manufacturer multiplies the measured conductivity value by a

corresponding factor (based on the conventional soil content of nitrogen, phosphorus and potassium) to arrive at a value for the nitrogen, phosphorus and potassium content. Due to the different soils and environments on site, such sensors cannot accurately measure the actual nitrogen, phosphorus and potassium content of the soil on site, but give an empirical, theoretical value.

The current technology for this device is still maturing, and the pH data may not be entirely stable. the pH values provided by this device should be used as a reference only.For more accurate measurements, we suggest using a glass electrode pH sensor.

Wiring Method

(1) If you are equipped with the weather station produced by our company, you can directly connect the sensor with the corresponding interface on the weather station.

(2) If the sensor is purchased separately, the wiring sequence of the sensor is as follows:

Wire Color	Definition
Red	Power +
Black	Power -
Yellow	RS485 +
Blue	RS485 -

Installation & Measurement

(1) Rapid measurement method: select a suitable measurement site, avoid stones, ensure that the electrode will not touch stones and other hard objects, according to the required measurement depth planing the surface soil, to maintain the original degree of tightness of the soil underneath, hold the sensor vertically inserted into the soil to ensure that the probe is completely inserted into the insertion of the probe can not be swayed back and forth to ensure that it is in close contact with the soil. A small range of measurement points are recommended to measure a number of times for the average value.

(2) Buried measurement method: according to the required depth, vertically dig a pit with a diameter of more than 20 cm, the depth according to the measurement needs, and then insert the sensor probe horizontally into the wall of the pit at the established depth, fill the pit with compaction to ensure that the electrodes and the soil are in precise contact. After stabilizing for a period of time, it can be tested and recorded continuously for several days, months or even longer.

If the measurement is made on a hard surface, the hole should be drilled (the hole diameter should be smaller than the diameter of the probe), then inserted into the soil and compacted before measurement. The sensor should be protected from violent vibration and shock, and should not be struck with hard objects.

MODBUS communication protocol

Communication parameters: baud rate 9600, data bit 8, no parity bit.

The interval between two communications should be at least 1000ms.

[1] Write device address

Send: 00 10 Adress CRC16 (5 bytes)

Return: 00 10 CRC16 (4 bytes)

Note: 1. The address bit of the read/write

address command must be 00.

2. Adress is 1 byte, the range is 0-255.

Example:

Send: 00 10 01 BD C0

Return: 00 10 00 7C

[2] Read device address

Send: 00 20 CRC16 (4 bytes)

Return: 00 20 Adress CRC16 (5 bytes)

Description：Adress is 1 byte, the range is 0-255.

Example: Send: 00 20 00 68

Return: 00 20 01 A9 C0

A. Read real-time data:

Assume the device address is: 0x01, valid range 0~254, 0 is broadcast address.

For example, send: 01 03 00 00 00 08 CRC16

No.	Define	Offset	Bytes	Description
1	Device address	0	1	Device Unique Address
2	Opcode (Read)	1	1	Fixed value 0x03
3	Register start number	2	3	First register number read
4	Number of registers to read	5	1	Sensor parameters
5	CRC16 checksum	6	2	Low before high after

Device Returns：

01 03 10 xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx CRC16

No.	Define	Offset	Bytes	Description
1	Address field	0	1	Address (0x01)
2	Operand	1	1	Read only (0x03)
3	Data Length Field	2	1	Data Length
4	Data field	3	16	PH value: 0x7FFF means invalid/not connected
5	Checksum field	19	2	Low before high after

Operation code: fixed to 0x03, i.e. read operation, no other operation is supported.

Register address start number: range 0-15, indicates the first register number to be read.

B. The device returns the data frame:

Example of communication (getting data from sensor):

Send: 01 03 00 00 00 08 44 0C

Return: 01 03 10 01 14 01 46 00 4B 02 D2 00 08 00 08 00 15 00 29 F8 0E

Temperature is 01 14 (276 i.e. 27.6°C),

Moisture is 01 46 (326 i.e. 32.6%),

Conductivity is 00 4B (75 i.e. 75us/cm),

PH is 02 D2 (722 i.e. 7.22pH),

N is 00 08 (8 i.e. 8mg/Kg),

P is 00 08 (8 i.e. 8mg/Kg),

K is 00 15 (21 i.e. 21mg/ Kg),

Salt value 00 29 (41 i.e. 41mg/L)

To read a parameter individually, change the start bit of the register.

Parameter	Register location	Parameter	Register location
Temperature	00 00	N	00 04
Moisture	00 01	P	00 05
Conductivity	00 02	K	00 06
PH value	00 03	Salt	00 07

If the PH value is read separately:

Send 01 03 00 03 00 01 74 0A

Return 01 03 02 02 AC B9 59

C. Changes in nitrogen, phosphorus and potassium coefficients

The coefficients are in the form of ax+b, multiples of a and constants of b. For nitrogen, phosphorus, and potassium, a all defaults to 0064 (100 which is 1.00 times) and b all defaults to 0000 (which is 0)

Read coefficient command: 00 60 02 crc

Change coefficient command: 00 60 01 0064 0000 0064 0000 0064 0000 crc

For example, the value of nitrogen x 2.00+100, phosphorus x 1.00+100, potassium x 3.00+100.

Send: 00 60 01 00C8 0064 0064 0064 012C 0064 FB 2F

Return: 00 60 01 98 00

D. Calculation of CRC16 check digit

1) Preset one 16-bit register to hex FFFF (i.e., all ones); call this register the CRC register;

2) Isolate the first 8-bit binary data (i.e., the first byte of the communication information frame) with the lower 8 bits of the 16-bit CRC register, and place the result in the CRC register;

3)Shift the contents of the CRC register right one bit (toward the lower bit) to fill the highest bit with 0, and check the shifted out bit after the right shift;

4) If the shifted out bit is 0: repeat step 3 (right shift one bit again);

If the shifted out bit is 1: the CRC register is iso-or with the polynomial A001 (1010 0000 0000 0001);

5) Repeat steps 3 and 4 until it is shifted right 8 times so that the entire 8-bit data is all processed;

6) repeating steps 2 through 5 for the next byte of the communication information frame;

7) exchanging the high and low bytes of the 16-bit CRC register obtained after all bytes of this communication information frame have been calculated according to the above steps;

8) The content of the CRC register obtained at last is the CRC16 code. (The CRC code is in the order of low before high)

Instructions for use

Wire the sensor according to the instructions in the wiring method, then insert the sensor probe pin into the soil you want to measure, turn on the power supply and collector switch, you can get the value of the soil parameter at the measurement point.

Caveat

1, please check whether the packaging is intact, and check whether the product model is consistent with the selection;

2, do not be wired with electricity, wiring is completed to check that there is no error before energizing;

3, the sensor line length will affect the product output signal, do not change the use of the product has been welded at the factory components or wires, if there is a need to change, please contact the manufacturer;

4, the sensor is a precision device, the user in the use of the user should not disassemble, with sharp objects or corrosive liquids in contact with the sensor surface, in order to avoid damage to the product;

5 、 Please keep the calibration certificate and certificate of conformity, and return with the product when maintenance.

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