Soil Temperature & Moisture sensor User Manual

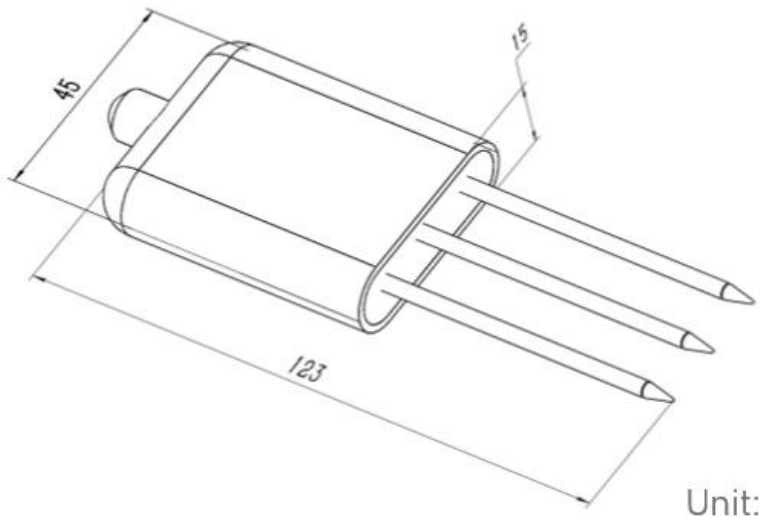
Version V1.0
By Gray

This soil sensor can be used to detect the soil moisture and temperature. It detects the stable and real moisture content by measuring the dielectric constant of the reaction of soil. Besides, it is completely sealed, acid and alkali corrosion, and can be buried in the soil or directly into the water for long-term dynamic testing.

Specifications

Soil temperature	
Range	-40℃~+80℃
Accuracy	+/- 0.5℃ (at 25℃)
Resolution	0.1℃
Soil moisture	
Range	0%~100%
Accuracy	+/-2%(between 0~50%), +/-3%(between 50%~100%)
Resolution	0.1%
General parameters	
Interface	RS485
Power supply	DC4.5V~30V
IP rating	IP68
Operating temperature	-40℃~+80℃
The material of the probe	Anti-corrosion special electrode
Sealing material	The black flame retardant epoxy resin

Size:



Unit: mm

Wiring:

Color	Description
brown	VCC
Black	GND
Yellow	RS485_A
Blue	RS485_B

Installation

There are two measurement method to determinate the moisture content and temperature directly.

A. One is rapid measurement method: selected the measurement locations which avoid the rocks to ensure the needle will not touch the hard object like stones; inserted the senor needle vertically into the soil, and maintain the tightness degree of the original soil below the sensor body. Note that the sensor cannot be inserted before and after shaking to ensure the close contact with the soil. A measuring point within a small range test should repeatedly averaging.
B. Other is buried in the underground measurement method: drilled vertically a pit with the diameter greater than 20cm and the suitable depth. Inserted the sensor needle horizontally into the pit wall, and fill the pit by compaction to ensure the sensor has a full contact with the soil. After a period of time with stable running, the sensor could be last for days, months or even long time to measure.

Communication

The sensor supports the Modbus protocol and provides the RS485 interfaces.

The communication parameters:

Data bits	8
Parity bits	no
Stop bits	1
Error-checking	CRC
Baud rate	2400bit/s, 4800bit/s(default), 9600bit/s

- Frame format

Address code: the sensor address, which default setting is 0x01.

Function code: the function indication transmitted by the master, (the indication 0x03 is used to read the sensor register)

Data code: the specific communication data, and note that the high of the 16bits data is in the first byte.

CRC code: 2bits error-checking.

The asking frame transmit from master:

Address	Function	Start address	Length of	Low of error	High of error

code	code	of register	register	checking	checking
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

The respond frame transmitted from slaver:

Address code	Function code	Length of data	First data	…	Low of error checking	High of error checking
1 byte	1 byte	1 byte	2 bytes	…	1 byte	1 byte

- Sensor registers

Parameter name	Register address (HEX)	Description
moisture	0000 H	Real value (a tenfold increase)
temperature	0001 H	Real value (a tenfold increase)
temperature calibration	0050 H	Integer (a tenfold increase)
moisture calibration	0051 H	Integer (a tenfold increase)
Device address	07D0 H	

- Communication sample:

For example: to read the register 0x0000-0x0001 of the sensor which the address is 0x01, that reads the moisture content and temperature.

Ask: 01 03 0000 0002 C4 0B

Address	1 byte	0x01
Function number	1 byte	0x03
Start register address	2 bytes	0x0000
Register number	2 bytes	0x0002
Check	2 bytes	0xC40B

Respond: 01 03 04 01 E6 FF 9F 1B A0

Address	1 byte	0x01
Function number	1 byte	0x03
Effective byte number	1 byte	0x04
Moisture register value	2 bytes	0x01
		0xE6
Temperature register value	2 bytes	0xFF
		0x9F
Check	2 bytes	0x1BA0

After success of the check, use the following formula to calculate the moisture and temperature (negative to complement representation):

Moisture content = (01 H * 256 + E6 H) /10 * 100 = 48.6%

The complement of the “FF9F” is “1000 0000 0110 0001”.
Temperature = (-1) * (00 H * 256 + 61 H)/10 = -9.7℃