Soil Moisture Sensor

JW-S1S(Z6) Analog Output

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1. Product Introduction

It measures soil moisture content. It sealed with resin packaged plastic body with sensing rods which can be insert directly into the soil with long time stability. Sensor with relatively small size and can be used for pot culture and Seedling tray. The sensor is applicable for science research, irrigation, greenhouse, smart agriculture etc.

2. Features

- Soil Moisture measurement with high sensitivity and accuracy
- Relatively small size 20*11*95mm for pot culture and Seedling tray
- Output Interface with Voltage
- Calibration formula for different growing mediaHigh accuracy with excellent stability
- Low salinity sensitivity
- Minimal soil disturbance
- Water proof to IP68 ratings and can be directly buried into soil
- High accuracy with excellent stability
- Reverse power protection and Built-in TVS/ESD protection

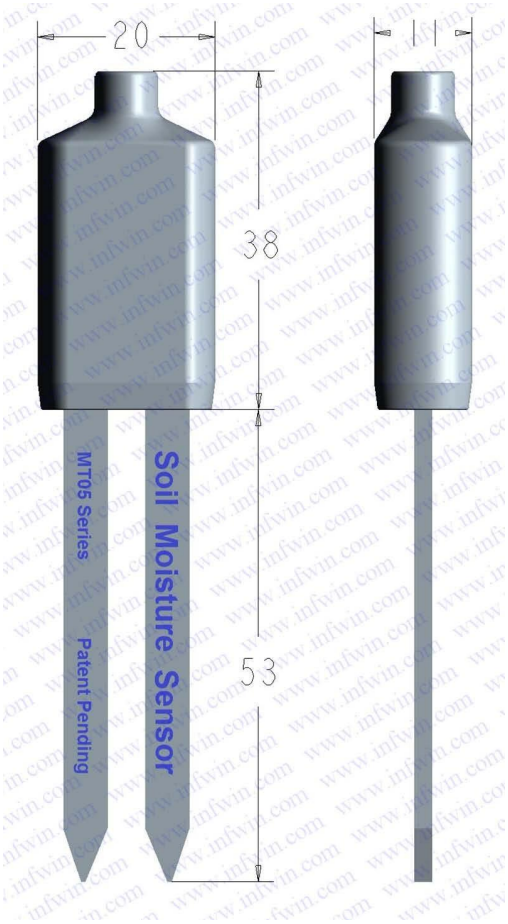
3. Technical Parameters

Measuring Parameters	Soil Moisture (Volumetric Water Content)
Soil Moisture Range	Range:0-100% Resolution: 0-55%: 0.1%; 55%-100%:1.5%. Accuracy: 0-50%:±3%; 50%-100%: ±5%.
Measuring Method	FDR
IP Ratings	IP68
Operating Temperature	-40~85°C
Sensor Sealed	Epoxy resin
Installation	Surface or buried installation
Cable Length	5 meters or Customize
Dimension	20*11*95mm
Power Supply	2.5-16V DC @ 15mA
Output	Analog voltage: max 2000mV Output impedance: 2Kohm

4. Wiring Diagrams

White: Power Supply +
Bare: Ground
Red: Analog Output

5. Dimension



6. Safety, Care and Installation

6.1 Safety and Care

■ The rods of the Sensor are sharp for ease insertion. Care must be taken and handling precautions followed.
■ Avoid touching the rods or exposing them to other sources of static damage, particularly when powered up.
■ Do not pull the sensor out of the soil by its cable.
■ If you feel any resistance when inserting the sensor into soil, it is likely you have encountered a stone. Stop pushing and re-insert at a new location.

6.2 Installation

Surface installation

- Clear away any stones. Pre-form holes in very hard soils before insertion.
- Push the sensor into the soil until the rods are fully inserted. Ensure good soil contact.
- If you feel strong resistance when inserting the sensor, you have probably hit a stone. Stop, and re-insert at a new location.

Note: The sensor is suitable for soil surface temperature measurements.

Installing at depth

- Make a 45mm diameter hole, preferably at about 10° to the vertical using a auger.
- Push the sensor into the soil until rods are fully inserted. Ensure good soil contact.
- Fill and repack the hole with soil.

Alternatively

- Dig a trench, and install horizontally.

7. Output Signal Conversion

7.1 Conversion Formula

In the description below, Vs is sensor power supply voltage,MV is milli-voltage of sensor output(max 2000mV),VWC is volumetric water content(0.0%-100.0%), ξ_a is epsilon (0.88-81.88)

7.1.1 Conversion for Commonly used mineral soil

VWC simplified conversion formula,used for Volumetric water content conversion, VWC ranges from 0%-saturated (0%- saturated)

Power Supply	Conversion Formula	Comment
Vs=2.5V	VWC=0.0007668*MV-0.4124162	N/A
Vs=2.6V	VWC =0.0007632*MV-0.4254611	N/A
Vs≥2.7V	VWC =0.0007564*MV-0.4261409	N/A

VWC full range conversion formula,used for Volumetric water content conversion, VWC ranges from 0%-100%

Power Supply	Conversion Formula	Comment
Vs=2.5V	When MV≤1203mV: VWC = 3.5458197E-07*MV^2 + 1.7633114E-04*MV - 1.9187369E-01 When MV>1203mV: VWC = 7.5595667E-05*MV^2 - 1.8141573E-01*MV + 1.0937923E+02	N/A
Vs=2.6V	When MV≤1227mV: VWC = 3.2251602E-07*MV^2 + 2.0814992E-04*MV - 2.1048563E-01 When MV>1227mV:	N/A

	VWC = 7.3693990E-05*MV^2 - 1.8031010E-01*MV + 1.1083086E+02	
Vs≥2.7V	When MV≤1240mV: VWC = 3.1651746E-07*MV^2 + 2.0687817E-04*MV - 2.1126387E-01 When MV>1240mV: VWC = 5.4820108E-05*MV^2 - 1.3474890E-01*MV + 8.3335703E+01	N/A

7.1.2 Conversion for Potting Soil

Power Supply	Conversion Formula	Comment
Vs=2.5V	When MV≤1212mV: VWC = 4.5968970E-09*MV^3 - 1.2904363E-05*MV^2 + 1.3230902E-02*MV - 4.3850236E+00 When MV>1212mV:growing media saturated,force MV=1212mV for calculation	N/A
Vs=2.6V	When MV≤1237mV: VWC = 4.1267600E-09*MV^3 - 1.1941604E-05*MV^2 + 1.2651331E-02*MV - 4.3233389E+00 When MV>1237mV:growing media saturated,force MV=1237mV for calculation	N/A
Vs≥2.7V	When MV≤1250mV: VWC = 4.0985755E-09*MV^3 - 1.1901467E-05*MV^2 + 1.2643467E-02*MV - 4.3400540E+00 When MV>1250mV:growing media saturated,force MV=1250mV for calculation	N/A

7.1.3 Conversion for Rock Wool

Power Supply	Conversion Formula	Comment
Vs=2.5V	When MV≤1000mV: VWC = -5.2284103E-09*MV^3 + 1.0973620E-05*MV^2 - 6.1765070E-03*MV + 1.1018837E+00 When MV>1000mV:growing media saturated,force MV=1000mV for calculation	N/A
Vs=2.6V	When MV≤1020mV: VWC = -4.7824052E-09*MV^3 + 1.0189069E-05*MV^2 - 5.7502508E-03*MV + 1.0102167E+00 When MV>1020mV:growing media saturated,force MV=1020mV for calculation	N/A
Vs≥2.7V	When MV≤1030mV: VWC = -4.4977589E-09x^3 + 9.6406909E-06^{x2} - 5.4229721E-03x + 9.4298186E-01 When MV>1030mV:growing media saturated,force MV=1030mV for calculation	N/A

7.1.4 Conversion for Perlite

Power Supply	Conversion Formula	Comment
Vs=2.5V	When MV≤1070mV: VWC= -3.6427604E-09*MV^3 + 8.1594992E-06*MV^2 - 4.7537898E-03*MV + 7.8831286E-01 When MV>1070mV:growing media saturated,force MV=1070mV for calculation	N/A
Vs=2.6V	When MV≤1090mV: VWC = -3.4253078E-09*MV^3 + 7.8086768E-06*MV^2 - 4.6118698E-03*MV + 7.6450087E-01 When MV>1090mV:growing media saturated,force MV=1090mV for calculation	N/A
Vs≥2.7V	When MV≤1110mV: VWC = -3.2285063E-09*MV^3 + 7.4140452E-06*MV^2 - 4.3738042E-03*MV + 7.1574605E-01 When MV>1110mV:growing media saturated,force MV=1110mV for calculation	N/A

7.1.5 Conversion for Epsilon

Power Supply	Conversion Formula	Comment
Vs=2.5V	When MV≤1004mV: ξ_a = 4.3203692E-05*MV - 2.7665077E-02*MV + 4.2257250E+00 When MV>1004mV: ξ_a = 3.8662858E-06*MV - 1.2256430E-02*MV + 1.3020159E+01*MV - 4.6105918E+03	N/A
Vs=2.6V	When MV≤1026mV: ξ_a = 4.0593611E-05*MV - 2.5665015E-02*MV + 3.5715591E+00 When MV>1026mV: ξ_a = 3.7399889E-06*MV - 1.2070000E-02*MV + 1.3047273E+01*MV - 4.7001585E+03	N/A
Vs≥2.7V	When MV≤1038mV: ξ_a = 3.8845836E-05*MV - 2.4119747E-02*MV + 3.1538131E+00 When MV>1038mV: ξ_a = 2.8198246E-06*MV - 9.0840887E-03*MV + 9.8205864E+00*MV - 3.5398361E+03	N/A

Appendix

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Version Control

Date	Version	Comment	Updated by
2019-12-24	V1.0	Initial Creation	fg49597