Wireless Soil Moisture Sensor

General Description

The **Soil Moisture Sensor** measures soil moisture tension and soil temperature within the soil. It uses a resistive granular matrix element to accurately measure the matric water potential (soil moisture tension) in the soil and a thermistor based temperature element to measure temperature.

Features

- Safe to use in both hot and freezing temperatures
- Reports matric potential (soil water tension) which is the best indicator of water availability in the soil.
- Moisture readings in centibar and kPa
- 0 to 240 centibar (kPA)
- Will not dissolve in soil
- Internally compensated for commonly found salinity levels
- Easy to install and use compared to traditional tensiometers
- Stainless steel electrodes
- No maintenance required
- Temperature readings in C/F.
- 5 ft removable lead

Principle of Operation

The Soil Moisture Sensor uses a resistive granular matrix element to accurately measure the matric water potential (soil moisture tension) in the soil.

Soil Moisture Element: The soil moisture element is unique in that it takes its resistive measurement within a defined and consistent internal matrix material, rather than using the surrounding soil as the measurement medium. This unique feature allows the sensor to have a stable and consistent calibration that does not need to be established for every installation.

Temperature Element: The soil moisture sensor also comes equipped with a temperature element on the end of the soil moisture lead to make accurate soil temperature measurements as well. The temperature reading is also used for temperature compensation of the soil moisture measurements so no need to worry about getting different moisture readings just because the temperature changes.

Features of Sensors

- Wireless range of 1,200+ feet through 12+ walls [1]
- Frequency-Hopping Spread Spectrum (FHSS)
- Best of class interference immunity
- Best of class power management for longer battery life [2]
- Encrypt-RF® Security (Diffie-Hellman Key Exchange + AES-128 CBC for sensor data messages)
- Datalogs 2000 to 4000 readings if gateway connection is lost (non-volatile flash, persists through the power cycle):
  - 10-minute heartbeats = ~ 22 days
  - 2-hour heartbeats = ~ 266 days
- Over-the-air updates (future proof)
- Online wireless sensor monitoring and notification system to configure sensors, view data and set alerts via SMS text and email

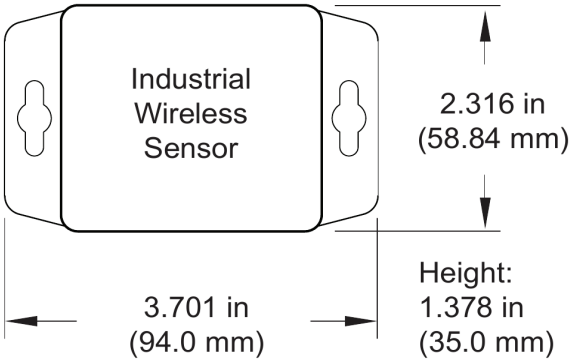
1 Actual range may vary depending on environment.

2 Battery life is determined by sensor reporting frequency and other variables. Other power options are also available.

Wireless Range Comparison

Example Applications

- Irrigation scheduling
- Water table monitoring
- Leak detection
- Agronomy research
- Environmental monitoring
- Almost any soil moisture/status application



Wireless Soil Moisture Industrial Platform | Technical Specifications		
Part Number		MNS2-9-IN-WS-WM-L05
Supply voltage		2.0–3.8 VDC (3.0–3.8 VDC using power supply) [1]
Current consumption		0.2 µA (sleep mode), 0.7 µA (RTC sleep), 570 µA (MCU idle), 2.5 mA (MCU active), 5.5 mA (radio RX mode), 22.6 mA (radio TX mode)
Operating temperature range		-40°C to +80°C (-40°F to +176°F)
Included battery	Max temperature range	-40°C to +80°C (-40°F to +176°F)
	Capacity	1500 mAh
Datalogging		Datalogs 2000 to 4000 readings if gateway connection is lost (non-volatile flash, persists through the power cycle): - 10-minute heartbeats = ~ 22 days - 2-hour heartbeats = ~ 266 days
Wireless range		1,200+ ft non-line-of-sight
Security		Encrypt-RF® (256-bit key exchange and AES-128 CTR)
Weight		4.23 ounces (120 g)
Enclosure rating		NEMA 1, 2, 4, 4x, 12 and 13 rated, sealed and weather
UL rating		UL Listed to UL508-4x specifications (File E194432)
Certifications		900 MHz product; FCC ID: ZTL-G2SC1 and IC: 9794A-G2SC1. 868 and 433 MHz product tested and found to comply with: EN 300 220-2 V3.1.1 (2017-02), EN 300 220-2 V3.1.1 (2017-02) and EN 60950

1. Hardware cannot withstand negative voltage. Please take care when connecting a power device.

Sensor Specifications	
Moisture Sensing Element	
Element Type	Resistive element with granular matrix
Range	0.0 to 240.0 centibar or kPa (Water Tension)
Resolution	~0.3 centibar or kPa[1]
Dimensions	Diameter: 0.875 in. (22 mm)
	Length: 3.25 in. (83 mm)
Materials	ABS plastic caps with stainless steel body over a hydrophilic fabric covered granular matrix. (Will not dissolve in soil or be compromised by freezing temperatures)
Response Time	~5 Minutes [2]
Temperature Sensing Element	
Element Type	Thermistor embedded in sealed metal bullet
Accuracy	+/- 1.0 Celsius
Measurement Range	-40° C to 125° C (-40° F to 257° F)
Resolution	0.1° C
Response Time	Typically less than 15 seconds
Cable Physical Specifications	
General Composition	Soil moisture and temperature leads coupled together in a single sealed cable wrapped in a braided sleeve. Sleeve ends fixed using adhesive lined heat shrink.
Length	63 in. (160 cm)
Connector End	Keyed M8 6-pin female connector, with M8 female coupling collar.
Cable Sleeve Material	Polyethylene terephthalate (PET)
Overall Cable Operating Temperature	-40° C to 80° C (-40° F to 176° F) [3,4]
Weight	4.07 oz. (115 g)
Sensor Base Connector	
Base Connector	Keyed M8 6-pin male connector
Data	
User Interface: xxx.x centibars or kPa, xxx.x° C or F [5]	**Raw Data:** Soil Moisture: unsigned int, raw / 10 = centibars Temperature: signed int, raw / 10 = Celsius

1. The resolution increases as the centibar readings get lower. Resolution at 0 centibar is ~0.05 centibar, at 240 centibar it is ~0.36 centibar. The sensor is limited to 0.1 centibar by the sensor firmware.
2. Response time calculated by measuring time it takes for sensor to go from fully dry to saturated by placing moisture element upright in 1" of water. Actual response times may vary.
3. Heatshrink adhesive melts at ~85° C. Using at temperatures at or above this level may compromise the waterproofing of the cable and allow the heatshrink and sleeve to slip and become loose.
4. The soil moisture element will not work properly while frozen but when thawed the sensor readings will return to normal.
5. UI units are user configurable via software.

Commercial Grade Sensors

Commercial grade sensors are designed for applications in ordinary environments (normal room temperature, humidity and atmospheric pressure). Do not use these sensors under the following conditions as these factors can deteriorate the product characteristics and cause failures and burnout.

- Corrosive gas or deoxidizing gas: chlorine gas, hydrogen sulfide gas, ammonia gas, sulfuric acid gas, nitric oxides gas, etc.
- Volatile or flammable gas
- Dusty conditions
- Low-pressure or high-pressure environments
- Wet or excessively humid locations
- Places with salt water, oils chemical liquids or organic solvents
- Where there are excessively strong vibrations
- Other places where similar hazardous conditions exist

Use these products within the specified temperature range. Higher temperature may cause deterioration of the characteristics or the material quality.

Industrial Grade Sensors | Type 1, 2, 4, 4X, 12 and 13 NEMA Rated Enclosure

Industrial sensors are enclosed in reliable, weatherproof NEMA-rated enclosures. Our NEMA-rated enclosures are constructed for both indoor or outdoor use and protect the sensor circuitry against the ingress of solid foreign objects like dust as well as the damaging effects of water (rain, sleet, snow, splashing water, and hose-directed water).

- Safe from falling dirt
- Protects against wind-blown dust
- Protects against rain, sleet, snow, splashing water, and hose-directed water
- Increased level of corrosion resistance
- Will remain undamaged by ice formation on the enclosure