PS100

1-Wire Soil Moisture and Temperature Sensor

Datasheet - 2 Sep 2026

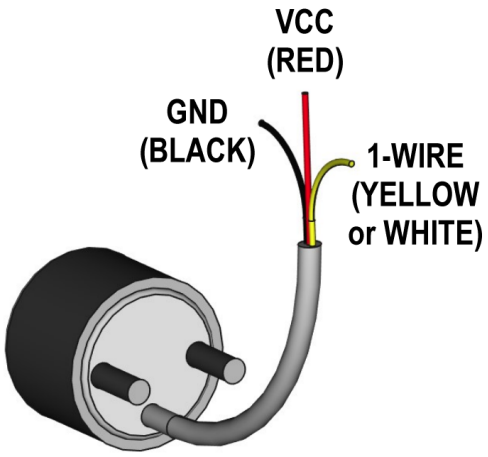
Overview

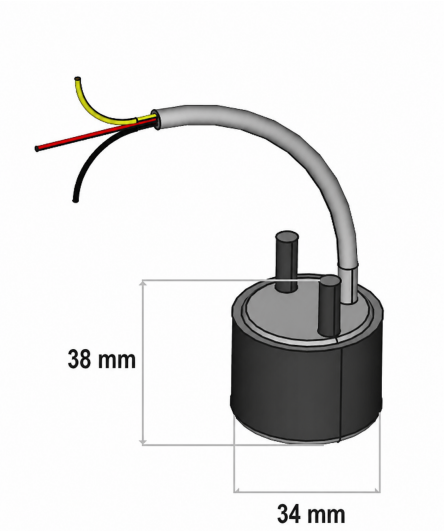
The PS100 combines a 16-bit, resistive, temperature-compensated soil moisture sensor with a 12-bit DS18B20-compatible temperature sensor.[1]

The sensor uses carbon-fiber probes and is encased in a high-density, waterproof silicone shell. With no metal sensing parts exposed to oxidation, electrolysis, or erosion, it is suitable for continuous monitoring of wet cultivation.

Soil resistivity is determined by measuring the charging time of a tantalum capacitor in an RC circuit, with the soil forming part of the circuit resistance. This method reduces susceptibility to electromagnetic interference (EMI) and provides stable long-term measurements.

Each sensor is factory-calibrated for consistent results across multiple nodes.





Features

- Temperature and soil moisture readings updated every 4 seconds.
- Dedicated Texas Instruments TPL5010 watchdog and interrupt IC.
- Low power consumption.
- Reverse-voltage protection.
- 3.3 V to 5.5 V operating range.
- Non-standard, error-tolerant 1-Wire implementation supporting multiple masters and slaves on the same network.[2]

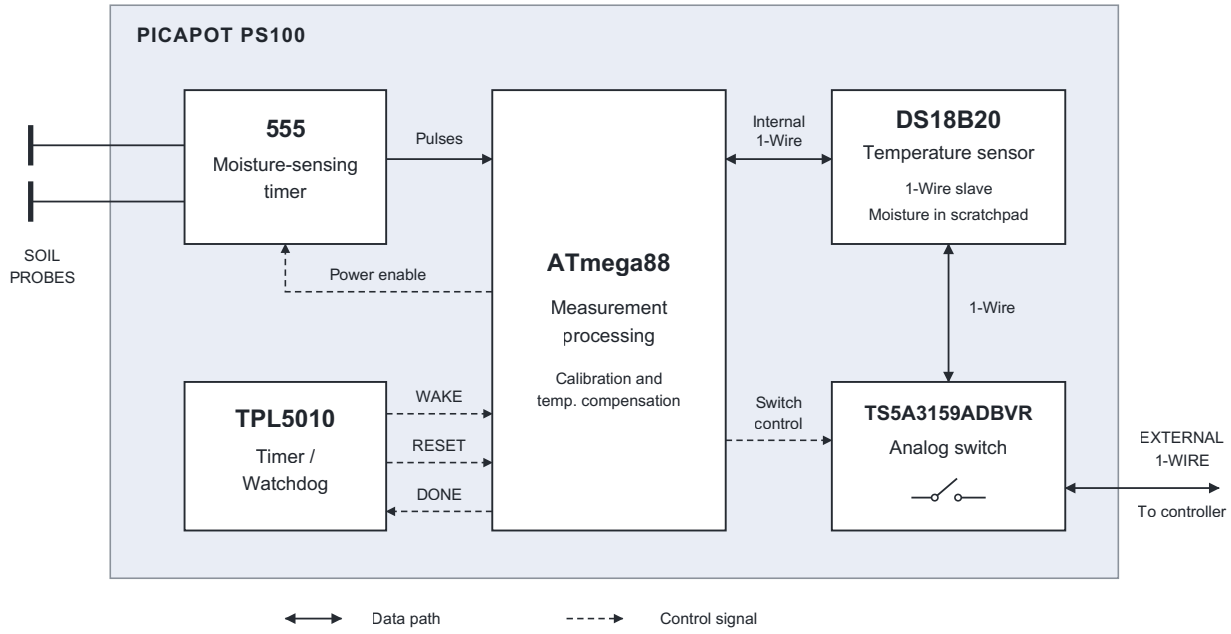
Electrical Characteristics

Characteristic	Min	Typ	Max	Unit
Input voltage range	3.3	5	5.5	V
Active average current (probes R = 10 kOhm)		350		uA
Maximum active current (probes R = 0 kOhm)			18	mA
Average power consumption at 5 V		1.75		mW
Operating ambient temperature range	-40		+85	Celsius

Package Dimensions

Characteristic	Min	Typ	Max	Unit
Sensor diameter		34		mm
Sensor length, including probes		37		mm
Sensor weight, without cable		30		g
Cable size, 3 conductors	22	24	26	AWG

Block Diagram



Operation

The PS100 uses a DS18B20-compatible device as both a precise temperature sensor and a reliable 1-Wire hardware slave.

Every four seconds, the PS100 requests a new 12-bit temperature conversion from its internal DS18B20-compatible device, measures soil moisture, and writes the result to the device's scratchpad memory.

An external 1-Wire master retrieves temperature and soil moisture by sending the standard **Read Scratchpad** command (`0xBE`). The master must read the complete 9-byte scratchpad and validate the CRC8 in byte 8 against bytes 0 through 7.

The 16-bit soil moisture value is stored in scratchpad byte 2 (high byte) and byte 3 (low byte):

```
moisture = byte2 * 256 + byte3
```

Valid results range from 1 to 65535. Lower values indicate lower soil moisture. A value of 0 indicates that the sensor did not complete a valid measurement, for example because of an internal timeout, and must be discarded.

The external master does **not** need to issue the Convert T command (`0x44`), because the PS100 requests temperature conversions automatically.

An Arduino UNO connection and reading example is available in the PS100Test repository. Refer to the DS18B20 datasheet for the standard 1-Wire commands and scratchpad temperature format.

Multiple-Master 1-Wire Protocol

The standard 1-Wire protocol normally uses one master and multiple slaves on the same network, with only the master issuing commands.

The PS100 intentionally operates outside that model. It acts as a secondary master when commanding its internal DS18B20-compatible device and writing the calculated soil moisture value into the scratchpad.

To prevent a collision with a simultaneous scratchpad read, the PS100 gives priority to its write operation by disconnecting the internal device from the external 1-Wire network for approximately 25 milliseconds. The internal write remains reliable because it takes place on a restricted network containing one master and one slave.

An external master's read can instead be ignored or disrupted if it occurs during this interval. With one sensor polled every two seconds, the expected collision rate is approximately 0.4%.

The external master must therefore:

1. Read all 9 scratchpad bytes.
2. Calculate the CRC8 over bytes 0 through 7.
3. Compare it with the CRC8 stored in byte 8.
4. Discard the response and repeat the read if the CRC does not match. Wait at least 30 milliseconds before retrying.

The Arduino example linked above includes a CRC8 implementation.

Operating Mode and Power Consumption

After each reset, the PS100 waits for the first temperature conversion to complete, approximately 750 milliseconds, before calculating a temperature-compensated soil moisture measurement.

From the second measurement onward, the PS100 uses the previously calculated temperature while the next conversion is in progress. This increases the main microcontroller's quiescent period.

The PS100 can remain continuously powered with an average current consumption of approximately 0.35 mA. It can alternatively be switched on only for a single measurement; in this second case, allow up to 1400 milliseconds before reading the sensor.

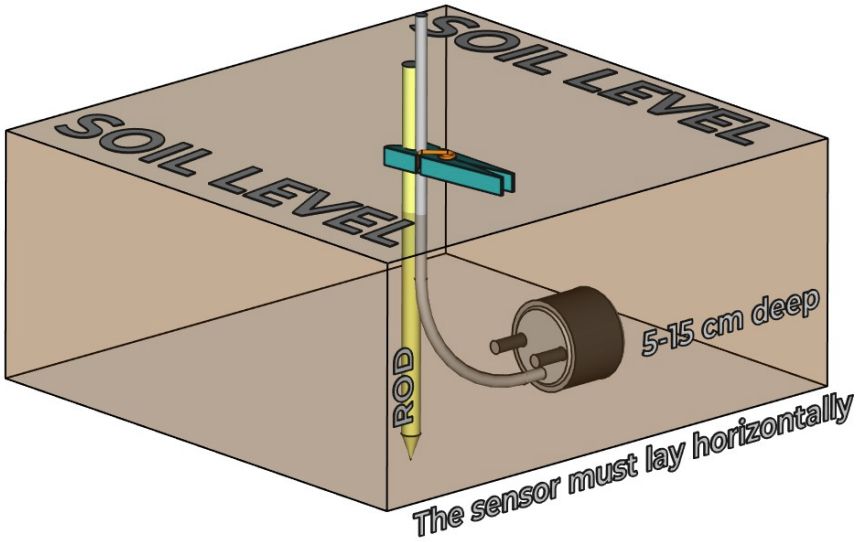
Installation

The PS100 can be used in pots or in open ground. Bury the sensor directly in the soil, laying it horizontally. Carefully fill the gap between the probes with the same soil, after removing wood, stones, fibers, and other impurities larger than 3 mm.

For pot cultivation, use a pot larger than 25 cm in diameter and preferably install the sensor in the pot receiving the most sun. Place it at a depth of approximately one-fifth of the pot height. Fabric and ceramic pots are preferred when higher evaporation rates are desirable.

For ground cultivation, select the installation depth according to the crop's root depth: deeper roots generally require deeper sensor placement.

Secure the sensor cable to a stable anchor point, such as a peg fixed to a rod or to the edge of the pot.



Recommended horizontal installation, 5 to 15 cm below soil level.

Horizontal placement helps prevent natural soil compression from creating a denser, moisture-retaining area between the probes.

For drip irrigation, position the sensor approximately one-third of the pot diameter from the dripper.

Installation Check

Use either of the following methods to verify the installation:

1. **Normal-cycle check - recommended.** Allow one or two normal watering cycles. A reading above 52000, approximately 80%, after this period indicates correct installation.
2. **Direct-water check.** Apply 150 ml of the normal irrigation water directly to the soil above the sensor. The reading should rise above 52000, approximately 80%. Depending on seasonal evaporation, allow one to seven days for the soil to normalize after this check.

Soil Moisture Measurements

After installation, the sensor provides consistent relative soil moisture measurements that can be used as a reference for triggering watering cycles.

The reported value does not directly represent the absolute quantity of water in the soil. Soil texture and the electrical conductivity of the irrigation water both influence the measurement.

Determine the appropriate watering threshold for the specific installation. A practical starting method is to keep the normal watering cycle active and monitor the minimum and maximum moisture readings over 24 hours. Use their average as an initial threshold, then tune it according to plant response and local conditions.

The daily measurement range depends strongly on evaporation. On cloudy winter days it may be as low as 1%, while in warmer months it can exceed 20%, making the appropriate threshold easier to identify.

Electrical Conductivity Influence

The PS100 is a resistive soil moisture sensor and is sensitive to changes in the electrical conductivity (EC) of the irrigation water. The indicated moisture may change by approximately 1% for each 80 microSiemens change in EC.

For example, consider an outdoor cultivation normally irrigated with water at 1000 microSiemens. After substantial rainfall at 50 microSiemens, the resulting soil EC could be approximately 600 microSiemens. The reading after the rain may consequently appear 5% to 6% lower than before the rain even though the soil is wetter.

Possible ways to manage this effect are:

- **Natural balancing.** Allow the irrigation system to continue operating after a low-EC rain event while the reading remains below the chosen threshold. One or two subsequent cycles with higher-EC irrigation water will normally reduce the difference. Occasional excess watering, typically in winter, may be an acceptable tradeoff for more efficient watering during warmer months.
- **Threshold adjustment.** Adjust the irrigation threshold to account for exceptional EC changes, such as prolonged rainfall with very low conductivity.
- **Seasonal shutdown.** Disable the Moisture Limit option or automatic irrigation entirely during periods of frequent winter rainfall.

Maintenance

Inspect and, if necessary, repeat the sensor installation every three to six months so that roots or other debris do not interfere with the measurement area.

User Assessment Disclaimer

Users must assess the suitability of the sensor and select irrigation settings according to their installation, plants, soil, water, and environmental conditions.

1. Depending on component availability, the PS100 may use either a DS18B20 from Analog Devices or a compatible equivalent from UMW.
2. See Multiple-Master 1-Wire Protocol for the required CRC and retry behavior.