Soil moisture and temperature sensor SMT-01

The Design

The design of the SMT-01 sensor is based on measuring the rate of dissipation of thermal energy depending on the moisture content in the soil.

The SMT-01 sensor is simple in design and consists of several components (see photo):

1. Heater - bipolar transistor **2N2222A**;
2. Thermometer – digital 1-Wire sensor **DS18b20**;
3. Cable - 4-wire, shielded;
4. PSB for electrical connection of components;
5. Epoxy body (diameter 9 mm, length 40 mm).

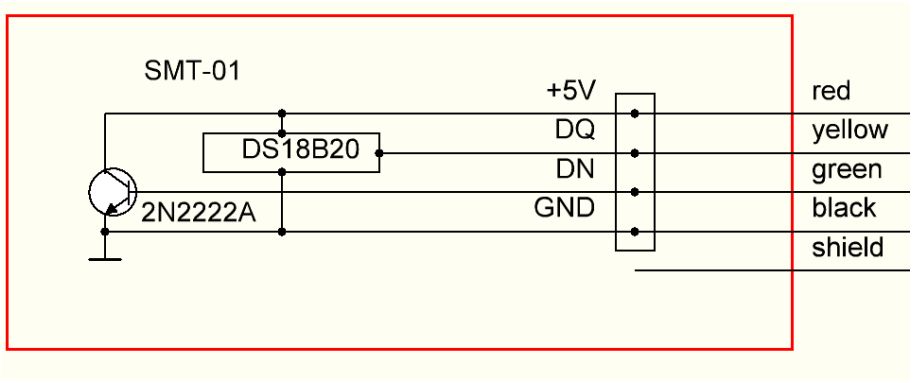


Рис.1 Electrical connection circuit.

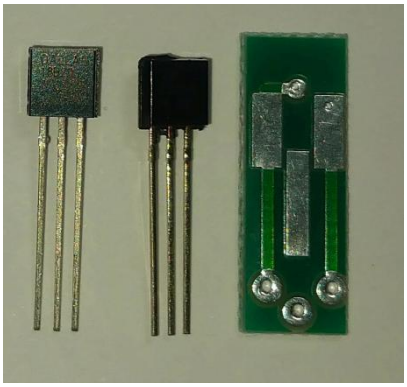


Photo 1. Components of SMT-01 before soldering.

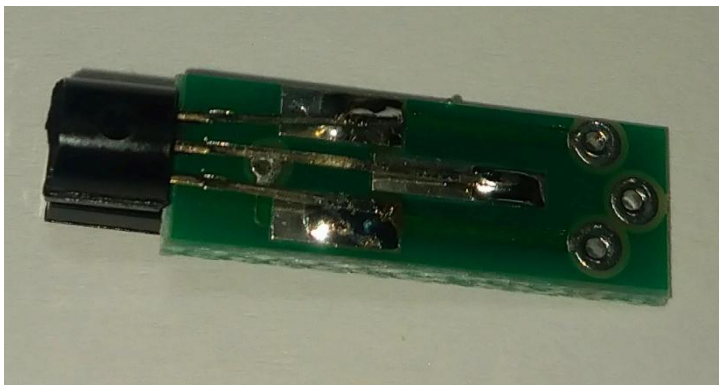


Photo 2. Components of SMT-01 after soldering.

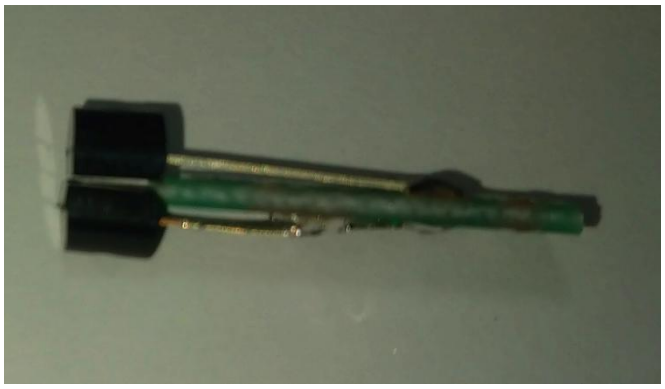


Photo 3. DS18b20 and 2N2222A are arranged flat surfaces to each other at a distance of about 1 mm.

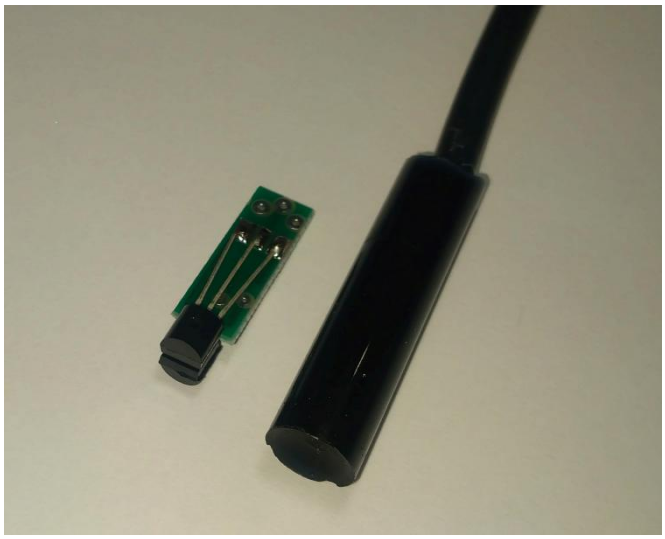


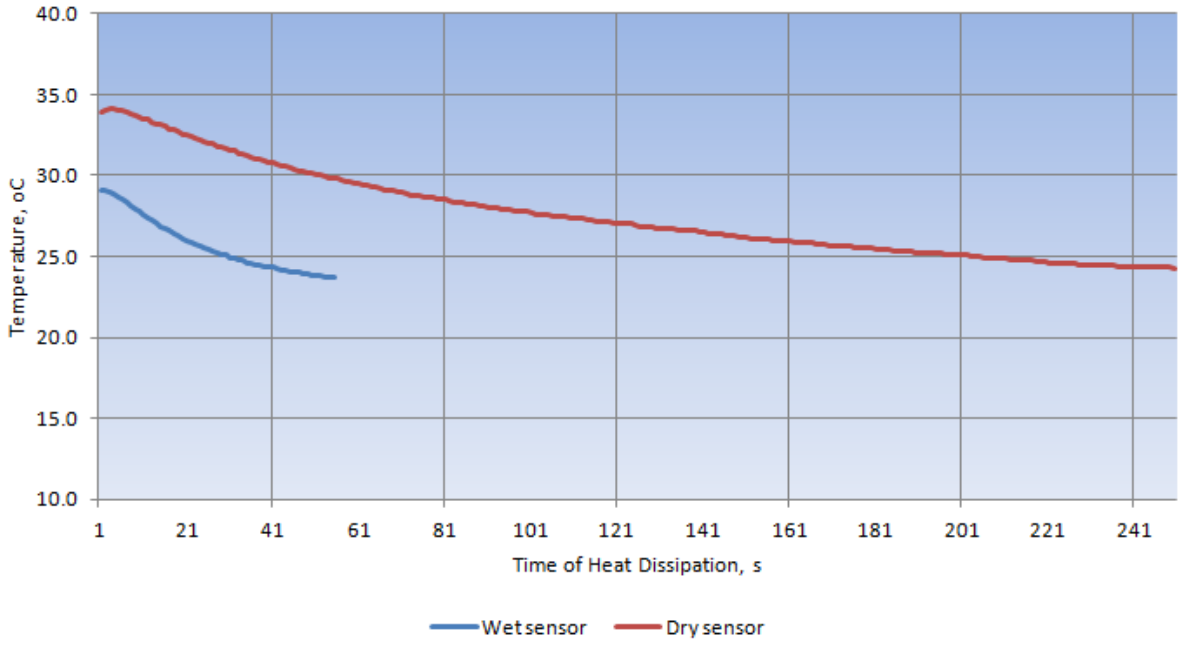
Photo 4. Components without and with epoxy coating

How the Sensor is works

Measurement of soil temperature Tsm (10 seconds)**:** Using **DS18b20** sensor and **1-Wire** protocol.

Heating of the Sensor (60 seconds)**:** through the resistor R1 voltage + 5V is applied to the base **2N2222A**. The collector current is in the range of 100-120 mA. The Sensor temperature increases about on 10° C.

Heating dissipation (30-250 seconds): through the resistor R1 voltage + 0V is applied to the base **2N2222A**. The collector current is near to 0 mA. While the temperature drops to **Tsm** + 1° C using **DS18b20** sensor and **1-Wire** protocol for temperature measurement.



Pic.2 Time of Heat dissipation for Wet and Dry sensor

Soil Moisture calculation

Time of Heat dissipation 55 seconds: corresponds to soil moisture 100%.

Time of Heat dissipation 250 seconds: corresponds to soil moisture 0%.

For practical purposes, in automatic irrigation systems, the dependence of Soil Moisture from Time of Heat dissipation time can assume to be linear. For accurate calculations, calibration is required for each soil type.