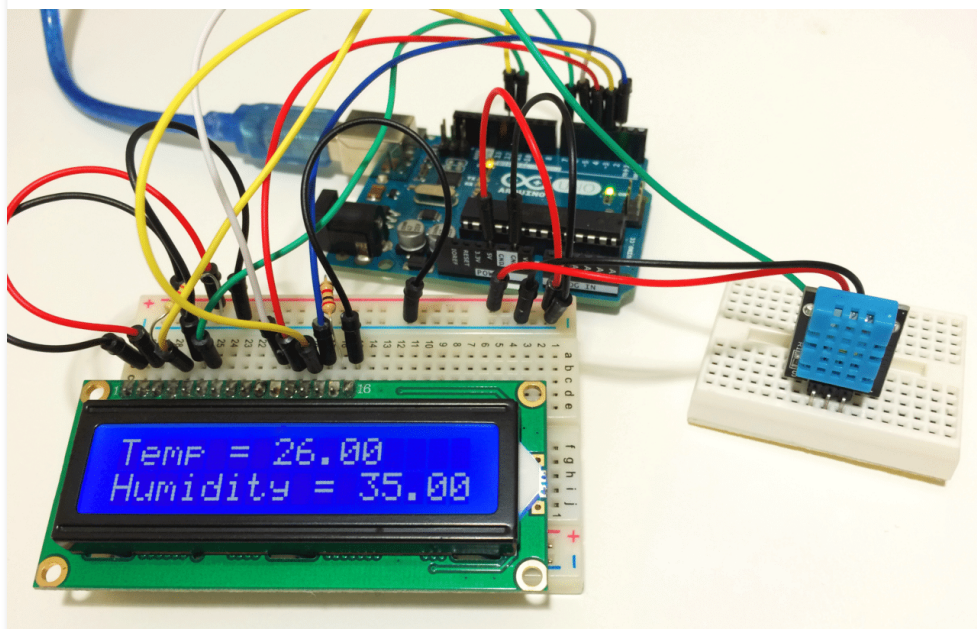




# HOW TO SET UP THE DHT11 HUMIDITY SENSOR ON AN ARDUINO

Posted by Scott Campbell | Arduino | 275



The [DHT11 humidity and temperature](#) sensor makes it really easy to add humidity and temperature data to your DIY electronics projects. It's perfect for remote weather stations, home environmental control systems, and farm or garden monitoring systems.

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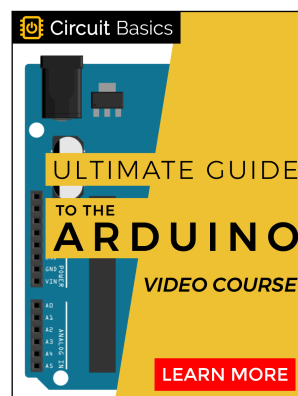


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In this tutorial, I'll first go into a little background about humidity, then I'll explain how the DHT11 measures humidity. After that, I'll show you how to connect the DHT11 to an [Arduino](#) and give you some example code so you can use the DHT11 in your own projects.

BONUS: I made a quick start guide for this tutorial that you can [download](#) and go back to later if you can't set this up right now. It covers all of the steps, diagrams, and code you need to get started.

Here are the ranges and accuracy of the DHT11:

- Humidity Range: 20-90% RH
- Humidity Accuracy:  $\pm 5\%$  RH
- Temperature Range: 0-50  $^{\circ}\text{C}$
- Temperature Accuracy:  $\pm 2\%$   $^{\circ}\text{C}$
- Operating Voltage: 3V to 5.5V

The DHT11 Datasheet:



[DHT11 Datasheet](#)

## WHAT IS RELATIVE HUMIDITY?

The DHT11 measures *relative humidity*. Relative humidity is the amount of water vapor in air vs. the saturation point of water vapor in air. At the saturation point, water vapor starts to condense and accumulate on surfaces forming dew.



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The saturation point changes with air temperature. Cold air can hold less water vapor before it becomes saturated, and hot air can hold more water vapor before it becomes saturated.

The formula to calculate relative humidity is:

$$RH = \left( \frac{\rho_w}{\rho_s} \right) \times 100\%$$

*RH : Relative Humidity*

*$\rho_w$  : Density of water vapor*

*$\rho_s$  : Density of water vapor at saturation*

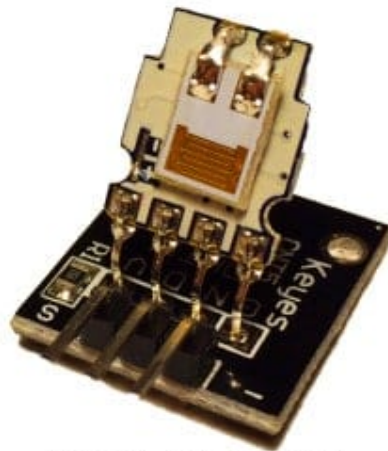
Relative humidity is expressed as a percentage. At 100% RH, condensation occurs, and at 0% RH, the air is completely dry.

## HOW THE DHT11 MEASURES HUMIDITY AND TEMPERATURE

The DHT11 detects water vapor by measuring the electrical resistance between two electrodes. The humidity sensing component is a moisture holding substrate with electrodes applied to the surface. When water vapor is absorbed by the substrate, ions are released by the substrate which increases the conductivity between the electrodes. The change in resistance between the two electrodes is proportional to the relative humidity. Higher relative humidity decreases the resistance between the electrodes, while lower relative humidity increases the resistance between the electrodes.

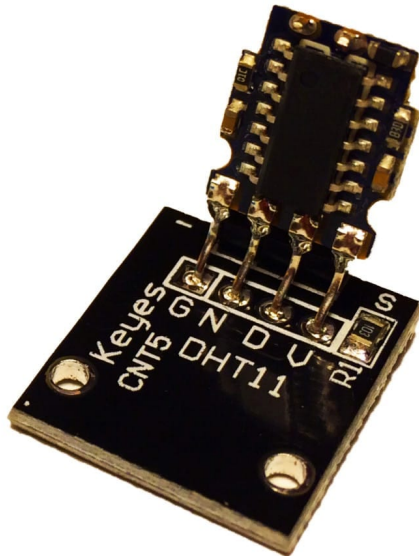
The DHT11 measures temperature with a surface mounted [NTC temperature sensor](#) (thermistor) built into the unit. To learn more about how thermistors work and how to use them on the Arduino, check out our [Arduino Thermistor Temperature Sensor Tutorial](#).

With the plastic housing removed, you can see the electrodes applied to the substrate:



Front view with  
cover removed

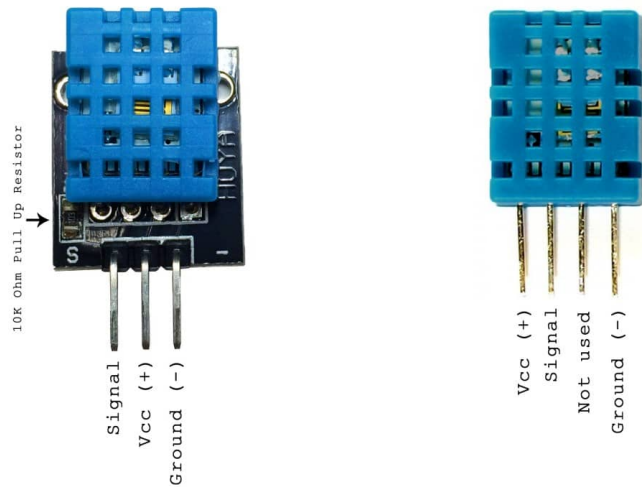
An IC mounted on the back of the unit converts the resistance measurement to relative humidity. It also stores the calibration coefficients, and controls the data signal transmission between the DHT11 and the Arduino:



Rear view with  
cover removed

The DHT11 uses just one signal wire to transmit data to the Arduino. Power comes from separate 5V and ground wires. A 10K Ohm pull-up resistor is needed between the signal line and 5V line to make sure the signal level stays high by default (see the datasheet for more info).

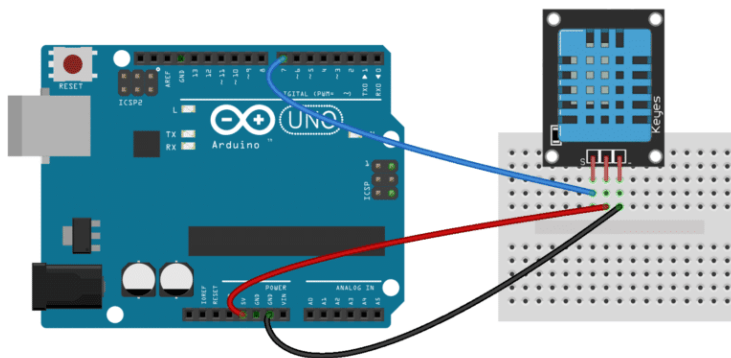
There are two different versions of the DHT11 you might come across. One type has four pins, and the other type has three pins and is mounted to a small PCB. The PCB mounted version is nice because it includes a surface mounted 10K Ohm pull up resistor for the signal line. Here are the pin outs for both versions:



## HOW TO SET UP THE DHT11 ON AN ARDUINO

Wiring the DHT11 to the Arduino is really easy, but the connections are different depending on which type you have.

### CONNECTING A THREE PIN DHT11:



### CONNECTING A FOUR PIN DHT11:

