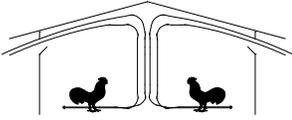




The University of Georgia

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Poultry Housing Tips

Calibrating Controller Temperature Sensors

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Figure 1. Environmental controller sensor

In order for a poultry house controller to properly maintain the desired environment, the environmental information the controller uses to determine how to operate fans, heaters, evaporative cooling pads, etc. needs to be as accurate as possible. A typical controller will primarily monitor house temperature and static pressure, though in some instances humidity, wind speed, and outside temperature will be measured as well. Of these variables, air temperature is generally the most important. Measuring house temperature accurately is not only important for optimizing bird performance but also for keeping operating costs to a minimum. During the first couple days of a flock the young chicks are very sensitive to even slight changes in house temperature. Recent studies conducted at the University of Georgia have shown that lowering air temperature just five degrees from 90° to 85°F on the first day of a chick's life can reduce body temperature by almost a half of a degree. Though it is doubtful that the entire house temperature would be off five degrees, if just one sensor were poorly calibrated a third or more of the chicks could be chilled or too hot. In addition an individual temperature sensor indicating that the house is a few degrees high or low could also result in exhaust fans and/or heaters operating more than they should, resulting in increased energy costs.

The question of course is how do we know if a controller's temperature sensors are reading correctly? One easy way is between flocks to place sensors a foot or two above the floor, fully open the tunnel doors/curtains, and turn on all the tunnel fans. After about ten minutes, the temperature sensors should read within one degree of one another. If an individual sensor is indicating a different temperature than the others, before assuming it is reading inaccurately, the sensor location should be checked to determine if there is something happening in that area of the house that is the cause of the difference. For instance, is the sensor not at the same height as the others? Is there a hole in the ceiling insulation near the sensor? Is an inlet open near the sensor in question? Is the side curtain leaking? Is the sensor on the opposite side of the house than the others (north vs.

south side)? Next, the quality of the connections between the temperature sensor and the wire connecting the sensor to the controller should be evaluated (Figure 2). Are the connections loose? Are the wires showing signs of corrosion? You may also want to check connections at the controller. After all this is done, and the sensor in question is still reading more than a degree off the others, then it should be calibrated so it reads the same temperature as the other sensors in the house.

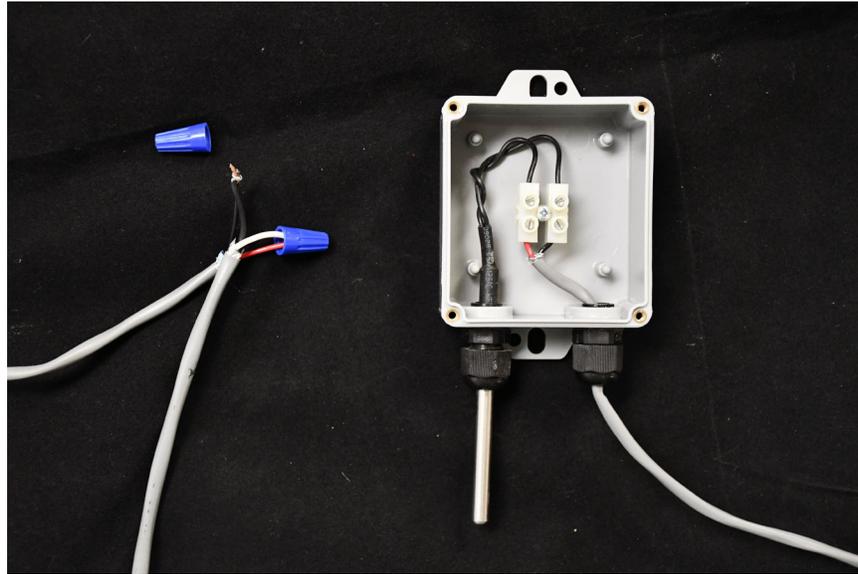


Figure 2. Sensor connections

Though ideally temperature sensors accuracy should be evaluated between flocks, in reality, questions about sensor accuracy tend to show up during the course of a flock. At this time, turning on all the tunnel fans is typically not an option and even if it were, the heat generated by the birds would cause the sensors at the tunnel fan end of the house to read higher than those towards the inlet end of the house. But, caution should be taken when evaluating temperature sensor accuracy during the flock. Just because a sensor is reading higher or lower than the others doesn't necessarily mean that the sensor is reading inaccurately. Temperature variations of up to five degrees are expected at times, in even the best of houses. Furthermore, even if you are standing next to a sensor and the temperature seems different from other locations in the house, it doesn't necessarily mean the sensor is reading incorrectly.

What is the best way to determine if a temperature sensor is reading accurately? Most importantly, an infrared/noncontact thermometer should not be used to check a controller's temperature sensor accuracy. Infrared thermometers do not measure air temperature; they measure the surface temperature of objects. As a result, when you point an infrared thermometer at a temperature sensor, chances are you are measuring the temperature of the floor/wall behind the sensor rather than the actual sensor. In addition, the accuracy of infrared thermometers is typically +/- 3°F, which is much lower than the accuracy of temperature sensor you are trying to check (*Poultry Housing Tips*. Using Noncontact Thermometers Vol 19 no 4)

If you want to evaluate the accuracy of a controller temperature sensor, you need to use a thermometer that has a higher accuracy than the controller sensors. This means that you need to have a thermometer that has an accuracy of at least +/- 0.5°F. It is important to realize that just because a digital thermometer might display tenths of a degree does not mean it has that level of accuracy. Carefully read a thermometer's documentation to determine its accuracy. What you will often find is that most have an accuracy of +/- 1 or 2°F, which is far below the level of accuracy required, and a digital thermometer with an accuracy of less than a degree can often cost hundreds of dollars.

Another potential problem when evaluating sensor accuracy is that the response time of the thermometer you are using to check the accuracy of the controller sensor can be very different from that of the controller sensor. The amount of time it takes a thermometer to accurately measure the temperature varies and is primarily a function of the size/mass of the sensor and air movement (Figure 3). The larger the sensor, the longer it takes to equilibrate with the room temperature. Some sensors have a response time of seconds, where others could take minutes to accurately measure the air temperature in house. Furthermore, the lower the amount of air movement over the sensor, the longer it takes to measure room temperature. With no air movement, it can easily take over five minutes for some relatively large controller sensors to accurately measure the air temperature. Making matters worse, if the room temperature is changing even a couple of degrees during the time the you are checking a sensor, it can become nearly impossible to determine if the sensor is reading accurately.

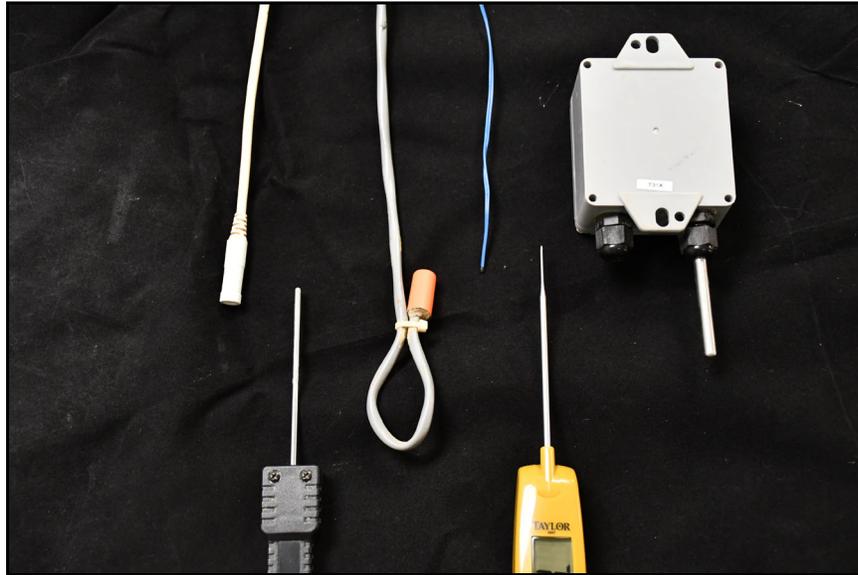


Figure 3. Sensor size can affect response time (the smaller the sensor the faster the response time)

One way to solve both issues is to first use a high-accuracy food thermometer. These thermometers are primarily intended to be inserted into food to check to see if it is cooked to the proper temperature. Some of these thermometers have accuracy of +/- 0.5 F and cost less than \$50 (Figure 4). The response time issue can be easily address by not checking the accuracy of controller sensors in air, but rather in water. Water conducts heat much faster than air, resulting in sensors accurately measuring water temperature in a matter of seconds rather than minutes.



Figure 4. High accuracy food thermometer (Taylor 9867FDA Turbo Digital Pocket Thermocouple Thermometer)

The calibration procedure is quite simple:

- 1) Fill a five-gallon bucket approximately half full of water. Ideally, the water temperature would be close to room temperature, but this is not a necessity.
- 2) Measure the water temperature with the high-accuracy thermometer. Take note of the water temperature (Figure 5).
- 3) Take the bucket of water to the first sensor in the house to be checked and insert the sensor into the water (Figure 6).
- 4) Wait a minute and check to see if the temperature the controller is indicating is the same as the water temperature measured. If it is a degree or more different, calibrate the controller sensor to match the water temperature.

- 5) Wipe the sensor dry.
- 6) Repeat the procedure for the remaining controller sensors. The temperature of water in the bucket will tend to stay the same long enough to check the calibration of all the sensors in a house, especially if the water temperature is relatively close to house temperature



Figure 5. Measuring water temperature



Figure 6. Placing controller sensor tip in water

After checking sensor accuracy using this method, what you will typically find is that the controller sensors rarely require calibration. Temperature sensors tend to be either good or bad. If they are more than a degree off from the water temperature, chances are there is a issue with the wiring/connections or the sensor is faulty and requires replacement. But this can only be determined by comparing controller sensors to a high-accuracy thermometer using a proven procedure.

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