Calibrate CO_2 sensors regularly

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Most modern single-stage setters and hatchers are fitted with carbon dioxide (CO_2) sensors, automating adjustment of the machine dampers according to the CO_2 accumulated from the developing embryos. This can work well, but only if the CO_2 sensors are accurate. Sensors which under or over record will result in the machine being incorrectly ventilated. When this happens, it can lead to gradually declining chick quality and hatchability.

The first step is to make sure that the CO_2 sensors are all reading correctly. Prolonged exposure to high humidity levels during sealed incubation, and to chick fluff and humidity during hatching or even washing water can all affect the sensor or sensor protection cap leading to inaccurate readings. The sensors must be calibrated regularly. Ideally, the sensors should be calibrated at low, mid and high CO_2 levels, proving that they are reading correctly across the desired range. A simple calibration can be done using an electronic meter (which is itself regularly calibrated against known standards) to check that both machine and calibration sensor are giving the same reading at room CO_2 levels.

This will usually be higher than the 400ppm (0.04%) normal for fresh air; both people and chick embryos will be producing CO_2 in the building which will drive the concentration up. However, mid- and high-end values can be checked during incubation only if your calibration instrument sensor can be inserted into the incubator next to the machine probe without opening doors or air vents.

Alternatively, higher CO_2 levels can be calibrated using a CO_2 gas mixture with a known, certified CO_2 concentration while the machine is empty. These are used to fill a cap or bottle sealed around the sensor unit. Mixtures with certified CO_2 concentrations of 5,000 and 8,000ppm (0.5 and 0.8%) are readily available on the market.

Having calibrated the sensors, you must then make sure that the machine is still able to support higher levels of CO_2. Levels can only rise if the incubator is well sealed against air leakage. Check that the seals around doors and dampers are not worn, and make sure that both can be closed tightly. The calibration on damper opening should also be checked. An easy way to check that the machine can be properly sealed is to stand inside the empty, powered down incubator with the doors and dampers closed. If you can see any light, the machine will not seal properly. High CO_2 levels will not of themselves improve hatchability or chick quality. However, measuring CO_2 build up can be a useful tool to show when a machine needs fresh air. For this to work consistently the sensors need to be calibrated accurately and the rate that CO_2 accumulates in the machine must be predictable. If either of these fail, then ventilation rates will be incorrect.

Figure 2 *The photograph above shows typical CO_2 sensors in a setter, protected by sensor protection caps. If the caps become clogged with dust or condensation, the sensor will give an artificially high reading.*