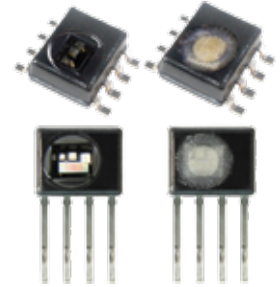


Application Note

Honeywell HumidIcon™ Digital Humidity/Temperature Sensors in Grain Drying Systems



Background

Introduction

Grain storage facilities are locations used for the bulk storage of grains such as corn, wheat, rice, rye, oats, etc. If the environmental conditions within the grain storage bin are not properly controlled, the quality of the grain can deteriorate. Regularly monitoring moisture and temperature throughout the storage period to ensure the desired grain moisture content, helps the grower maximize grain sales and return on investment.

Grain Drying System

To avoid grain degradation, optimizing moisture and temperature of the bin is essential to preventing the infestation of insects and mites. When microorganisms feed on the grain, heat is produced which increases the temperature of the surrounding grain. This often results in hot spots which can damage the grain. A grain drying system is the process of drying grain to prevent damage during storage. Maintaining low storage temperatures is recommended to ensure safe storage to prevent microbial growth.

The Effects of Humidity and Temperature

Moisture content in grain is related to the humidity and temperature of the surrounding air. Humidity and temperature sensors help the grain bin storage manager uniformly maintain an optimum level of relative humidity and temperature in the silo.

- **Humidity:** The lower the relative humidity, the drier the air. Too dry means less grain mass or grain that won't germinate, which is undesirable to the grower/seller. Too much humidity in the air can lead to grain damage or spoilage. Ideal moisture content of grain also varies by the type of grain, so reliable humidity monitoring is important to control the humidity level and grain quality.
- **Temperature:** Grain drying systems may heat the air inside the silo to expedite the drying process. If the air temperature is too high, the grain kernel may be damaged. If the air temperature is too cold, the grain cannot dry properly and could degrade.

Measuring Grain Moisture and Temperature

- **Moisture cables:** Cables suspended from the top of the silo are distributed within the bulk grain. Nodes along the length of the cable contain sensors that measure relative humidity and temperature of the grain at the top, middle and bottom of the silo.

- **Inlet and exhaust areas:** Humidity and temperature sensors can be located at the fans and vents within the grain silo to measure ambient conditions.
- **Grain probes:** Long probes containing humidity and temperature sensors can be inserted into the grain via access holes to measure moisture content.

Customer Needs

Grain storage managers require the following:

- **Easy environment monitoring:** Simple, remote methods of monitoring the moisture level in the grain silo to ensure proper drying and eliminate grain spoilage.
- **Reduce high cost of failure:** High humidity sensor accuracy and performance are critical in grain drying systems that require the sensor to provide 1) maximum performance and, 2) very tight accuracy, typically $\pm 2\%$ interchangeability from one sensor to another, which can often mean the difference between good or spoiled grain.



Grain Drying System

Application Note

Honeywell HumidIcon™ Digital Humidity/Temperature Sensors

Customer Needs, continued

- **Small sensor package size:** A small humidity sensor allows the grain storage manager to easily fit the sensor into the node at the end of the cable.
- **High sensor performance:** A humidity sensor with hydrophobic filter protects the sensor die from contamination due to dust or excessive moisture that can potentially negatively affect sensor performance.
- **Reduce costs:** As the cable extends through the grain, it encounters different levels of humidity and temperature. The grain drying control system effectively optimizes temperature and humidity within the silo through the use of fans. A combined humidity and temperature sensor in a single package within the node signals the control system to make the fans blow hotter or cooler. If the node did not utilize a combined sensor package, the grain storage manager would have to utilize either a larger (and likely more expensive) node to accommodate two separate sensors, or utilize two cables and individual nodes for each separate humidity and temperature sensor, potentially increasing costs.
- **Long term sensor stability:** Relative humidity (RH) sensors can drift over time. For most sensors, typically the relative humidity accuracy level out of the box could be 2 %; however, five years later that accuracy level can drift 4 % to 5 %. This is important to effectively drying the grain. For example, if the grain drying control system is trying to maintain an RH level of 62 %, sensor drift of 4 % to 5 % can equate to an RH range of 58 % to 66 %, potentially negatively affecting grain drying performance.
- **Ideal storage techniques to maximize grain price:** When the grain bin storage manager sells the grain, they can promote their storage techniques. Good storage practices can equate to higher grain prices. The value of the grain is related to the moisture content of the grain (% mass of water / grain).

Honeywell Solution

Honeywell HumidIcon™ Digital Humidity/Temperature Sensors, HIH9000 Series, can be used in cable-mounted grain drying management systems to measure the moisture content and temperature level inside the grain silos to help the grains remain dry.

- **Industry-leading long-term stability (1.2 %RH over five years):** Minimizes drift over time, helping to maximize grain drying performance
- **Combined humidity and temperature sensor in a single, small package:** Allows the grain manager to purchase one sensor instead of two, helping to reduce costs
- **Optimization of humidity and temperature range:** Honeywell can optimize the sensor to the exact humidity and temperature range specifications the grain manager requires for their application
- **Accuracy:** ±1.7 %RH accuracy (humidity performance) and ±0.3 °C accuracy (temperature performance)
- **Hydrophobic filter:** Protects the sensor die from contamination due to dust or excessive moisture

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Honeywell HumidIcon™ Digital Humidity/Temperature Sensors

Find out more

Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office.

To learn more about Honeywell's sensing and control products, call **1-800-537-6945**, visit

sensing.honeywell.com, or e-mail inquiries to **info.sc@honeywell.com**

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