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Advanced Technology Humidity Sensors Optimize Designs, Reduce Solution Costs

by Valerie Rothermel-Nelson, Honeywell Sensing & Control

When considering a relative humidity sensor for one's application, the selection process involves a series of choices to meet application requirements and key parameters while, at the same time, insuring that the product selected delivers the lowest total cost solution. Despite the diversity in humidity sensor applications and specifications, the desire for technology that provides for highly automated manufacturing processes, tighter sensor interchangeability, a compact profile, and stable and dependable accuracy over the application life is the commonality between all industry segments.

Key parameters for customers in almost every case include sensor interchangeability and product packaging. Excellent sensor interchangeability reduces or eliminates calibration activity and cost in the original equipment manufacturer's (OEM) manufacturing process. Compact, surface mount (SMD) sensor packaging delivered on tape and reel offers application flexibility and accommodates many OEM's automated pick-and-place PCB manufacturing and wave soldering processes, further simplifying, speeding, and reducing cost for the OEM.

Sensors with excellent interchangeability and packaging not only help to speed the OEM's manufacturing process and reduce cost, but those with stable and dependable accuracy will help to insure that, through the life of the application, the OEM's system performs as specified. They also help to prevent field failures or

costly and unnecessary warranty claims. Potential applications exist in Heating, Ventilation and Air Conditioning (HVAC), Medical Equipment, Refrigeration Equipment (both transport and bulk/stationary systems), Air Compressors, Telecommunications, Weather Stations, and more.

Product Packaging
Sensors that employ capacitance technology using a multi-layered thermoset polymer capacitor are inherently more rugged than other available technologies; this is because thermoset polymers provide much better environmental resistance than typical thermoplastic polymers. The CMOS-based, thermoset polymer capacitor sensors also offer a broad relative humidity sensing range. This, along with design ruggedness and inherent stability over numerous environmental conditions, typically offers the OEM the lowest total cost solution. On-chip signal conditioning, coupled with CMOS technology and laser trimming, deliver a higher degree of sensor interchangeability and accuracy.

Sensors with on-chip signal conditioning require limited or zero support electronics and typically offer direct input to control devices. This is another way that the sensor allows for fast, easy and lower cost installation at the OEM. And with typical current draws of only 200 ?A, these sensors are often ideally suited for low drain, battery operated systems. One example is sleep apnea machines or Positive Airway Pressure (PAP) machines.

Sufferers of sleep apnea (the repeated cessation of breathing during sleep) wear a mask that uses pressure to send air flowing through the nasal passages to prevent nasal collapse, which can temporarily stop a patient’s breathing. Humidity sensors are used in the machine to monitor and control the amount of moisture in the air the patient receives, keeping it at appropriate levels. A proper air humidification level is critical to the patient’s comfort and to help insure the patient’s sleep is uninterrupted. This is an increasingly common application for low current draw type humidity sensors in compact, SMD packaging style, such as Honeywell’s HIH-4030/4031 Series. These sensors are available with or without hydrophobic filters for enhanced application flexibility and for use in environments where condensation may be present.

Interchangeability and Accuracy
Tight sensor interchangeability (i.e., low part to part variation) reduces or eliminates OEM production calibration costs. Sensor interchangeability is closely related to sensor accuracy, hysterisis, repeatability and output linearity. Today’s thermoset

polymer capacitor-based humidity sensors offer accuracies as tight as 2% over the specified relative humidity sensing range. To further optimize sensor accuracy, OEM's can order humidity sensors with their factory calibration data, as an option. For example, Honeywell's HIH-4030 Series of humidity sensors offers interchangeability of + / - 5% RH over the range of 0% RH to 59% RH, accuracy (best fit straight line) of + / - 3.5% RH, hysterisis of + / - 3% RH, and repeatability of + / - 0.5% RH.

SMD-designed humidity sensors can save time and money for highly automated manufacturing processes and have become a popular choice for many applications. Besides the sleep apnea machine example already provided, other potential uses for an SMD humidity sensor include:

* Incubators/micro-environments
* Transport and stationary refrigerated containers
* Air compressors (moisture in lines can lead to mechanical failures)
* Commercial or residential building environmental controls
* Thermostats
* Humidistats
* Humidifiers and dehumidifiers
* Fan systems
* Enthalpy sensors (measures heat density of air)
* Telecommunication cabinet – environmental control systems
* Weather or meteorological stations

While an SMD sensor is vastly popular for high volume OEM users, other applications may require different features and packaging. That is why it is always important to work closely with the sensor provider when determining the right sensor for one's application. Access to and assistance from sensor experts and application engineers is critical to making the right choices.

Reader Inquiry
For more information on Honeywell's humidity sensor product line, visit www.honeywell.com/sensing [1] or call +1-800-537-6945 or email to info.sc@honeywell.com [2].

Sensing Organic Compounds: Comparing Sensor Technology for Environmental Sensing Applications

by Brian Elias, Cal Sensors Inc.

Environmental sensing is a critical area that is expanding as new sensors and techniques are developed to monitor both naturally and artificially occurring environmental constituents. Organic compounds are particularly important for analysis and control, but because of their molecular structures they are difficult to analyze with traditional visible spectrum spectrographic techniques. They do, however, lend themselves quite well to analysis in the near and mid-infrared regions.

Many organic compounds can be analyzed by detecting the vibrational modes of their molecular bonds. Several organic compounds with O-H, N-H and C-H bonds, for example, have fundamental vibrational modes that can be excited by photons in the 2.5 to 5µm region. Detectors that operate in shorter wavelengths must rely on analysis of the overtones of these fundamental vibrational modes, which are often difficult to analyze because of their small and indistinguishable absorptions.

Fortunately a sensor technology exists that addresses these environmental sensing applications. Lead Selenide (PbSe) and Lead Sulfide (PbS) photoconductors cover the wavelength from 1µm to 5µm and are extremely cost effective compared to other technologies that cover these wavelengths of interest. They are also significantly more sensitive and faster responding than thermal detectors, such as Pyroelectrics and Thermopiles.

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