Precision humidity calibration in data centers

Maintaining data center assets in top shape is vital to the bottom line but it's not just the assets themselves that need attention. In a data center, temperature and humidity monitoring matter just as much.

The electronic equipment housed in data centers is extremely sensitive to temperature and humidity fluctuations. Routers, servers, and battery backups need optimal environmental conditions to run at peak performance and avoid premature breakdowns. Smart data center managers and technicians employ sensors to constantly monitor humidity and temperature changes, making adjustments as needed to avoid catastrophic failures.

Without proper and regular humidity calibration, data centers risk asset failure and data loss due to electrostatic discharge (ESD) or condensation. Over time, sensors lose their accuracy and need to be recalibrated to take accurate measurements. The right calibration tools simplify precision humidity monitoring and give teams peace of mind.

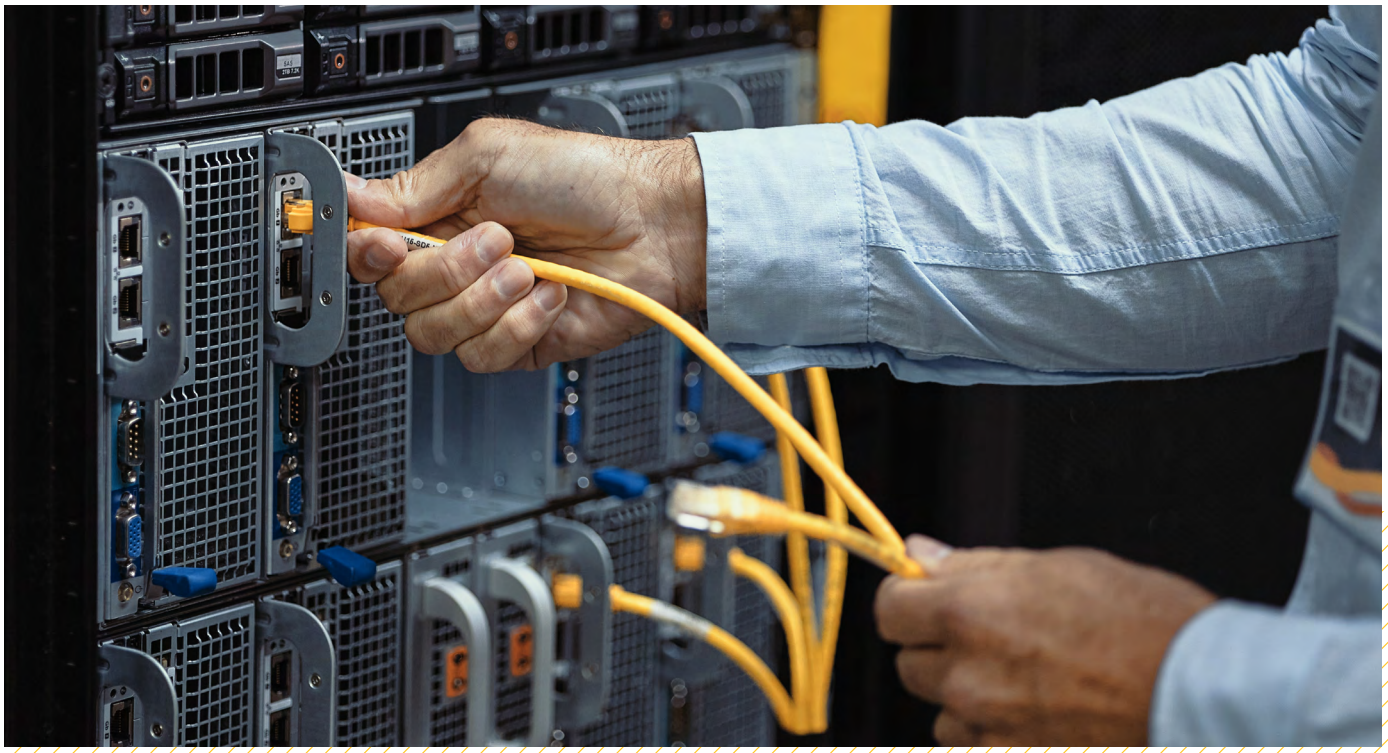
Why humidity is bad news for data centers

Both high and low humidity can cause extensive damage to data center equipment.

One of the biggest risks to electronic systems is electrostatic discharge (ESD). ESD occurs when two charged objects come into contact and create a burst of electricity. It is more common when air is dry, since charges easily build up in environments with low humidity. Even small electric shocks have the potential to damage electronic equipment. Technicians easily build up a static charge through mundane actions that cause friction; removing a sweater, adjusting position in a fabric-coated chair, or shuffling across a carpet. When they get close to a piece of equipment, that charge transfers into the machine, causing irreparable damage to sensitive electronics and even outages.

The true cost of ESD damage in the electronics industry is unknown, but experts estimate it is at least half a billion dollars per year. Most data center teams are already aware of these risks, which is why they invest in high-quality anti-static equipment like mats and gloves. But it is equally important to track and adjust humidity across the entire facility to reduce the chances of equipment damage.

> Beyond ESD, poor humidity control also leads to condensation, bacterial growth, mold, metal warping, and corrosion. Once these issues take hold, equipment will need extensive repairs or full replacement. The less time and money spent fixing existing equipment, the more resource can be directed towards growth.



The benefits of humidity control

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recommends that data centers maintain relative humidity (RH) levels of around 60%. This general guideline applies to most data centers but may change based on the type of equipment in the facility. Where a data center experiences higher levels of copper and silver corrosion, ASHRAE recommends that RH should generally stay lower than 60%.

Every data center will have its own recommended RH range based on individual needs, calculated from quality assurance (QA) and testing guidelines. Once the right humidity level has been determined, teams can track RH with wall- or machine-mounted sensors and adjust humidity with equipment like humidifiers.

Over time, maintaining correct humidity levels minimises the risk of ESD and condensation, ensuring continuous and reliable operation. It also prevents corrosion and other moisture-related damage, extending the lifespan of expensive hardware. And optimized RH levels contribute to the overall energy efficiency of cooling systems, reducing operational costs and environmental impact.

Temperature and humidity: understanding the relationship

Humidity is not the only metric that matters. Temperature and humidity have an interdependent relationship that data center teams need to manage together.

When temperature increases, so does the air's capacity to hold moisture, meaning humidity can get higher in hotter environments than in cooler ones. This matters because heat buildup from machines is a major problem in data centers. Cooling technology keeps heat levels down to prevent machines from overheating, but it also plays a direct role in humidity control. Equally, in facilities located in buildings that experience extreme winters or heavy air conditioning in summer, ensuring temperatures don't drop too low is important for keeping machines in top shape.

ASHRAE recommends keeping dry bulb temperature between 18°C and 27°C (64.4°F and 80.6°F) inside a data center. Temperatures colder than that range promote static-forming conditions, and temperatures hotter than that range encourage too much moisture build-up.

Some facilities can safely operate outside that range depending on the type of equipment and quality assurance expectations, specific ASHRAE or OEM guidelines should be consulted to determine the best temperature limits for each facility.

The best way to ensure humidity and temperature stay at optimal levels is to track them via sensors. However, sensors lose accuracy over time, which is why humidity calibration is needed.

Humidity control and calibration

Humidity generators like the Fluke 5128A calibrate sensors, ensuring measurements are as accurate as possible. Periodic calibration gives teams confidence in room-level humidity measurements, allowing them to make adjustments that promote equipment longevity and decrease downtime.

The Fluke 5128A works by generating humidity and temperature in a controlled chamber with a drier and humidifier system. The calibrator measures the difference between the humidity and temperature in the chamber versus the device under test (DUT). The discrepancy between the two outlines how much the DUT needs to be adjusted to maintain humidity measurement accuracy.

The 5128A is specifically designed for room-level sensors with probes. It is lightweight and compact, so it can be placed on a cart and rolled to each sensor in the facility. The calibrator allows probes to be measured in multiple ways, providing flexibility for varying sensor sizes and specifications. It can test several probes at once — up to five half-inch sensors fit inside the chamber together — and calibrates multiple test points simultaneously, making it far more accurate and thorough than a handheld humidity meter. The setup and calibration process is straightforward by design.

Using the Fluke 5128A for humidity sensor calibration

The calibration process typically follows these steps.

First, gather the necessary tools and accessories, and fill the humidity reservoir on the 5128A according to the manufacturer's instructions. Verify that the measurement chamber is empty and free of excess condensation.

Next, remove the humidity sensors from wherever they are mounted in the data center and place them in the calibrator. Depending on their size, either the entire sensor goes inside the chamber or partially through the outside holes. Alternatively, the 5128A can be rolled to the location of the sensor and used to test it in place without removal.

Then choose set points for temperature and humidity that correspond with the manufacturer specifications for the DUT and program them into the calibrator. Starting with lower temperature and humidity points first and ramping up slowly at each step helps prevent excess moisture buildup in the chamber — though some DUTs may require working from high to low instead, so manufacturer calibration instructions should be consulted where possible.

Once the chamber and DUT have had time to stabilize, record the calibrator's temperature and humidity readings alongside the reading on each DUT. The discrepancy between the two indicates how much each sensor needs to be adjusted to restore it to manufacturer specifications. Make those adjustments, and in cases of extreme discrepancy, consider replacing the sensors entirely. Finally, place the sensors back in their monitoring stations to continue tracking humidity across the facility.

Manufacturer recommendations, environment, and use case will all influence how frequently each humidity sensor needs calibrating. As a general rule of thumb, data centers kept clean and dry should calibrate each sensor at least once per year.

Keeping data centers running

Regular humidity calibration protects data centers from costly outages, equipment damage, and data loss. When sensors provide accurate RH readings, teams can maintain recommended humidity levels across the facility, ensuring machines run optimally for as long as possible. Extended equipment lifespans, increased reliability, and higher energy efficiency all follow from effective humidity control, and with tools like the Fluke 5128A, the process of maintaining that control is straightforward.