Belimo CO₂ Sensor Lowers Air Handler Energy Costs

Opened in April 2018, the Mission Event Center is a 40,000 square foot [3720 square meters], state-of-the-art commercial space located in the thriving city of Mission, Texas. The building has become a premier venue for corporate and social events in South Texas, featuring an 18,000 square foot [1670 square meters], ballroom with partition options for seven different salons equipped with projectors, screens, and LED ambiance lighting. The center also includes a full-service kitchen and multiple bar/lounge areas, along with a stunning exterior patio, relaxing gardens, and walking trails.

As is the case with many high-occupancy commercial spaces, such as classrooms, theaters, arenas, etc. the Mission Event Center falls under ASHRAE 62.1-2013 Ventilation for Indoor Air Quality, which mandates the use of Demand Control Ventilation (DCV). DCV is a control method in which the rate of outdoor air introduced into an enclosed space is modulated based on occupancy. To help enable this energy-saving functionality, the HVAC controls contractor for Mission Event Center, Climatec, turned to Belimo.
Indoor CO₂ Measurements
Reset Ventilation Airflow Rate to Save Energy

Facility and Project Overview
Climatec selected Belimo to supply multiple products for the HVAC system at the facility, including 25 Variable Air Volume (VAV) damper actuators and two chilled water butterfly isolation valves. Sensors were also provided, including CO₂, air temperature, humidity, and water temperature.

Climatec installed combination temperature and humidity sensors on each of the six AHU ducts to maintain space comfort with dehumidification routines. Immersion temperature sensors were also installed on both the supply and return sides of the chiller plant, along with a single outdoor air temperature sensor to monitor ambient heat levels. The outdoor temperature sensor input to the control system saves energy by allowing the VAV auxiliary electric heat to only run below a user-adjustable setpoint, initially set at 85°F [29.4°C].

CO₂ Readings Indicate Occupancy Levels
The CO₂ sensors played a particularly important role in the project relative to the DCV control sequence. CO₂ is a byproduct of human respiration, and the amount of CO₂ measured in a space is an accepted indicator of the number of people in that space. Climatec installed a total of six Belimo CO₂ sensors – one for each of the air handling units (AHUs) in the Event Center. The sensors were installed on the return air ducts of the AHUs and continuously monitor CO₂ concentrations in the spaces they serve throughout the building. With DCV, nearly equal amounts of outdoor air enter a space as return air is exhausted outside, all while the control system maintains a slightly positive building pressure to avoid infiltration of moist outdoor air into the building structure.

Without DCV, the design population rate of ventilation air exchange is fixed based on the maximum occupancy of the space. The corresponding open position of the AHUs outdoor air damper is the “design minimum” position during scheduled occupancy periods. In many cases, with fixed-air ventilation systems, a much larger volume of fresh air is exchanged than is required to maintain safe indoor air quality. The result is higher energy costs with an increased need for cooling or heating.

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Lenny Lopez, Project Manager, Climatec, LLC
Ventilation Requirements
Demand Control Ventilation allows the outdoor and return air dampers to modulate to a “zero population minimum position” to save air conditioning energy cost when people are not in the space during occupancy periods – which often occurs at the beginning or end of the period. When this happens, the measured amount of indoor CO₂ is equal to the outdoor ambient air.

In Mission, Texas, the ambient CO₂ level is 500 ppm. During occupancy periods for the Mission Event Center, this value is the zero population minimum setpoint for the AHU ventilation dampers. When the measured CO₂ level in the space rises to 1200 ppm, the ventilation dampers move to the design minimum position established by ASHRAE 62.1. When concentrations of CO₂ are between 500 ppm and 1200 ppm, the ventilation rate is reset proportionally between the design minimum position and the zero population minimum position to save energy and provide fresh outdoor air to maintain indoor air quality.

"Utilizing a Demand Control Ventilation strategy in which a variable amount of outdoor air enters the space depending on the CO₂ levels is particularly beneficial in South Texas, where both humidity and temperature are often very high," said Lenny Lopez, Project Manager at Climatec. "Bringing in just the right volume of fresh air allows us to ensure occupant comfort and to keep the HVAC system at Mission Event Center running optimally at all times, which equates to energy savings."
Simplified Procurement and Field Installation

Customer Satisfaction
The Belimo sensors provided for the Mission Event Center feature a compact modular design with a detachable mounting plate and snap-on cover for opening and closing without tools to simplify installation. BACnet and Modbus communication protocol provide superior data access for custom application configuration and commissioning.

“Installing and commissioning the sensors was straightforward,” said Lopez. “All of the sensors have the same footprint and came packaged with the necessary brackets, which greatly reduced the amount of work for our technicians. Additionally, the housings for all the sensors were NEMA 4X / IP65 rated, so we didn’t have to worry about their installation location.”

Overall, the use of Belimo sensors, damper actuators, and valves enabled Climatec to implement an HVAC system design that provides superior occupant comfort while ensuring compliance with all relevant ASHRAE standards.

“We are very happy with all the Belimo products. The sensors really stand-out visually, which is great when we’re showing the customer the mechanical room,” added Lopez. “It’s been a little over a year since the building opened, and everything has been working perfectly. We will absolutely be using Belimo products on future jobs.”

TEMPERATURE SENSORS
- Up to eight active measurement ranges reduce stock storage for maximum flexibility.
- Variety of output signals: passive NTC, RTD, 0...5/10 V, 4...20 mA.
- Sintered moisture protection coating on all duct, immersion, and cable sensors protects against condensation, mechanical stress, and vibrations.

HUMIDITY SENSORS
- Complementary Metal Oxide Semiconductor (CMOS) polymer-based capacitive sensor with an accuracy of ±2% relative humidity
- Multi-sensor with selectable output measurement values: relative humidity, absolute humidity, enthalpy, and dew point.
- Up to four active temperature measurement ranges simplify field configuration to meet design specifications.

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