

DEMAND CONTROL OPTIONS SAVE ENERGY

Night Setback Strategy

During the unoccupied mode, the night setback strategy is to close the outdoor air damper and turn off the blower to save energy. However, in some humid environments, there is still a high infiltration rate of moist outdoor air into buildings during unoccupied times creating excessive humidity levels.

In these instances, it is desired to add a recirculation damper to the system and turn on the blower and compressors to remove the unwanted moisture during unoccupied times.

Desert Aire has two system configurations that provide night setback. This capability is available on Desert Aire's TotalAire™ series by adding our enthalpy wheel option and an internal mixing damper. The Zone Reset of Supply Air Temperature Control package must be ordered to receive the zone sensors.

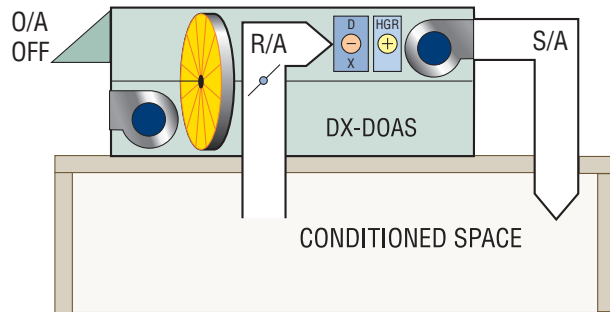


Figure 1 - Diagram of a TotalAire™ Series unit with a wheel in night setback mode.

CO₂ Control Strategy

As engineers continue to meet ASHRAE 62 ventilation code air flow rates, they also are trying to minimize energy costs where ASHRAE 90.1, LEED programs, GSA P100, or other codes and standards are required. Using additional sophistication in the controls can be an excellent way to minimize energy cost while maintaining proper indoor air quality and building pressurization.

The Ventilation Rate procedure of ASHRAE 62 is a prescriptive procedure that indicates the outdoor air intake flow rate based on the level and type of occupancy as well as the floor area. The Ventilation Rate procedure allows for a dynamic reset of the outdoor air intake flow as operating conditions change. Although the floor area in any building is fixed, the level and type of occupancy may change from day to day or even throughout a single day.

One of the most effective methods of dynamically changing the flow rate based on occupancy is the utilization of CO₂ sensors. Although expected concentrations of CO₂ are not considered a direct contaminant, it is an excellent measurable "tracer gas" that indicates the number of occupants present and their activity level. CO₂ sensors are also relatively inexpensive and durable devices.

Desert Aire TotalAire™ units can be ordered with a CO₂ control strategy that optimizes the energy efficiency by providing an optimized level of outdoor air at all times. The addition of two CO₂ sensors and variable frequency drives work together to maintain constant total system air flow by recirculating zone air and introducing varying outdoor air flow rates.

Since the zone floor area and the rate required for the floor area are fixed in any one application, the TotalAire™ unit can be programmed with a minimum outdoor air flow rate to account for this. When a change in CO₂ is sensed due to occupants entering or exiting the breathing zone, the outdoor air dampers account for this change in occupancy. The outdoor air flow rate will vary between the minimum flow rate programmed and 100% outdoor air as needed, always optimizing the indoor air quality and energy use.

The return air is used to maintain the supply air flow rate while the outdoor air flow rate varies. The constant supply air flow rate ensures that the duct system operates as intended. It also ensures that diffusers are able to deliver ventilation air at the correct velocity so that it reaches the breathing zone at all times as required by ASHRAE 62.1.

Desert Aire's basic CO₂ strategy incorporates one indoor CO₂ sensor and one outdoor CO₂ sensor. The controller calculates the differential CO₂ level (ppm) between the indoor and outdoor signals and then uses this value to properly adjust both the outdoor ventilation air and the bypass return air to deliver a constant volume to the space.

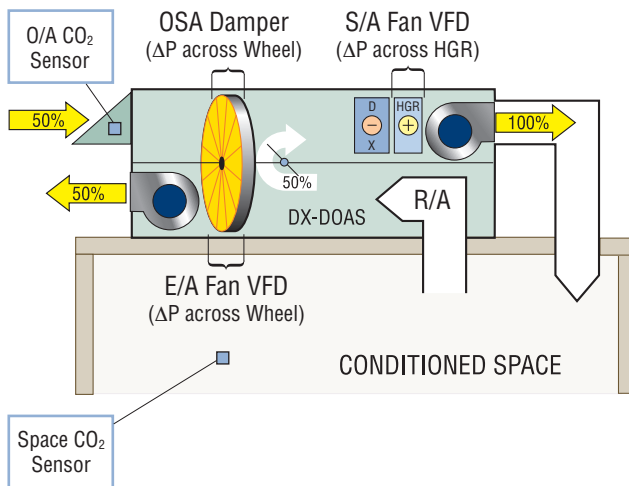


Figure 2 - VFD Control of Fans Using Pressure Sensors

The differential value is used to modulate the outside air damper and the bypass damper positions in order to provide adequate ventilation and maintain a constant supply air volume to the space.

Furthermore, using a differential calculation eliminates errors in estimating the natural background levels of CO₂ and changes in the levels in urban areas. Also, when sensor drift does occur, the sensors tend to drift in a similar fashion. Calculating a differential helps to ensure accuracy between calibrations. Desert Aire equipment includes a control loop that further optimizes the outdoor air flow rate by controlling to a specific concentration of CO₂ differential through the use of a PID (proportional/integral/derivative) control loop. In contrast to many other controls for CO₂ which have proportional only control and introduce more air than required during partial occupancy, the TotalAire™ unit further optimizes energy efficiency by closely maintaining the correct outdoor air flow rate required at any time for any given occupancy.

Since these applications must bring return air back to the unit, it is most beneficial to use an enthalpy wheel to reduce energy consumption.

For applications that require the same Desert Aire unit to monitor multiple indoor CO₂ sensors, we suggest working with the project's engineer to determine the best method to process these multiple signals into a final, single indoor CO₂ level for the unit to use in the differential calculation. This would be an average of all CO₂ sensors in the space, or using the signal from the one indoor CO₂ sensor detecting the greatest concentration of CO₂. In any event, the Desert Aire controller will only accept a single input for the indoor CO₂ level and a single input for the outdoor CO₂ level to calculate a final CO₂ differential value. The controller then uses this

CO₂ MODULATION CONTROL

Zone CO₂ > Setpoint (Occupied)

The bypass damper modulates closed and the outdoor air damper modulates open. This continues until the zone CO₂ setpoint is met or 100% outdoor air is introduced. The supply air blower VFD adjusts to an established pressure differential across the hot gas reheat coil. The pressure drop corresponds to the design supply air volume. Also, the exhaust air blower VFD adjusts to an established pressure differential setpoint across the wheel's exhaust air side to maintain design exhaust air volume. Please note that the supply and exhaust air volumes can be different to maintain a design positive pressure in the space.

Zone CO₂ < Setpoint (Occupied)

The bypass damper modulates open and the outdoor air damper modulates closed. This continues until the zone CO₂ setpoint is met or the minimum outdoor air flow rate is sensed. The supply air blower VFD will adjust to maintain the same pressure differential setpoint across the hot gas reheat coil to maintain the specified supply air volume. The exhaust air blower VFD will adjust to a new pressure differential setpoint across the wheel to meet the exhaust air volume.

Unoccupied Time


During unoccupied times, the system can be turned off or enter the night setback mode where the outdoor air is off, the mixing damper opens and the unit controls the humidity within the space based on the standard sequence described in the previous section.

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