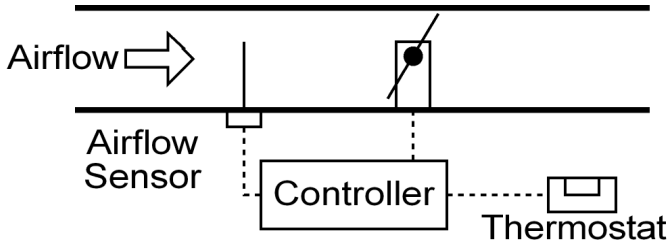
Zone control with Variable Air Volume controls (VAV)

The goal of any HVAC system is to maintain a temperature within a space or zone. When the space is large, such as an auditorium or open factory space, the HVAC system delivers tempered supply air based on a single setpoint and space temperature. However, when the system must maintain the comfort level in several zones the problem becomes more complex. For example, an office area system must maintain a comfortable temperature based on multiple setpoints in individual rooms. This complex problem is often solved by installing a system of variable air volume controls on branch outlets.

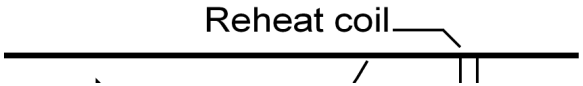
The simplest variable air volume control (VAV) system controls air from a single supply duct and varies the airflow to each zone or room based upon the temperature in the room. A VAV system consists of four basic parts: a thermostat, a precision actuator controlled damper, an airflow sensor, and a controller.

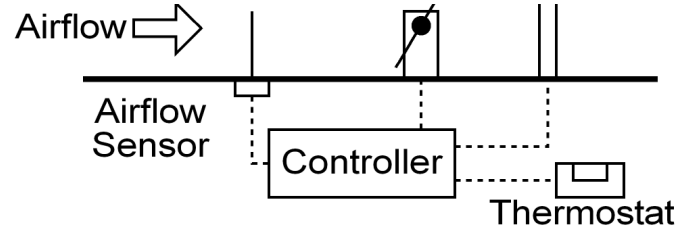


When the thermostat senses the space temperature is at the temperature setpoint, the controller closes the damper until the airflow reaches a predefined lower limit. As the room temperature moves away from setpoint, the controller opens the damper until the airflow reaches a predefined upper limit. In a typical cooling application the temperature of the air supplied air to a VAV control is 55° Fahrenheit. If the room is at the temperature setpoint, the damper in the VAV closes to minimum airflow. As room temperature rises above setpoint, the VAV controller opens the damper to introduce the cool supply air into the room, which returns the temperature to setpoint. The exact position of the damper varies between minimum airflow and maximum airflow as the requirements for cooling in the room change.

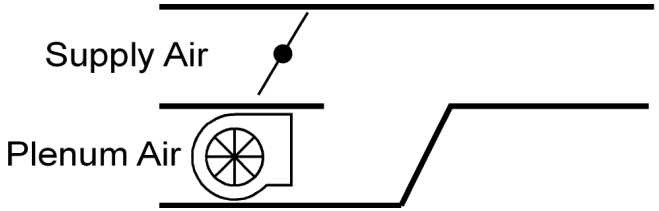
VAV controls are often designed with some variations. One of the most common variations is to add heat to the air passing through the VAV system. This process is referred to as “reheat”. Reheat is typically added to a few perimeter rooms or zones. Although it may seem that heating air that may have been previously cooled is wasteful, using reheat in

a few locations may be more economical when both heating and cooling is required from a single air supply. The reheat component is typically an electric resistance element, but hot water coils are also used for reheat.





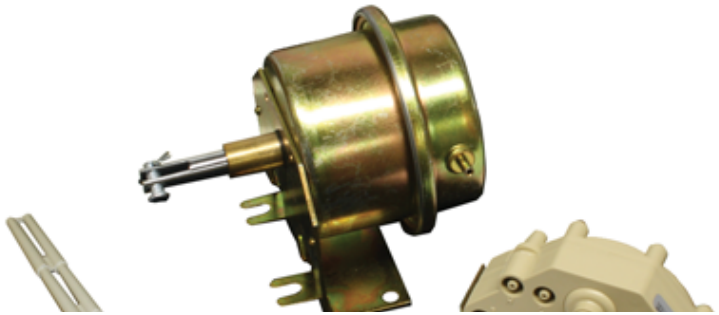
Because most modern buildings use the area above suspended ceilings as the return air plenum, VAV efficiency is increased by pulling the warm plenum air into the VAV system and mixing it with the cooler supply air. This type of VAV is referred to as a parallel fan VAV. A parallel fan VAV may also include a reheat coil.



Series fan VAV controls are also used to increase airflow through a VAV without increasing the demand on the supply air fan.

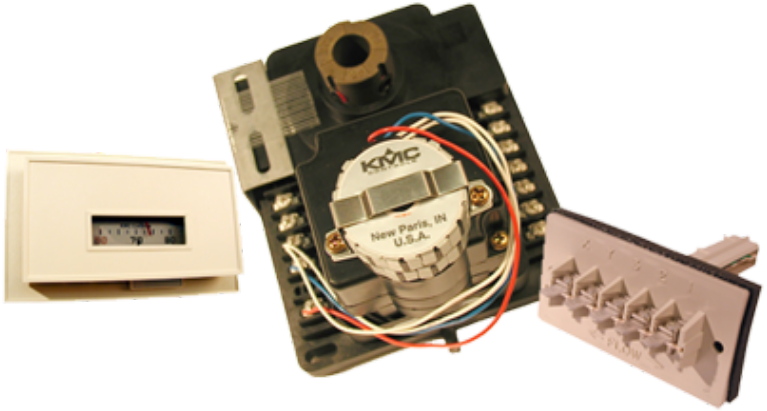
The generations of VAV

Early VAV systems were originally designed using the pneumatic technology of the time. The components of the pneumatic VAV system are connected together with a series of tubing and are powered from a source of compressed air.



SSS-1000, MCP-8031, CTC-1621, CSC-3000

As electronic controls became more available in the HVAC industry, VAV pneumatic systems were replaced with electric actuator motors, electric controls, and thermostats.



CTE-1001, CEP-4000, SSE-1000

Embedded computing became widely available in the mid-1980's and the HVAC industry moved toward direct digital control or DDC. In a DDC variable air volume control, the flow sensor, actuator, and microprocessor are combined into a single unit requiring only an external airflow probe and a temperature sensor. Setpoints are controlled either by fixed values in controller programming or by a sensor in the zone. Some DDC controls use a digital display that can also include temperature and humidity sensing.

SSS-1000, BAC-7001, KMD-1281

With DDC, the controller for the VAV system regulates not only the temperature by positioning the damper but, it can

also control for reheat, fans and even lighting in the zone. When connected to a local area network, the DDC controller can be monitored and configured from a central location, which is often miles away over an internet connection.

Upstream—The air handling unit

In VAV systems, the stream of tempered air is supplied by a single air handling unit to a network of VAV controls. The air handler unit must be able to respond to the fluctuations in duct pressure caused by the individual VAV dampers constantly opening and closing. To maintain air pressure, a controller senses the air pressure in the ductwork and then adjusts the output of the fans in the AHU to sustain the required duct pressure. Fan output is usually controlled either by changing the fan speed with variable frequency motor controls or fan output with moving inlet guide vans.

KMC and variable air volume systems

Since 1969 when we produced our first pneumatic controller, KMC Controls has been involved with all aspects of VAV controllers. Notable innovations are the first pressure independent volume controller, a system powered VAV controller and the industry's first electronic VAV controller to include an actuator. Today, KMC Controls continues to be a major innovator and supplier of VAV controls to the building automation industry with direct-digital controls, including BACnet, the industry standard open system for building automation.

KMC Controls, Inc.
19476 Industrial Drive
New Paris, IN 46553

Toll Free: 877.444.5622
Tel: 574.831.5250
Fax: 574.831.5252