3.1 Most Commonly Used HVAC Control Systems

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The five most commonly utilized HVAC control systems are:

1. Pneumatic Controls
2. Electric Controls
3. Self-Powered Controls
4. Electronic Controls
5. Direct Digital Controls

3.1.1 Pneumatic Controls

Pneumatic Controls

Pneumatic systems utilize low-pressure compressed air, generally 0–30 psi, as a source of energy, to sense and control devices. Typically, an air compressor provides dry, clean, and moisture-free air at 90 psi. This pressure is reduced to approximately 30 psi through a pressure-reducing valve. The compressed air is then delivered to the components via pneumatic tubing. Pneumatic tubing varies in size, often ¼-inch diameter at the zone control level, depending on the consumption of the air. A zone is an area controlled by one thermostat. This may be the pneumatic tubing from the thermostat to the reheat coil control valve for that zone. Figure 3-1 illustrates a simple pneumatic control system. See Chapter 9 for pneumatic controls and DDC.

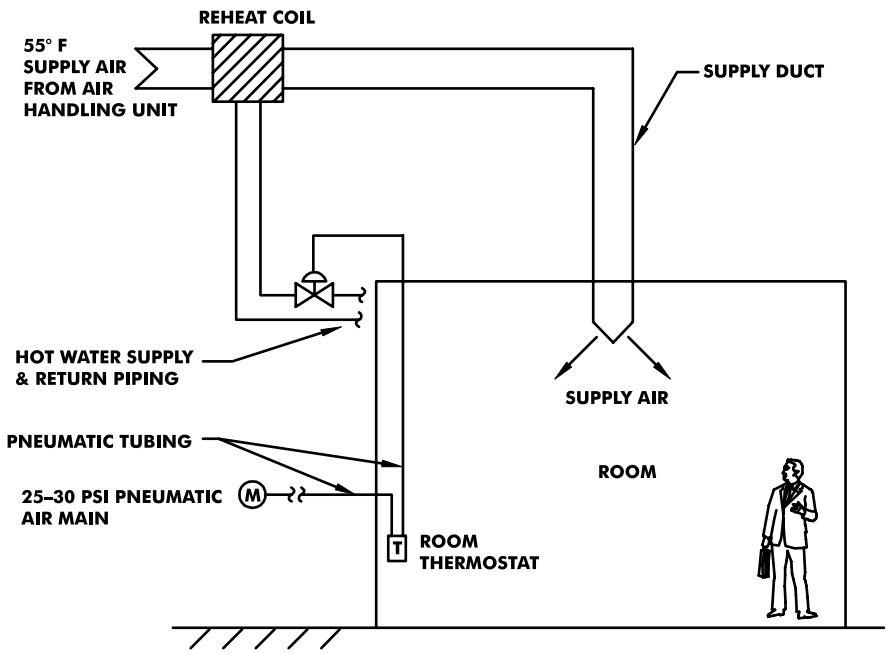

Figure 3-1: A simple pneumatic control system. The control valve modulates in order to maintain optimum room temperature.

3.1.2 Electric Controls

Electric Controls

Electric control systems typically operate by starting and stopping the flow of electricity. Electric control systems are inherently two-position; however, modulation may be provided by varying voltage and current by means of rheostats or bridge circuits. Figure 3-2 illustrates a simple electric control system. See Chapter 9 for electrical controls and DDC.

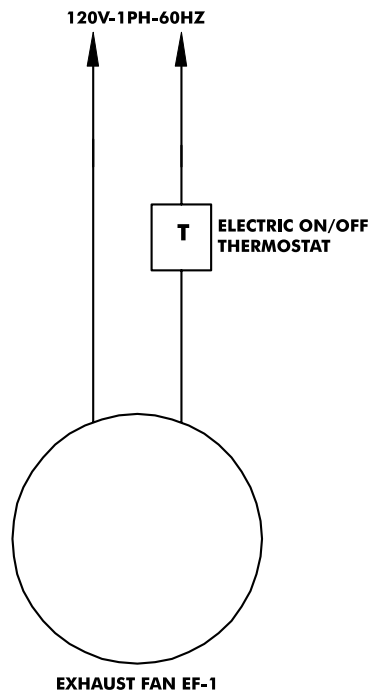

Figure 3-2: A simple electrical control. When the temperature exceeds 80°F, the contacts at the electric thermostat touch and the exhaust fan EF-1 starts.

3.1.3 Self-Powered Controls

Self-powered control systems are those that require no outside source of energy to operate. The energy is typically provided by the controlled variable. Some self-powered control components simply operate based upon the expansion and contraction characteristics of their internal components. Various manufacturers offer various techniques for similar solutions. Good examples of this are self-contained variable air volume diffusers and the self-contained pressure-sustaining valves. Both of these are commercially packaged and available. Figure 3-3 illustrates the function of self-contained pressure-sustaining valves.

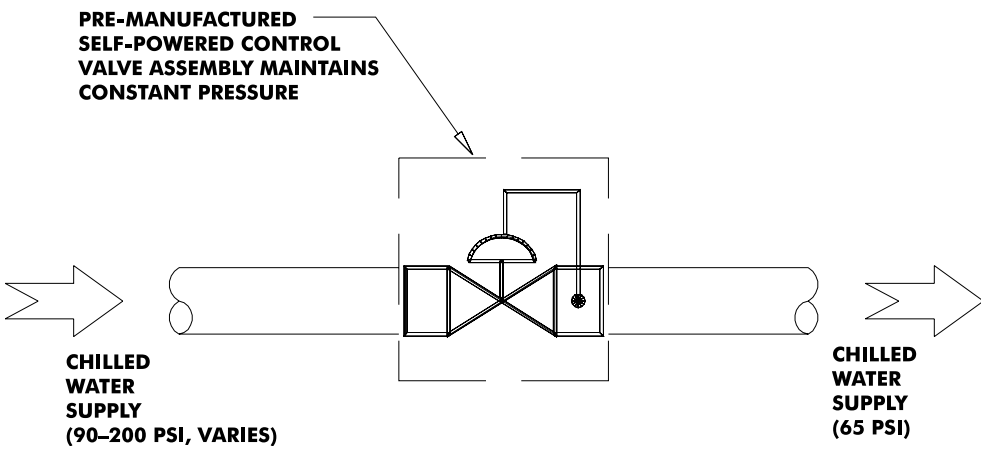

Figure 3-3: A simple self-powered control example. The pressure-sustaining valve shown above utilizes no outside source of energy. It modulates the control valve in order to maintain 65 psi water supply outlet.

3.1.4 Electronic Controls

Electronic Controls

Electronic control systems are commonly used in control panels of packaged equipment, chillers, computer room air conditioning units, and various other pieces of equipment. They utilize low-voltage electricity, i.e., 24 volts or less, in order to monitor and control. The best example of an electronic control system is the control system for your microwave oven at home. Electronic systems typically allow for minimal operator interface. Often the operator involvement is limited to on/off and set point and time adjustment. However, the operator does not have direct control over the process programming since the program and algorithm are already established by the manufacturer. Refer to Figure 3-4.

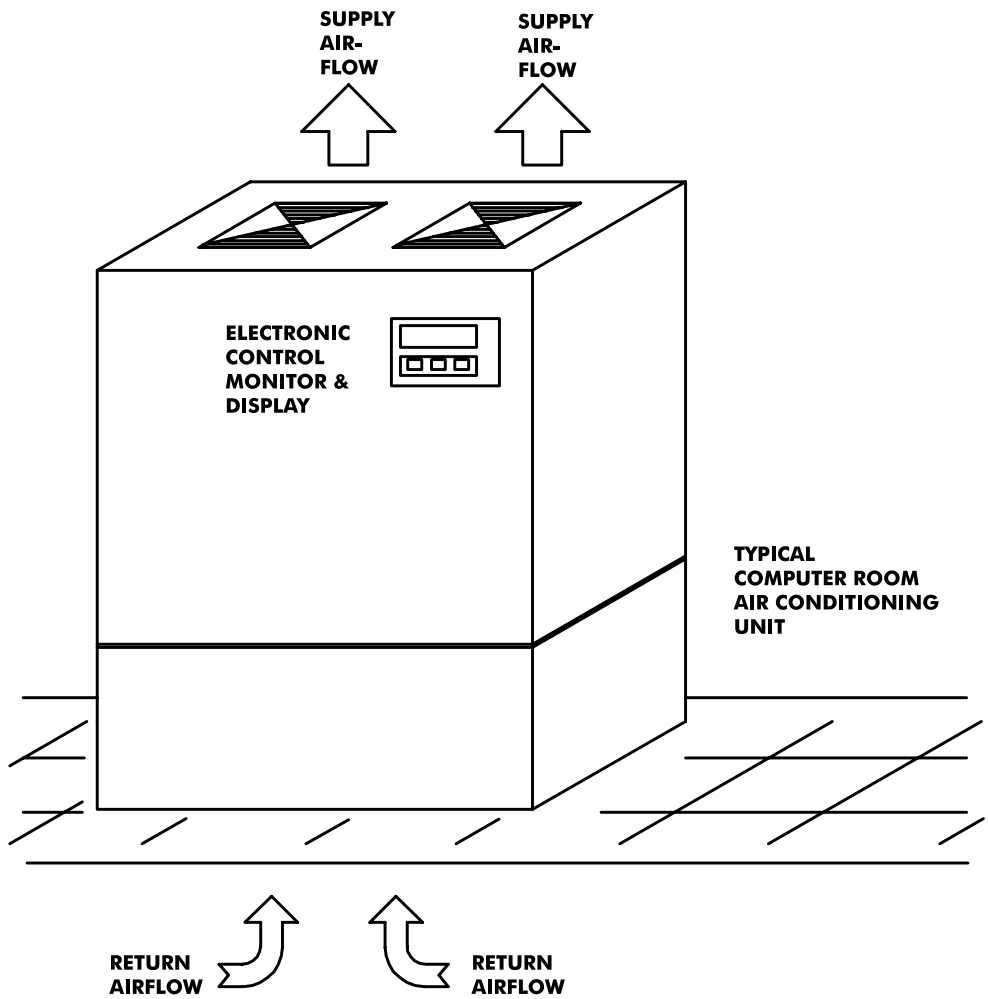

Figure 3-4: A simple electronic control system. Electronic system within a typical computer room air conditioning unit. The operator may change the set points. However, the operator does not have direct control over the process programming.