5-3 FEEDBACK CONTROLLERS

This section presents the most important types of industrial controllers. Specifically, we will consider the different types of algorithms used in analog controllers and the most common ones used in distributed control systems (DCSs) and in "stand-alone controllers," which are also sometimes referred to as single-loop controllers or simply as loop controllers.

As presented in Chapter 1, the DCSs and the "stand-alone" controllers are computer-based, so they process the signals not on a continuous basis but rather in a discrete fashion. However, the sampling time for these systems is rather fast, usually ranging from 10 times a second to about once a second. Thus for all practical purposes, these controllers appear to be continuous.

Chapter 15 presents other details related to discrete controllers, such as how the algorithms are written for discrete operation and the effect of sampling time.

Briefly, the controller is the "brain" of the control loop. As we noted in Chapter 1, it is the device that performs the decision (D) operation in the control system. To do this, the controller:

1. Compares the process signal it receives, the controlled variable, with the set point. The set point is the desired value of the process signal.
2. Sends an appropriate output signal to the control valve, or any other final control element, in order to maintain the controlled variable at its set point.

Figure 5-3.1 shows different types of controllers. Figs.5-3.1a and b show some stand-alone controllers. These controllers have a series of buttons/windows that make it possible to adjust the set point, read the value of the controlled variable, transfer between the automatic and manual modes, read the output signal from the controller, and adjust the output signal when in the manual mode.

Most loop controllers have these options on the front panel for ease of operation. Fig. 5-3.1~ shows what is known as a distributed control system (DCS).

The auto/manual button determines the operation of the controller. When this button is in the auto (automatic) position, the controller decides on the appropriate signal and outputs it to the final control element to maintain the controlled variable at the set point. In the manual position, the controller stops deciding and allows operating personnel to change the output manually. In this mode, the controller just provides a convenient (and expensive) way to adjust the final control element. In the auto mode, information from the manual adjustment is ignored, or disabled; only the set point influences the output. In the manual mode, on the other hand, the set point has no effect on the controller output; only the manual output influences the output. When a controller is set in manual, there is not much need for the controller. Only when the controller is in automatic are the benefits of automatic process control obtained.