Basic Principles of Motor Control

Unit 1—Introduction

This unit discusses the basic concepts of motor control, including “motor control language” and the types of wiring diagrams used.

Motor Control Circuits

Motor control circuits are an effective way to reduce cost by using smaller wire and reduced-amperage devices to control a motor. Imagine trying to wire a pushbutton station for a 100A motor using 3 AWG conductors. Many smaller motors use the same size conductors for both control and power circuits, but as the horsepower increases it becomes impractical to do so, Figure 1–1. Motor control circuits are often connected to lower voltages than the motor they control to make it safer for operators and maintenance personnel. A motor control circuit for the most part, is simply a switch (or group of switches) and a motor. If you keep the word “switch” in mind, it helps keep the intimidating subject of “motor control” in its proper context. For example, the following can be considered motor controls:

A time clock that operates a pool or sprinkler pump isn’t more than an automatic switch. At a preset time, a set of contacts open or close (turn off or on). Figure 1–2

An automatic garage door opener uses a radio signal to operate a switch that activates the garage door in much the same manner as a typical “up-down” pushbutton station.

Many motors are controlled by computerized control systems, solid-state logic controls, or programmable logic controllers (PLCs). The fundamentals of control systems still apply. The PLC controls an external output based on the logic of a control program, and that output controls the motor or groups of motors by using a magnetic starter, and in some cases additional relays. PLCs and other solid-state control devices were originally invented to provide less expensive replacements for older automated systems that used large numbers of relays and mechanical timers. In some cases, a single PLC can replace thousands of relays resulting in less expensive wiring systems that offer greater flexibility in control designs.