

Components in PLC circuits

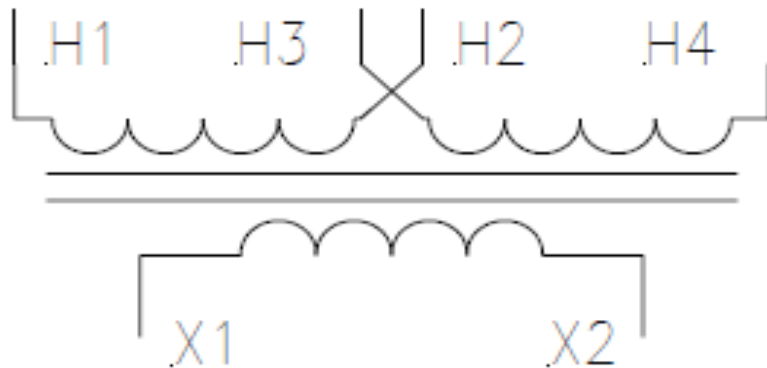
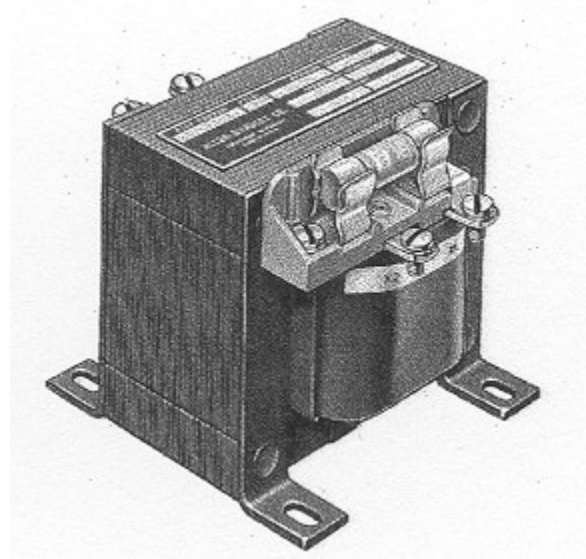


Figure 1-1 - Control Transformer



to make large powerful machines efficient and cost effective and reduce line current, most are powered by high voltages (240VAC, 480VAC, or more). This means the line voltage must be reduced to 120VAC or less for the controls. This is

Components in PLC circuits

- **Switches**
- There are two fundamental uses for switches. First, switches are used for operator
- input to send instructions to the control circuit. (PUSH BUTTONS)
- Second, switches may be installed on the moving parts of a machine to provide automatic feedback

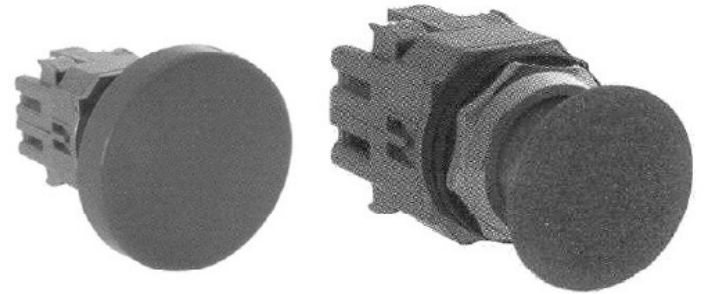


Figure 1-4 - Momentary Pushbutton Switches

RELAYS

- A relay, or contactor, is an electromagnetic device composed of a frame (or core) with an electromagnet coil and contacts (some movable and some fixed).
- The movable contacts (and conductor that connects them) are mounted via an insulator to a plunger which moves within a bobbin. A coil of copper wire is wound on the bobbin to create an electromagnet.
- A spring holds the plunger up and away from the electromagnet. When the electromagnet is energized by passing an electric current through the coil, the magnetic field pulls the plunger into the core, which pulls the movable contacts downward.

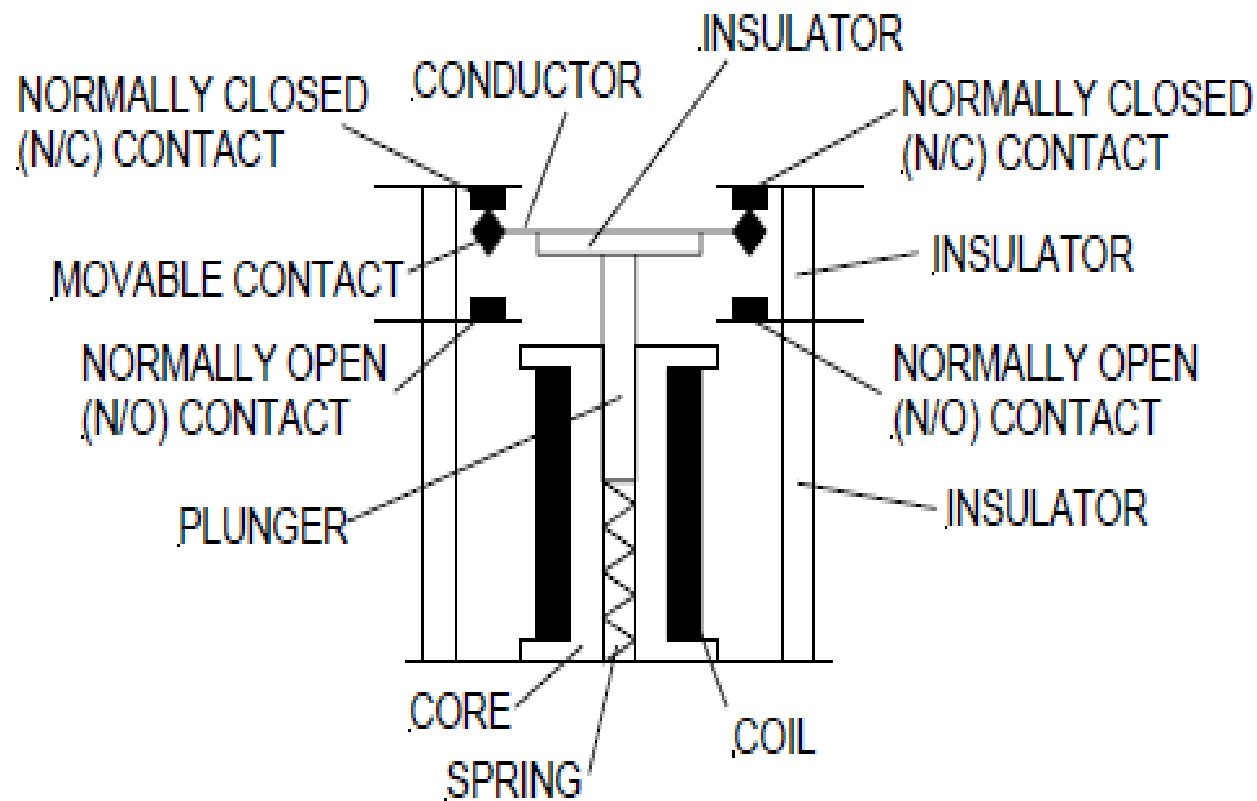


Figure 1-13 - Relay or Contactor

Time Delay Relays

- Delay-On Timer (TON) Relay

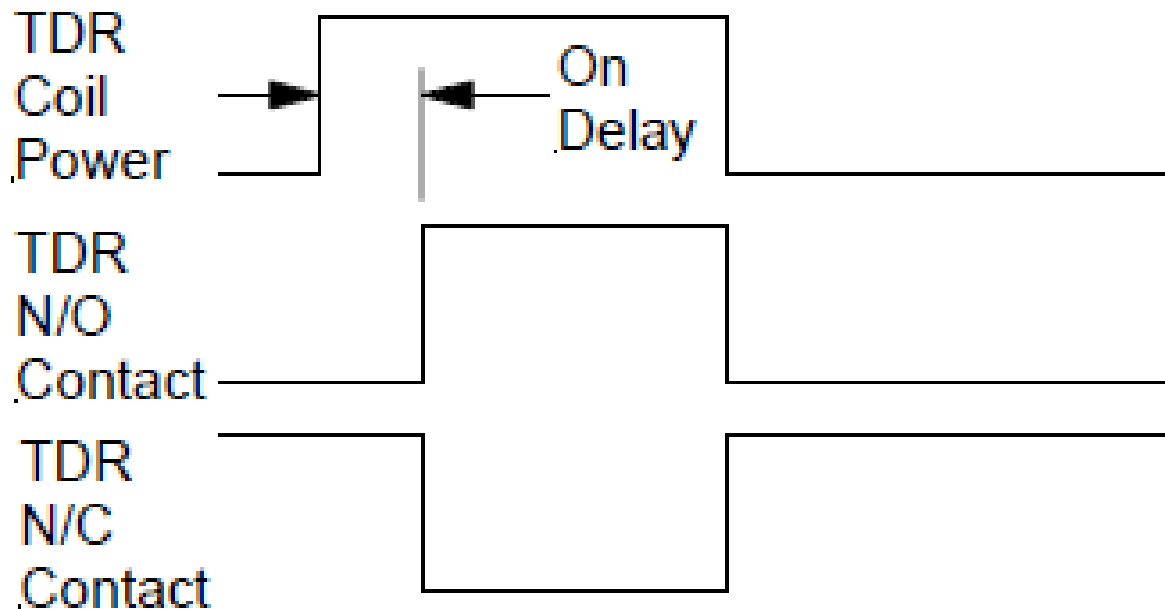


Figure 1-16 - Delay-On Timer Relay

Delay-Off Timer (TOF) Relay

- at the instant power is applied to the relay coil, the contacts activate - that is, the N/O contacts close, and the N/C contacts open. The time delay occurs when the relay is switched off. After power is removed from the relay coil, the contacts stay activated until the relay times out.

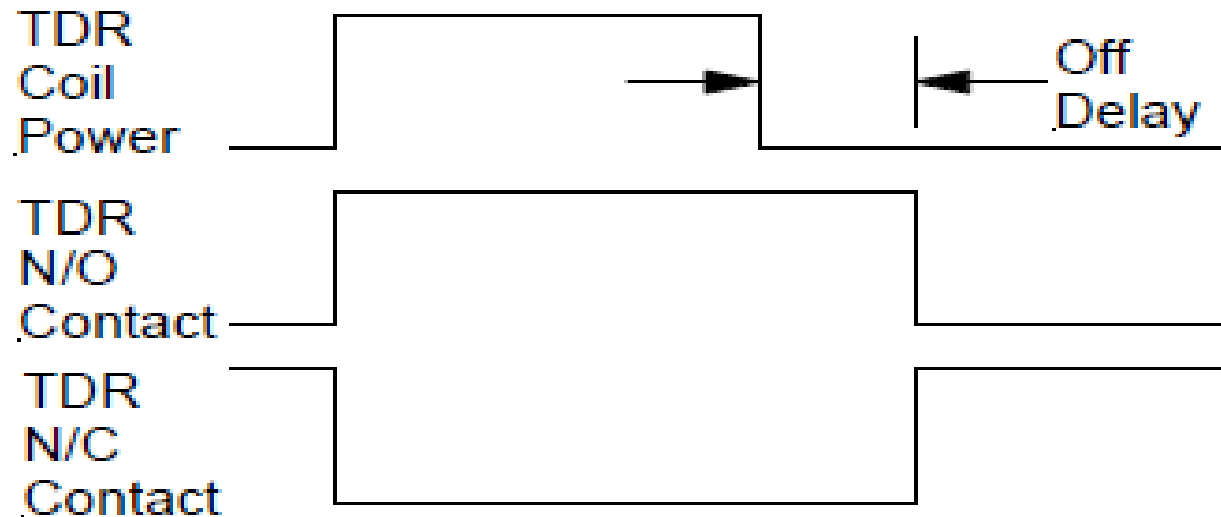


Figure 1-17 - Delay-Off Timer Relay

Fundamentals of Ladder Diagrams

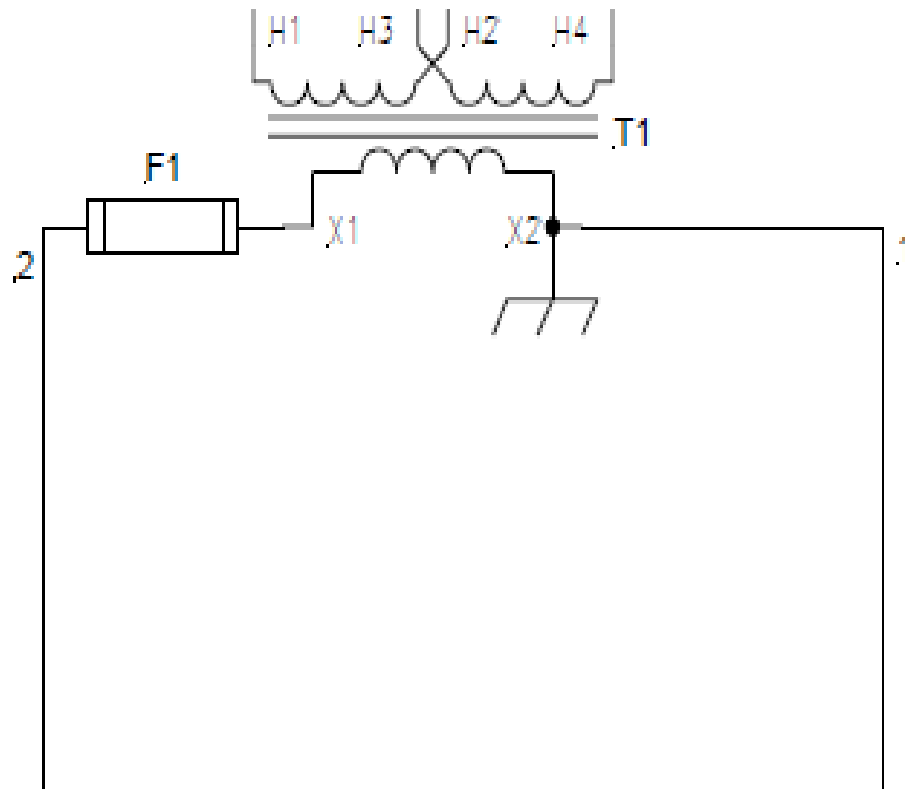


Figure 1-18 - Basic Control Circuit

Boolean Logic and Relay Logic

1)AND

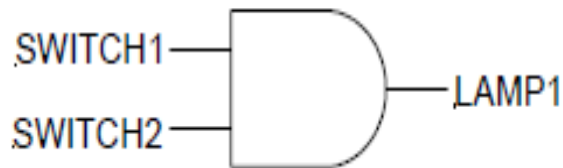
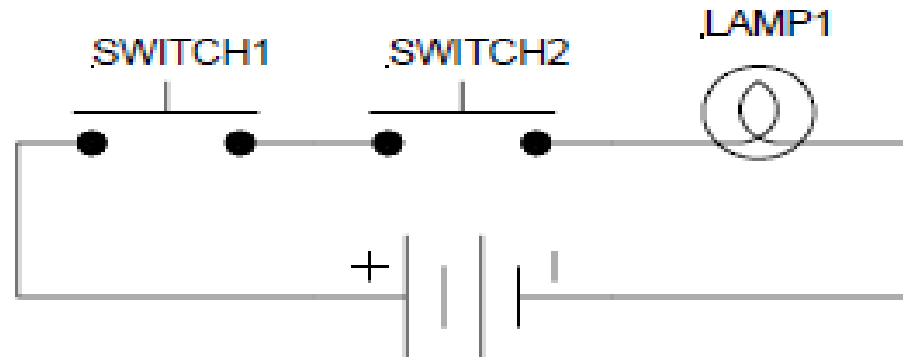
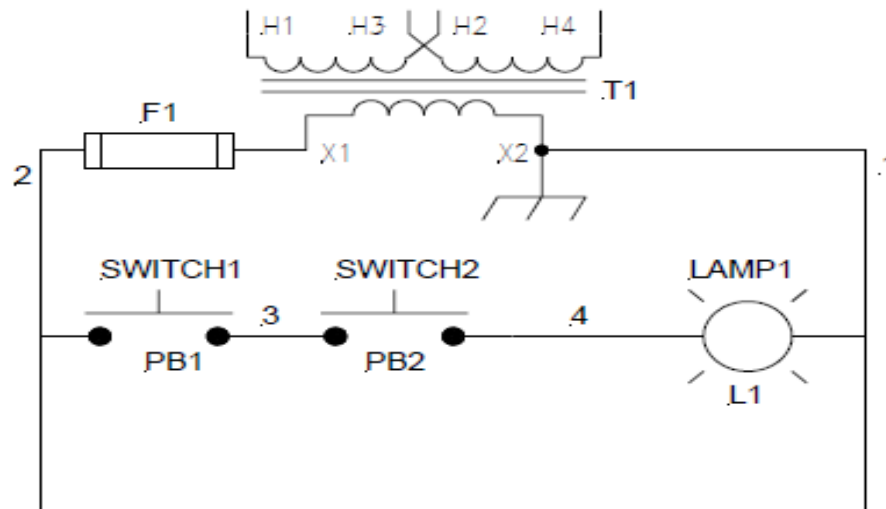


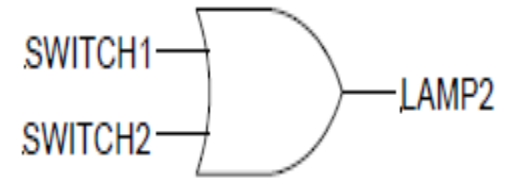
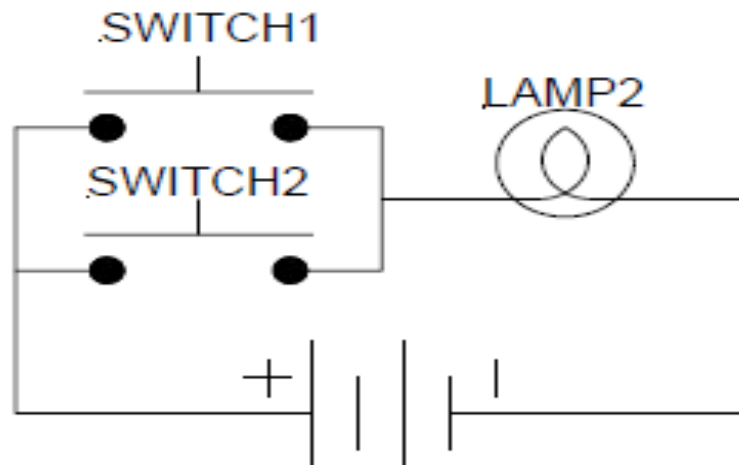
Figure 1-21 - AND Circuit



$$Lamp1 = (Switch1) \cdot (Switch2)$$



OR



$$Lamp2 = (Switch1) + (Switch2)$$

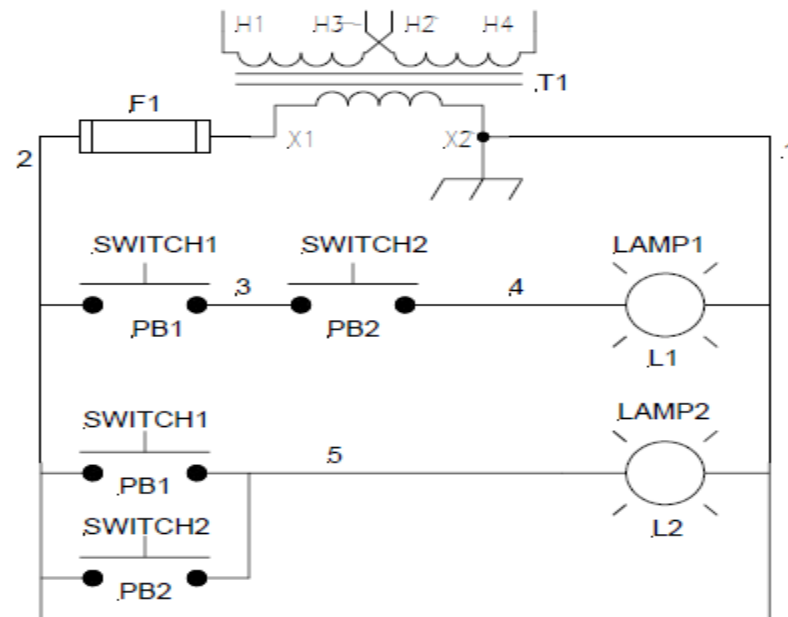


Figure 1-25 - Add Rung 2

AND OR

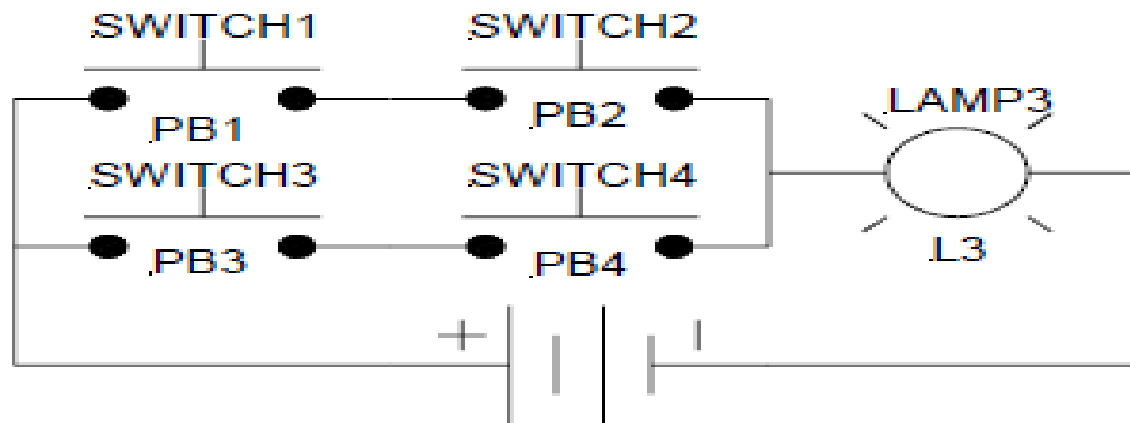


Figure 1-26 - AND-OR Lamp Circuit

OR AND

$$Lamp3 = (Switch1 \cdot Switch2) + (Switch3 + Switch4)$$

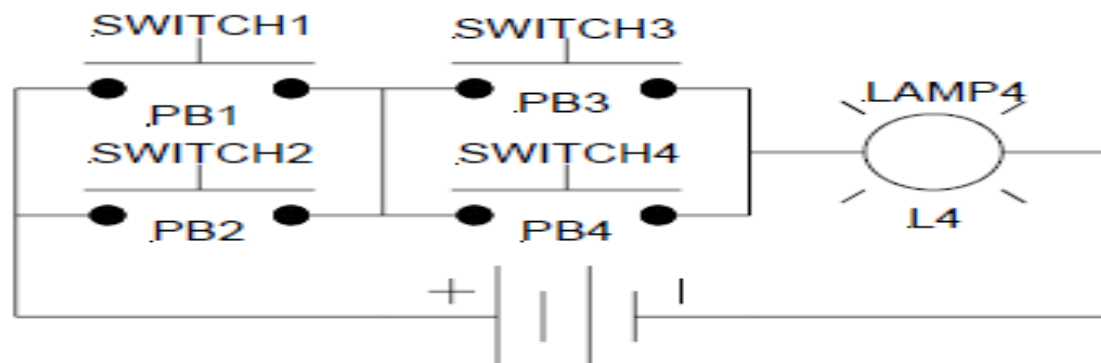


Figure 1-27 - OR-AND Lamp Circuit

Latch circuit

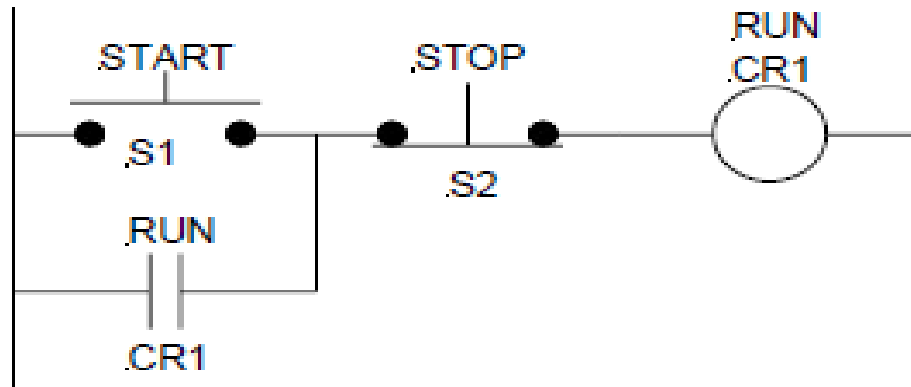


Figure 1-30 - Latch Circuit

First, when power is applied to the rails, CR1 is initially de-energized and the N/O CR1 contact in parallel with switch S1 is open also. Since we are assuming S1 has not yet been pressed, there is no path for current to flow through the rung and it will be off. Next, we press the START switch S1. This provides a path for current flow through S1, S2 and the coil of CR1, which energizes CR1.

As soon as CR1 energizes, the N/O CR1 contact in parallel with S1 closes (since the CR1 contact is operated by the CR1 coil). When the relay contact closes, we no longer need switch S1 to maintain a path for current flow through the rung. It is provided by the N/O CR1 contact and N/C pushbutton S2. At this point, we can release S1 and the relay CR1 will remain energized. The N/O CR1 contact “seals” or “latches” the circuit on, and the contact is therefore called a **sealing contact or**