

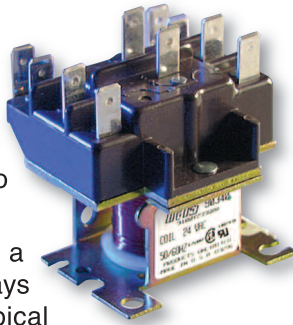
SWITCHING RELAYS

Switching relays are commonly used devices in a variety of HVAC/R applications. Typically they are used to switch light current loads, ranging from fan motors to damper controls.

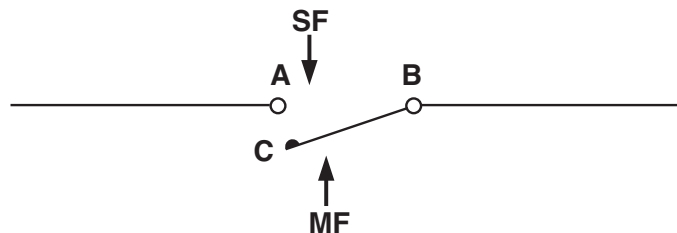
A relay is a device that acts as a remotely controlled switch. Relays used in control circuits of typical HVAC/R systems may be electromechanical or solid state. For this paper, we will focus on electromechanical relays.

Electromechanical relays consist of an electromagnetic coil, an electromagnet, an armature (movable conductor) and electrical contacts electrically separate from the circuit that powers the electromagnet.

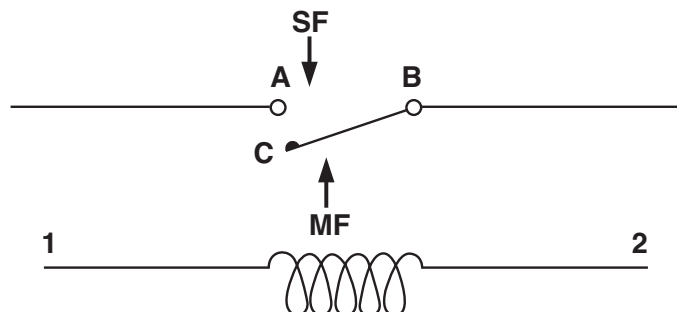
We want to close the circuit below by connecting electrical points A and B.



With the use of a moveable arm (an armature) with an electrical contact (C), we can close A and B by making contact between A and C. B is a “pole” of the relay. A pole is a switching point in an electrical circuit.



SF stands for the force applied by a mechanical spring. SF pushes A and C apart, holding electrical contact points A and B open. MF stands for the force applied by magnetic attraction. MF pushes A and C together. If one force is stronger than the other, A and C will either remain open or will close depending on which force is the strongest.



This illustrates the use of an electro magnet, wired between electrical points 1 and 2 that will supply the magnetic force needed to close contacts A and B. Here you see two separate electrical circuits. The bottom circuit that controls the electromagnet also controls the top circuit with our two original electrical circuit points, A and B.

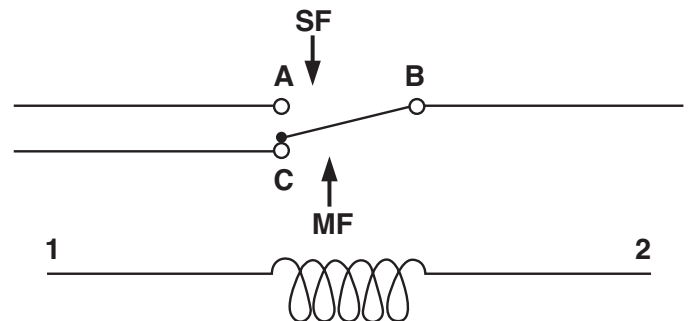
In this example, when power is applied to the electromagnet, the magnetic force (MF) overcomes the opposing spring force (SF) and the contacts A and B (close) make.

POLES AND CONTACT ARRANGEMENTS

Poles are electrical points of circuits that are available as switching points. In relay applications, the number of poles indicates the number of separate electrical circuits that can be controlled by a relay or contactor. In the following examples a pole may be switched in several different configurations.

In an electromechanical relay, contacts can be arranged to accomplish connecting (making) or disconnecting (breaking) an electrical circuit. If an activated (power applied) relay makes a circuit, the contacts are said to be normally open. If an activated relay breaks a circuit, the contacts are said to be normally closed. The term “normally” refers to the state of a circuit without power applied to a switching relay.

Here we have a second electrical circuit that is represented by normally closed contacts B and C, connected by the armature represented by B and C. Contacts A and B are normally open.



This drawing illustrates a single pole double throw relay with contact points A and B normally open and contact points B and C normally closed. When power is applied to the magnetic coil wired between 1 and 2, the resulting magnetic force (MF) overcomes the opposing spring force (SF) and contacts A and B (close) make and contacts B and C (open) break.