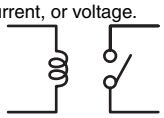
■ Types of Relays

There are different ways to classify relays. The following groupings will be used in this technical guide.

Control Relays

Relays with Contacts

As the name indicates, these relays have contacts and use an electromagnetic operation to mechanically open and close these contacts to transmit and cut signals, current, or voltage.



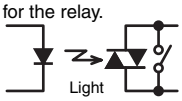
Relays without Contacts

These relays do not have a mechanical moving part that the relays with contacts do. Instead they are made up of internal triacs, resistors, or other semiconductors and electronic parts that transmit and cut the signal or power electronically by the operation of these electronic circuits.

Note: Relays without contacts are not included in this technical guide.

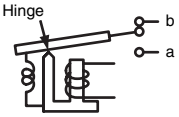
Hybrid Relays

Hybrid relays are a combination of the best of both relays with contacts and relays without contacts. Semiconductor elements transmit and cut the signal or power and contacts are used to supply the power for the relay.

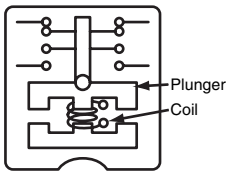


Classification by Structure

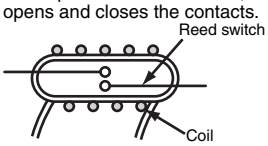
· **Hinged Relays**
With hinged relays, the armature of the electromagnet rotates around a fulcrum. This action directly or indirectly opens and closes a contact.



· **Plunger Relays**
Plunger relays use mainly the power of a plunger-shaped electromagnet as the armature section to open and close contacts.

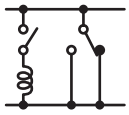


· **Reed Relays**
Reed relays consist of a pair of magnetic strips sealed within a glass envelope. These reeds are the contacts. Magnetic flux applied to a coil wrapped around the glass envelope moves these reeds, which opens and closes the contacts.

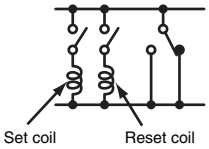


Classification by Function

· **Single-side Stable Relays**
The contact turns ON or OFF only while an input signal is received. Single-side stable relays have no other special functions in their operation elements.



· **Latching Relays (Bistable Relays)**
The contact turns ON or OFF when an input signal is received and maintains that status even if the input signal is cut.



· **Other Relays**
- Ratchet Relays
- Latch-in Relays
- Time Relays
- Motor Relays
- Thermal Relays

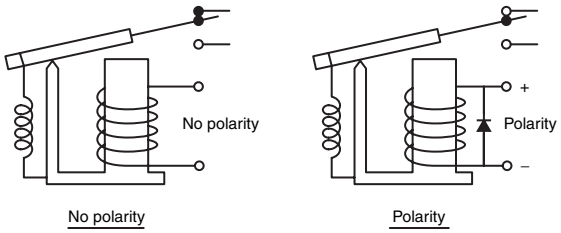
■ Types of Electromagnets

Relays are classified into the following types, depending on whether or not they have a permanent magnet.

Non-polarized Relays

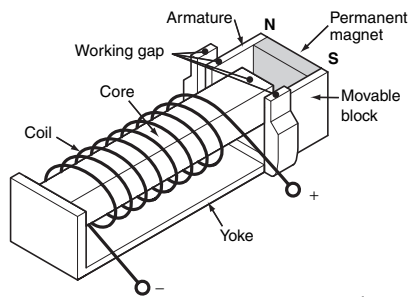
Non-polarized relays do not use a permanent magnet in their electromagnetic section.

This means that generally the operating coils do not have polarity. There are some non-polarized relays, such as those with built-in operation indicators or surge-absorbing diodes, whose operating coils have polarity.

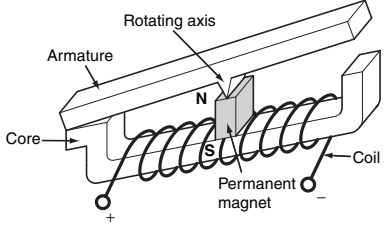


Polarized Relays

Polarized relays use the magnetic flux of the permanent magnet in their electromagnetic sections. This means that the operating coil has polarity.



Moving Loop System (OMRON name)



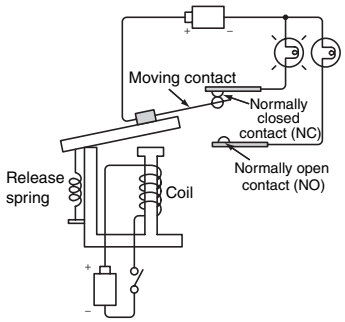
Super Moving Loop System (OMRON name)

■ Description of Relay Operation

Single-side Stable Relays

Release State

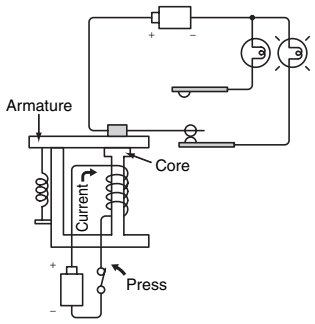
• Battery Not Connected to the Coil



No current is applied to the operating coil, so the electromagnet does not operate. The armature is pulled by the force of the release spring in the counterclockwise direction and, as a result, the moving contact makes contact with the normally closed contact (turns ON) and the normally open contact stays disconnected from the moving contact (remains OFF).

Operating State

• Battery Connected to the Coil



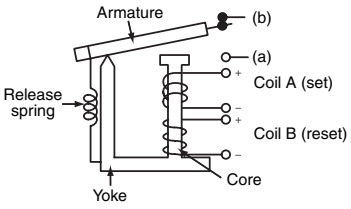
When current flows to the operating coil the electromagnet is magnetized and the armature is drawn to the core. As a result, the moving contact moves away from (turns OFF) the normally closed (NC) contact and connects (turns ON) the normally open (NO) contact.

Latching Relays (also called 'Bistable' or 'Keep' Relays)

Magnetic Latching Relays: Two-coil Latching Relays

Relaxed State (after Reset)

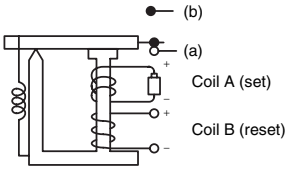
• Battery Not Connected to Coil



The diagram shows the relay in the relaxed state.

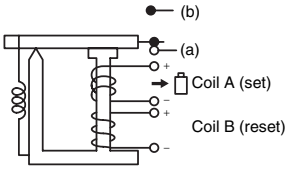
Latching relays are the same as the single-side stable relays described previously except that the core, yoke, and armature are made from semi-hard magnetic material and there are at least two coils in the relay.

Operating State (Set)



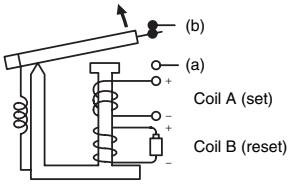
When current flows through coil A, the electromagnet (made of semi-hard material) is magnetized and the armature is attracted to the core.

As a result, the moving contact moves away from the normally closed (NC) contact (turns OFF) and makes contact (turns ON) with the normally open (NO) contact.



In the set state, the residual magnetic flux in the semi-hard magnetic material (material that has properties similar to a permanent magnet) will keep the armature attracted to the core even if a current is no longer applied to coil A.

Release State (Reset) →Relaxed State



If a current is applied to coil B, which is wound in the opposite direction to coil A, the residual magnetic flux in the semi-hard magnetic material will reduce and the magnetic attraction will weaken. The power of the release spring will become stronger than the magnetic attraction, so the armature will release and the relay will be in a relaxed state.

When the armature has released, there will be almost no residual magnetic flux in the semi-hard magnetic material.

Note: In contrast to the hard magnetic material used in a permanent magnet, semi-hard magnetic material requires less energy to magnetize and de-magnetize.