### Types of Relays

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

#### 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.
### 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 the normally closed (NC) contact and connects (turns ON) with 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.