

Relays



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What is a Relay?

- A relay is an electromagnetic switch which uses an electric signal to actuate
- It can be used to control a larger current with a very small current
- Because a relay uses mechanical contacts, it can safely switch much higher voltages and currents than the control circuit that operates it.

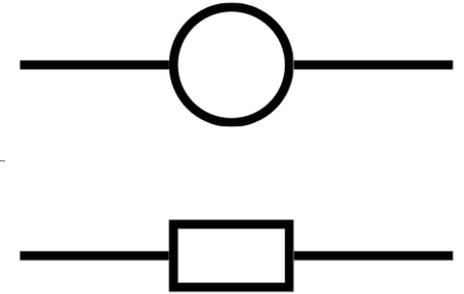


Relay vs Transistor

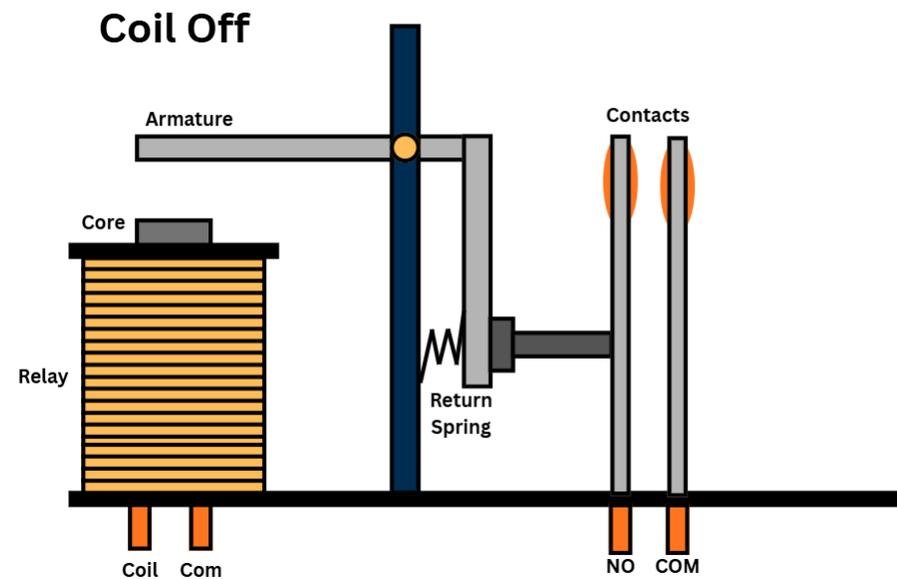
- Relays and Transistors play very similar roles. Though they have some major differences:
- **Relay:** mechanical switch, can handle very high voltage/current, electrically isolated from the control circuit.
- **Transistor:** electronic switch, faster and smaller, but limited by semiconductor power ratings.



Parts of a Transistor - Coil

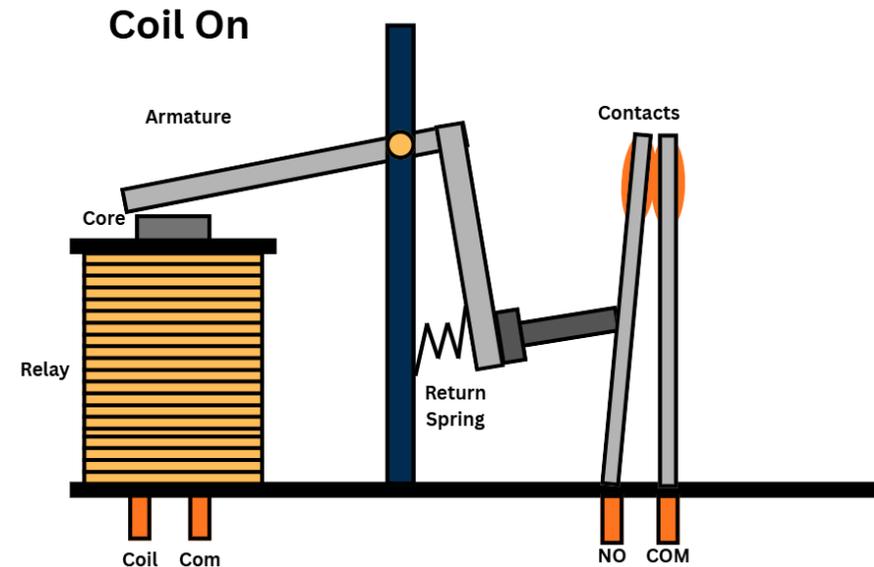
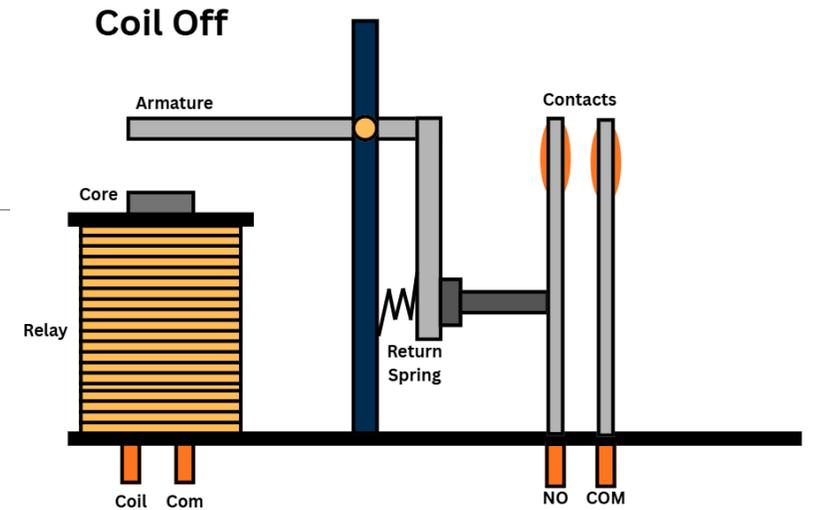


- The coil is the part of a relay that creates the magnetic force needed to operate the switch.
- It is made from a length of insulated copper wire wrapped around a metal core. When an electrical current flows through the coil, it produces a magnetic field.



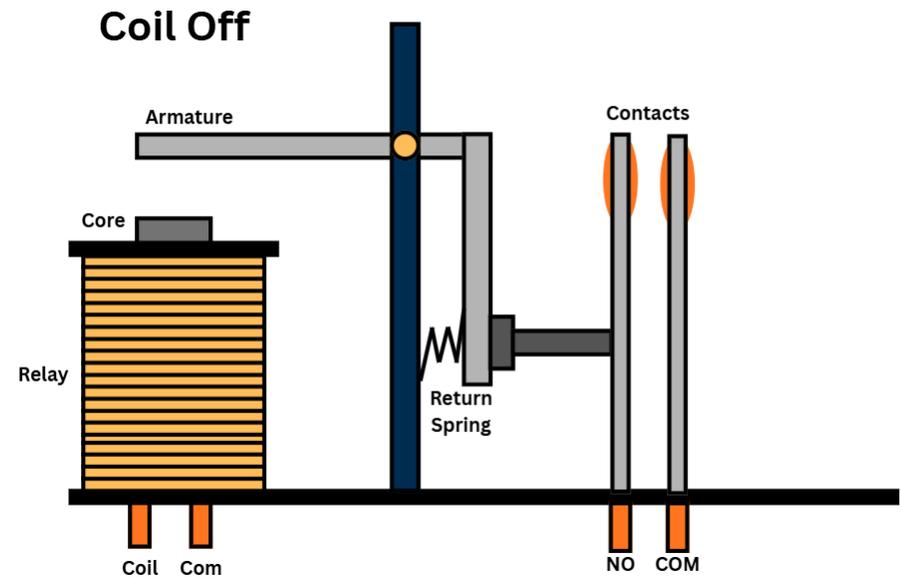
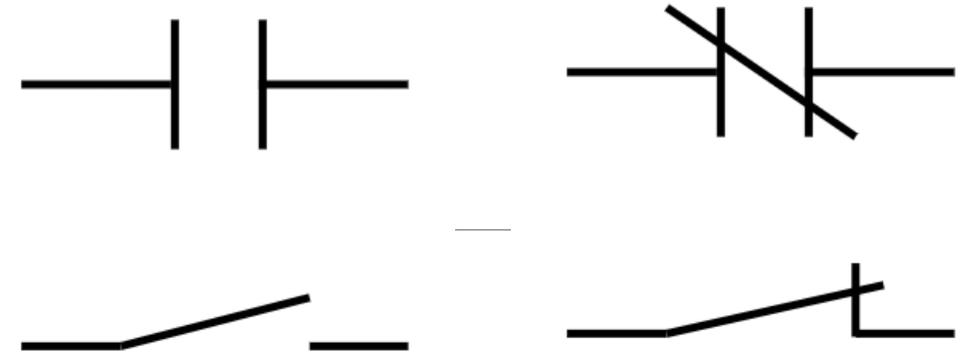
Parts of a Transistor - Armature

- The armature is the movable metal part inside a relay that operates the switch contacts.
- When the coil is energised, it creates a magnetic field that pulls the armature toward the coil. This movement causes the relay contacts to open or close, switching the external circuit.
- When power to the coil is removed, the magnetic field disappears and a spring pushes the armature back to its original position, returning the contacts to their default state.

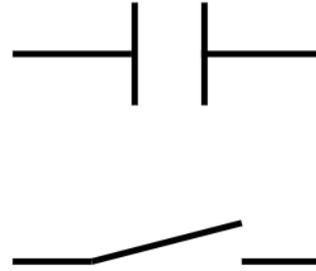


Parts of a Transistor - Contacts

- The contacts are the parts of the relay that open or close the electrical circuit being controlled.
- They are small metal conductors that touch together to allow current to flow, or separate to stop the current.
- The contacts are connected to the armature, so when the armature moves, the contacts change position.

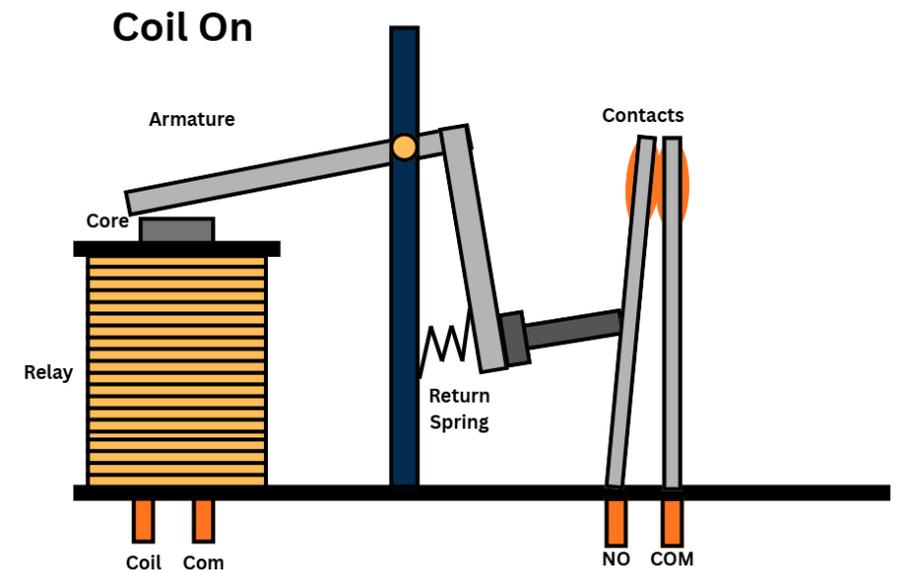
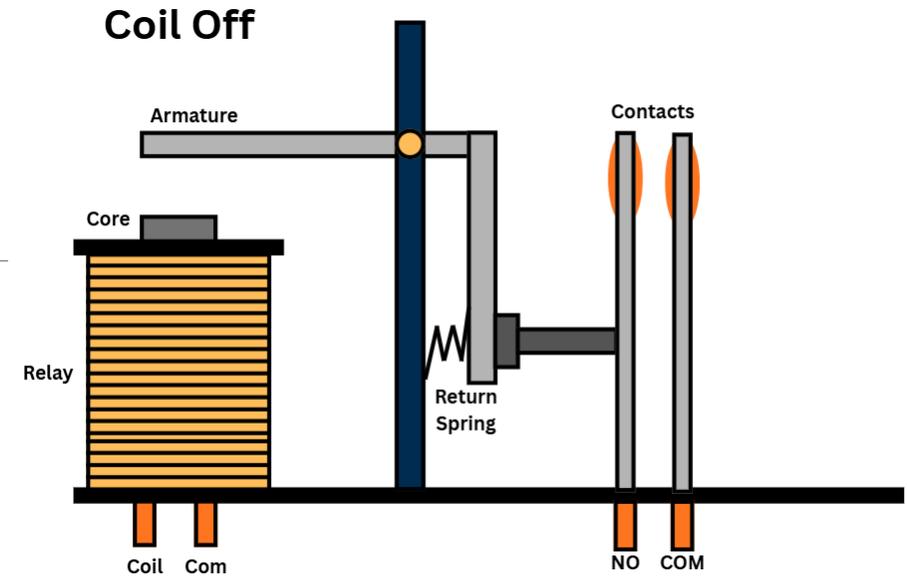


NO Contact

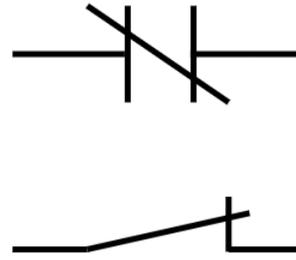


- A “normally open” contact is a contact where the circuit is not usually complete
- When power is given to the coil it moves the armature and completes the circuit

Input Condition	Contact State	Output State
False (Not Activated)	Open	No Signal Flows
True (Activated)	Closed	Signal Flows

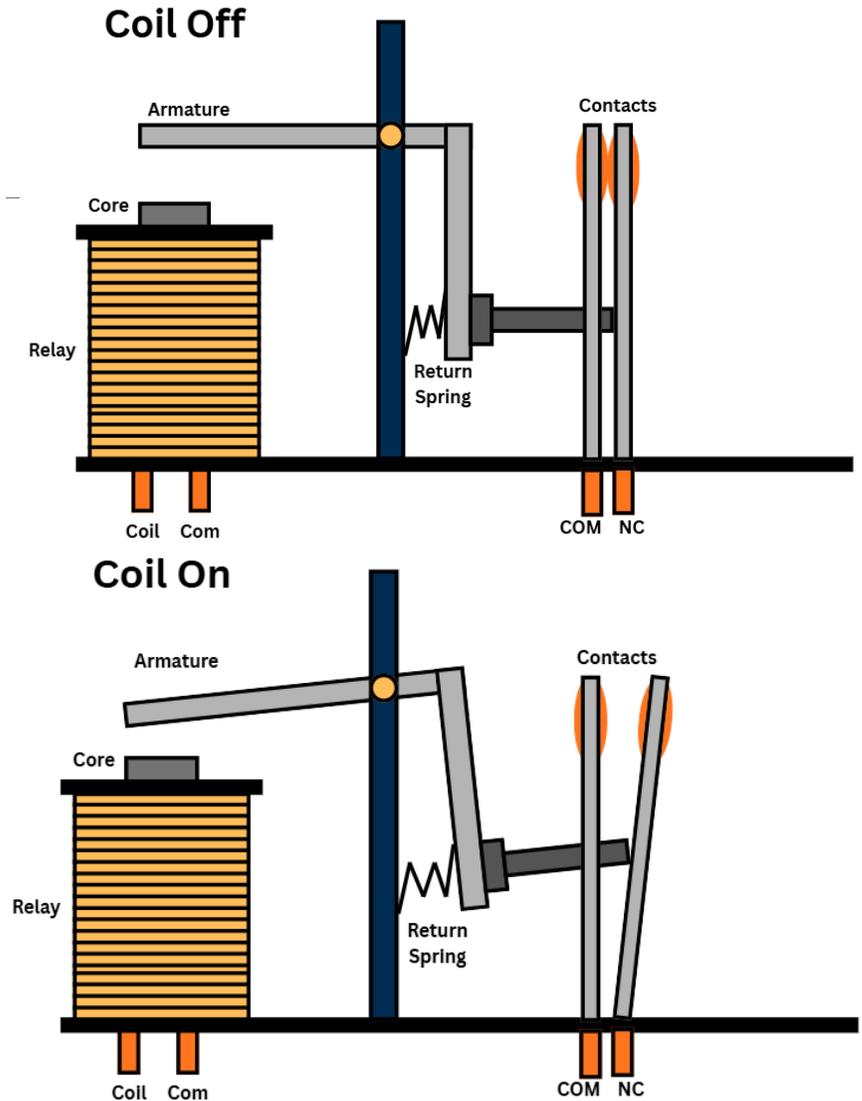


NC Contact



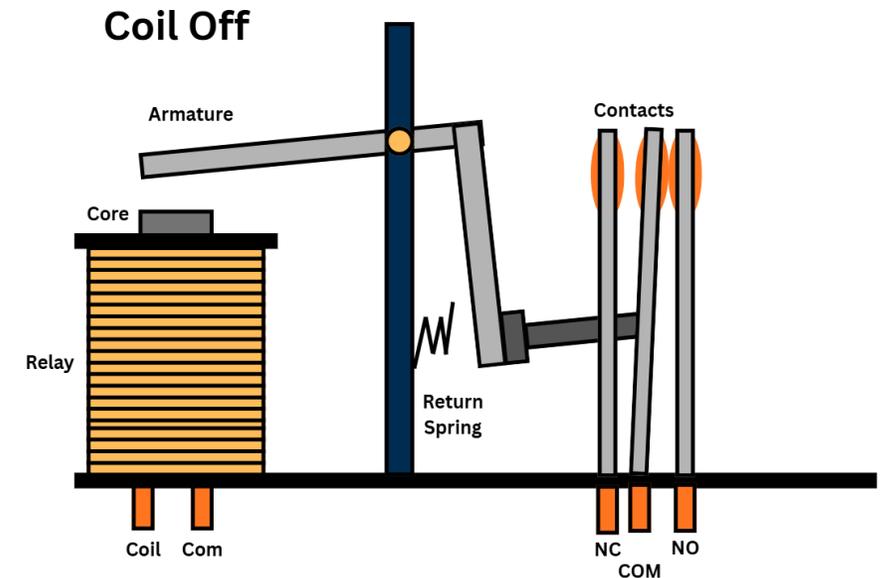
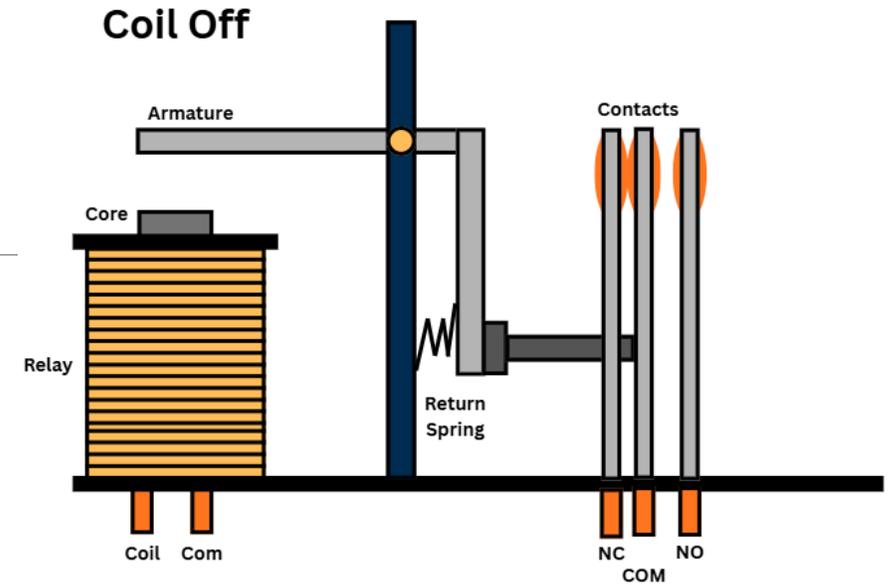
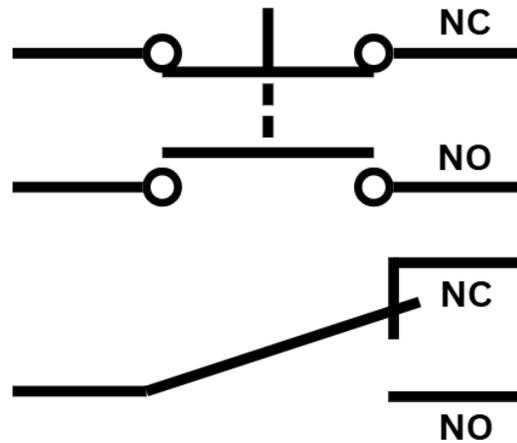
- A “normally closed” contact is a contact where the circuit is not usually complete
- When power is given to the coil it moves the armature and completes the circuit

Input Condition	Contact State	Output State
False (Not Activated)	Closed	Signal Flows
True (Activated)	Open	No Signal Flows



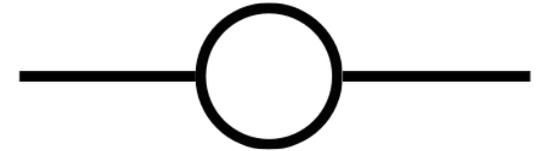
Changeover Contact

- A switch over contact is a combination of a NO and NC contact
- It allows us to switch between two different outputs



Representing Relays

- In electrical diagrams, a relay is usually represented by two separate parts: the coil and the contacts. These are drawn separately to make complex control circuits easier to understand.
- Relay Coil
 - The coil symbol represents the part of the relay that is energised by the control circuit.
 - When voltage is applied to the coil, it creates a magnetic field that activates the relay.
 - The coil is normally labelled with an identifier (for example K1, R1, or CR1) so that the related contacts can be identified elsewhere in the diagram.
- Relay Contact
 - The contacts represent the switching part of the relay that controls the load circuit.
 - Contacts are shown in their normal state (the position when the coil is not energised).



ANSI vs IEC

- IEC (International Electrotechnical Commission) and ANSI (American National Standards Institute) are two different standards used for drawing electrical diagrams.
- Both describe the same components, but the symbols look different.

ANSI	IEC
<ul style="list-style-type: none">• Commonly used in Europe and the UK• Symbols are usually simpler and more geometric• Often used in industrial automation, PLC diagrams, and control panels• Contacts and coils are normally shown separately in ladder logic	<ul style="list-style-type: none">• Mostly used in North America• Symbols often look more like physical representations of the component• Common in electrical engineering schematics and older control diagrams• Sometimes groups relay components closer together in diagrams