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# Understanding Electric Relays: Types and their Roles

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**ABSTRACT:** A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The traditional electromechanical form of a relay uses an electromagnet to close or open the contacts, but relays using other operating principles have also been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays or safety relays.

Relays, utilizing electromagnetism, serve as vital switches in electronic circuits. They convert low-voltage signals into higher voltages, enabling control over various devices. This overview highlights their operation, switching between Normally Open (NO) and Normally Closed (NC) states upon input voltage application. While limited in powering high-consumption devices, relays find wide application in home appliances, electronic circuit protection, robotics, and more. Relays are indispensable for efficient electrical control in diverse fields.

**KEYWORDS:** Understanding the information, types & roles of electric relay

## I. INTRODUCTION

Image Relay is an automatic switch, which opens and closes the circuit electronically. It uses electromagnetism from small voltage to provide higher voltages. It has two basic contacts i.e. NO (Normally Open) and NC (Normally closed). When input voltage is applied across its coil, NC changes to NO and NO changes to NC. When input voltage is supplied, we say that the relay is energized. It has several features e.g. it can be used for switching smaller voltage to higher. However, it cannot be used in power-consuming devices. It has a wide range of applications. It can be used in home appliances, electronic circuits where there is a need of protection, robotics for controlling its motors for the proper motion and many more. A basic relay is given in the figure shown below.

A relay comprises of an electromagnet and a contact unit. The definition is: Activating the contact unit using electromagnetic attraction, which is produced when electric current exceeding the specified value flows to the electromagnet; the voltage and current (input signal) applied to the coil opens or shuts the contact. Relays used for i. as interfaces between control circuits and load circuits, ii. For signal multiplication, iii. For separation of direct current and

alternating current circuits, iv. Linking information. Function Numbers of pins Description 1 2 Normally closed contact 3 4 Normally open contact 5 6 Normally closed contact, time delay 7 8 Normally open contact, time delay 1 2 4 Changeover contact 5 6 8 Changeover contact, time delay A1 A2 The coil terminals ( common ) relay contacts are either normally open (NO) or Normally closed (NC), The term “normally” refers to the state in which the coil is not energized. Relays can have many independent contacts, some NO and others NC and each contact can be used in a different circuit for a different task, When the coil is energized, all NO contacts belonging to that relay close, whereas all NC contacts open.

## II. RELATED WORK

A Relay is a simple electromechanical switch. While we use normal switches to close or open a circuit manually, a Relay is also a switch that connects or disconnects two circuits.

Instead of a manual operation, a relay uses an electrical signal to control an electromagnet, which in turn connects or disconnects another circuit.

- Relay works on the principle of electromagnetic induction.
- When the electromagnet is applied with some current, it induces a magnetic field around it. Image shows working of the relay. A switch is used to apply DC current to the load.
- In the relay, Copper coil and the iron core acts as electromagnet.
- When the coil is applied with DC current, it starts attracting the contact as shown. This is called energizing of relay.
- When the supply is removed it retrieves back to the original position. This is called De energizing of relay.

## III. METHODOLOGY

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The traditional electromechanical form of a relay uses an electromagnet to close or open the contacts, but relays using other operating principles have also been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems, these functions are performed by digital instruments still called protective relays or safety relays.

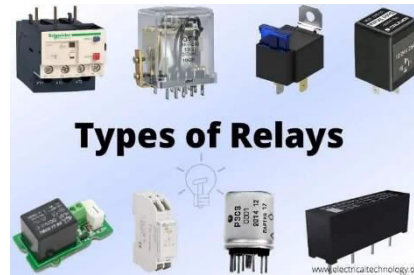
Latching relays require only a single pulse of control power to operate the switch persistently. Another pulse applied to a second set of control terminals, or a pulse with opposite polarity, resets the switch, while repeated pulses of the same kind have no effects. Magnetic latching relays are useful in applications when interrupted power should not affect the circuits that the relay is controlling.

## IV. EXPERIMENTAL RESULTS

### Role of Electrical Relays in Circuit Protection:

Before we dive into the details, let's first grasp the essence of electrical relays. In simple terms, a relay is an electromechanical device that either opens or closes a circuit in response to the flow of current. Think of them as the 'traffic cops' of the electrical realm, guiding the current flow to avert traffic (current) jams that could result in accidents (short circuits and appliance damage).

- Overcurrent Protection: The relay operates when the current passing through the circuit exceeds a predetermined limit. It automatically interrupts the circuit, thereby preventing any potential damage to the connected appliances.
- Voltage Regulation: Electrical relays regulate voltage levels to guarantee that the connected equipment receives a stable, non-detrimental voltage supply.
- Switching Operations: They facilitate the control of high-power circuits using low-power signals without the need for physical intervention

**Types of relays:**

The types of the electric relays are as follows:

1. Electromagnetic relay
2. Earth Fault Relay
3. Differential Relay
4. Latching relay
5. High voltage relay
6. Distance relay
7. Microprocessor-based relay
8. Sequence relay
9. Buchholz relay
10. Master Trip Relay

**V. CONCLUSION**

In summary, relays provide an efficient solution for remotely controlling circuits by leveraging electromagnetic induction. Their simple design and reliable operation make them essential components in diverse applications, from household appliances to industrial machinery.

We understand what a relay is, working of relay module, relay contact types and different types of relays and roles in the electric circuit protection of relay. We have seen relay works on the principle of electromagnetic attraction when it gets energized it operates according to the signal given.

Nowadays, this signal is given by the micro-controllers or microprocessors. These relays are also used in power system operation to detect and prevent the fault.

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