



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

19EET304/ IOT FOR ELECTRICAL SCIENCES

III YEAR VI SEM

UNIT 4 – ACTIVATION DEVICES

TOPIC 5 – Relay and power Contactor



Consider an example,



Find the Difference





What is a Relay?

Relay is a simple electromagnetic switch which makes or breaks the electric connection between the power supply and the load. A typical relay uses an electric signal to control an electromagnet, which operates the armature of the relay for making or breaking the connection.

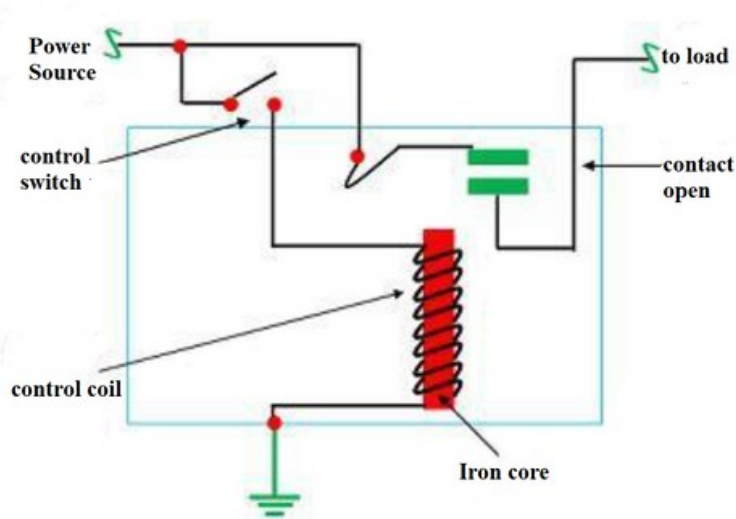
What is a Contactor?

A **contactor** is an electromagnetic switch which is designed to make or break the connection between the electric power supply and the load. In practice, The contactors are mainly used to control the high power-consuming devices because they offer heavy-duty contacts so as to provide safe switching of power circuits.



Relay Construction

<https://www.electronicshub.org/what-is-relay-and-how-it-works/>



Relay Construction

Relays can be of different types like electromechanical, solid state.

Electromechanical relays are frequently used

Although many different types of relay were present, their working is same.

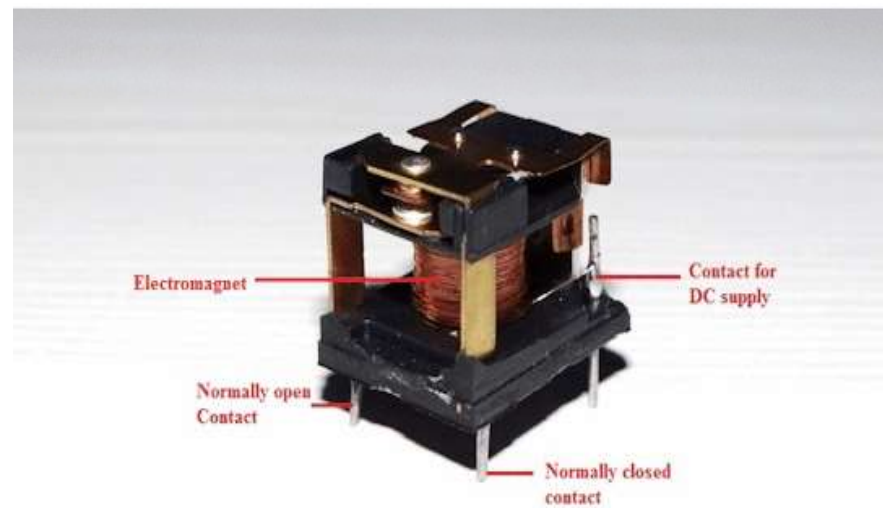
Every electromechanical relay consists of an consists of an

- Electromagnet
- Mechanically movable contact
- Switching points and
- Spring




Relay Construction

Electromagnet is constructed by wounding a copper coil on a metal core. The two ends of the coil are connected to two pins of the relay as shown. These two are used as DC supply pins.



Relay Construction

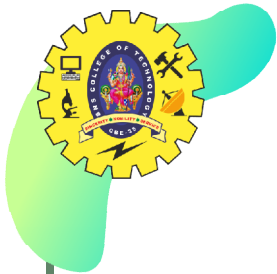


Generally two more contacts will be present, called as switching points to connect high ampere load. Another contact called common contact is present in order to connect the switching points.

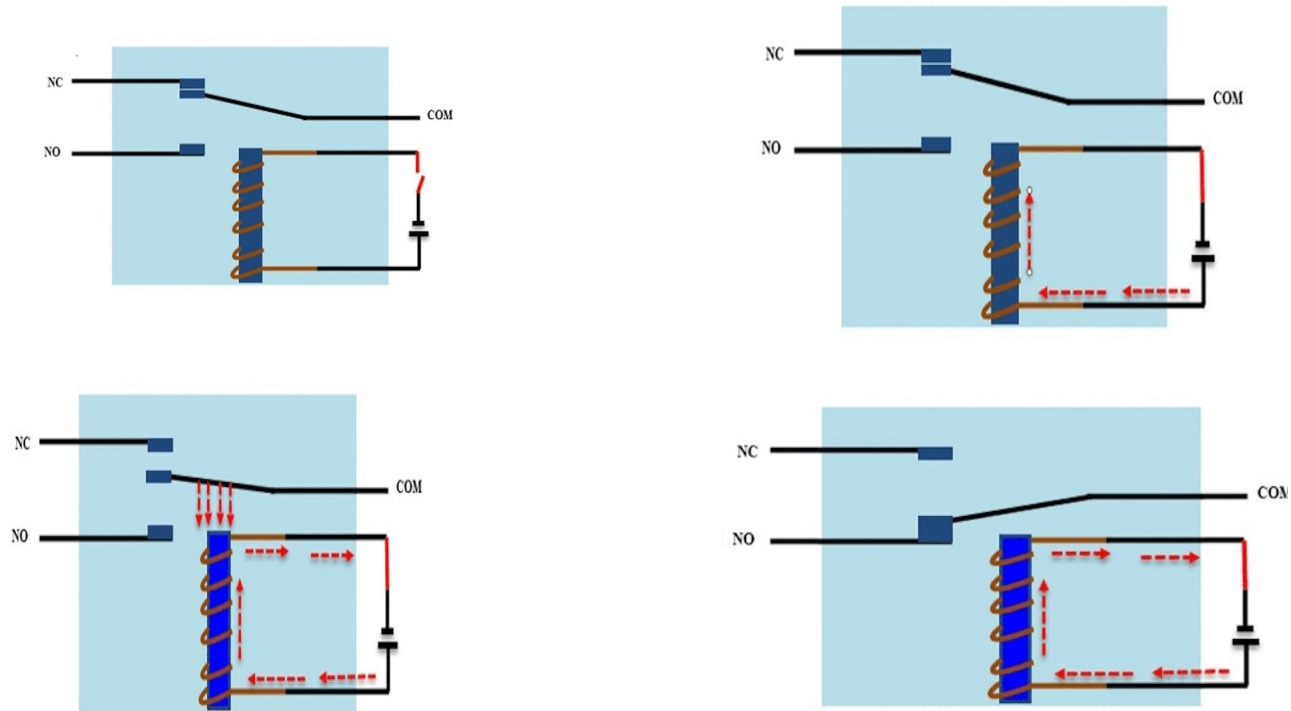
These contacts are named as normally open (NO), normally closed (NC) and common (COM) contacts.

We can use a Relay either in a AC circuit or a DC Circuit. In case of AC relays, for every current zero position, the relay coil gets demagnetized and hence there would be a chance of continuous breaking of the circuit.

So, AC relays are constructed with special mechanism such that continuous magnetism is provided in order to avoid above problem. Such mechanisms include electronic circuit arrangement or shaded coil mechanism.



How a Relay Works?



How a Relay Works?

- Relay works on the principle of electromagnetic induction.
- When the electromagnet is applied with some current, it induces a magnetic field around it.
- Above 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.



Relay Contact Types

- There are also such relays, whose contacts are initially closed and opened when there is supply i.e. exactly to opposite to the above shown relay.
- Solid state relays will have sensing element to sense the input voltage and switches the output using opto-coupling.
- Relay is a switch. The terminology “Poles and throws” is also applicable for relay. Depending on the number of contacts and number of circuits it switches relays can be classified.

Poles and Throws

- Relays can switch one or more circuits. Each switch in relay is referred as pole. Number of circuits a relay connects is indicated by throws.
- Depending on the poles and throws, relays are classified into
 - Single Pole Single Throw
 - Single Pole Double Throw
 - Double Pole Single Throw
 - Double Pole Double Throw

Poles and Throws



Single Pole Single Throw

- A single pole single throw relay can control one circuit and can be connected to one output. It is used for the applications which require only ON or OFF state.

•Single Pole Double Throw

- A single pole double throw relay connects one input circuit to one of the two outputs. This relay is also called as changeover relay.

- Though the SPDT has two output positions, it may consist of more than two throws depends on the configuration and requirement of the application.

•Double pole single throw

- A double pole single throw relay has two poles and single throw and it can be used to connect two terminals of a single circuit at a time. For example, this relay is used for connecting both phase and neutral terminals to the load at a time.

Poles and Throws



Double pole single throw

A double pole single throw relay has two poles and single throw and it can be used to connect two terminals of a single circuit at a time. For example, this relay is used for connecting both phase and neutral terminals to the load at a time.


Double pole double throw

A DPDT (double pole double throw) relay has two poles and two throws for each pole. In motor direction control, these are used for phase or polarity reversal.

The switching action between contacts for all these relays is performed when the coil get energized.



Types of Relays



Relays can be classified into different types depending on their functionality, structure, application etc. We listed out some of the common types of relays here.

Electromagnetic

Latching

Electronic

Non-Latching

Reed

High-Voltage

Small Signal

Time Delay

Multi-Dimensional

Thermal

Differential

Distance

Automotive



Relay Applications

Relays are used to protect the electrical system and to minimize the damage to the equipment connected in the system due to over currents/voltages. The relay is used for the purpose of protection of the equipment connected with it.

These are used to control the high voltage circuit with low voltage signal in applications audio amplifiers and some types of modems.



Relay Applications

These are used to control a high current circuit by a low current signal in the applications like starter solenoid in automobile. These can detect and isolate the faults that occurred in power transmission and distribution system. Typical application areas of the relays include

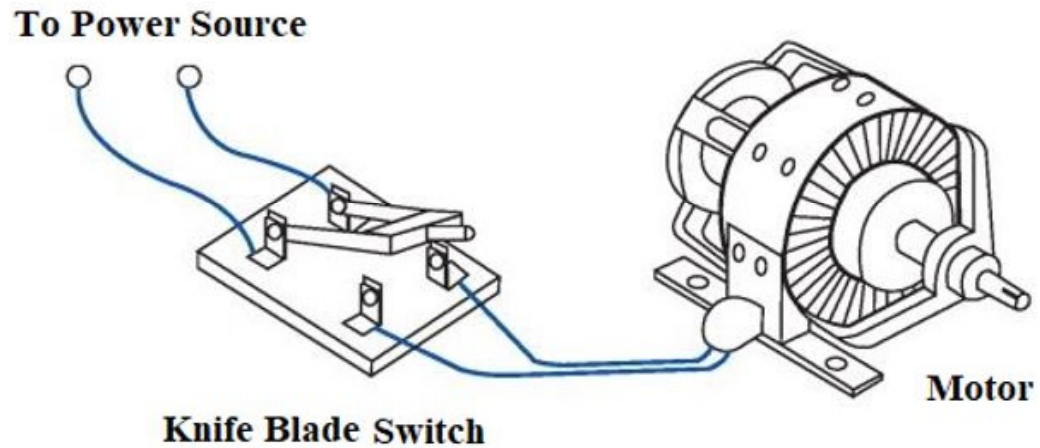
- Lighting control systems
- Telecommunication
- Industrial process controllers
- Traffic control
- Motor drives control
- Protection systems of electrical power system
- Computer interfaces
- Automotive
- Home appliances



ASSESSMENT - 1

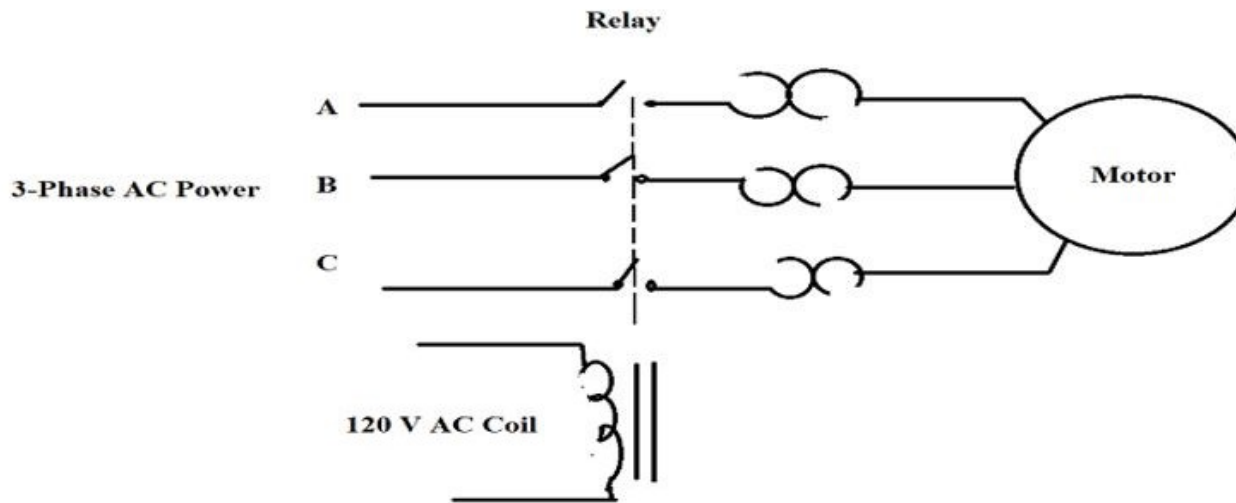


How to replace the switch by contactor



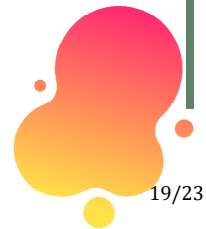
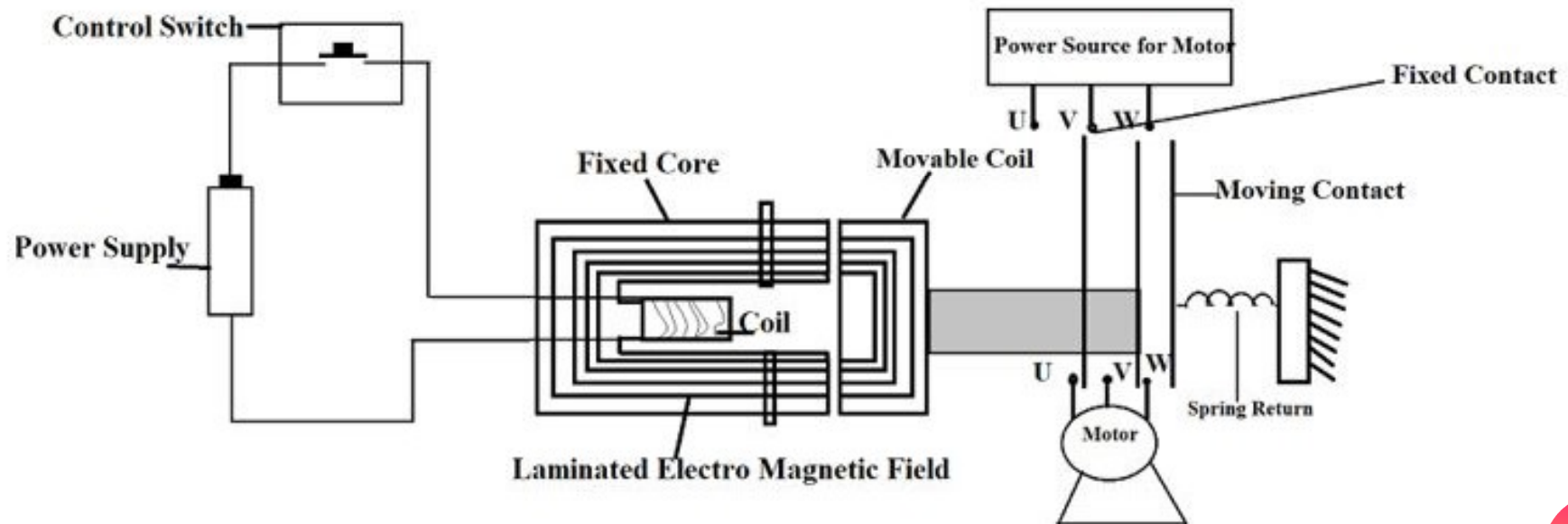


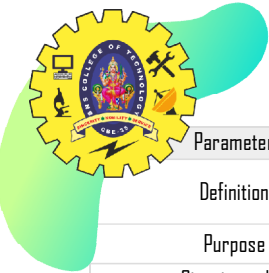
Construction of a Contactor





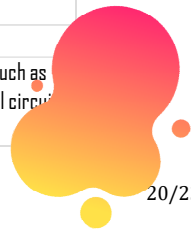
Working Principle of Contactors





Difference between Contactor and Relay

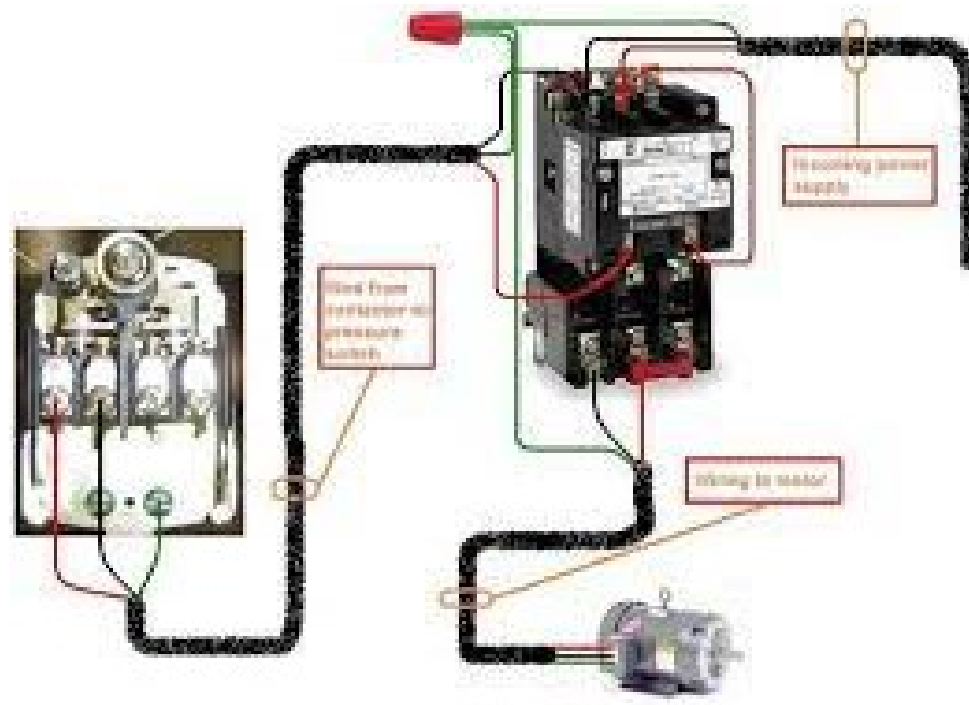
Parameter	Contactor	Relay
Definition	A contactor is an electrically operated switch which is designed to make or break the electrical power circuits.	A relay is an electromagnetic switch that is designed to operate electrically and used for switching the circuits by using low power signals.
Purpose	The switching of high voltage and current circuits is the main purpose of contactors.	The switching of low voltage and current circuits is the purpose of relays.
Circuit symbol		
Load capacity	The contactors are generally used for the switching of loads greater than 10 A.	The relays are generally used for switching of the loads of 10 A or less.
Voltage rating	Contactors are rated up to 1000 V.	The voltage ratings of relays are up to 250 V.
Power consumption	The size of electromagnet used in a contactor is large, thus it consumes more power.	The size of electromagnet used in a relay is relatively smaller in size, thus it requires less power to energize than a contactor.
Open & close contactor standards	Contactors are mostly designed to operate with normally open (NO) contacts. Thus, when the electromagnet of contactor is de-energized there is no connection.	Relays are commonly designed to have both normally open (NO) and normally closed (NC) contacts depending upon the application.
Auxiliary contacts	Contactors are often fitted with some auxiliary contacts that can be NO or NC. However, the auxiliary contacts are provided to perform additional functions related to control of the contactor.	A typical relay does not have any auxiliary contacts.
Switching speed	For the same application, the switching speed of a contactor is slow.	The switching speed of a relay is relatively more.
Suitability	Contactors are suitable for switching of both control and power circuits.	Relay is suitable for control circuits only.
Size	The physical size of a contactor is relatively larger.	The size of a relay is smaller than a contactor.
Spring loaded contacts	As contactors are used for switching high power loads, thus they should contain spring loaded contacts to ensure the circuit is broken when de-energized to provide additional safety.	The use of spring loaded contacts is much less common in relays because they are used in low power switching applications.
Arc suppression	Arc suppression is provided in contactors because they carry high power loads.	As the relays are not designed for high power applications, thus the arcing is not a concern and hence, the arc suppression feature is commonly not used in relays.
Overload safety	Overload safety is provided in contactors that interrupts the circuit if the current exceeds a set threshold for a selected period of time (usually 10 to 30 seconds). This helps to protect the equipment from damages due to high currents.	The overload safety is not generally provided in case of relays.
Safety	Contactors provide more safety measure in the circuit.	Relays provides less safety to the circuit.
Cost	Contactors are expensive devices.	Relays are less expensive than contactors.
Applications	Contactors can be used for switching of 1-phase as well as 3-phase loads such as motor power circuits, motor starters, switching circuit of capacitor banks, magnetic starters, etc.	The relays are mostly used in control circuits of single phase loads such as protection systems, control circuit of circuit breakers, motor control circuit etc.





ASSESSMENT - 2

Find the Process



References



- <https://www.elprocus.com/what-is-contactor-construction-types-and-applications/>
- <https://www.electricaltechnology.org/2020/06/electrical-contactor.html>
- <https://www.electricalclassroom.com/contactor-working-application-types/>
- <https://realpars.com/contactor/>





Thank You

