

Module - 1

## Introduction to Electrical Control Systems

Lecture - 2

### Introduction to Control System Components

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EEET 221 : Electrical Control Systems.

EEET 221 Electrical Control System.

## Outcomes

- List basic components of an electrical control system
- Identify different components and read schematic diagram and symbols

## Introduction

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- Every electrical control system consists of a number of basic components connected together to achieve the desired performance.
- The size of components varies with the power of motor, but principle of operation remain the same.
- Using these basic components, very complex control systems can be designed.

## Basic Components

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- Disconnecting Switches
- Manual circuit breaker
- CAM switches
- Push buttons
- Control relays
- Thermal relays
- Magnetic contactors
- Pilot lights
- Limit switches
- Special switches

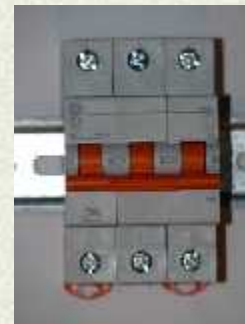
## Disconnecting switches

- ❑ Disconnecting switch isolates the motor circuit from the power source.
- ❑ It consists of three knife switches and three line fuses enclosed in a metallic box.
- ❑ The knife switches open and close simultaneously by means of external handle.
- ❑ An interlocking mechanism prevents the hinged cover from opening when switch is closed.
- ❑ These switches are designed to carry full load current indefinitely and to withstand short circuit currents for short period of time.



## Manual circuit breaker

- ❑ A manual circuit breaker opens and closes a circuit like a toggle switch.
- ❑ It trips (opens) automatically when the current exceeds a predetermined limit.
- ❑ After opening it can be reset manually.
- ❑ Circuit breakers are often used instead of disconnecting switches because no fuses have to be replaced.



### ■ CAM switches

- CAM switch has a group of fixed contacts and an equal number of moveable contacts.
- The contacts can be made to open and close in a preset sequence by rotating a handle or knob.



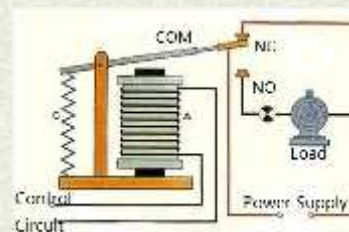
### ■ Push buttons

- A push button is a switch activated by finger pressure. Two or more contacts open or close when the button is depressed.
- Push buttons are usually spring loaded so as to return to their normal position when pressure is removed.



## Control Relays

- A control relay is an electromagnetic switch that opens and closes a set of contacts when a so called relay coil is energized.
- The coil produces a strong magnetic field which attracts a moveable armature bearing the contacts.
- Control relays are mainly used in low-power circuits.
- They include time delay relays whose contact open or close after a definite time interval.



### ■ Magnetic contactors

- A magnetic contactor is basically a large control relay designed to open and close a power circuit.
- It possesses a relay coil which activates a set of contacts.
- Magnetic contactors are used to control motors ranging from 0.5 hp to several hundred horse power.



### ■ Pilot lights

- A pilot light indicates the ON/OFF state of a remote component in a control system.



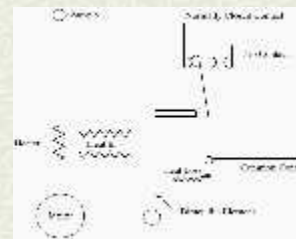
### ■ Limit switches and special switches

- A limit switch is low-power snap action device which opens or closes a contact depending upon the position of mechanical part.
- Other limit switch are sensitive to pressure, temperature liquid level, direction of rotation



### ■ Thermal relays

- A thermal relay (or overload relay) is a temperature sensitive device whose contacts open or close when motor current exceeds a preset limit. The current flows through a small calibrated heating element which raises the temperature of the relay.

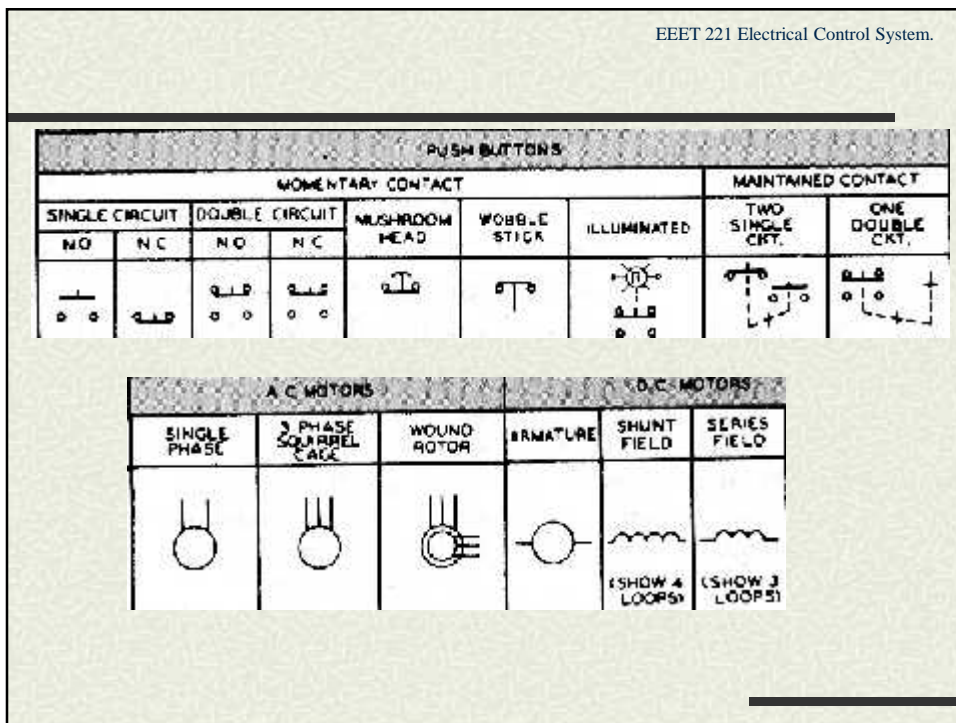
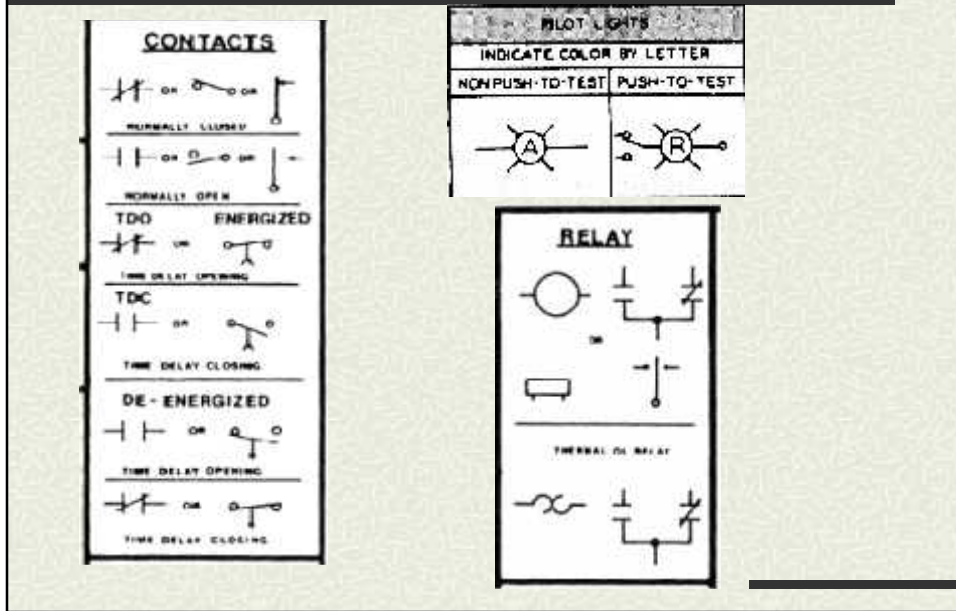


## Control System **Diagrams and Symbols**

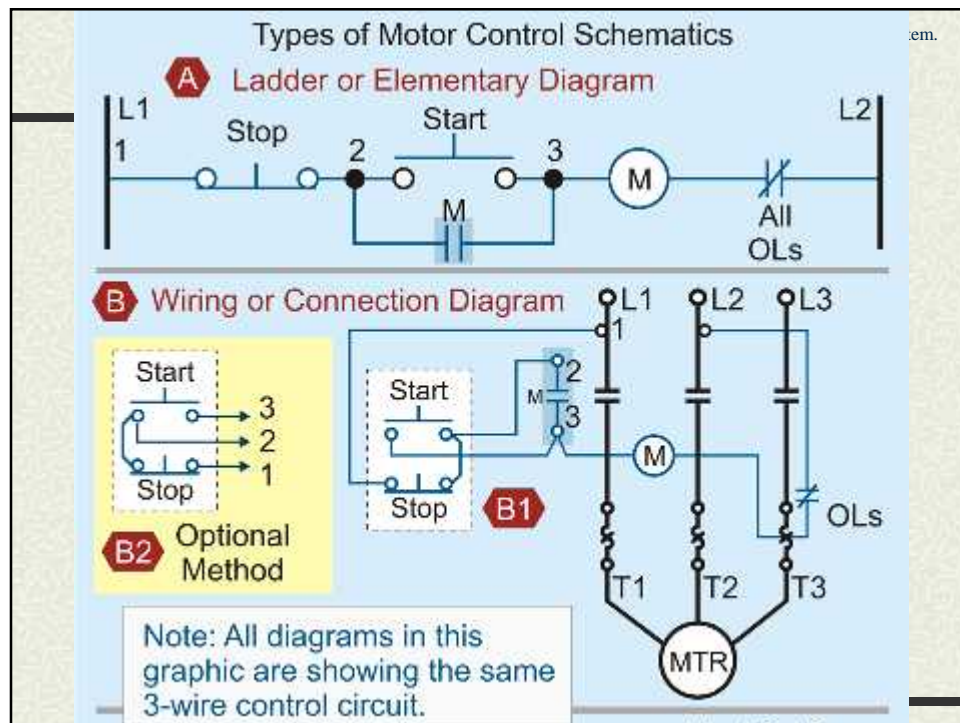
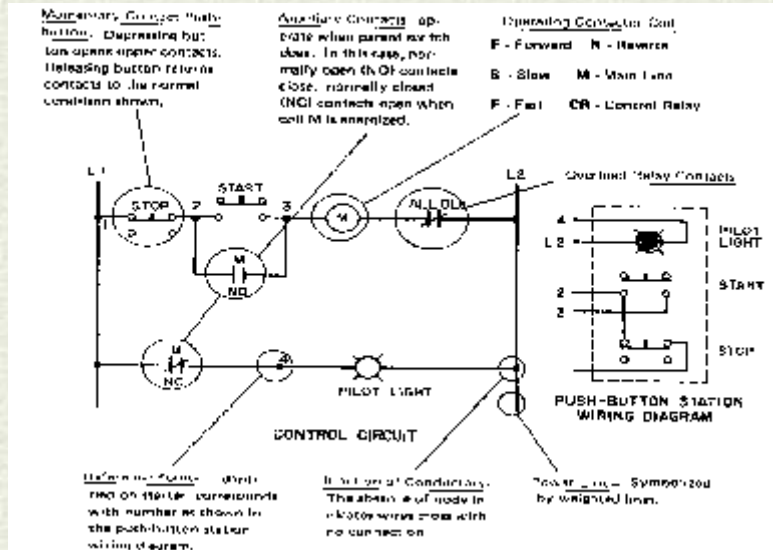
- The electrical diagram shows the electrical relationship of the components and not how they physically appear in the equipment.
- Graphic symbols are used as a shorthand means of illustrating and defining elements and functions of an electrical circuit.
- There are two types of diagrams
  - Wiring diagrams include all the devices in the system and show the physical relationships between the devices.
  - Line diagrams also represent the circuit but do not show a physical relationship between the devices.
- Standards
  - National Electrical Manufacturers Association (NEMA).
  - American Standards Association (ASA).
  - American National Standards Institution (ANSI)

EEET 221						TERMS		
<h1>Symbols</h1>						SPST - SINGLE POLE SINGLE THROW SPDT - SINGLE POLE DOUBLE THROW DPST - DOUBLE POLE SINGLE THROW DPDT - DOUBLE POLE DOUBLE THROW N. O. - NORMALLY OPEN N. C. - NORMALLY CLOSED		
						<b>SWITCHES</b>		
DISCONNECT	CIRCUIT INTERRUPTER	CIRCUIT BREAKER WITH THERMAL O.L.	CIRCUIT BREAKER WITH MAGNETIC O.L.	CIRCUIT BREAKER WITH THERMAL AND MAGNETIC O.L.	LIMIT SWITCHES		FOOT SWITCHES	
					NORMALLY OPEN	NORMALLY CLOSED	N.O.	N.C.
					HELD CLOSED	HELD OPEN		
PRESSURE & VACUUM SWITCHES		LIQUID LEVEL SWITCH		TEMPERATURE ACTUATED SWITCH		FLOW SWITCH (AIR, WATER, ETC.)		
N.O.	N.C.	N.C.	N.C.	N.O.	N.C.	N.O.	N.C.	

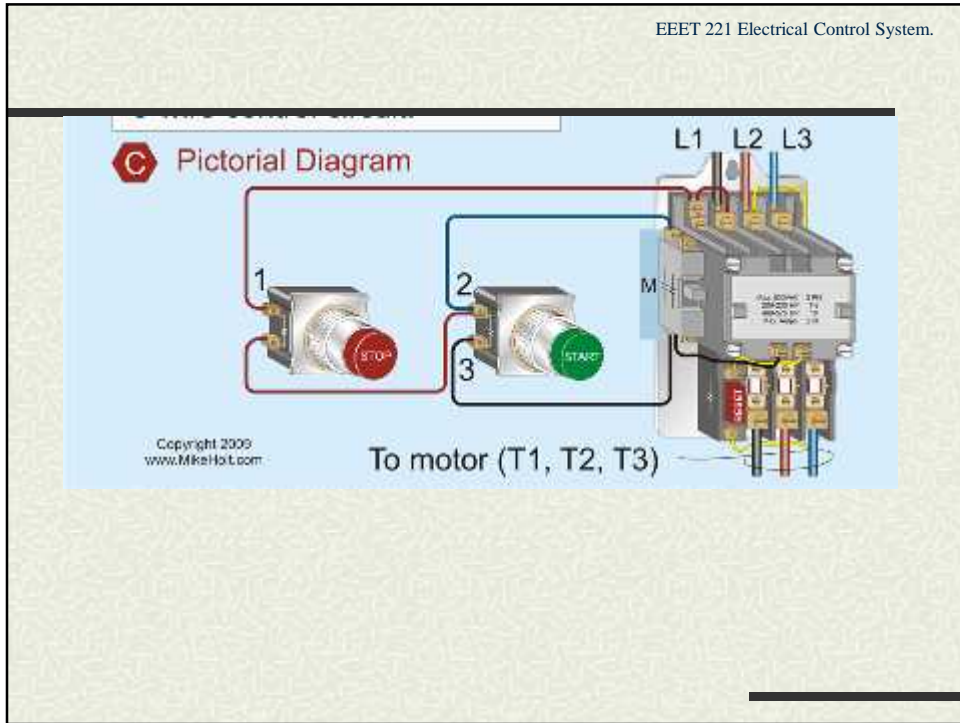
# Symbols ...



# Line Diagram and Wiring Diagram







## Abbreviations

Function or device	Abbreviation	Function or device	Abbreviation
Ammeter	A	Wattmeter	W
Centrifugal Switch	CS	Disconnect Switch	DS
Circuit Breaker	CB	Contactors	C
Control Relay	C R	Voltmeter	V
Current Transformer	CT	Pressure Switch	PS
Overload	OL	Pushbutton	PB
Float Switch	FS	Resistor	R
Fuse	FU	Reactor	X
Limit Switch	LS	Selector Switch	SS
Transformer	T	Silicon-controlled Rectifier	SCR
Squirrel-cage Induction Motor	SCIM	Wound-rotor Induction Motor	WRIM