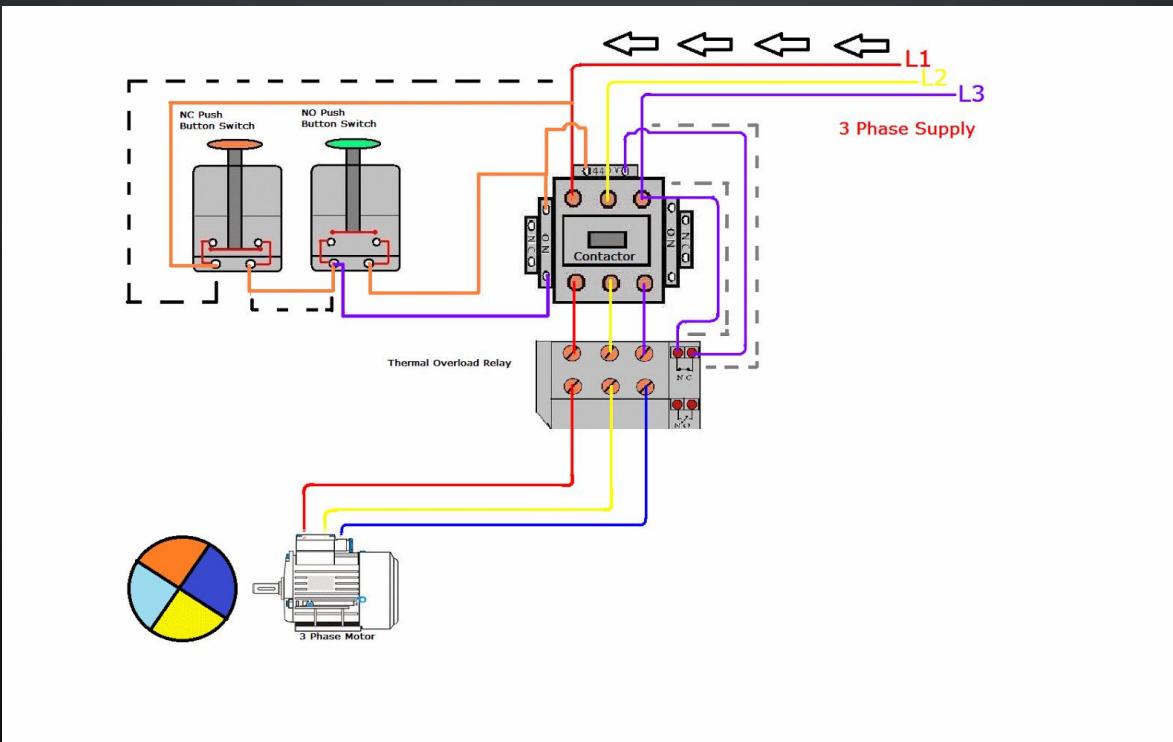


ELECTROMECHANICAL SYSTEM

CHAPTER 4: MOTOR CONTROL CIRCUITS - INTRODUCTION
TO POWER CIRCUITS

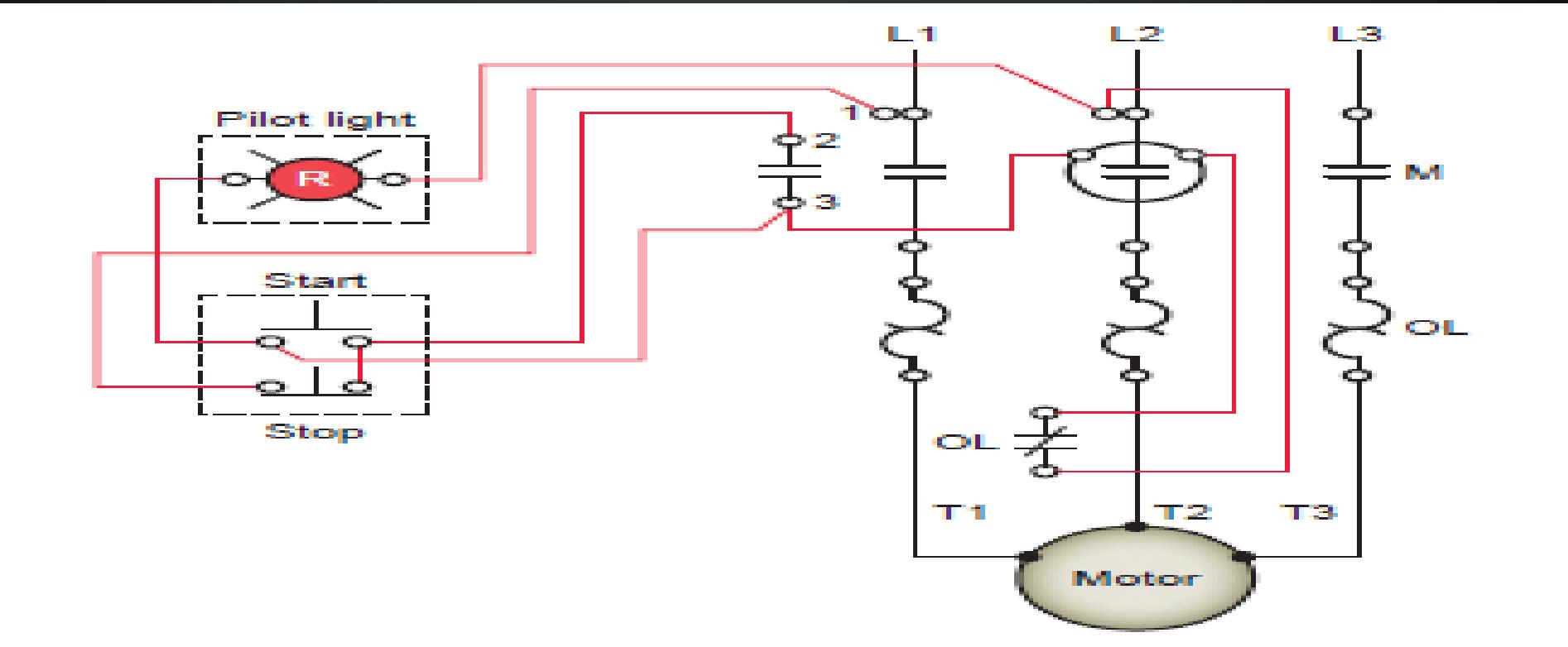
MOTOR CONTROL

A MOTOR CONTROL CIRCUIT CAN BE DEFINED AS A MEANS OF SUPPLYING POWER TO AND REMOVING POWER FROM A MOTOR.



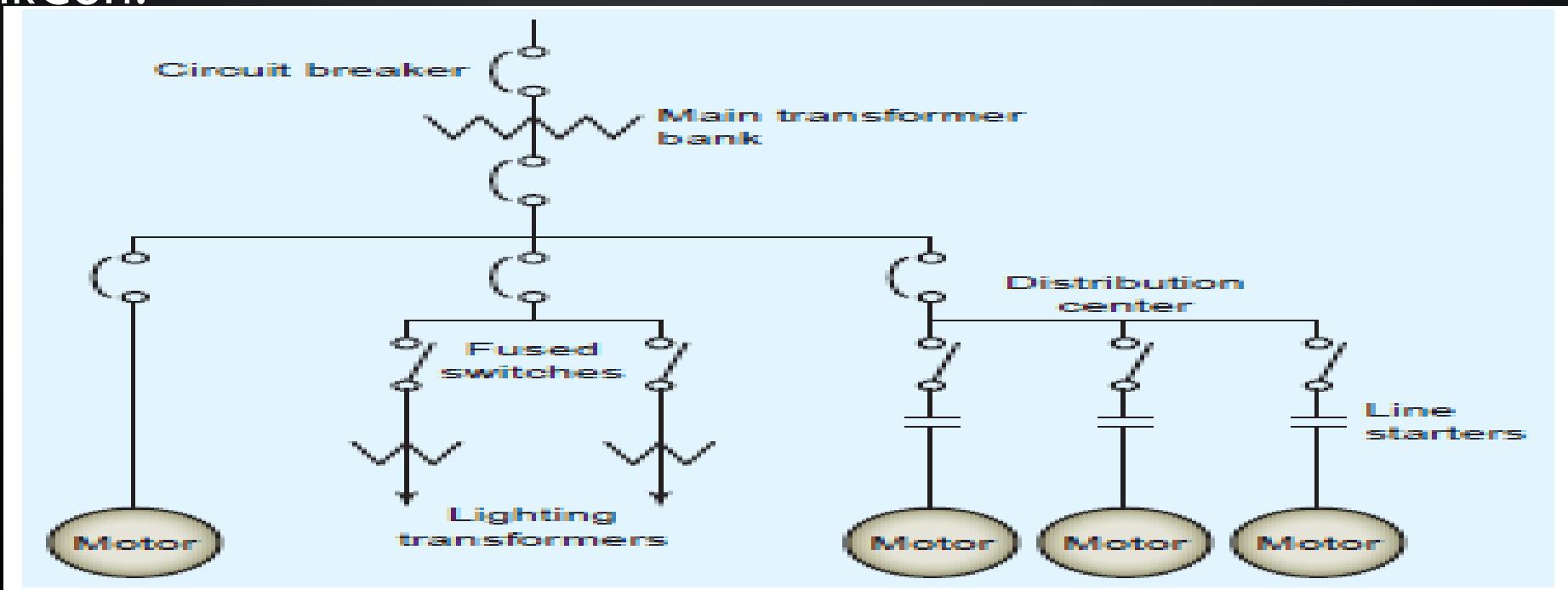
TYPES OF MOTOR CONTROL CIRCUIT DIAGRAMS

1. WIRING DIAGRAMS - GIVES THE NECESSARY INFORMATION FOR ACTUALLY WIRING UP A DEVICE OR GROUP OF DEVICES FOR PHYSICALLY TRACING WIRES IN TROUBLESHOOTING. HOWEVER, IT IS DIFFICULT TO DETERMINE CIRCUIT OPERATION FROM THIS TYPE OF DRAWING.



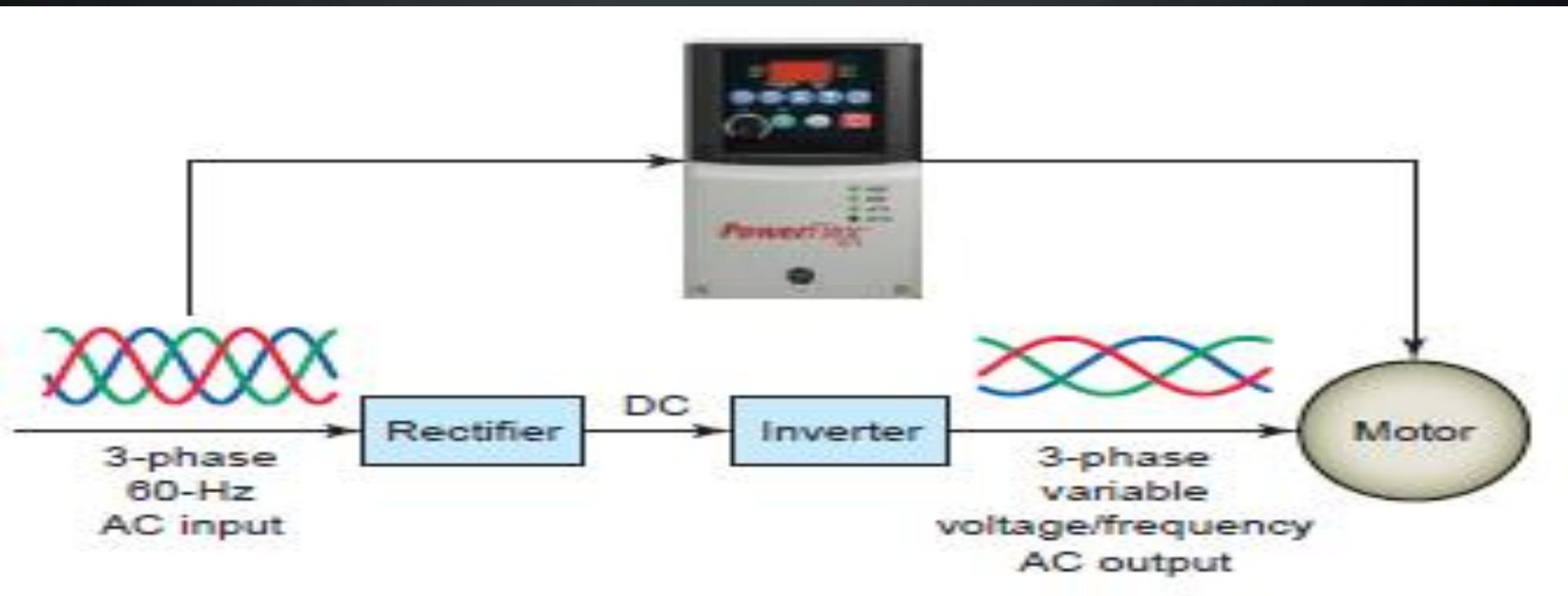
TYPES OF MOTOR CONTROL DRAWINGS

2. SINGLE-LINE DIAGRAMS - (ALSO CALLED A ONE-LINE) DIAGRAM USES SYMBOLS ALONG WITH A SINGLE LINE TO SHOW ALL MAJOR COMPONENTS OF AN ELECTRIC CIRCUIT. THE INSTALLATION IS REDUCED TO THE SIMPLEST POSSIBLE FORM, YET IT STILL SHOWS THE ESSENTIAL REQUIREMENTS AND EQUIPMENT IN THE CIRCUIT.



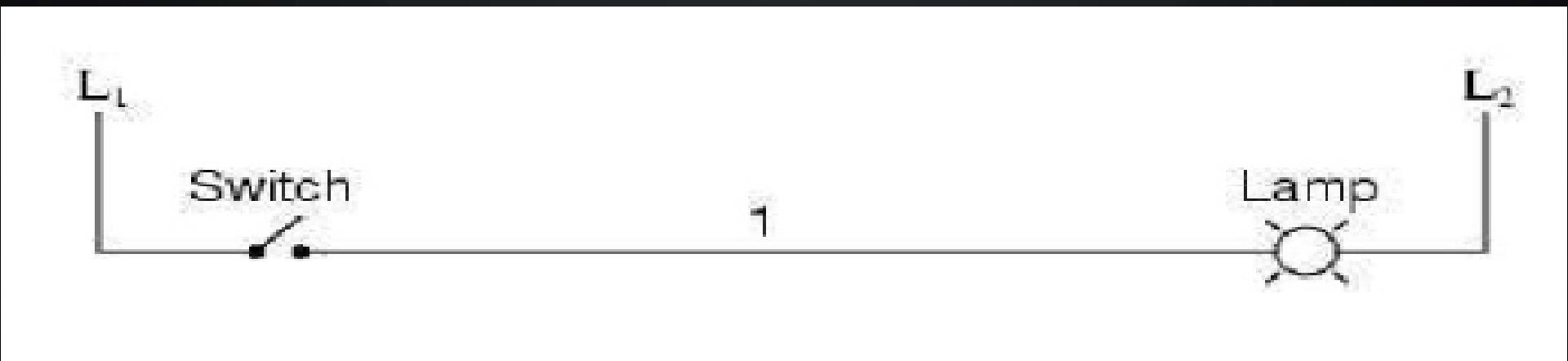
TYPES OF MOTOR CONTROL DRAWINGS

3. BLOCK DIAGRAM - represents the major functional parts of complex electrical/electronic systems by blocks rather than symbols. Individual components and wires are not shown. Instead, each block represents electrical circuits that perform specific functions in the system.



TYPES OF MOTOR CONTROL DRAWINGS

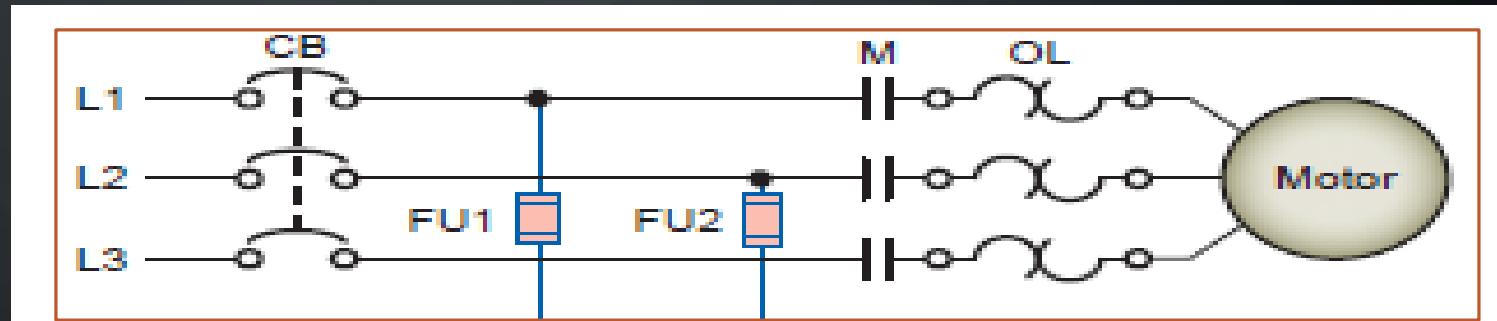
- 4. LADDER DIAGRAM - FOCUSES ON THE ELECTRICAL OPERATION OF A CIRCUIT, NOT THE PHYSICAL LOCATION OF A DEVICE. THEY ARE CALLED "LADDER" DIAGRAMS BECAUSE THEY RESEMBLE A LADDER, WITH 2 VERTICAL RAILS (SUPPLY POWER) AND AS MANY "RUNGS" (HORIZONTAL LINES) AS THERE ARE CONTROL CIRCUITS TO REPRESENT.
 - ALSO USED IN ELECTRO-PNEUMATICS, ELECTRO-HYDRAULICS AND PLC PROGRAMMING.



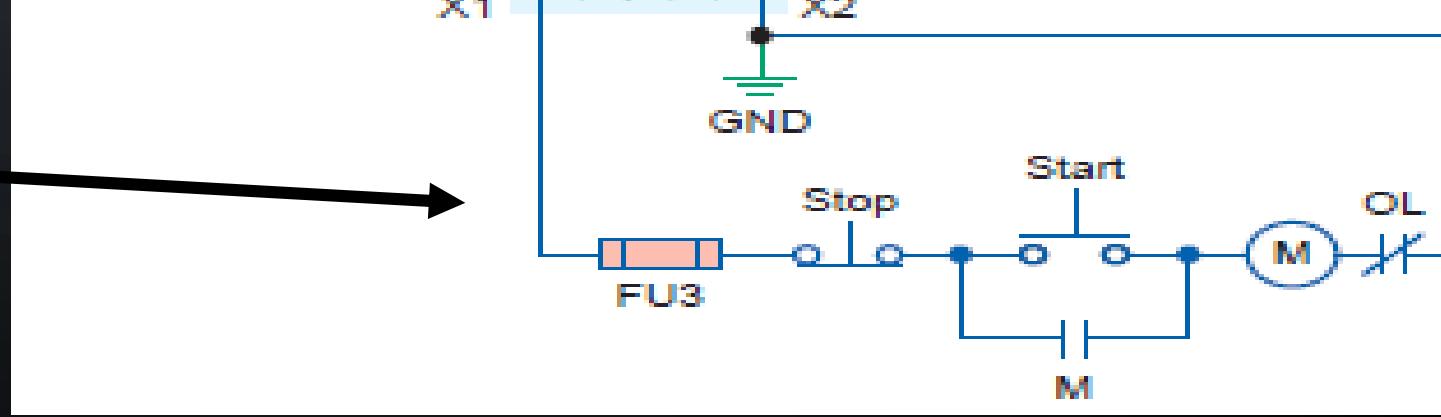
TYPES OF MOTOR CONTROL DRAWINGS

4. LADDER DIAGRAM – MOTOR CONTROL LADDER DIAGRAM HAS TWO PARTS

POWER CIRCUIT



CONTROL CIRCUIT



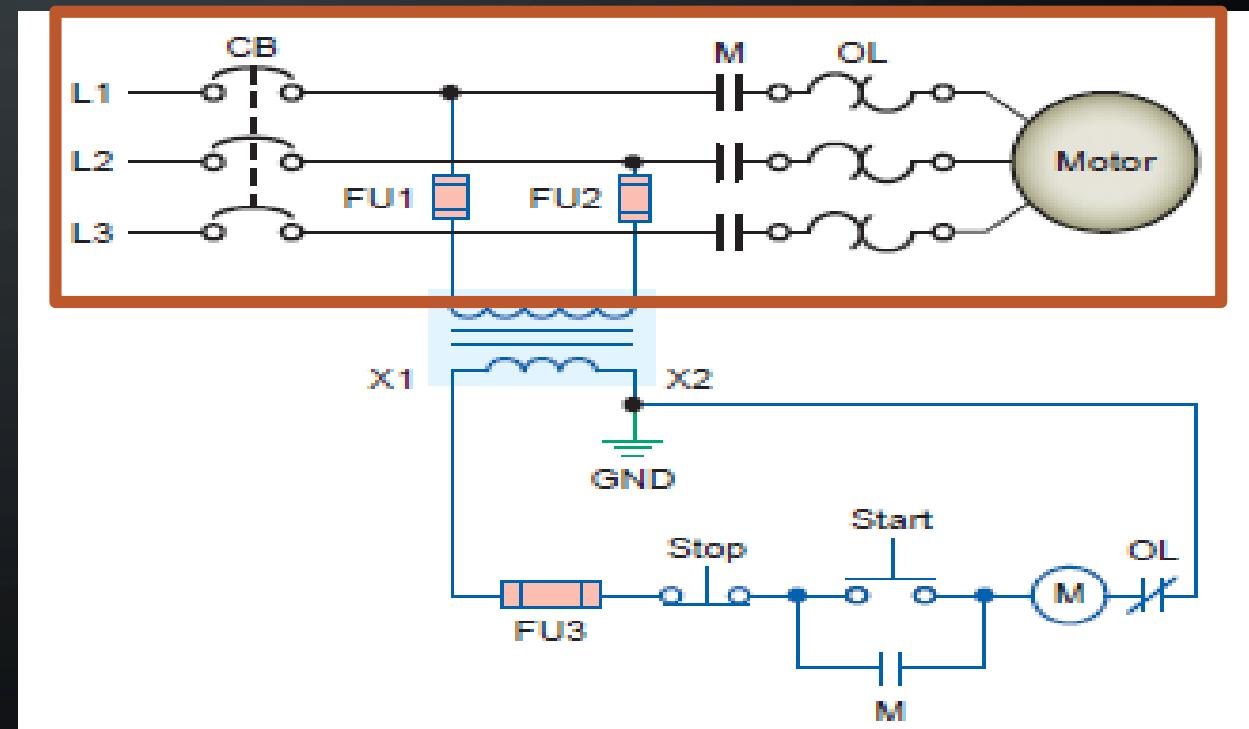
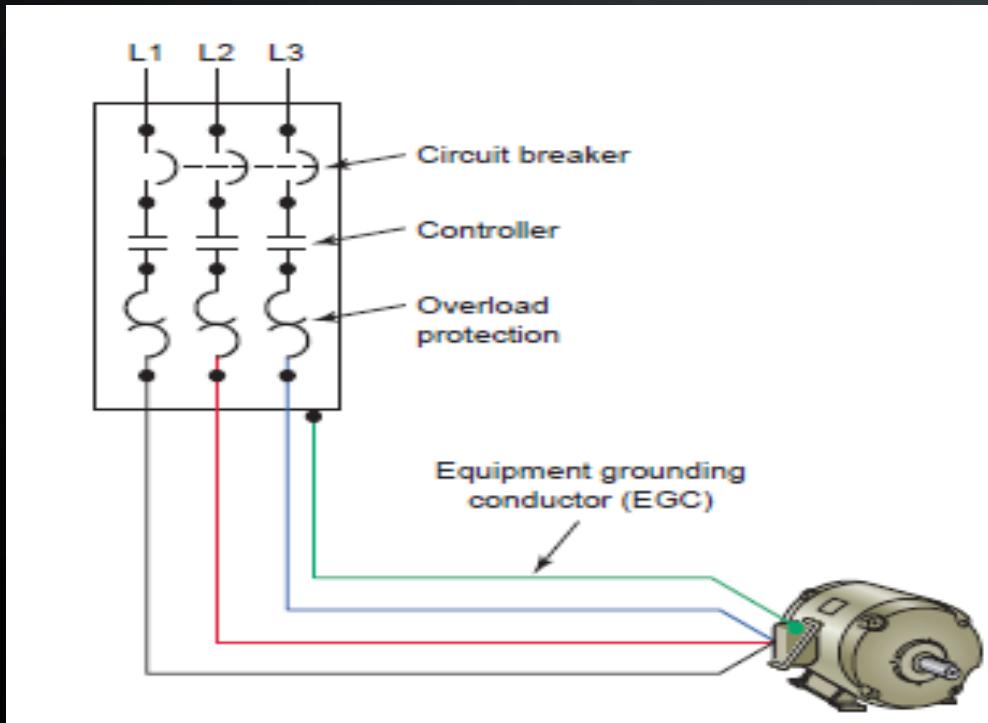
TYPES OF MOTOR CONTROL DRAWINGS

4. LADDER DIAGRAM

POWER CIRCUIT – DRAWN WITH A HEAVY LINE, IS THE CIRCUIT THAT SUPPLIES POWER TO THE MOTOR

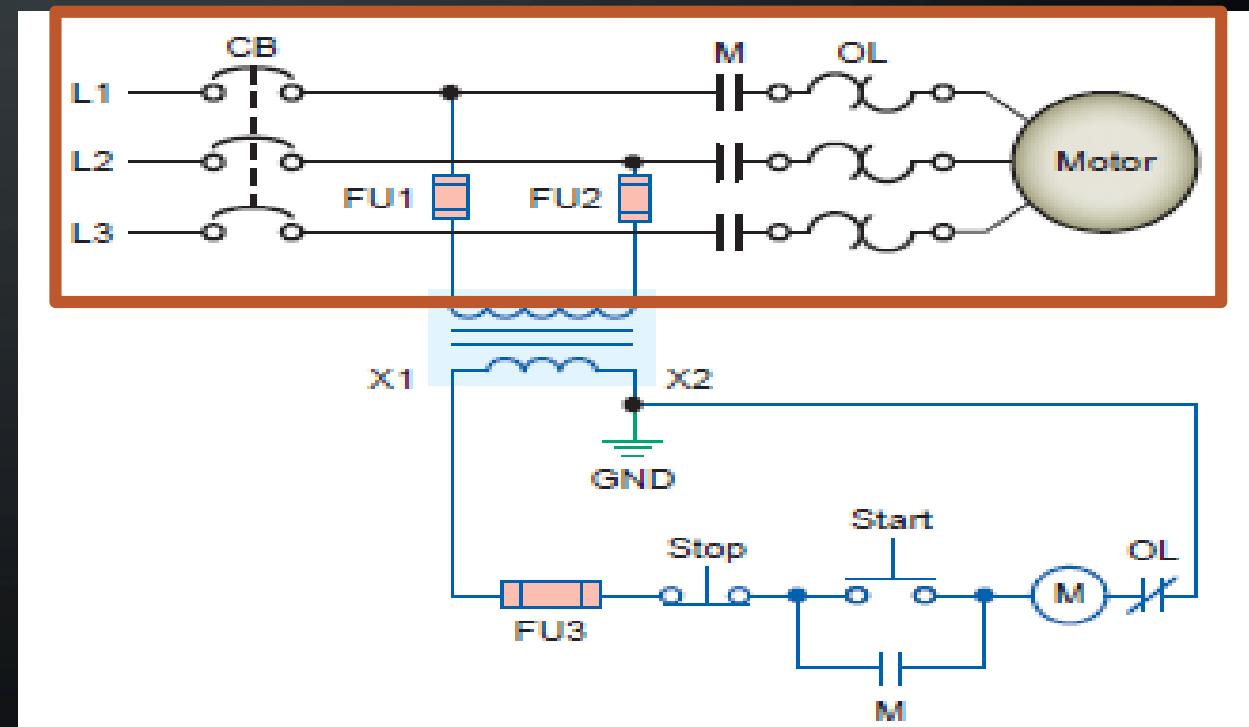
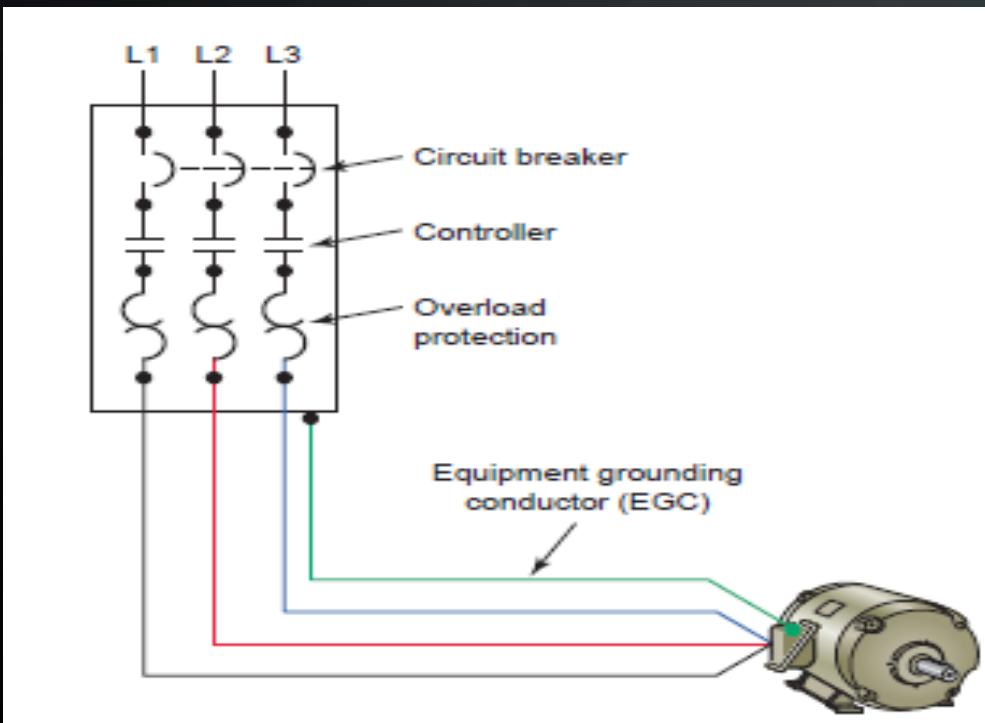
CONTROL CIRCUIT – DRAWN WITH A LIGHT LINE, CONTROLS THE DISTRIBUTION OF POWER

POWER CIRCUIT - DRAWN WITH A HEAVY LINE, IS THE CIRCUIT THAT SUPPLIES POWER TO THE MOTOR
- CONNECTED TO THE DISTRIBUTION PANEL AND PARTS CONSIST OF CIRCUIT BREAKER W/ FUSE, MOTOR STARTER AND THE MOTOR



REVERSING THE DIRECTION OF ROTATION

THE DIRECTION OF CURRENT IS CONTROLLED BY THE POLARITY OF THE VOLTAGE. SO IN ORDER TO CHANGE THE DIRECTION OF ROTATION, WE CAN SIMPLY REVERSE THE VOLTAGE, CAUSING THE CURRENT TO FLOW IN THE OPPOSITE DIRECTION, CHANGING THE FORCE BY 180 DEGREES AND THE MOTOR TO BE DRIVEN 'BACKWARDS'.



MOTOR CONTROL CENTERS (MCCs)

A MOTOR CONTROL CENTER IS AN ASSEMBLY PRIMARILY OF MOTOR CONTROLLERS HAVING A COMMON BUS. THE STRUCTURE SUPPORTS AND HOUSES CONTROL UNITS, A COMMON BUS FOR DISTRIBUTING POWER TO THE CONTROL UNITS, AND A NETWORK OF WIRE TROUGHS FOR ACCOMMODATING INCOMING AND OUTGOING LOAD AND CONTROL WIRES.

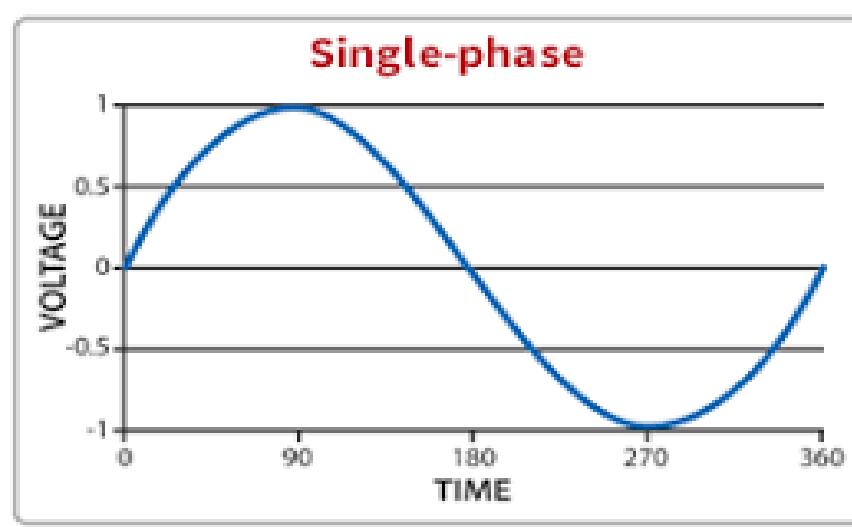


SINGLE PHASE AND THREE PHASE AC POWER SUPPLY

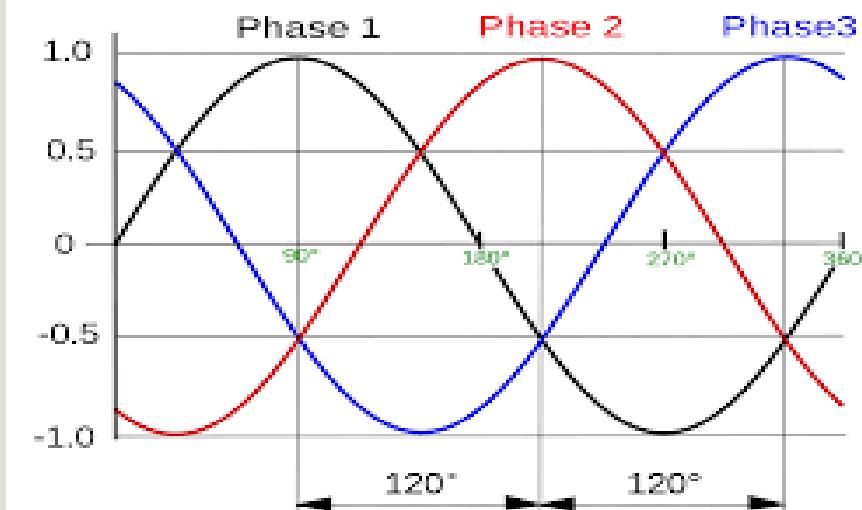
- PHASE IN ELECTRICITY IS THE CURRENT OR THE VOLTAGE AMONG AN EXISTING WIRE AS WELL AS A NEUTRAL CABLE. PHASE MEANS THE DISTRIBUTION OF LOAD, IF A SINGLE WIRE IS USED, AN ADDITIONAL LOAD WILL OCCUR ON IT & IF THREE WIRES ARE USED THEN LOADS WILL BE SEPARATED BETWEEN THEM.
- THE MAIN DIFFERENCE BETWEEN THESE SINGLE AND THREE PHASE SUPPLIES IS THE RELIABILITY OF DELIVERY.

SINGLE PHASE AND THREE PHASE AC POWER SUPPLY

Single Phase



Three Phase



BOTH THREE-PHASE AND SINGLE-PHASE DEVICES CAN BE POWERED FROM A THREE-PHASE SUPPLY. A THREE-PHASE CIRCUIT IS COMBINATION OF THREE SINGLE PHASE CIRCUITS.

SINGLE PHASE AND THREE PHASE AC POWER SUPPLY

SINGLE PHASE	THREE PHASE
<ul style="list-style-type: none">SINGLE PHASE POWER HAS ONLY ONE SINE WAVE VOLTAGESINGLE PHASE POWER NEEDS ONLY TWO WIRES TO COMPLETE THE CIRCUITTHIS POWER SUPPLY IS APPLICABLE FOR HOMES AS WELL AS BUSINESSES.USED TO SUPPLY PLENTY OF POWER FOR HOMES, AS WELL AS NONINDUSTRIAL BUSINESSES.THIS POWER SUPPLY IS SUFFICIENT TO RUN THE MOTORS UP TO ABOUT 5 HORSEPOWER (HP).	<ul style="list-style-type: none">THREE PHASE POWER USED THREE SEPARATE SINE WAVES THAT ARE OFFSET 120 DEGREES FROM EACH OTHERTHREE PHASE POWER NEEDS AT LEAST 3 WIRES, ONE FOR EACH PHASETHESE TYPES OF SUPPLIES ARE USED IN POWER GRIDS, MOBILE TOWERS, DATA CENTERS, AIRCRAFT, SHIPBOARD, UNMANNED SYSTEMS, AS WELL AS OTHER ELECTRONIC LOADS LARGER THAN 1000 WATTS.IT IS APPLICABLE TO INDUSTRIAL, MANUFACTURING, AND LARGE BUSINESSES.THESE ARE USED IN POWER-HUNGRY AND HIGH-DENSITY DATA CENTERS.

RELAY/CONTACTOR AND OVERLOAD RELAY

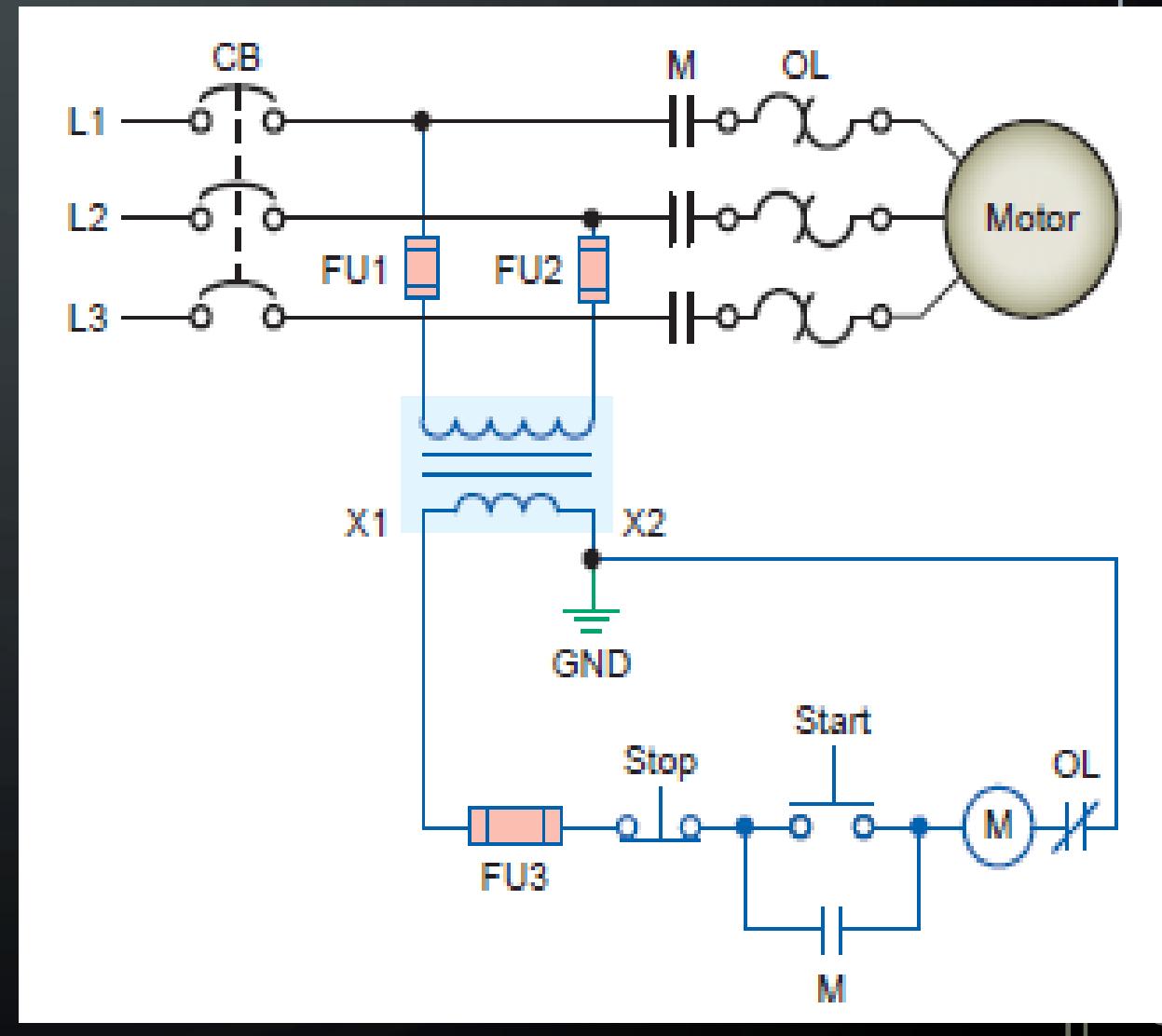
[https://drive.google.com/file/d/1h121bST9yMJcdMpKSB8OS4y1DXM8jE7u/v
iew?usp=sharing](https://drive.google.com/file/d/1h121bST9yMJcdMpKSB8OS4y1DXM8jE7u/view?usp=sharing)

RELAY/CONTACTOR VOLTAGE CHANGE SITUATIONS

SITUATION 1: CONTROL AND POWER CIRCUIT SUPPLY IS BOTH AC PHASE POWER

SITUATION 2: CONTROL CIRCUIT SUPPLY IS AC PHASE BUT SOME ELECTRICAL COMPONENTS ARE USING DC SUPPLY

SITUATION 3: CONTROL CIRCUIT SUPPLY IS 24V DC BUT SOME ELECTRICAL COMPONENTS ARE USING AC SUPPLY



END OF CHAPTER 4