EEE3112 ELECTRICAL ENGINEERING PRACTICE

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Course Syllabus

Electrical Drwaing:

- Electrical & Electronics Symbols
- Various ypes of Electrical & Electronics Diagrams
  -Electronics/Power Equipments/ Power Systems
- Views of Electrical Equipments

Design:

- Ratings/Specification of components/ equipment

Use of Measuring Instruments:

- Instruments for Electrical/Non-Electrical
- Instrument Specifications Range/ Resolution/Accuracy/Reliability/Linearity/Drift/Limitations
- Earthing, Source of errors, Error calculation
- Fault finding, Maintenance, Repair techniques

Course Syllabus

Static Mechanics

- Deflection of beams with concentrated/Distributed loading
- Torsional stresses/ twisting in circular shafts
- Helical, torsion,leaf springs
- Static equilibrium of coplanar
- 3-D force/ torque systems

Dynamic Mechanics

- Rotating Bodies moment of inertia of plane figures
- 3-dimensional symmetrical objects

Course Breakdown

- Assignments/Tutorials: 5 %
- Min Project: 9 %
- 6 Labs: 6 %
- 1 Mid Semester exam 20 %
- 1 Final Exam 60%

Total **100%**

NOTE: Attendance 80% to sit for Final Exam

Text Books

Prescribed Texts:

- Gregory.B.A., An Introduction to Electrical Instrumentation and Measurement Systems, 2rd Ed., 1981, Longman (ELBS) ,ISBN 0-333-32836-1.
- Meriam J.L., Engineering Mechanics Vol.I: Statics, 1980, Macmillan, ISBN 0-471-05808-4.

Recommended Text:

- Meriam J.L., Engineering Mechanics Vol.II: Dynamic, 1980, Macmillan, ISBN: 0-471-05810-6.

Electrical Drawing

By M.M

Electrical & Electronics Symbols

EE392 By M.M

Electrical & Electronic Symbols

- Electrical & electronic circuit symbols are used for drawing schematic diagram.
- Circuit symbols are used in circuit diagrams & sinlge line diagrams.
- Symbols represent electrical & electronic components.
- There are variuos types of symbols used to represent a component.
- In this section will discuss various types of symbols and electrical/electronics diagrams

Symbols

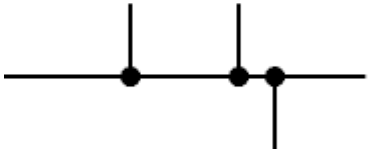
Wires & Connections:

Component **Circuit Symbol**

- Wire

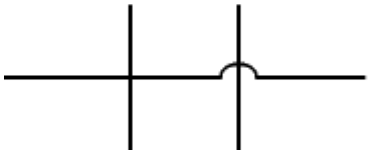
  - Conductor : pass current from one part of a cct to another

- Wires Joined



  - blob should be drawn where wires are connected

- Wires not joined



  - In complex diagrams it is often necessary to draw wires crossing even though they are not connected

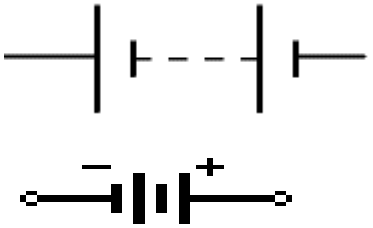
Symbols

Power Supplies:

Component **Circuit Symbol**

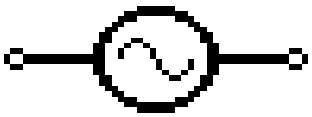
- Cell
  - -Generates constant voltage

- Battery
  - -Generates constant voltage, more than one cell



- DC Supply
  - -Supplies DC electrical energy in one direction

- AC Supply

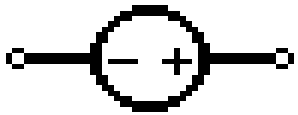


Symbol

Power Supply:

Component **Circuit Symbol**

- Voltage Source



-Generates constant voltage

- Current Source

-Generates constant current

- Generator

-Electrical energy is generated by mechanical rotation of the generator

Symbols

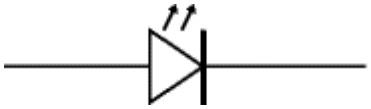
Diodes:

Component **Circuit Symbol**

- Diode

-A device which allow current to flow in one direction only

- LED Diode

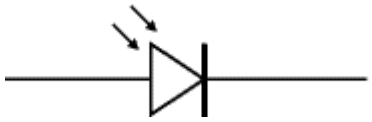


-A transducer which convert electrical energy to light

- Zener Diode

-A special diode which is used to maintain a fixed voltage across its terminals

- Photodiode



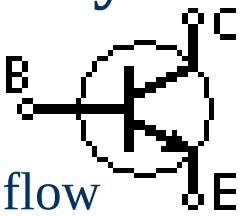
-A light sensitive diode, allows current to flow when exposed to light

Symbols

Transistors:

Component **Circuit Symbol**

- Transistor NPN:

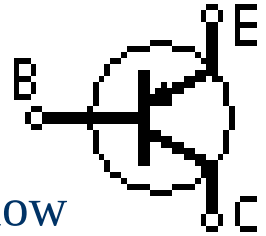


-A transistor amplifies current. High V at B current flow

-It can be used with other components to make

-an amplifier or switching circuit

- Transistor PNP:

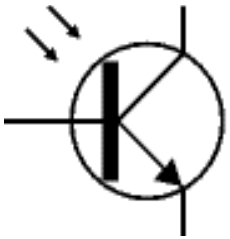


-A transistor amplifies current. Low V at B, current flow

-It can be used with other components to make

-an amplifier or switching circuit

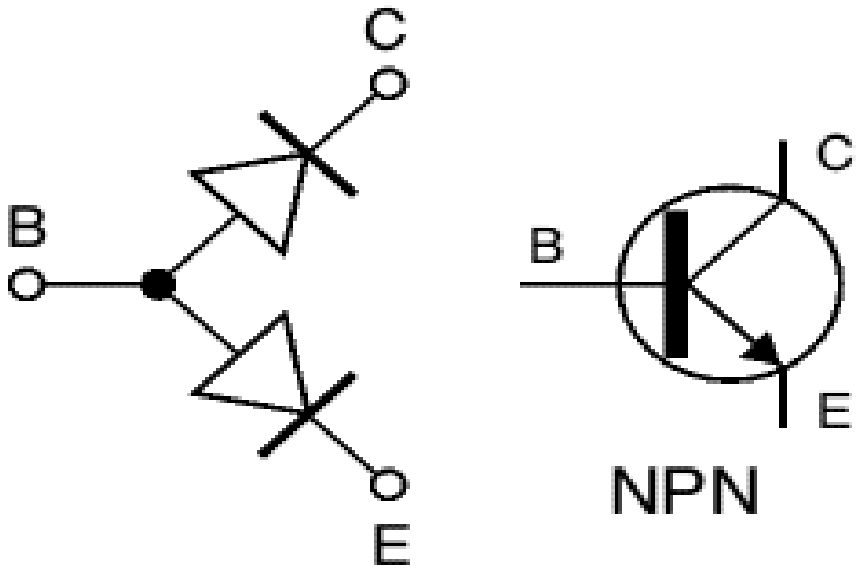
- Phototransistor



-A light sensitive transistor

Symbols

- **Transistor**
- The diagram shows how the junctions behave in an NPN transistor.
- The diodes are reversed in a PNP transistor.



Symbols

Resistor:

Component **Circuit Symbol**

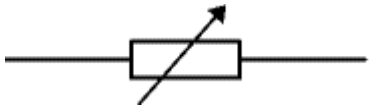
- Resistor

IEC 

-It restrics flow of current

IEEE 

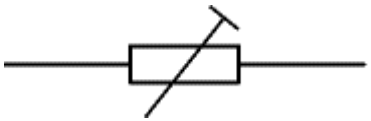
- Variable Resistor (Rheostat)



-Used to control current

-E.g adjusting lamp brightness, motor speed

- Variable Resistor (Preset)



-Operated with a small screwdriver or similar tool

-it is designed to be set when cct is made & left like that

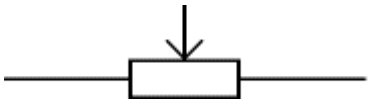
-cheaper than normal variable resistor

Symbols

Resistors:

Component **Circuit Symbol**

- Variable Resistor (Potentiometer)



-This type has 3 contacts

-Used to control voltage

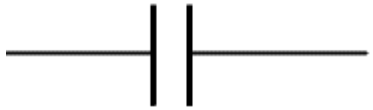
-It can be used like this as a transducer converting position to an electrical signal

Symbols

Capacitor:

Component **Circuit Symbol**

- Capacitor



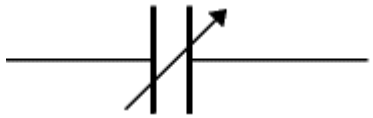
-Stores electric charge, used with resistor in timing cct

-Used as a filter, to block DC signals but pass AC signals

- Capacitor Polarised

-Same as capacitor uses

- Variable Capacitor



-Used in radio tuners

- Trimmer Capacitor

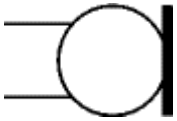
-Same as preset resistor

Symbols

Audio & Radio Devices:

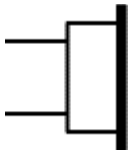
Component **Circuit Symbol**

- Microphone



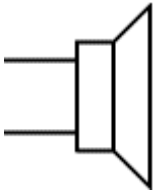
  - A transducer which converts sound to electrical energy

- Earphone



  - A transducer which converts electrical energy to sound

- Loudspeaker



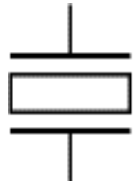
  - A transducer which converts electrical energy to sound

Symbols

Audio & Radio Devices:

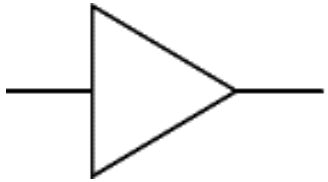
Component **Circuit Symbol**

- Piezo Transducer

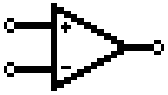


  - A transducer convert electrical energy to sound

- Amplifier (General Symbol)

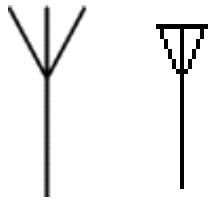


  - An amplifier cct with one input
  - Block diagram symbol, OP



  - It represents a cct rather than one component

- Aerial (Antenna)



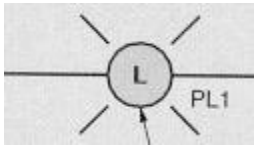
  - A device which is designed to receive or transmit radio signals.

Symbols

Output Devices: Lamps, Heater, Motor, etc.

Component **Circuit Symbol**

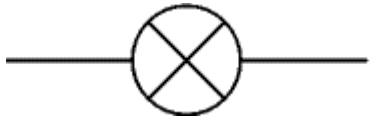
- Lamp (Lighting)



-A transducer converts elctrical energy to light.

-Symbol used is for lamp providing illumination e.g car headlamps or touch bulb.

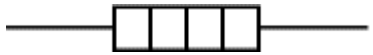
- Lamp (Indicator)



-A transducer converts electrical energy to light.

-Symbol used is for lamp which is an indicator e.g warning light on car dashboard

- Heater



-A transducer converts electrical energy to heat

Symbols

Output Devices:

Component **Circuit Symbol**

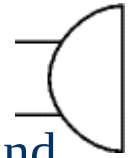
- Motor

-A transducer converts electrical energy to kinetic energy (motion)

- Bell

-A transducer converts electrical energy to sound

- Buzzer



- A transducer converts electrical anergy to sound

- Inductor (Coil, Solenoid)

-Coil of wire creates magnetic field when current passes through it

-it may have an iron core inside the coil, used to convert EE to mech energy by pulling something

Symbols

Output Devices:

Component **Circuit Symbol**

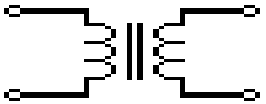
- Iron Core Inductor

  -Include iron

- Variable Inductor

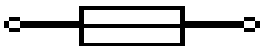
Other Devices:

- Transformer



  -Change AC voltage from high to low or low to high

- Fuse



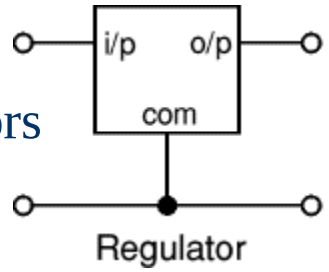
  -Used to protect cct from high current

Symbols

Other Devices:

Component **Circuit Symbol**

- Voltage Regulator IC



-ICs have 3 leads and look like power transistors such as the IC 7805, +5V, 1A

-typical values 5, 12, & 15V

-Have a hole for attaching **heatsink if necessary**

Symbols

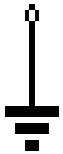
Ground :

Component **Circuit Symbol**

- Earth Ground

  -Used for zero potential reference

  -Use for electrical shock prtotection



- Chassis Ground

  -Connected to the chassis of the cct

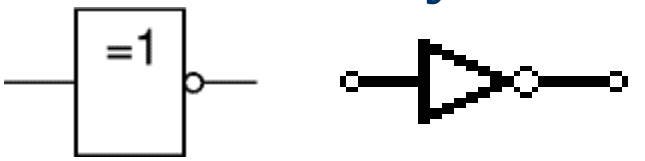
- Digital/ Common Ground

Symbols

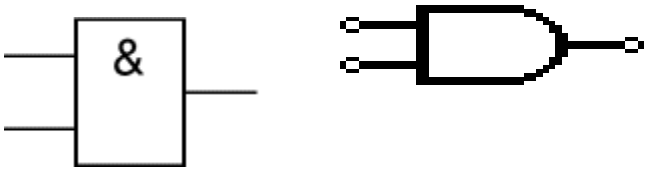
Logic Gates:

Component **IEC/Circuit Symbol**

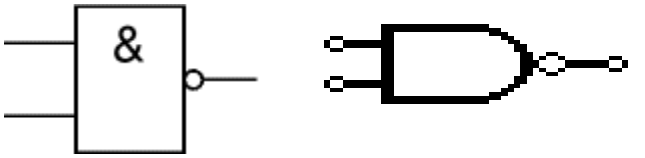
- NOT Gate(Inverter)
  - -Outputs 1 when input is 0



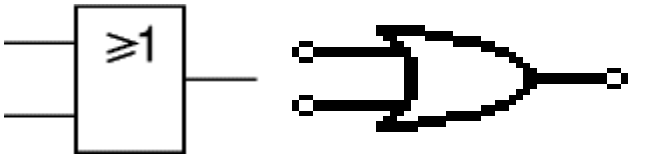
- AND Gate
  - -Ouputs 1 when both inputs are 1



- NAND Gate
  - -Ouputs 0 when both inputs are 1 (NOT+AND)



- OR Gate
  - -Outputs 1 when any input is 1

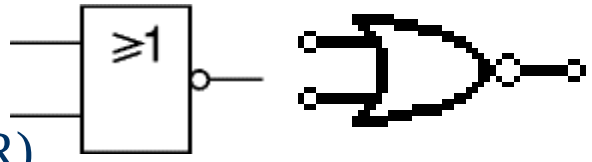


Symbols

Logic Gates:

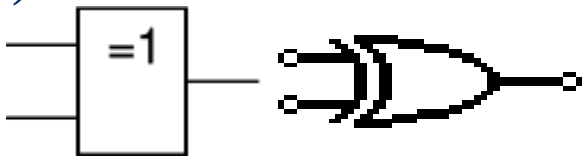
Component **IEC/Circuit Symbol**

- NOR Gate



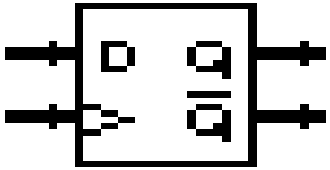
-Outputs 0 when any input is 1 (NOT + OR)

- XOR Gate



-Outputs 1 when inputs are different(Exclusive OR)

- D Flip-Flop



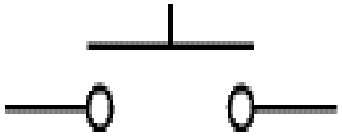
-Stores one bit of data

Symbols

Switches:

Component **Circuit Symbol**

- Pushbutton Switch(N.O)



  -Allows current to flow only when pressed

  -E.g Used to operate a doorbell

- Pushbutton Switch(N.C)

  -Normally closed (on)

  -Open (off) only when pressed

- On-Off Switch (SPST)

  -SPST= Single Pole, Single Throw

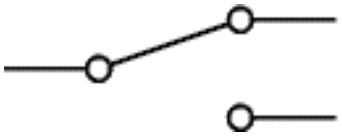
  -Allows current to flow only when it is in closed position

Symbols

Switches:

Component **Circuit Symbol**

- 2-Way Switch (SPDT)

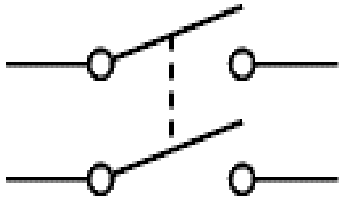


-SPDT=Single Pole, Double Throw

-2-way changerover switch directs flow of current to one of two routes according to position

-SPDT have a central off position described as on-off-on

- Dual On-Off Switch (DPST)



-DPST=Double Pole, Single Throw

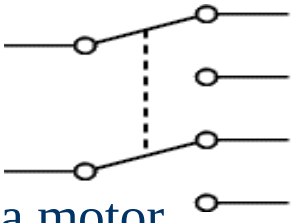
-Used to switch mains electricity because it can isolate both the live and the nerutral connections

Symbols

Switches:

Component **Circuit Symbol**

- Reversing Switch (DPDT)

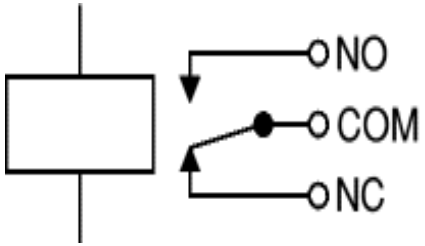


-DPDT=Double Pole, Double Throw

-Can be wired up as a reversing switch for a motor

-Have a central off position

- Relay



-An electrically operated switch

-E.g 9V battery cct connected to the coil can switch a 230V AC mains cct.

NO=Normally Open, COM= Common, NC= Normally Closed

Symbols

Switches:

Component **Circuit Symbol**

- Jumper

  - Close connection by jumper insertion on pins.

- Solder Bridge

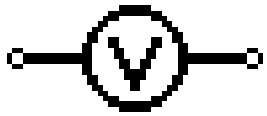
  - Solder to close connection

Symbols

Meter:

Component **Circuit Symbol**

- Voltmeter

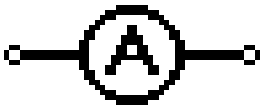


-Measures voltage

-Have high resistance

-Connected in parallel with equipment

- Ammeter



-Measures electric current

-Has near zero resistance

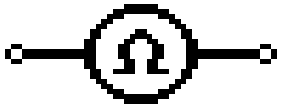
-Connected in series with equipment

Symbols

Meter:

Component **Circuit Symbol**

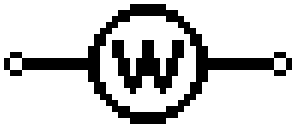
- Ohmmeter



-Measures resistance

-Most multimeters have an ohmmeter setting

- Wattmeter



-Measures electric power

- Galvanometer

-Very sensitive meter

-Used to measure tiny currents, usually 1mA or less

Symbols

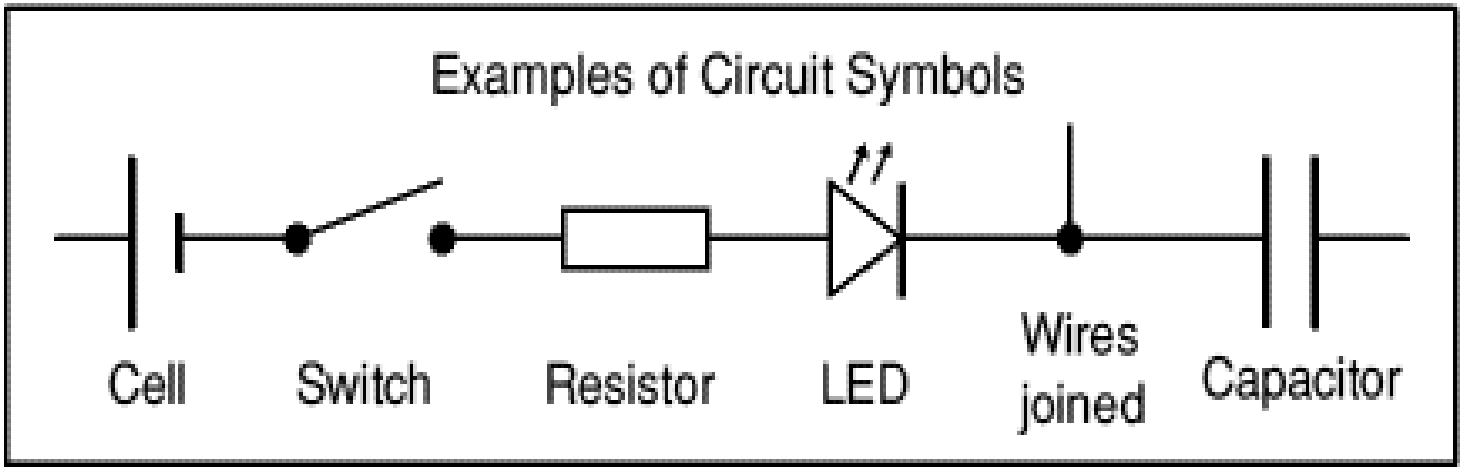
Meters:

Component **Circuit Symbol**

- Oscilloscope

-Used to display the shape of electrical signals

-It can be used to measure their voltage and time period

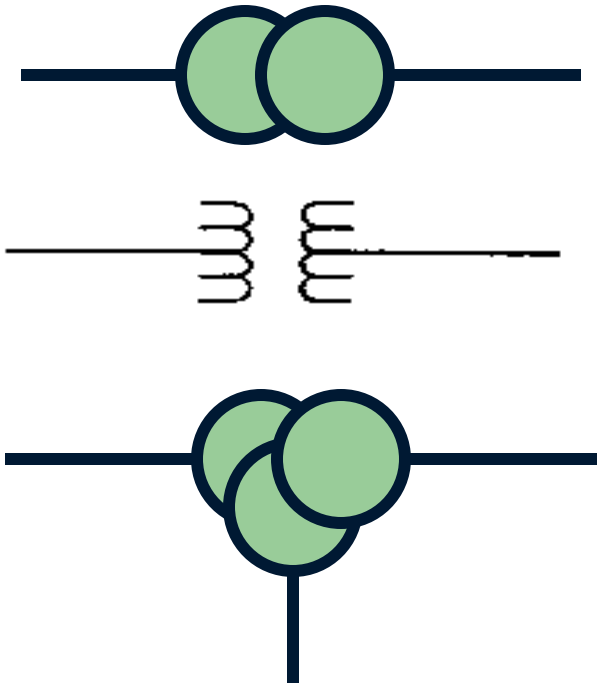


Power Symbols

- m/c (rotating armature):

  motor M Generator G

- Transformers



2 winding power Tx

3-winding power Tx

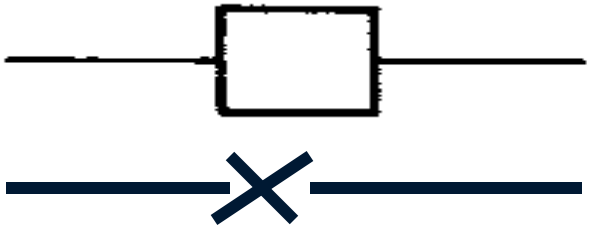
- **Transmission/Distribution Lines:**

  -Overhead/Cables:

  -Busbar:

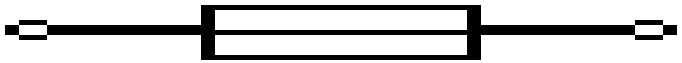
- **Circuit Breaking:**

  - Oil Circuit Breaker:



  -Isolator:

  -Fuse:



  -Current Tx:

- Voltage Trnasformer:

- 3-Ph Delta Connection:

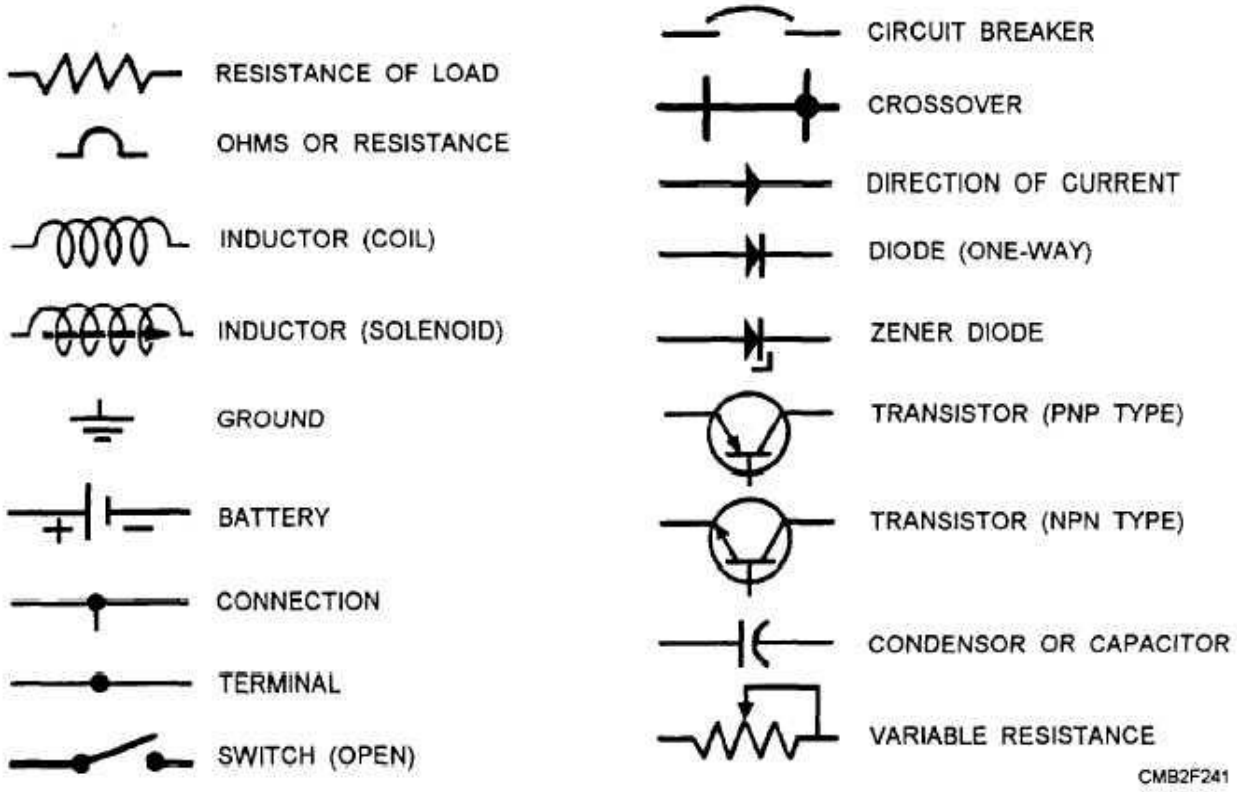
- 3-Ph Star Connection:

- 3-Ph Star Connection with ground Neutral:

- Shunt Capacitor: 
- Load: 
- Air Circuit Breaker: 

Summary

Summary



Summary

Summary

-Electrical and Electronic symbols

- Helps how to read circuit diagrams: handy legend of commonly used on electrical diagrams it is not comprehensive
- Helps to troubleshoot electric ccts: we use either a wiring diagram or schematic or both that come with the appliance
- These diagrams are usually included with the technical sheet that's carefully and clearly hidden inside the appliances, safety out of sight of owners who usually just end up losing it if they happen to stumble on it
- If you are working on an electrical problem and you don't have the wiring or schematic diagram, its like trying to drive around an unfamiliar city without a map
- You have to know what the symbols mean in order to understand what the map is telling you same with wiring diagram or schematic