

INTRODUCTION

- \* Now a days industries are increases the demanding process automation in all section in possible direction. Because the automation only the Boost results, Better quality and Increased Production with Reduced costs.
- \* In many modern adjustable, speed drives the demand is for a continuous control of speed, Torque, with long term stability, good transient performance and highly efficient.
- \* So DC Drives are widely used in such an application. But due to mechanical commutators <sup>(sparky, bulky)</sup> DC Motors need frequent maintenance. It's adopted in limited application like rolling mills, machine tools and fraction.
- \* The AC motors like cage Induction Motor, Synchronous Reluctance and permanent magnet synchronous have brush less robust construction and it requires less maintenance. These Motors have flexibility in speed and operated with normally available AC supply.
- \* In recent years the power semiconductors are easily available for AC and DC Drives with fast control.

Drives:-

A Particular system (or) Machines employed for motion control is called drives and may employ any of the prime movers for supplying

## Mechanical energy for motion control:

- \* The Prime movers such are diesel/cor Petrol engine, gas/cor steam turbine engines and electric motors
- \* Motion control is needed in large number of applications like Transportation systems, Machine tools, robots, washing machines, Pumps, fans, textile mills and etc

## Electric Drives:

The system employed for motion control by using electric motor as a prime mover is called electric drive.

### Advantages of Electric Drive:-

- The advantages are
- \* cheap source of power & it's nature friendly.
  - \* smooth speed control
  - \* wide range over load capacity
  - \* Flexible control characteristics
  - \* Automatic fault detection provision
  - \* do not need retuning, preheating, they can be started instantly.
  - \* Easy starting
  - \* do not pollute the environment

### ⇒ Basic Elements of Electrical Drive.

The Basic Block diagram for electric drive used for motion control.

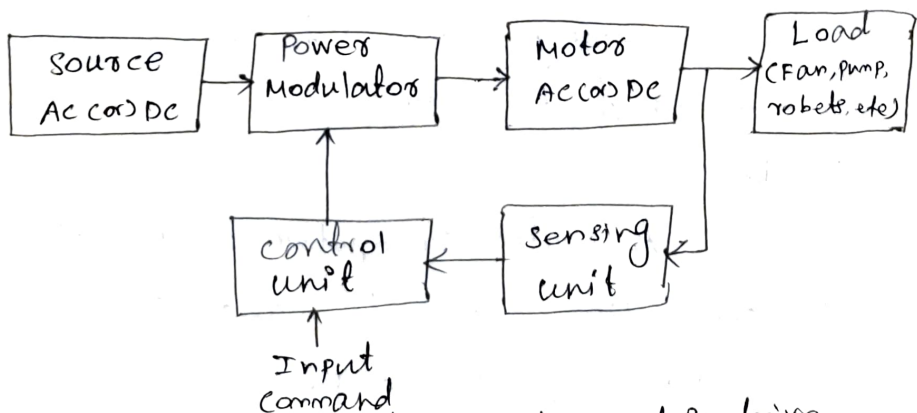


Fig: Block diagram of Electric drive

The Basic elements are

(3)

1. Source
2. power Modulators
3. Electric Motor
4. sensing unit
5. control unit
6. Load.

ci) source:

- \* Generally we have two readily available type of electrical supplies and they are 1 $\phi$  & 3 $\phi$  Ac supplies.
- \* Drives which runs in Ac supply for low power, will be given with 1 $\phi$  supply.
- \* Drives run by higher power 3 $\phi$  supply will be given.
- \* For traction purposes, the drives needs Dc supply.
- \* Some drives are powered from a battery. For eg forklift trucks and milk vans.

cii) power Modulators:

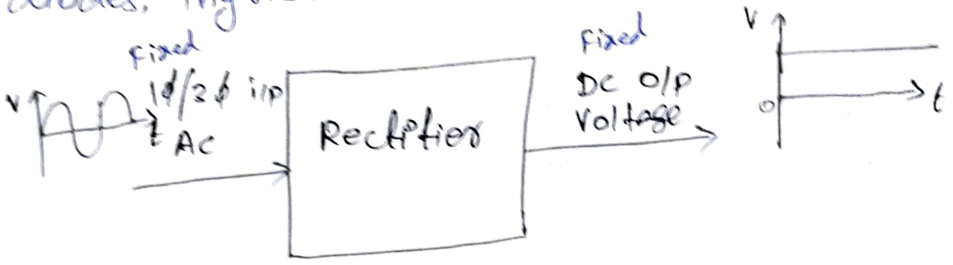
It's functions are

- \* It modulated the flow of power from source to load through motor.
- \* During transient operations, such as starting, Braking, speed reversal, it restricts source and motor current within permissible level.
- \* Also used as inverter, if source is Dc but the induction motor is employed as a drive, then it converts Dc into Ac with suitable frequency.
- \* It's also used for selecting the operating Mode such as motoring, Braking.

The Power Modulator has various applications

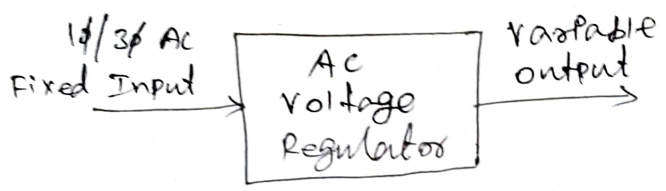
(a) Ac to DC <sup>Rectifiers</sup> Converters (Rectifier):

The process of converting Ac into Dc is called Rectification. The Rectifier can be designed by using semiconductor devices like diodes, Thyristors.



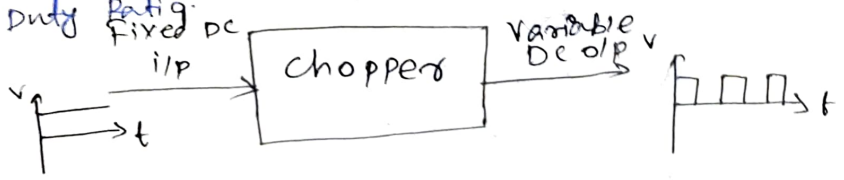
(b) Ac voltage controllers or Regulators:

It's used to convert from fixed voltage to variable voltage of same frequency. It's done by auto transformers, tap changing transformers, thyristors controllers.



(c) choppers or DC to DC converters:

used to convert the fixed DC input to variable DC output by using power semiconductor devices like power transistors, Power MOSFETs, Thyristors and GTO's. based on Duty Ratio.

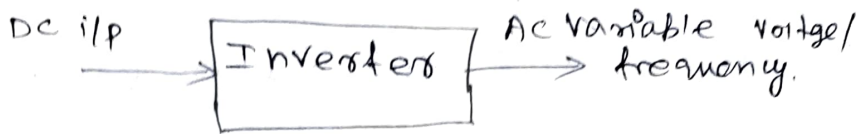


$$\text{Duty Ratio} = \frac{T_{ON}}{T_{ON} + T_{OFF}}$$

$$= \frac{T_{ON}}{T} \Rightarrow T_{ON} \cdot f \quad \left[ \because T = \frac{1}{f} \right]$$

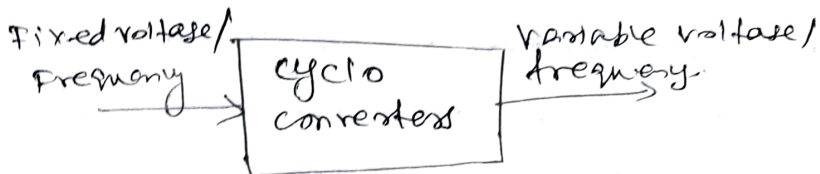
### (a) Inverters:

Used to convert from fixed DC into variable AC voltage and frequency by using Power transistors, IGBT's, GTO's and power MOSFET's with the help of PWM techniques.



### (c) cyclo converters:

This is used to convert the fixed <sup>AC</sup> voltage and frequency into AC variable voltage and frequency with the help of power semiconductors.



### (iii) Electric Motor:-

Motor is the machine which drives the load so motor will have the capability of driving the load, without overheating and without causing any other damages.

Motors used as a electric drives are

- \* DC Motors - shunt, series, compound, permanent magnet.
- \* AC Motors - Induction Motor
  - (a) squirrel cage IM.
  - (b) wound rotor slip ring IM
  - (c) Linear IM.

### (iv) sensing unit:

It's sense the actual parameters of the motor i.e voltage, current, speed,

(b) Temperature of the Machine etc., ~~It's also~~

\* It's sensing too control the drive operation and safe guard the drive from any major damage.

\* The sensing unit will give the necessary control signal to the control unit.

### (v) Control Unit:

The control unit will control the power modulators depending upon the control signal received from sensing unit and input command.

\* For this control semiconductor converters, it's firing circuit, transistors and a microprocessors are used.

### (vi) Load:

\* Normally loads are employed for accomplishing the given task.

\* For eg. Fans, pumps, robots, washine machine.