

INDUSTRIAL ELECTRONICS AND CONTROL OF DRIVES

Unit IV : Thyristor Control of Electric Drives

Topic: Electric Drives: Concept, Block Diagram and Advantages

Important Questions with Answers (5th Semester, Electrical Engg.)

By Sunil Saharan

Short Answer Questions

Q.1 What is an electric drive? Draw its block diagram and explain.

Ans. An electric drive is a system that controls the motion of a mechanical load (its speed, torque, direction, starting and stopping) by using an electric motor together with a power converter and a control unit.

Block diagram of an electric drive

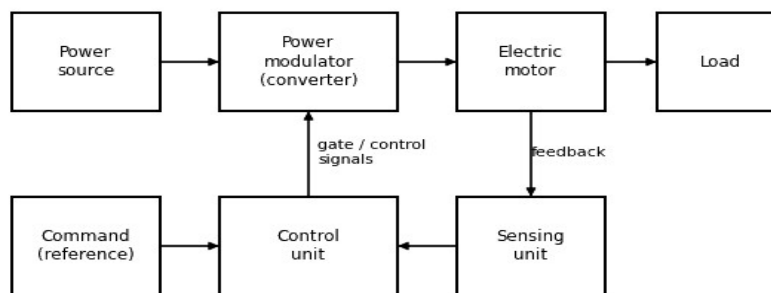


Fig. 1 Block diagram of an electric drive

Parts of the drive:

Part	Function
Power source	Gives electrical energy to the drive: the AC mains or a DC supply
Power modulator (converter)	Controls the power that flows from the source to the motor. It can be a controlled rectifier, chopper, inverter, cyclo-converter or AC voltage controller. It also limits the starting current and selects motoring or braking.
Electric motor	Changes electrical energy into mechanical energy
Load	The machine to be driven: a fan, pump, lift, rolling mill and so on
Control unit	Compares the command with the feedback and gives gate pulses to the power modulator
Sensing unit	Measures the speed, current or torque and gives feedback to the control unit
Command (reference)	The desired value, for example, the set speed

Working:

The operator sets the command (for example, a speed). The control unit gives gate pulses to the power modulator, which feeds a suitable voltage (and frequency) to the motor. The motor drives the load. The sensing unit measures the actual speed and sends it back. The control unit corrects the gate pulses until the actual speed is equal to the set speed. This is a closed-loop drive.

Q.2 List the advantages of electric drives.

Ans. The advantages of electric drives are given below.

1. Easy and smooth control of speed, torque, starting and stopping.
2. Quick response; the drive can be started at once and needs no warming up.
3. High efficiency, and no fumes or smoke, so the working place stays clean.
4. Low noise and low maintenance cost.
5. Available for a very wide range of power and speed.
6. Remote control and automatic control are easy.
7. Electric braking is possible, and in regenerative braking the energy is returned to the source.

Q.3 What do you mean by a DC drive and an AC drive?

Ans. DC drive: A drive in which a DC motor is controlled by a variable DC voltage obtained from a thyristor converter (controlled rectifier or chopper). The speed is controlled by changing the voltage fed to the motor.

AC drive: A drive in which an AC motor (usually an induction motor) is controlled by a thyristor converter that changes the voltage and the frequency fed to the motor (AC voltage controller, inverter or cyclo-converter).

Q.4 Explain the types of electric drives (individual, group and multi-motor drives).

Ans. Electric drives can be classified by the arrangement of motors and machines (textbook classification).

Type	Meaning	Example
Individual drive	One motor drives one machine	A ceiling fan, a lathe with its own motor
Group drive	One motor drives several machines through a common shaft and belts	Old workshops with line shafts
Multi-motor drive	Different motors drive the different moving parts of one machine	A crane, a rolling mill, a paper machine

Long Answer Question

Q.5 Explain the concept of an electric drive with its block diagram, parts, advantages and types.

Ans. An electric drive is a system that controls the motion of a mechanical load by using an electric motor together with a power converter and a control unit. Thyristor converters are used because they change the voltage, current or frequency of the motor smoothly and with very little power loss.

Note: In the exam, draw Fig. 1 (block diagram) given in Q.1.

Block diagram and parts:

1. The power source gives the AC or DC energy.
2. The power modulator (converter) controls the power flow to the motor and limits the starting current.
3. The electric motor converts the electrical energy into mechanical energy and drives the load.
4. The control unit gives the gate pulses to the power modulator, according to the command and the feedback.
5. The sensing unit measures the speed, current or torque and sends the feedback to the control unit.

Advantages:

1. Smooth and easy control of speed, torque, starting and stopping
2. Quick response and high efficiency
3. Clean, quiet and low maintenance
4. Wide range of power and speed; easy remote and automatic control
5. Electric and regenerative braking

Types:

1. **DC drive** (DC motor) and **AC drive** (AC motor).
2. **Individual drive, group drive and multi-motor drive.**

Points to Remember (for MCQ and True/False)

1. An electric drive controls the motion of a load using an electric motor and a controller.
2. The power modulator controls the power flowing from the source to the motor.
3. The sensing unit gives feedback to the control unit.
4. A DC drive uses a DC motor; an AC drive uses an AC motor.

5. Advantages of an electric drive: smooth control, quick response, high efficiency, low maintenance.