

## Rectifiers

Rectification is a process of converting an alternating current or voltage into a direct current or voltage. This conversion can be achieved by variety of circuits based on and using switching devices. The widely used switching devices are diodes, thyristors, power transistors etc. The rectifier circuits can be classified broadly into three classes: uncontrolled, fully controlled and half controlled.

- (1) **Uncontrolled Rectifiers:** It uses only diodes & the DC output voltage is fixed in amplitude by the amplitude of the AC supply.
- (2) **Fully Controlled Rectifiers:** The fully controlled rectifier's uses thyristors as rectifying components & DC output voltage is a function of the amplitude of the AC supply voltage & the point on wave at which thyristors are triggered is called as firing angle ( $\alpha$ ).
- (3) **Half Controlled Rectifier:** In half controlled rectifier a combination of diodes & thyristors, allowing a more limited control over the DC output voltage-level than the fully-controlled rectifier. The half controlled rectifier is cheaper than a fully controlled rectifier of the same rating but has operational limitations. Uncontrolled and half controlled rectifiers will permit power to flow only from the AC system to the DC load and are, therefore, referred to as unidirectional converters. However, with a fully controlled rectifier it is possible, by control of the point on wave at which switching takes place, to allow power to be transferred from the DC side of the rectifier back into the AC system. When this occurs, operation is said to be in the inverting mode. The fully controlled converter may therefore be referred to as a bidirectional converter.

### Concept of Phase Angle Control

As we know that SCR is 3 terminal devices i.e. Anode, Cathode & Gate. To turn it 'ON' by the gate at some angle with respect to the applied voltage, this firing angle is measured with respect to the given reference at which the firing pulses are applied to the thyristor gates. The reference point is the point at which the application of the gate pulses results in the maximum mean positive DC-terminal voltage of which the converter is capable i.e. a firing angle of  $0^\circ$  corresponds to the conditions when each thyristor in the circuit is fired at the instant its anode voltage becomes at positive in each cycle, under this condition, therefore, the converter operates in exactly the same manner as it was an uncontrolled rectifier circuit. The symbol ' $\alpha$ ' is known as firing angle. Hence the most common method to turn ON the thyristor is achieved by varying the firing angle of the thyristor. This method of thyristor control is known as phase angle control. This method is very efficient for the controlling the average power to the load such as lamps, heaters, motors, DC transmission.