5.3 THREE PHASE AC VOLTAGE CONTROLLER

- To control the current and voltage of three phase loads, Three Phase AC Voltage Controller are required. The single phase controller described previously can be introduced singly in each phase or line, to form a three phase controller. There exist a variety of connections for Three Phase AC Voltage Controller.

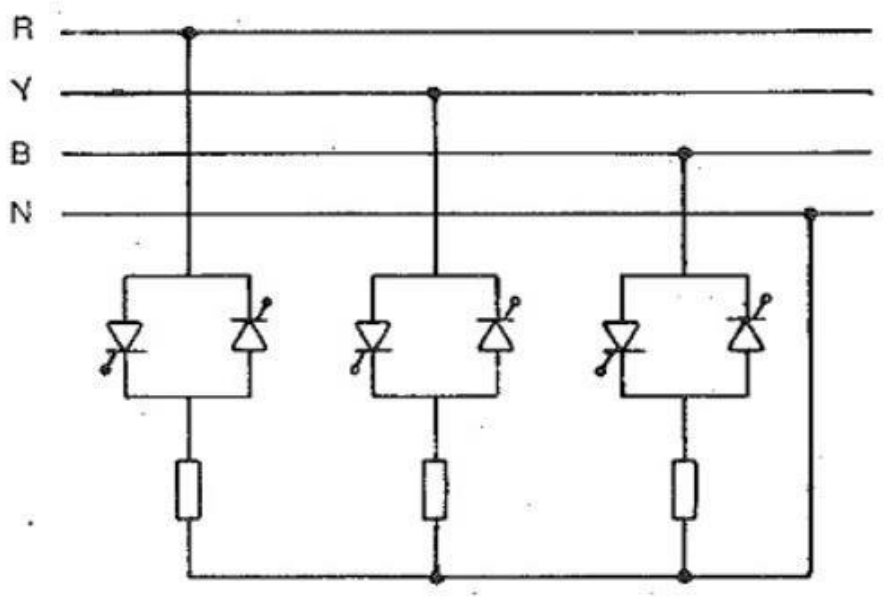


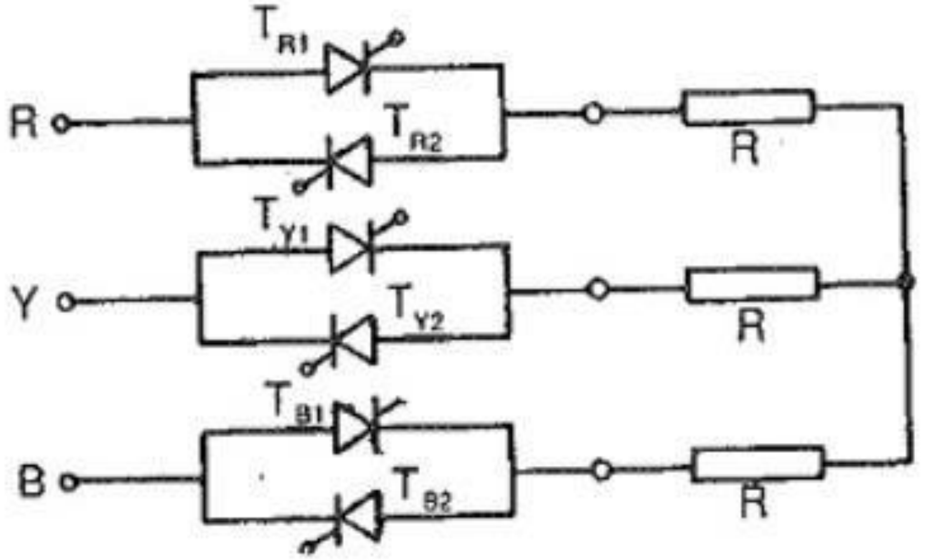
Figure 5.3.1 Block diagram of Three Phase AC voltage controller

[Source: "Power Electronics" *by* P.S.Bimbra*,* Khanna Publishers *Page: 398]*

- A three phase four wire controller is shown in Fig 5.6. The load neutral and supply neutral are connected together. Each of the three controllers can be independently controlled to feed the load impedance. Each phase has the same relations as a single phase controller. The neutral and line currents contain triplet harmonics along with other odd harmonics.

A Three Phase AC Voltage Controller has symmetrical control if both the back to back connected thyristors have the same firing angle. It has asymmetrical control if the firing angles differ or if one of the thyristors is replaced by a diode, or if the controllers are placed in only two of the three lines.

We now discuss the features of a symmetrically controlled three phase, three wire, star-connected controller for both ohmic and inductive loads.



5.3.2 Three phase ac voltage controller feeding a resistive load

[Source: "Power Electronics" *by* P.S.Bimbra*,* Khanna Publishers *Page: 399]*

The schematic of a three phase, three wire voltage controller feeding a three phase, star-connected balanced resistance is shown in Fig. 5.10. Phase control of the thyristors is employed. The phase and line voltages of the three phase system are shown in Fig. 5.10. For a controller, the control pulse is of a long duration, equal to the conduction period of the thyristor. This is to make sure that the firing pulse is available at the gate whenever the thyristor is forward biased, so that the thyristor can go into conduction.

It also ensures the firing of the thyristor whenever a forward current is expected. If, because of some circuit condition, the current goes to zero the thyristor turns off. A lengthy pulse can bring it into conduction. Further, slow building up of current in the load circuit when the thyristor is fired (to give maximum load voltage) may cause the thyristor to go to an off state if it is not fully turned on.

For current to flow it is necessary to trigger at least two thyristors at a time. If we define the instantaneous input phase voltages as:

$$v_{an} = V_m \sin \omega t$$

$$v_{bn} = V_m \sin (\omega t - 2\pi / 3)$$

$$v_{cn} = V_m \sin (\omega t - 4\pi / 3)$$

The instantaneous input line voltages are

$$v_{ab} = 3\ v_{an} = 3\ v_m \sin (\omega t + \pi/6)$$

$$v_{bc} = 3\ v_{bn} = 3\ v_m \sin (\omega t - \pi/2)$$

$$v_{ca} = 3\ v_{cn} = 3\ v_m \sin (\omega t - 7\pi/6)$$