Electronics and
Computer Science

ELEC2208 Power Electronics and Drives

Cycloconverter

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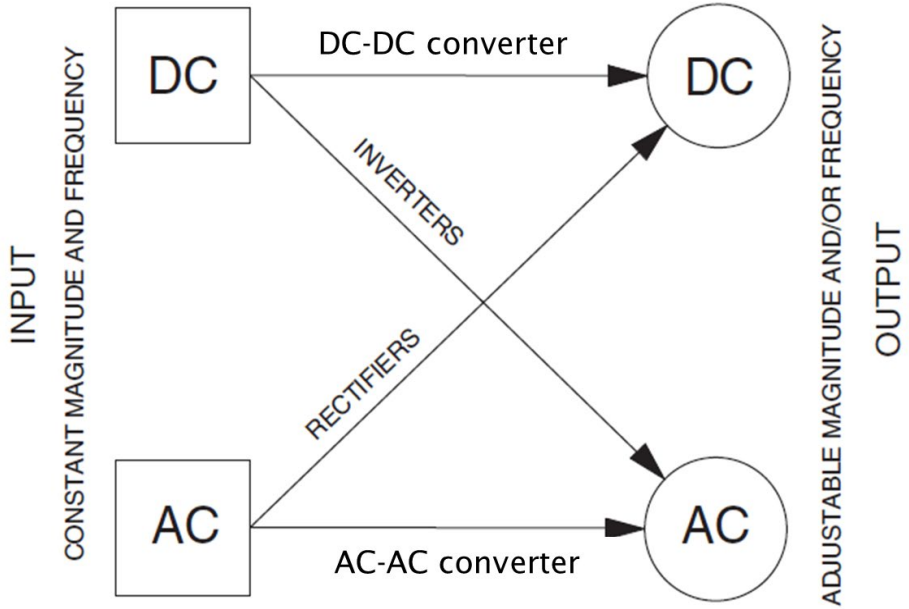
Classification

- Phase-Controlled Thyristor Converter **AC-AC, Voltage**
- Rectifier **AC-DC**
- Cycloconverter **AC-AC, Frequency**
- Inverter **DC-AC**
- DC-to-DC Converter **DC-DC**



What is Cycloconverter?

- Cycloconverter is a device that converts AC voltages to AC voltages at a frequency that is lower than the supply frequency.

- Mainly high-power converter for variable speed drives in high-torque and low-speed applications.

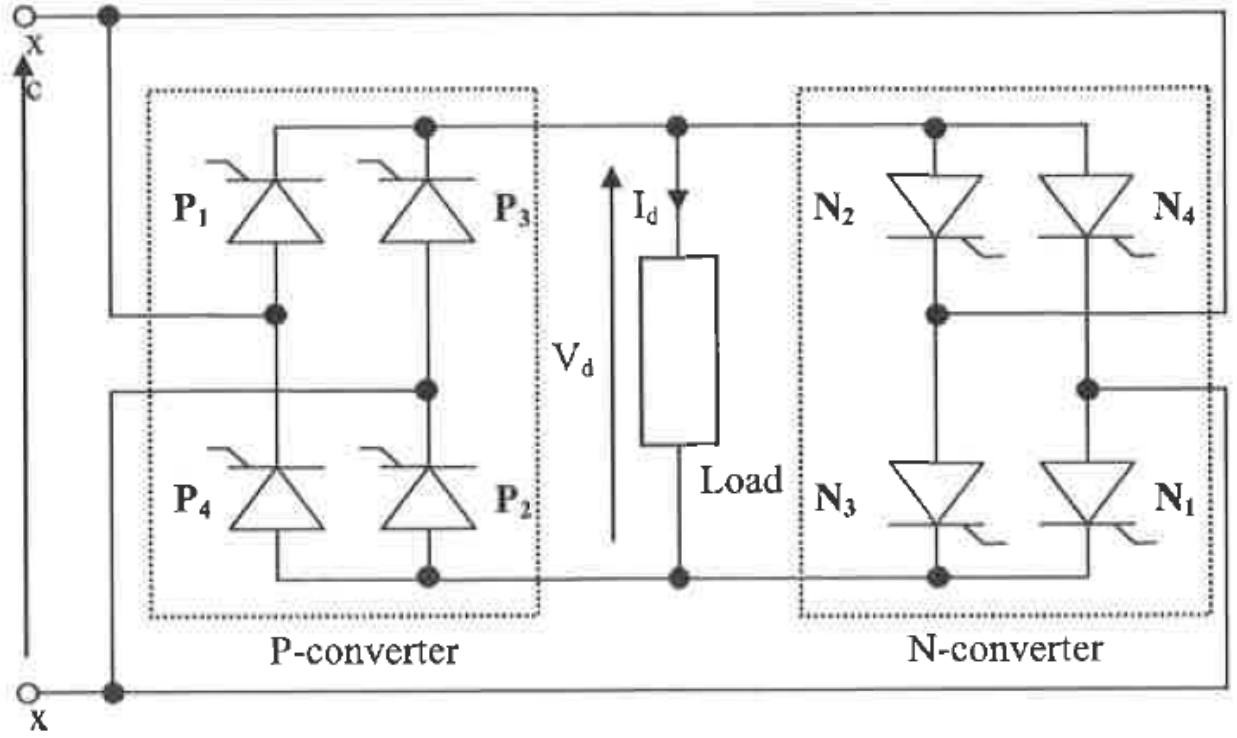
Three options

- Single phase (to single phase) cycloconverter
- Three phase to single phase cycloconverter
- Three phase to three phase cycloconverter

Single-phase Cycloconverter

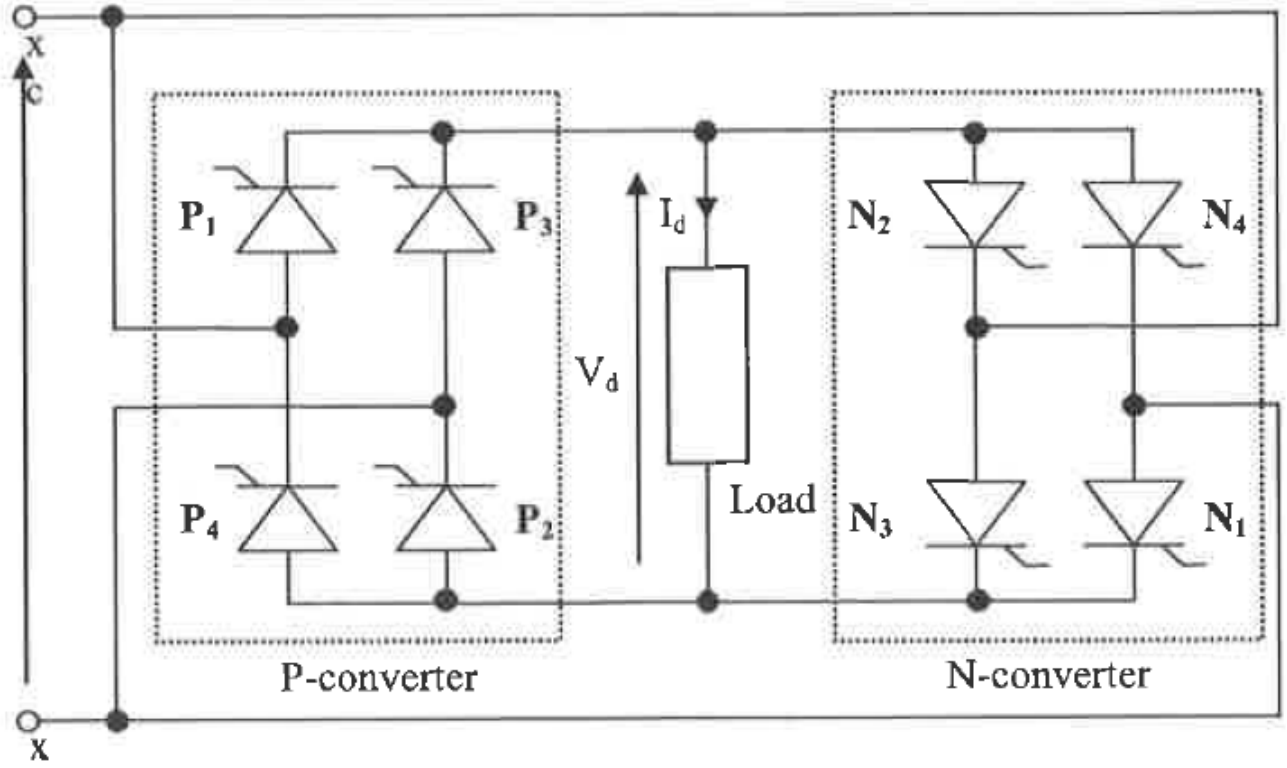
Two phase controlled thyristor converters in back to back configuration can be used to produce ac voltage with varying magnitude and reduced frequency.

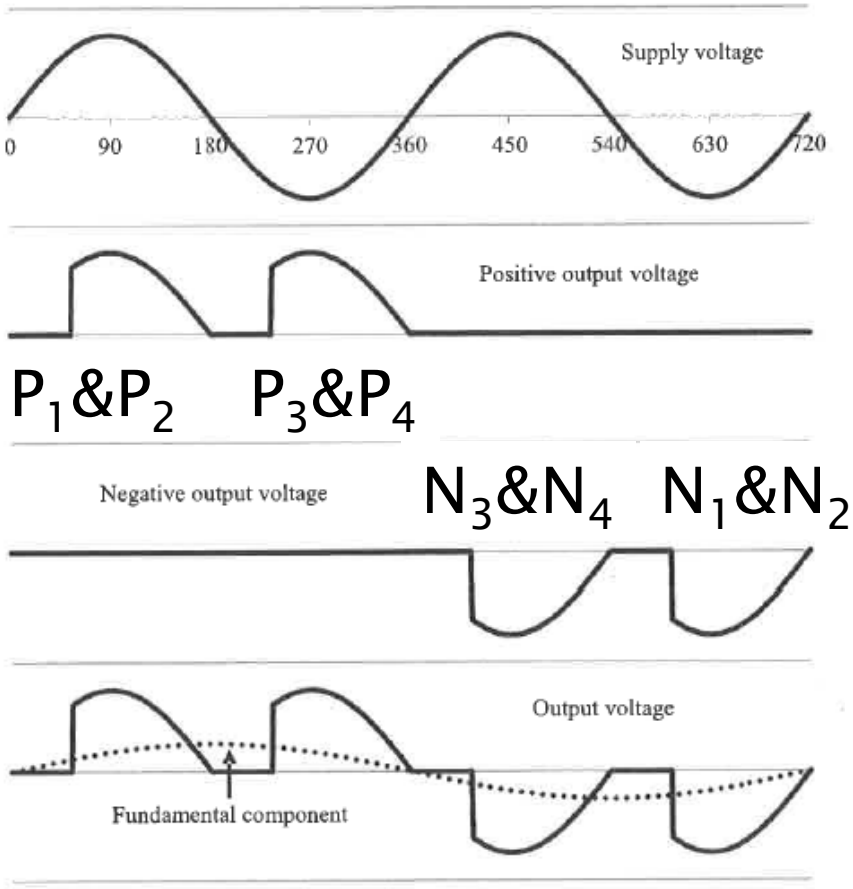
Supply



8 Thyristors

Single-phase Cycloconverter



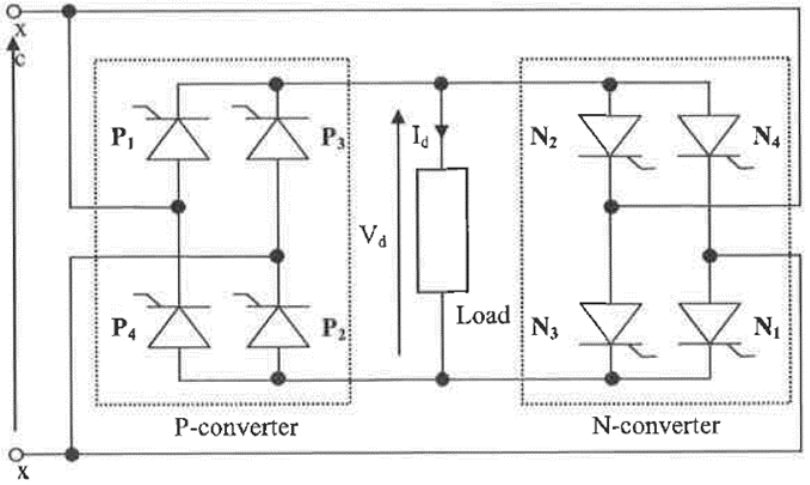


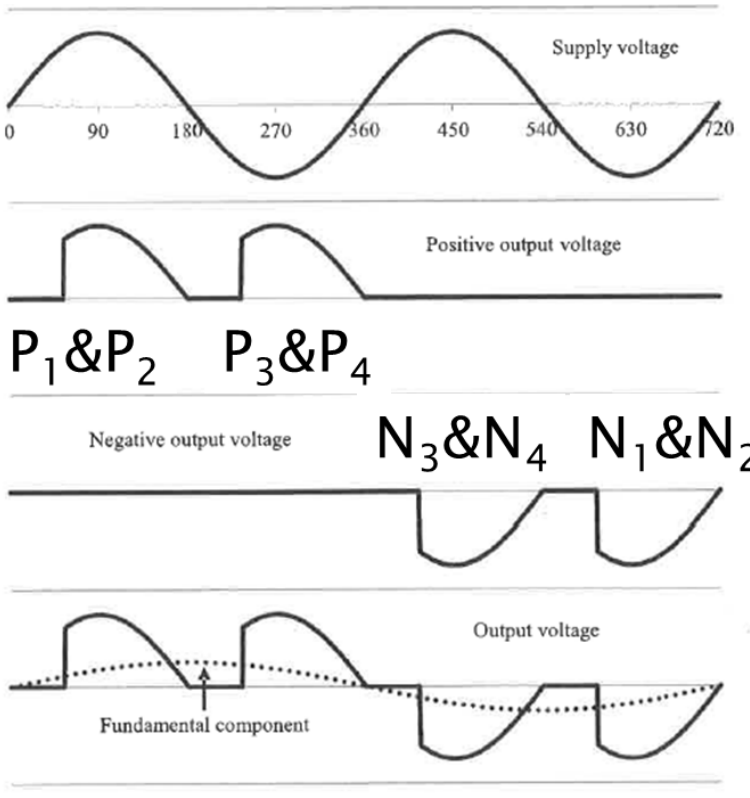
Period of fundamental component is changed.

Frequency is reduced.

Single-phase Cycloconverter

- P-converter operates in rectification mode and produces positive voltage for first half cycle.
- N-converter operates in rectification mode and produces negative (due to opposite polarity) voltage for second half cycle.
- The output frequency is lower than the supply frequency depending on number of half-sinusoidal waveforms produced/rectified by each converter in one half cycle, e.g. a 50Hz supply with 5 positive half-sinusoidal waveforms and 5 negative half-sinusoidal waveforms forms a 10Hz output (5 input cycles produce 1 output cycle).
- Voltage magnitude can be varied by controlling the firing/delay angle.





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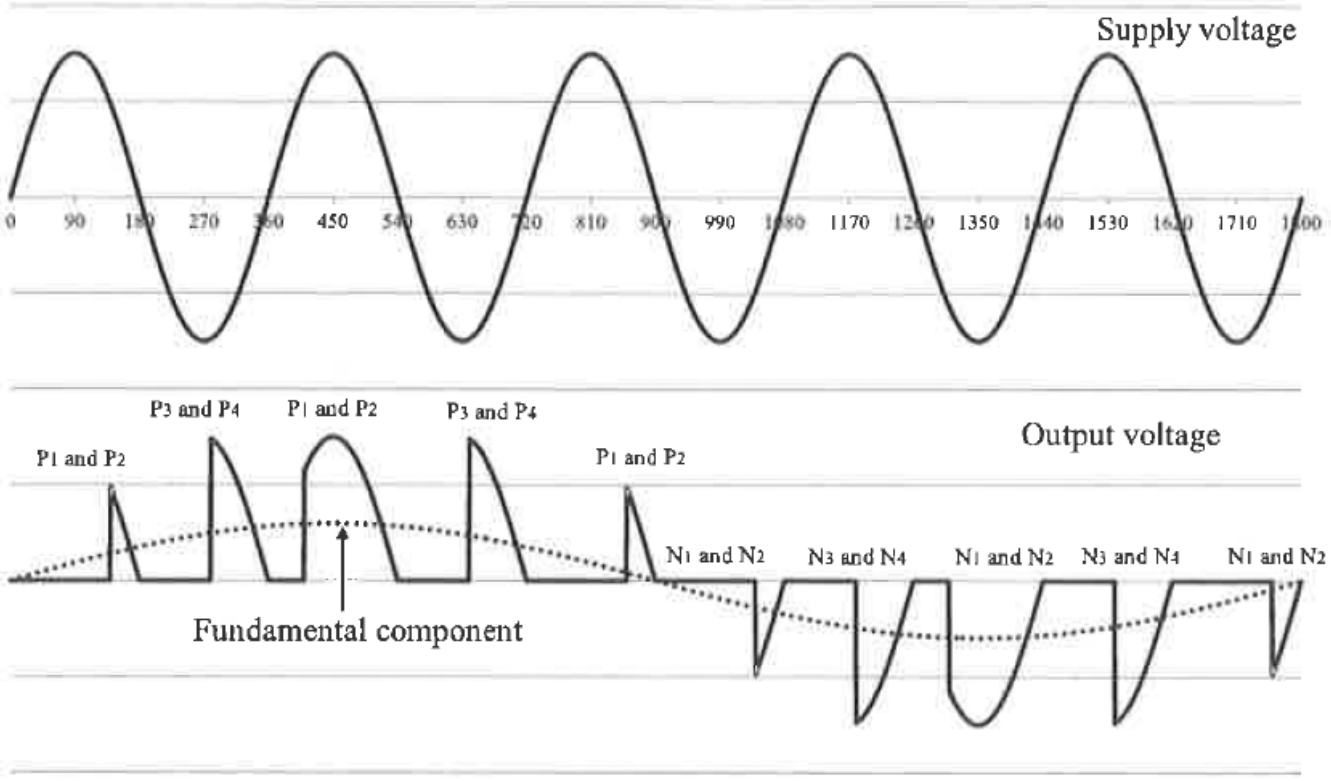
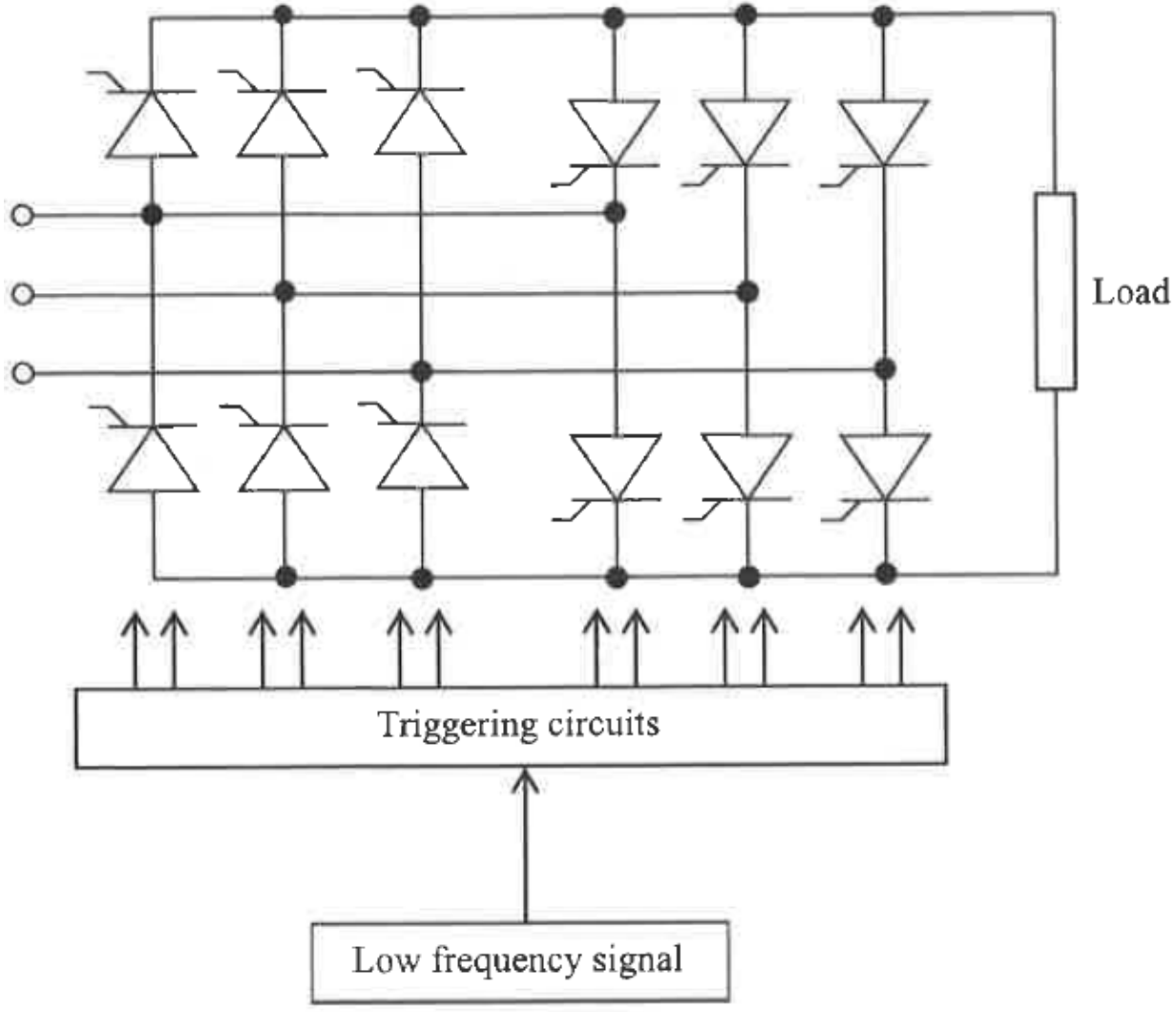
Single-phase Cycloconverter

To reduce voltage distortion, large delay angle is selected for half-cycle near to zero crossing e.g. 1st and 5th half-cycles when the voltage should be low. The delay angle should be lowest (to produce highest voltage) for half-cycle at peak of fundamental component.



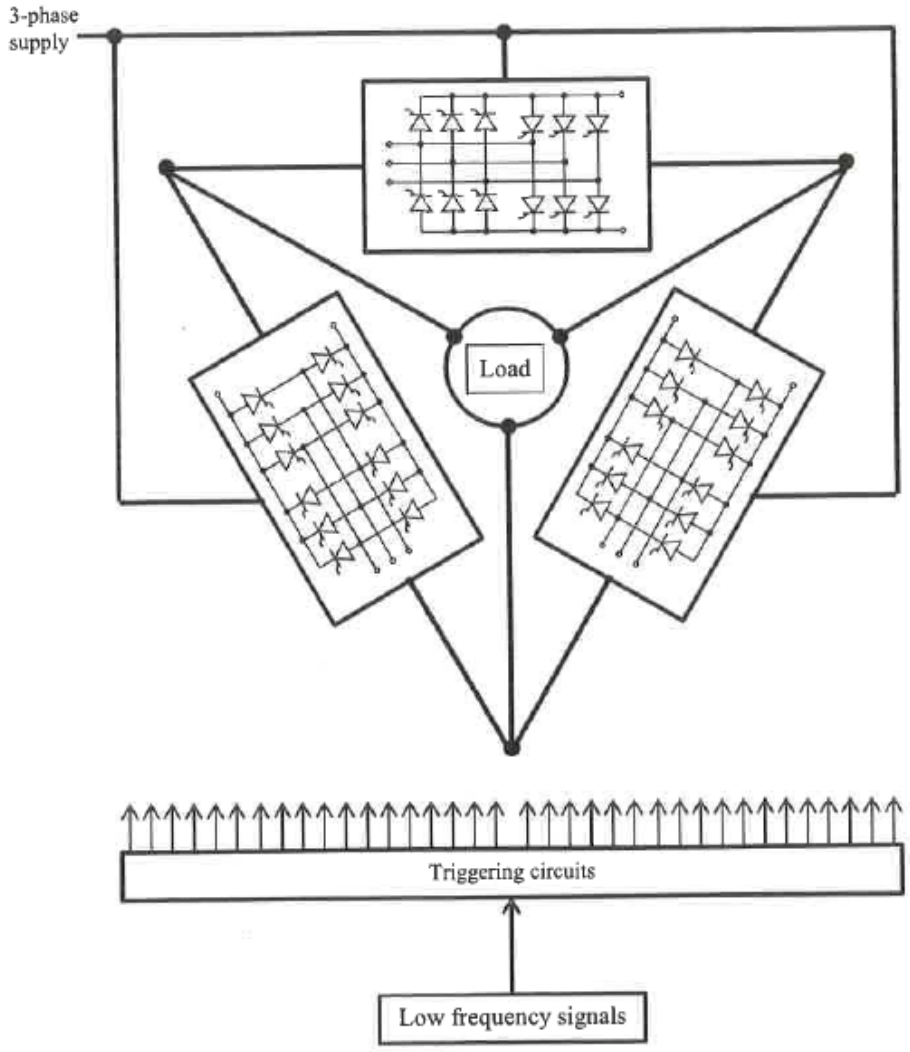
Three-phase to Single-phase Cycloconverter



Three phase to single phase cycleconverter consists of twelve thyristors arrange as two back-to-back converters

Three-phase to Three-phase Cycloconverter

Three phase to three phase cycloconverter consists of three groups of three phase to single phase cycloconverter.



Summary

- Cycloconverter can convert AC voltages to AC voltages at a lower frequency than that of supply.

- The resulting waveform can be shaped by choosing a number of pulses, timing, and delay angles for each pulse, appropriately.

- Three options: (1) Single phase cycloconverter, (2) Three phase to single phase cycloconverter, and (3) Three phase to three phase cycloconverter.