

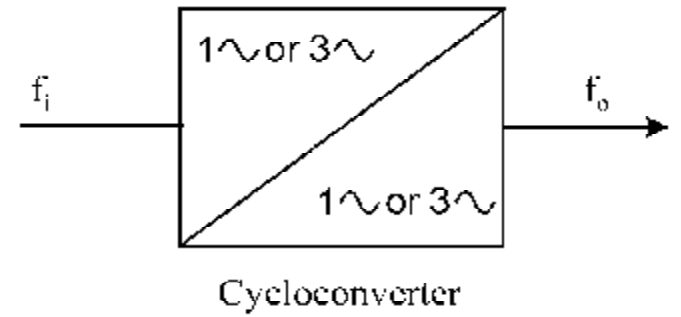
CYCLOCONVERTER

In industrial applications, two forms of electrical energy are used: direct current (DC) and alternating current (AC). Usually constant voltage constant frequency single-phase or three-phase AC is readily available. However, for different applications, different forms, magnitudes and/or Frequencies are required. There are four different conversions between DC and AC power sources. These conversions are done by circuits called power converters. The converters are classified as:

1. **Rectifiers:** from single-phase or three-phase AC to variable voltage DC.
2. **Choppers:** from DC to variable voltage DC.
3. **Inverters:** from DC to variable magnitude and variable frequency, single-phase or three phases AC.
4. **Cycloconverters:** From single-phase or three-phase AC to variable magnitude and variable frequency .A cycloconverter or a cycloinverter converts an AC waveform, such as the mains supply, to another AC waveform of a lower or higher frequency. They are most commonly used in three phase applications - while single phase cycloconverters are possible, they are so impractical that they are never used in real systems. The amplitude and the frequency of input voltage to a cycloconverter tend to be fixed values, whereas both the amplitude and the frequency of output voltage of a cycloconverter tend to be variable. A circuit that converts an AC voltage to another AC voltage at the same frequency is known as an AC/AC chopper.

A typical application of a cycloconverter is for use in controlling the speed of an AC traction motor and starting of synchronous motor. Most of these cycloconverters have a high power output - in the order a few megawatts - and silicon controlled rectifier (SCRs) are used in these circuits. By contrast, low cost, low-power cycloconverters for low-power AC motors are also in use, and many such circuits tend to use TRIACs in place of SCRs. Unlike an SCR which conducts in only one direction, a TRIAC is capable of conducting in either direction, but it is also a three terminal device. It may be noted that the use of a cycloconverter is not as common as that of an inverter and a cycloinverter is rarely used. However, it is common in very high power applications.

Traditionally, AC-AC conversion using semiconductor switches is done in two different ways: 1- in two stages (AC-DC and then DC-AC) as in DC link converters or 2- in one stage (AC-AC) cycloconverters (figure 1). Cycloconverters are used in high power applications driving induction and synchronous motors. They are usually phase-controlled and they traditionally use thyristors due to their ease of phase commutation.



Block diagram of a Cycloconverter
Figure 1

There are other newer forms of cycloconversion such as AC-AC matrix converters and high Frequency AC-AC (HF AC-AC) converters and these use self-controlled switches. These converters, however, are not popular yet.

Some applications of cycloconverters are:

- Cement mill drives
- Ship propulsion drives
- Rolling mill drives
- Scherbius drives
- Ore grinding mills
- Mine winders