# Single phase to two converter

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Three-phase induction motors may operate adequately on an unbalanced supply if not heavily loaded. This allows various imperfect techniques to be used. A single-phase motor can drive a three-phase generator, which will produce a high-quality three-phase source but at a high cost to the longevity of the system. While there are multiple phase conversion systems in place, the most common types are:

A Digital Phase Converter creates a three-phase power supply from a single-phase supply. A Digital Signal Processor (DSP) is used to control power electronic devices to generate a third leg of voltage, which along with the standard, single-phase voltage from the supply creates a balanced three-phase power supply.

AC power from the utility is converted to DC, then back to AC using insulated-gate bipolar transistors (IGBTs).[2] This conversion process allows for the generation of the third leg from the existing power supply.

In one type of digital phase converter, the input rectifier consists of IGBTs being used alongside inductors to create the third leg of power. The IGBTs are controlled by software in the DSP to draw current from the single-phase line in a sinusoidal fashion, charging capacitors on a constant-voltage DC bus. Because the incoming current is sinusoidal, there are no significant harmonics generated back onto the line as there are with the rectifiers found in most VFDs. The controlled rectifier input allows power factor correction to take place.

Since Digital Phase Converters are solid-state designs, there are little to no moving parts except for cooling fans. In turn, this allows digital phase converters to be fit into small packages and operate between 95% and 98% efficiency. These converters also do not draw power when idling, reducing overall costs and increasing longevity.

In Europe, electricity is normally generated as three-phase AC at 50 hertz. Five European countries: Germany, Austria, Switzerland, Norway and Sweden have standardized on single-phase AC at 15 kV 16 2/3 Hz for railway electrification. Phase converters are, therefore, used to change both the phase and the frequency. [citation needed]

If two full converters are connected back to back as shown in Fig. 1 both the output voltage and load current flow can be reversed. The system will provide four quadrant operation and is called as dual converter. Dual converters are normally used in high power variable speed drives. If a1 and a2 are the delay angles of converters 1 and 2 respectively, the corresponding average output voltages are Vo1 and Vo2.

The delay angles of converters are controlled in such a way that one converter operates as a rectifier and other converter operates as an inverter, but both converters produce the same average output voltage. Fig. 1 (b)

shows the output waveforms for two converters, where the two average Output voltages are the same. The average output voltage of converter 1 is,

Since the instantaneous output voltages of two converters are out of phase, there will be an instantaneous voltage difference and this will result In circulating current between two converters. This circulating current will not flow through the load and is normally limited by circulating current reactor L1 as shown in Fig. 1.

The dual converters can be operated with or without circulating current, only one converter operates at a time. When circulating current is not present however, Other converter is completely blocked by inhibiting gate pulses.