Inverter

The DC to AC power converters are known as Inverters. An inverter is a circuit, which converts a DC power into an AC power at desired output voltage and frequency. The AC output voltage could be fixed or variable frequency. This conversion can be achieved either by controlled turn on and turn off devices (e.g. BJT's, MOSFETs, IGBTs, MCTs, SITs, GTOs, and SITHs) or by forced commutated thyristors, depending on applications. The output voltage waveforms of ideal inverter should be sinusoidal. The voltage waveforms of practical inverters are, however, nonsinusoidal and contain certain harmonics. Square wave or quasi-square wave voltages are acceptable for low and medium power applications, and for high power applications low, distorted, sinusoidal waveforms are required. The output frequency of the inverter is determined by the rate at which the semiconductor devices are switched on and off by the inverter control circuitry and consequently, an adjustable frequency AC output is readily provided. The harmonic contents of output voltage can be minimized or reduced significantly by switching techniques of available high speed power semiconductor devices. The filtering of harmonics is not feasible when the output frequency varies over a wide range, and the generation of AC waveform with low harmonics content is important. When the AC output voltage of an inverter is given to a transformer or AC motor, this output voltage must be varied in conjunction with frequency to maintain the proper magnetic conditions. Therefore, the output voltage control is an essential feature of an adjustable frequency system.

The DC power input to the inverter may be battery, fuel cell, solar cells or other DC source. But in most industrial applications, it is fed by rectifier. This configuration of AC to DC converter and DC to AC inverter is called a DC link converter because it is a two stage static frequency converter in which AC power at network frequency is rectified and then filtered in the DC link before being inverted to AC at an adjustable frequency. Rectification is achieved by standard diode or thyristor converter circuits. Inverter is mainly classified as voltage source inverters and current source inverters. A voltage fed inverter (VFI), or voltage source inverter (VSI), is one in which the DC source has small or negligible impedance. In other words, a voltage source inverter has stiff DC voltage source at its input terminals. Because of low internal impedance, the terminal voltage of voltage source inverter remains substantially constant with variations in load. It is, therefore, equally suitable to single motor and multimotor drives. Any short circuit across its terminals causes current to rise very fast, due to the low time constant of its internal impedance. The fault current cannot be regulated by current control and must be cleared by fast acting fuse links. On the other hand, the current fed, or current source, inverter (CSI) is supplied with controlled current from a DC source of high impedance. Typically, a phase controlled thyristor rectifier feeds the inverter with a regulated current through a large series inductor. Thus, load current rather than load voltage is controlled, and the inverter output voltage is dependent upon the load impedance. Because of a large internal impedance, the terminal voltage of a current source inverter changes substantially with change in load. Therefore, if used in a multi-

motor drives; a change in load on any motor affects other motors. Hence current source inverters are not suitable for multi-motor drives. Since the inverter current is independent of load impedance, it has inherent protection against short circuits across its terminals.

Some of the important industrial applications of inverters are:

1. Variable speed AC motor drives
2. Induction Heating
3. Uninterruptible power supplies (UPS)
4. High Voltage DC Transmission lines