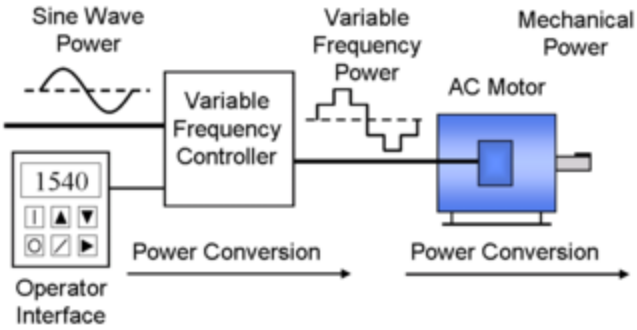
# Variable Frequency Drives

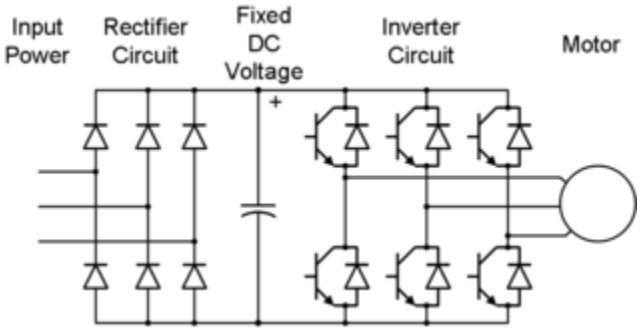
A variable-frequency drive (VFD) is a system for controlling the rotational speed of analternating current (AC) electric motor by controlling the frequency of the electrical power supplied to the motor.


Variable-frequency drives are also known as adjustable-frequency drives (AFD), variable-speed drives (VSD), AC drives, micro-drives or inverter drives. Since the voltage is varied along with frequency, these are sometimes also called VVVF (variable voltage variable frequency) drives.
All VFDs use their output devices (IGBTs, transistors, thyristors) only as switches, turning them only ON or OFF.
Drives can be classified as: Constant voltage, Constant current or Cyclo-converter
In a constant voltage converter, the intermediate DC link voltage remains approximately constant during each output cycle. In constant current drives, a large inductor is placed between the input rectifier and the output bridge, so the current delivered is nearly constant.
A cyclo-converter has no input rectifier or DC link and instead connects each output terminal to the appropriate input phase.
The most common type of packaged VF drive is the constant-voltage type, using pulse width modulation to control both the frequency and effective voltage applied to the motor load.
A variable frequency drive system generally consists of an AC motor (mostly 3 phase induction motor), a controller (solid state electronic power conversion devices like diodes,thyristors,IGBTs,etc.) and an operator interface as shown in picture.




An embedded microprocessor governs the overall operation of the VFD controller. The operator interface, also commonly known as an Human Machine Interface (HMI), provides a means for an operator to start and stop the motor and adjust the operating

**VFD Operation**




When an induction motor is connected to a full voltage supply, it draws several times (up to about 6 times) its rated current. As the load accelerates, the available torque usually drops a little and then rises to a peak while the current remains very high until the motor approaches full speed.

By contrast, when a VFD starts a motor, it initially applies a low frequency and voltage to the motor. The starting frequency is typically 2 Hz or less. Thus starting at such a low frequency avoids the high inrush current that occurs when a motor is started by simply applying the utility (mains) voltage by turning on a switch. After the start of the VFD, the applied frequency and voltage are increased at a controlled rate or ramped up toaccelerate the load without drawing excessive current. This starting method typically allows a motor to develop 150% of its rated torque while the VFD is drawing less than 50% of its rated current from the mains in the low speed range. A VFD can be adjusted to produce a steady 150% starting torque from standstill right up to full speed. Note, however, that cooling of the motor is usually not good in the low speed range. Thus running at low speeds even with rated torque for long periods is not possible due to overheating of the motor. If continuous operation with high torque is required in low speeds an external fan is needed. Please consult the manufacturer of the motor and/or the VFD.

**Source: http://electrical-all.blogspot.in/p/variable-frequency-drives.html**