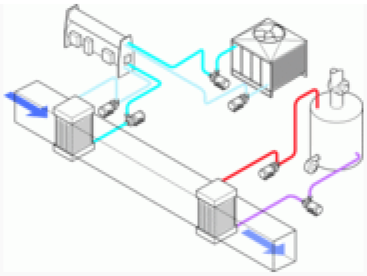
AC DRIVES



AC Drives

The word "drive" is used loosely in the industry. It seems that people involved primarily in the world of gear boxes and pulleys refer to any collection of mechanical and electro-mechanical components, which when connected together will move a load, as a "drive". When speaking to these people, an **AC drive** may be considered by them as the variable frequency inverter and motor combination. People in the electrical field and electrical suppliers usually refer to a variable frequency inverter unit alone, or an SCR power module alone (when discussing DC drives) as the "drive" and the motor as the "motor".

AC drive is a type of adjustable-speed drive used in electro-mechanical drive systems to control AC motor speed and torque by varying motor input frequency and voltage.AC Drives are used in applications ranging from small appliances to the largest of mine mill drives and compressors.

However, about a third of the world's electrical energy is consumed by electric motors in fixed-speed centrifugal pump, fan and compressor applications and AC drive's global market penetration for all applications is still relatively small. This highlights especially significant energy efficiency improvement opportunities for retrofitted and new AC drive installations.

Over the last four decades, power electronics technology has reduced VFD cost and size and improved performance through advances in semiconductor switching devices, drive topologies, simulation and control techniques, and control hardware and software.AC drive are available in a number of different low and medium voltage AC-AC and DC-AC topologies.

Control Performance

AC drives are used to bring about process and quality improvements in industrial and commercial applications' acceleration, flow, monitoring, pressure, speed, temperature, tension and torque. Fixed-speed operated loads subject the motor to a high starting torque and to current surges that are up to eight times the full-load current. AC drives instead gradually ramp the motor up to operating speed to lessen mechanical and electrical stress, reducing maintenance and repair costs, and extending the life of the motor and the driven equipment.

Variable speed drives can also run a motor in specialized patterns to further minimize mechanical and electrical stress. For example, an S-curve pattern can be applied to a conveyor application for smoother deceleration and acceleration control, which reduces the backlash that can occur when a conveyor is accelerating or decelerating.

Performance factors tending to favor use of DC, over AC, drives include such requirements as continuous operation at low speed, four-quadrant operation with regeneration, frequent acceleration and deceleration routines, and need for motor to be protected for hazardous area.

Generic Topologies

AC drives can be classified according to the following generic topologies:

Voltage-source inverter (VSI) drive topologies

In a VSI drive, the DC output of the diode-bridge converter stores energy in the capacitor bus to supply stiff voltage input to the inverter. The vast majority of drives are VSI type with PWM voltage output.

Current-source inverter (CSI) drive topologies

In a CSI drive, the DC output of the SCR-bridge converter stores energy in series-reactor connection to supply stiff current input to the inverter. CSI drives can be operated with either PWM or six-step waveform output.

Six-step[e] inverter drive topologies

Now largely obsolete, six-step drives can be either VSI or CSI type and are also referred to as variable-voltage inverter drives, pulse-amplitude modulation (PAM) drives,square-wave drives or D.C. chopper inverter drives.In a six-step drive, the DC output of the SCR-bridge converter is smoothed via capacitor bus and series-reactor connection to supply via Darlington Pair or IGBT inverter quasi-sinusoidal, six-step voltage or current input to an induction motor.

Load commutated inverter (LCI) drive topologies

In a LCI drive, a special CSI case, the DC output of the SCR-bridge converter stores energy via DC link inductor circuit to supply stiff quasi-sinusoidal six-step current output of a second SCR-bridge's inverter and an over-excited synchronous machine.

Cycloconverter or matrix converter (MC) topologies

Cycloconverters and MCs are AC-AC converters that have no intermediate DC link for energy storage. A cycloconverter operates as a three-phase current source via three anti-parallel connected SCR-bridges in six-pulse configuration, each cycloconverter phase acting selectively to convert fixed line frequency AC voltage to an alternating voltage at a variable load frequency. MC drives are IGBT-based.

Doubly fed slip recovery system topologies

A doubly fed slip recovery system feeds rectified slip power to a smoothing reactor to supply power to the AC supply network via an inverter, the speed of the motor being controlled by adjusting the DC current.

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