

From Torque to Tech: The Smart Future of Variable-Speed Drives

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The flexibility of coordinating power makes variable-speed drives a vital component in the electricity distribution process. Besides regulating voltage and saving energy, it also notably reduces maintenance costs. Over the years, these devices have become more efficient and compact due to semiconductor technology upgrades. Moreover, integration with IIOT and progress in control precision have also brought remarkable outcomes.

Control algorithms in variable speed drive regulate motor speed and torque, on the basis of operational requirements. It saves energy, with some applications reducing almost 60% of the consumption. For example, ABB's ACS880 drives allow the motors to run efficiently. The systems have integrated sensors and IoT connectivity that provide important data for predictive maintenance. Operators observe repair needs before problems arise, keeping track of motor speed, torque, and other parts. These preventive measures not only minimize downtime or lower maintenance costs but also run the entire operation smoothly. It results in long-term efficiency and reliability. For example, drive train is a powerful combination of the element and the motor that has been completely re-engineered for the VSDsseries by the Atlas Copco R&D team. Atlas Copco VSD compressors have a rotary screw element. It features two twin rotors rotating in opposite directions, compressing the air between them.

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The Industrial Internet of Things is using faster and easier communication to collect device data from machines. At present, it is reporting real-time system analytics and performance data used to calculate machine usage, throughputs, energy consumption, and device health. This is used to improve efficiency, uptime, and manufacturing quality. Moreover, adding VFD to the industrial network allows for control from PLCs and information to be stored in a data historian/SCADA system. Remote condition monitoring of important equipment controlled by VFDs also allows technicians to remotely monitor and solve VFD issues before they lead to downtime.

In addition, drives and motors have become sensor hubs, facilitating the collection of temperature or vibration measurements. These are used for predictive maintenance or other monitoring purposes. IIoT and Industry 4.0 have introduced modern designs for VFD products to make them accessible through an Ethernet network. This also highlights the need for more flexibility through software. The VFD is expected to require more software functions to create useful information from the acquired data .

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Using VSDs to control motor systems typically saves 15-40% of energy used in applications where the load on the system is variable. The European Committee of Manufacturers of Electrical Machines and Power Electronics reports that global electrical energy consumption can be reduced by 8% if VSDs are used in every suitable application. For instance, all regenerative braking system takes kinetic energy during the deceleration in EVs and converts it to electricity. This not only acts as an energy storage facilitator for reuse but also offers a compact design with minimal engineering costs and installation footprints. An increase in demand for such efficient energy crisis solutions is expected to bring lucrative opportunities in the variable speed drive market.

Emerson announced the launch of its original Copeland 110cc variable speed scroll compressor, in August 2021, with a 36kW inverter drive solution. Both were manufactured in China and made available for global distribution. The new products were intended to save energy and provide environmentally friendly improvements to a wide range of commercial air conditioning solutions, including chillers, data centers, and compact air conditioning systems.

The integration of improved control algorithms, regenerative braking, and IIoT has transformed how VDSs regulate motors. The development and subsequent evolution of these devices reflect a broader commitment to energy conservation and functional efficacy, marking a significant step forward for various industries that seek efficiency and environmental responsibility.

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