Model-15 Variable Speed Drive

Precise, reliable surface control of Induction or Permanent Magnet Motors

Applications

Control of induction (IMs) or permanent magnet motors (PMMs) used with

- Electric submersible pumps (ESP)
- Electric submersible progressing cavity pumps (PCP)
- Horizontal pumping systems (HPS)

Benefits

- Superior reliability increases uptime of pumping systems
- A wider range of lift system options using a single drive
- Integrated output filter reduces drive footprint
- Optimized motor efficiency with vector control for PMMs reduces OPEX

Features

Open loop vector control of PMMs

Scalar control of IMs

Protective Lexan screen for internal components

Cascade-NT HMI

Specialized ESP application software

- Gas Lock Ride Thru
- Current Mode
- Various Pump Unfreeze modes
- PID-loop operation mode
- Extended ramp-up

Backspin detection and catch-up

Data integration and communications interface

Interface for various downhole sensors' panels

The Model-15 variable speed drive (VSD) intelligently controls induction motors or permanent magnet motors used in ESP and electric submersible PCP applications. The flexibility of motor options combined with advanced software makes the Model-15 VSD capable of operating and controlling submersible pump systems efficiently even in the most challenging well conditions.

Flexibility and enhanced safety considerations are built into the design of the Model-15 VSD. It incorporates an integrated sine wave output filter minimizing the drive's total footprint. With industry-leading electrical efficiency, this VSD provides a near sinusoidal electrical waveform output to downhole equipment.

Lexan screens are provided in order to avoid touching of Model-15 VSD energized components. SCADA, analog, and digital I/O interconnections are made easily without exposure to any high voltage, through an integral control box mounted externally to the drive cabinet side.

Input and output power cables are connected in dedicated junction boxes on the back side of the variable speed drive.

While the Model-15 VSD is capable of controlling motors using both scalar and vector methods, it is the proprietary vector control algorithm that enables the superior performance and efficiency of Levare PMMs.

Running on a high-speed processor in the Model-15 drive, the vector control algorithm is able to resolve the applied three-phase stator current into two components: a magnetizing current and a torqueing current. Adding specific downhole motor characteristics as input, the algorithm permits independent control and adjustment of the two quantities.

In this manner, unlike scalar control, vector control is able to optimize current and power consumption across the full spectrum of motor load encountered during PMM-ESP operation.

The Model-15 VSD controller is further equipped with additional advanced software that supports drive performance in response to challenging well conditions such as gas and solids. Specialized algorithms are available to the operator that help the downhole pump system overcome conditions such as gas lock, scale buildup, or difficulty at startup.

The Model-15 VSD is available in multiple size ratings from 160 A to 1,600 A; with either 380 V or 480 V input voltage rating. Enclosed in a IP54 cabinet, the Model-15 VSD can withstand harsh environmental conditions.

Specifications

Input voltage	480 V -25% / +10% 380 V -15% / +15%
Full power range	132 – 1,328 kVA at 480 V 105 – 1,053 kVA at 380 V
Input frequency	47 – 63 Hz
Efficiency	>95% across all speeds
Output frequency	2 – 240 Hz (0.1 Hz resolution)
Inverter output	PWM
Output distortion	<5% after PWM filter
Intermittent overload	125% for 900 seconds
Temperature	Operational ambient temperature -10°C to 55°C or -60°C to 55°C (with heater package)
Altitude	Full rating to 1,000 meters
Noise	<75 db at 1 meter
SCADA/ I/O built in (i.e., more options available with additional cards)	• RS485 MODBUS Slave • TCP Ethernet MODBUS Slave • 8 digital inputs • 8 analog inputs 0-10 V DC / 4-20 mA (3 built-in, 5 available as option card) • 3 digital outputs • 2 analog outputs (0-10 V DC / 4-20 mA)
Fault and event logging	Operational history is stored in HMI internal memory and can be downloaded via USB-port

Special Application Software Algorithms

Gas Lock Ride Thru

The Gas Lock Ride Thru function works to break or eliminate gas-lock conditions. When enabled and specific conditions of underload are detected, this application steps the drive through multiple predetermined frequencies and detection time frames until gas-locking conditions are overcome.

Current Mode

The Current Mode function acts to reduce or increase motor frequency in order to maintain preset running amps.

Pump Unfreeze Function

The Pump Unfreeze applications enable operator control to free a stuck downhole pump system by means of either controlled reversal of direction (JOG or ROCKING start) or controlled application of increased torque level (CURRENT mode).

Output Voltage Optimization

In scalar control mode for induction motors Model-15 is capable to automatically vary output voltage in order to reduce motor current and increase motor power factor.

PID-loop Control

PID-loop control mode provides intelligent maintenance of Pump Intake Pressure or Analog Input level.