



ENERSAVER[®]

PMM DRIVE SYSTEM

CONTROL AND ENHANCE OILFIELD OPERATIONS

INDUSTRIAL-GRADE DRIVE PACKAGE

The Lifting Solutions FL6 motoring package provides enhanced motor speed control to optimize your operations. The system is outfitted with an extensive feature set and has been designed for simple, user-friendly operation. The drive can be further customized to suit your needs with such features as dynamic braking solutions, semi-conductor fusing, broad communication options, and a variety of chokes. The integrated unit can operate as a standalone unit or as part of other systems.

All Lifting Solutions oilfield-control, energy efficiency products are designed and manufactured by industry professionals with years of combined experience and expertise.

SPECIFICATIONS

- 5 hp–200 hp power range
- 3 voltage classes available
- Standard duty 150% overload – field selectable from 120% – 180%
- Heavy duty 200% overload available
- NEMA 3R standard enclosures
- 35 kA short-circuit current rating (SCCR)
- Standard main breaker power disconnect

FEATURES AND BENEFITS

- Application-specific software for Artificial Lift system optimization
- I/O configuration for Presco switch, P,T, Flow inputs
- POC Interface relay option
- User-friendly HMI screen option
- Harmonic filter options available
- Fully outdoor-rated for harsh environments
- Available in two mounting configurations:
 - Free standing or wall-mounted

PERMANENT MAGNET MOTOR APPLICATION

- Application-specific software for Artificial Lift system optimization
- I/O configuration for Presco switch, P,T, Flow inputs
- Enersaver VFD provides full torque throughout full RPM range
- Improved energy efficiency over traditional Induction motors
- Integrated Danfoss FC-302 with SALT (Sensorless Artificial Lift Technology)
- Dynamic Brake System w/ 30% Duty Cycle, 155% Braking Torque
- Option: Fail-Safe Electric Braking System to control backspin
- Overload capability of up to 150%
- Custom PMM programming based on lifting application
 - Custom HMI User Interface – Can be tailored to client's needs
 - Capable of integration with any POC
 - NEMA 3R standard rating. Available in NEMA 4 outdoor rating
 - IEEE-519 integrated harmonic package available
 - Modbus communication supported without additional hardware



The FL6 drive system is designed and tested for a wide range of applications.

SPECIFICATIONS - PCP PMM APPLICATION | STANDARD PACKAGE

Application Range	15 - 200 HP (Includes Electronic Thermal Overload Relay)
Rated Current (Amps)	Rate by size 15HP-200 HP
Input Voltage	Three-phase 380 to 500 Vac 50/60 Hz (Over voltage trip point 810 VDC)
Allowable Voltage Fluctuation	-10% to +10% (Undervoltage Trip 373 VDC Bus)
Allowable Frequency Fluctuation	±5%
Max Output Voltage	Three-phase 380 to 480 V (relative to input voltage)
Max. Output Frequency	590Hz (300Hz - Flux Mode)
Overload Tolerance	Heavy Duty Rating: 155% of rated output for 1 min/10min.
Technology	Harmonic Input Line Filter, Input - Diode Bridge, Output - Insulated Gate Bipolar Transistor (IGBT), Integrated IGBT Brake Controller
Applications for Oil Wells	Progressive Cavity Pump
Control Methods	<ul style="list-style-type: none"> • U/f (Volts/Hz) • Voltage Vector Control • Flux Sensorless • Flux w/ Motor Feedback
Power Factor	>= 0.98 at rated load
Efficiency at Full Load	> = 98% at rated current and frequency
Torque Instant Overload	155% Rated Torque
Maximum Operating Torque from 0-60 Hz	100% Rated Torque
Programmable Acceleration Time	0 - 3600.00s
Programmable Deceleration Time	0 - 3600.00s
Non-Condensing at Ambient Humidity	5% - 95%
Stop Types	Coast To Stop - Well must stop backspinning prior to restarting. Optional Fail-safe brake system for PMM applications
Maximum Internal Operating Temperature(40 °C)	Force Air Fan Cooling (850 CFM)
Auxiliary Input Types:	0 - 10 VDC, 4 - 20mA., by Communication Protocol Modbus RTU, additional communication protocols supported with additional hardware
Enclosure Cooling Methods	NEMA 3R fan cooled - full integrated self standing - hook for hoisting
Input Protection	Thermomagnetic adjustable input breaker with mechanical handle, door lock system, semiconductor fast fuses one per phase can be added
MCCB/ Fast Fuses Per Phase	60A-400 A/ 60A-400A (3 Phase)
Input Varistors	Type II Surge protective device. Protection capability 50kA, modular replacement with failure indicators. DIN Rail mounted.
Input/Output	Terminal Connection Inputs / Terminal Connection Outputs to Motor
Motor Protection	Electronic Thermal Relay (ETR) - Based on present loading and time
Re-Starting	Programable restart: with time between re-start 0.00 - 3600.00 seconds
Communication Protocol	Protocol - Modbus RTU connection (RS-232/RS485) / Additional options available with added hardware
Moisture Protection	Conformal coating on control boards
Installation (Mounting Type)	Mounting Legs, Flange Mount, Custom Stand Optional - Lifting anchors attached to the roof
Number of Analog Inputs	1 Free Analog Input by default (1 Used for Speed Control on door), can be expanded to 3 Analog Inputs with additional expansion board
Number of Analog Outputs	1 Analog Output Programmable by default, can be expanded to 2 Analog Outputs with additional expansion board
Number of Digital Inputs	1 Free Digital Input, others are used as VSD control terminals. Can be expanded to 8 Digital Inputs with additional expansion board
Number of Digital Outputs	2 Digital Outputs, can be expanded to 5 Digital Outputs with additional expansion board
Fault record and Alarms from VFD	Logs latest 7 faults and provides additional VFD information at time of fault

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Enclosure Dimensions (H X W X D) (in) 15-40 HP, 50-100HP, 125-200HP	Size 2 (36" x 24" x 16"), Size 3 (48" x 36" x 20"), Size 4 (60" x 48" x 20"), All White Powder Coated
Wiring Size	3C - 1000 VAC Insulation Multi-Stranded (Actual AWG size dependent on application size)
Compliance Standards	CSA, UL Certifications, IEEE 519 / THID ≤ 5% at PCC at input of drive (Full Harmonic Filter Option Required),
Variables accessible via Keypad	Rod Speed, Motor Torque and Speed, Output Current, Input/Output Voltage, With HMI Option: - Rod Torque and Speed, Motor Torque and Speed, DC Bus, Input Voltage, Output Voltage, Current Consumption, Power Consumption
Inverter Input/Output Protection	Standard use of protection is Thermomagnetic breaker circuit breaker with operating handle on the door. Fusing can be installed in addition to the circuit breaker for increased SCCR up to 100kA. Input voltage is rated to 480VAC. Electronics are coated circuit boards.
Inverter Modules	Solid State IGBT Module
Rectifier Modules	Solid State Diode Bridge
Dynamic braking system	For PMM PCP applications Dynamic Braking System sized to 30% Duty Cycle and 155% Braking Torque for rugged operation for PMM backspin situations. This is required for PMM operation.
Intermediate Circuit Coils, Capacitors and Resistors	Filtering components are installed within NEMA 3R cabinet. VFD comes with built in DC Chokes.
Physical Structure	Electronics are freely accessible once the cabinet door is opened.
Mounting Types	12" Legs For Enclosure With Mounting Holes For Bolts On Legs. Can Be Installed On Stands.
Enclosure	NEMA Type 3R enclosure, grounding with ground connections mounted to backpan.
Cable Entry	Cable connections require knock outs through bottom of cabinet, however system is designed for cable entry through the bottom of the cabinet.
Data/Downloads	No data download from HMI. VFD can be locally connected to with free software with datalogging capability of up to 4 variables.
Warranty	1 - Year Warranty Period
PCP Application Software	PCP Control: 1) Torque control and protection of rod string (Torque control through torque limiting on forward direction.) - Programmable torque limit with automatic speed adjustment to work within torque limit. System can be configured to trip within up to a 59s delay if torque cannot be reduced below torque limit. - Under load limit - programmable under load limit that is bypassed during startup. Trip drives if drive operates below underload limit for programmable time delay. - Torque adjustment while drive is operating. - Low speed alarm - Configurable low speed alarm setpoint with delay time. 2) Voltage sag/drop capability up to 25% 3) No PCP Speed Control software - PCP speed is set manually through speed potentiometer. 4) Automatic Restart - Selectable number of automatic restarts after power loss or VFD fault. -Includes automatic restart delay time to prevent restarts during backspinning. Up to 3600.00s delay time. 5) Fault tracking up to 7 previous faults at event of fault. HMI Options: 6) HMI interface with drive and drive variables. Additional drive keypad interface is available on cabinet door. - HMI can be customize to display client specific information if possible. - Improved interface over standard VFD keypad simplifies user experience. Easy to adjust specific PCP drive parameters. 7) HMI logs up to last 50 fault names and fault time of occurrence.

SPECIFICATIONS - PCP PMM APPLICATION | AVAILABLE OPTIONS

HMI (Human Machine Interface)	Touch Screen 7" Display, Single serial port provides RS-485 serial communication through Modbus RTU protocol. Option which enhances user interface and provides additional well data.
HMI Variable Displays	7" Touch Screen Display, Displays VFD Well Parameters - Rod Torque, Motor Torque, Rod Speed, Motor Speed, DC Bus Voltage, Input Voltage, Output Motor Voltage. VFD diagnostic information available.
Well Control Software (SALT)	Integrated Danfoss FC-302 with SALT (Sensorless Artificial Lift Technology)
Failsafe Braking System	Failsafe braking system is available for PMM applications as an additional option.