

24 October 2014

Magnetic Pumping Solutions PM-VSD™ Drives

This is a provisional specification subject to change.

Purpose designed submersible pump drives 25 – 300kVA

- High performance permanent magnet motor sensor-less control technology
- Integrated controlled sine filter for reliability in long cable applications
- Integrated acquisition of drive/motor/pump operation, downhole gauge and surface process data
 - Virtually unlimited internal data logging
 - Retrievable memory card and wireless data transfer
 - Remote control and monitoring options
- Oilfield-specific process control applications like intake pressure, dewatering and low-influx.
- Comprehensive alarm and automatic restart options
- Easy to use full colour touchscreen with large clear display of 10 parameters at a time, easy navigation, touch-to-change units, security levels, graphical displays and comprehensive history reporting
- NEMA 3R enclosures for worldwide use
- IO terminals and air filter element accessible during operation
- Latest generation power electronics and gate array computing technology

Sensor-less control of new-technology permanent magnet motors

- Safe, controlled, high torque and stuck pump starting
- For PM-PCP® direct-drive motors
 - Backspin control
 - Low speed, < 100rpm

Scalar control of induction motors

- Universal drive
- Brings advanced features to conventional ESPs



Control

Conventional ESP drives output a variable voltage at constant volts/Hz ratio and the motor controls itself as if operating off a variable utility supply. This *scalar control* is very simple and sufficient for induction motors used in these applications. It is possible nevertheless to over-amp the motor at start-up, just as it is when using switchboards.

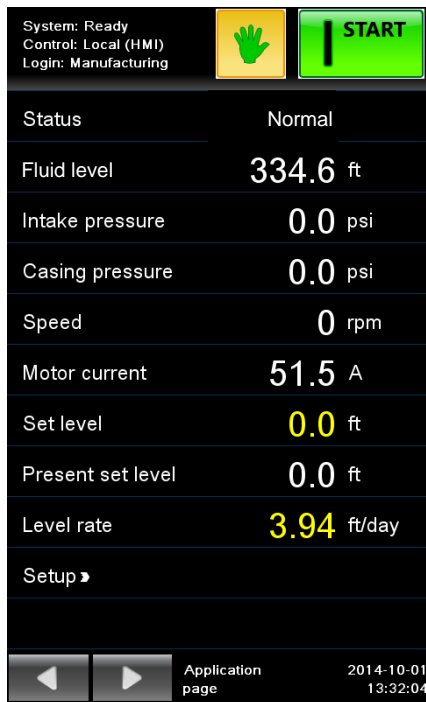
MPS permanent magnet motor technology requires *closed-loop control*, the result of many years of application-specific research and development. These motors are synchronous, that is the applied voltage and current must be in a stable phase relationship with the rotor position. In common industrial applications like robotics, shaft sensors are used to assist the drive. With submersible motors these sensors are not feasible. MPS drives use *sensor-less control*: the drive output voltage and current are measured thousands of times per second and at each point an accurate electrical model of the motor and installation back to the drive is used to adjust the output so as to maintain the rotor in synchronism. The result is stable operation with fluctuating loads, control of torque throughout the speed range – there is no danger of a snapped shaft – and in PM-PCP® applications a remarkable ability to operate below 100rpm.

Operation.

MPS drives are easy to set-up ...

- 1 Select the installation type: - **PM-ESP®**, **PM-PCP®** and **ESP Induction Motor**.
- 2 Select the application type: - **Speed Control**, **Pressure Control**, **Level Control**, **Optimised Intermittent Lift (OIL™)**, and **Automatic Well Dewatering**.
- 3 Enter the pre-start parameters from the nameplate or catalogue information; check the pre-calculated alarm settings and gauge readings
- 4 Touch the **Start** icon.

The touch screen display has easy to use navigation screens that allow the user to easily set up the drive operation and all units can be swapped between metric and imperial with one touch on the screen.



The large screen displays everything needed for routine monitoring. Touch to change the main page to list power details, gauge details and so on. Touch the Home key and a smaller display pops up for you to quickly navigate for further information.

Change a value? Touch a yellow (alterable) entry and up will pop a keypad showing only the needed keys. Default, Cancel buttons and limits checks all help smooth the process.

Your settings are saved automatically and can be restored at any time or reverted to the settings that your serviceman prepared for you. You can take the settings away on an SD card for safe keeping and apply them to another drive.

Why should you need to enter or remember file names? You don't. The drive logs everything all the time, and you can pop-in an SD card in the door to fetch missing files or leave it in to stay current until you are ready to collect it. Files are unique to the drive, so just use the same card for several jobs on one collection round. Drives internally record a minimum of 12 month's data.

If the drive detects something you should know about, the top left status alternates with an indication – information, warning or fault; touch the screen and up pops a list of all issues with suggestions for further action. An event viewer allows you to browse back for any significant events, like stops, starts, faults and parameter changes.

Applications

In the drive's process applications, production is controlled using some function of process measurements like pump intake pressure to smoothly regulate motor speed. It is possible at any time to override the regulator by touching to turn to Speed control mode and touching again to revert to regulation. Mode change is bumpless – nothing sudden will happen. For example if you temporarily go to Speed mode and do nothing, the Speed will hold at its last regulated point. Or you can change speed and later the process regulator will smoothly restore the correct speed. This is useful to temporarily observe inflow behaviour or rapidly adjust casing fluid level.

Specifications

Output		
	3 phase sine wave	Integral sine filter option
300kVA nominal rating	300kVA/0.85PF/400A/450V	
100kVA nominal rating	117kVA/0.85PF/150A/450V	
100kVA nominal rating	100kVA/0.85PF/90A/650V	For higher voltage PM-PCP® applications
50kVA nominal rating	50kVA/0.85PF/70A/450V	
25kVA nominal rating	25kVA/0.85PF/35A/450V	
Overload	150% for 1min/10min cycle	
Frequency	30 – 150Hz (PM-ESP™) 1 – 30 Hz (PM-PCP™)	
Control	MPS Sensor-less	Permanent magnet motors Speed and Process control
	Scalar	Induction motors Frequency and Process control
Back-spin control unit		PM-PCP® option
Protection	Motor isolation switch	Required for permanent magnet motors, which generate voltage when back-spinning.
	Comprehensive fault protection and event log diagnostic reporting	Short circuit, over-load, under-load, thermal, internal faults, supply fault – over 100.
	User-accessible trip loop	24V loop bypassing electronics and firmware.

Output ratings are at nominal supply voltage and without sine filter option.

Supply		
Voltage	3 phase 380 – 480VAC +5% -10%	Nominal 480VAC drives
	3 phase 690VAC +5% -10%	Nominal 690VAC drives
Frequency	48 – 63Hz	
Power factor	>95%	Fundamental
Protection	MOVs across lines, and to earth on grounded systems.	In incoming junction box
	Circuit breaker 50kA symmetrical breaking capacity	With instantaneous and thermal trip levels
	Soft start	Negligible inrush current, ideal for weak utility connection and generators.
Harmonics and EMC		Consult factory for external low-pass filter option. Not required for generator supplies.
Isolation	PM-PCP® requires floating mains supply or isolating transformer.	PM-ESP® will normally use output step-up transformer.

Physical/Environmental		
Air-cooled Enclosure	NEMA 3R with bolt-down base	Integral junction boxes for supply and load connections. Integral data cabinet for IO connections and access during drive operation.
Handling	Integral plinth with fork-lift slots. Lifting eyes provided on frame size F4.	
Finish	White powder coat	
Ambient temperature – operating	-20C to +50C	Options: Cold weather and hot weather kits.
Altitude	0 – 1000m	Consult for higher altitude
Cooling	Filter forced air.	Easy filter replacement while drive operating.

Door mounted		
Operator interface	Colour touch screen under protective viewing door.	Integrated display of motor/pump operation, gauge data, graphical data. Memory card for data transfer.
Wireless operator interface		Bluetooth option
Door lamps	Run, Warning, Fault	Alternative visual encodings possible.
Emergency stop switch		Option
Breaker		Main door interlock with power supply breaker.

Data Cabinet		
Internal IO	1x Analogue input $\pm 10V$ 2x Analogue input 4-20mA 2x Analogue output $\pm 10V$ or 4-20mA programmable 4x 24V Digital output 4x 24V Digital input 24VDC 100mA loop supply Modbus slave (isolated)* Modbus master* 24V trip loop	Wire into drive cabinet
IO Module	2x Analogue input $\pm 10V$ 4x Analogue input 4 – 20mA 2x Analogue output $\pm 10V$ or 4-20mA programmable 4x 24V Digital output 6x 24V Digital input 4x 240VAC 5A relay output 24VDC 250mA loop supply 3x Modbus master/slave Modbus TCP/IP (Ethernet) 1x Modem port Dedicated link to Oxmos gauge interface.	IO Option Module in data cabinet IO isolated from ground

Ordering information

Part Number	Supply (V)	Output current (A)	Frame size	Weight (kg)
MPS-501003505	480	35	F2	140
MPS-501007005	480	70	F2	150
MPS-501015005	480	150	F4	500
MPS-501040005	480	400	F4	600
MPS-501010007	690	100	F4	500

Frame Sizes

Part Number	Dimensions (metres)
F2	1.4 H x 1.04 W x 0.5 D
F4*	2.0 H x 1.6 W x 1.0 D (1.0W without junction boxes, 0.79D without rear vent)

*Pilot series drives vary – consult applications engineer.

Options

Code		
001	EMC supply filter	Consult factory for specific requirements.
002	Active sine load filter	Recommended for all installations.
003	Passive sine supply filter	Low harmonic supply load without multi-pulse transformers and associated wiring.
004	Active sine supply filter	Near ideal low harmonic supply load with internal power electronics, not available on all drives.
010	NO junction boxes	Power and load cables to be run directly into the enclosure.
011	Cold weather kit	To -35C. Consult factory for colder temperatures.
012	Pedestal	For frame size F2 as alternative to wall mount.
020	Backspin protection	Mandatory for PM-PCP® installations.
021	Flying start	Catch PM-ESP® motor backspin.
022	Emergency stop switch	Door-mount to augment customer's own trip loop switches.
030	Expansion IO	Module for data cabinet.
031	Bluetooth	
5xx	Customer-specific	Special markings, logo, menus, Modbus maps, lamp coding.

Your MPS applications engineer will advise on option selection and whether the options may be fitted in the field.