

Progressive Cavity Pump Controller

Firmware Version 1.06

Manual Revision 1.00

User Operation and Configuration Manual

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Technical Specifications			
Input Voltage	24 VDC		
Maximum Current Consumption	270 mA		
Battery-Backed RAM	7 year typical at 25 °C, replaceable without opening the controller.		
Display Size and Resolution	5.7 Inch, 320x240 Pixels		
Display Colors	65,536 (16-Bit)		
Touchscreen	Analog Resistive		
Keypad	On-Screen Only		
Digital Inputs	7 Total, NPN 5, General Purpose 2, Dedicated Purpose		
Analog Inputs	2, 0-10 VDC 1, 4-20 mA		
Digital Outputs	2 Relay 4 Transistor		
Serial Ports	 2 Serial RS232/RS485 with galvanic isolation. Port 1 is dedicated to SCADA communication. Port 2 is dedicated to VFD communication. 1 USB Used for programming and PC access. COM Port 1 is disabled when using USB connected to a PC. 		
Date, Time, and Supervisor	Real-Time Clock and Watchdog		
Parameter and Event Storage	Removable SD Card		
Temperature	Operation: 0 to +50 °C (32 to 122 °F) Storage: -20 to +60 °C (-4 to 140 °F)		
Humidity	5 % to 95 %, non-condensing		
Physical	7.75" x 5.77" x 2.7" (197 mm x 146.6 mm x 68.5 mm)		



<u>! CAUTION !</u>

Always verify that the power has been disconnected from both the OptiPump PC controller and the Fuji Mega variable frequency drive (VFD) before making changes to the wiring.

Failure to do so may result in severe injury or death!

High DC voltages may still be present for a period of time after main power has been removed from the variable frequency drive. Take note of the red **Charge** LED, labeled CRG, located on the drive. Depending on the size of the drive, the LED may be visible through the front cover. The LED will go dark when the DC bus has been discharged. Until then, potentially dangerous voltages may still be present for several minutes after disconnecting power.

You should always verify that terminals are no longer powered by using a properly working and tested multimeter.

Attention:

When wiring 4-20 mA transducers to the system, the use of shielded, twisted cable is REQUIRED. Failure to use shielded, twisted signal cable may result in unexpected or erratic behavior.

The shield/drain wire should be connected to an earth ground at ONE end of the cable only. Do NOT connect both ends of the shield/drain wire to earth ground. Doing so may result in unexpected or erratic behavior.

Do NOT run transducer signal cables in the same duct or conduit as the VFD motor or other power leads. Transducer signal cables should be run only with other low voltage, DC signal cable.

Navigation

The OptiPump PC controller on-screen interface is navigated using the touchscreen. Elements that are touch-sensitive are marked with a dark blue background with white text. A few examples are shown below, with several (but not all) of the buttons circled in red.

Buttons that perform critical or non-reversible functions (such as clearing history items) may be marked in yellow or red to indicate to proceed with caution.

All parameter screens have a Menu button located in the lower center of the screen. Pressing the Menu button will return you to the menu for the group of parameters currently displayed.

Remember, if for some reason you ever find yourself lost in the interface, simply press the Menu button located in the lower center screen to return instantly back to the menu. Then, to return to the Home Screen, press the Home button located in the lower center of the screen of any menu.



Home Screen

VFD Desired Speed 49.80 Hz	AID Advanced Industrial Devices	VFD Desired Speed 49.80 Hz	AID Advanced Industrial Devices
VFD Output Speed	Controller is	VFD Output Speed	Controller is
49.80 Hz	active and	0.00 Hz	FAULTED.
VFD torque in LB-Ft	RUNNING.	VFD torque in LB-Ft	Underload
0.00 Lb-Ft		0.00 Lb-Ft	Detected.
Polished Rod Torque	Total Run Hours	Polished Rod Torque	Total Run Hours
0.00 Lb-Ft	0.00	0.00 Lb-Ft	0.00
VFD Running	g FORWARD	VFD S	FOPPED
Well Metrics Alarms	Status Setup	Well Metrics Alarms	Status Setup

Normal Operation



The Home screen provides an overview of the current operating conditions of the system.

Four user-selectable monitors are displayed on the left of the screen, with the system status and total run hours displayed on the right. The VFD status is displayed just above the navigation buttons. Depending on the status of the system and VFD, these monitors will change color to provide a quick visual indication of the status.

The navigation buttons located at the bottom of the Home Screen provide quick access to important system information and configuration settings.

Well Metrics – Charting of critical system values.

- Alarms Detailed information about system alarms and VFD faults.
- **Status** Detailed I/O status and VFD diagnostic information.
- **Setup** Configure the system using application and site-specific settings.

Well Metrics



Well Metrics provides real-time charting of voltage, current, frequency, and torque, which allows a user to quickly get an overview of the pump operation over time.

This feature presents the most valuable trending data all in one place, to make it simple to diagnose performance issues with the pump.

The Start / Stop button located in the lower-left corner of the screen starts and stops the charting

function. The multicolored buttons for Amps, Hz, Volts, and Trq toggle the individual plots above.

Menus

Setup Menu			<i>;</i>	Alarms	s Menu	
Operation (Application Specific)	ation Motor n Specific) (Under/O∨erload, Ratios)		System			VFD
Digital Inputs (Alrms, Shtdwns)	Analog Inputs (Scaling, Alrms, Shtdwns)		Clear Histo (Use Cautio	ory on)		
Home Screen (Monitors, Display)	SD Card / Data Storage (Logging)					
Advanced Configuration Manual Control (Use Caution) (Use Caution)						
Home				Ho	me	

The Setup Menu provides a central location for managing the configuration of the OptiPump PC controller. Each of the parameter groups is described in further detail in the Parameters section of this manual.

The Setup Menu is protected by a user-definable password. The default value for this password is "444".

The Alarms Menu separates the alarms/shutdowns into System and VFD specific types, and provides the option to delete the history via the Clear History button. In order to prevent unintended clearing of the alarm/shutdown history, the Clear History button must be held for 5 seconds to access this feature.

Alarms

Sys Alarms	s / Shutdown	is 0/199	VFD) Alarn	ns / Sh	utdowi	ns 0/19	99
The lir termina		OH2	-An exterr on an X ter	nal limit shu minal tripp	itdown ed			
Date: 07	/30/18 Time:	09:11 AM		Date: (07/30/18	Time:	09:13 AM	
Ref Frequency	Motor Power	DC Bus Voltage	Ref	Frequency	Moto	r Power	DC Bus Voltag	ge
49.60 Hz	- 0.05 %	624 V		49.60 H	z	0.00 %	627	V
Output Frequency	Output Current	Inside Temp	Output	t Frequency	Outpu	it Current	Inside Temp	5
49.60 Hz	0.04 %	44 Deg C		0.00 H	Z	0.00 %	44 D	eg C
Torque	Output Voltage	Heatsink Temp	T	Forque	Outpu	t Voltage 👘	 Heatsink Tem 	np
0.00 %	414.0 V	25 Deg C		0.00 \$	%	0.0 V	24 Dej	gC
< == Prev ==	Menu	== Next ==>	<==	Prev ==	M	lenu	== Next ==:	Ý

System Alarms / Shutdowns include non-VFD related alarms/shutdowns, such as underload, overload, analog and digital inputs, etc.

VFD Alarms / Shutdowns include only VFD-related alarms/shutdowns. These alarms/shutdowns are the result of a VFD fault, which will display an error code on the VFD keypad.

When an alarm/shutdown occurs, a detailed snapshot of the operating conditions at the time is stored in history. 200 snapshots each, of both System and VFD, are retained in history for review, and can be very helpful when troubleshooting potential problems.

Clearing the alarm/shutdown history permanently deletes the history – it cannot be recovered, so please use caution when selecting this item from the Alarms Menu.

Status

System Sta	atus	2/2	VFD	Status	6			1
VFD Size 15 HP	Modbus CMD PENDING	PAR GLA PENDING GLR	Ref F	r <mark>equency</mark> 9.60 Hz	Out Fre 49	<mark>quency</mark> .60 Hz	DC	Bus Volta 625
GL Average 0.00 %	GLIS:N O	GL Deviation	Out	Voltage 414.0 V	Out C	urrent 0.0 A	0	ut Torque - 0.0
GLA Threshold 0	GLA React Delay 00:00.00	GLA Reset Delay 00:00.00	Form DC B	r <mark>ard</mark> R rakeAc	.everse :celerate	Stoppe Deceler	ed rate	Bus Go Busy
GLR SV 0.0	GLR Detect Delay 00:00.00	GLR Reset Delay 00:00.00	Fa X1 X2 0 0	ult V 2 <mark>X3 X4 X</mark> 0 0 0	olt Limit (<mark>5 ×6 ×7</mark> 0 0 1	Current L Y1 Y 0	.imit <mark>(2 </mark>	Torque L 8
< == Prev ==	Home	== Next ==>	<==	Prev ==	Ho	me	-	= Next ==:

The VFD and System Status screens provide a broad overview of current operating conditions, and can

be very useful when commissioning a new site, or troubleshooting configuration or installation problems.

When the digital inputs (X1 - X7) and outputs (Y1 - Y5, 30) are active, a "1" is displayed below the corresponding input or output. A "0" is displayed below the corresponding input or output when it is inactive.

Manual Control

Manual Co	ontrol	1/1				
! WARNING ! ! ALL FAULTS / SHUTDOWNS ARE DISABLED !						
Ref Frequency	Out Frequency	Forward				
60.00 H:	z 0.00 Hz	Reverse				
Motor Current	Rod Torque 0 LbFt	Stop				
VFD STOPPED						
	Menu					

During commissioning or troubleshooting, temporarily disabling the shutdowns may be useful. The Manual Control feature, accessible from the Setup Menu, allows a user to operate the pump with all shutdowns temporarily disabled.

In order to access this feature, the Manual Control button on the Setup Menu must be held for 5 seconds.

After leaving this screen, by pressing the Menu button, all previously defined shutdowns will become

active again, and the system will return to normal operation.

Motor Parameters

Underl	oad Setp	oint 1	17 Underl	oad Reac	tion 2/7
Setpoint 0.0 A	Output Speed 0.00 Hz	Motor Current Rod Torqu 0.0 A 0 Lb	ue Setpoint Ft 0.0 A	Output Speed 0.00 Hz	Motor Current Rod Torque 0.0 A 0 LbFt
Detection	Torque	Detect underload as motor current, rod torque, or both.	Reaction	Shutdown Timed Restart	How to react when an underload condition is detected.
Adaptive Current	Not Used	Automatically adjust the motor current setpoint based on pum	p. Start Delay	00:01:00	Delay detection of an underload for this time at startup.
Mtr Amps @ 60 Hz	0.0 A	Motor underload current at 60 Fixed, if Adaptive set to Not Us	Hz. Detection red. Delay	00:00:30	After Start Delay, time underload must be present to be detected.
Rod Torque	55 LbFt	Rod underload torque setpoint	Restart Delay	00:10:00	Time before automatic restart, if Reaction is set for Timed Restart.
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Overio	ad Setpo	int 3	7 Overlo	ad Reacti	ion 4/7
Setpoint	Output Speed	Motor Current Rod Torqu	Je Setpoint	Output Speed	d Motor Current Rod Torque
Detection	Torque	Detect overload as motor current, rod torque, or both.	Reaction	Shutdown Timed Restart	How to react when an overload condition is detected.
Adaptive Current	Not Used	Automatically adjust the motor current setpoint based on pum	p. Start Delay	00:01:00	Delay detection of an overload for this time at startup.
Mtr Amps @ 60 Hz	0.0 A	Motor overload current at 60 H Fixed, if Adaptive set to Not Us	z. Detection æd. Delay	00:00:30	After Start Delay, time overload must be present to be detected.
Rod Torque	150 LbFt	Rod overload torque setpoint.	Restart Delay	00:10:00	Time before automatic restart, if Reaction is set for Timed Restart.
	-	4			

For Underload and Overload related parameters, the real-time monitors for Setpoint, Output Speed, Motor Current, and Rod Torque are displayed at the top of the screen for reference.

The Underload and Overload features can be tripped using motor current, rod torque, or both. For most PC pump applications, rod torque will be selected.

The controller can react to an Underload or Overload condition with No Shutdown, Shutdown with Manual Reset, or Shutdown with Timed Restart.

Motor Tuning 5/7						
Motor Speed	1200	RPM	M Synchronous speed of the motor connected to the VFD.			
Auto Tune	S Auto	Start Starts the Auto - Tune process Auto - Tune to determine motor characteristic				
Accurate motor information is critical to the operation of the torque -vector mode. Auto -Tuning can only be performed while the VED is stonged						
·						
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For PC pump applications, accurately tuning the motor is a critical step in the commissioning process. This requires the motor nameplate information be readily available: rated horsepower, rated speed, and full-load amps.

Select the appropriate Motor Speed, then press the Start Auto-Tune button and follow the on-screen instructions.

The VFD **MUST BE STOPPED** before performing the Auto-Tune procedure. Verify that the motor is not still



spinning as well.

In cases where an output transformer is connected to the VFD, the motor voltage and current can automatically be calculated based on the transformer primary/secondary ratio.

Rather than manually calculating this ratio, the OptiPump PC controller can determine the ratio by simply entering the rated voltage taps configured at the site.

For example, if the primary rating of the output transformer is 480 VAC, and the secondary of the

transformer is tapped at 1000 VAC, simply enter these values in the Primary / Input (Volts) and Secondary / Output (Volts) parameters. The OptiPump PC controller will automatically calculate a ratio of 2.08:1, and display the correct Xformer Output Voltage and Xformer Output Current on the Home Screen monitors.



A PC pump drive head typically includes a set of pulleys used to slow the speed and increase the available toque of the rod string. Since the rod string has a rated maximum torque that can result in damage if exceeded, determining the accurate rod torque is critical to the operation of a PC pump. The OptiPump PC controller provides a simple method of determining the pulley ratio for these applications.

In order for the OptiPump PC controller to calculate the pulley ratio, only the motor and polished rod pulley diameters are needed. These values may be obtained either through the specifications on the drive head, or by simply measuring the pulley diameters with a tape measure.

Once the pulley diameters are known, the values are entered into the parameters Motor Pulley Diameter (Inches) and Polished Rod Pulley Diameter (Inches). The OptiPump PC controller will automatically calculate the ratio.

When setting Underload, Overload, and Limiting values for Torque, please note that these values are in Polished Rod Torque Lb-Ft, and are calculated by using the motor torque and the pulley ratio.

Operation Parameters

The Operation parameters control the behavior and reactions of the system to application and sitespecific requirements.

Control & Speed 1/13						
Start / Stop Source	Digital Input X7	Device contro and stopping	olling the starting of the system.			
Speed Source	Speed Potentiometer	Device contro of the system.	blling the speed			
Minimum Speed	15.0 Hz	Minimum oper (0 - 120 Hz)	ating speed.			
Maximum Speed	60.0 Hz	Maximum operating speed. (25 - 120 Hz)				
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Control & Speed parameters determine which device controls the starting and stopping of the system, as well as the how the speed is controlled. The subsequent parameter screens will apply depending on the parameter values chosen on this screen.

The Minimum Speed and Maximum Speed, which apply to all operation and control methods, are also set on this screen.

Start / Stop Source

Digital Input X7 – The system will run when terminal X7 is closed. Analog Input C1 Level – Start and stop will be based on set levels of Analog Input C1. Analog Input V2 Level – Start and stop will be based on set levels of Analog Input V2. Time Clock – Run and stop durations will be based on set times. SCADA Remote Control – A remote device will start and stop the system.

Speed Source

Speed Potentiometer – The system speed will be manually set using the speed-pot connected to T12. Analog Input C1 Tank Drain – When used to drain a tank, the OptiPump PC controller will automatically decrease the speed as the tank level decreases based on Analog Input C1 (see Analog Speed Tank Drain parameters later in this manual). Analog Input V2 Tank Drain – When used to drain a tank, the OptiPump PC controller will automatically decrease the speed as the tank level decreases based on Analog Input V2 (see Analog Speed Tank Drain parameters later in this manual).

SCADA Remote Control – A remote device will set the speed of the system.

Analog Input C1 PID – The system will attempt to maintain a level using PID control, with the feedback as Analog Input C1.

Analog Level Start / Stop 2/13							
Start Level	15.0	FEET	Scaled analog level to start.				
Stop Le∨el	3.0	FEET	Scaled analog level to stop.				
Start Delay	00:0	0:01	Start delay when Start Level is met.				
Stop Delay	00:0	0:01	Stop delay when Stop Level is met.				
Start / Stop Source must be set to Analog Input C1 Level or Analog Input V2 Level.							
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Start / Stop Source must be set to Analog Input C1 Level or Analog Input V2 Level in order for these parameters to apply.

The OptiPump PC controller can start and stop based on the level of Analog Input C1 or Analog Input V2. The Start and Stop Levels are based on the scaled (engineering unit) values configured for the chosen analog input.

The system will start when the analog input level is equal to the Start Level for the time set by Start

Delay, and the system will stop when the analog input level is equal to the Stop Level for the time set by Stop Delay.

The default values for the Start Delay and Stop Delay are 1 second. Depending on how steady the signal from the analog input is, either electrically from noise or mechanically from the process, the time may need to be extended in order to prevent the system from starting and stopping too quickly.

Analog Speed Tank Drain 3/13							
Minimum Le∨el	3.0	FEET Scaled analog level to run minimum speed.					
Maximum 15.0 FEET Scaled analog level to run maximum speed.							
The VFD will run minimum speed when the tank level is at or below the Minimum Level, and will run maximum speed at or above the Maximum Level. In between, the VFD will modulate speed.							
Speed Source must be set to Analog Input C1 Tank Drain or Analog Input V2 Tank Drain.							
<== Prev == Menu == Next ==>							

Speed Source must be set to Analog Input C1 Tank Drain or Analog Input V2 Tank Drain in order for these parameters to apply.

Analog Speed Tank Drain offers an alternative to PID control for tank drain applications. Rather than spending time tuning the PID settings in order to maintain a tank level, this method requires only two parameters to be set.

The system will run at Minimum Speed at or below the Minimum Level parameter, and at Maximum

Speed at or above the Maximum Level. In between these points, the VFD will scale the speed linearly, like a traditional signal-following setup. This allows the controller to find a level between the two points that matches the inflow rate. Think of this method as defining the tank levels that the application can tolerate, and the system will find a value within that tolerance to maintain.

Both the Minimum Level and Maximum Level parameters are based on the scaled (engineering unit) values configured for the chosen analog input.

Time C	loci	ς		4/13
Run Time	00:8	50:00	System will ru	in for this time.
Stop Time	00:3	30:00	System will st	op for this time.
Start / Stop Source must be set to Time Clock.				
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Start / Stop Source must be set to Time Clock in order for these parameters to apply.

The Time Clock operation mode works just like a traditional mechanical time clock, without accounting for the time of day. The system will run for the time set in Run Time, and then stop for the time set in Stop Time.

PID 5/13						
PID Action	Nor	mal	Normal: Raise output to raise PV. Inverse: Lower output to raise PV			
Setpoint	7.5	FEET	Target value	arget value VFD will maintain.		
Auto Tune	St Auto -	art Tune	Auto-Tunes PID loop and fills P, I, and D values based off process.			
Proportional	l lt	ntegral	Derivativ	'e	Sample Time	
10.0		10	0		1.00	
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Speed Source must be set to Analog Input C1 PID in order for these parameters to apply.

PID speed control attempts to maintain a specific value set by the parameter Setpoint. The Setpoint is scaled using the same units as the Analog Input C1.

The PID Action controls the response of the controller to a change in the feedback. A Normal response causes the VFD speed to increase in order to increase the value of Analog Input C1. An Inverse response causes the VFD speed to decrease in order to

increase the value of Analog Input C1.

Tuning the PID response by hand can be a time-consuming process. The OptiPump PC controller includes an auto-tuning function for the PID control that can dramatically decrease the time required for tuning the response. While the system is running, press the Start Auto-Tune button to begin the process. Please be aware that the auto-tuning process can force the speed of the pump to the set limits, as well as overshoot and undershoot the target Setpoint. The process must be capable of handling these reactions safely in order to use the auto-tuning feature.

The Proportional, Integral, Derivative, and Sample Time parameters will automatically be set by the auto-tuning process, but can be overridden or set by the user, if necessary.

Varible Frequency Drive 6/13						
VFD Mode	Torque -Vector Mode	VFD operatio recommende	n mode. Ve d for PC pur	ctor nps.		
Carrier Frequency	2 kHz	Carrier freque (1 · 10 kHz)	ncy.			
Maximum Voltage	460∨	Maximum out (160 - 500 V)	put voltage. I			
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General, VFD-related parameters are available on the Variable Frequency Drive parameter screen. Typically, these parameters only need to be set during the initial commissioning of the site or system.

The VFD Mode switches between V/Hz and Torque-Vector operation modes. V/Hz mode simply creates a predefined relationship between the output voltage and frequency from the VFD. This is the most basic operation mode of a VFD. Torque-Vector mode allows the drive to automatically determine the torque requirements of the load, and increase

available torque to prevent the motor from stalling. Generally, the Torque-Vector mode allows for 100% motor torque throughout the speed range of the motor, and is the recommended VFD mode for PC pump applications.

For PC pump applications, the Carrier Frequency plays a role in how smoothly and quickly the VFD reacts to changes in torque requirements. Ideally, this value should be set as high as possible. However, increasing the Carrier Frequency also increases the electrical noise generated by the VFD, as well as the heat generated by the VFD. The recommended Carrier Frequency for most applications and sites is 6 kHz. This provides a good balance between torque control, electrical and audible noise, and heat generation.

The Maximum Voltage should be set to match the rated voltage of the motor.

Torque Limiting 7/13				
Torque Limit	Enable	d	Limit polished rod t	orque.
Start Time	00:01:0	0	Time from start to u	use Start Limit.
Start Limit	66 Lb	Ft	Polished rod torque start.	e limit during
Run Limit	10 LbFt		Polished rod torque	e limit during run.
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The OptiPump PC controller includes high-speed torque limiting that protects costly PC pump components, and can be easily enabled using the Torque Limit parameter. All limits are set in Polished Rod Lb-Ft, and automatically take into account the configured pulley ratio on the drive head.

For applications where a higher or lower startup torque is required, a Start Limit can be configured. The Start Limit applies for the Start Time during startup. After the Start Time elapses, the Run Limit applies.

The torque limiting feature relies on having accurate motor information and successfully performing the auto-tuning procedure prior to operation.

Currer	nt Limiting	j –	8/13	
Current Limit	Enabled	Limit motor cu	rrent.	
Start Time	00:01:00	Time from star	t to use Start Limit.	
Start Limit	50.0 A	Motor current	limit during start.	
Run Limit	23.0 A	Motor current	limit during run.	
<== Prev	/==	/lenu	== Next ==>	

In addition to limiting torque, the OptiPump PC controller can limit motor current to provide another layer of equipment protection, and can be enabled using the Current Limit parameter. All limits are set in Motor Current Amps, and automatically take into account the configured transformer ratio.

For applications where higher or lower starting current is required, a Start Limit can be configured that differs from the Run Limit. The Start Limit applies for the Start Time during startup. After the Start Time elapses, the Run Limit applies.

As with torque limiting, current limiting relies on having accurate motor information configured, and the auto-tuning procedure performed prior to operation.

Minimum Speed Shutdown 11/13					
Detection	Ena	abled	Detect minimum speed condition.		
Start Delay	00:0	02:00	Delay detection of minimum speed for this time at startup.		
Detection Delay	00:0	01:00	Time from start to use Start Limit.		
Restart Delay	00:3	30:00	Time from start to use Start Limit.		
Reaction	on (1/4) Shutdown - Requires manual reset.				
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When enabled, Minimum Speed Detection allows the controller to detect that the motor is running at or below the set Minimum Speed, and shut down after a predetermined time. This provides extra equipment protection for conditions that result in the output speed being pushed lower than the desired speed, such as current or torque limiting strongly engaging for an extended period of time.

The detection of a minimum speed condition will be ignored for the time set in Start Delay at startup. After the Start Delay elapses, the Detection Delay will

apply. Once a minimum speed condition is detected after the Start Delay, the condition must remain present for the time set in Detection Delay in order to trigger a reaction to the condition.

Once a minimum speed condition is set, the Reaction will apply. The Reaction to the condition can be to shutdown the system or simply indicate the condition as an alarm. Both of these conditions can be configured for manual or timed reset.

Reaction

Shutdown – Requires manual reset. Shutdown – Restart after Restart Delay. Alarm indication – Requires manual reset. Alarm indication – Clears after Restart Delay.

Fault R	leset		12/13
Auto Reset	Enabled	Automatically faults.	reset VFD -related
Restart Delay	00:05:00	Delay detecti for this time a	on of minimum speed t startup.
<== Pre\	/== N	/lenu	== Next ==>

In the event of a VFD-related fault, the OptiPump PC controller can be configured to automatically reset the fault condition by enabling the Auto Reset parameter. The controller will wait for the time configured in Restart Delay before initiating the restart.

The Auto Reset feature is recommended to be disabled in order to catch and notify the user of a potential issue with the application or equipment. If needed as a short-term bypass or for dealing with a known site-related issue, the Auto Reset feature can

be enabled until the issue can be fully resolved. In general, VFD-related faults should not occur during proper and normal operation of the equipment.

Start S	peed		13/13
Start Speed	Enabled	At startup, sy: normal refere	stem will override nce for set time.
Startup Speed	10.00 Hz	Override refer startup.	ence frequency at
Timer	00:00:10	Time to apply startup.	Startup Speed at
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In some circumstances, allowing the controller to override the desired speed for a period of time at startup can be beneficial. Enabling the parameter Start Speed will override the normal operating mode speed to the Startup Speed for the time set in Timer.

Once the time set in Timer elapses, the Start Speed parameters no longer apply until the system stops, and the cycle starts over again.

Analog Input Parameters

Analog Input C1 - 0.0 mA 1/2							
Input Name /	' Descript	tion	Low Ra	inge	High Ran	ige	Units
C1			0	.0	30.0)	FEET
Low Shutdo	wn/Alarn	n Star	t Delay	Dete	ect Delay	Re	start Delay
0.0	FEET	00:	00:00:10 00:00:04 00			0:04:00	
High Shutdo	wn/Alam	n Star	t Delay Detect Delay Restart		start Delay		
0.0	0.0 FEET 00:			0:10 00:00:04		0	0:04:00
Low Action	(6/6) Ar	(6/6) Analog Input Disabled					
High Action	(6/6) Analog Input Disabled						
<== Prev	/==		Menu			Ne:	d ==>

Analog Input V2 - 0.0 VDC 2/2						
Input Name /	' Descripti	on	Low Ra	inge	High Rar	ige Units
V2			0	.0	30.0) PSI
Low Shutdo	wn/Alarm	Star	t Delay	Dete	ect Delay	Restart Delay
0.0	PSI	00:	00:10	00	:00:04	00:04:00
High Shutdo	wn/Alarm	Star	t Delay	Detect Delay Restart Dela		
0.0	PSI	00:10	00:00:04		00:04:00	
Low Action	(6/6) Ana	alog Inp	out Disat	oled		
High Action	(6/6) Analog Input Disabled					
<== Prev	/==		Menu			Next ==>

The analog input screens are responsible for configuring all aspects of each associated analog input. For ease of use, the current input value (mA or VDC) is displayed at the top of the screen.

The Input Name / Description is a user-defined name for the input that will be displayed on the Home Screen in the event of an alarm or shutdown, and provides a more application or site-specific meaning than a generalized name.

As part of the commissioning process, the analog inputs should be scaled into meaningful engineering units. The Low Range, High Range, and Units parameters scale the 4-20 mA or 0-10 VDC inputs.

Low Range

The display value for 4 mA or 0 VDC.

High Range

The display value for 20 mA or 10 VDC.

Units

Up to 5 characters that represent the engineering units associated with the input.

The analog input alarms and shutdowns are also configured on these screens. The units displayed next to the low and high setpoints will change based on the value entered in the Units parameter.

Low/High Shutdown/Alarm

Setpoint based on the scaled (engineering units) of the analog input that triggers an alarm or shutdown. For a Low Shutdown/Alarm, the value must be equal to or less than the setpoint. For a High Shutdown/Alarm, the value must be equal to or greater than the setpoint.

Low/High Start Delay

The low or high analog input condition will be ignored for the time set in Start Delay during startup.

Low/High Detect Delay

The low or high analog input condition must be present for the time set in Detect Delay after the Start Delay has elapsed before an alarm or shutdown will be set.

Low/High Restart Delay

If a low or high alarm or shutdown has been set and the associated Low/High Action is configured to automatically clear or reset, the condition will automatically clear or reset after the time set in Restart Delay has elapsed.

Low/High Action

Shutdown – Requires manual reset. Shutdown – Restart after Restart Delay. Alarm Indication – Requires manual reset. Alarm Indication – Clears after Restart Delay. Monitor Only – No shutdown or alarm.

Digital Input Parameters

Digital	Input X1	- OPEN 1/:	5		
Input Name	X1				
Expected State	Normally Open - [NO] Active on contact close.				
Start Delay	00:00:05	Delay detection of a Reaction for this time at startup.			
Detection Delay	00:00:05 After Start Delay, time Reaction must be present to be detected.				
Restart Delay	00:01:00	00:01:00 Time before automatic restart, if Reaction uses Restart Delay.			
Reaction (1/8) Shutdown - Requires manual reset.					
<== Prev == Menu == Next ==>					

The OptiPump PC controller has 5 general-purpose, digital inputs available for field use. As all 5 inputs are configured similarly, only the configuration screen for Digital Input X1 is shown to the left.

The digital inputs expect a dry contact closure between the input and the CM terminal. Do NOT apply external voltage of any level to the digital input. The input and/or VFD may be permanently damaged.

The digital input screens are responsible for configuring all aspects of each associated digital

input. For ease of use, the current state of the input (OPEN or CLOSED) is displayed at the top of the screen.

In addition to providing alarm and shutdown capabilities, the general-purpose, digital inputs can also be configured as momentary start/stop or maintained run inputs. These additional functions are selections of the Reaction parameter.

The Input Name is a user-defined name for the input that will be displayed on the Home Screen in the event of an alarm or shutdown, and provides a more application or site-specific meaning than a generalized name.

Expected State

Normally Open – (NO) Active on contact close. Normally Closed – (NC) Active on contact open.

Start Delay

The active condition of the digital input will be ignored for the time set in Start Delay during startup.

Detection Delay

The active condition of the digital input must be present for the time set in Detect Delay after the Start Delay has elapsed before an alarm or shutdown will be set.

Restart Delay

If an alarm or shutdown has been set and the Reaction is configured to automatically clear or reset, the condition will automatically clear or reset after the time set in Restart Delay has elapsed.

Reaction

Shutdown – Requires manual reset. Shutdown – Restart after Restart Delay. Alarm Indication – Requires manual reset. Alarm Indication – Clears after Restart Delay. Momentary Input to Start Momentary Input to Stop Maintained Input to Start Digital Input Disabled

Home Screen Parameters

Home Screen Setup 1/1								
Line 1	(1/20	(1/20) VFD Desired Speed						
Line 2	(2/20	(2/20) VFD Output Speed						
Line 3	(3/20	(3/20) VFD Output Amps						
Line 4	(5/20	(5/20) VFD Output Voltage						
Theme	Ba	Black ckground	Screer Saver	00:20:00.00				
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The Home Screen can be customized to the needs of the individual user or site, and is the screen that will be most often viewed by users.

Two color themes are available for the Home Screen. The White Background is the classic theme historically used by many of our controllers. The Black Background provides an updated, high-contrast Home Screen that is easily viewable in bright sunlight.

The Screen Saver time will automatically turn off the display after the period of touchscreen inactivity set in the parameter.

The 4 monitors shown on the Home Screen are user-selectable from the following:

VFD Desired Speed VFD Output Speed VFD Output Amps Xformer Output Amps VFD Output Voltage Xformer Output Volts VFD Torque in % VFD Torque in Lb-Ft Motor HP Analog Input C1 Analog Input V2 Gas Potential Polished Rod Torque



The following data is stored in the CSV file:

Date Time Motor Amps Motor Voltage Motor Speed (Hz) Torque Lb-Ft DC Bus Volts Heat Sink T Deg C VFD Board Deg C

Advanced Parameters

The Advanced Parameters are parameters that are not typically needed during the commissioning of a new site, but can be helpful in troubleshooting or meeting requirements of non-standard applications.

Advanced 1					1/4
Base Freq	60.0 Hz		Base frequency. (25.0Hz - 120.0Hz)		
Accel Time	20.00 s		Acceleration time.		
Decel Time	20.00 s		Deceleration time.		
Stop Mode	Coast		Coast to stop, or decelerate using Decel Time above.		
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When used with an optional, properly-formatted SD card, the OptiPump PC controller will automatically log samples of the following data at the interval set on this screen. The files are stored in the Excel folder, inside the Excel1 subfolder on the SD card. For convenience, the files are created once per day, with the date the file was created used as the filename.

The SD card formatting utility can be obtained by contacting the Technical Support Department or your distributor.

The Base Frequency should be set to the rated frequency listed on the nameplate of the motor.

The Accel Time and Decel Time parameters apply when changing speeds, including starting and stopping, and determine how fast or slow these changes occur.

The Stop Mode controls the stopping behavior of the VFD. When set to Coast, the drive immediately cuts off the output when a stop command is given. This allows the motor to freewheel until it comes to a

stop. When set to Decel, the time set in Decel Time applies, and brings to motor to a stop in a controlled manner.

Advanced 2/4				
Torque Boost	0.0 %	Boost availab (0.0% - 20.0%	le motor torque. %)	
Regen Action	Brake (Disabled)	Action on regeneration. Used to prevent overvoltage faults.		
Regen Frequency	5.0 Hz	The amount of when Regen	of overspeed allowed Action is enabled.	
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Torque Boost can supply extra torque by increasing the output voltage at low speeds for hard-to-start applications. Torque Boost only applies when the VFD Mode is set to V/Hz Mode. When configured for Torque-Vector Mode, the torque is controlled automatically by the VFD, so Torque Boost does not apply.

Occasionally, PC pump applications may suffer from regen – meaning that the motor and polished rod are running faster than the VFD output frequency. This means that voltage is regenerated back into the VFD,

which raises the DC bus voltage. The rise in DC bus voltage can result in an overvoltage fault. Setting the Regen Action to Control By Torque or Control By DC Bus Voltage may prevent the overvoltage fault from occurring in this situation. If either of these methods does not resolve the overvoltage fault, the amount of overspeed allowed in parameter Regen Frequency may be increased.

Advanced 3/4				
Password	444	Password for accessing parameters.		
VFD Detection	Automatic (Mega)	Automatic: For Fuji Mega VFDs. Manual: For all other Fuji VFDs.		
VFD Size	30HP & Below	Parameter disabled when VFD Detection set to Auto.		
Phase Detect	Single Phase	Disables phase -loss detection when used with 1 -phase supply.		
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The Password protects the Setup Menu, and can be changed by the user. Only numbers can be used.

When used with a Fuji Mega VFD, set the VFD Detection to Automatic (Mega). The OptiPump PC controller will automatically configure the VFD for use with the controller and full communication capabilities will be available.

When used with a single-phase supply, the system will need to be configured to ignore this phase-loss condition. Set the parameter Phase Detect to Single

Phase when used with a single-phase supply, and Three Phase when used with a three-phase supply.



The parameters configured in the OptiPump PC controller can also be saved to the SD card, if available. As with the data logging, a properly formatted SD card must be installed in the controller.

The SD card formatting utility can be obtained by contacting the Technical Support Department or your distributor.

Enter a filename in the blue box using numbers and letters only, and up to 8 characters. Then press the Save All Settings button to write the parameter

values to the SD card.

Settings can be loaded from the SD card into the controller only if the firmware versions are identical. If the version of the controller does NOT match the version of the controller the parameters were saved from, DO NOT load the parameters into the controller. Unexpected behavior and operation may result.

To reset the OptiPump PC controller to factory settings, including clearing the history, perform the following:

- 1. Remove power from the controller.
- 2. Remove the Battery door located on the back of the controller on the left side.
- 3. Remove the coin battery from the holder.
- 4. Wait approximately one minute for the internals of the controller to fully discharge.
- 5. Reinstall the coin battery in the holder.
- 6. Reinstall the Battery door.
- 7. Apply power to the controller.
- 8. Reconfigure the controller as necessary.



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