California Motor Controls

PUMP Vision™ PV600

UNIVERSAL PUMP CONTROLLER

LEVEL CONTROL

Installation and Operation Manual

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Overview of Standard Features

The PUMP Vision PV600 is considered a “universal pump controller” because it can be configured to operate up to four pumps in the three main water/waste water applications; Pressure Booster, Level , and Well Pump control. The PV600 combines these three applications into one easy to use, cost effective controller without compromising features or functions.

When the controller is first initialized, one of the three application modes is selected, and the controller then boots up in the specific application mode (Pressure Booster, Level, or Well Pump). and provides all of the necessary “Dashboard” screens needed to provide the user with the most advanced and intuitive pump control available.

While the three application modes share many common configuration features, the PV600 operations manual is broken into three separate manuals to help simplify the manual for the user who will be interested in only one of the modes anyway. This manual address the Level Control mode.

Overview of PUMP Vision PV600 Level Control

MAIN DASHBOARD - A main dashboard provides an overview of the entire pump station status including pump, level, alarm, flow, and more. Easy access is provided to data logs, pump dashboards, setup and alarm handler.

PUMP DASHBOARD - A pump dashboard provides control of the pump and an overview of pump status and running conditions. Buttons are provided to access the pump Run Log, VFD Alarm Log.

SETUP AND CONFIGURATION - Numerous screens present the application’s setup an configuration options to the user in an easy to understand and operate format. This manual provides a guide through those screens.

Please see the PV600 Brochure for more details of the features in an overview format.

Overview of Standard Features

The PUMP Vision PV600 is housed in a rugged 5.77" x 7.75" case that can be door mounted with NEMA 4X or IP65 protection. All wiring is terminated at pull out terminals, making it simple to replace the unit should the need arise.

The backlit 320 x 240 pixel 5.7" TFT QVGA, LCD display is graphical and can display any font type, bitmap images, and animated graphics.

If the PUMP Vision's data logger function is enable, a removable SD memory card is required. A 7 year battery is provided to retain the Real Time Clock memory.

The PUMP Vision base unit includes 18 digital inputs, 4 analog inputs and 15 relay type outputs. Two of the inputs can be used as high-speed counter inputs. The base configuration is suitable for most applications of up to four pumps. Additional I/O, up to 128 points, can easily be added with the modules mounting on standard DIN rail. Digital, analog, RTD and other types of I/O are available.

Communication

Two RS232C or RS485 (user configurable) ports and an (optional) ethernet port are provided and each can be used to program the unit, or connect to other controllers in a network. These ports can each be set to communicate with the Modbus protocol and the PUMP Vision can be set to operate as a Modbus master or slave. In the Modbus master mode, the PV600 controls VFDs, RVSS starters, and MOTOR Vision starters. In the slave mode the PV600 connects to BAS and SCADA systemsand other monitoring equipment.

Remote Access

One of the remote control options available for the PUMP Vision PV600 is our Remote Operator software. Once connected to the PUMP Vision, either directly through the COM port, or through a remote connection method such as dial-up modem (land-line or GSM cellular), Internet, or radio, a user can open the Remote Access software program that provides a "virtual" PUMP Vision on the screen of the PC. This software can be downloaded from our Website

Operation of the system is identical to being there. The user simply uses the mouse to press the "buttons" of the on-screen version of the PUMP Vision. All of PUMP Vision information and set point screens can be accessed. The pumps can be started and stopped. Alarm messages can be read, set points can be changed, data and trends can be viewed.

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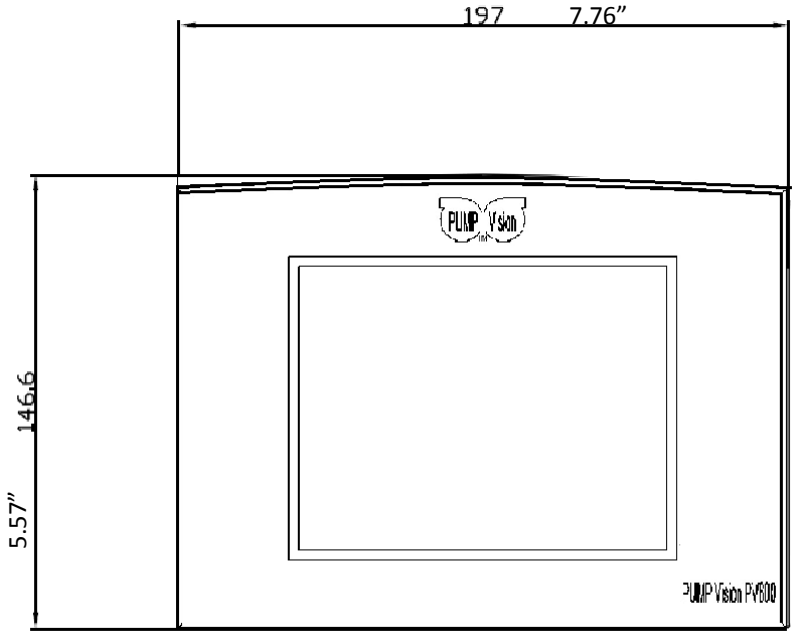
SAFETY CONSIDERATIONS

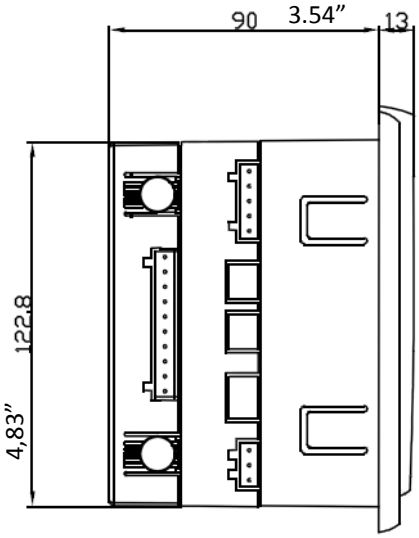
- Failure to comply with appropriate safety guidelines can result is severe personal injury or property damage. Always exercise proper caution when working with electrical equipment.
- Do not attempt to use the controller with voltage exceeding permissible levels. Permissible voltage levels are listed in the technical specifications provided in this manual.
- Install an external circuit breaker or fuse and take all appropriate safety measures against short-circuiting in external wiring.
- Do not install in areas with: excessive or conductive dust, corrosive or flammable gas, moisture or rain, excessive heat, regular impact shocks or excessive vibration.

- Do not place in water or let water leak onto the controller.
- Do not allow debris to fall inside the unit during installation.
- Double-check all the wiring before turning on the power supply.
- Ascertain that terminal blocks are properly secured in place.
- Do not touch live wires.
- Stay as far as possible for high-voltage cables and power equipment..
- Leave a minimum of 10mm space for ventilation between the top and bottom edges of the controller and the enclosure walls.
- A non-isolated power supply can be used provided that a 0V signal is connected to the chassis.
- Standard safety considerations require that metal cabinet panels be grounded to avoid electrocution.

- Do not connect either the Neutral or Line signal of the 120VAC circuit to the device's 0V terminal.
- In the event of voltage fluctuations, or non-conformity to voltage power supply specifications, connect the device to a regulated power supply.
- The wiring of this device is specifically designed to be safe any easy. A technician or engineer trained in the local and National Electric Code should perform all tasks associated with the electrical wiring of the device.

Dimensions





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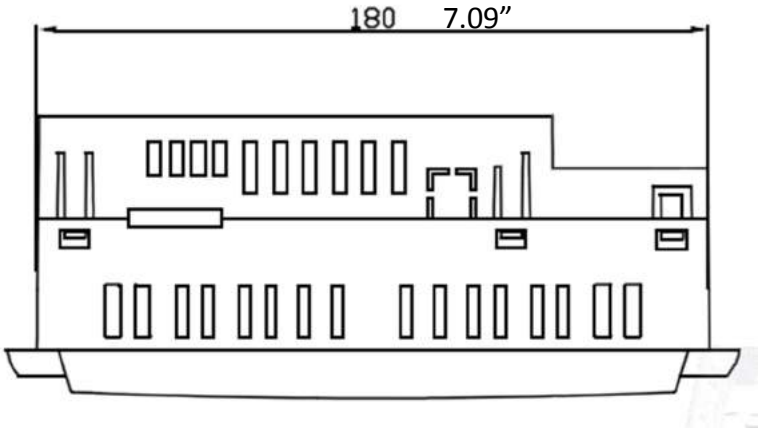
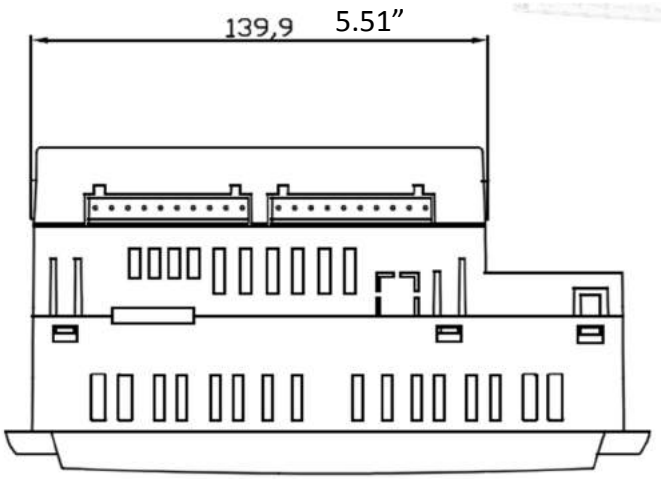




Dimensions

Panel Mounting

Before you begin, note that the panel itself cannot be more that 0.197" thick.

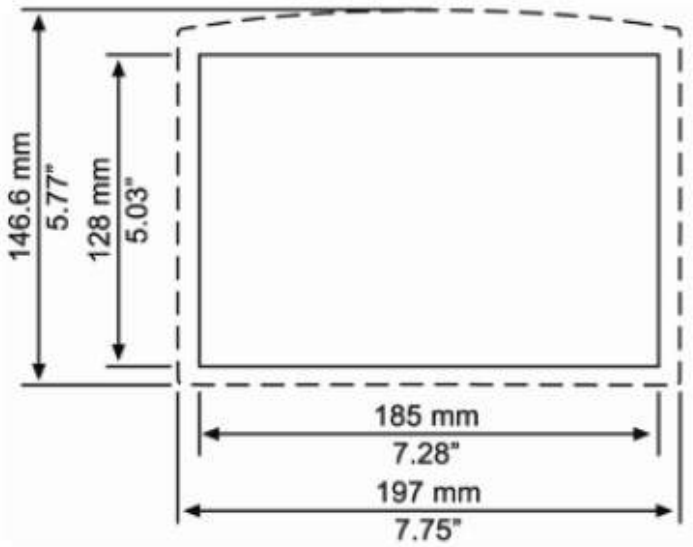
1.Make a panel cut-out that measures 185mm x 128mm (7.283" x 5.039").

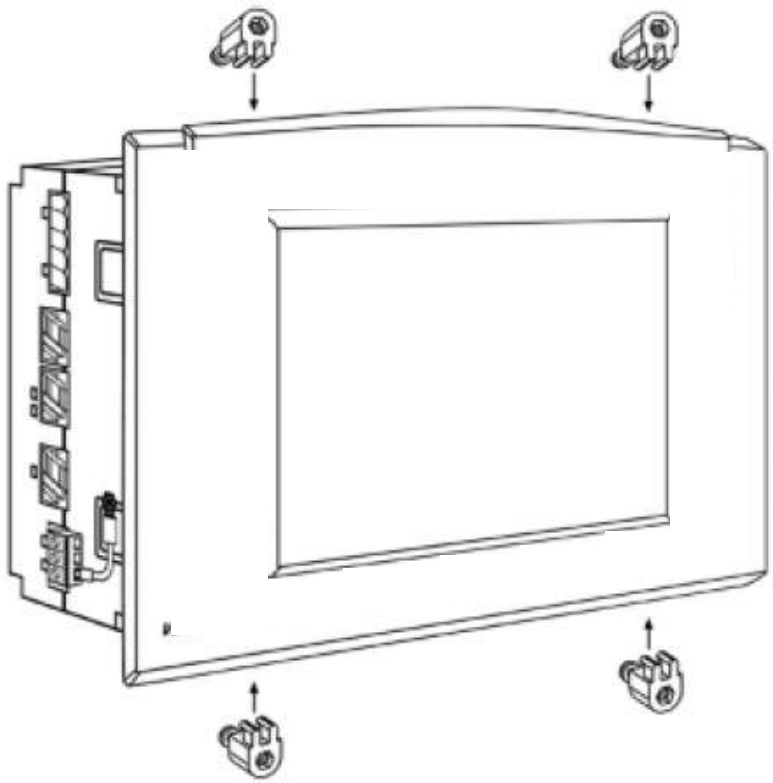
2.Check the seal that is placed over the back of the unit. The seal must fit snugly against the back rim of the operating panel.

3.Slide the controller into the cut-out.

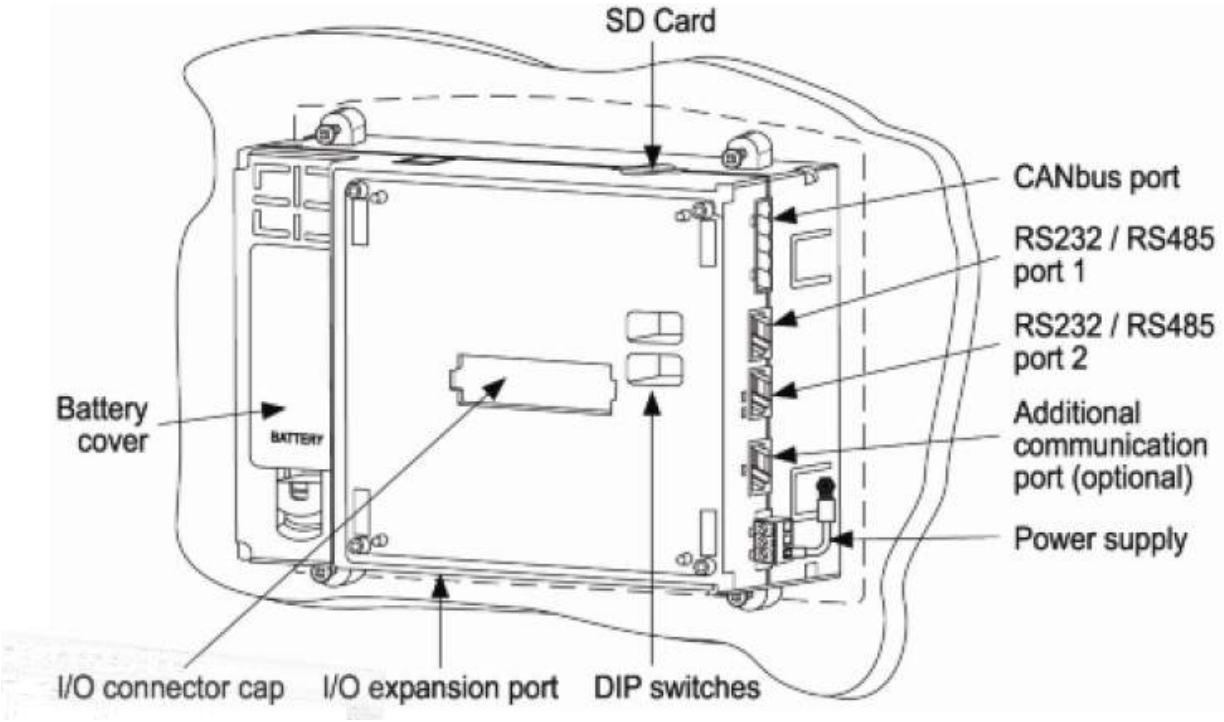
4.Push the four black plastic mounting brackets into their slots on the sides of the controller.

5.Tighten the bracket screws against the panel. Hold the bracket securely against the unit while tightening the screw.





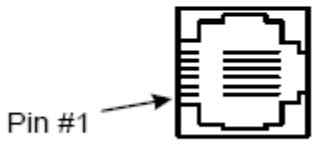
Dimensions


SD Card
CANbus port
RS232 / RS485 port 1
RS232 / RS485 port 2
Additional communication port (optional)
Power supply
Battery cover
BATTERY
I/O connector cap
I/O expansion port
DIP switches

Communication Ports

The PUMP Vision PV600 has two serial ports. Both can be set for RS232 or RS485 independently.

Table 1: RS232: Pinout

Diagram	Pin Number	RS232: Function
	1	DTR signal
	2	0V reference
	3	TxD signal
	4	RxD signal
	5	0V reference
	6	DSR signal

The PUMP Vision is connected directly to the PC with a standard RJ11 type cable which should not be longer than 10’ when using RS232. An RJ11 to 9 pin D connector is used to connect to the PC.

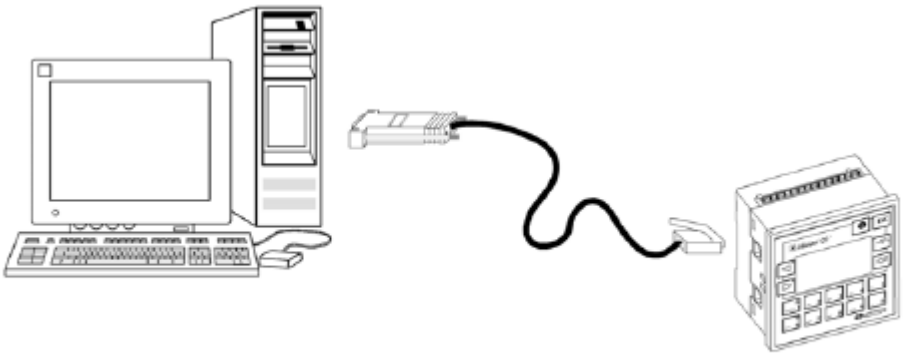
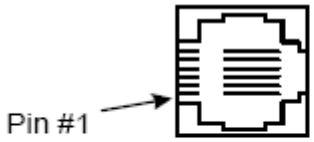


Figure 10. Connecting the PC to the Controller

RS485

Use RS485 to create multi-drop network containing up to 32 stations, or for Modbus communications.

Table 2: RS485: Pinout

Diagram	Pin Number	Function
	1	A signal (+)
	2	(RS232 signal)
	3	(RS232 signal)
	4	(RS232 signal)
	5	(RS232 signal)
	6	B signal (-)

Note that when a port is set to RS485, both RS232 and RS485 can be used simultaneously if flow control signals DTR and DSR are not used.

..Note that the ports are not isolated. If the controller is used with a non-isolated external device, avoid potential voltage that exceeds ±10V.

..To avoid damaging the system, all non-isolated device ports should relate to the same ground signal.

..Use shielded, twisted pair cable.

..Minimize the drop length leading form each device to the bus.

..Ideally, the main cable should be run in and out of the network device.

..Do not cross positive (A) and negative (B) signals. Positive terminals must be wired to positive and negative terminals to negative.

Wiring

Wiring Considerations

..A technician or engineer trained in the local and National Electric Code should perform all tasks associated with the electrical wiring of the controller.

.

..Input or output cables should not be run though the same multicore cable or share the same wire.

..Do not lay input or output cables near high voltage power cables.

..Allow for voltage drop and noise interference with input and output lines used over an extended distance. Use wire that is properly sized for the current load.

..Double-check all the wiring before turning on the power supply.

..Unused I/O terminals should not be connected. Ignoring this directive may damage the controller.

On-board I/O

I/O connection points are provided by external connectors at the top and bottom of the controller. The connectors plug in, enabling quick and easy removal. They provide screw-type connection points for the power source, inputs an outputs. The connection points are clearly labeled on the controller itself.

The top generally provides connections for the power supply, analog inputs and digital inputs. The bottom connector provides terminals for the relay outputs.

Connections to the Controller

1.Strip the wire to a length of 0.250-0.300 inches.

2.Unscrew the terminal to its widest position before inserting a wire.

3.Insert the wire completely into the terminal to ensure a proper connection.

4.Tighten enough to keep the wire from pulling free.

5.Use 14 gauge to 26 gauge wire.

6.Do not exceed 1 inch pounds of torque.

7.We recommend crimp connectors (ferrules) on the wire ends.

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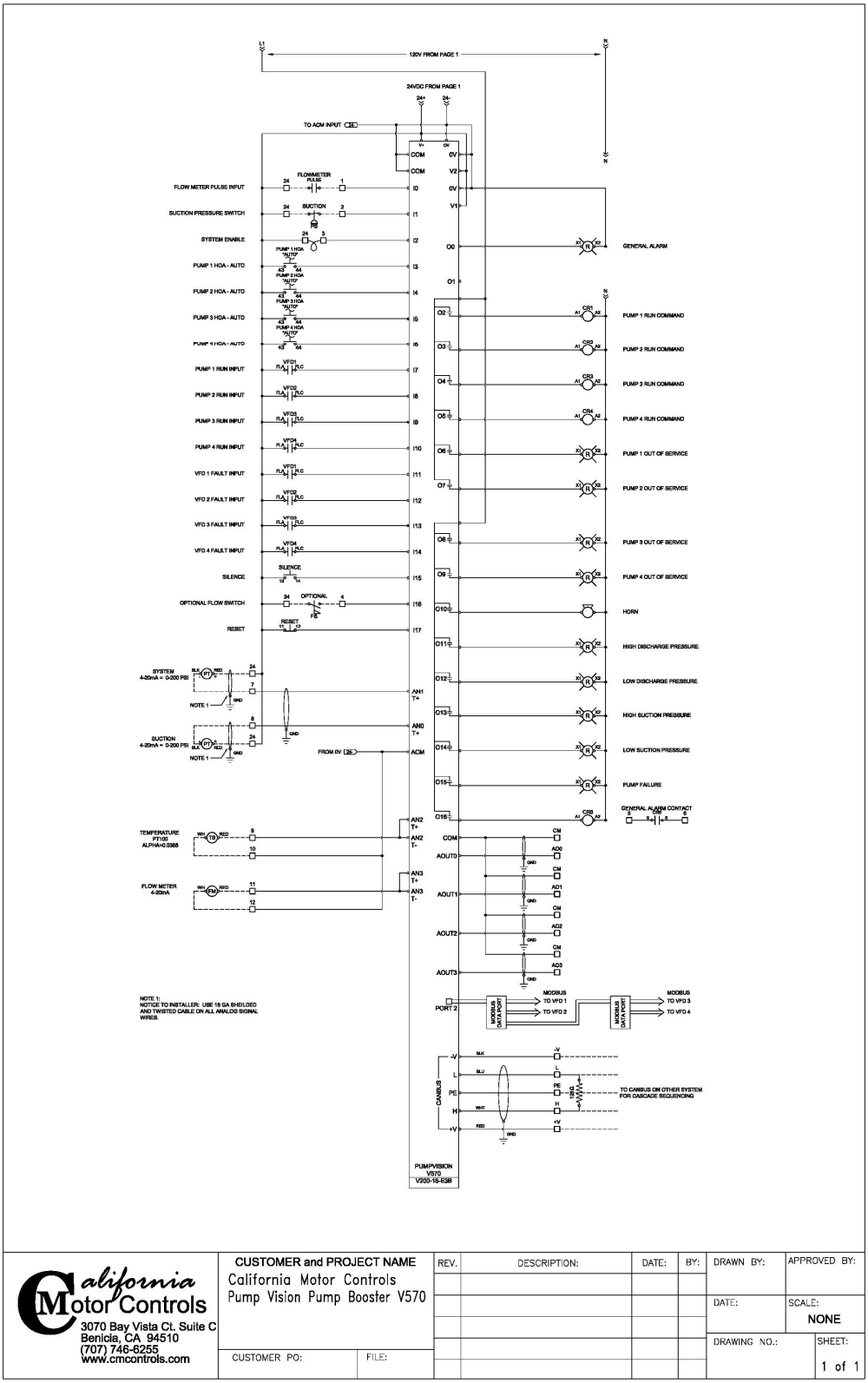
Wiring Diagram

Typical Wiring Diagram for Constant Speed or VFD Mode



California Motor Controls 3070 Bay Vista Ct. Suite C Benicia, CA 94510 (707) 746-6255 www.cmcontrols.com	CUSTOMER and PROJECT NAME California Motor Controls Pump Vision Pump Booster V570	REV.	DESCRIPTION:	DATE:	BY:	DRAWN BY:	APPROVED BY:
						DATE:	SCALE: NONE
	CUSTOMER PO: / FILE:					DRAWING NO.:	SHEET: 1 of 1

I/O List

Connect input and output devices as needed.

Digital Inputs

I0	Redundant backup low level float switch
I1	Redundant backup high level float switch
I2	Pump 4 seal failure
I3	Pump 1 HOA - AUTO
I4	Pump 2 HOA - AUTO
I5	Pump 3 HOA - AUTO
I6	Pump 4 HOA - AUTO
I7	Pump 1 Run Input
I8	Pump 2 Run Input
I9	Pump 3 Run Input
I10	Pump 4 Run Input
I11	Pump 1 over-temperature
I12	Pump 2 over-temperature
I13	Pump 3 over-temperature
I14	Pump 4 over-temperature
I15	Pump 1 seal failure
I16	Pump 2 seal failure
I17	Pump 3 seal failure

Optional

I32	Generator running
I33	Generator fault
I34	Power failure
I35	UPS failure
I36	Dry well water
I37	Intrusion
I38	Low level float switch/Mutli-segment 1/Option alarm 1
I39	High level float switch/Mutli-segment 2/Option alarm 2
I40	Stop float switch/Mutli-segment 3
I41	Start float switch/Mutli-segment 4
I42	Start 1st lag pump float switch/Mutli-segment 5
I43	Start 2nd lag pump switch/Mutli-segment 6
I44	Start 3rd lag pump switch/Mutli-segment 7
I45	Low level float switch/Mutli-segment 8/Option alarm 3
I46	Low level float switch/Mutli-segment 9/Option alarm 4
I47	Low level float switch/Mutli-segment 10/Option alarm 5

Analog

AN0	4-20mA Primary level sensor
AN1	4-20mA Secondary level sensor
AN3	4-20mA Flow Meter

I/O List

Digital Outputs

O0	General Alarm Indicator
O1	Pump 4 failure
O2	Pump 1 Run
O3	Pump 2 Run
O4	Pump 3 Run
O5	Pump 4 Run
O6	Pump 1 out of service
O7	Pump 2 out of service
O8	Pump 3 out of service
O9	Pump 4 out of service
O10	Horn
O11	High level alarm
O12	Low level alarm
O13	Pump 1 failure
O14	Pump 2 failure
O15	Pump 3 failure
O16	General Alarm Contact

Analog Outputs

AOUT0	4-20mA VFD 1 speed reference
AOUT1	4-20mA VFD 2 speed reference
AOUT2	4-20mA VFD 3 speed reference
AOUT3	4-20mA VFD 4 speed reference

(these are used only if VFDs are not connected by network to the PV600)

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Sequence of Operation - Pump Staging

When the PV600 has been fully configured, all of the level control set points have been entered and all alarm conditions are satisfied, the system is ready to operate. The PV600 has a "dashboard" for each pump that provides a HAND-OFF-AUTO selector switch for control of the pump. When in the HAND position, the PV600 will command the pump to run as long as there are no alarm conditions that are configured for pump shutdown on fault. In the AUTO position, the pumps will run when called by the pump sequencer. The PV600 can be configured in a number ways since the sequencer has two parts; the pump stager and the alternator. The pump stager calls for the pumps as needed based on the level set points. The alternator determines which pump will run when the stager calls.

PUMP STAGING

FVNR or RVSS Starters, Pump Down Operation

When the PV600 is configured for Pump Down operation, the pumps work to empty the tank or sump.

When then level of the liquid in the tank or sump rises to the Start Lead Pump set point, the lead pump starts. In multiple pump systems, if the level continues to rise to the Start Lag Pump set points, the lag pumps start, in sequence.

When liquid level drops to the Stop Pump set point(s), the pump(s) stop. The pumps stop at individual stop set points if the PV600 is in Multipoint Stop mode, or all at once if in the Single Point Stop mode.

FVNR or RVSS Starters, Pump Up Operation

When the PV600 is configured for Pump Up operation, the pumps work to fill the tank or other vessel.

When then level of the liquid in the tank falls to the Start Lead Pump set point, the lead pump starts. In multiple pump systems, if the level continues to fall to the Start Lag Pump set points, the lag pumps start, in sequence.

When liquid level rises to the Stop Pump set point(s), the pump(s) stop. The pumps stop at individual stop set points if the PV600 is in Multipoint Stop mode, or all at once if in the Single Point Stop mode

VFD Starters, Pump Down Operation, Proportion Mode

When then level of the liquid in the tank or sump rises to the Start Lead Pump set point, the lead pump starts and accelerates to its proportional point in the Proportion Band. In multiple pump systems, if the level continues to rise to the Start Lag Pump set points, the lag pumps start, in sequence and at thir respective proportional speed set points.

When liquid level drops, the pumps ramp down in speed, following the proportion band, to the Stop Pump set point(s), the pump(s) stop. The pumps stop at individual stop set points if the PV600 is in Multipoint Stop mode, or all at once if in the Single Point Stop mode.

Proportion Mode - The speed of the pumps is directly proportional to the position of the liquid within the "level band". The level band is the distance between the last Lag Pump Start set point in the system (second pump in a duplex, third in a triplex, etc.) where the pumps will run at maximum speed, and the Stop Lead Pump set point when the pumps will be running at their minimum speed.

Sequence of Operation - Pump Staging

The speed of the pumps is linearly proportional those two points.

An example system: A triplex (three pump) system

The start set point for the 2nd lag pump is 5.0'
The start set point for the 1st lag pump is 4.0'
The start set point for the 1st lag pump is 3.5'
The stop set point for the lead pump is 2.0'

Level Band - In this example, the level band is 3.0', which is the difference between the 2nd lag start set point and the stop lead pump set point.

In the VFD configuration, the VFDs are set up to have a maximum speed of 100% and a minimum speed of 40% due to the pump curves. In this example, the Speed Band is 60%.

In this example, the lead pump will start at 70% speed and if the level rises, the speed of the pump rises. At the 1st Lag Pump Start set point, the second pump will start and the speed of the pumps will be 80%. If the level rises to the 2nd Lag Pump Start set point, the third pump will start and the speed of all pumps will be 100%.

When the level drops, the speed of the pumps drop until the stop set points, where the speed of the pump(s) will be at 40%.

VFD Starters, Pump Up Operation, Proportion Mode

When then level of the liquid in the tank or sump drops to the Start Lead Pump set point, the lead pump starts and accelerates to its proportional point in the Proportion Band. In multiple pump systems, if the level continues to drop to the Start Lag Pump set points, the lag pumps start, in sequence and at their respective proportional speed set points.

When liquid level rises, the pumps ramp down in speed, following the proportion band, to the Stop Pump set point(s), the pump(s) stop. The pumps stop at individual stop set points if the PV600 is in Multipoint Stop mode, or all at once if in the Single Point Stop mode.

See the above description of the Proportion Mode for an example of how the speed of the pumps is controlled as the same example could be used with reversed set points.

VFD Starters, Pump Down Operation, PID Mode - Constant Level

The PID mode is used to maintain a specific level in a tank or sump. Depending on the configuration, the pump(s) may or may not ever shut down.

When the liquid level rises to the Start Lead Pump set point, the lead pump Start Delay Timer begins timing, When the timer expires, the lead pump VFD will start and immediately ramp to the minimum speed set point at the rate programmed into the VFD acceleration function (CMC recommends a 5 second VFD acceleration set point).

When the VFD reaches Minimum Speed, the PID loop begins and the speed of the pump will be modulated to maintain the Target Level set point. With each sample cycle, a change may be made to the VFD speed, proportional to the level deviation from the Target Level set point.

Sequence of Operation - Pump Staging

The speed of the VFD can increase up to the Maximum Speed set point and can decrease to the Minimum Speed set point. The speed changes occur at the interval set in the Sample Cycle timer.

The proportion of the speed change can be adjusted in the PID setup screen, and is entered as a ratio of 0.1 ft. : 1% Speed.

If a 1.0 : 1 ratio is set, the VFD speed will change 1% for each 0.1 feet of deviation from target set point.

The amount of change is limited by the Trim set points. The Trim set points are used to keep the VFD speed from changing too much in reaction to a high deviation from set point. Limiting the change will prevent the VFD from going to Maximum speed or Minimum speed with it doesn't need to.

As the level rises, the pumps that are running speed up to try to maintain the target set point. When the speed of the running VFDs meets or exceeds the Lag Pump Start set point, the Lag Pump Start Delay timer begins timing. When the timer expires, the lag pump will start and ramp up to the VFD speed reference (the speed at which the pumps are running). The pump accelerates at the rate programmed into the VFD acceleration function (5 seconds Accel and Decel timers are recommended).

All running pumps modulate at the same speed. In triplex and quadruplex systems, the lag pumps all start in the same manner, each with separate Start Delay timers.

As the level drops, the speed of the pumps slows. When the speed reaches the Lag Stop set point, the last pump to start shuts down first. When it drops out, the speed of the pumps that are running may speed up to maintain level, or depending on the influent condition, the speed may stay below the Lag Stop set point and the next pump in the sequence will de-stage.

The lead pump will stop if the level drops to the Lead Pump Stop set point. This will only happen if the inflow is less than what the lead pump will handle when running at minimum speed.

VFD Starters, Pump Up Operation, Mode - Constant Level

When the liquid level drops to the Start Lead Pump set point, the lead pump Start Delay Timer begins timing, When the timer expires, the lead pump VFD will start and immediately ramp to the minimum speed set point at the rate programmed into the VFD acceleration function (CMC recommends a 5 second VFD acceleration set point).

When the VFD reaches Minimum Speed, the PID loop begins and the speed of the pump will be modulated to maintain the Target Level set point. With each sample cycle, a change may be made to the VFD speed, proportional to the level deviation from the Target Level set point.

As the level drops, the pumps that are running speed up to try to maintain the target set point. When the speed of the running VFDs meets or exceeds the Lag Pump Start set point, the Lag Pump Start Delay timer begins timing. When the timer expires, the lag pump will start and ramp up to the VFD speed reference (the speed at which the pumps are running). The pump accelerates at the rate programmed into the VFD acceleration function (5 seconds Accel and Decel timers are recommended).

All running pumps modulate at the same speed. In triplex can quadruplex systems, the lag pumps all start in the same manner, each with separate Start Delay timers.

Sequence of Operation - Pump Staging

As the level rises, the speed of the pumps slows. When the speed reaches the Lag Stop set point, the last pump to start shuts down first. When it drops out, the speed of the pumps that are running may speed up to maintain level, or depending on the effluent condition, the speed may stay below the Lag Stop set point and the next pump in the sequence will de-stage.

The lead pump will stop if the level rises to the Lead Pump Stop set point. This will only happen if the outflow is less than what the lead pump will handle when running at minimum speed.

VFD Starters, Pump Down Operation, PID Mode - Constant Flow

The Constant Flow Mode is used to pump out a sump, but limit the amount of flow out of the pumps. This mode of operation requires a hardwired flow meter, either pulse or 4-20 mA, be connected to the PUMP Vision.

When the liquid level rises to the Start Lead Pump set point, the lead pump Start Delay Timer begins timing, When the timer expires, the lead pump VFD will start and immediately ramp to the minimum speed set point at the rate programmed into the VFD acceleration function (CMC recommends a 5 second VFD acceleration set point).

When the VFD reaches Minimum Speed, the PID loop begins and the speed of the pump will be modulated to maintain the Maximum Discharge Flow Rate set point. With each sample cycle, a change may be made to the VFD speed, proportional to the flow deviation from the Maximum Flow set point.

The speed of the VFD can increase up to the Maximum Speed set point and can decrease to the Minimum Speed set point. The speed changes occur at the interval set in the Sample Cycle timer.

The proportion of the speed change can be adjusted in the PID setup screen, and is entered as a ratio of 1.0. GPM. : 1% Speed.

If a 1.0 : 1 ratio is set, the VFD speed will change 1% for each gallon per minute of deviation from target flow set point.

The amount of change is limited by the Trim set points. The Trim set points are used to keep the VFD speed from changing too much in reaction to a high deviation from set point. Limiting the change will prevent the VFD from going to Maximum speed or Minimum speed with it doesn't need to.

As the flow increases, the pumps that are running speed up to try to maintain the target flow set point. When the speed of the running VFDs meets or exceeds the Lag Pump Start set point, the Lag Pump Start Delay timer begins timing. When the timer expires, the lag pump will start and ramp up to the VFD speed reference (the speed at which the pumps are running). The pump accelerates at the rate programmed into the VFD acceleration function (5 seconds Accel and Decel timers are recommended).

All running pumps modulate at the same speed. In triplex and quadruplex systems, the lag pumps all start in the same manner, each with separate Start Delay timers.

As the flow decreases, the speed of the pumps slows. When the speed reaches the Lag Stop set point, the last pump to start shuts down first. When it drops out, the speed of the pumps that are running may speed up to maintain level, or depending on the influent condition, the speed may stay below the Lag Stop set point and the next pump in the sequence will de-stage.

The lead pump will stop if the level drops to the Lead Pump Stop set point.

Sequence of Operation - Alternation

Jockey Alternation

In Jockey Alternation mode, Pump 1 is always the first pump to run. The remaining lag pumps are alternated as if they were in a full alternation sequence. For example, in a triplex jockey alternation system where the first lag called in this cycle is Pump 2, the next pumping cycle will call Pump 3 as the first lag. Jockey Alternation is only available for triplex and quadruplex systems.

Full Alternation

Each time a pumping cycle starts after the system has been at rest, the next pump in sequence will be the lead pump. So if pump 1 is lead pump in this cycle, Pump 2 will be lead pump in the next cycle. The other pump(s) in the system will start as lag pump(s) as needed.

Constant Lead

In Constant Lead mode, a certain pump is selected to always be the lead pump.

Slave Mode

The PV600 can be configured to run any individual lag pump as a “slave” to the lead pump. When a lag pump is set to Slave mode, it will run in unison with the lead pump.

Standby Mode.

The PV600 can be configured to run any individual lag pump as a “standby pump” to the system. The standby pump only runs if another called pump has failed. This is used when there are more pumps in the system than there is capacity to handle the flow, and the extra pump(s) are in the system for redundancy.

Sequence of Operation - Alarms

Alarm Conditions

All alarm conditions with operate according to the way they are set up. Each alarm can optionally be set up to:

- Be enabled or disabled
- Stop the pumps
- Require manual reset
- Sound the horn
- Light the alarm light
- Flash the alarm light
- Close the alarm contact
- Send an email
- User adjustable time delay

All enabled alarm conditions will be logged into the alarm data logger.

All enabled alarm conditions will be managed by the fault handler.

For all alarm conditions, touching the screen of the PV600 will silence the horn output.

Inputs are provided for the following alarm conditions:

- High Level - Main Level Sensor
- Low Level - Main Level Sensor
- Transducer Failure
- Pump Failure
- MOTOR Vision Fault
- VFD Failure
- High Level Alarm - Backup Float Switch
- Low Level Alarm - Backup Float Switch
- High Temperature
- Moisture in Motor

In VFD mode the VFD Fault conditions are monitored through Modbus and annunciated on the controller.

Pump Failure

This condition is determined by the motor starter failing to close an input to the controller within a preset time period. If a pump fails to start, the pumping duty is automatically transfer to the next available pump in sequence.

The pump can be taken “Out-of-Service” and this failure alarm is prevented, by putting either the “soft” HOA, or the panel HOA into the OFF position. This allows maintenance of the pump without generating an alarm condition. As with a pump failure condition, the pumping duty is automatically transferred to the remaining pump(s).

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Sequence of Operation - Alarms

Fault Data Logging

Fault conditions are logged into memory with a date and time stamp. When a fault condition occurs, the fault status indicator will light on the main screen and the Alarm Log will display any active faults. Touching the fault status indicator will take the user to the Alarm Handler, where alarm conditions can be viewed and managed.

The Alarm Log will display any active alarms. Touching the Alarm Log button will allow the user to scroll through any active alarms if more than one are present. Holding the Alarm Log will take the user to the System Alarm Log, where details including the time date, time of occurrence and alarm condition can be viewed and managed. The screen can be scrolled down through the past 1000 fault conditions. When the screen is exited and then re-entered, the log automatically returns to showing the latest fault conditions.

Trending

The on screen trending graph plots the sump or tank level with a reading saved every second. It saves history for the past 1.5 hours. The graph can be scrolled by the user to view the history. The optional micro SD card records the trend data in a file that is automatically created once a month. A maximum of 63 months is retained on the SD card.

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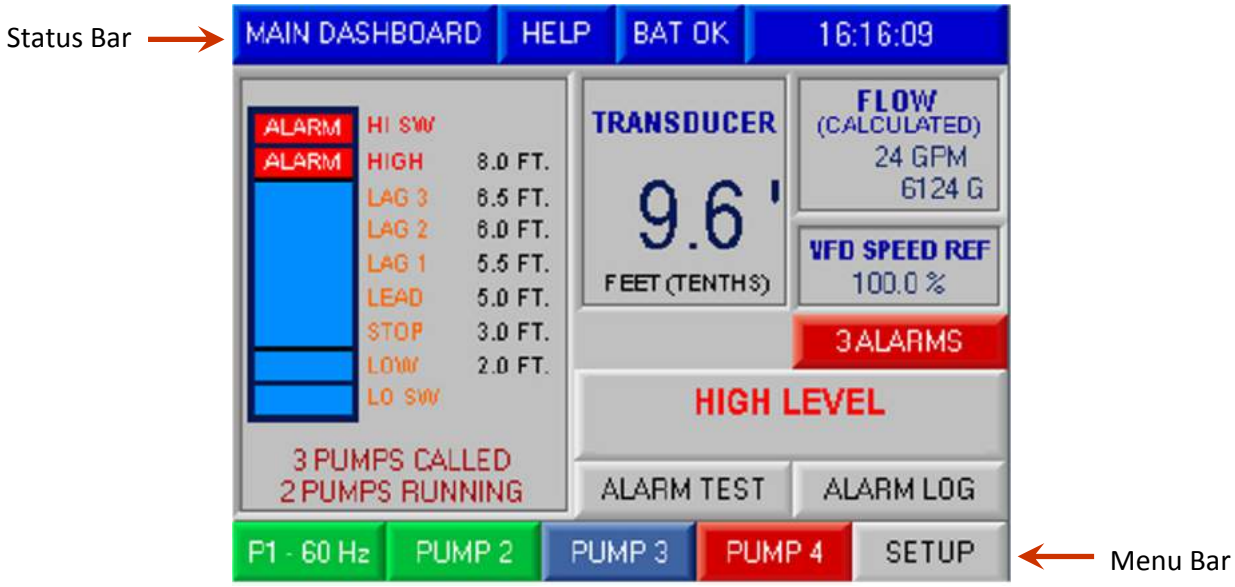
Main Dashboard



Overview

For each application type, the PUMP Vision PV600 has a Main Dashboard that provides a complete overview of the system status and touch access to pump dashboards, logs, trends, set points, and complete system configuration.

Main Dashboard Screen Elements and Functions

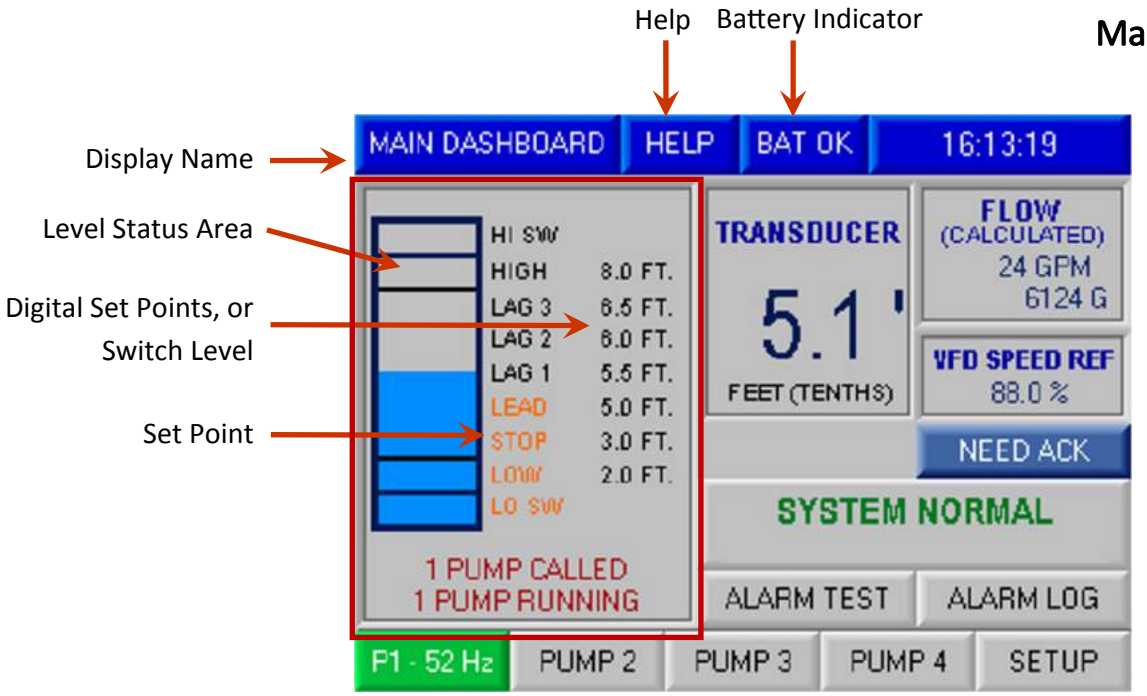
Status Bar - Found at the top of the screen, the status bar holds

Name of the current display screen
Help button
Battery Status
System Time

A Status Bar is on every display screen in the PV600 controller, except for the help screens. All Status Bars include the display name, and most include the level display and a help button.

Menu Bar - Depending on what screen you are on, different menu options appear. The Main Dashboard's Menu Bar includes buttons to access the Pump Dashboards and the Setup display.

Main Dashboard



Overview

Display Name - MAIN DASHBOARD - Touch for program information (only on the Main Dashboard).

Help - Touch this button to see a Help screen specifically for the Main Dashboard.

Battery Indicator - This button will give instructions on how to change the battery. It will change color to yellow and display a warning message when the battery is low. The PV600 uses a 3V Lithium CR2450N coin type battery that is located behind a user accessible cover in the back of the unit. The lithium battery will last for up to 10 years in the PV600 if the unit is kept powered up. The battery is used to maintain the current time, and to retain the system configuration and user set points that are stored in RAM memory. Note: the configuration and user set points are also stored in non-volatile Flash RAM memory if the system has been backup up, but the PV600 will need user intervention to restore the system if the power fails while the battery is dead.

Level Status Area - The Main Dashboard includes a Level Status area that includes the following information:

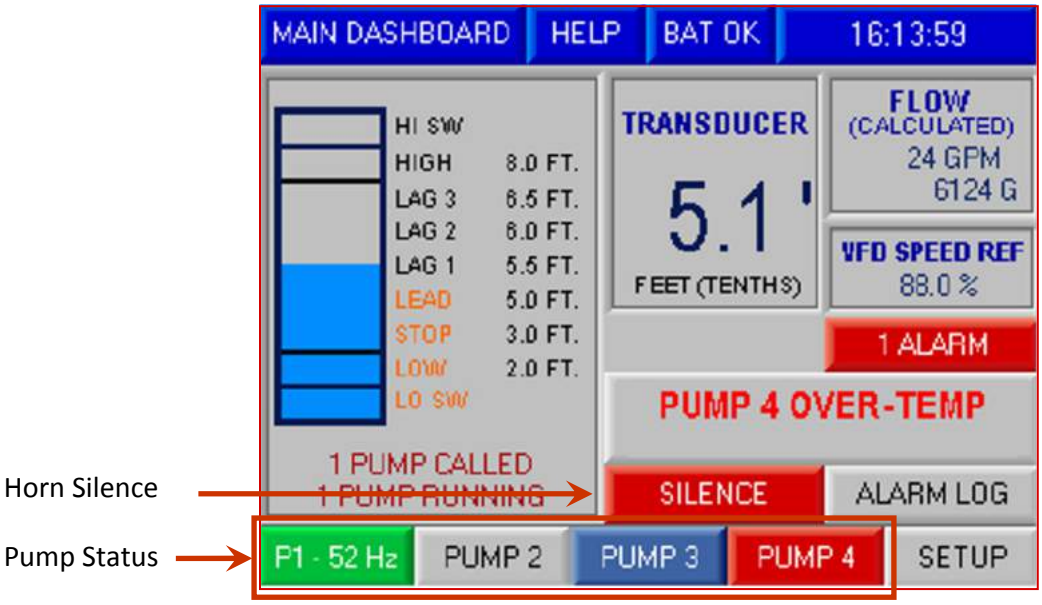
Digital Set Points, or Switch Level - The user entered set points from the setup screen are shown here.
Set Point Status Labels - The set point's function label changes color to indicate status:

Black = Level below set point
Orange **=** Level above set point
Red **=** Alarm condition

Alarm Message Bar - Displays system normal or fault condition. If there are multiple faults, touching this Message Bar will scroll through all active alarms.

Setup - Touch this button to navigate to a System Settings page.

Main Dashboard

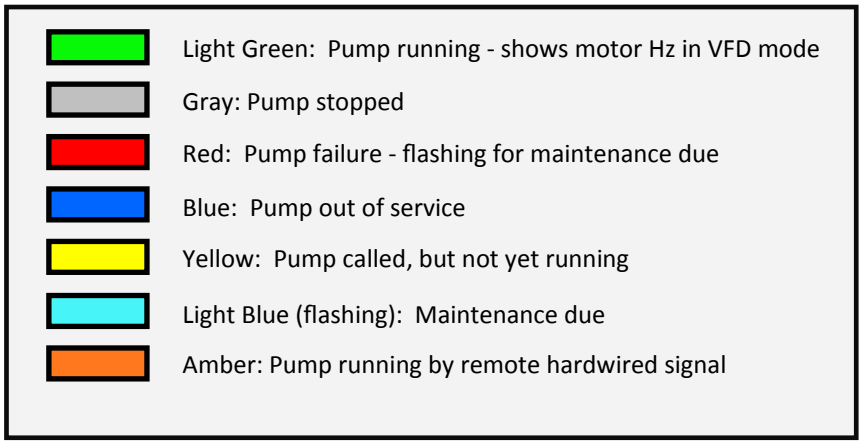


Touch for access to Pump Dashboards

Pump Status Buttons

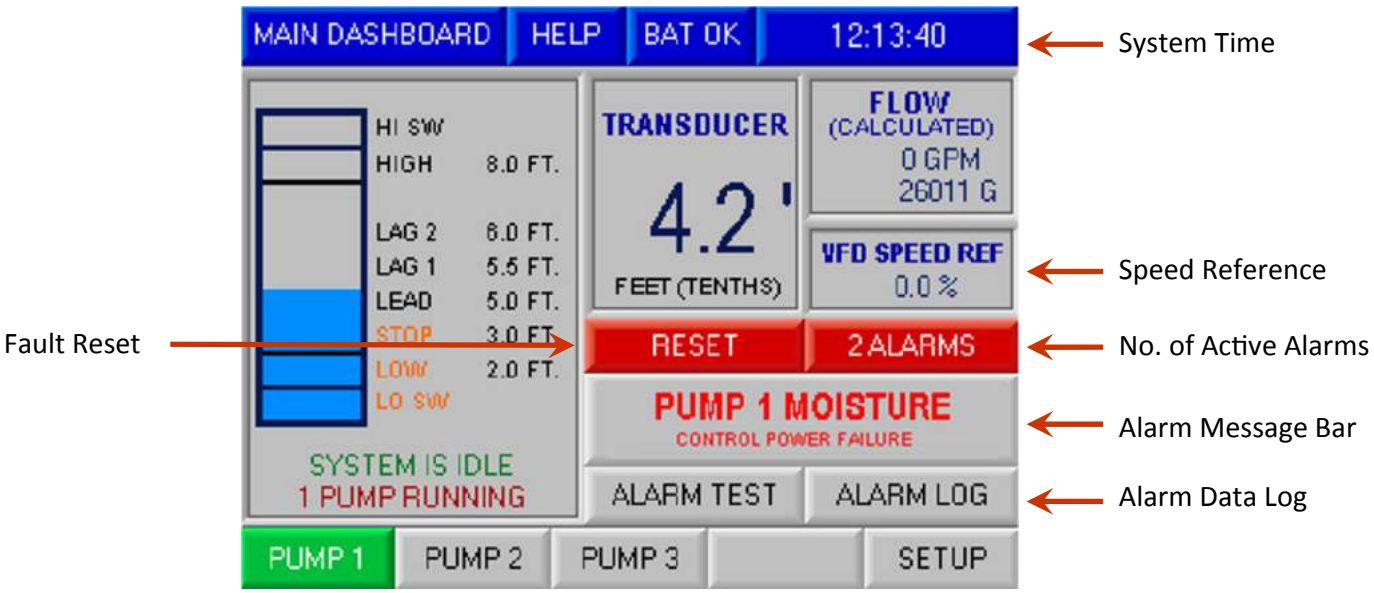
The Main Dashboard has a Status button for each pump configured in the system. The Status button changes color to indicate pump status, indicates VFD frequency in VFD configured systems, and provides touch access to the Pump Dashboards.

Horn Silence - This button only appears when the alarm horn is sounding. Any touch of any display screen will also silence the horn.



The key above shows the default Pump Status Button colors. The colors can be "remapped" by the user to other color themes in the PV600 Option Configuration screen in the Level 3 configuration mode.

Main Dashboard



System Time - Displays the current system time. Touch the button to set Time and Date of the PV600. The system time is used to provide a date and time stamp to system events, data logging, and trending. Keeping the time accurate will assist in providing useful diagnostic information. When the PV600 is connected to the Internet, it can keep the date and time current automatically with periodic connection to an NIST Time Server.

Speed Reference - Displays the speed command to the VFDs in percentage of maximum speed. Touching this element will access the Main Trend Log. Not displayed when the system is not configured for VFDs.

Fault Reset - This button only appears when there is a fault condition that can be manually reset. Touching the button will reset the alarm if the condition has cleared.

Number of Active Alarms - If there are active alarms, this button displays red and indicates the number of active alarm conditions. Touch the button for the Alarm Handler. The button does not appear if there are no unacknowledged alarms.

Alarm Message Bar - If there are active alarms, this message bar displays the alarm condition.

If there is no alarm, SYSTEM NORMAL is displayed.

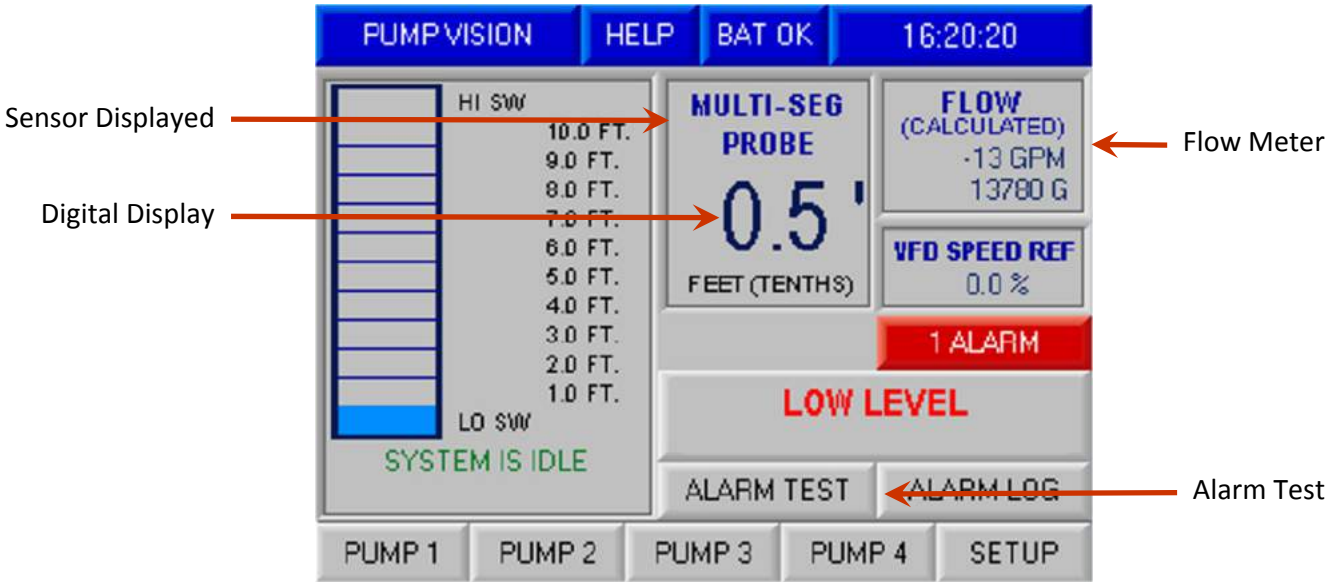
Touching the message text will scroll through all of the active alarm conditions if more than one condition is active.

The large message bar shows the 10 possible level control alarms.

The small message bar shows the 10 possible system alarms.

Alarm Data Log - Touch the button for the Alarm Data Log.

Main Dashboard



Sensor Displayed - When the optional Secondary Level Sensor is installed, touch the label to toggle the displayed value of the two sensors and to change the Level Status display. A three minute timer automatically reverts the display to the primary sensor unless the primary is failed, and then the backup becomes the default display.

All modes of level sensing are monitored for failure. The 4-20 mA sensors are monitored for out of range signals, and the floats and multi-probe are monitored for switches out of sequence. If there is a failure of either the primary or secondary sensor, it will be indicated on the level label.

The system automatically transfers to the backup level sensor if the primary sensor fails.

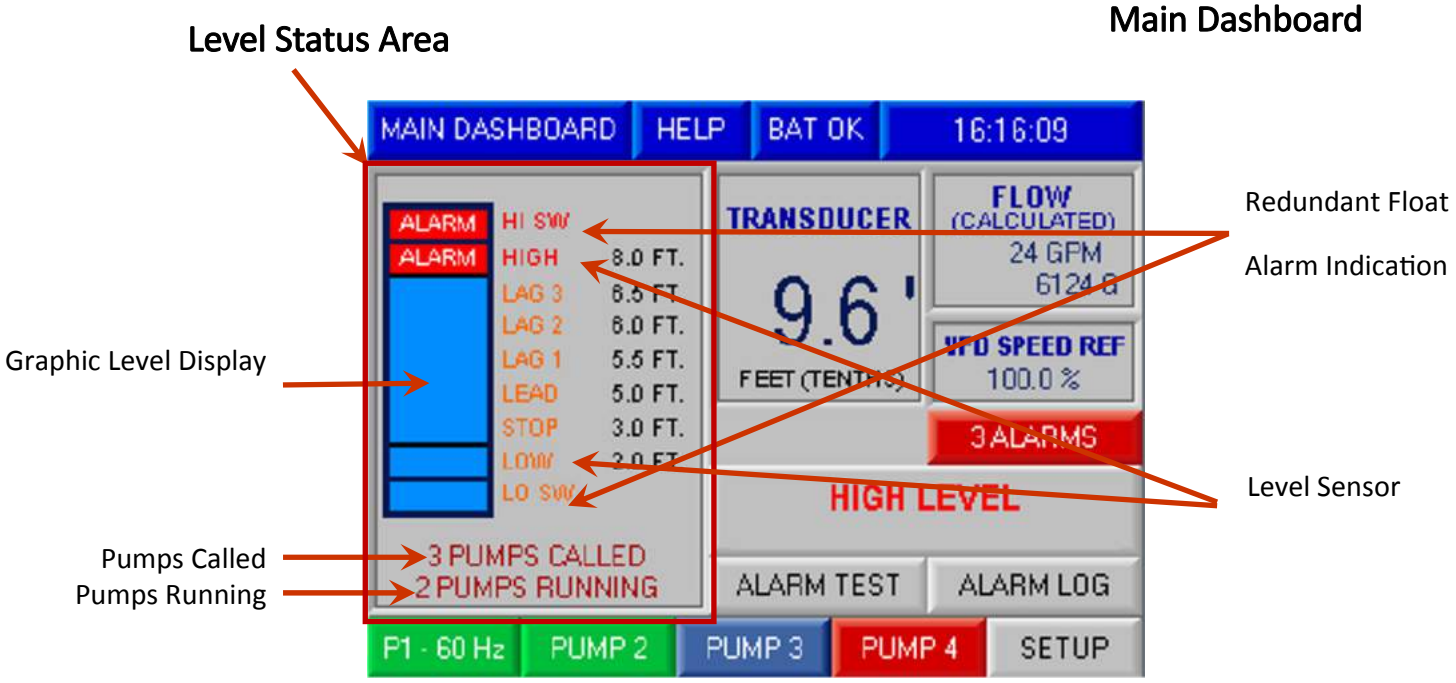
Digital Display - Liquid level display in tenths of feet. Touch the digital level display for the Main Trend Log.

The PV600 level controller can be configured to have a primary and an optional secondary level sensor. The sensors can be any 4-20 MA sensor, float switches, or 10 segment probe (multi-probe). Regardless of sensor type, the level is displayed digitally. With float switches and multi-probe, the level is interpreted by the closure of level switches.

Alarm Test/Silence - Touch the button for the Alarm Test screen. This button will read "SILENCE" when the horn is sounding as it doubles as the alarm silence button.

Flow Meter - When the system is configured for either a wired flow meter or calculated flow, the flow data is displayed here. The flow rate and total gallons are shown. When configured for calculated flow, a negative number appears when no pumps are running, showing the calculated inflow rate. Touch the label for the Flow Trend Log.

Main Dashboard



The Level Status area of the Main Dashboard includes the status information showing how the PV600 is interpreting the level, comparing the level to the user set points, and what the pump response is. Included in the Level Status area:

Pumps Called - As the level rises (or drops in tank fill applications) the pump start set points are tripped and pumps are "called" to run. This field indicates either:

SYSTEM IS IDLE

(X number) PUMPS RUNNING

TIME CLOCK SHUTDOWN (displayed with the Time Clock option is enabled and has shut down the system.

The color of the text changes from green for idle, amber for one pump called, and red for more than one pump called.

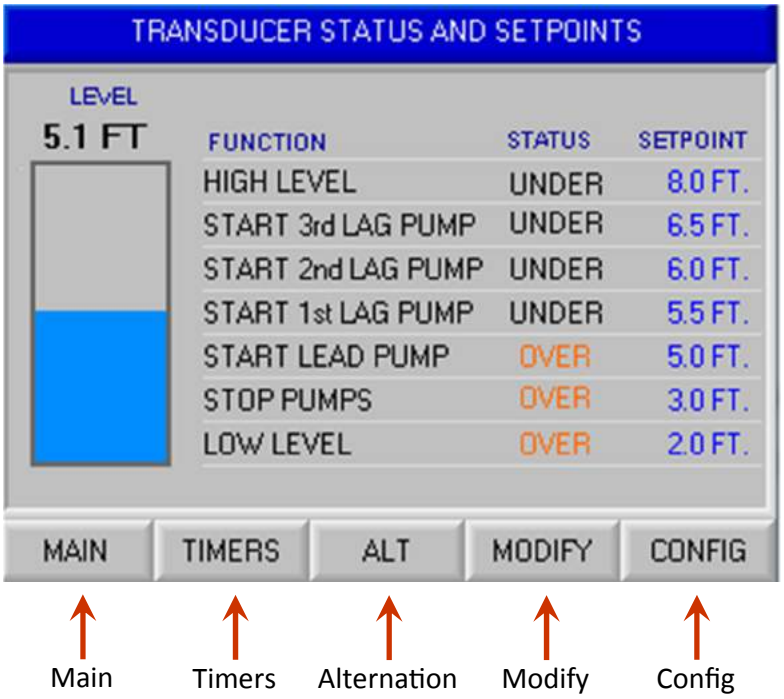
Pumps Running - This field responds back with the number of pumps running and is blank when no pumps are running.

Level Sensor Alarm Indication - The column graph display will indicate alarm for high and low primary sensor alarms in these two areas of the graph.

Redundant Float Alarm Indication - The status of the redundant high and low level float switches are shown here (if installed).

Graphic Level Display—Liquid Fill - The column graph display of the liquid level is scaled to the same range as the level sensor and "fills" with blue liquid proportional to the level in the sump or tank.

System Settings - 4-20 mA Level Sensor



Overview

The Status and Set Points screen displays the operational set points for all pumps and alarms. The set points can be changed by touching the MODIFY button on the menu bar. The user is taken to a Level 1 password entry screen. After the password is successfully entered, the desired set point can be altered by touching the entry values, which are blue when in the edit mode, and entering a new value through the numeric keypad.

Main - This button takes the user back to the Main Dashboard.

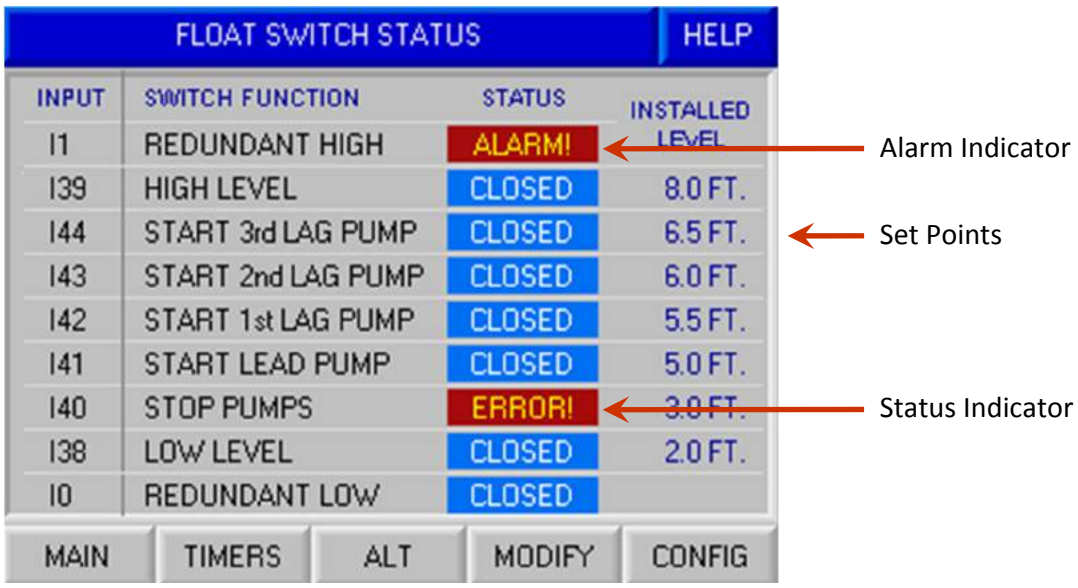
Timers - This button takes the user to the Timers menu, which provides access to the various timers that can be setup for additional pumping functions.

Alternation - This button takes the user to a screen where Alternation settings can be viewed and altered.

Modify - This button takes the user to a password entry screen. Once the Level 1 password is properly entered, the set point values can be altered by touching them. Note: when the password has been entered correctly the variable color will change from black to blue. At this point all Timer display screens and the Alternation screen are unlocked until the user returns to the Main Dashboard.

Config - Takes the user to a password entry screen. Depending on the level password entered, different setup options become available.

System Settings - Float Switch



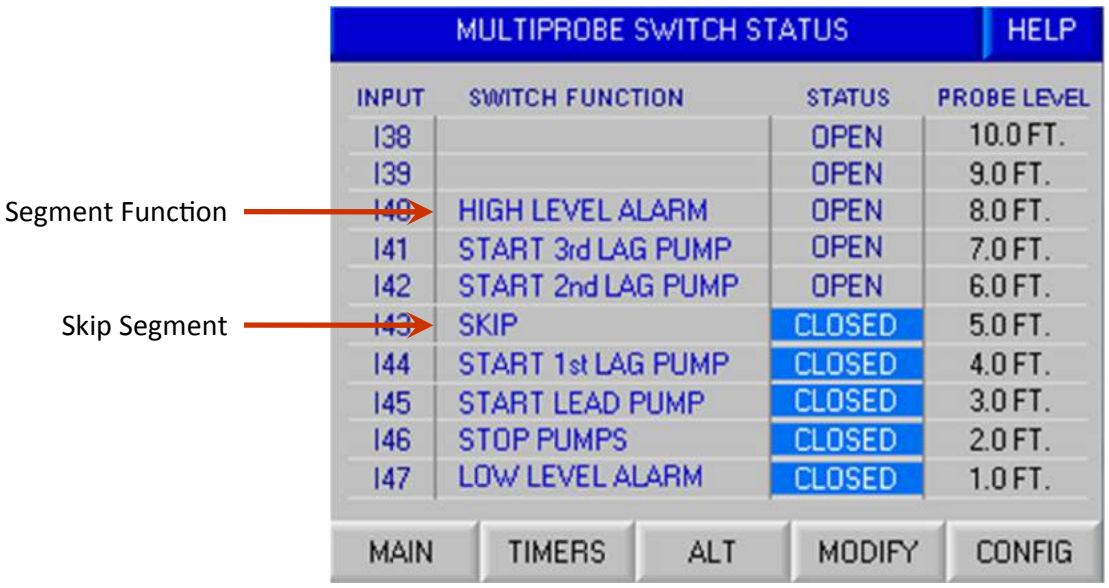
Set Points - The set points are then blue in color and can be changed by touching them and entering a new value. In a float switch system, the "set points" are the elevations at which the float switches are installed. These elevations must be manually measured and entered for the PV600 to be able to display and trend the approximate level of the sump or tank.

Status Indicator - The status indicator changes text and color to indicate when the level is above the float switch. When in the float switch mode, the PV600 uses the CMC "smart" controller logic that monitors the float switches and looks for "out of sequence" problems. If a float switch fails to close, the "Error!" Message is displayed. The controller automatically shifts control to the next float in sequence.

Alarm Indicator - When redundant float switches are installed and there is an alarm condition, the status will be "Alarm!"

Only installed float switches will be displayed.

System Settings - Multi-segment Probe



Overview

The PV600 can use a 10 segment probe rod as a level sensor, either for the primary sensor, or as a backup. In both cases the Setup screen provides an easy way to configure the function for probe segment switch. Each segment is wired to a digital input on the PV600 . The probes come in various lengths and the length of the installed probe must be entered into the Level Sensor setup screen.

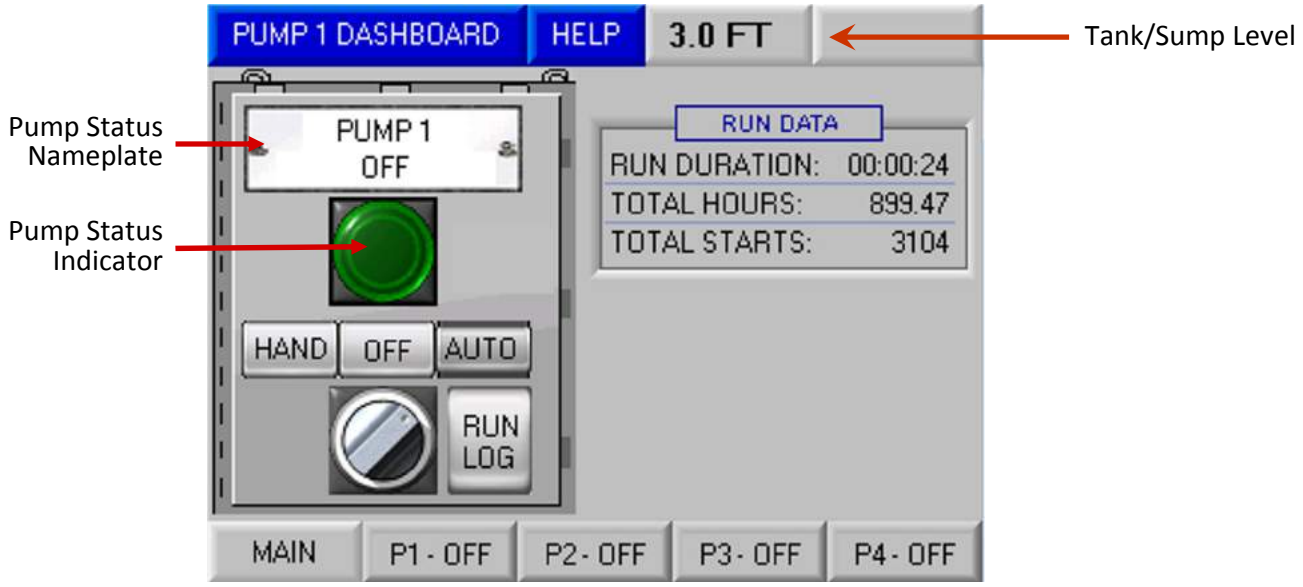
Status Indicator - The status indicator changes text and color to indicate when the level is above the multi-probe switch and the text changes from OPEN to CLOSED.

Assigning Functions - The PV600 automatically assigns the function to the multi-probe switches starting at the lowest level with the necessary functions for the number of pumps configured in the system. To "skip" a switch, simply touch the label to toggle from the assigned function to "skip". When "skip" is selected the PV600 automatically shifts all subsequent functions one position higher on the rod. If the segment is touched when "skip" is displayed, the next function in sequence will move to the segment position.

Rod Segments - The rod has segments at a regular intervals which correlate to a water level that is displayed here

Always start the switch function setup at the lowest level

Pump Dashboard



Overview

Pump Dashboards

A "dashboard" is provided for each pump that is configured in the system. Just as the Main Dashboard provides an overview of the entire pump station, the Pump Dashboards provide an overview of the operation and status of the individual pumps. The image above shows the full display, though some features are shown that will only be displayed if the system is configured for them. For example non-VFD systems will not have any of the VFD related elements on the dashboard.

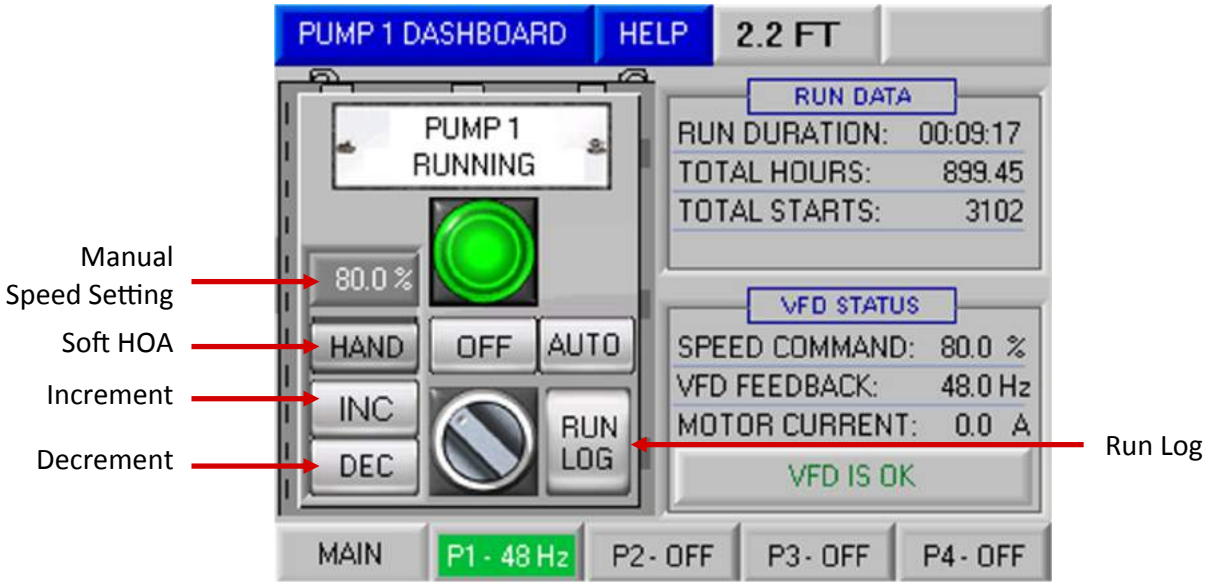
Pump Status Nameplate - Displays the current status of the pump. Status messages include: OFF, CALL, RUNNING, OUT OF SERVICE, FAILED, REMOTE RUN, and MAINT. DUE.

Pump Status Indicator Light - Visually indicates status of the pump (see legend below).

- Light Green: Pump running - shows motor Hz in VFD mode
- Dark Green: Pump stopped
- Red: Pump failure - flashing for maintenance due
- Blue: Pump out of service
- Yellow: Pump called, but not yet running
- Light Blue (flashing): Maintenance due
- Amber: Pump running by remote hardwired signal

The key above shows the default Pump Status Button colors. The colors can be "remapped" by the user to other color themes in the PV600 Option Configuration screen in the Level 3 configuration mode.

Pump Dashboard



Run Log - Touching this button takes the user to the Run Log screen, where pump run data is displayed. The PV600 records the length of time that the pump has been running during its current run cycle, or last run cycle if currently idle.

The run duration is logged with start time and date into the Pump Run Log, accessed by touching this button.

Manual Speed Setting - Displays the current VFD speed in terms of percentage. The speed can also be directly adjusted by touching the manual speed display and then entering the desired set point on the keypad screen.

Increment - This button gradually increases the VFD manual speed.

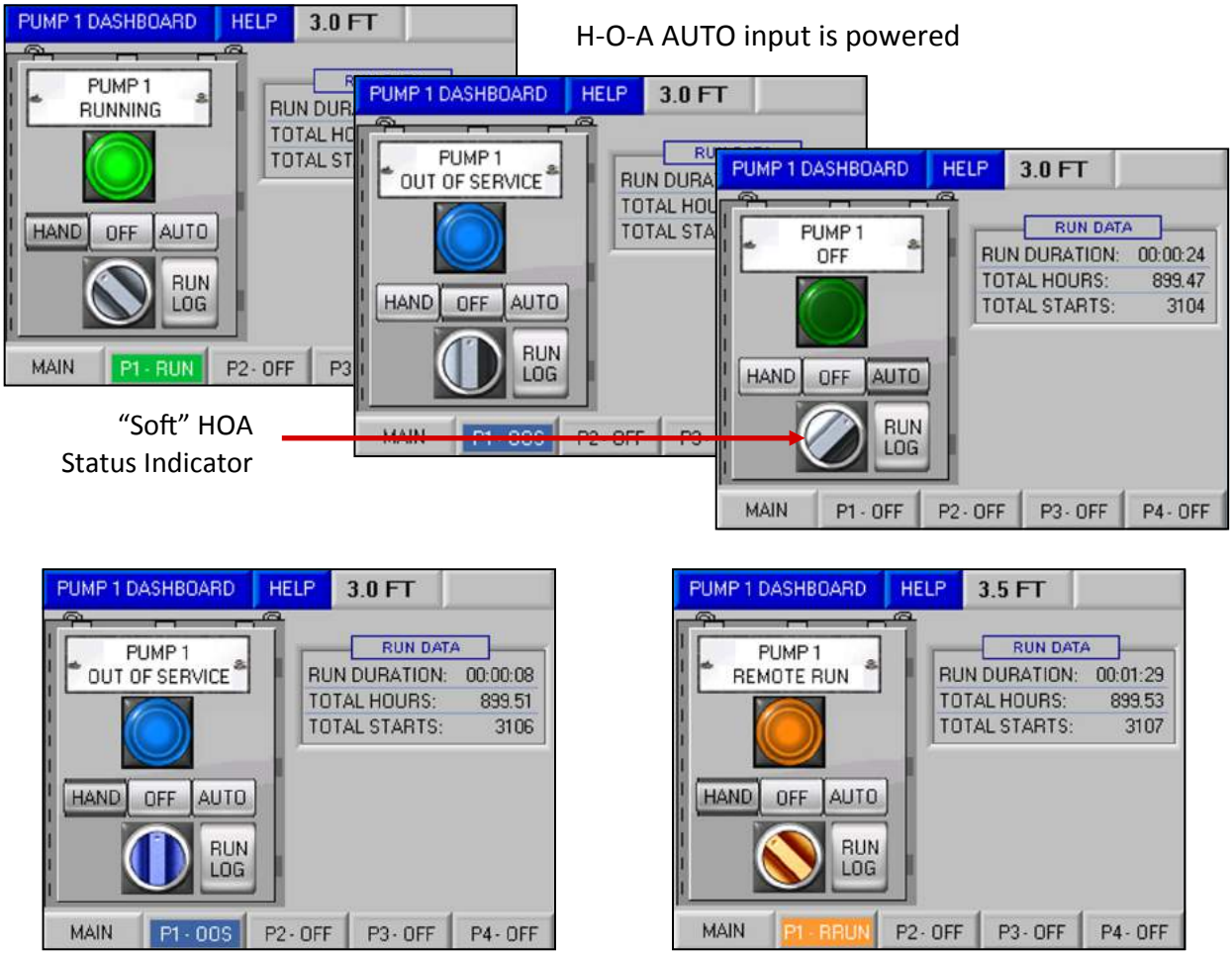
Decrement - This button gradually decreases the VFD manual speed.

Note: Touching an Increment/Decrement button changes the value by 0.1%. Touch and hold to auto-increment the set point.

"Soft" HOA - Touch these buttons to change the status of the "soft" HOA switch. The "soft" HOA is in the PUMP Vision to allow remote control of the pumps when the controller is wired through a network or wireless connection.

HAND	Setting the switch to hand runs the pump as long as there are no shutdown conditions.
OFF	Setting the switch to off puts the pump into the out-of-service condition.
AUTO	Setting the switch to auto make the pump ready to run when called by the sequencer.

Pump Dashboard



H-O-A AUTO input is not powered

H-O-A AUTO input is not powered, but pump is running

"Soft" HOA Status indicator - A virtual three position switch allows the user to see whether the soft HOA is set to HAND, OFF, or AUTO. It also provides an indication of what the position the hardwired pump Hand-Off-Auto selector switch is in.

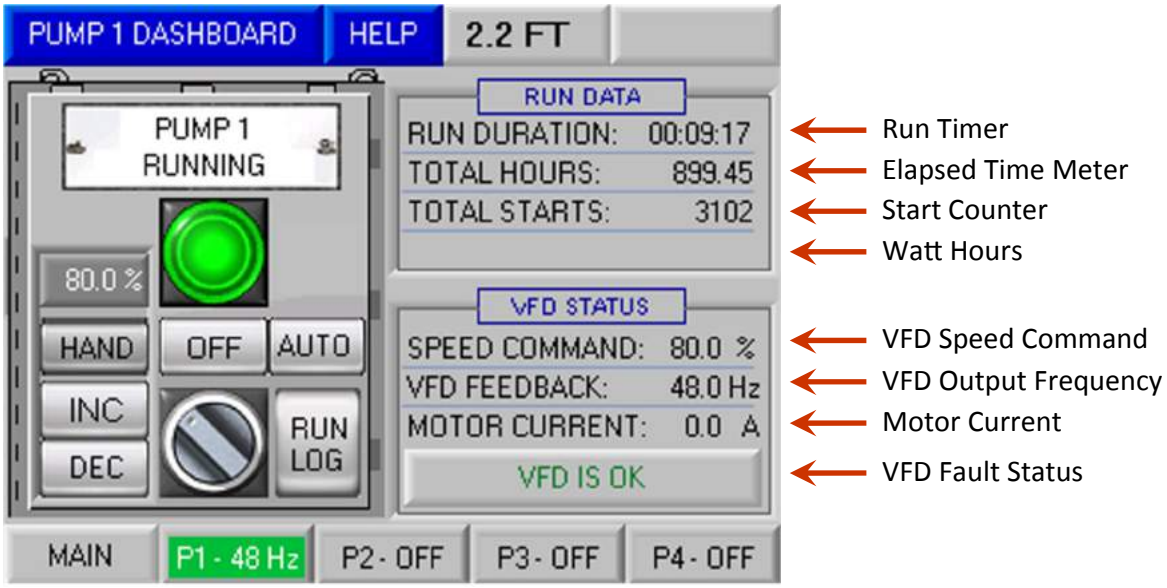
When the hardwired pump Hand-Off-Auto selector switch is in the AUTO position, the HOA AUTO input of the PV600 is energized and the "Soft" HOA Status indicator is gray in color. When the "soft" HOA buttons are touched, the status indicator moved to indicate the mode chosen.

When the hardwired pump Hand-Off-Auto selector switch is in the OFF position, the HOA AUTO input of the PV600 is de-energized and the "Soft" HOA Status indicator moves to the OFF position and is blue* in color, indicating "out of service". In this mode, the status indicator will not change positions when the buttons are touched.

When the hardwired pump Hand-Off-Auto selector switch is in the OFF position, and the pump RUN input of the PV600 is energized, the "Soft" HOA Status indicator moves to the HAND position and is amber* in color, indicating "remote run". In this mode, the status indicator will not change positions when the buttons are touched.

* The colors shown for the OOS and Remote Run modes are default and can be changed to other choices by the user in the Special Options configuration.

Pump Dashboard



Overview

Other features of this screen can include:

Run Timer - Displays the Current (or previous, if ide) run duration.

Elapsed Time Meter - Displays the total run time of the pump. The display is in hundredths of an hour and will display over 40 million hours. These can be reset in the ETM & Counter Reset screen in the Diagnostics Menu.

Start Counter - Displays the total number of pump starts. This counter can count to over 32,000 starts. These can be reset in the ETM & Counter Reset screen in the Diagnostics Menu.

Watt Hours - Displays the total number of kilowatt hours (if available from starter or VFD).

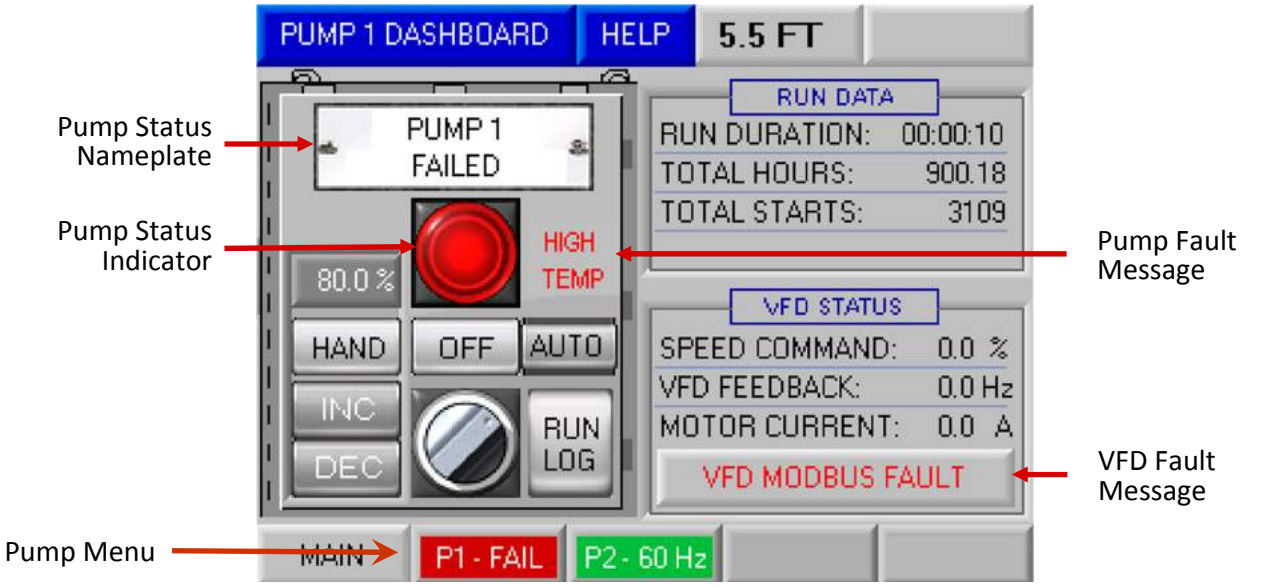
VFD Speed Command - Displays the current VFD Speed Reference sent from the PV600 in percentage (0-100%).

VFD Output Frequency - Displays the current VFD output frequency in hertz (0-60 Hz).

Motor Current - Displays the motor current draw in Amps.

VFD Fault Status - Displays the current VFD status or fault. Touch the button to go to the VFD fault log. The VFD Fault Log displays the last 250 VFD fault conditions. Fault Logging is only available on the Schneider, A-B, and ABB VFDs.

Pump Dashboard



Overview

Pump Fault Indicators - When there is a pump fault condition, it will be indicated in four places on the pump dashboard:

Status nameplate indicates failure

Status indicator turns red

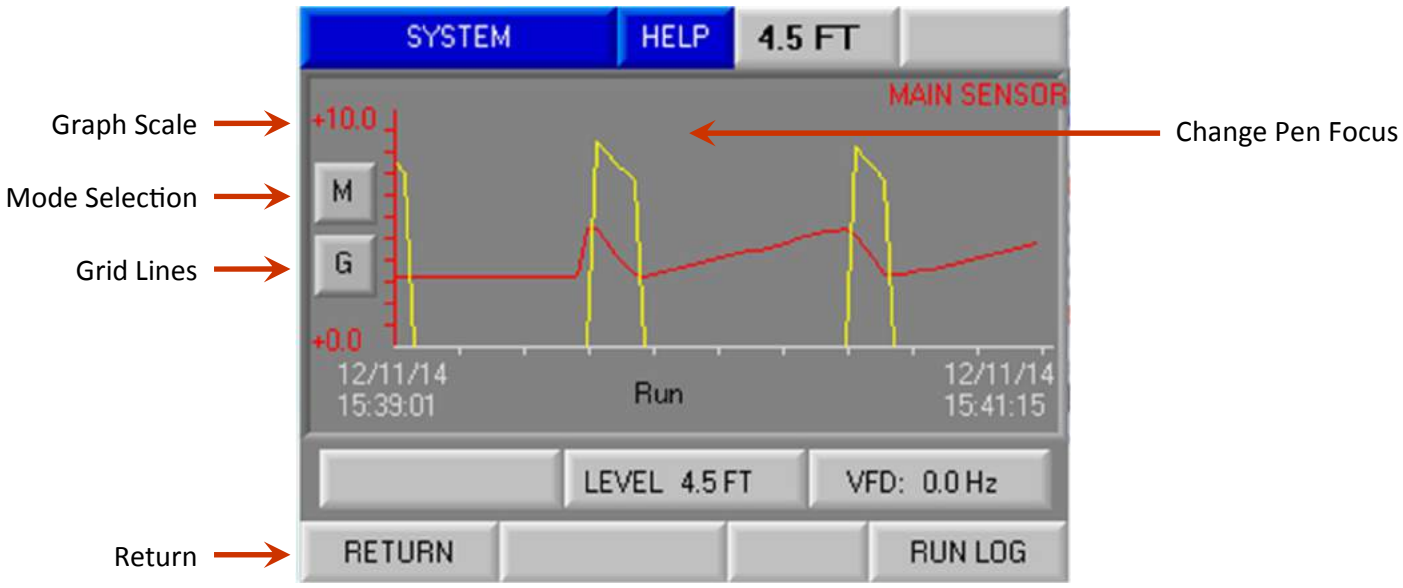
Fault message display

Pump menu button turns red

Pump Fault Message - Touch the message here to scroll through any active pump fault conditions.

VFD Fault Message/Fault Log - This button display and active VFD fault or "VFD is OK". Touch the message here to access the VFD Fault Log to show the past 250 VFD faults.

Main Trending Screen



Overview

The trend screen charts the sump/tank level and VFD speed, or sump/tank level and number of pumps running in non-VFD systems.

A separate trend chart is available for flow enabled systems by touching the flow data on the Main Dashboard.

Main Trend Graph

The main trend graph has two possible “pens”.

Red pen = main sensor

Yellow pen = VFD % speed, or number of pumps running in non-VFD systems

Change Pen Focus - To change the “focus” of the graph so that the scale of a different pen is shown, touch the graph to toggle through the choices.

Graph Scale - Each pen has its own scale. The scale for each pump is user adjustable by touching the scale’s max. Number and entering a new value.

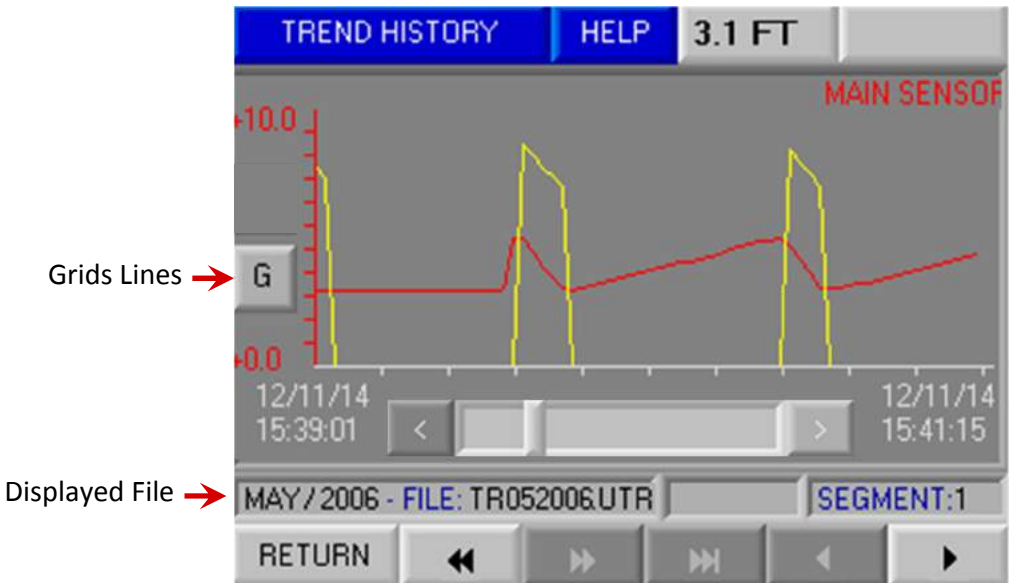
Mode Selection - Touch this button to toggle between Run and History mode.

Run - the graph shows current time for the past minute (approximately).

History - the graph can be scrolled using the forward and backward buttons.

Grid Lines - Touch the **G** button to add graph lines to the display. Touch again to hide the lines.

Historical Trend Screen



When an SD card is install in the PV1200 and Trending is enabled in the SD Memory Card Data Logging setup screen, the main trend chart is recorded onto the SD Card. The PV1200 automatically creates a new trend data file each month. A maximum of 63 months of data can be stored on one card before files must be deleted or a new card installed. Within each data file are "segments". At least one segment exists in each file and a new segment is created within the month's file each time the PV1200 is power cycled.

Tip: To maintain single segment charts within each file, install a UPS to the PV1200 power supply to prevent power cycling the controller.

The files can be displayed on the PV1200 screen, or they can be downloaded or copied from the SD card to a PC and reviewed using the SD Card Manager software. When the screen above is accessed from the Main Trend screen, the most current month's data file is initially displayed. Depending on the length of the first segment, it may take some time (up to a couple of minutes) to load the data for display. Once the data is displayed it can be scrolled though to review trends. If multiple segments exist within the month's data file, they can each be viewed by scrolling through the segments.

The historical trend graph has three possible "pens".

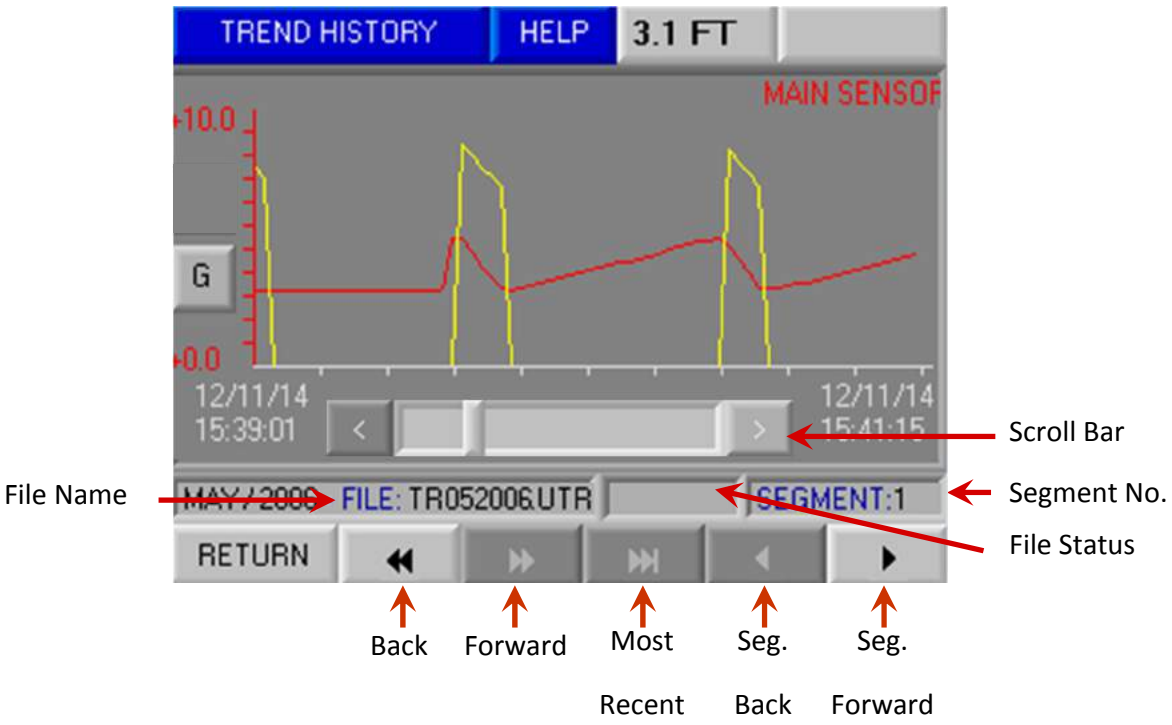
Red pen = main sensor

Yellow pen = VFD % speed, or number of pumps running in non-VFD systems

Green pen = suction level or pressure

Displayed File- Displays the month and year of the chart being displayed .

Historical Trend Screen



File Name - This is the name of the file as stored on the SD memory card.

Scroll Bar - The scroll bar controls where in the graph segment is being displayed. The graph can be scrolled by the page by touching the arrow button at either end, or "dragging" the handle and sliding it to a point elsewhere in the chart.

Segment No. - Shows the segment number currently being displayed.

Back - Touch this button to view to the previous month's file. If no file exists for the month being request, 'FILES DOES NOT EXIST IS DISPLAYED'.

Forward - Touch this button to view to the following month's file. If no file exists for the month being request, 'FILES DOES NOT EXIST IS DISPLAYED'.

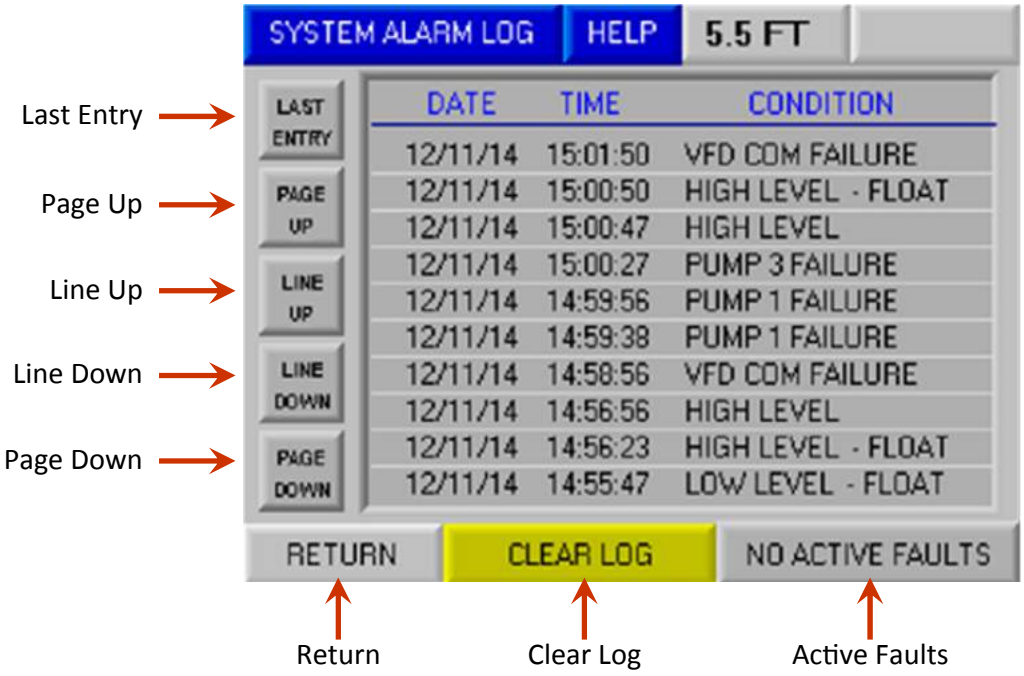
Most Recent - Touch this button to advance to the most recently month's file.

Seg. Back - Touch this button to return to the previous segment in the month.

Seg. Forward - Touch this button to advance to the next segment in the month. Each segment must load in turn and each may take some seconds to load.

File Status - Shows LOADING when a data file segment is in the process of being read to the screen and END OF FILE when the last segment in the file is being displayed.

Alarm Log



Overview

By touching the Alarm Log label on the main screen, the user can access the Alarm Log screen, that displays the alarm conditions with date and time of occurrence. This log saves the past 1,000 alarm conditions.

Last Entry - Touch this button to return to the most recent alarms after scrolling.

Page Up - Touch this button to move up a page in the alarm history.

Line Up - Touch this button to scroll up one line in the alarm history.

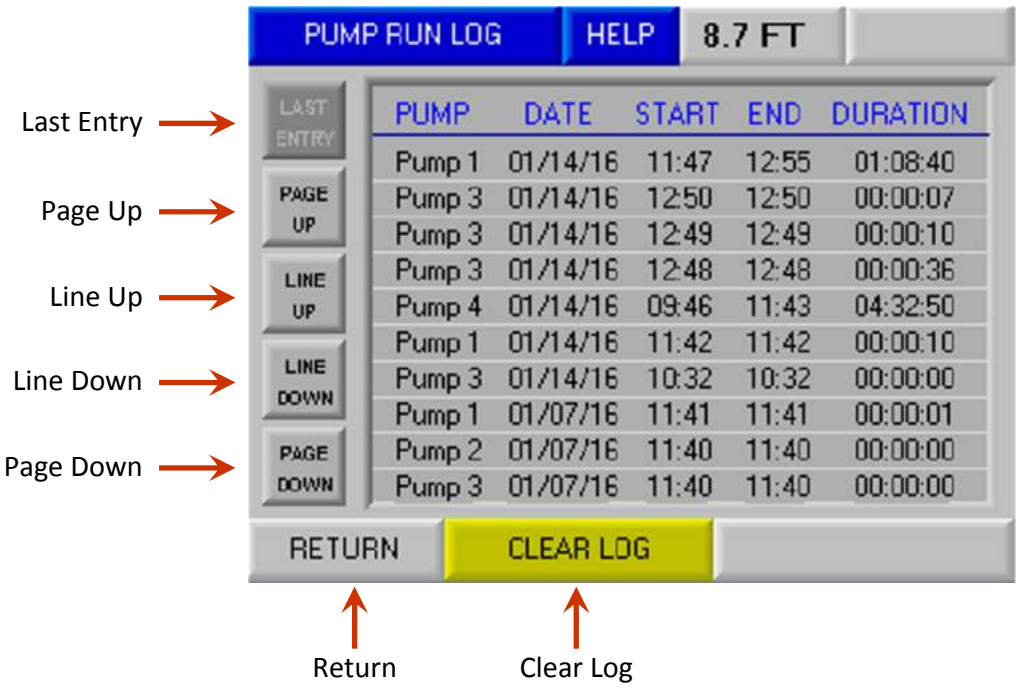
Line Down - Touch this button to scroll down one line in the alarm history.

Page Down - Touch this button to move down a page in the alarm history.

Return - Touch this button to return to the Main Screen.

Clear Log - Touch this button to clear the Alarm Log. A password screen will pop up that requires the entry of the clear log password, 1234.

Run Log



Overview

The Pump Run Log records the past 500 pump run events. It is accessed from the Pump Control screen. The Pump Called, Date, Start/End times and Duration are stored each time a pump is run.

Last Entry - Touch this button to return to the most Run history after scrolling.

Page Up - Touch this button to move up a page in the run history.

Line Up - Touch this button to scroll up one line in the run history.

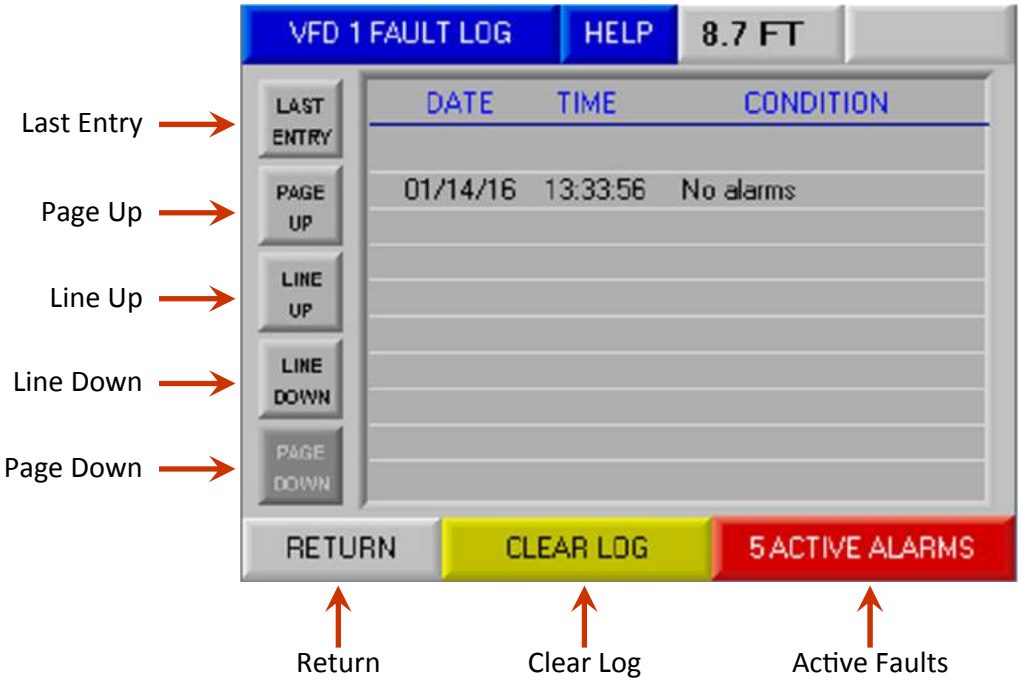
Line Down - Touch this button to scroll down one line in the run history.

Page Down - Touch this button to move down a page in the run history.

Return - Touch this button to return to the previous screen.

Clear Log - Touch this button to clear the Run log. A password screen will pop up that requires the entry of the clear log password, 1234.

VFD Fault Log



Overview

There is a separate fault log for each of the VFDs, accessed from the Pump Control screen when the system is in the VFD mode (when communicating with the PV600 through Modbus). The VFD logs save the last 250 fault conditions.

Last Entry - Touch this button to return to the most recent fault after scrolling.

Page Up - Touch this button to move up a page in the fault history.

Line Up - Touch this button to scroll up one line in the fault history.

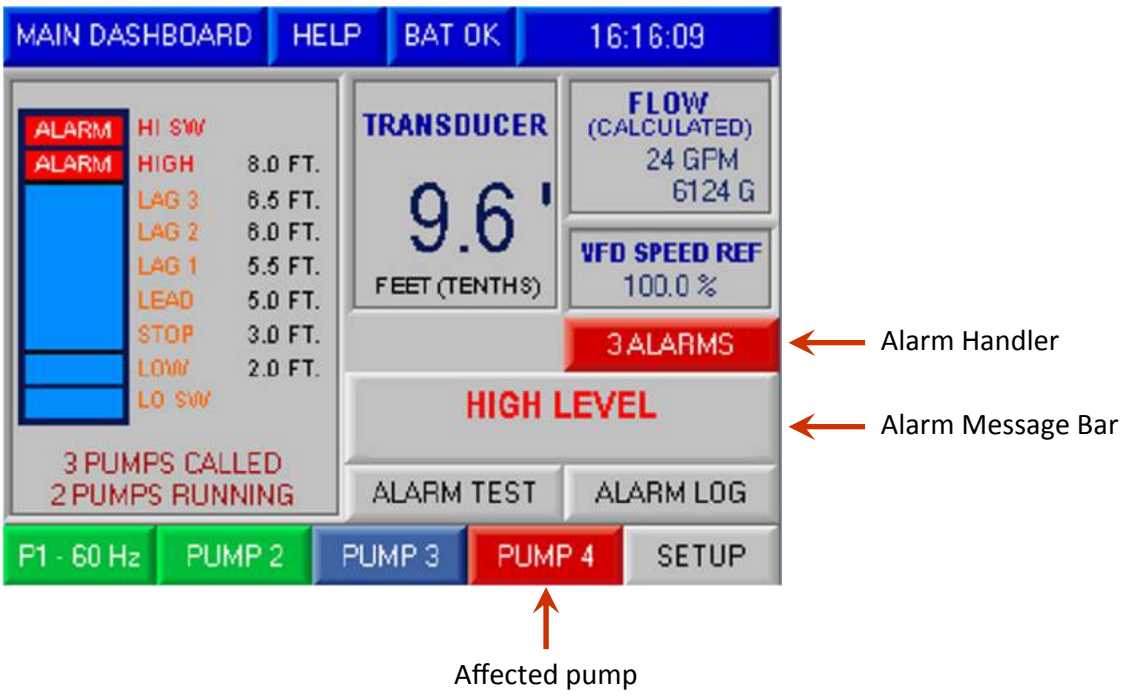
Line Down - Touch this button to scroll down one line in the fault history.

Page Down - Touch this button to move down a page in the fault history.

Return - Touch this button to return to the Pump Screen.

Clear Log - Touch this button to clear the fault log. A password screen will pop up that requires the entry of the clear log password, 1234.

Alarm Handler



Overview

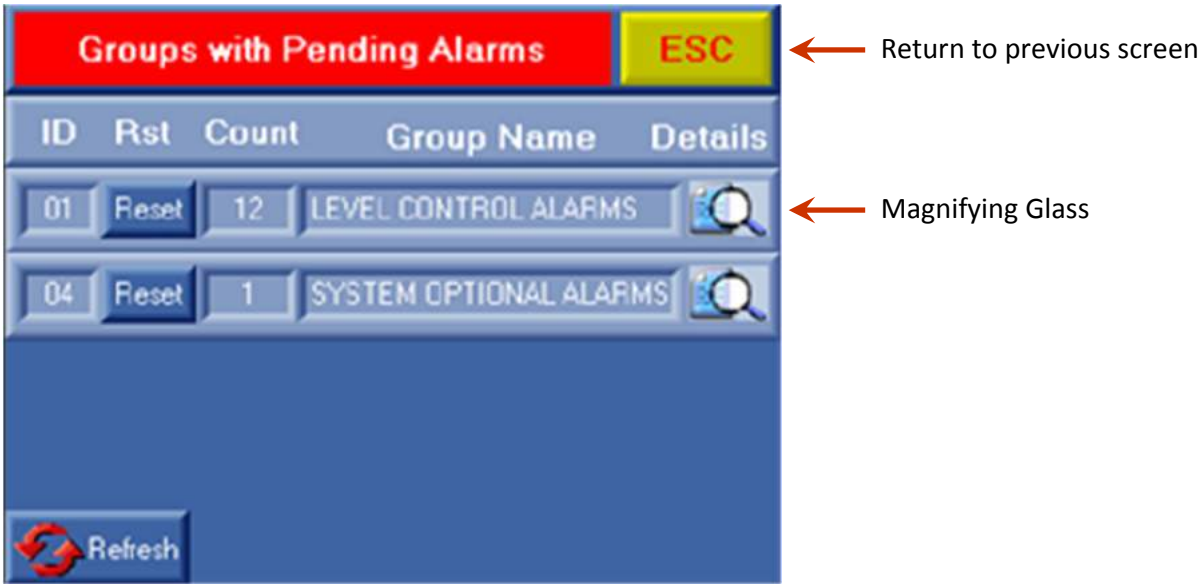
In the event of an alarm condition, 3 indications will appear on the main screen.

The alarm message bar will display the alarm that has occurred. In the event of multiple alarms being triggered, the latest alarm will be displayed. Touching the alarm message bar will scroll through the alarm messages.

The Alarm Handler will appear showing the number of active alarms. Touching the Alarm Handler will take the user to the alarm handler screen. Once the alarms are no longer active, the Alarm Handler will display FAULTS NEED ACK (acknowledgment). Once the user has acknowledged the alarms the Alarm Handler will disappear.

At the bottom of the screen, the pump affected will be highlighted in bold red indicating that there is an alarm condition.

Alarm Handler



Overview

The Alarm Handler is a series of screens that provides access to active and non-acknowledged alarm conditions. The handler displays information about each alarm condition.

This is the first screen that appears when entering the Alarm Handler and the user must touch the “Magnifying Glass” button to go to the alarm display page.

Alarm Handler

Overview

The second level of the Alarm Handler is list of all alarm conditions that are either still active, or are inactive but have not been acknowledged by the operator. Once an alarm is no longer active and it has been acknowledged, it is removed from the list.

Alarm Time - This shows what time the alarm condition occurred.

"Magnifying Glass" - Touch this to go to the next level screen. Each alarm condition has one of these buttons to give access to the level 3 screens and specific information on the alarm status and condition.

Alarm Status - This shows whether or not the alarm has been acknowledged.

Alarm Name - This shows the alarm condition.

Refresh - Touch this button to refresh the list.

Alarm Handler

Overview

The third level of the Alarm Handler is detailed information about the specific alarm condition.

Alarm Name - This shows what the alarm condition is.

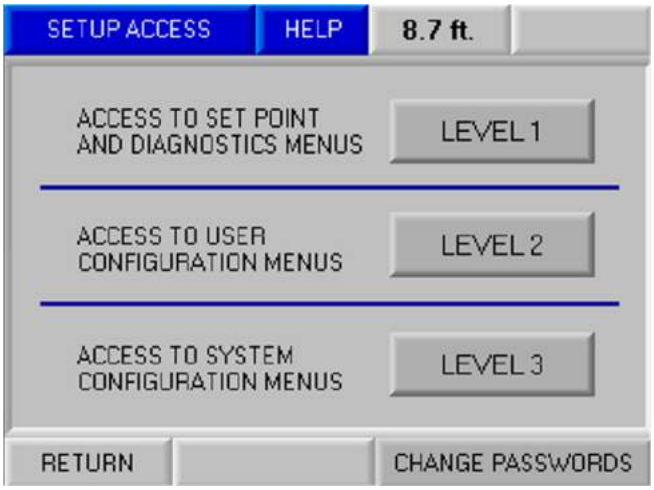
Alarm Time and Date - This shows what time the alarm condition occurred.

Count - This shows how many times the alarm condition has occurred.

Status - This shows if the alarm has been acknowledged or not.

Acknowledge - Touch the "Ack" button to acknowledge this alarm. Touch the << or >> buttons to scroll through the other unacknowledged alarms.

Config - Setup Access



Level 1 Configuration Access

Level 2 Configuration Access

Level 3 Configuration Access

Change the Passwords

Accessing the Setup Menu requires that a password be entered. Touch the LEVEL 1, LEVEL 2, or LEVEL 3 button and the password entry keypad will appear. Enter the password to proceed.

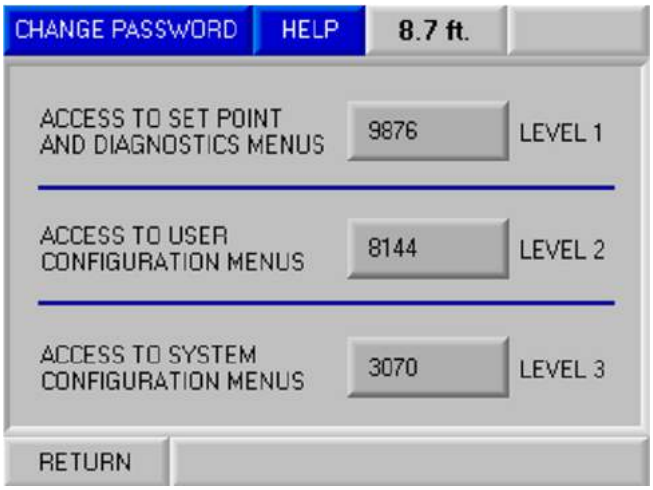
Three levels of access are provided so that the higher level configuration functions can be protected.

Level 1 - Access to all set points, timers, alternation, and other operational settings

Level 2 - All Level 1 functions, plus email address and alarm configuration

Level 3 - Access to all functions including top level configuration

Change the Passwords - Touch here to access the Change Password screen. The Level 3 password must be entered to access the change screen. Once the correct password is entered, the screen below appears and new passwords can be entered for all three levels. The password must be numeric only and can be up to 9 characters long.



FACTORY DEFAULTS

Level 1 Default Password is 9876

Level 2 Default Password is 8144

Level 3 Default Password is 3070

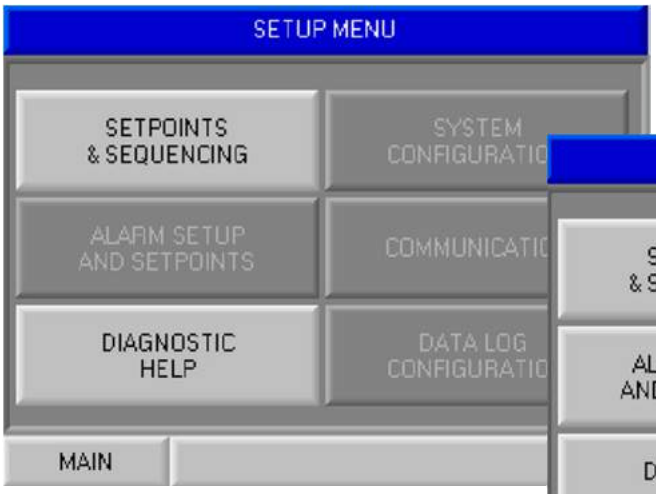
NOTE: make note of all passwords if changed. If the Level 3 password is lost, the controller must be factory initialized to restore access to the system.

Setup Menu

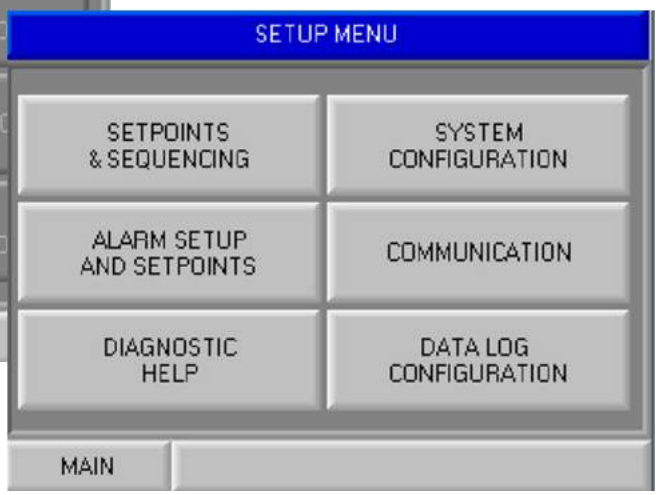
Data Entry / Password Entry

The data entry screen will pop up whenever any set point or data entry field is touched. The screen is intuitive. Touch the number buttons to enter a value, touch the enter button to accept the new value. Touch the Esc button to leave the data entry screen.

Setup Menu Level 1

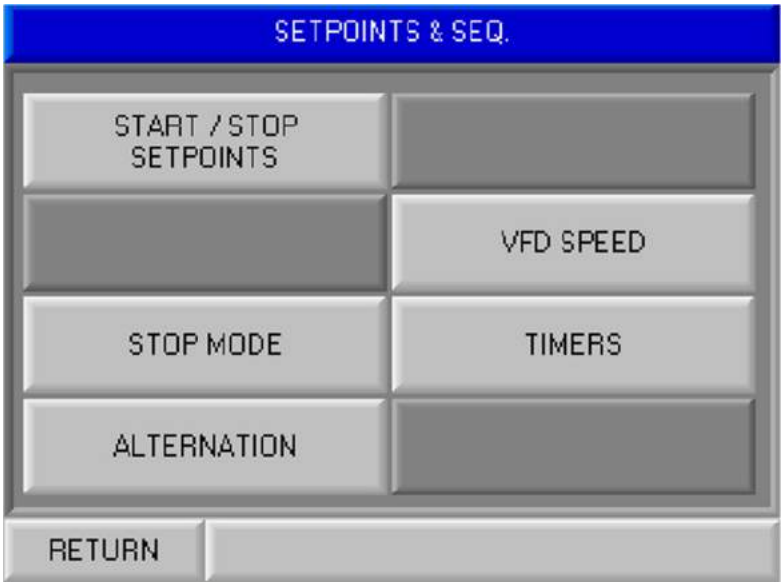


Setup Menu Level 2, 3



Once the correct password is entered for the level selected, the SETUP MENU appears. Depending on the access level, some menu options may be grayed out, preventing access to that area of system setup.

Set Points & Sequencing Menu

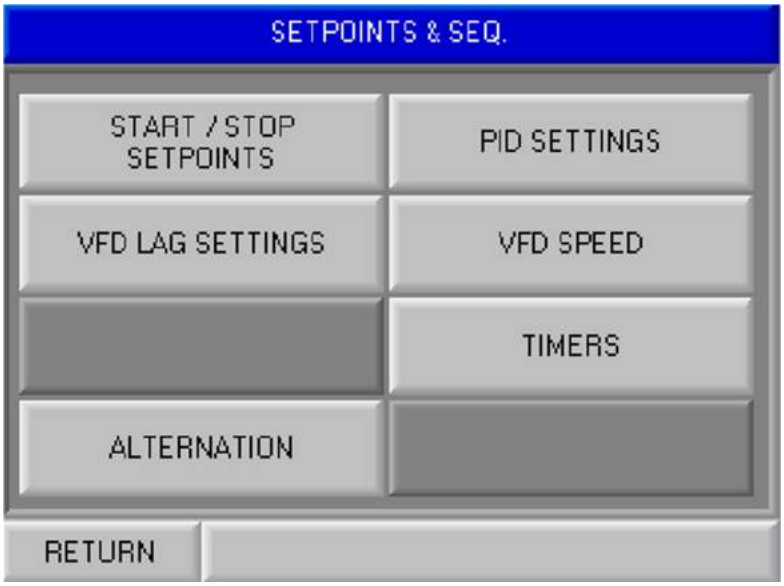


Overview

The Set points & Sequencing menu displays the following options in all system configuration modes except VFD PID.

MENU ITEM	ACCESS	FUNCTION
START/STOP SET POINTS	1	Pump start and stop set points for lead and lag pumps
STOP MODE	1	Select single or multiple stop set point modes Not visible on simplex systems
ALTERNATION	1	Pump sequencing control Not visible on simplex systems
VFD SPEED	1	Set the minimum and maximum VFD speeds for AUTO and MANUAL mode Only visible on VFD configured systems
TIMERS	1	Access to the Timer Menu

Set Points & Sequencing Menu - VFD PID Mode

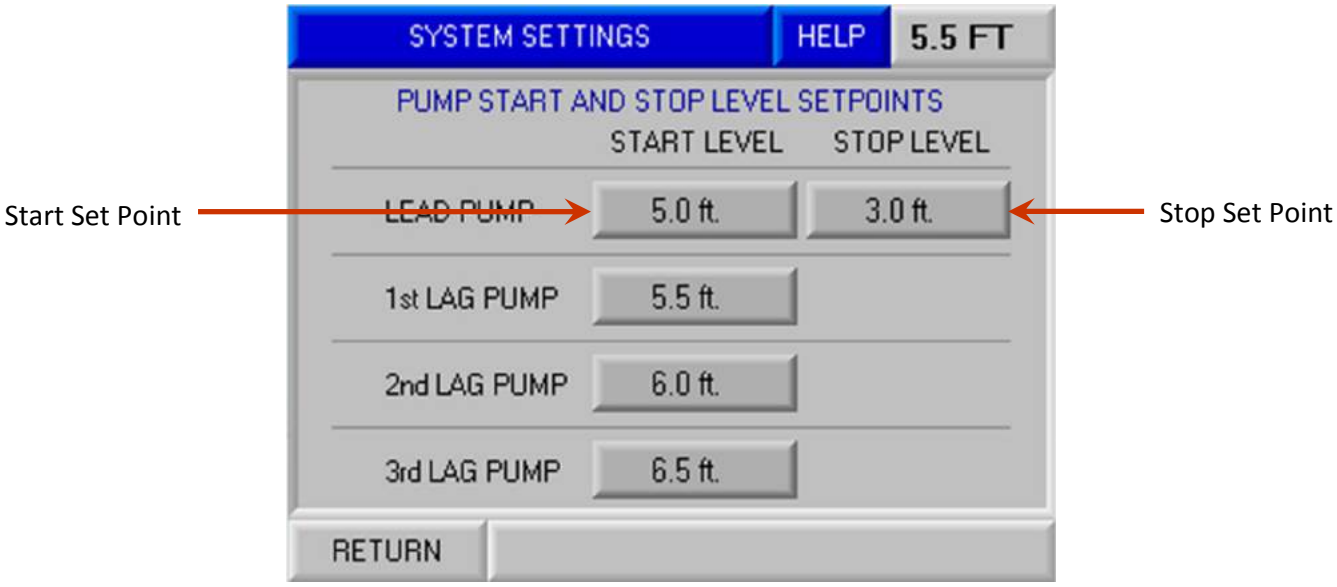


Overview

The Set points & Sequencing menu for systems configured for VFD PID mode has the following menu options:

MENU ITEM	ACCESS LEVEL	FUNCTION
START/STOP SET POINTS	1	Pump start and stop set points for lead pump Target level set point
VFD LAG SETTINGS	1	Lag pumps start and stop VFD speed Not visible on simplex systems
ALTERNATION	1	Pump sequencing control Not visible on simplex systems
PID SETTINGS	2	Adjust the VFD speed control loop
VFD SPEED	1	Set the minimum and maximum VFD speeds for AUTO and MANUAL mode
TIMERS	1	Access to the Timer Menu

Set points & Sequencing - Start/Stop Set Points



Overview

The pump start and stop set points can be entered on the Systems Settings screen, as well as on the Setup screen accessed from the Main Dashboard.

It is important to consider all of the system needs when setting the pump start and stop set points. Factors may include:

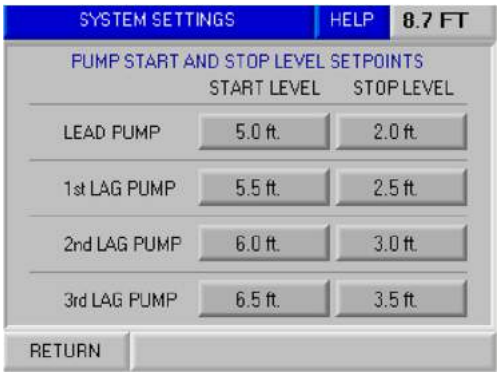
..Minimum water level to protect submersible pumps.

..Keep a minimum distance between lead pump start and pumps stop to prevent “short cycling” of the pumps.

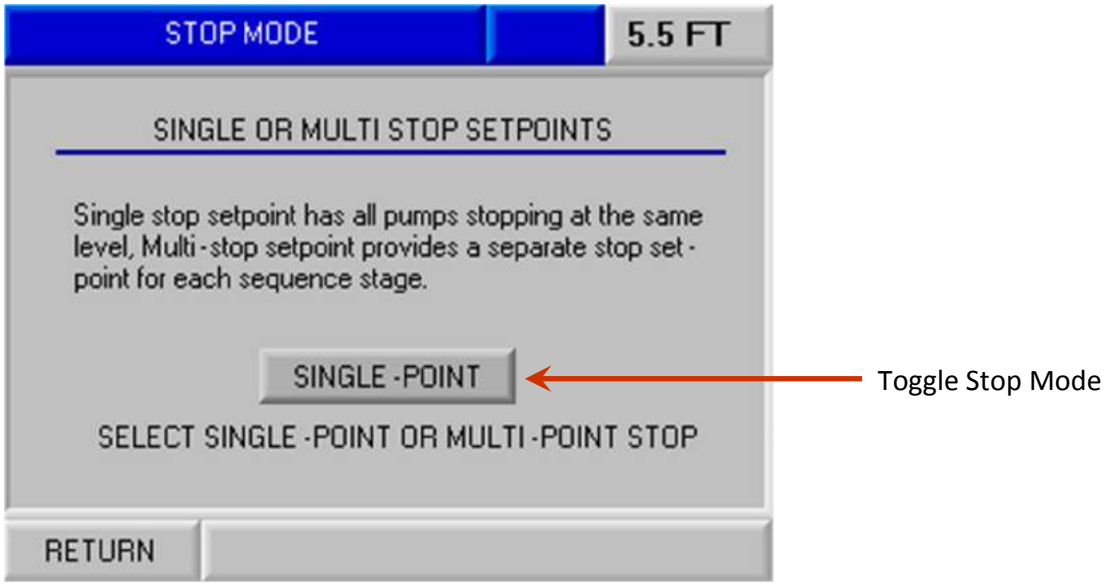
..Keep sufficient distance between lead pump start and lag pumps start set points to prevent starting lag pumps needlessly.

Start Set Points - Enter the start set points here.

Stop Set Point (or Points) - Enter the pumps stop set point here. For multiple stop set points, set the Stop Mode to MULTI-POINT.



Set points & Sequencing - Stop Mode



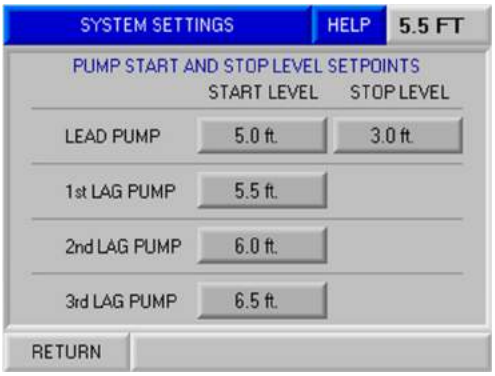
Overview

Stop Mode Configuration

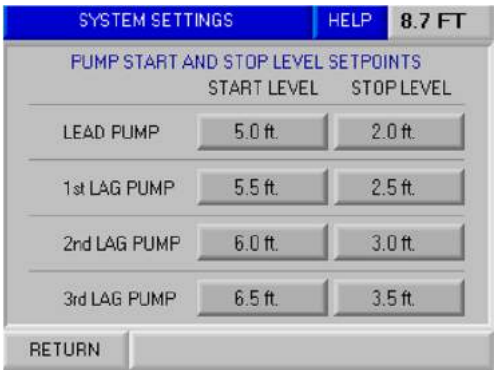
When the mode is set to single point, the start/stop set points screen has only one stop set point and all running pumps stay on until they reach that set point.

When the mode is set to multi point, the start/stop set points screen has a stop set point for each pump, so each pump stops at its own set point.

Toggle Stop Mode - Touch here to select between single-point or multi-point stop mode.

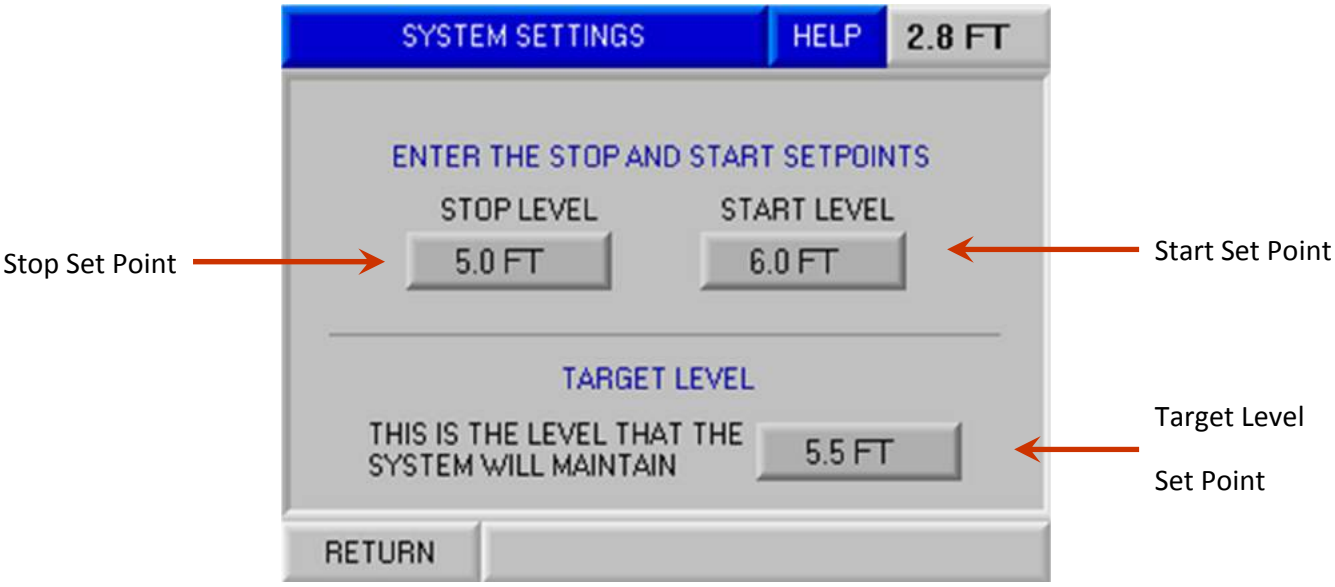


Single stop set point



Multiple stop set points

Set points & Sequencing - Start/Stop Set Points - VFD PID Mode



Overview

The pump start and stop set points can be entered on the Systems Settings screen, as well as on the Setup screen accessed from the Main Dashboard.

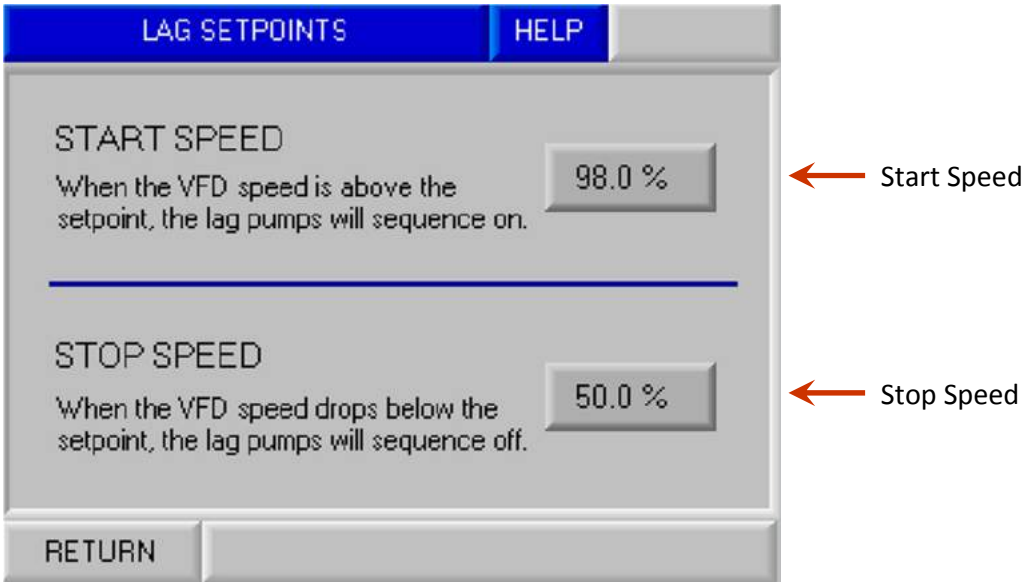
In the VFD PID mode, the PV600 will modulate the speed of the VFDs to maintain a target level. Whether the pump will start and stop with the set points depends on where the VFD minimum speed setting puts the pump on the curve and the rate of flow in and out of the vessel.

Start Set Points - Enter the start set points here.

Stop Set Point - Enter the pumps stop set point here.

Target Level Set Point - Enter the level that the system is to maintain here.

Set points & Sequencing - VFD Lag Settings - VFD PID MODE



Overview

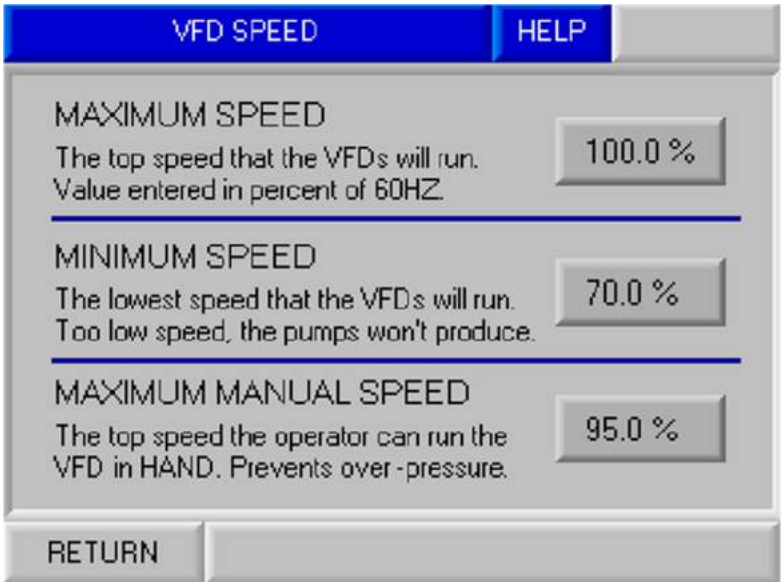
Lag Pump Staging - VFD PID Mode

As the water level rises (or falls in a tank fill application) the speed of the pump increases to maintain a constant level and if the speed rises above a set point that is user set near the top of the pump curve, another pump is staged on. When the VFD speed drops below a set point that is user set near the low end of the pump curve, a pump is stopped.

Start Speed - Touch here to enter the speed above the VFD set point at which the lag pumps will sequence on.

Stop Speed - Touch here to enter the speed below the VFD set point at which the lag pumps will sequence off.

Set points & Sequencing - VFD Speed

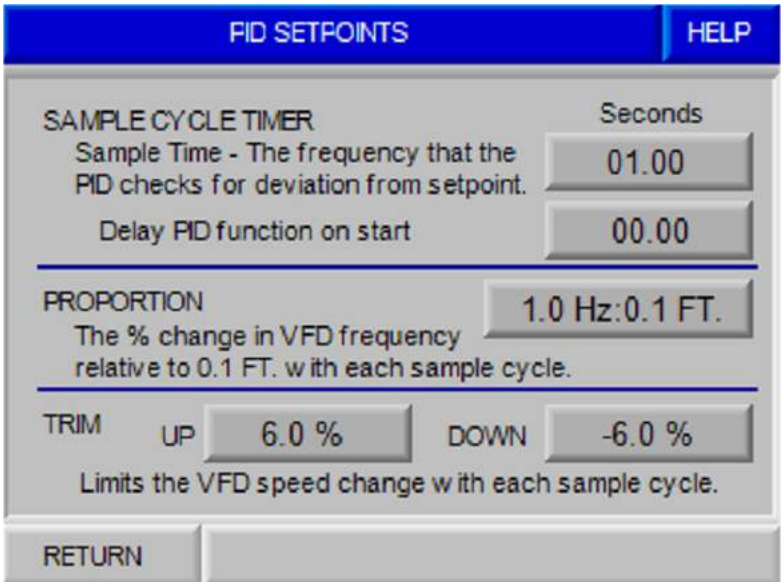


Maximum Speed - The top speed that the VFDs will run. Values are entered in percent of 60Hz. The maximum speed can be set up to 150%, but extreme care must be given in over-revving the pumps.

Minimum Speed - The lowest speed that the VFDs will run. Values are entered in percent of 60Hz. The minimum speed set point must be lower than the lag stop set point, or else the lag pumps cannot de-stage.

Maximum Manual Speed - The top speed the operator can run the VFD in Hand mode. Values are entered in percent of 60Hz. Prevents over-pressure. This set point should be determined by running one pump in hand mode during typical flow and adjusting the VFD speed for demand.

Set points & Sequencing - PID Settings - VFD PID Mode



Sample Time

Overview

The PV600 uses an algorithm that samples the level on a preset time interval to determine deviation from set point. Based on the deviation from set point, the controller will make an adjustment to the VFD that is proportional to the deviation.

The adjustment will be up (faster speed) when the level is too high, or down (slower speed) when the level is too low. This mode can be reversed for tank fill applications. The amount of change can be limited with the trim settings.

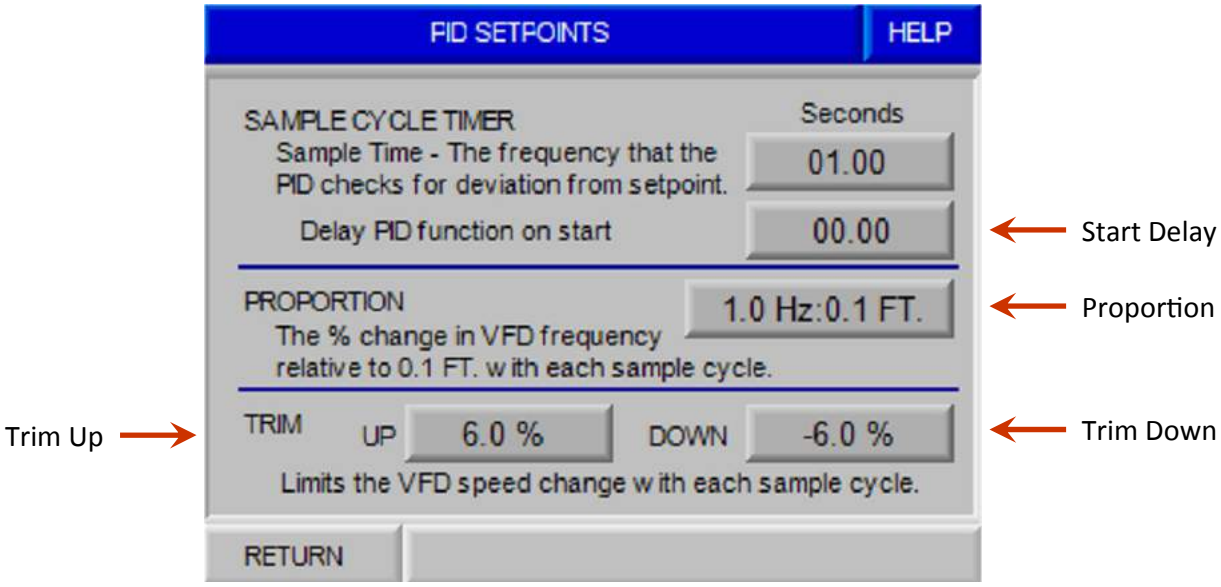
Sample Time - Select here to modify the Sample Timer frequency. Sample time is the frequency at which the level will be checked. This time setting is dependent on the size of the sump or tank being pumped and the size of the pumps.

For systems with a small sump or tank, and with larger pumps relative to tank size, the controller needs to be faster acting. Lower the time interval to perhaps 5 seconds or less to achieve a smooth reaction to the changes in flow conditions. On a large system, where it takes more time for the pump speed to have influence on the level, increase the time to 30 seconds or more. When changes are made to the time interval, an offsetting adjustment is usually needed to the proportion setting.

As the sample cycle time interval is shortened, the proportion of change to the VFD speed for each 0.1 ft. of level change will need to be reduced so that there aren't rapid large changes to the VFD speed. Rapid small changes to the drive speed provide a smoother reaction. Conversely, when the sample timer is set slower, a larger proportion of VFD speed for each 0.1 ft. of level is needed.

A little trial and error is needed for tuning, but once it is dialed in for a particular application, the PV600 provides responsive and stable reaction to the system needs.

Set points & Sequencing - PID Settings - VFD PID Mode



Start Delay - Select here to modify the Start Delay Timer. It is important to delay the start of the PID function until the VFD has ramped up to the minimum speed set point since that is the beginning of the pump curve and the flow rated needs to be tested before ramping higher on the pump curve.

On VFD Modbus systems, the controller knows when the VFD has reached minimum speed set point. On VFD hardwired systems, it doesn't have that feedback.

The delay time should be as long as it takes to get the drive to minimum speed. For example, if the minimum speed is 60% and the VFD acceleration time is 5 seconds* to 100%, the PID delay timer should be 3 seconds.

*the recommended setting to properly respond to the PV600

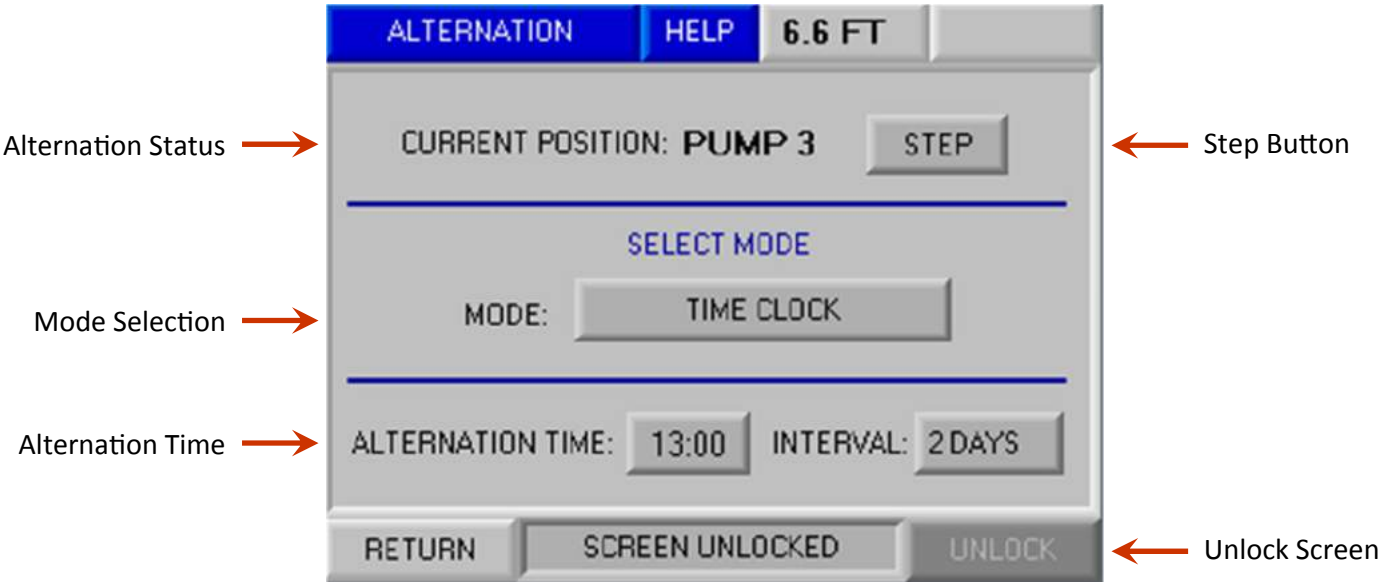
Proportion - Enter the proportion of VFD speed change % to each 0.1 ft. of level deviation. This setting is default and gives a 1% change in VFD speed for each 0.1 feet of level.

Trim Up - The upper limit of VFD speed change with each sample cycle in percent.

Trim Down - The lower limit of VFD speed change with each sample cycle in percent.

The trim is used to limit the VFD speed change with each sample time, which can help control the VFD from making too radical a speed change if the deviation is great. The default is 6.0 Up and -6.0 Down. These can be individually set as some systems may be more reactive in one direction than the other.

Set points & Sequencing - Alternation



Overview

The pump alternator automatically sets the pump lead based on the alternation parameters set within this menu. Pump alternation allows the PV600 to balance usage between pumps by changing the leads on a timed or cyclic interval. This screen also allows the PV600 to select a constant lead, when alternation between pumps is not desired.

Alternation Status - Indicates the current position/lead pump of the alternator.

Mode Selection - Touch this button to scroll through the possible alternation modes.

Automatic - Change of lead duty after each pump cycle

Time clock - Change of lead duty only by clock interval. Up to 99 days at specific time of day.

Least Hours - Lead is pump with least total run hours

Pump 1 - Pump 1 is always the lead pump

Pump 2 - Pump 2 is always the lead pump

Pump 3 - Pump 3 is always the lead pump

Pump 4 - Pump 4 is always the lead pump

Step Button - The lead pump can be manually stepped to the next pump in sequence by touching the step button. Note that this can be done while the pumps are running and will occur instantly.

Alternation Time - Indicates the time of day (24 hour) that the system will alternate (on the day interval) when in time clock alternation mode. Touch here to change the alternation time.

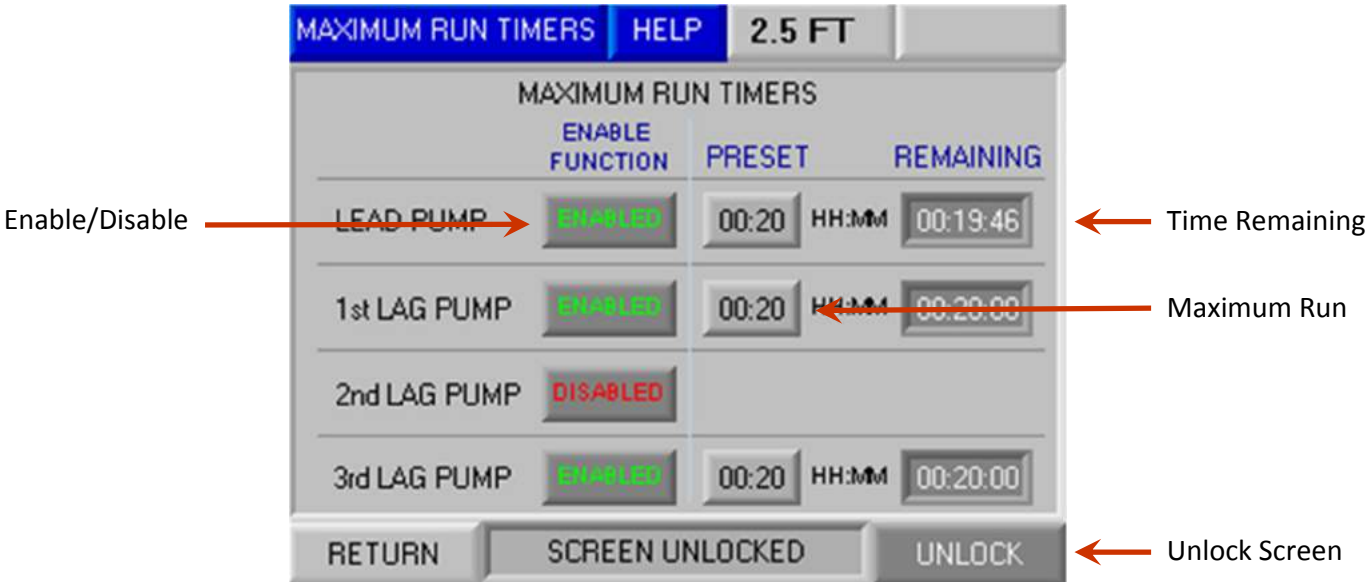
Timers Menu

Overview

The Timers menu displays the following options depending on system configurations. This menu can be access either from the Setup display, or the Set Points & Sequence Menu.

MENU ITEM	ACCESS LEVEL	FUNCTION
START DELAY	1	"Stagger starts" the pumps
PUMP DOWN	1	Periodically extends a pump cycle to the low level set point to help clear sump debris
EXERCISE	1	Periodically runs the pumps to keep them from seizing during too long of an idle period
MAXIMUM RUN	1	Sets a maximum amount of time a pump can run in a given cycle The pumps can restart if demand requires
FLUSH	1	Runs the VFDs a 100% speed at the end of a pumping cycle to help clear the discharge pipe Disabled in non VFD systems
TIME CLOCK	1/3	Allow pump operation during specific periods of time during the day Must be enabled in Level 3 Options Setup
PURGE CYCLE	1	Cycle timer for a bubbler purge solenoid. Must be enabled in Level Sensor setup.
MAINTENANCE	1	Monitors pump run time and issues alert when maintenance period is exceeded.

Timers - Maximum Run



Overview

The purpose of the maximum run timer is to prevent a pump from running too long in the event that the normal pump shutdown triggers don't occur. If the timer function is enabled, the timer begins when the pump starts. If the timer expires, the pump stops. If the pump call condition is still present, the pump will restart. When a timer expires, pumps downstream in the sequence will stop as well. This screen allows the user to configure the maximum run timers individually for up to 4 pumps.

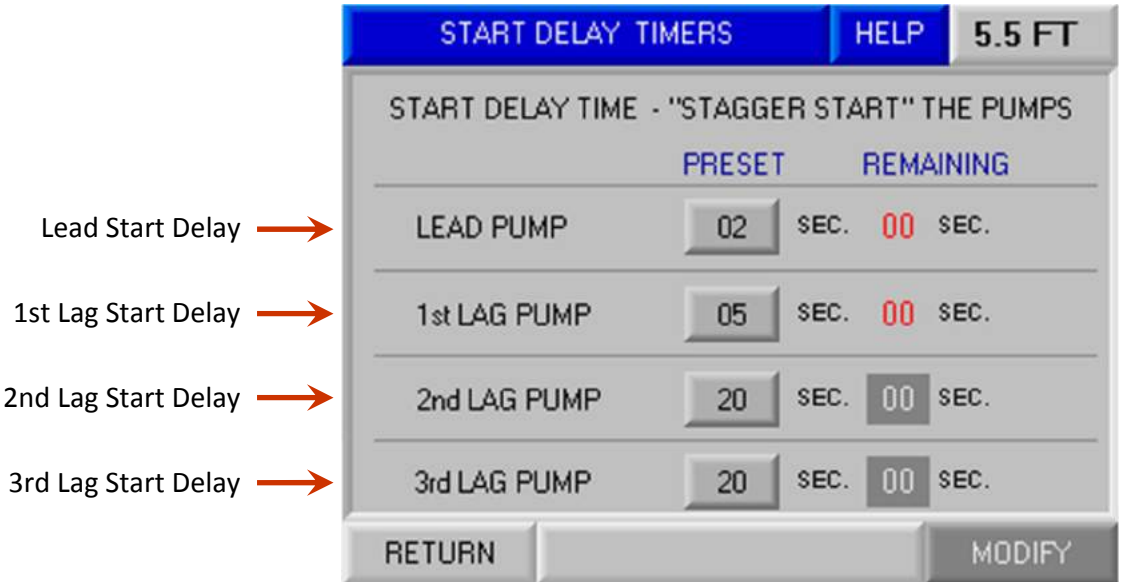
Enable/Disable - Touching this button toggles between 'ENABLED' and 'DISABLED'. Most systems do not need this function.

Time Remaining - Remaining time these are red when currently active.

Maximum Run Timer - The maximum amount of time that the pump is allowed to run. This feature can be enabled or disabled.

Unlock Screen - The set points are read only until the unlock button is touched and the Level 1 password is entered to the password keypad. The screen locked indicator will change to screen unlocked.

Timers - Start Delay



Overview

This screen allows the user to configure the maximum run timers individually for up to 4 pumps.

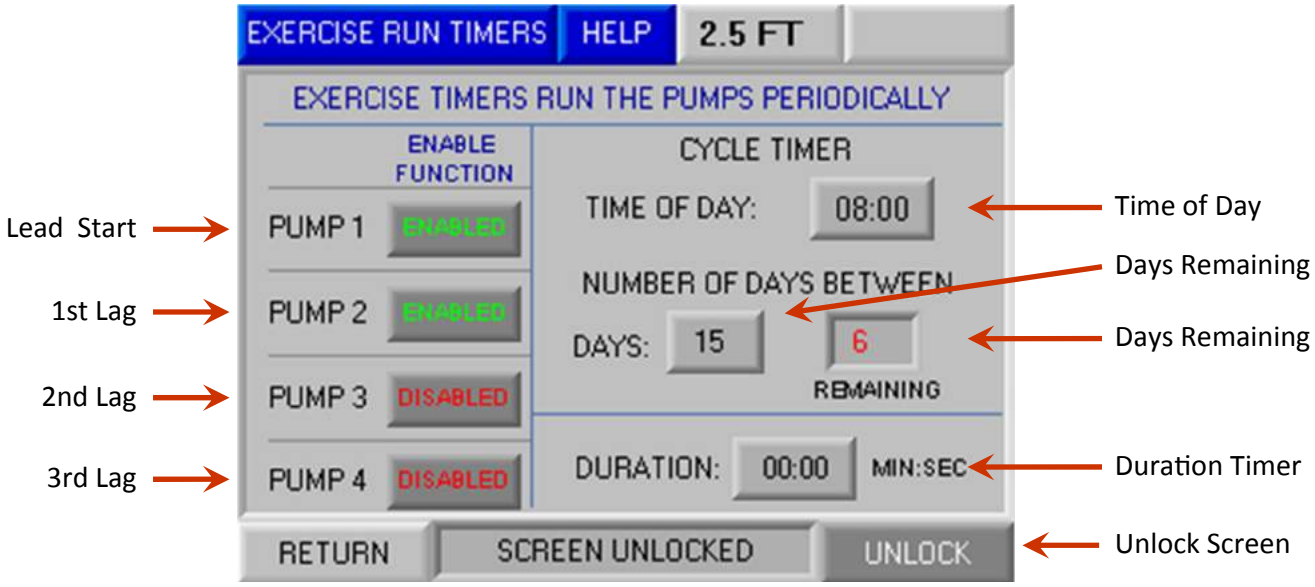
Start Delay Timer - The primary purpose of the Start Delay is to stagger the start of all pumps when power is restored after a power failure. This staggered start prevents power surge and voltage drop on the utility system and is especially important when the system is operating on an emergency power generator.

The lead pump start will be delayed until the controller is finished with its power on self-test, and then each subsequent pump is delayed by the amount of time set on the start delay timer. The recommended delay time is 3 seconds.

When operating in the VFD-PID mode on 3 and 4 pump systems, it is important to increase to time to at least 20 seconds. The reasons is that lag pumps are sequenced on when the pump or pumps that are running reach a determined speed (set as the lag pump start speed). In VFD systems with more than two pumps, if the time delay is too short, the lag pump that is called to start will not have enough time to ramp up to the current VFD speed command and have an impact on the PID function in time to prevent the next lag pump from starting. It may take some experimentation to determine the best delay time in these systems as there are several factors that come into play. It is recommended that the time be set to the minimum possible without causing all pumps to sequence on unnecessarily.

The set points are provided only for the pumps configured in the system. Each timer starts when the previous expires. They are read-only until the modify button is touched and the Level 1 password is entered to the password keypad.

Timers - Exercise



Overview

The purpose of the exercise timer is to prevent a pump from sitting idle too long and rusting up. This is a useful function when a system sits idle for periods of time in areas where corrosion is a problem. The set points are read only until the UNLOCK button is touched and the Level 1 password is entered to the password keypad. The screen locked indicator will change to screen unlocked.

Exercise Run Timer - The maximum amount of time that the pump is allowed to run. This feature can be enabled or disabled.

Time of Day - Time of day that the exercise function will run. 24 hr format.

Pump Enable/Disable - Touching this button toggles between 'enabled' and 'disabled'. Most systems do not need this function.

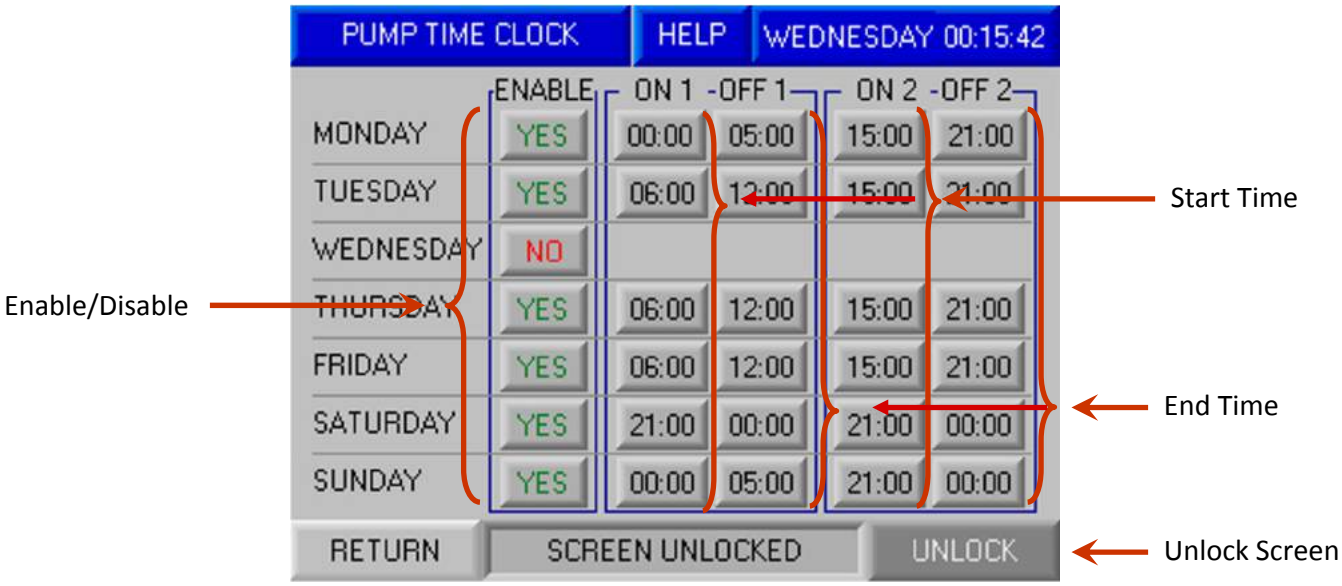
Days Remaining - The number of days remaining. When the number is 0, the pumps will run when the current time matches the time of day set point.

Cycle Timer - This is the time interval between each exercise run cycle with maximum interval of 999 days.

Duration timer - This is the length of time that the pump runs with a maximum run time of 99 minutes, 59 seconds.

Unlock Screen - The set points are read only until the unlock button is touched and the Level 1 password is entered to the password keypad. The screen locked indicator will change to screen unlocked.

Timers - Time Clock



Overview

The function of the time clock is to setup specific time periods that the pumps can run. The clock is "7 day", so a different time period can be established for each day of the week. Any day of the week can be excluded from the run program as well. **Note:** the pump time clock function must first be enabled in the System Options configuration.

Start Time - The time of day (24 hour clock) that the pumps allowed to run.

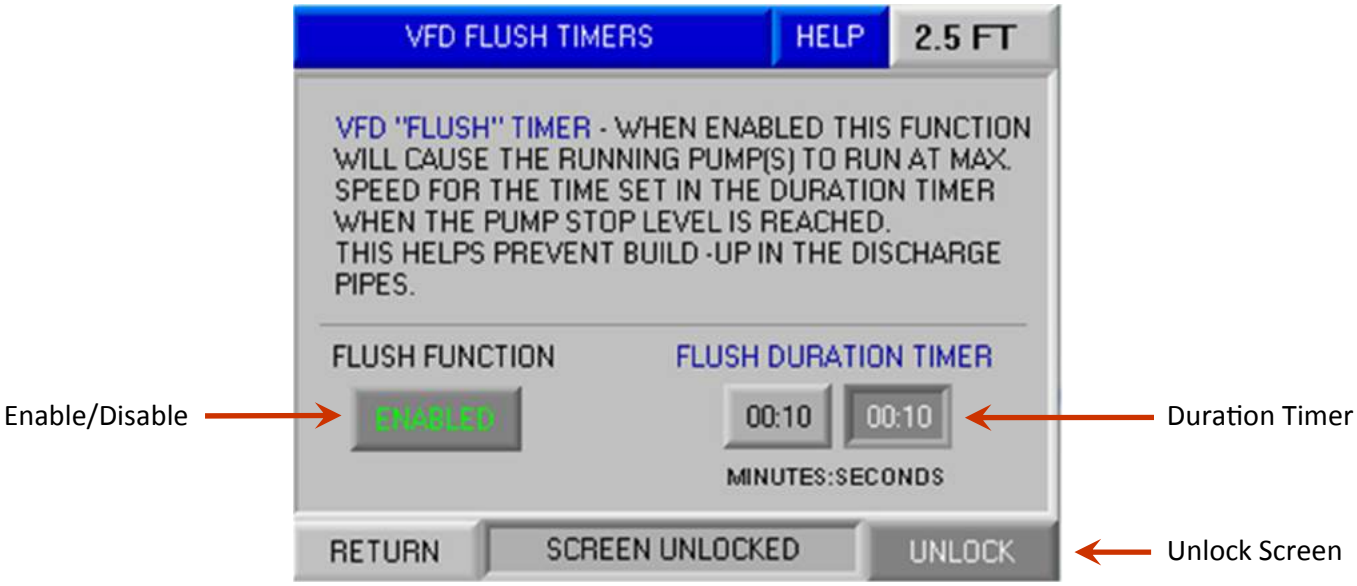
End Time - The time of day (24 hour clock) that the pumps are shutdown.

Enable/Disable - Touching this button toggles between 'YES' and 'NO', enabling or disabling the run time for that day. Each day of the week is individually controlled.

Unlock Screen - The set points are read only until the UNLOCK button is touched and the Level 1 password is entered to the password keypad. The screen locked indicator will change to screen unlocked.

Example Above- Two start and stop times are provided for each day, primarily to provide a way to have one run period that spans midnight, in addition to giving two separate run periods during the day. The example shows how to set up an overnight run period and daily dual run periods. In the example, the pumps run twice each Tuesday, Thursday and Friday from 0600 to 0900 and from 1500 to 2100. On Saturday and Sunday nights, the pumps run overnight from 2100, until 0500 the next day. Monday is still running from Sunday night until 0500, then starts again at 1500. Wednesday is a day off. Notice that on Saturday both start and stop times are set the same due to the fact that there is only one run period that day. The way to "turn off" one of the run periods for the day is to have the two periods overlap in time.

Timers - VFD Flush



Overview

VFD Flush Timers - This function is especially useful in proportion mode VFD systems where the pumps are running very slowly as they reach the stop set point and are not ejecting sewage well.

With this function enabled, the pumps run at the VFD maximum speed for the amount of time preset into the flush duration timer. This process tends to flush the discharge pipes out and prevent problems with valves near the pumps.

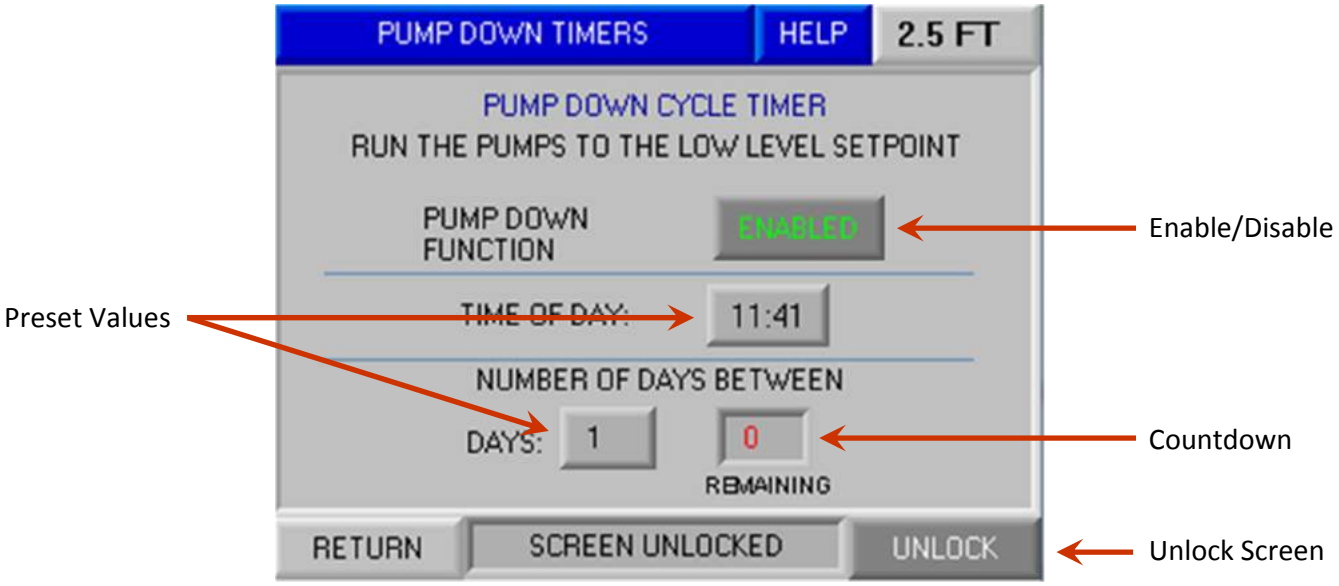
It is important to do a timed draw down test to ensure sufficient liquid will remain in the sump and set the pump stop set points and duration timer accordingly.

Enable/Disable - Touching this button toggles between 'ENABLED and 'DISABLED.

Preset Values - Enter the duration of the flush time.

Unlock Screen - The set points are read only until the unlock button is touched and the Level 1 password is entered to the password keypad. The screen locked indicator will change to screen unlocked.

Timers - Pump Down



Overview

Pump Down Timers

This function can assist is clearing buildup of solids in sump pump systems by drawing down the water level to a lower than normal set point. When enabled, this function will start the lead pump, regardless of the level, and run the pump to the low level set point. The user can set the number of days between the pump down cycles and the time of day for the pump down function to occur.

The low level alarm is disabled during the operation of this function.

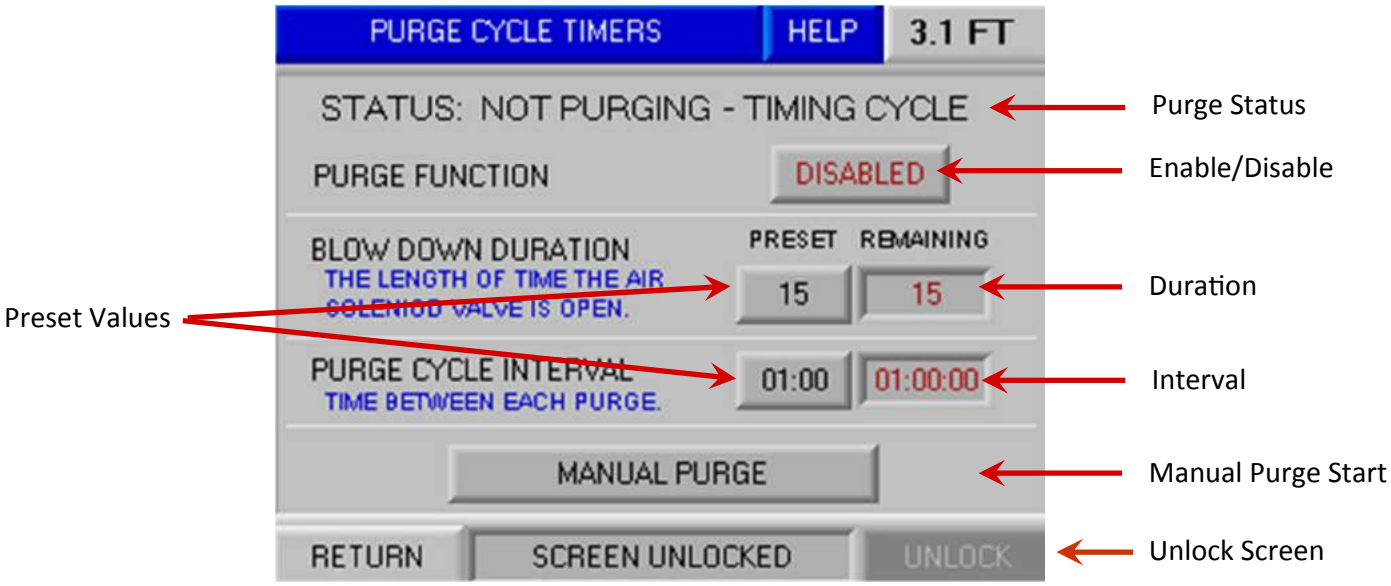
Preset Values - Enter the time of day and the number of days between pump down cycles.

Enable/Disable - Touching this button toggles between 'ENABLED' and 'DISABLED'.

Countdown - Number of days until next pump down cycle.

Unlock Screen - The set points are read only until the unlock button is touched and the Level 1 password is entered to the password keypad. The screen locked indicator will change to screen unlocked.

Timers - Purge



Overview

This function provides control of a purge solenoid valve in a bubbler or trapped air type level sensing system. The solenoid opens to allow air into the sensing tube to help keep it clear of debris and recharge the air in the event of leak.

Enable/Disable - Touch this switch to toggle between 'ENABLED' and 'DISABLED'.

Duration - Enter the number of seconds that the solenoid will be open.

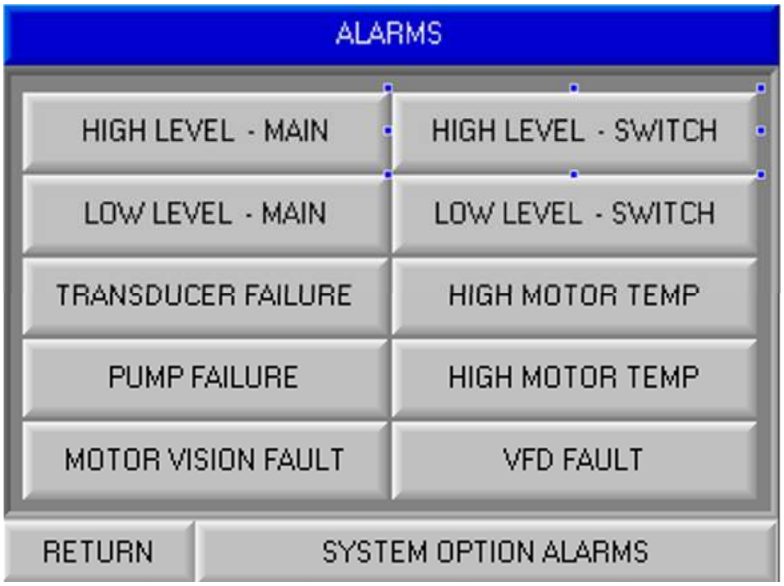
Interval - Enter the number of hours and minutes, up to 99:59, between each purge cycle.

Purge Status - The phase of the purge cycle is displayed here. When the interval timer expires, a two second timer begin to give the system time to stabilize the level sensor signal before it potentially is exposed to higher than normal pressures. Then the solenoid opens and the duration timer begins. When the duration timer is finished, the solenoid closes and a ten second timer begins timing to allow time for excess air pressure to bleed out of the sensor tube. Then the purge cycle is finished and the interval timer begins again.

Manual Purge Start - Touch this button to manually begin a purge cycle.

Unlock Screen - The set points are read only until the unlock button is touched and the Level 1 password is entered to the password keypad. The screen locked indicator will change to screen unlocked.

Alarms Menu



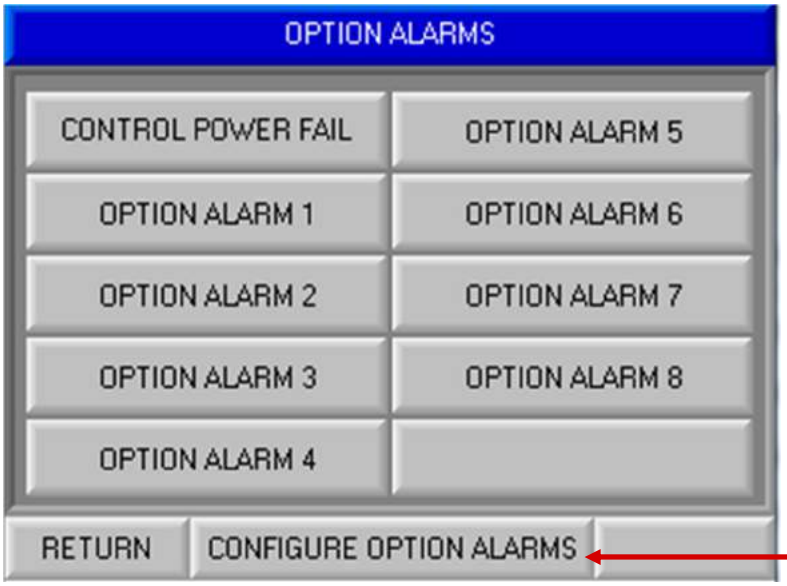
Touch to access System Option

Overview

The Alarms Menu displays the following possible options, depending on system configuration. Ten additional alarms are available when the optional digital input module is installed.

MENU ITEM	ACCESS LEVEL	FUNCTION
HIGH LEVEL ALARM-MAIN	2	High level alarm signal from the main level sensor Includes set point except in Multi-segment sensor mode
LOW LEVEL ALARM-MAIN	2	Low level alarm signal from the main level sensor Includes set point except in Multi-segment sensor mode
TRANSDUCER FAILURE FLOAT SWITCH FAILURE	2	Monitors the primary level sensor input for out of range condition. Transducer only visible in 4-20 mA sensor mode Float switch failure only visible in the Float switch mode
PUMP FAILURE	2	No read back from starter after pump call
MOTOR Vision FAULT	2	MOTOR Vision fault signal through Modbus
HIGH LEVEL ALARM– BACKUP	2	High level backup float switch
LOW LEVEL ALARM –BACKUP	2	Low level backup float switch
HIGH MOTOR TEMP	2	Temperature switch in motor winding
MOISTURE IN MOTOR	2	Moisture probe in motor housing
VFD FAULT/RVSS FAULT	2	Fault signal from VFD or RVSS Only visible in VFD /RVSS configured systems

Alarms Menu - System Options



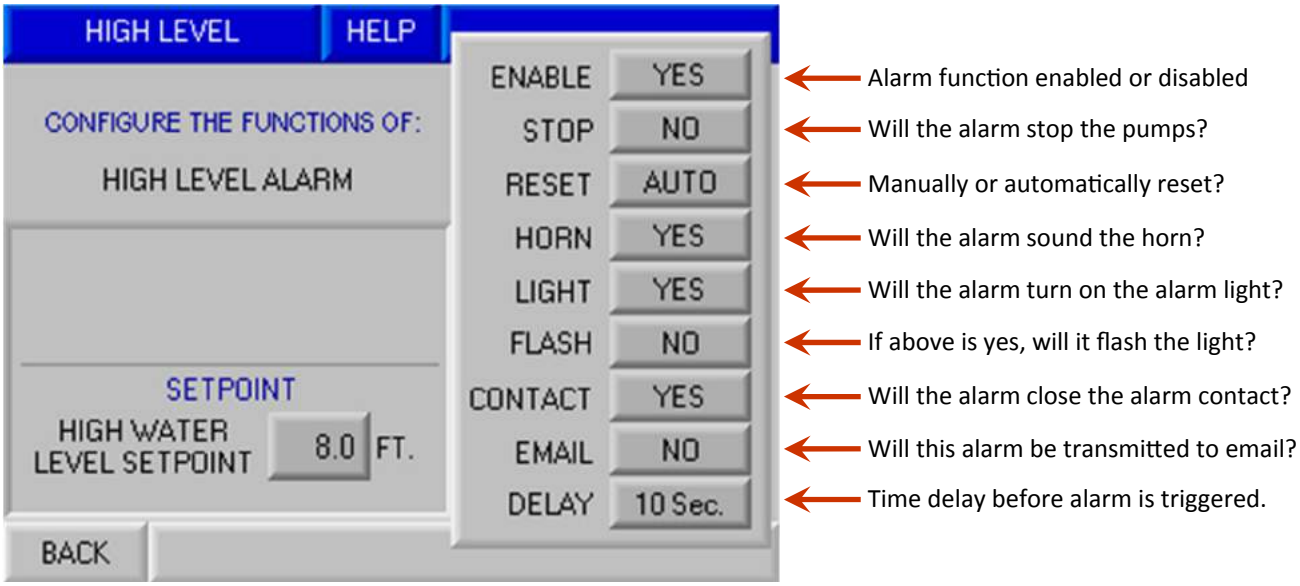
Overview

The System Options Alarms Menu displays the following possible options that are available only if the optional digital input expansion module is installed. Except for the Control Power Failure alarm, the alarm names are user definable, as are the input contact being Normally Open or Normally Closed contact.

Define Alarm - Touch this button to access the Option Alarm Setup Menu

MENU ITEM	ACCESS LEVEL	FUNCTION
CONTROL POWER FAILURE	2	Monitors analog input 2—see wiring schematic
OPTION ALARM 1	2	Monitors digital input I32
OPTION ALARM 2	2	Monitors digital input I33
OPTION ALARM 3	2	Monitors digital input I34
OPTION ALARM 4	2	Monitors digital input I35
OPTION ALARM 5	2	Monitors digital input I36
OPTION ALARM 6	2	Monitors digital input I37
OPTION ALARM 7	2	Monitors digital input I45 Not available when multi-segment probe is installed
OPTION ALARM 8	2	Monitors digital input I46 Not available when multi-segment probe is installed
OPTION ALARM 9	2	Monitors digital input I47 Not available when multi-segment probe is installed

Alarm Setup and Set Points



Overview:

A screen is provided for each type of alarm:

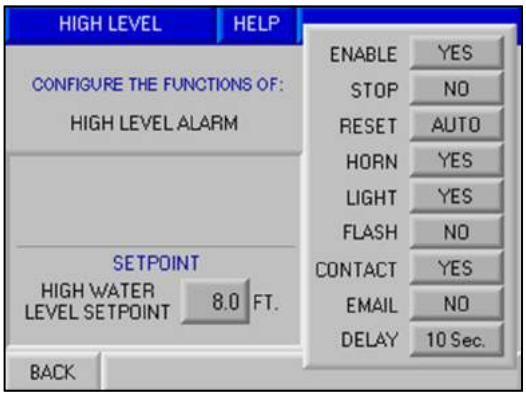
- High Level - Main Level Sensor
- Low Level - Main Level Sensor
- Transducer Failure
- Pump Failure
- MOTOR Vision Fault
- VFD Failure
- High Level Alarm - Backup Float Switch
- Low Level Alarm - Backup Float Switch
- High Temperature
- Moisture in Motor

If the alarm is not enabled, the input and condition will be ignored by the controller. No alarm handling or logging will occur.

If the alarm is set for manual reset, the alarm must be reset by touching the ALARM RESET button on the main menu screen.

Alarm Setup and Set Points

High Level - Main Level Sensor



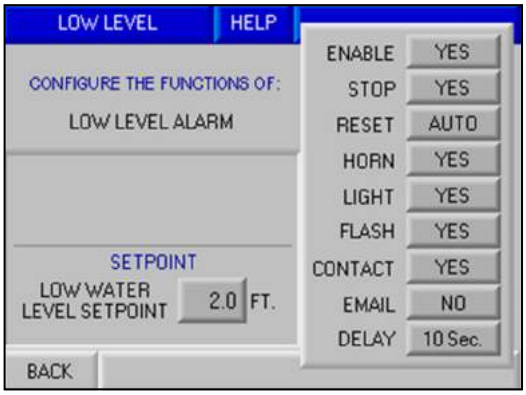
Overview

This screen allows the user to input the High level alarm set point, as well as alarm configurations, if desired.

This alarm is available for all level sensor modes. For the Multi-segment sensor, the set point is not visible.

See "Alarm Configuration" for a more detailed explanation of options.

Low Level - Main Level Sensor



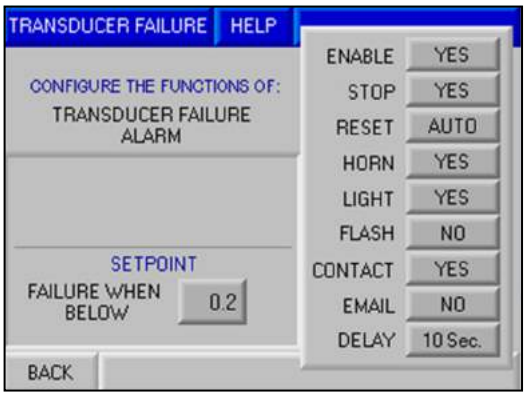
Overview

This screen allows the user to input the Low Level Alarm set point, as well as alarm configurations, if desired.

This alarm is available for all level sensor modes. For the Multi-segment sensor, the set point is not visible.

See "Alarm Configuration" for a more detailed explanation of options.

Transducer Failure



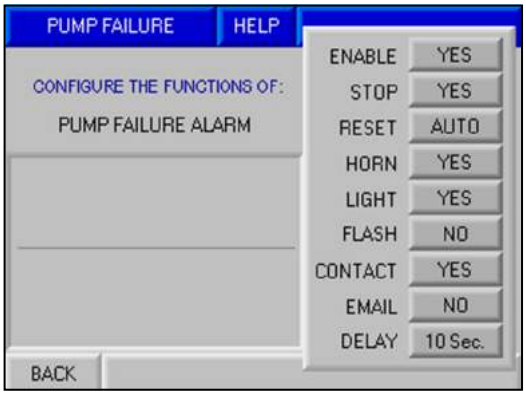
Overview

When the level drops below this set point the alarm will trigger.

See "Alarm Configuration" for a more detailed explanation of options.

Alarm Setup and Set Points

Pump Failure



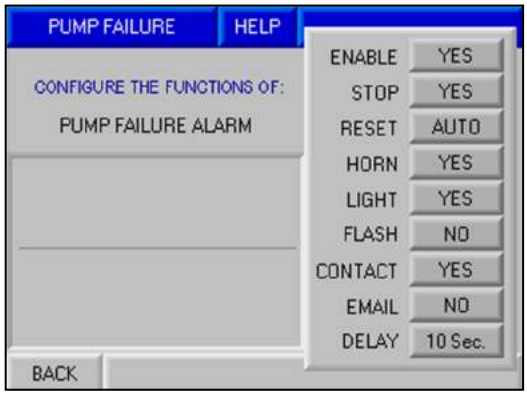
Overview

This screen allows the user to configure the Pump Failure alarm options.

When the PV600 calls for a pump to run, a signal is sent to the starter or VFD, either by hard wire or by Modbus. If a read back signal is not received at either the Pump Run Read Back input, or through Modbus, a Pump Failure Alarm is initiated.

See "Alarm Configuration" for a more detailed explanation of options.

MOTOR Vison Fault



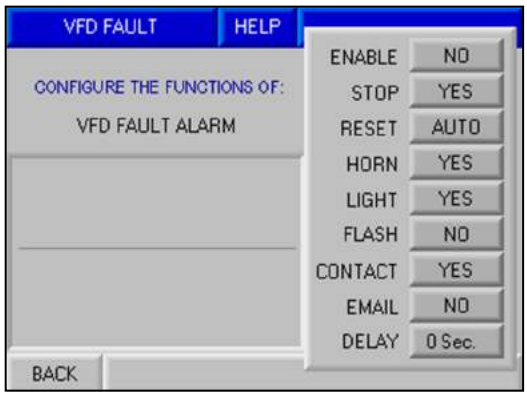
Overview

This screen allows the user to configure the MOTOR Vision alarm options.

When a MOTOR Vision enabled system receives a fault signal through Modbus, the alarm is triggered. It is advisable to shut down the pumps on a MOTOR Vision fault.

See "Alarm Configuration" for a more detailed explanation of options.

VFD Failure / RVSS Failure



Overview

This screen allows the user to configure VFD Fault (or RVSS if configured with soft start starters) alarm options.

The VFD fault signal can come from either a N.O. contact wired to the VFD fault input, or from a Modbus connection to the VFD.

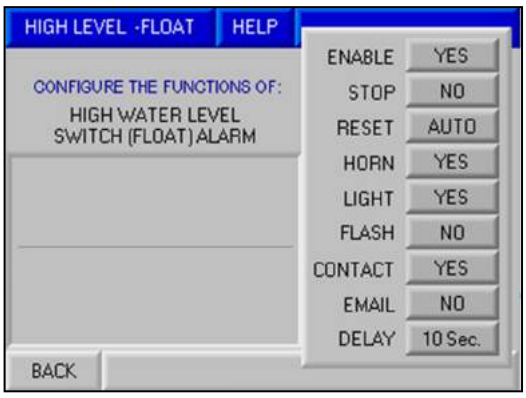
See "Alarm Setup & Set Points" for a more detailed explanation of options.

Alarm Setup and Set Points

Redundant High and Low Level Float Switches

For any pump system involving sewage, or any other critical application, it is imperative that a backup control system be included in the overall control scheme. In addition to wiring the signals to the PV600 for alarm annunciation and data logging, the float switches should be wired so that the high level float starts the pumps and the low level float stops the pumps. This wiring should be independent of the PV600 controller commands to the motor starters or VFDs.

High Level Alarm - Backup Float Switch

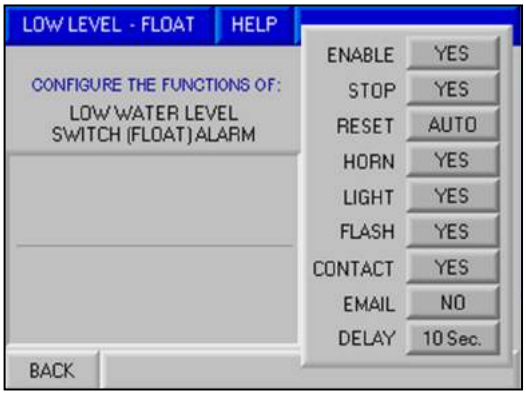


Overview

This screen allows the user to configure the High Level Backup Float Switch alarm options.

See "Alarm Configuration" for a more detailed explanation of options.

Low Level Alarm - Backup Float Switch



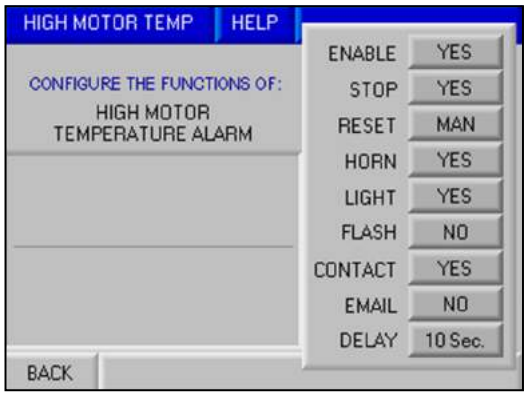
Overview

This screen allows the user to configure the Low Level Backup Float Switch alarm options.

See "Alarm Configuration" for a more detailed explanation of options.

Alarm Setup and Set Points

High Temperature



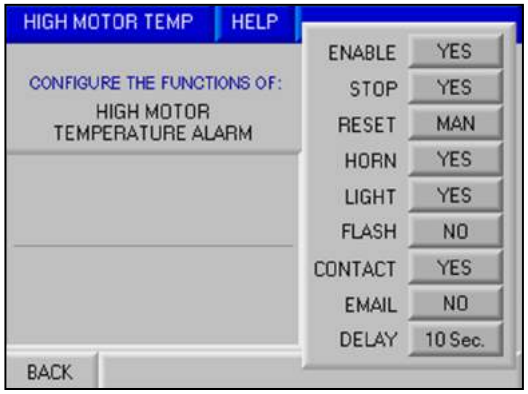
Overview

This screen allows the user to input the High Temperature set point. If the motor winding temperature rises to the point of tripping the thermal switch, the pumps should be shut down.

The PV 600 requires a N.C. contact wired to the Motor Temperature input for each pump.

See "Alarm Configuration" for a more detailed explanation of options.

Moisture in Motor



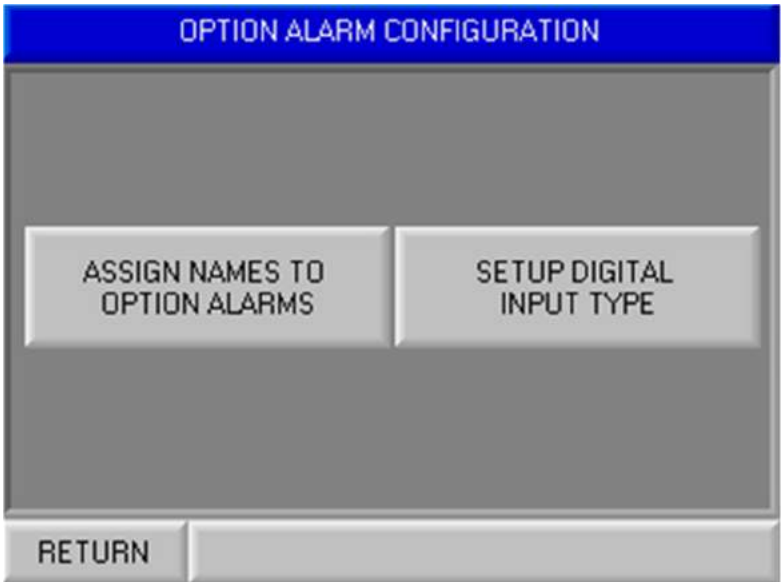
Overview

This screen allows the user to configure the Moisture/Seal Failure alarm options.

See "Alarm Configuration" for a more detailed explanation of options.

The PV 600 requires a N.O. contact wired to the Moisture input for each pump.

Option Alarm Configuration Menu



Overview

When the optional digital input expansion module is attached, the PUMP Vision PV600 controller includes nine user definable alarm “channels” that monitor the inputs change in status to alarm, data log, and email conditions. The conditions can be faults, or normal functions that need to be monitored.

The logic is already in the PUMP Vision for all channels. The user needs to provide 24 VDC to the proper input and enable the alarm in each of the alarm channels to be used, then assign customized names of up to 20 characters. The input type must be set to match the resting state of the input contact, N.O. or N. C.

Once set up, all of the PUMP Vision functions such as data logging, Alarm Handler, Alarm Message Bar, email messages, and PV600 display screens will use the user defined name and alarm configuration.

MENU ITEM	ACCESS LEVEL	FUNCTION
ASSIGN NAMES TO OPTION ALARMS	3	Assign user defined option alarm names
SETUP DIGITAL INPUT TYPE	3	Select Normally Open or Normally Closed input contacts

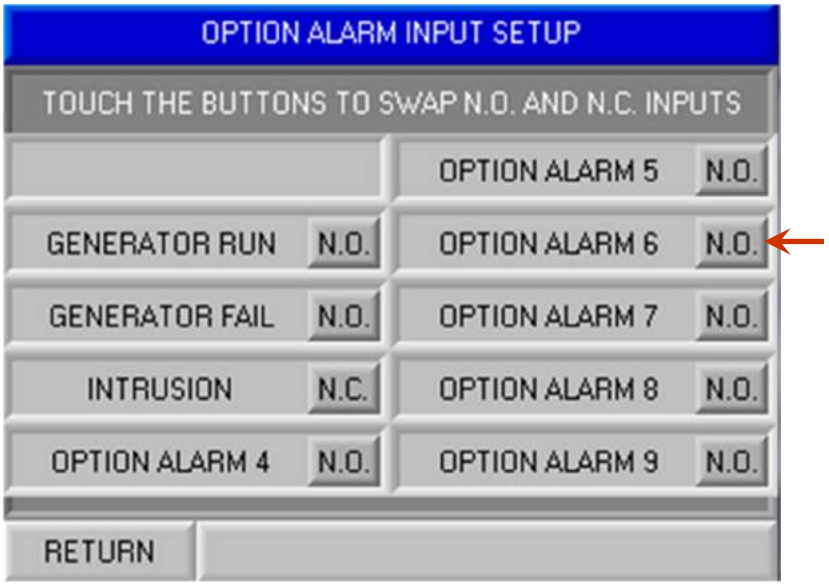
Option Alarm Configuration Menu - Assign Names

Enter Names →

Enter Names- Touch these buttons to enter a user defined option alarm name of up to 20 characters for each alarm channel that is enabled. If the channel is disabled, the button will be 'grayed out'.

The Control Power Failure alarm is permanently assigned to Option Alarm Channel 1. No name change is possible.

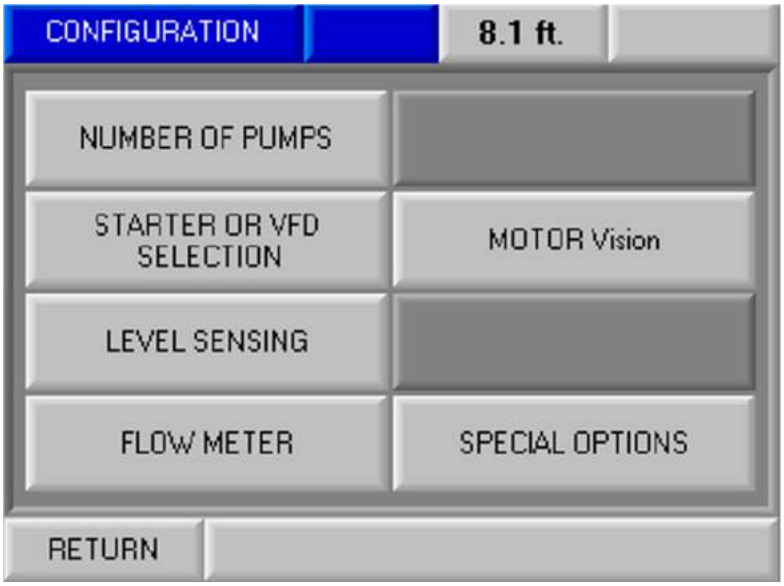
Option Alarm Configuration Menu - Set Contact Type



← Set Contact Type

Set Contact Type - Touch these buttons to toggle between N.O. (Normally Open) and N.C. (Normally Closed) for each alarm channel that is enabled. If the channel is disabled, the button will be 'grayed out'.

Configuration Menu

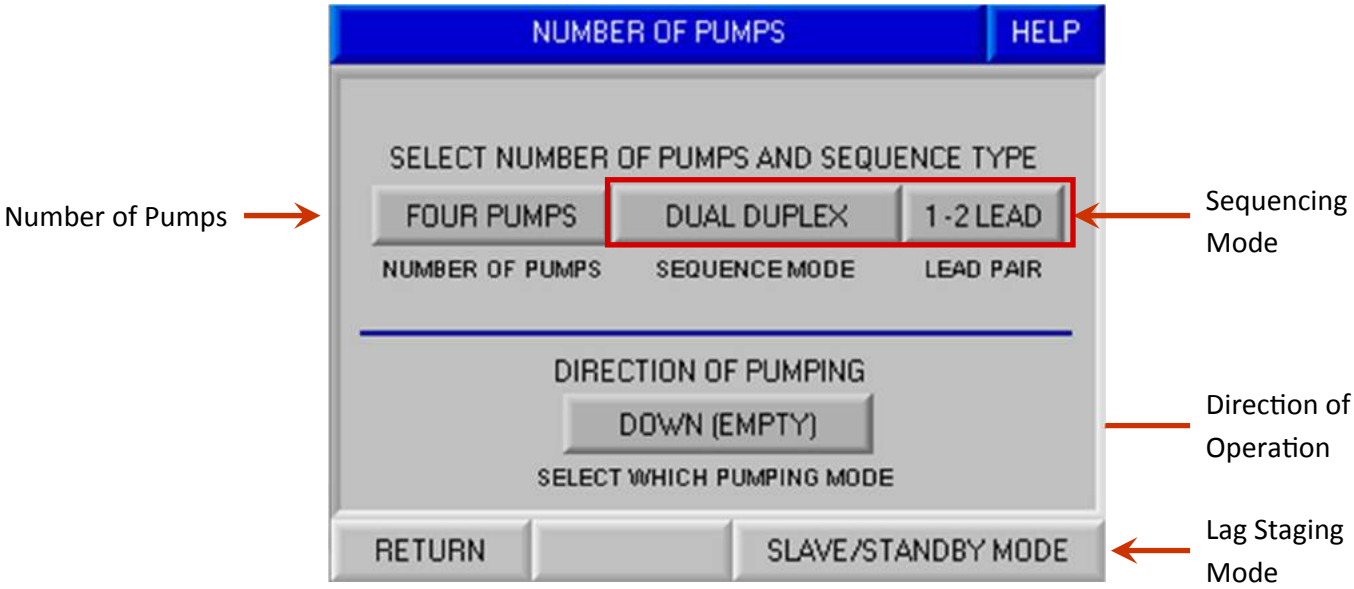


Overview

The Configuration menu displays the following options. This menu can be access either from the Setup display, or the Set Points & Sequence Menu.

MENU ITEM	ACCESS LEVEL	FUNCTION
NUMBER OF PUMPS	3	Select the number of pumps, the pump sequencing scheme, and the direction of pumping
STARTER OF VFD SELECTION	3	Select the starter or VFD type and type of communication to smart starters and VFDs. Also set the VFD mode of PID or Proportional
LEVEL SENSING	2	Setup the primary and secondary level sensors
FLOW METER	3	Setup a wired flow meter or calculated flow sump or tank size
MOTOR Vision	2	Setup the starters with MOTOR Vision. Only visible when the Starter Selection is configured with MOTOR Vision.
SPECIAL OPTIONS	3	Access the Special Options Menu

Configuration - Number of Pumps



Number of Pumps in this System - Touch this button to scroll through the choices of one, two, three, or four pumps. Once the number of pumps is selected, the screen throughout the controller are changed to reflect the number of pumps configured in the system.

Sequencing Mode - Touch this button to scroll through the different sequencing modes. The modes are named as listed below:

Full Alternation - Full alternation means that all of the pumps in the system are all available for normal duty and alternate equally. While the alternation cycle includes all of the pumps configured in the system, pumps can still be staged as standby or slave in the sequence setup screen.

Jockey Pump - Jockey pump systems typically have one small pump and one, two, or three main (larger) pumps. In this sequence, the small pump runs as constant lead and the main pump(s) are lag. When the jockey pump can't keep up with flow, the lead main starts and the jockey stops. The system de-stages in the same manner. The main pumps alternate on triplex and quadraplex systems.

Peak Pump - Peak Demand pump systems typically have two or three small pumps and one large pump. In this sequence, the small pumps run as either a duplex or triplex pump system with a large pump that is reserved as a standby for very high demand flows such as a hundred year storm. When the large pump starts, the smaller pumps are all shut down after a 10 second time delay.

This mode is available in triplex or quadraplex systems. In a two pump system, the Jockey Pump Mode provides the same function as the Peak Pump mode.

Dual Duplex - Only available on four pump systems, this sequence runs two pair of two pumps. Usually one pair is smaller than the other and run in lower flow periods. If they can't keep up with the flow, the systems uses the larger main pumps. Touch **Lead Pair** button to toggle between pump lead pair sequence, 1-2 or 3-4.

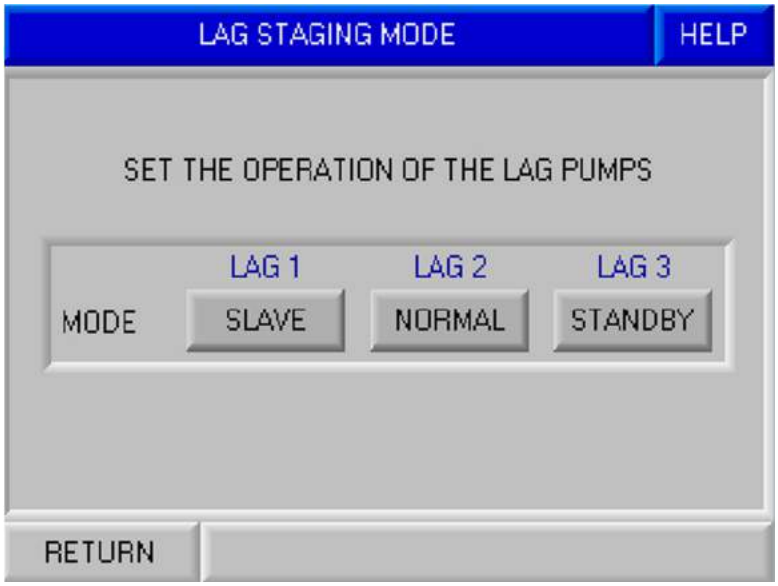
Direction of Operation - Touch this button to toggle between the two modes. The PV600 level controller can be set for one of two modes:

Empty - for sump pump, storm water, and other dewatering

Fill - maintain a liquid level in a tank

Lag Staging Mode - Touch this button for access to the Lag Staging Mode screen. The lag staging mode allows the pumps to be staged on as slave pumps to the lead pump, or reserve them as standby pumps.

Configuration - Number of Pumps - Lag Staging Mode



Mode Selection

Overview

The Lag Staging Mode screen can be accessed through the Number of Pumps screen.

The ability to set the mode of operation on the lag pumps gives the PV600 flexibility in the way the pumps are staged on and off. In a normal pump sequence, a lead pump is called, then a lag pump, then other pump, and so on. However some pump systems need an alternate sequence. For example a triplex pump system where the discharge capacity is limited to two pumps, however the station is critical and must have two pumps always available. The LAG 2 pump would be set to STANDBY. Then the third pump in the sequence will only run in the event that one of the other two pumps has failed.

In another triplex pump application there may be a need to have two pumps always running and having the third, again, available as a standby pump. The LAG 1 would be set to SLAVE and the LAG 2 would be set to STANDBY.

In all cases, the pump alternation scheme is not affected by the Lag Staging Mode settings.

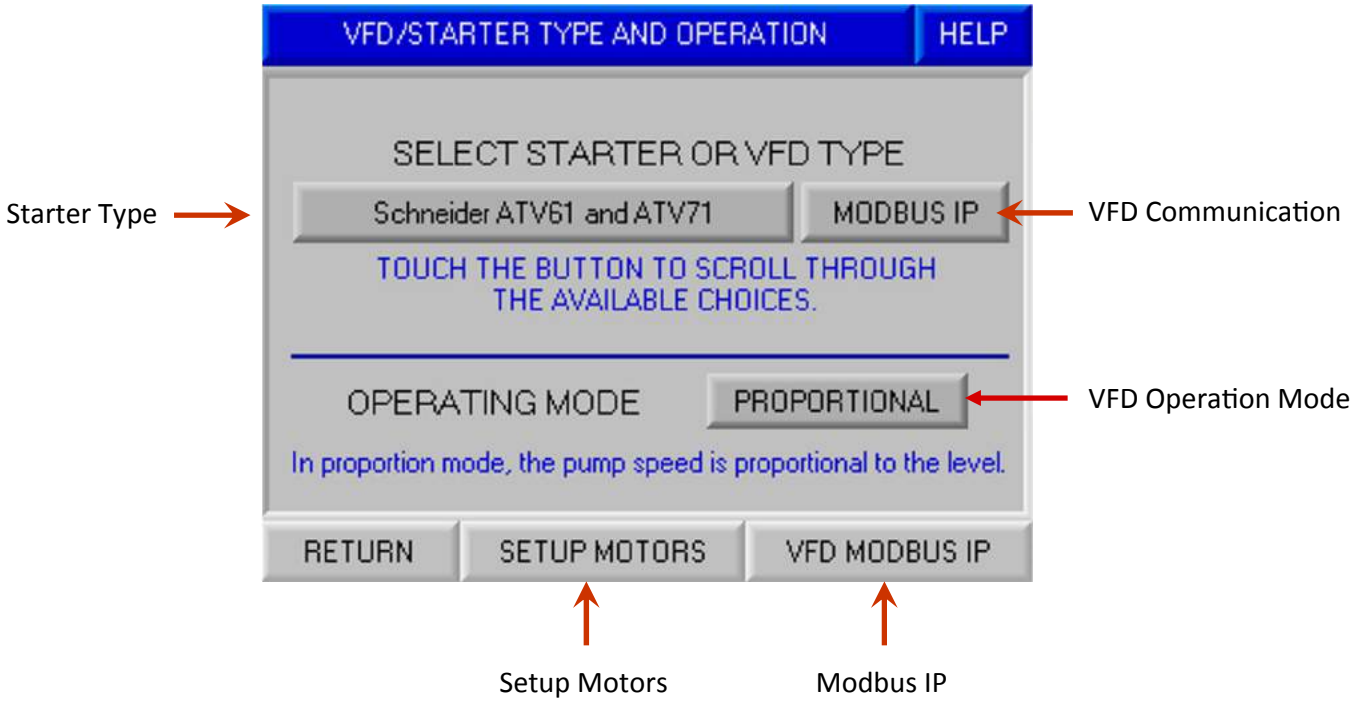
Mode Selection - Touch these buttons to scroll through the operation mode for each lag pump. The lag staging mode options available are:

NORMAL - The pump will stage in the normal lead, lag sequence.

SLAVE - The pump will run whenever the lead pump runs.

STANDBY - The pump is not a part of the staging sequence, but it will be available to run if a running pump has failed.

Configuration - VFD/Starter Type and Operation



Overview

Starter Type - Touch this button to scroll to the pump starter type. The choices include:

FVNR - Across-The-Line starters

FVNR with MOTOR Vision starters

RVSS - Reduced Voltage Soft-starters (constant speed, but with a reduced current inrush on start)

VFD - hard wired to I/O

VFD - connected by Modbus

VFD Communication - Touch this button to select the method of communication from the PV600 to the VFD. The PV600 can communicate with either the RS485 serial port, or the optional Ethernet port.

NOTE: This button is only visible when a VFD is selected that supports Ethernet communication and the Modbus IP button is as well.

Modbus IP - Touch this button to access the VFD MODBUS IP CONFIGURATION screen.

VFD Operation Mode - Touch this button to SCROLL between the three modes. Three modes of VFD level control are available:

Proportional - the speed of the pumps is proportional to the level of the liquid.

PID LEVEL - the speed of the pumps is modulated to maintain a specific level in the sump or tank.

PID FLOW - the speed of the pumps is modulated to maintain a specific flow rate from the pumps.

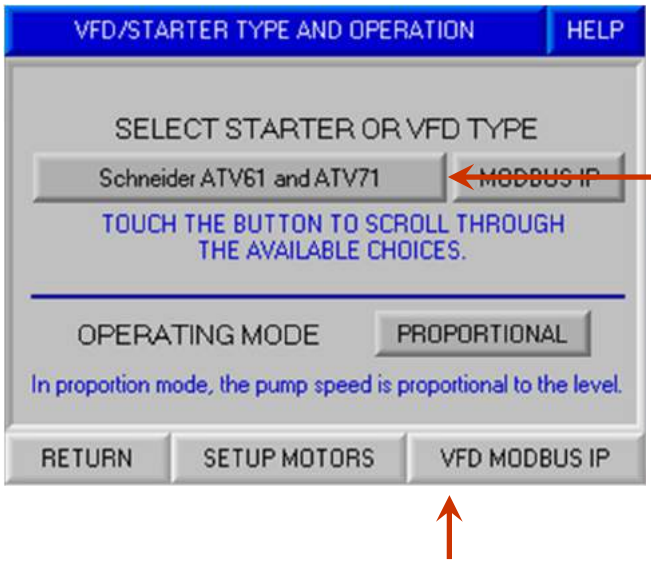
See the Description of Operation section for information about the operation of each of these modes.

NOTE: This button is only visible when a VFD is selected as the starter type.

Setup Motors - Touch this button to access the PUMP VFD/RVSS MOTOR SETUP screen. . This button is only visible when the starter type is RVSS or VFD.

Configuration - VFD/Starter Type and Operation

VFD Selection



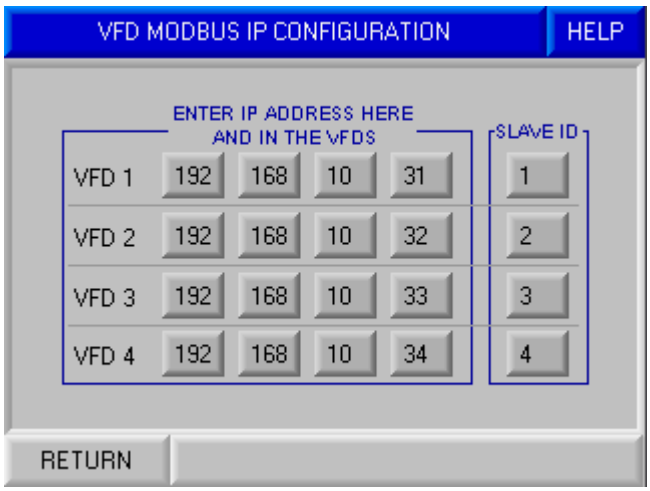
Touch this button to select the FVNR starter, MOTOR Vision starter, RVSS starter, or VFD model in the system. The VFDs listed below are the models that have been previously tested with the controller. Others that have Modbus network connection can be programmed and tested by CMC.

The button will display the VFD that is selected:

- Square D Altivar 21
- Square D Altivar 61/71
- Square D Altivar 630 series
- ABB ACS/ACH550
- Danfoss/Trane
- Westinghouse Teco N3
- Allen-Bradley 525 series

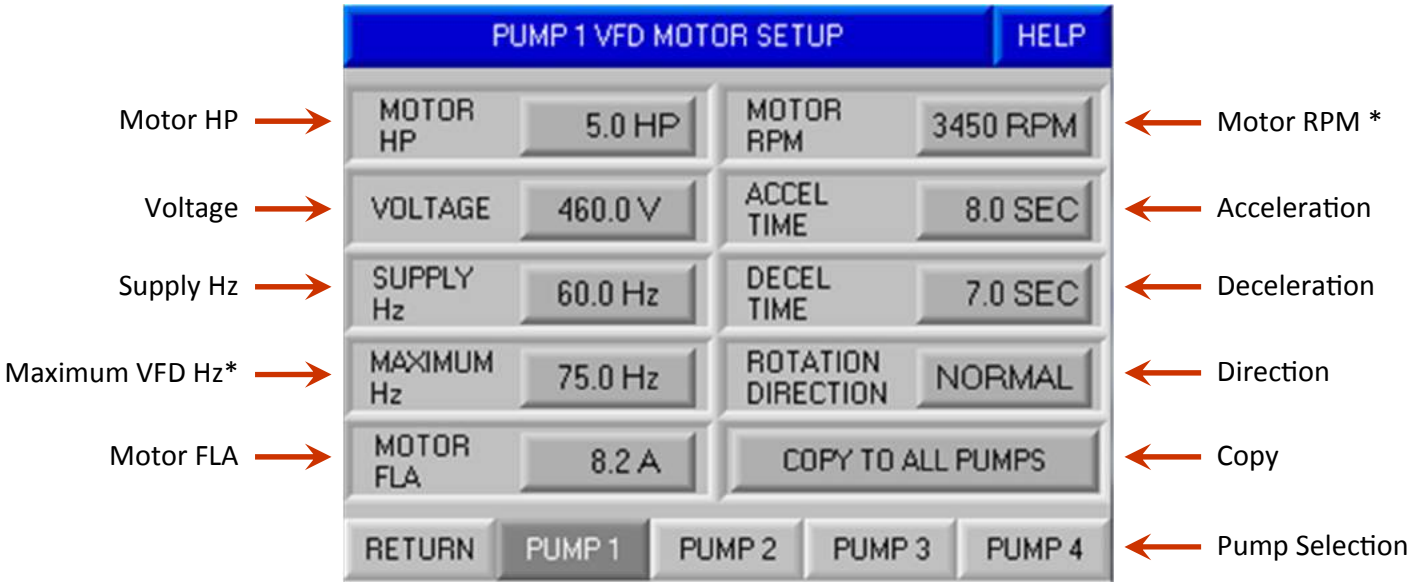
Some of the listed VFDs can communicated with the PV600 by Modbus IP. For those that can, a button appears here. Touch the button to bring up the VFD Modbus IP Configuration screen.

Modbus IP Configuration



When using Modbus IP communication, The VFD Modbus IP Configuration screen becomes selectable. Here the individual IP addresses and slave ID's for each VFD can be set.

Configuration - VFD/RVSS Motor Setup



Overview

When the PV600 is connected by Modbus to an RVSS or VFD selected as the pump starter the PV600 provides access to the basic motor setup parameters of the VFD or RVSS. This feature reduces the need to access the internally mounted VFD or RVSS keypad.

Motor HP - Enter the motor nameplate HP (or kW on some VFDs or RVSSs)

Voltage - Enter the supply voltage to the VFD or RVSS

VFD Maximum Frequency - In some applications, it may be desirable to run the pump past the normal design rpm. This is possible by adjusting the maximum frequency of the VFD. The allowable range is 50Hz—99.9Hz. Default setting is 60Hz. Use extreme caution when considering higher speeds as it may harm the pump and/or motor.

Motor FLA - Enter the motor nameplate full load amperes.

Motor RPM - Enter the motor nameplate RPM (only on VFD configured systems)

Acceleration - Enter the desired acceleration time for the RVSS or VFD. On VFD PID systems, the acceleration time should be set for 5 seconds to allow the PV600 to provide smooth control of the PID loop.

Deceleration - Enter the desired deceleration time for the RVSS or VFD. On VFD PID systems, the deceleration time should be set for 5 seconds to allow the PV600 to provide smooth control of the PID loop.

Direction - NORMAL is the default setting. If for some reason it is suspected that the pump is running backward, the direction of rotation can be changed by touching the button and setting the VFD or RVSS in reverse run mode. This can eliminate the need to physically reverse the motor leads to reverse pump rotation.

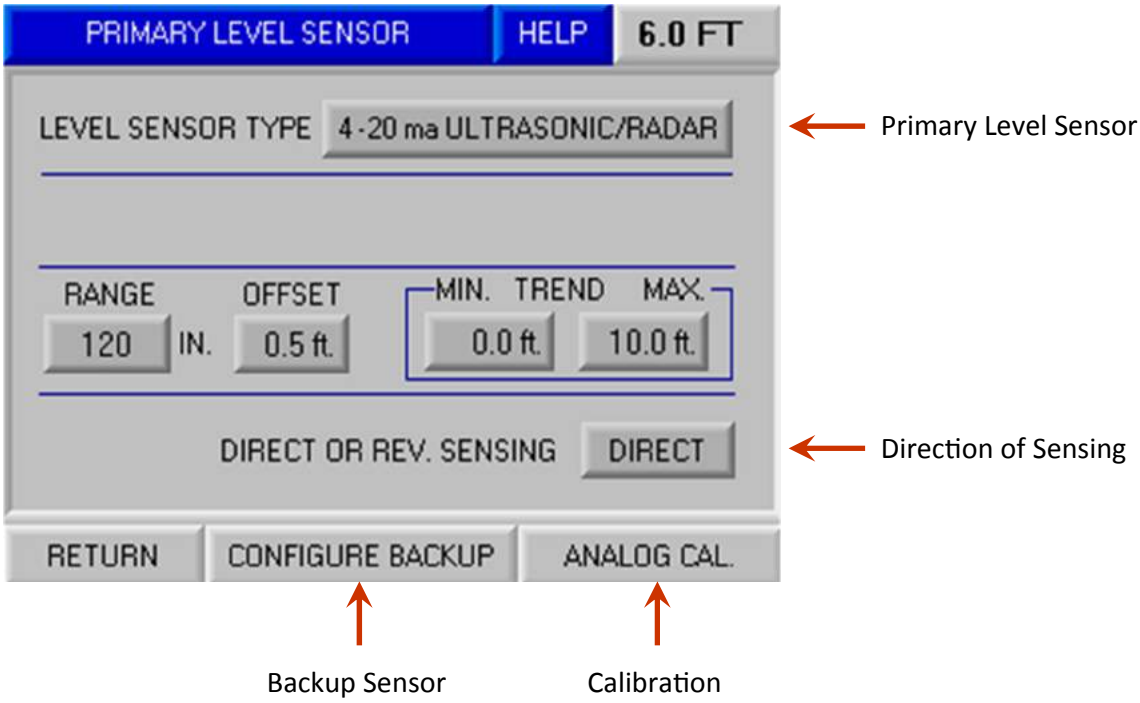
Copy - Touch this button to copy the currently selected pump's RVSS or VFD configuration settings to all of the other connected VFDs or RVSSs in the system.

Pump Selection- Touch these buttons to access each pump's VFD or RVSS settings individually.

* These parameters are not shown on RVSS configured systems.

CAUTION: This should only be done by trained personnel as damage to the pump can be severe if the pump is improperly configured!

Configuration - Level Sensor



Overview

The PV600 level controller can operate with almost any type of level sensor including 4-20 mA transducers, 4-20 mA ultrasonic sensors, float switches, and multi-segment rods.

The PV600 also supports the use of two level sensors on the same system. When two level sensors are connected, one is designated to be the primary sensor and the other is the backup sensor. The purpose of the backup sensor is to take over control of the system in the event of a primary sensor failure.

When only one sensor is connected, this screen provides access to the configuration options.

Primary Level Sensor - Touch here to select one of the level sensor options. The options are:

4-20 mA Transducer (submersible, bubbler, trapped air, any other 4-20 mA level sensor)

4-20 mA Ultrasonic Level Transducer

Float Switches (low level, stop, start for each pump, high level)

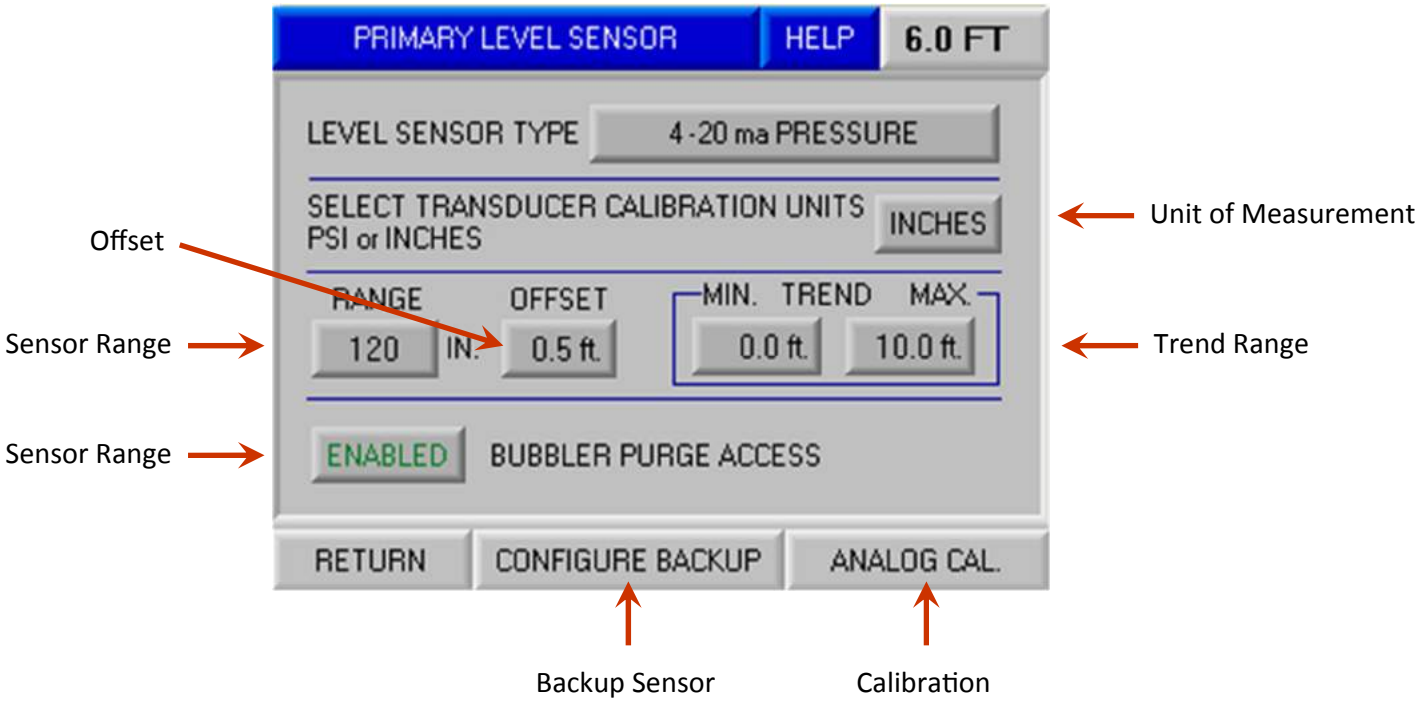
Multi-segment Probe (for a 10 contact probe rod)

Direction of Sensing - Touch this button to select between direct and reverse sensing for ultrasonic sensors. Ultrasonic sensors configured to read water height are considered “Direct”, and sensors configured to read distance from sensor, or sensor offset, to liquid surface are considered “Reverse”.

Backup Sensor - Touch this button to access BACKUP LEVEL SENSOR configuration screen.

Calibration - Touch this button to access ANALOG INPUT CALIBRATION configuration screens.

Configuration - Level Sensor



Unit of Measurement - Inches or PSI:

When 4-20 mA pressure is selected as the primary sensor, it is necessary to select **Inches** or **PSI** as the transducer scale unit of measurement. If the transducer to be connect is scaled in feet or inches, select inches and enter the range directly in inch format.

When the transducer is scaled in psi, select psi here and enter the transducer psi range. The PV600 will convert the psi range to feet using 2.31 feet/psi as the conversion.

Offset - With all sensor types except float switches, an offset can be entered. The offset is used to correct the level reading when the sensor is located above the zero elevation reference point. The offset is added to the level sensor input reading and then used for the level display and set point comparators.

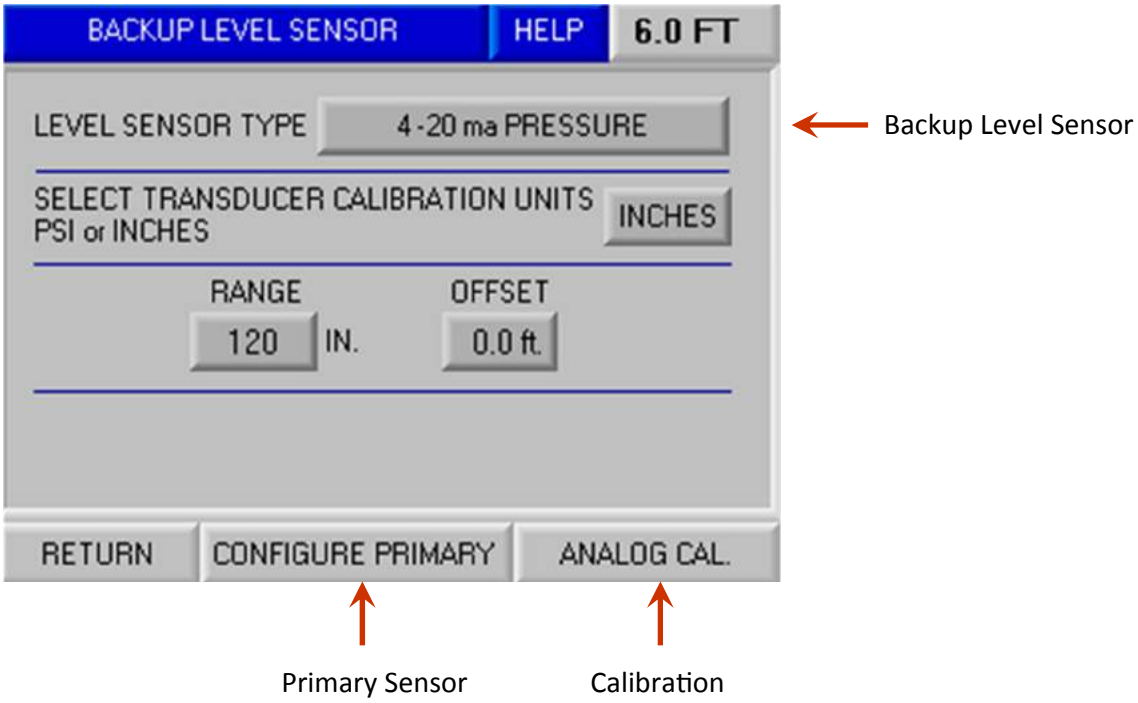
Trend Range - With all sensor types a range can be entered that is used for the trend graph. This is useful when a tighter resolution is needed for viewing the trending graph history. The minimum and maximum set points entered here will be the minimum and maximum points possible on the trend graph.

Purge Solenoid - Touch this button to enable the purge solenoid timer. The timer then becomes available for setup in the Timers Menu. This is only visible when one of the sensors is 4-20 mA transducer.

Backup Sensor - Touch this button to access BACKUP LEVEL SENSOR configuration screen.

Calibration - Touch this button to access ANALOG INPUT CALIBRATION configuration screens.

Configuration - Backup Level Sensor



Backup Level Sensor - The choices and setup options for the backup level sensor are the same as for the primary sensor. "None" is the default sensor. Selecting any other sensor type enables all of the backup sensor control and alarm functions throughout the controller. Touch here to return to the primary sensor configuration screen.

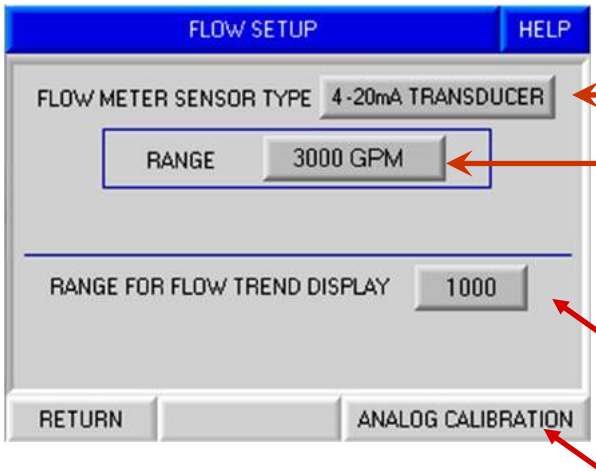
When a backup sensor is installed in the system, the PV600 will automatically transfer control to the backup sensor in the event of a primary sensor failure. The handling of the sensor failure alarms is configurable in the ALARM SETUP screens

Primary Sensor - Touch this button to return to the PRIMARY LEVEL SENSOR configuration screen.

Calibration - Touch this button to access ANALOG INPUT CALIBRATION configuration screens.

Configuration - Flow Meter

Flow Meter Setup - 4-20 transmitter



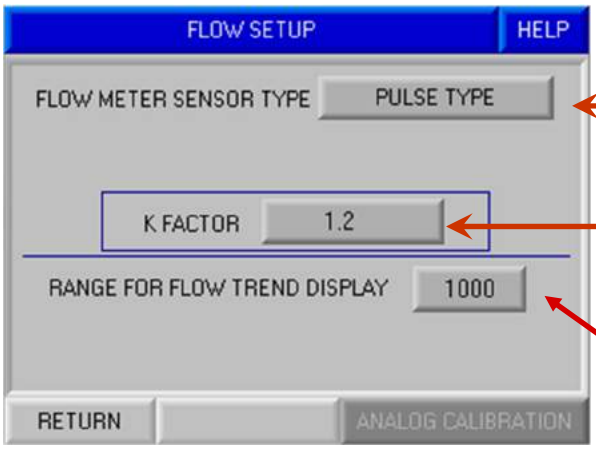
Flow meter sensor type - Can be set to 4-20mA TRANSDUCER

Range: Appears when transducer is set for sensor type. The top of range is input in a data entry screen in Gallons Per Minute (GPM). This should be the range as calibrated on the flow meter.

Range for Flow Trend Display: This range may be different than the transducer range to improve resolution of the graph.

Touch this button to access the ANALOG INPUT CALIBRATION screens.

Flow Meter Setup - Pulse transmitter

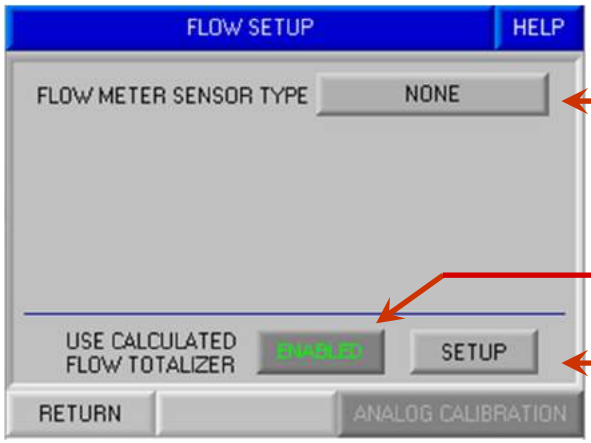


Flow meter sensor type - Can be set to PULSE type

K Factor: Appears when sensor type is set to Pulse type. Enter the K Factor from the flow meter data sheet.

Range for Flow Trend Display: This range may be different than the transducer range to improve resolution of the graph.

Flow Meter Setup - None, or Calculated Flow



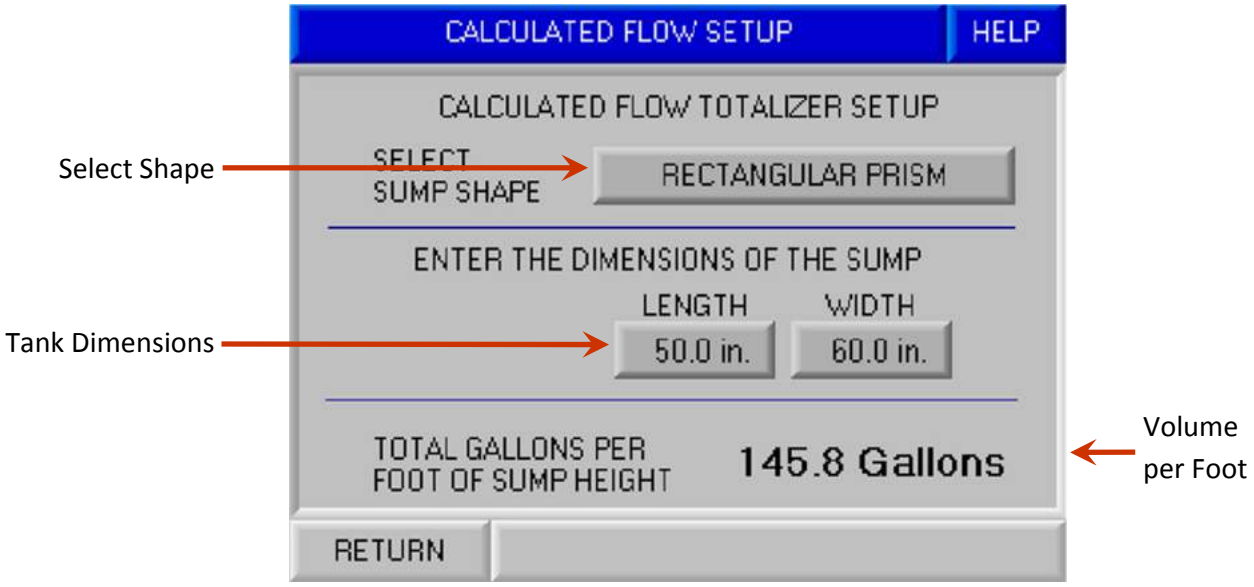
Flow meter sensor type - Can be set to NONE

The PV600 can calculate the flow rates and totals if the measurements of the sump or tank are entered into the Calculated Flow Setup screen.

Touch this button to 'ENABLE' or 'DISABLE' the calculated flow function.

Once the function is enabled, the SETUP button is available.

Configuration - Flow Meter - Calculated Flow



Rectangular Prism Tank Shape

Overview

The PV600 level controller can calculate both the inflow and outflow in a sump or tank, even if no flow meter if connected to the controller. All that is required is that the sump or tank be a cylinder or a rectangular prism, with regular and parallel sides, and the dimensions of the shape be entered into the calculated flow setup screen.

Gallons per foot calculation - once the size of the sump or tank is entered, the PV600 can calculate the gallons per foot of elevation. Since the PV600 has stop and start pump set points entered, it can calculate a fixed volume of water.

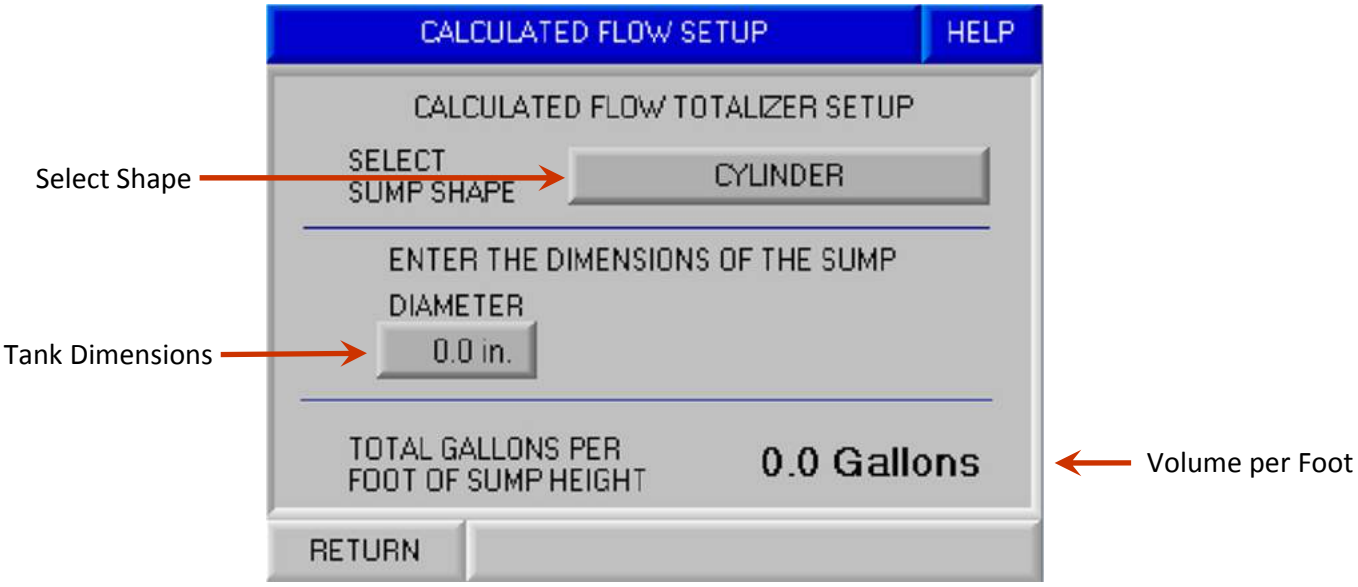
Calculated Inflow - When the pumps stop pumping water, it is at the stop pump's set point. With the pumps off, there is only liquid entering the tank. When the level rises, it reaches the lead pump start set point and a pump starts pumping. The PV600 measures the time that the pumps are off and can calculate the average inflow gpm.

In an example; the tank holds 100 gallons per foot of elevation. The stop set point is 3.0 ft. and the start lead pump set point is 5.0 ft. In this system there is 200 gallons of fill while the pumps are off. If it takes 10 minutes to fill that amount, the inflow rate is 20 gpm average.

Calculated Outflow - When the pumps start pumping water, the PV600 times how long it takes to reach the stop set point. Again, it can calculate the gpm with the data. Using the previous example, if the pump runs for 2 minutes to lower the level back to the stop set point, the outflow rate is 100 gpm, plus the 20 gpm average inflow rate, for a total outflow rate of 120 gpm.

On systems with widely inconsistent inflow rates, the margin of error will be greater.

Configuration - Flow Meter - Calculated Flow



Cylindrical Tank Shape

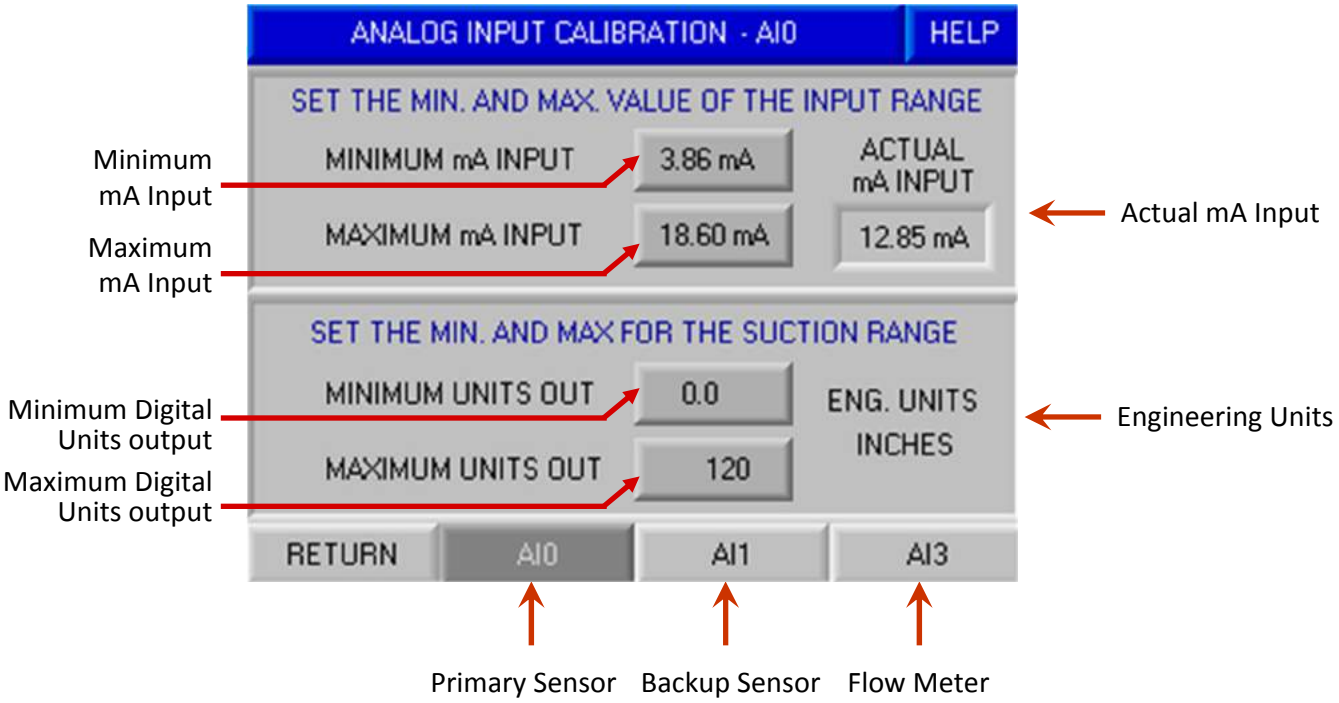
Calculated totals - The PV600 uses the calculated flow rate data to calculate a totalized flow per day, week, and month.

Select Shape - Select the shape of the tank or sump (cylinder or rectangular prism).

Tank Dimensions - Enter tank dimensions in inches (accurate to 1/10th inch).

Volume per Foot - The PV600 calculates the total gallons per foot of tank or sump elevation.

Configuration - Analog Input Calibration



Overview

The PV600 level controller has three 4-20 mA analog inputs and are scaled by factory default to 4-20 mA. Although it is usually not required when the factory calibration of the sensor is accurate, it is possible if necessary to make adjustments to both sides of the analog to digital conversion scales. While the field sensor is normally scaled to provide a 4-20 mA analog input, there are times when the sensor may not output exactly 4-20 mA. In the above example, the actually readings are not to that exact scale and an adjustment on both the minimum mA input and maximum mA input is needed.

Actual mA Input - The actual input reading can obtained with either a voltmeter, or by looking at Actual mA Input value on Analog Input Calibration screen. Once the full scale of the sensor is determined, the values can be input.

Minimum mA Input - Enter the value obtained with the sensor is at its minimum output.

Maximum mA Input - Enter the value obtained with the sensor is at its maximum output.

Minimum Digital Units Output - Enter the minimum scale of the sensor output (usually 0) .

Maximum Digital Units Output - Enter the maximum scale of the sensor output.

Actual mA Input - This is the actual mA input at the PV600 analog input terminal. This value can be verified by an external digital multi-meter.

Engineering Units - The units of measurement are shown here. This can be change for the pressure sensors on the sensor configuration screen. (touch RETURN).

Touch the buttons at the bottom of the screen to access the other two analog inputs if they are configured in the

Configuration - Special Options

Enable Option

Touch to access help screen

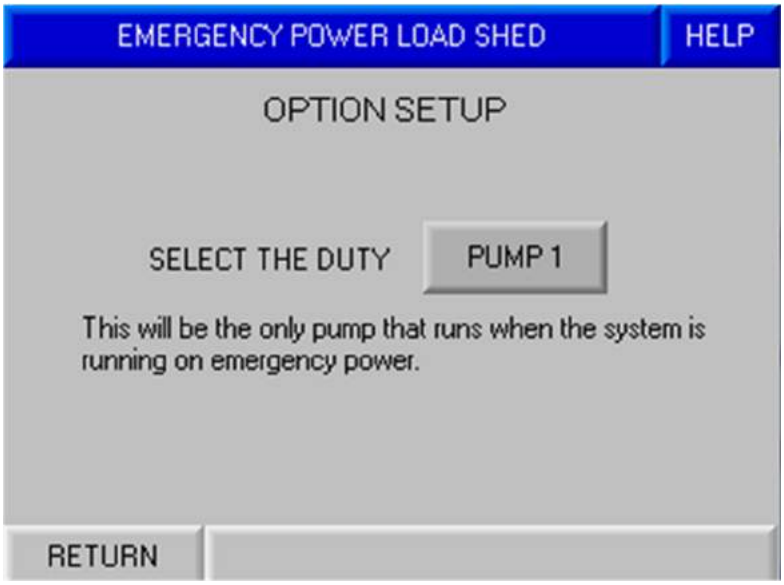
Refer to PV600's help screen for further information about the options.

Touch here to continue to the next options page

The Special Options screens are a series menus that give access to enabling special functions in the PV600 controller. The table below shows the options available, the modes that they are available, and the function performed.

MENU ITEM	BOOSTER	LEVEL	WELL	FUNCTION
GENERATOR LOAD SHED	X	X		Reduce number of pumps in operation when running on emergency power
ANALOG OUTPUTS	X	X	X	Select which process signals to output to the 4-20 mA analog outputs.
ANALOG OPTION OUTPUTS	X	X	X	Select which process signals to output to the optional 4-20 mA analog outputs (if installed)
TIME CLOCK CONTROL	X	X	X	Set specific time periods within a 7-day schedule in which the pumps can run
PUMP STATUS INDICATOR COLOR	X	X	X	Select custom colors for the pump status indicators
ANALOG SET POINT ADJUST	1			Enable Remote Analog Set Point (RAS) or Remote Analog Set Point Adjust (RASA)
PID LEVEL W/MAX. FLOW		1		Maintain constant level. If flow reaches set point, switch to PID Flow. Auto Reset
LOW FLOW BYPASS TIMER	1	1	1	Set alarm and lag pump start time delay in low pressure/ level events
NETWORK READBACK DISABLE	1	1	1	Set run priority to digital feedback inputs
DISABLE ALARMS	1	1	1	Enable/Disable external alarm bit
HIDE HOA OFF BUTTONS	1	1	1	Change visibility of OFF button on HOA switches
REDUNDANT TRANSDUCER	1		1	Automatically use a backup transducer in the event of a primary transducer failure
HIGH SYSTEM PRESSURE SWITCH	1		1	Override high pressure set point with pressure switch
TARGET SET. P/W BYPASS	X		X	Enable ability to modify target pressure set point without a password
I2 SYSTEM ENABLE		X		Reads input I2 to enable or disable pump operation (not for quadraplex w/seal failure sensor)
I32 SYSTEM ENABLE		X		Reads input I2 to enable or disable pump operation

Special Options - Emergency Power Load Shed



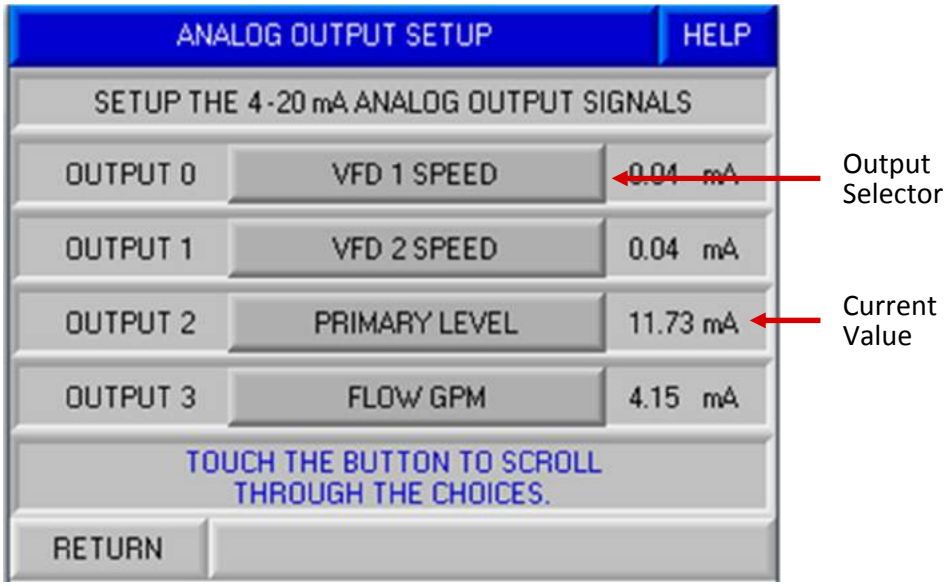
Overview

The PV600 can be configured to minimize load in applications where a backup generator is connected that doesn't have enough power for all of the pumps in the system.

Once enabled in the Special Options menu, the user is able to assign the duty pump, which will be the only pump to automatically operate while in emergency power/load shed mode.

The option requires that the I/O input expansion module be installed and a contact from the generator run signal be wired to input 32.

Special Options - Analog Outputs



Overview

This option allows the "connection" of any system configured process variables (listed below) to be sent through one of the PV600's four 4-20 mA analog outputs.

None	No output
VFD Speed	(0-100%)
System Pressure	(PSI scale of transducer input)
Suction Pressure/Level	(PSI scale of transducer input)
Temperature	(0-200 F scale of PT100 sensor input)
Flow	(GPM scale of transmitter input)
Primary Level	(distance scale of transducer input)
Secondary Level	(distance scale of transducer input)

Output Selector - Touch each of the output selectors to chose which process signal to "connect" to the analog output for each of the four outputs. When VFDs are installed that are not connected by Modbus and hardwired analog signals are needed as a speed reference, it is not possible to change the selection from VFD SPEED.

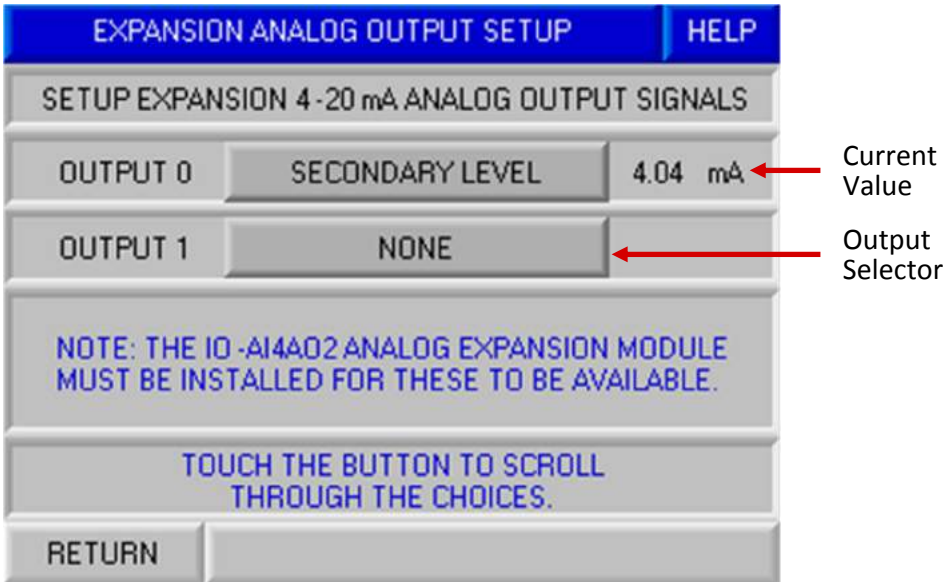
Each output has the same selections, except that the VFD Speed signals are for specific pumps (Pump 1 outputs to Output 0, Pump 2 outputs to Output 1, and so on).

It is possible to "connect" the same process signal to multiple analog outputs.

NOTE: Only process signals configured in the system will be available for selection.

Current Value - The value being outputted at the PV600 analog output terminal is shown.

Special Options - Expansion Analog Output Setup



Overview

In some configurations, there may not be sufficient analog outputs to meet the project's needs and an expansion analog I/O module must be added to the PUMP Vision system. This option allows the "connection" of any system configured process variables (listed below) to be sent through one of the PV600's two optional expansion 4-20 mA analog outputs.

None	No output
System Pressure	(PSI scale of transducer input)
Suction Pressure/Level	(PSI scale of transducer input)
Temperature	(0-200 F scale of PT100 sensor input)
Flow	(GPM scale of transmitter input)
Primary Level	(distance scale of transducer input)
Secondary Level	(distance scale of transducer input)

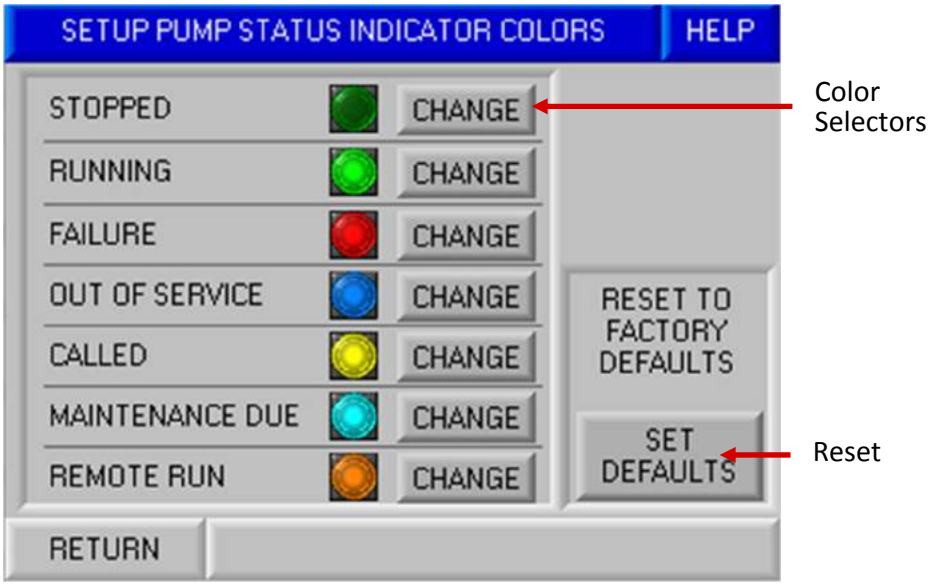
Output Selector - Touch each of the output selectors to chose which process signal to "connect" to the analog output for both of the outputs. Each output has the same selections.

It is possible to "connect" the same process signal to both expansion analog outputs and these can be set for the same functions as the base controller's.

NOTE: Only process signals configured in the system will be available for selection.

Current Value - The value being outputted at the PV600 analog output terminal is shown.

Special Options - Setup Pump Status Indicator Colors



Overview

Some facilities may have an indictor light color scheme that requires compliance from all HMIs and control panels to a certain color scheme that does not match the PUMP Vision "standard". One of the more common alternatives to the PUMP Vision default is a red RUN indicator, green OFF indicator, amber FAULT indicator, etc.

This screen makes it possible to change the default color scheme to a custom color scheme.

Color Selectors - Touch the color selectors to scroll through the available choices.

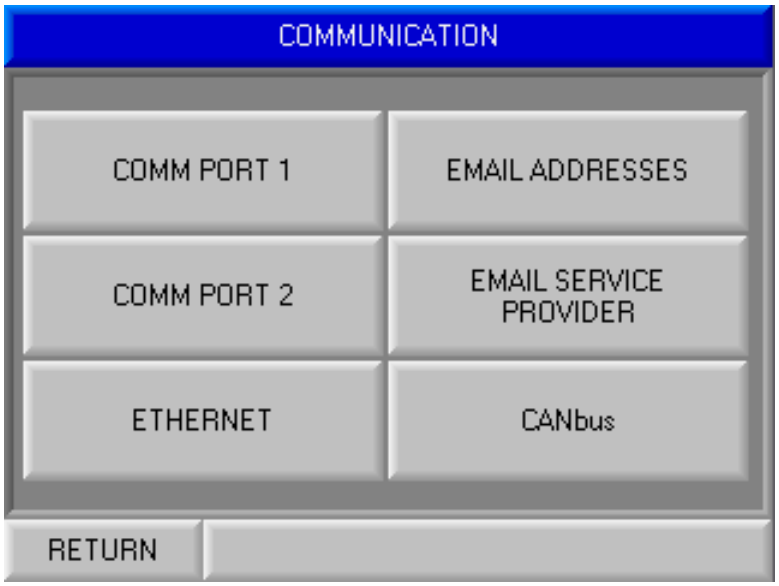
Reset - Touch the SET DEFAULTS button to return to the standard scheme.

The table below shows the colors that are available for each status indication. The X's show the possibilities and the D's indicate the default colors. The default colors are also shown in the picture above.

NOTE: The colors chosen for Out 0f Service and Remote Run will also be used for the "soft" HOA switch when it is in OOS or Remote Run.

FUNCTION									
STOPPED	D	X	X				X		
RUNNING		D	X			X			
FAILURE			D		X	X			X
OUT OF SERVICE				X			X	X	D
CALLED			X		D			X	
MAINTENANCE DUE			X	D	X			X	
REMOTE RUN		X		X		D			

Communication Menu

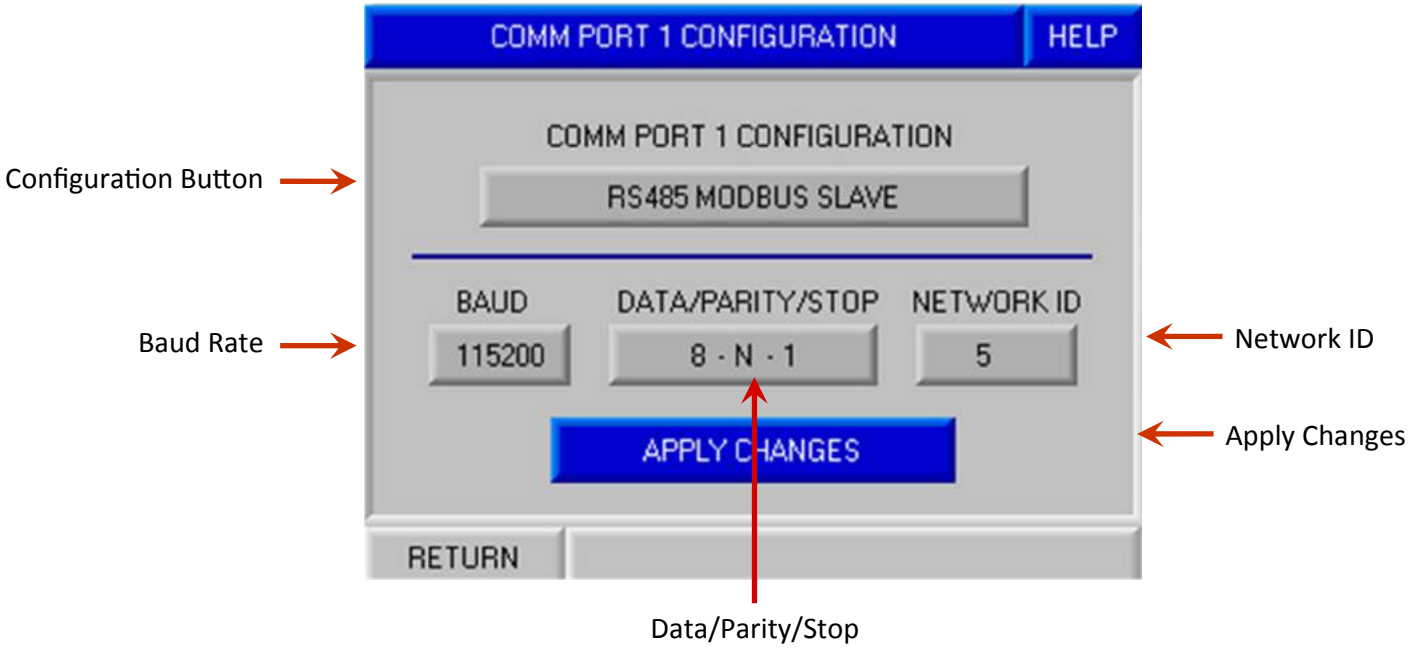


Overview

The Timers menu displays the following options when the optional Ethernet card is installed.

MENU ITEM	ACCESS LEVEL	FUNCTION
COMM PORT 1	3	Setup RS232/RS485 port for Modbus communication with SCADA or BAS
COMM PORT 2	3	Setup the Modbus communication to the VFDs or the MOTOR Vision starters
ETHERNET	3	Setup Ethernet port for network connection Not available when no Ethernet card is installed
EMAIL ADDRESSES	3	Setup email addresses for alarm notification Not available when no Ethernet card is installed
EMAIL SERVICE PROVIDER	3	Setup the email service provider IP address and login information Not available when no Ethernet card is installed
CANbus	3	Setup link to second system

Communication - Comm Port 1 Setup



Overview

The PV600 has two serial ports used for Modbus communication. Port 1 is available for user connection as a Modbus slave. The port can be user configured to most serial port types and speed by simply making the selections on this screen and touching the 'Apply Changes' button to re-initialize the serial port.

Port wiring information is shown in the installation section of this manual. A list of the Modbus registers is available from cmcontrols.com.

Configuration Button - Touching this button scrolls through three options:

RS232 Modbus Slave
RS485 Modbus Slave
None

Note that depending on the communication option chosen, the dip switches on the back of the controller must be set.

Baud- Touch this button to scroll through the possible baud rates:

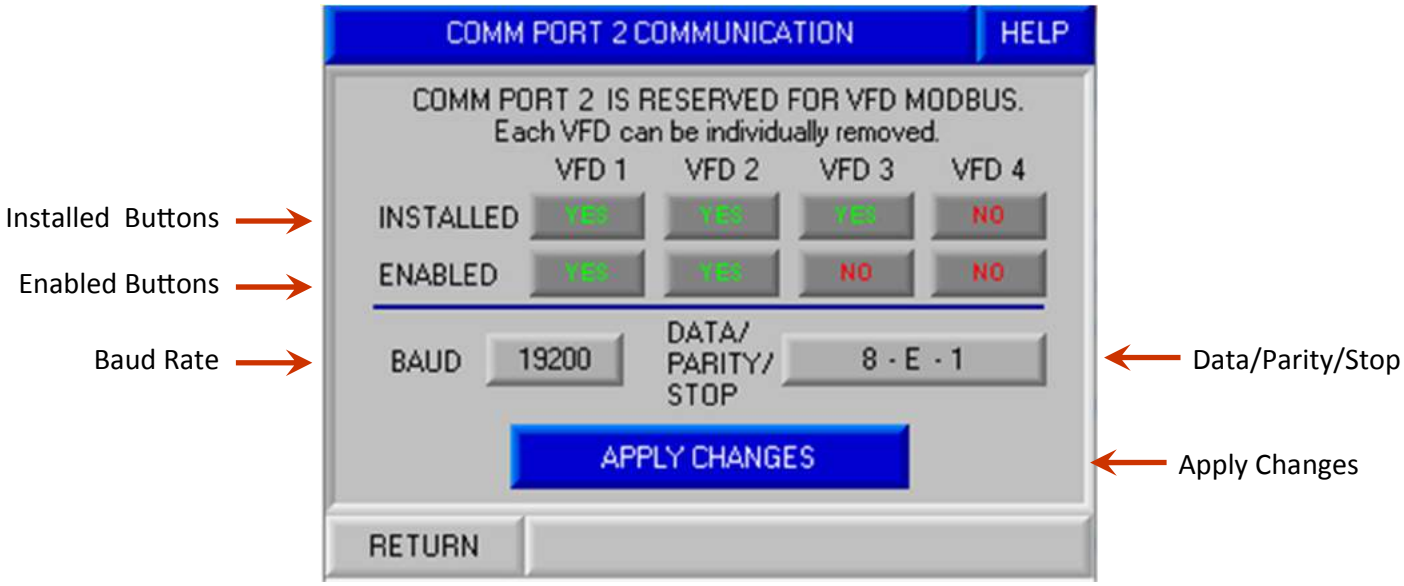
9600
19200
38400
57600
115200

Data/Parity/Stop - Touch this button to toggle between 8-N-1 and 8-E-1.

Network ID - Touching this button brings up a numeric entry screen. Valid entries range from 0 to 127.

Apply Changes - Touch this button to make any changes made active.

Communication - Comm Port 2 Setup



Overview

This port is used exclusively for internal Modbus connection to VFDs or MOTOR Vision.

Installed Button - Touching this button toggles between YES for installed and NO for no VFD or MOTOR Vision starter. Each starter has its own button, to allow individual removal. This feature allows a system to have a VFD on one pump and a FVNR starter on another.

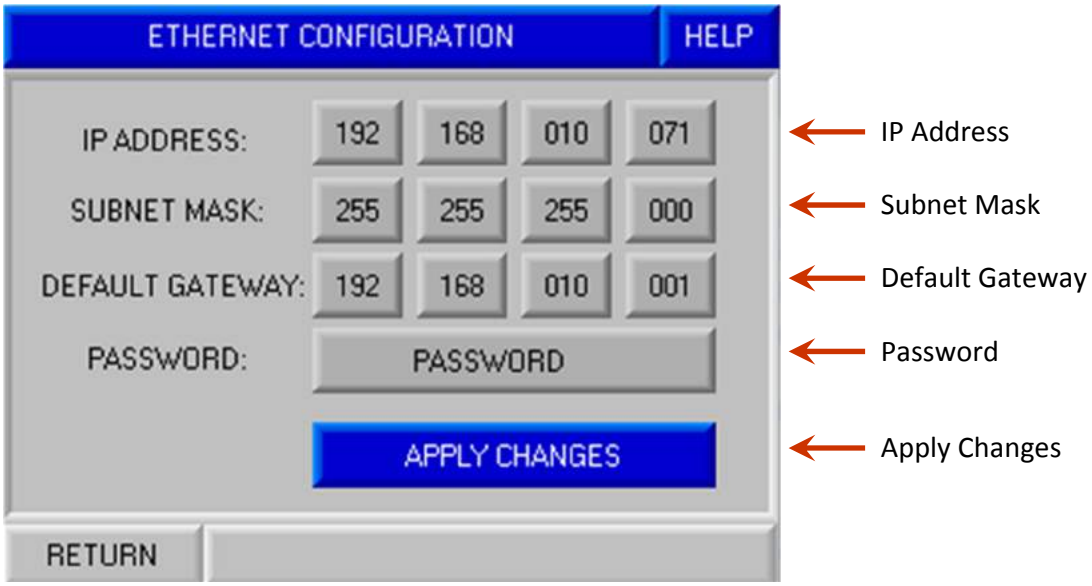
Enable Button - Touching this button toggles between YES for enabled and NO for disable communication to the VFD or MOTOR Vision starter. Each starter has its own button, to allow individual removal. This feature allows a system to have a Modbus VFD on one pump and non Modbus VFD on another.

Baud- Touch this button to toggle between 9600 and 19200 baud rates

Data/Parity/Stop - Touch this button to toggle between 8-N-1 and 8-E-1

Apply Changes - Touch this button to make any changes made active.

Communication - Ethernet Port Setup



Ethernet Setup

If the PV600 has the optional Ethernet board, the system will initialize the port on power up and enable the configuration screen. Once enabled and configured, the port supports four simultaneous connections through "sockets". Ethernet access from the Remote Access and programming software, as well as a Modbus IP connection, are automatically enabled.

IP Address - Touch each button to enter the numbers of the desired IP address.

Subnet Mask - Touch each button to enter the numbers of the desired Subnet Mask.

Default Gateway - Touch each button to enter the numbers of the desired Default Gateway.

Password - Touch this button to enter the password for the controller. The password will be needed In order to remotely connect to the controller with Remote Access or Remote Operator.

Apply Changes - Touch this button to make the changes active. This is also a method of re-initializing the Ethernet port in the event that communications to the port are lost.

Communication - Email Addresses

Overview

On this screen the user can enter a list addresses for up to six email recipients. For each recipient on the list, Send Alarms and Send Files can be individually set.

Email Address - Touch these buttons to enter the email address up to 36 characters.

Send Alarms- These buttons toggle between YES and NO. Message sending can be individually disabled per user without removing their name from the SEND TO list. When a alarm email event is triggered, the email handler will send out a message to each enabled recipient on the list.

Send Files - These buttons toggle between YES and NO. File sending can be individually disabled per user without removing their name from the SEND TO list. When a file email event is triggered, the email handler will send out the file to each enabled recipient on the list. NOTE: When sending a file message to a text message address, the message will arrive, stripped of the file. The files can only be sent to email addresses.

File Send Setup - Touch this button to access the FILE SEND SETUP screen when each data file type can be setup to send automatically on a periodic basis.

Text Message - To send a text message, send an e-mail to the cell phone using the format of 5555551212@provider.com where the phone number of the cell phone and the cell phone service provider are entered in the email recipient address.

Contact your service provider or check their website for their email address format.

Some common service providers:

AT&T - cellnumber@txt.att.net

Verizon - cellnumber@vtext.com

T-Mobile - cellnumber@tmomail.net

Sprint PCS - cellnumber@messaging.sprintpcs.com

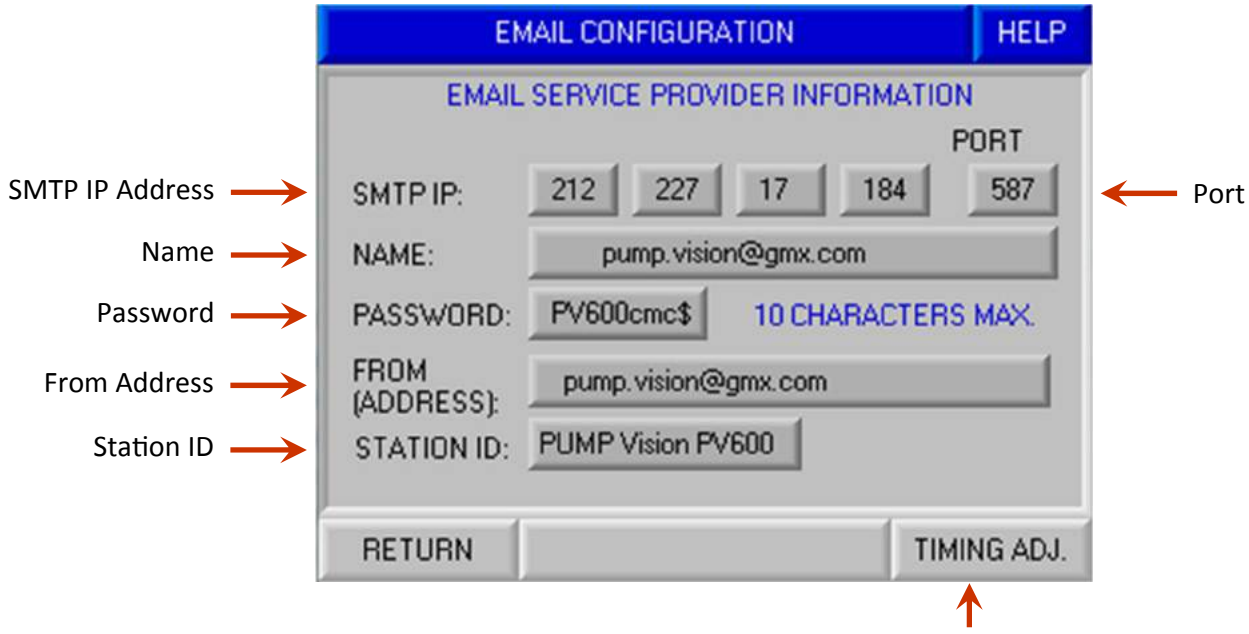
US Cellular - cellnumber@email.uscc.net

Nextel - cellnumber@messaging.nextel.com

Boost - cellnumber@myboostmobile.com

Alltel - cellnumber@message.alltel.com

Communication - Email Service Provider



Overview

The PV600 can send out alarm e-mail and text messages, as well as data files, if configured with the optional Ethernet board and if connected to the Internet. An SMTP server with a static IP address is also required. The ESP information above is a working email box that is available for use in testing a system. For full time use, each user must establish their own email service provider and mailbox.

First, an e-mail account must be established with a user login name and password.

Next, the IP address of the SMTP server must be determined as the PV600 cannot resolve a DNS name. To find out what the IP address is for your server:

- …From your Windows Start button click RUN.
- …When the RUN box opens, enter CMD into the command line and click OK.
- …At the DOS prompt that appears, type “ping mail.server.com” (substitute the name of your SMTP server for the mail.server.com) and press enter.
- …The IP address of your server will be displayed in brackets.
- …Use this address to enter your IP address into the controller.

SMTP IP Address - Touching these buttons will bring up a text entry screen. Enter in the SMTP IP Address.

Port - Enter the Port number here.

Name - Enter the ‘name’ of the email account.

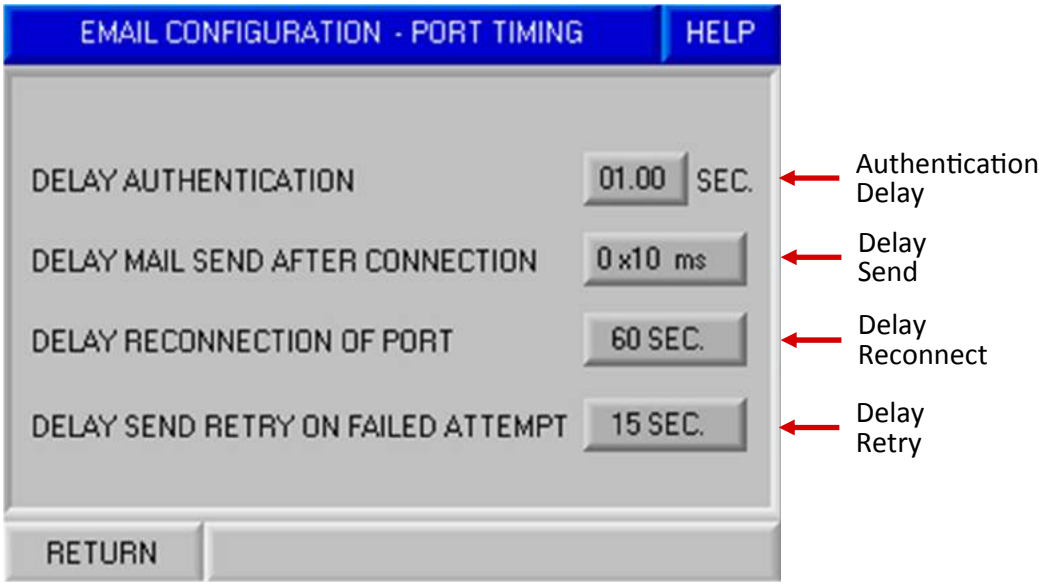
Password - Enter the ‘password’ for the email account.

From Address - Enter the address you want to appear in the ‘From’ line in the emails.

Station ID - Enter the ‘station ID’ here.

Timing Adjustment - Touch to access the email timing setup screen

Communication - Email Timing



Overview

These timers are necessary to control the process of connecting to the remote email service provider, providing user name and password, then sending the message or file. Additional timers are needed to control the reconnection and retry attempts on the server.

Delay Authentication - It is recommended to set this timer to one second to allow the PV600 time to establish its connection to the server. Slightly longer times may be needed in some case with slower Internet speeds or service providers. A value too low will result in an 'authentication failure' message on the TEST EMAIL screen.

Delay Send - This timer adds time after authentication before sending the message or file. A value of 0 will often work here, but with some cellular connections a slight delay of perhaps 100 ms will prevent a message send failure.

Delay Reconnect - Depending on the type of email account that has been established with the email service provider, there may be a limitation on the number of times per minute that the PV600 can connect to send a message due to the ESPs security against 'robot' emailers. Since the way that the PV600 manages the message queue, each message is a separate connection and the ESP is recognizing that there is a machine sending the message. With free email accounts, the limitation may be to as little as once a minute. In paid accounts, there may be very little limitation to the frequency. If the frequency is higher than the ESPs limit, the connection will be rejected and the PV600 connection retry timer will start timing down to a reconnect try.

Delay Retry - If a connection attempt is rejected by the ESP, the PV600 will retry the connection for three times before failing the email address and moving to the next recipient on the list. The setting on this timer should be high enough that three times the setting is longer that the ESPs connection frequency limit.

NOTE: Experiment with the Delay Reconnect timer to get the least time possible without connection failures. The shorter the time, the quicker the message gets to all the recipients on the email list. Use the TEST EMAIL screen in the DIAGNOSTICS MENU to test the connection and monitor failure messages.

Communication - CANbus - Cascade Pump Control

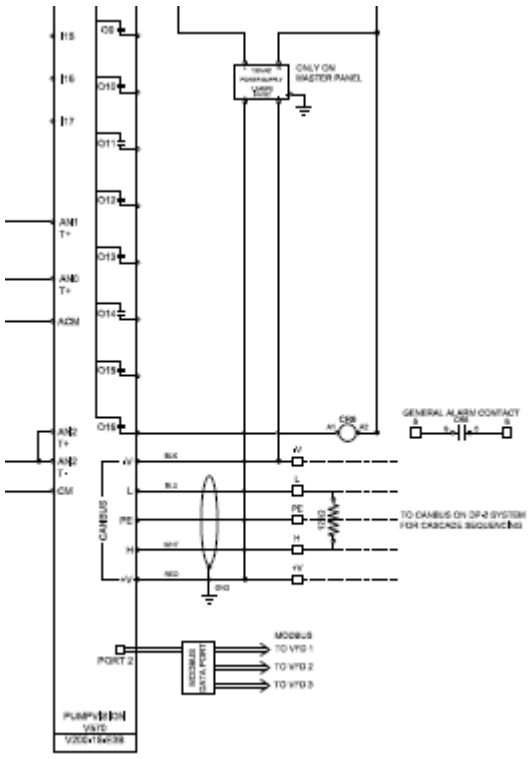
Two PV600s can be connected together with a CANbus port to effectively create an 8 pump controller. This requires special wiring for each system shown on the following pages.

Once the wiring is complete, one unit must be set as the master and the other as the slave on the CANBus network. In addition the master controls which system's pumps will operate as the lead pumps and which are lag. The lead duty is automatically transferred on a weekly basis.

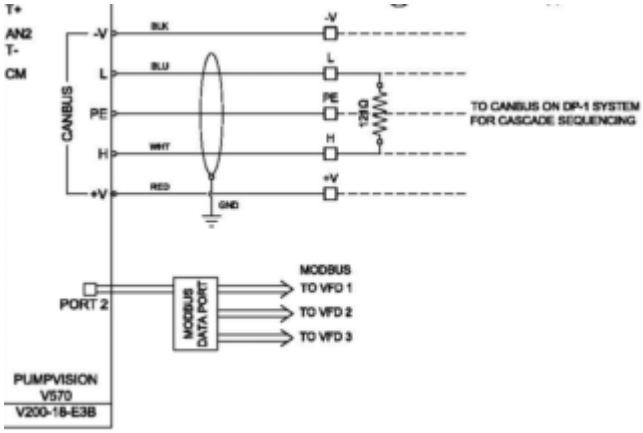
For example, two Triplex systems are linked. This week, this station's pumps will alternate as lead 1,2,3 - 3,2,1 etc. and the other station's pumps alternate as lag 4,5,6 - 5,6,4 etc. if needed. Next week, it is reversed. This station is 4,5,6 - 5,6,4 and the other is 1,2,3 - 2,3,1 - 3,1,2.

Can be used with any combination of two panels and number of pumps.

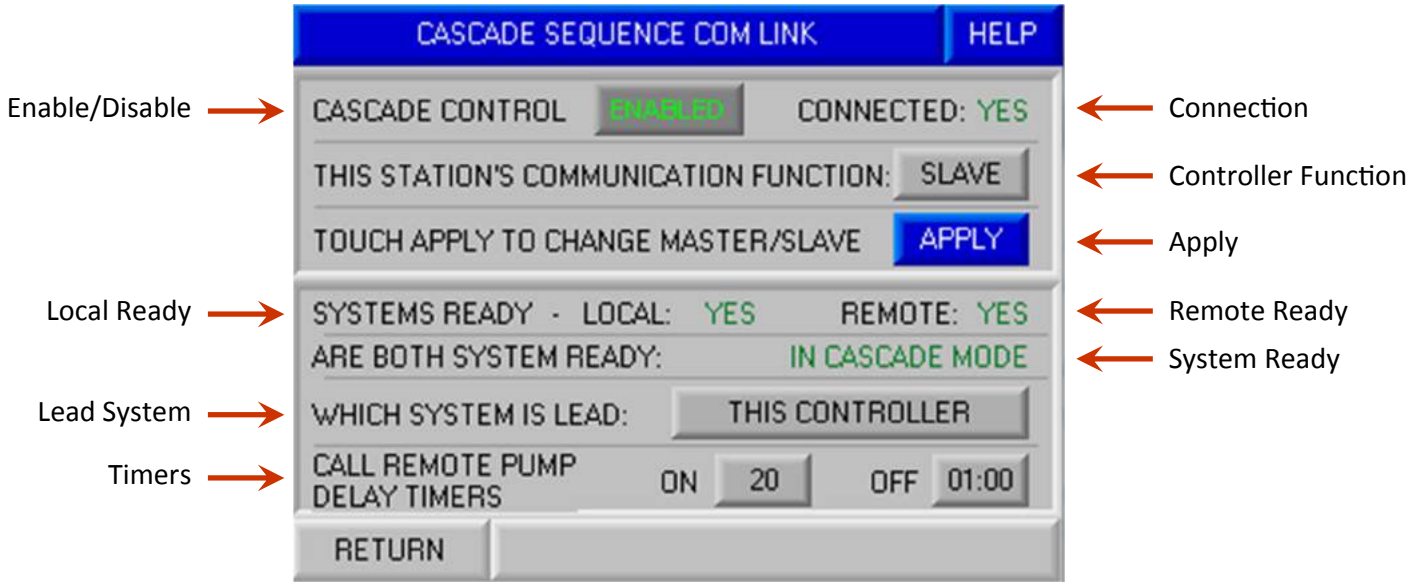
MASTER wiring



Slave Wiring



CANBus -Cascade Control



Overview

Using the PV600's CANbus connection, two panels can work in tandem as one system that operates up to eight total pumps. Shown above is a screen from a system that is connected and running in Cascade Mode.

Cascade Control Enable - This must be enabled in order to use cascade sequencing through CANbus. Touch the button to toggle between ENABLED or DISABLED.

Controller Function - Touch this button to select MASTER or SLAVE. One station must be the master and one must be the slave. This is a network communication relationship and also the manager of the Lead System control.

Apply - Touch this button to 'Apply' the change after changing the control master/slave function. The button is not visible when a change has not been made by touching the 'Controller Function' button.

Connected Indicator - Once the systems have been properly wired together and the master/slave function has been set and systems rebooted, the 'Connected' indicator will read YES.

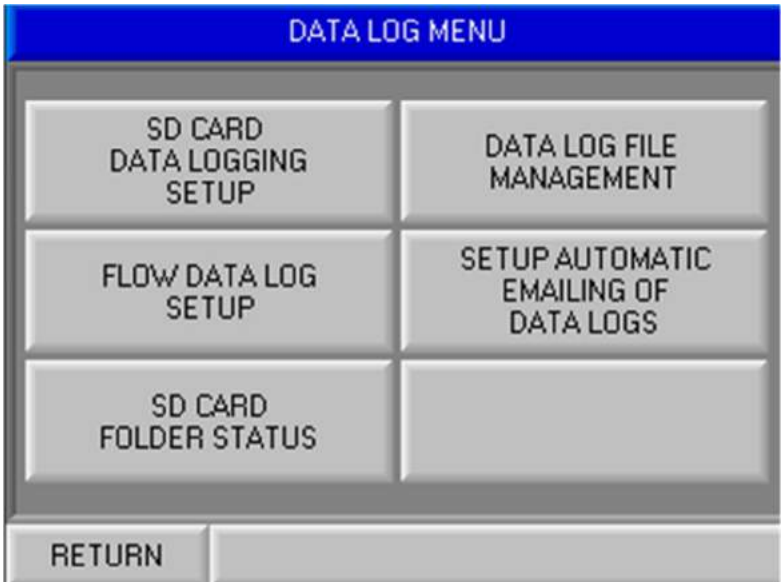
Lead System - As described previously in this section, the lead duty of each PV600 automatically changes on a weekly basis. One of the controllers will read "This Controller' and the other will read 'Remote Controller'. This button not only serves as an indicator of the duty status, touching the button manually changes which system is lead.

Ready Indicators - Local, Remote, System - Shows the status of each system and total system status. When the 'System Ready Indicator' will read 'IN CASCADE MODE' when both systems are connected and ready.

Call Remote Delay Timers On - The amount of time the system waits to call the pumps of the other system.

Call Remote Delay Timers Off - The amount of time the system waits to shutdown the lead pump of the standby system.

Data Log Configuration Menu

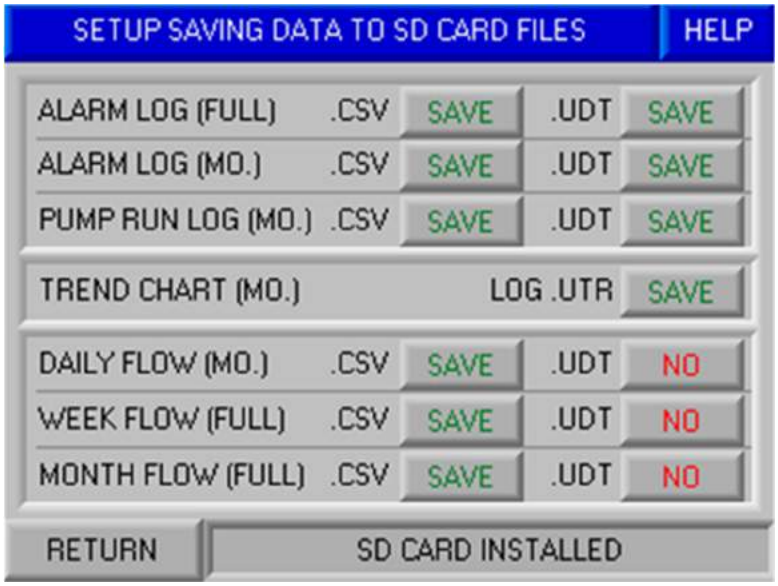


Overview

The Data Log Menu displays the following options when the optional PUMP Vision SD memory card is installed.

MENU ITEM	ACCESS LEVEL	FUNCTION
SD CARD DATA LOGGING SETUP	2	Enable the various data logs and trends. Only available if the optional SD memory card is installed.
FLOW DATA LOG SETUP	2	Enable and setup the Flash RAM flow data logging for Day, Week, Month logs.
SD CARD FOLDER STATUS	2	View the files in the SD card folders with 'remaining time' status indicator and MB space remaining on the card.
DATA LOG FILE MANAGEMENT	2	Access the File Manager Folder Selection Screen. From that screen, the File Manager is accessed. The File Manager can view the contents of the data log folder, delete unwanted files, and manually email data log files. Only available if the optional SD memory card is installed.
SETUP AUTOMATIC EMAILING OF DATA LOGS	2	Setup which data log files to automatically email and the frequency that the emails are sent out.

Data Log Configuration - SD Card Data Logging Setup



Overview

This screen allows the user to enable saving the trend and log files to the SD card. There are a total of thirteen separate data log types being saved. Some are a continuous log and some are monthly logs. The contents of the logs are:

Alarm Log (full)	An 'eternal' log. This log will keep every alarm event into one log.
Alarm Log (monthly)	A monthly log. New log is created each month with only alarms from that month being logged.
Run Log (monthly)	A monthly log. New log is created each month with only run events from that month being logged.
Trend Chart (monthly)	A monthly log. New log is created each month with the trend chart from that month being logged.
Daily Flow (monthly)	A monthly log. New log is created each month with the daily flow totals from that month being logged.
Weekly Flow (full)	A 'eternal' log. One log is created with the weekly flow totals being logged.
Monthly Flow (full)	A 'eternal' log. One log is created with the monthly flow totals being logged.

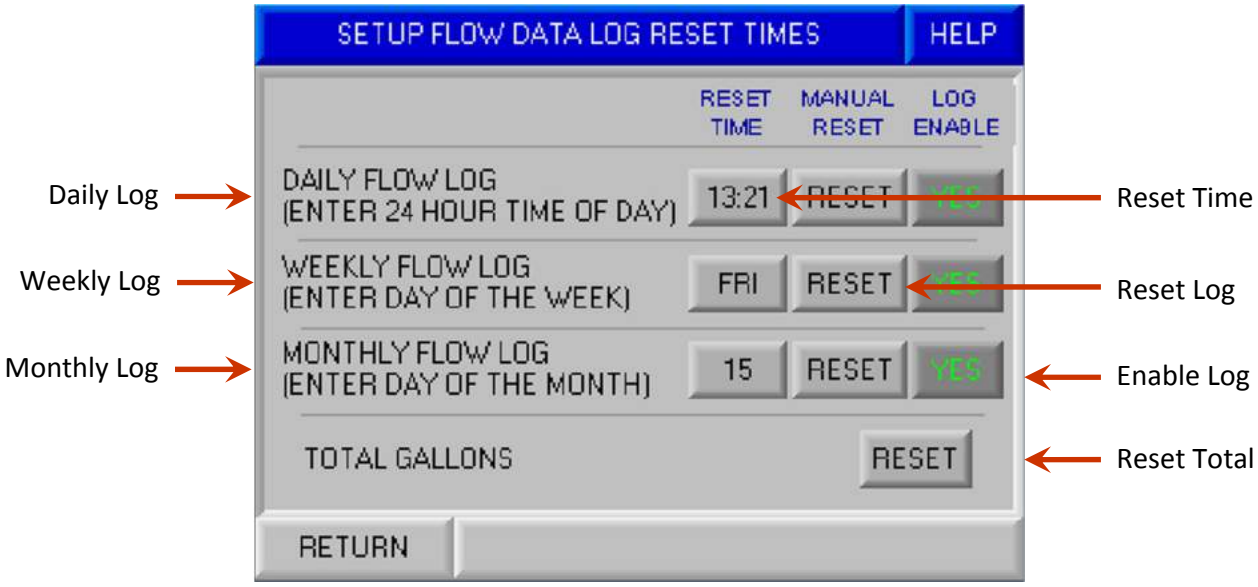
For each log that is enabled, a file is automatically created and written to the SD Card for each month, except the flow logs which are run continuously.

Each file folder on the SD card can save up to 63 files, so 63 months of data are available for each log and the trend.

Save File Type - Touch each of the buttons to enable/disable each file type for each log or trend.

Each log can be saved as both .UDT files which can be viewed and managed with the available PC based SD Card Manager software, or .CSV format which can be viewed and managed with Excel.

Data Log Configuration - Flow Data Log Reset Times



Overview

The PV600 can log the flow data to the internal Flash RAM memory. Three separate logs are kept of the total GPM and number of pumping cycles during the period. The logs can be individually enabled or disabled, reset, and configured for start point. Each of the three logs stores the past 100 log periods in a FIFO data log.

Daily Log - A separate total for each day, with the log beginning time being the Reset Time.

Weekly Log - A separate total for each week, with the log beginning time being the Reset Time and Day of Week.

Monthly Log - A separate total for each month, with the log beginning time being the Reset Time and Month.

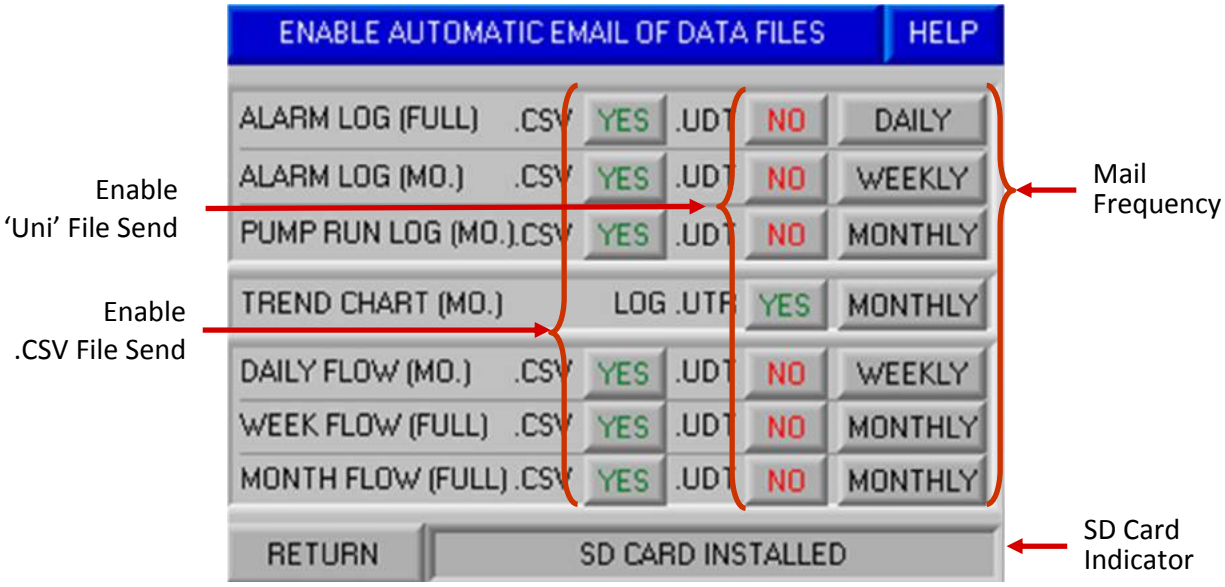
Reset Time - Set the time of the day that the log will write a new line.

Enable Log - Set the day of the week that the log will write a new line.

Reset Total - Set the day of the month that the log will write a new line.

Reset - Reset the total gallons on the Main Dashboard and calculated Flow Summary page.

Communication - Email File Automation



Overview

With the optional Ethernet port and SD memory card installed, the PUMP Vision PV600 can data log alarms, run times and durations, process variables (trend chart), and flow totals. These files can be sent automatically to the recipients on the email list at regular intervals.

To set up email file sending, the following steps must be completed.

1. Establish connection to email service provider by sending a test email. ESP connection can be verified in the TEST EMAIL screen.
2. Enable data logging for each of the file types that are to be sent. This is done in the SD DATA LOG SETUP screen. It is possible to enable the automatic sending of a file that has not been created. This will result in an email being sent with a failed file attachment.
3. Enable file sending for each file type that is to be sent with the Enable buttons on this screen.
4. Set the frequency for sending the file with the Mail Frequency buttons
5. Enable 'Files' for each recipient on the email address list in the EMAIL ADDRESS LIST screen.

A separate email is required for each file type, and for each recipient on the list, and each file may take some time. The batch of files to be sent are processed daily at 0300 to limit the possibility that the controller is busy sending a file when an alarm message is needed, as any current email job must be completed before a new one can begin.

The PV600 gives alarm messages priority over file sending and holds the file queue until all the alarm message queue is empty.

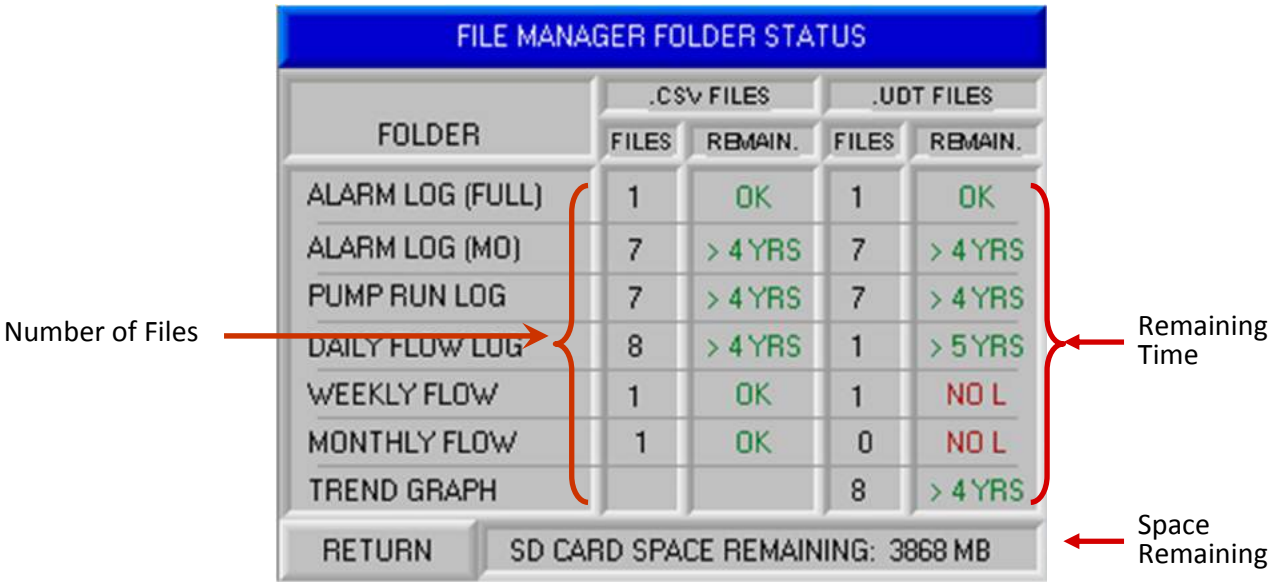
Enable 'Uni' File Send - Touch these buttons to toggle between YES and NO. When enabled, the .UDT or .UTR files will be sent. These file types are handled with the SD Card Suite software available online.

Enable .CSV File Send - Touch these buttons to toggle between YES and NO. When enabled, the ..CSV files will be sent. These file types are typically handled with a spreadsheet program such as MS Excel.

Mail Frequency - Touch these buttons to scroll though the available choices; DAILY, WEEKLY, or MONTHLY. Keep in mind that some of the files will only be logged to once a month, giving no reason to send the file more frequently.

SD Card Indicator - This message bar shows that the SD card is installed an ready in the PV600.

Data Log Configuration - SD Card Folder Status



Overview

This screen allows the user to view the status of all the data log folder that are enabled by system configuration. Each folder can hold 63 months of files. As the folders start to become full, warning messages will appear on the Main Dashboard, Alarm Log, Alarm Handler, and will be emailed if the system is configured for email. A warning is generated when any log reaches three months of remaining file space, again at two months, one month and at 'full'. A warning is also generated if the remaining space on the SD card is less than 10MB.

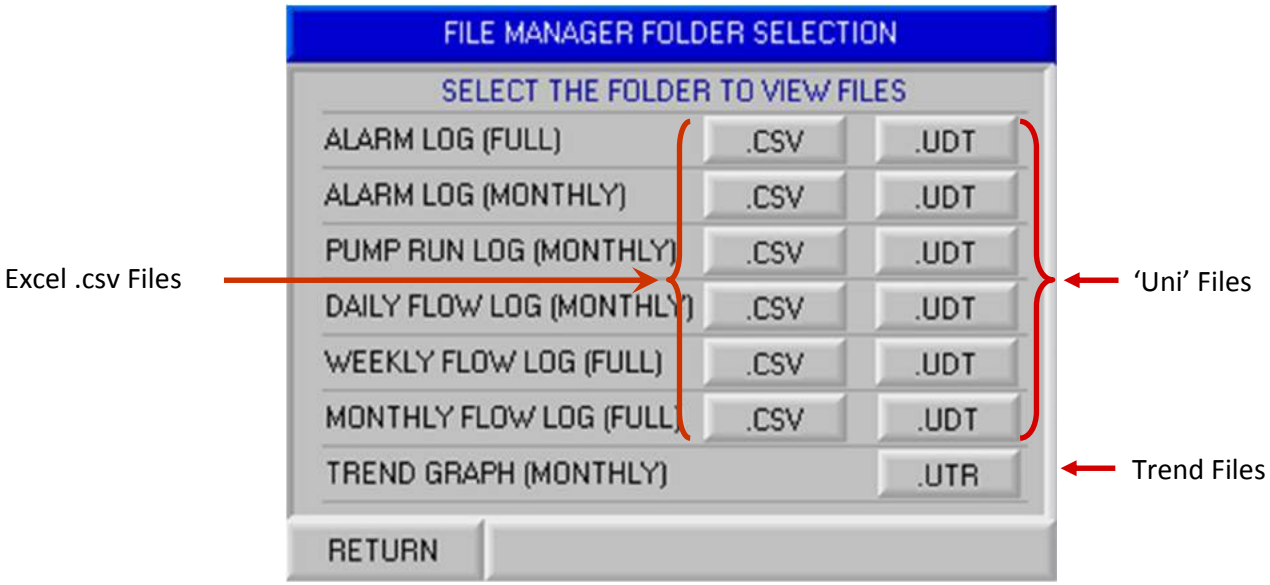
To deal with an SD card that is full, either delete previous files or install a new SD card. Old files can be deleted with the SD card in the PUMP Vision controller, or by removing the card and using a PC to manage the files. On systems configured for email, the old files can be emailed for retention prior to deletion.

Number of Files - The number of files in each folder type is displayed. For the Alarm Log, and the Weekly and Monthly Flow Logs, there is only one possible file in the folder. In folders where data logging has not been enabled and no file exists, a 'No Log' message is indicated instead of a number of files.

Remaining Time - The remaining time each folder type is displayed. For the Alarm Log, and the Weekly and Monthly Flow Logs, there is only one possible file in the folder, so there is no chance of reaching the 63 file limit and the only data logging limitation is total card space. In folders where data logging has not been enabled and no file exists, a 'No Log' message is indicated instead of remaining time.

Space Remaining - The total number of megabytes of memory remaining in the PUMP Vision SD card is displayed.

Data Log Configuration - File Manager Folder Selection



Overview

This screen allows the user to access the data logging and trend file folders which have been saved to the SD card. Each log is type is stored in a separate file folder to help with file management, with the exception that all the weekly and monthly flow logs are both the same folder.

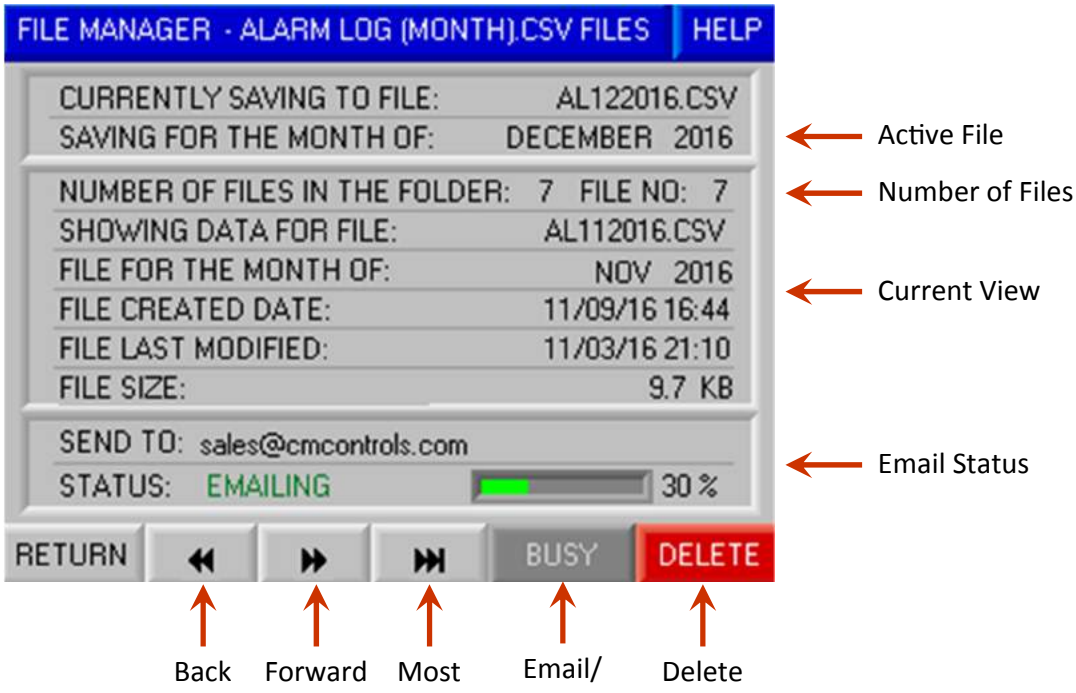
Touch any button to be taken to that trend or data log's SD Card File Manager screen.

Trend File - Touch this button to open the folder where the trend history files are stored.

Data Table Folders - Touch these buttons to open the folders where the Data Table Format files are stored.

CSV Files - Touch these buttons to open the folders where the Excel .csv files are stored. Comma separate value files can be viewed in most spreadsheet programs.

SD Card File Manager



Overview

The SD Card File Manager screen allows the user to scroll through and view the files in the trend and log file folders to view the file information and manually email or delete the file.

Active File - This is the name of the file to which data is currently being saved. If the log is not enabled in the Save to SD Card screen, this will read 'NOT SAVING'.

Current View - This is the name of the file currently being displayed.

Number of Files - The total number of files in the folder is displayed. When the folder is first entered, the most recent file is displayed and it's number is the last number in the folder. As the file scroll buttons are touched, the file number increments or decrements.

The other data displayed in the Current View are the file's creation date and time, as well as the file size.

Back - Touch this button to view to the previous month's file. If no file exists for the month being request, 'FILES DOES NOT EXIST IS DISPLAYED'.

Forward - Touch this button to view to the following month's file. If no file exists for the month being request, 'FILES DOES NOT EXIST IS DISPLAYED'.

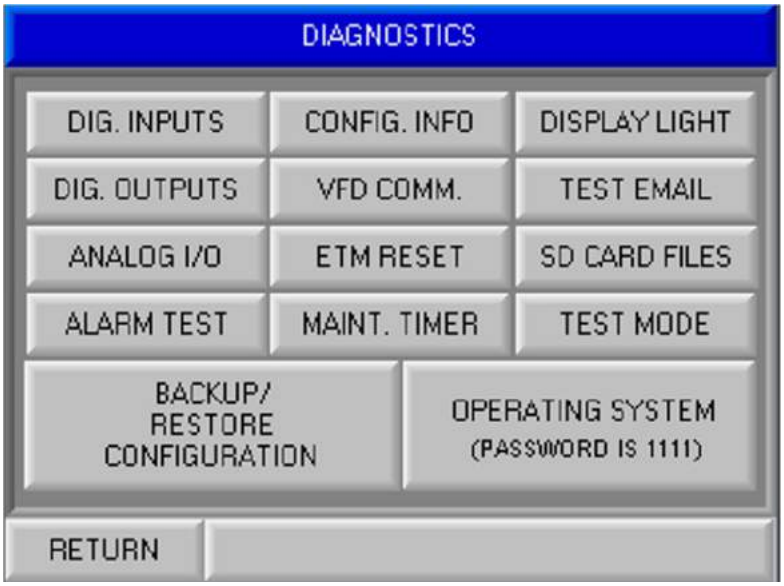
Most Recent - Touch this button to advance to the most recently month's file.

Delete - Touch this button to delete the currently displayed file. Enter the clear log password, 1234, when prompted. **Caution: this will permanently delete the file from the SD card.**

Email/Busy - Touch this button when Email is display to send the currently displayed file the enabled recipients on the email list.

Email Status - This area shows the file email progress and will show the port countdown timer when active.

Diagnostic Menu



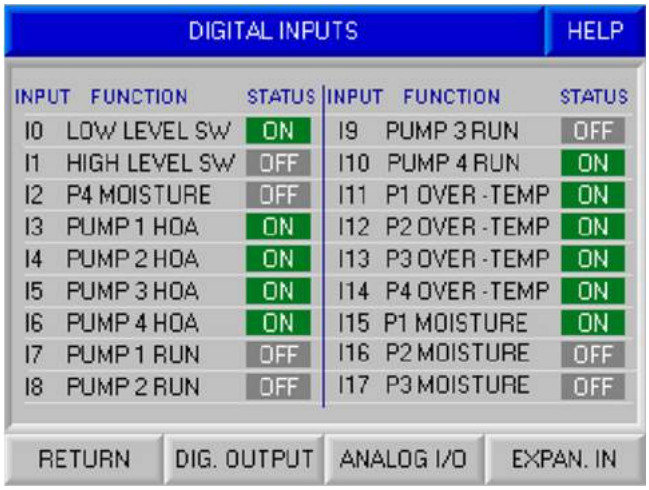
Overview

The Diagnostic Menu displays the following options when the optional Ethernet card is installed.

MENU ITEM	ACCESS LEVEL	FUNCTION
DIGITAL INPUTS	1	Monitor digital inputs, base and expansion
DIGITAL OUTPUTS	1	Monitor digital outputs
ANALOG I/O	1	Monitor analog sensor inputs and VFD speed outputs
ALARM TEST	1	Live test the alarm functions
CONFIGURATION INFO	1	Overview of the PV600 configuration
VFD/MV COMMUNICATION	1	Monitor status of Modbus communication to VFD/MV
ETM RESET		Reset the start counters and pump run time meters
MAINTENANCE TIMERS	1	Setup pump maintenance alert timers
DISPLAY LIGHT	1	Setup backlight brightness and screen saver time out
TEST EMAIL	2	Send test emails out
SD CARD FILES	1	Check status of configuration SD card backup file
TEST MODE	2	Run complete system test
OPERATING SYSTEM		Enter the PV600 operating system
BACKUP/RESTORE CONFIG	2	Backup and restore the PV600 configuration

Diagnostic - Digital Input Monitor

Base Inputs



Digital Input Monitor - Diagnostic Screen

This screen shows the status of the digital inputs. If the input has power to it, the status indicator will read ON.

Only I/O that are configured in the system will be displayed, and the labels will change as needed for the system configuration, or when displaying the expansion input module.

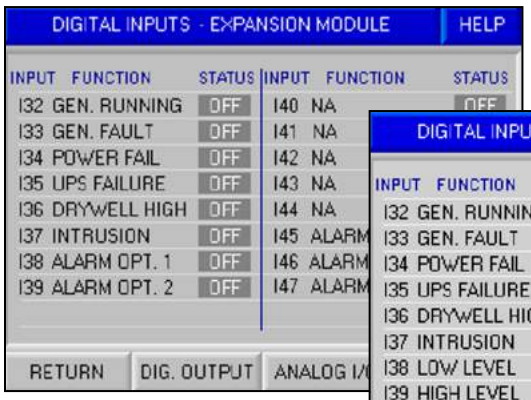
Touch these menu bar buttons to access monitors for:

- Expansion digital inputs
- Digital outputs
- Analog inputs and outputs

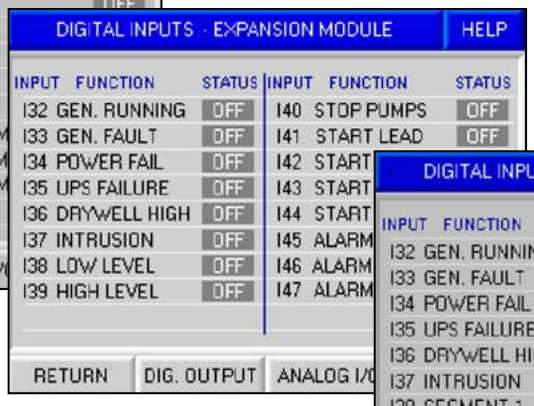
Expansion Digital Inputs

When the PV600 is configured for float switch or multi-segment probe control, or when some optional inputs are needed for station monitoring functions, an expansion input module can be connected to the controller. The I/O monitor shows the status of the expansion I/O and shows the functions of the inputs in three possible configuration modes.

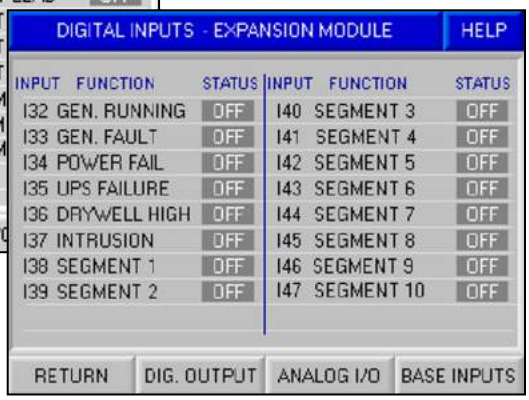
Without Float Switches or Multi-segment Probe



With Float Switches

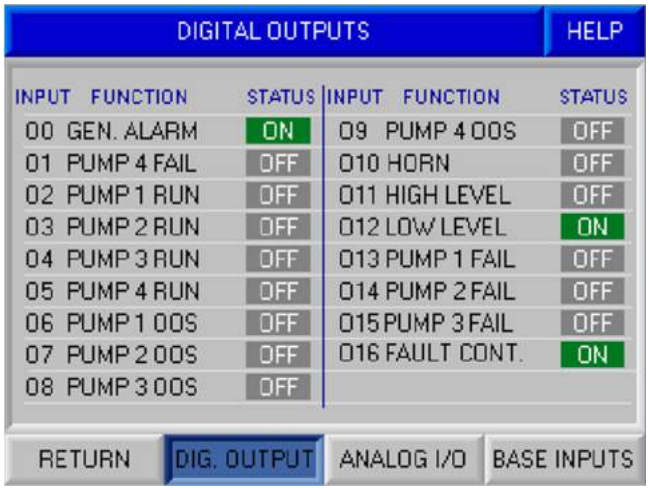


Multi-segment Probe



Diagnostic - Digital Output Monitor

Digital Outputs



Digital Output Monitor - Diagnostic Screen

This screen shows the status of the digital outputs. If the output is showing on, the output contact should be closed.

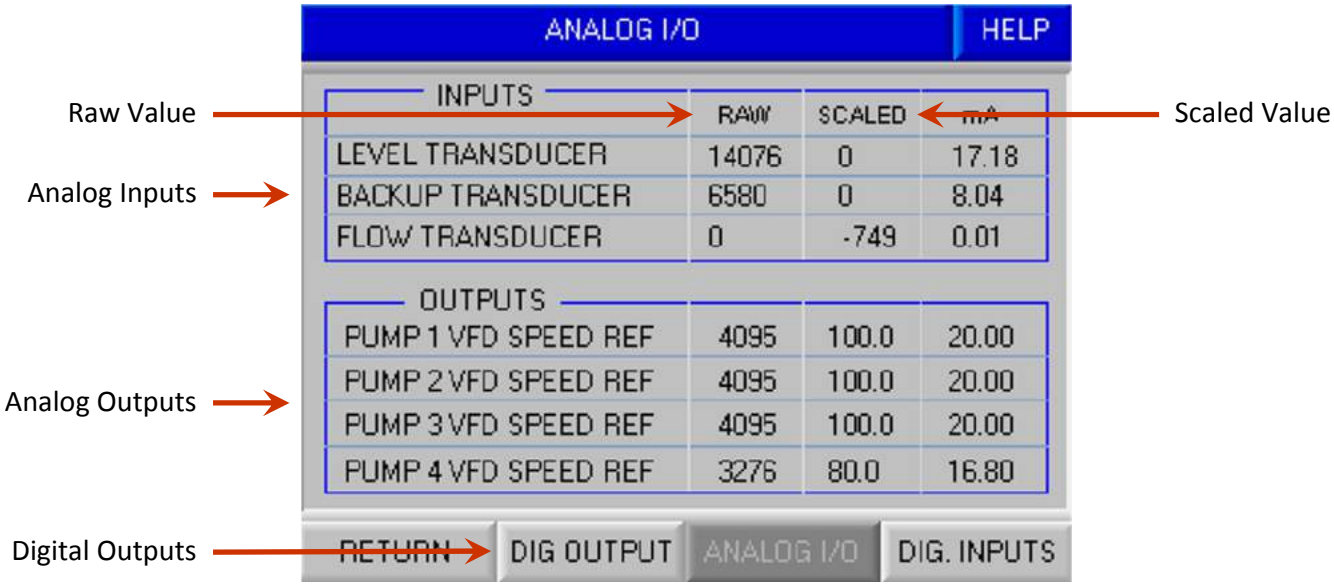
Only I/O that are configured in the system will be displayed, and the labels will change as needed for the system configuration, or when displaying the expansion output module.

← Touch these menu bar buttons to access monitors for:

Digital Inputs

Analog inputs and outputs

Diagnostic - Analog I/O Monitor



Overview

Analog Input and Output Monitor - Diagnostic Screen

The analog I/O monitor provides a view of the controller's handling of the analog to digital and digital to analog conversions.

Raw Value - The raw value is the digital value that will be converted to mA.

Scaled Value - The scaled value is the engineering units that have been set up in the transducer configuration screens.

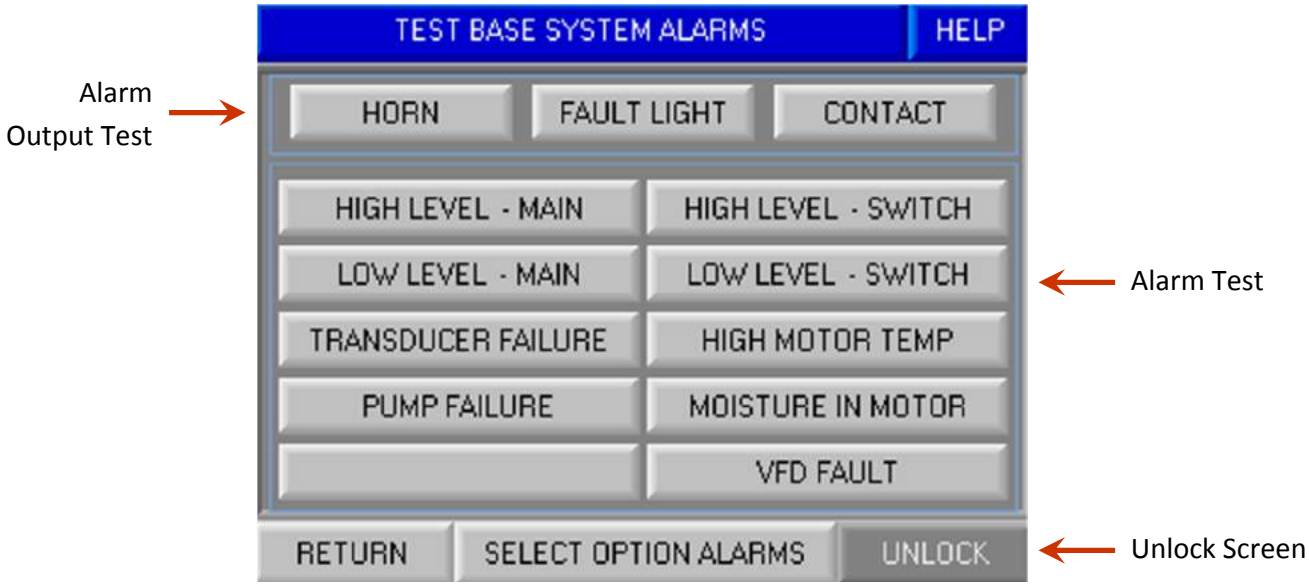
Analog Inputs - The inputs are 14 bit, so the raw range is 3273-16383 = 4-20 mA.

Analog Outputs - The outputs are 12 bit so the raw range is 0-4095 = 4-20 mA.

Only I/O that are configured in the system will be displayed, and the outputs will only be displayed if the starters are set as "VFD - Hardwired".

Digital Outputs/Digital Inputs - Touch these buttons to access the DIGITAL OUTPUTS and DIGITAL INPUTS monitor screens.

Diagnostic - Alarm Test



Overview

The Alarm Test screen can be access either from the Main Dashboard, or from the Diagnostic Menu.

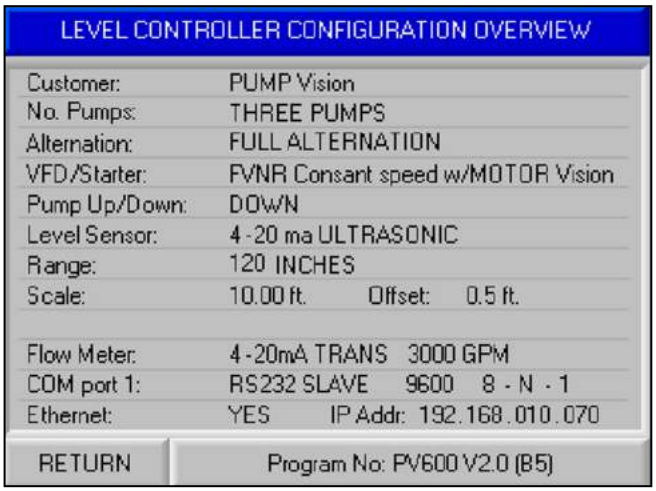
Alarm Output Test - Testing the alarm outputs is possible without entering a password. Touch and hold any of these buttons to activate the output contact for the function selected. Release the button to end the test.

Alarm Test - Once the screen is unlocked, each alarm function can be individually tested by touching the button for the function to be tested. The alarm is logged into the alarm log, SD card, and alarm handler. The test will also cause the alarm to process as configured in the alarm setup screen, with pump shutdowns, emails, horns, lights, etc. Note that the horn will only sound for a moment because it is instantly silenced.

Unlock Screen - Testing the alarm functions is possible only when the screen is unlocked by touching here and entering the password.

Diagnostic - Configuration Info

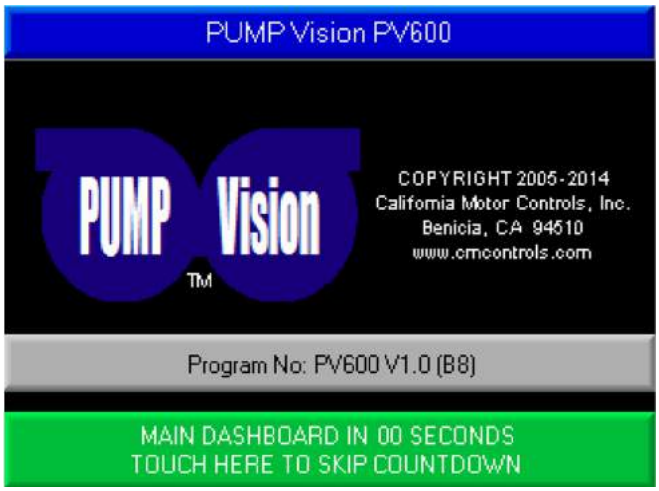
Configuration



Overview

This screen gives an overview of the configuration of the controller. The information on this page can be a tool used to understand the operation of the system and is necessary for technical support from CMC.

This information screen can also be accessed by touching the MAIN DASHBOARD label on the Main Dashboard, then touching the program number bar.



PUMP Vision Information Screen

This screen is displayed automatically for 10 seconds when the PUMP Vision is booting up. It can be bypassed by touching the bypass button.

This screen can be accessed by touching the MAIN DASHBOARD label on the Main Dashboard, then touching the program number bar.

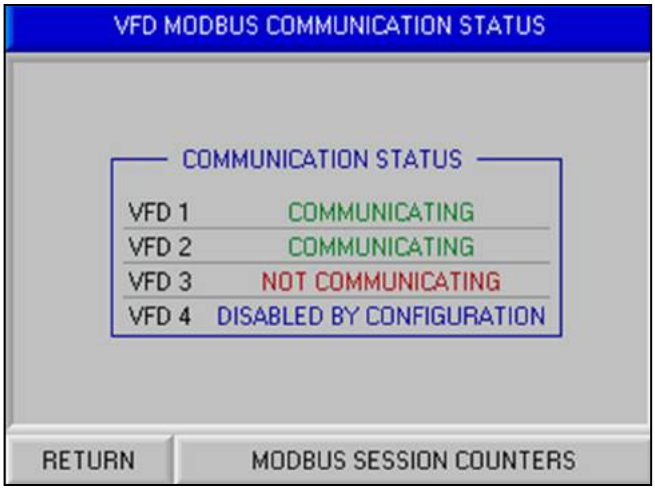
Program No. Label

Touch the Program. No. Label to access the Configuration Info screen.

Countdown Bypass

Touch the green countdown label to bypass the 10 second countdown timer and go to the Main Dashboard screen.

Diagnostic - VFD/MV/RVSS Modbus Communication Monitor



Overview

This screen shows the communication status between the Modbus connected VFD, RVSS, or MV starter and the controller.

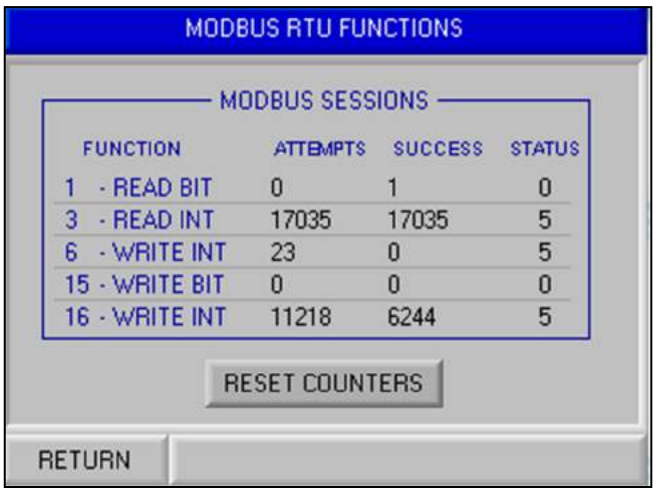
The bottom of the screen has a button where the user can reset the counters.

← Touch to access the Modbus Sessions Counters screen.

Modbus Sessions Counters

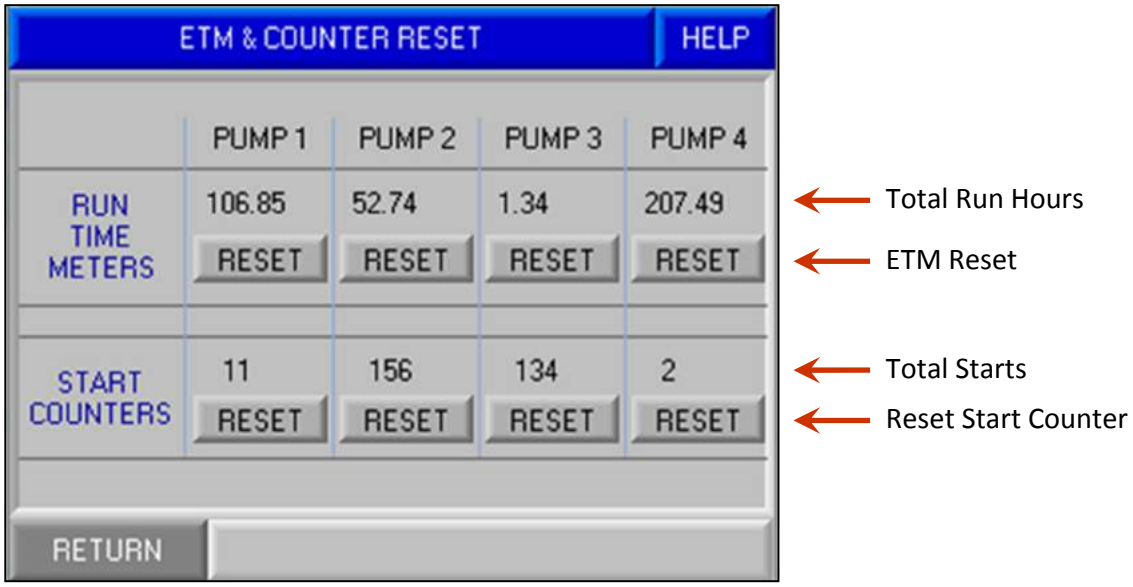
Overview

This screen shows the communication status of separate Modbus session types. The VFDs connected will determine the sessions types used in a given application and not all session types will be used.



The data on this screen can be used to help diagnose Modbus communication failure causes.

Diagnostic - ETM and Start Counter Reset



Overview

This screen allows the user to zero the pump elapsed time meters and start counters. It is accessed from the Diagnostic Menu and requires a Level 2 password to prevent unauthorized reset of the registers.

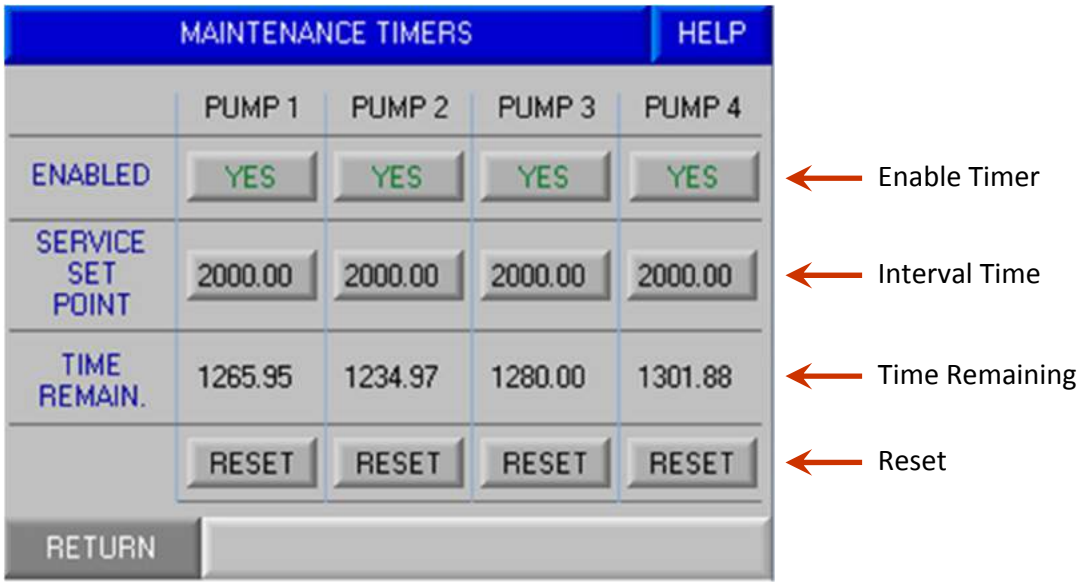
Total Run Hours - The pump ETM hours.

ETM Reset - Touch this button to reset the pump's elapsed time meter. A separate reset button is provided and visible for each pump that is configured in the system.

Total Starts - The total number of times the pump starter has energized.

Reset Start Counter - Touch this button to reset the pump's start counter. A separate reset button is provided and visible for each pump that is configured in the system.

Diagnostic - Maintenance Timers



Overview

The PV600 can be set up to monitor the pump run time and announce when it is time to perform preventative maintenance on the pump. When the timers count down to zero, the pump status indicators will begin flashing red and the pump status nameplate will read “maint. due”. When the maintenance due condition activates, an email notification will also go out to the email recipient list, if the email function is enabled.

Enable Timer - Enable the function by touching the button for each pump. The function is not enabled by factory default.

Interval Time - Enter the pump manufacturer’s service interval here. The maximum number of hours that can be entered is 99,999.99.

Time Remaining - The time remaining is displayed here.

Reset - To load the preset Interval Time into the time remaining, touch the reset buttons. This will also acknowledge the alarm.

Diagnostic - Display Backlight and Screen Saver

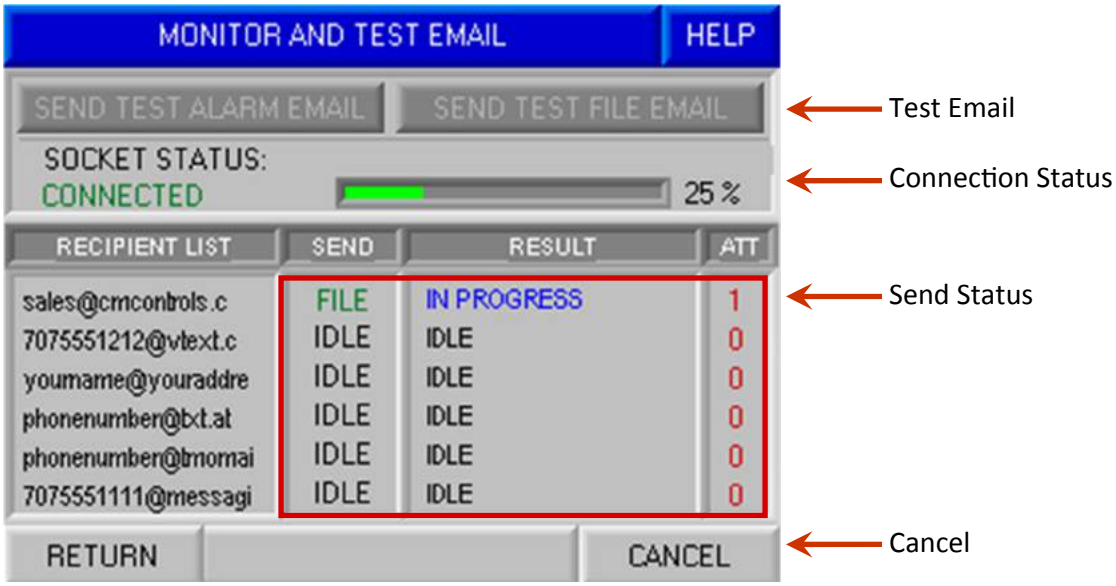
Overview

Back Light Intensity - The intensity of the back light can be adjusted by entering the percentage of illumination here.

Screen Saver - Touch here to enable/disable the screen saver function. The LCD screen of the PV600 is backlit with a light that can be turned off to increase screen life.

Delay Timer - Enter the amount of time of inactivity until screen saver activates.

Diagnostic - Monitor and Test Email



Overview

The Monitor and Test Email screen gives a view of the PUMP Vision's email processor and provides buttons to send test emails to the email recipients enabled in the EMAIL ADDRESS screen.

Test the Email Function - Touch this button to begin test. The buttons are disabled when the email function is active.

Connection Status - This indicator provides the status of the connection to the email service provider. The status will show the following:

NOT CONNECTED = Waiting for email task
CONNECTING = Attempting to connect to the server
CONNECTED = Connection and authentication successful

The status of the PV600 email reconnection delay timer will be displayed here when the timer is active.

Send Status - Once the test button has been touched, the PV600 will scan through the email address list and send an email to all enabled addresses. The Send Status area has three columns.

SEND - Shows whether the email is an alarm or a file email.

RESULT—The send status indicators will show the following:

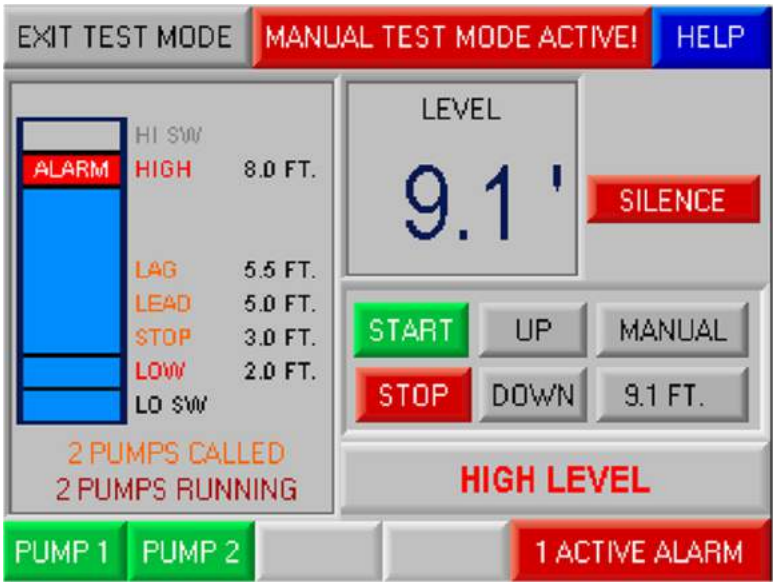
IDLE = Email process inactive
IN PROGRESS = Attempting to send email
SUCCESS = Send email successful
CONNECT FAILURE = Undetermined connection failure
FAIL: (failure condition) = Specific failure condition detected (eg "FAIL: Password no-authen.")

ATT - Shows the number of connection attempts in the process of sending the email

Once the PV600 has finished sending the first email, it continues to the next email address on the list. If the PV600 encounters a failure with sending an email, it will continue to the next email on the list after a failure delay timer has lapsed.

Cancel - The email test function can be cancelled at any time during the process by touching the cancel button.

Diagnostic - Level Control Test Mode



Overview

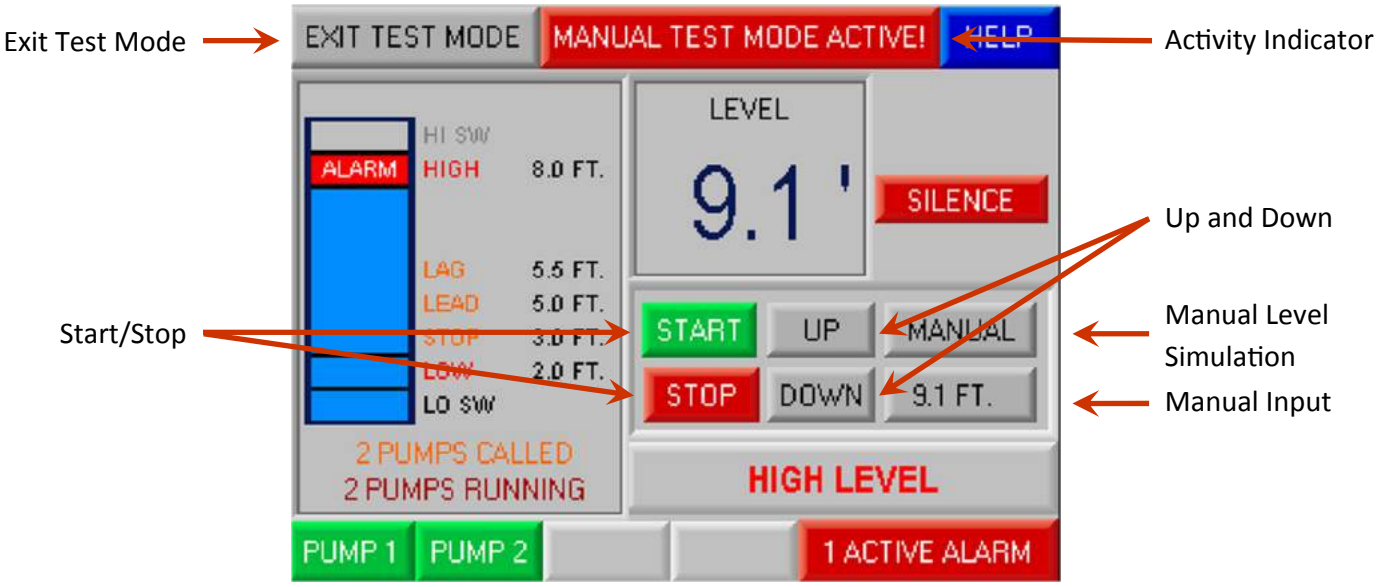
Manual Test Mode - The PV600 level controller can provide a simulated liquid level to fully test all functions of the control system strategy. When placed into the manual test mode, the simulated level will allow verification that the pumps properly run when called and that all alarm functions operate as intended.

The test mode screen is similar to the main dashboard and provides many of the same status displays including level display, level status area, pump status, and alarms status.

CAUTION: only activate the manual test mode if all equipment is ready for operation. This includes making the control system electrically safe for operation and ensuring that the pumps are either ready for operation, or are locked out by disconnection from power (this will cause pump failure alarms).

Note: the test mode will automatically terminate after 2 minutes if the screen is not touched. This prevents an operator from leaving a system in test mode instead of returning it to normal operation.

Diagnostic - Level Control Test Mode



Activity Indicator - Indicates when the test mode is on.

Up and Down Buttons - Touch these buttons to manually adjust the level up or down by 0.1 ft. per touch. Hold the buttons for a 0.1 ft./sec automatic pulse.

Start/Stop - To activate the test mode, touch the start and stop pushbuttons.

Manual Level Simulation - When the system is set to manual by touching this button, the simulated level is manually entered by the user either by touching the up and down buttons or by direct entry. Whichever method is used, the level is held until a new level is entered.

Manual Level Input - Touching here will access the direct entry keypad.

Auto Level Simulation - When the system is set to auto by touching this button, the level automatically rises and falls between the full scale of the sensor at a rate of 0.1 ft./0.5 sec. Additionally, the user can influence direction of simulation by touching the up and down buttons.

Up and Down Buttons - Touch these to manually set the direction of the auto level simulation.

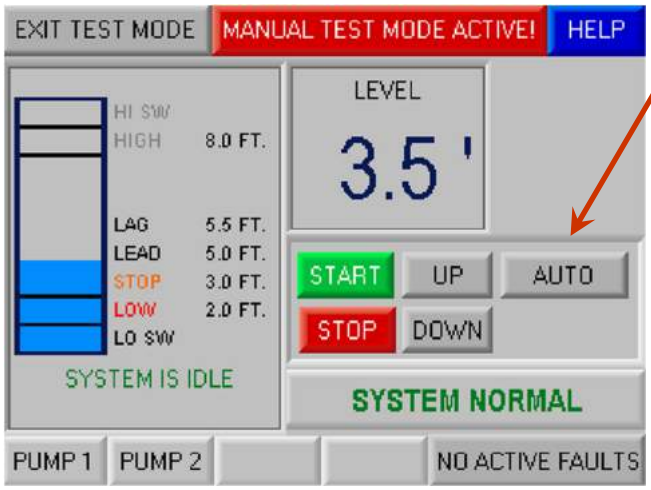
Simulation mode is designed to simulate a properly running system by starting and stopping one pump. It is not designed for any normal test function.

When the system is set to simulate by touching this button, the level automatically rises and falls between the lead pump start set point and the pump start set points.

Note: when in the simulate mode, the test mode screen can be exited to the main dashboard without turning the simulate function off. The system will stay in the simulate mode for two hours before automatically returning to normal operation. A warning screen provides an exit alert.

Diagnostic - Level Control Test Mode

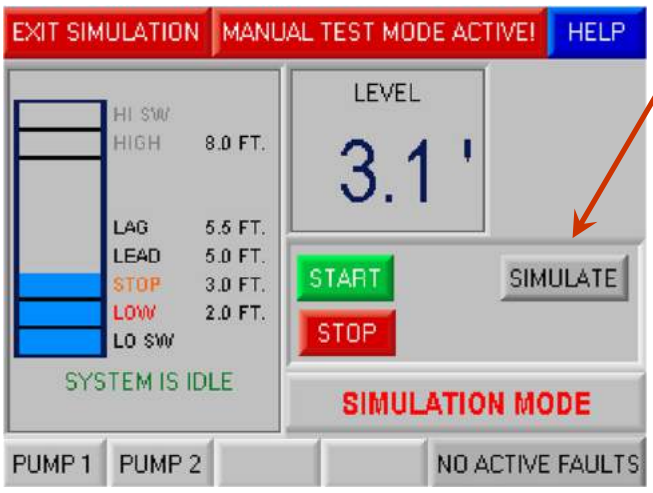
Auto Level Simulation



Auto Level Simulation - When the system is set to auto by touching this button, the level automatically rises and falls between the full scale of the sensor at a rate of 0.1 ft./0.5 sec. Additionally, the user can influence direction of simulation by touching the up and down buttons.

Up and Down Buttons - Touch these to manually set the direction of the auto level simulation.

Simulation Mode

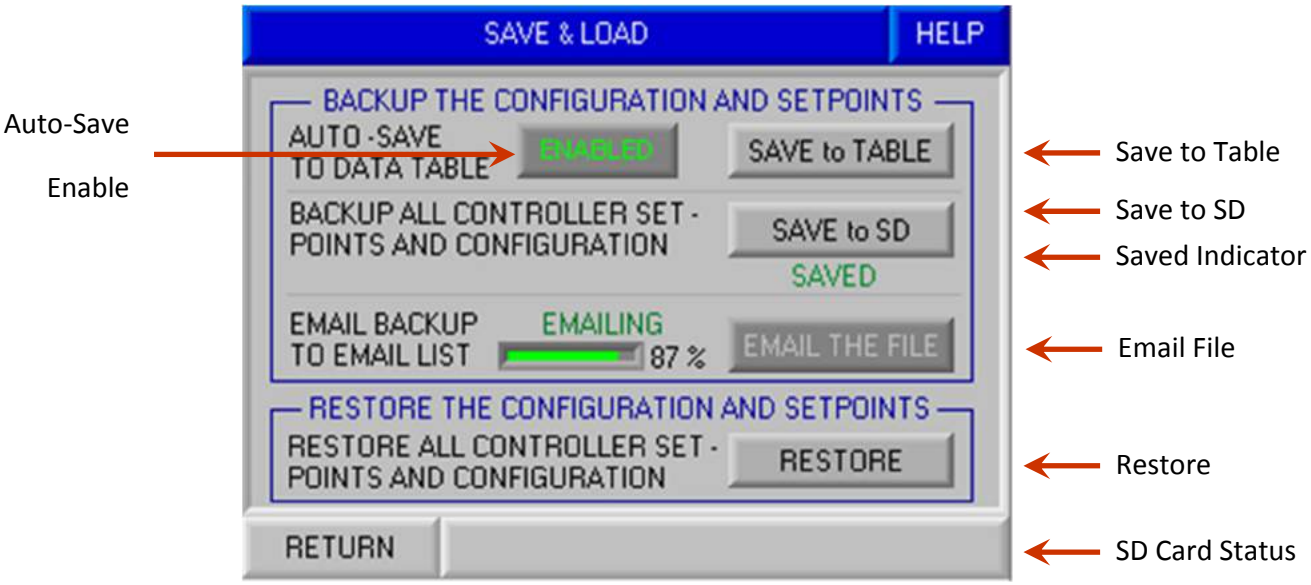


Simulation Mode is designed to simulate a properly running system by starting and stopping one pump. It is not designed for any normal test function.

When the system is set to simulate by touching this button, the level automatically rises and falls between the lead pump start set point and the pump stop set point.

Note: when in the simulate mode, the test mode screen can be exited to the main dashboard without turning the simulate function off. The system will stay in the simulate mode for two hours before automatically returning to normal operation. A warning screen provides an exit alert.

Diagnostic - Backup and Restore



Backup & Restore Configuration and Set Points

The PV600 can save the entire system configuration and all of the user set points to internal flash memory, called the data table, and also to a removable SD memory card. When the system configuration is backed up to an SD memory card, the configuration can be restored into a new or duplicate controller. This makes replacement of a controller very simple and eliminates the possibility of user error in setting it up. Saving the configuration to the flash memory is important too, as is provides protection against a failed controller battery, though not a failed controller.

Save to SD - Touch here to save the system configuration and set points to the SD memory card. This button is disabled if an SD card is not present in the PV600.

Saved Indicator - When the configuration has been completely saved, saved will be indicated here.

Auto Save Enable - Toggle the automatic flash RAM backup function by touching here. The PV600 will automatically back up the configuration to the internal flash RAM when exiting the configuration screens if the controller is set for automatic backup.

Save to Table - Touch here to manually save the set points to the Flash RAM memory.

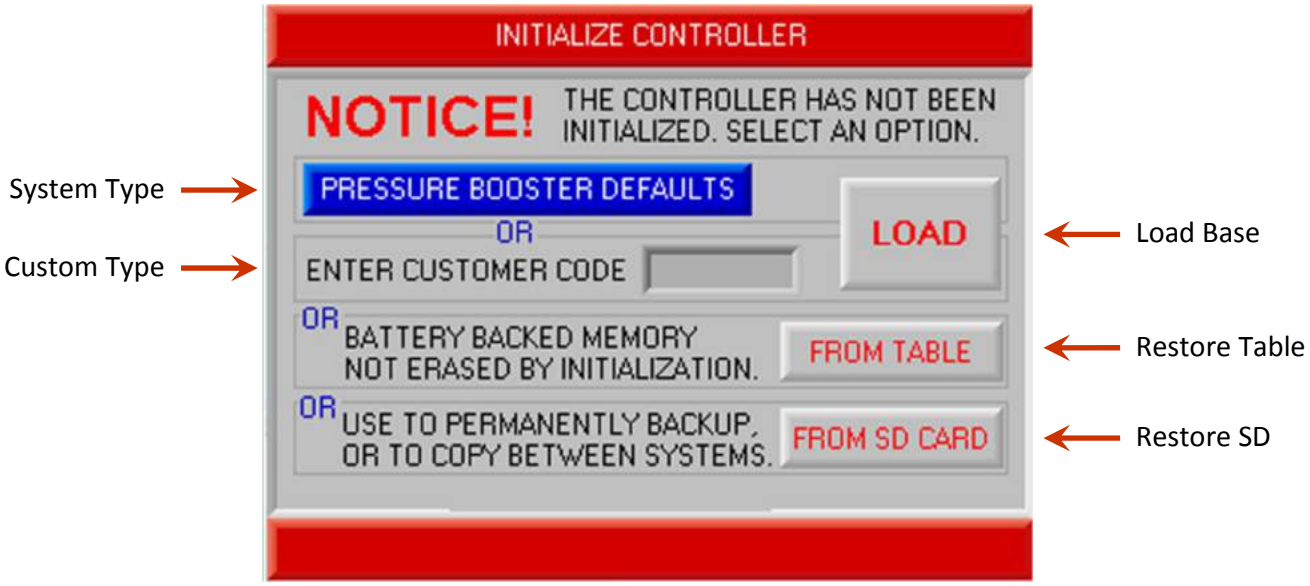
Email File - Touch here to manually send the configuration file to the recipients enabled on the EMAIL ADDRESS screen. The file can then be saved on a computer for use if necessary to restore a damaged controller. This option is only available on systems configured for email file sending.

Restore - Touch here to restore a controller from either the flash RAM memory or from an SD card. The PV600 will reboot and the Initialize Controller screen will be displayed. **Warning: proceeding with the restore function will erase the existing configuration.**

SD Card Status - Touch here to access the SD Card Status screen.

A properly formatted SD memory card is available from www.cmcontrols.com. When a properly formatted card is inserted into the back of the controller, this option becomes available.

Diagnostic - Backup and Restore - Initialization Screen



Overview

The PV600 must be 'initialized' whenever it has been factory reset, or when the RESTORE button has been touched on the Backup and Restore screen. The controller will also need to be re-initialized if ever the backup battery has failed and the controller subsequently loses power. When initialization is required, this screen will appear when the controller boots up. A choice must be made between the three options described below.

To boot with a factory default:

System Type - Touch this button to scroll through the three system types:

Booster Pump
Level Control
Well Pump

Custom Type - Touch this button to enter your customer code.

Load Base - Touch this button to load the factory default configuration for the system selected.

To boot from the Flash RAM

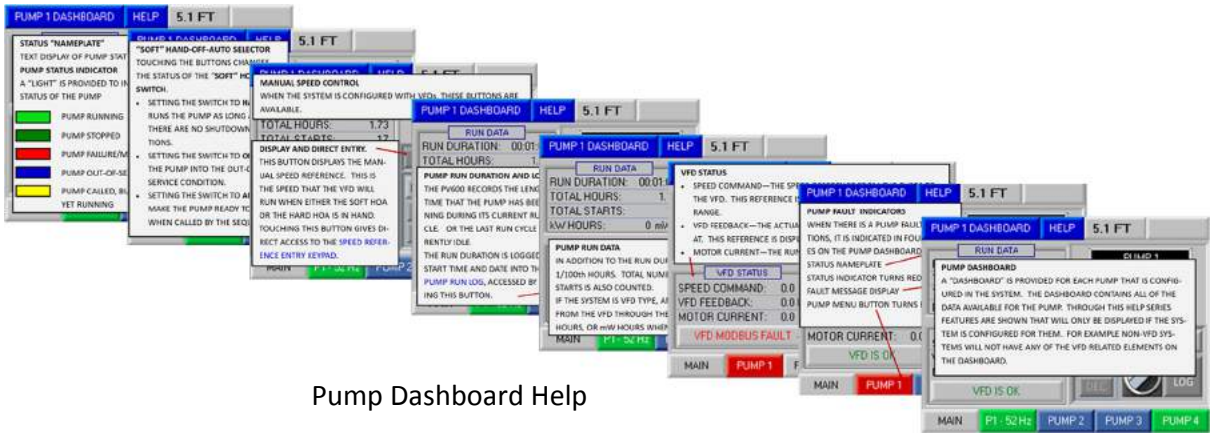
Restore Table - Load all configuration and set point data from the internal Flash RAM memory.

To restore from the SD Card

Restore SD - Load all configuration and set point data from the SD memory card.

Once a choice has been made by touching one of the three load buttons, the controller will countdown three seconds, then reboot with the new configuration to the PUMP Vision Information Screen.

Diagnostic - Help Screens



Pump Dashboard Help

Overview

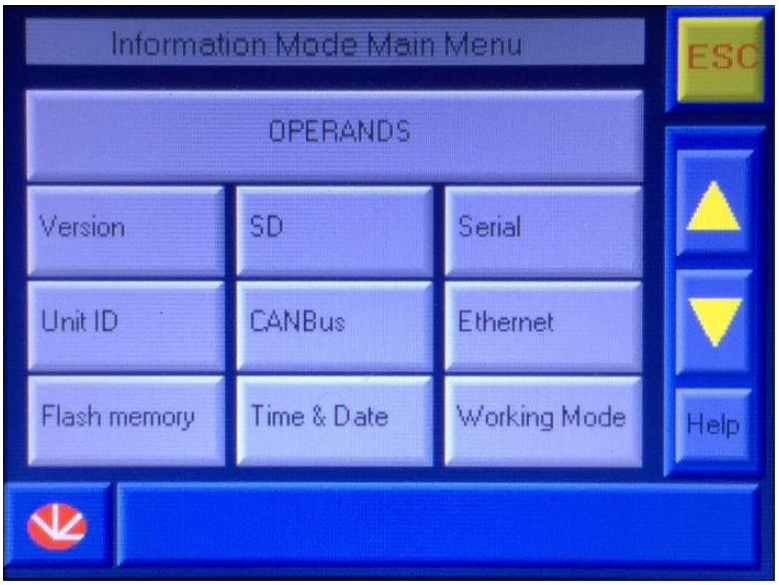
Help screens are available on most PV600 screens, except for rudimentary screens such as menus and message screens.

To access the help screens for a topic, touch the HELP button in the Status Bar of the desired screen. The help topic for that screen will be displayed. The help screens are all .jpg images and have no “live” buttons. So help topics have more than one screen of help information.

To page through the pages of the help topic, simply touch the screen anywhere and the next page of the topic will be displayed. When there are no more pages to the topic, the display will return to the application screen.

Once the help topic has been entered, all pages must be scrolled though to exit the help topic.

Diagnostic - Information Mode



Overview

The Information Mode accesses some of the PV600's operation system. Most functions in this menu are not intended for the user and are reserved for certified technicians. Within this menu it is possible to make changes that will require re-initialization of the controller.

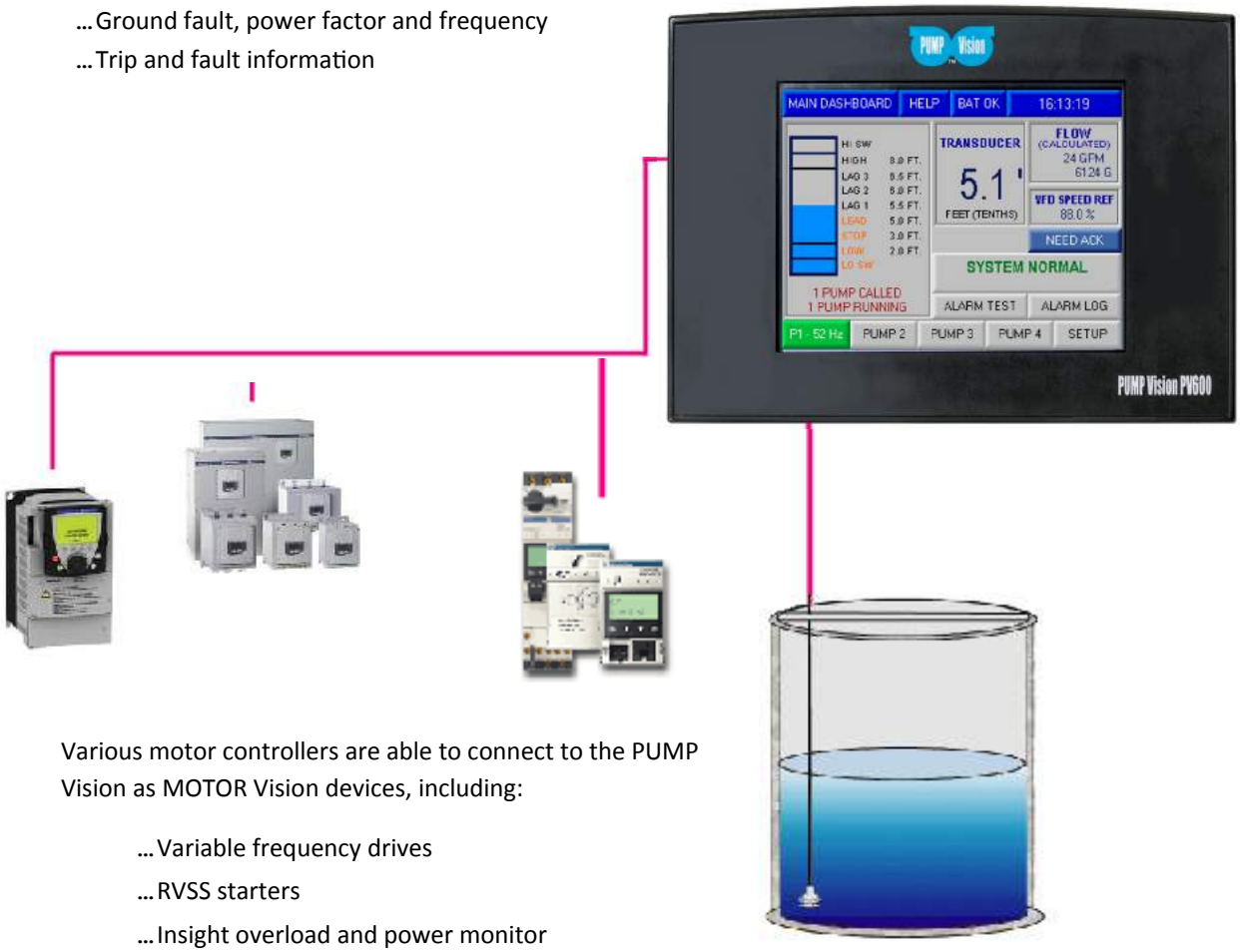
MENU ITEM	ACCESS LEVEL	FUNCTION
OPERANDS	1111	Access to view and edit all system registers and timers
VERSION	1111	O/S version information
UNIT ID	1111	This unit's ID on a CANBus system
FLASH MEMORY	1111	Load and monitor RAM application memory to FLASH RAM.
SD	1111	Unavailable for Copyright reasons
CANBus		Monitor CANBus network traffic
TIME & DATE	1111	Set the system time and date
SERIAL	1111	Monitor serial network traffic
ETHERNET	1111	Monitor Ethernet network traffic and set IP address
WORKING MODE	1111	Stop, Run, Reboot, Initialize the controller

The MOTOR Vision System

The PUMP Vision PV600 can communicate with smart motor starters via a Modbus connection that enables the PUMP Vision to display a variety of important pump and motor information.

Depending on the type of MOTOR Vision starter that is connected, the PUMP Vision can display:

- …Current per phase, average and imbalance
- …Voltage per phase, average and imbalance
- …Ground fault, power factor and frequency
- …Trip and fault information

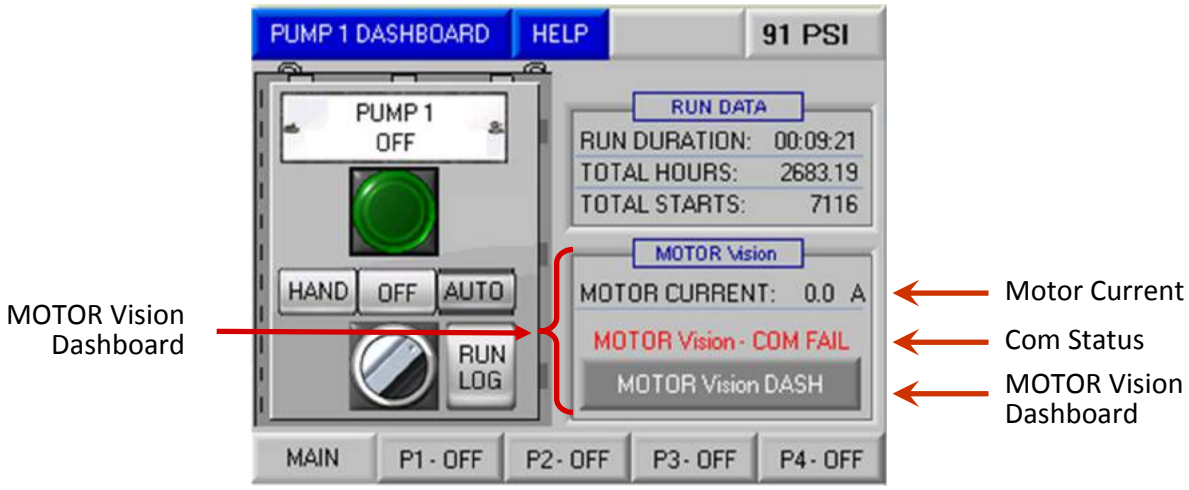


Various motor controllers are able to connect to the PUMP Vision as MOTOR Vision devices, including:

- …Variable frequency drives
- …RVSS starters
- …Insight overload and power monitor
- …U-Line integrated motor starter

MOTOR Vision

Pump Dashboard with MOTOR Vision enabled



Overview

When MOTOR Vision is enabled in the PV600, the Pump Dashboards will show the **MOTOR Vision Panel**.

Motor Current - The operating amperes of the pump motor.

Com Status - 'MOTOR Vision—NORMAL' when the Modbus communication from the PV600 to the MOTOR Vision motor starter is good. 'MOTOR Vision - COM FAIL' is displayed when the communications has failed.

MOTOR Vision Dashboard - Touch this button to access the MOTOR Vision Dashboard.

MOTOR Vision Starter Selection Options

When FVNR starters (constant speed pumps) are needed in the system, two options are available to enable MOTOR Vision in the PV600. The Schneider U-Line complete motor starter, which is good for pumps up to 20HP @ 480 volts, and the Eaton Insight overload relay, which can be used on any motor up to 400HP at 480 volts.

Below is a list of the data that is available, through Modbus, to the PV600 with each of the two options.

Schneider U-Line Motor Starter

Monitored by the U-Line

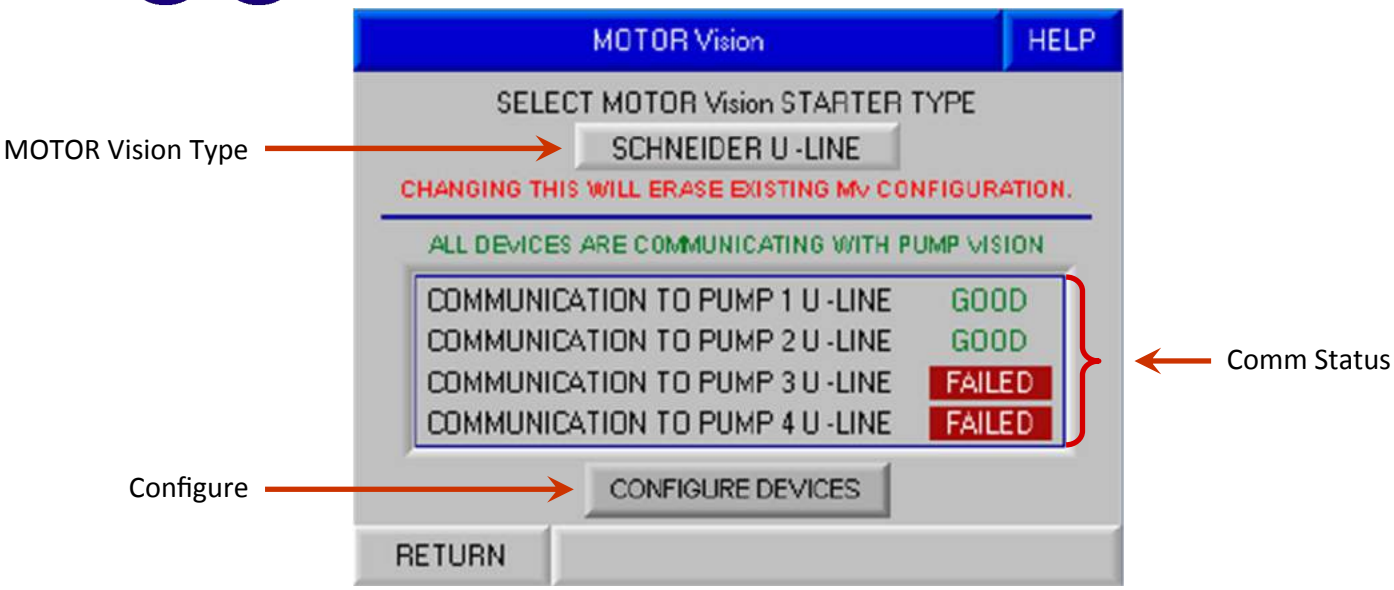
Thermal overload
Short-circuit
Ground fault
Low current (pump running dry)
Mechanical jam
Long start
Phase failure and reversal
Contactor failure
Amps per phase, average amps, and current imbalance

Eaton Insight Overload Relay

Monitored by the Insight

Thermal overload
Short-circuit
Ground fault
Low or high voltage
Low current (pump running dry)
Mechanical jam
Long start
Phase failure and reversal
Contactor failure
Amps per phase, average amps, and current imbalance
Volts per phase, average volts, and voltage imbalance

MOTOR Vision - Starter Selection



MOTOR Vision is enabled in the PV600 by selecting 'FVNR Constant speed w/MOTOR Vision' on the VFD/ Starter Type and Operation screen. Once that selection has been made, the MOTOR Vision setup button appears on the Configuration Menu. This is the screen that is access from that button.

On this screen, the type of MOTOR Vision starter that is connected must be selected. Touch the MOTOR Vision Type button to toggle between the two choices. The button has a safeguard built in to prevent accidental erasure of all MOTOR Vision set points as the two MOTOR Vision start types have incompatible configurations and must be erased when a change is made. A message is displayed that reads 'Change this will erase existing MV configuration', followed by 'Touch again within 10 seconds to confirm". To make the confirmation that the type is to be changed, the button must be touched again within the 10 seconds. If no changed is needed, do not touch the button again and the option will reset automatically.

MOTOR Vision Type - Touch this button to select between the Schneider U-Line and Eaton Insight starters.

Comm Status - This field will indicate the communication status of the starters. When the MOTOR Vision starters are properly configured for Modbus, COM port 1 is properly configured and matched to the MOTOR Vision starter, and the wiring is correct, the status will read 'GOOD'.

Pump 1 MOTOR Vision Starter - Modbus address 11
Pump 2 MOTOR Vision Starter - Modbus address 12
Pump 3 MOTOR Vision Starter - Modbus address 13
Pump 4 MOTOR Vision Starter - Modbus address 14

Configure - Touch this button to go to the MOTOR VISION - U-LINE OVERLOAD CONFIGURATION screen. If communication if failed to all MOTOR Vision starters configured in the system, this button is disabled.

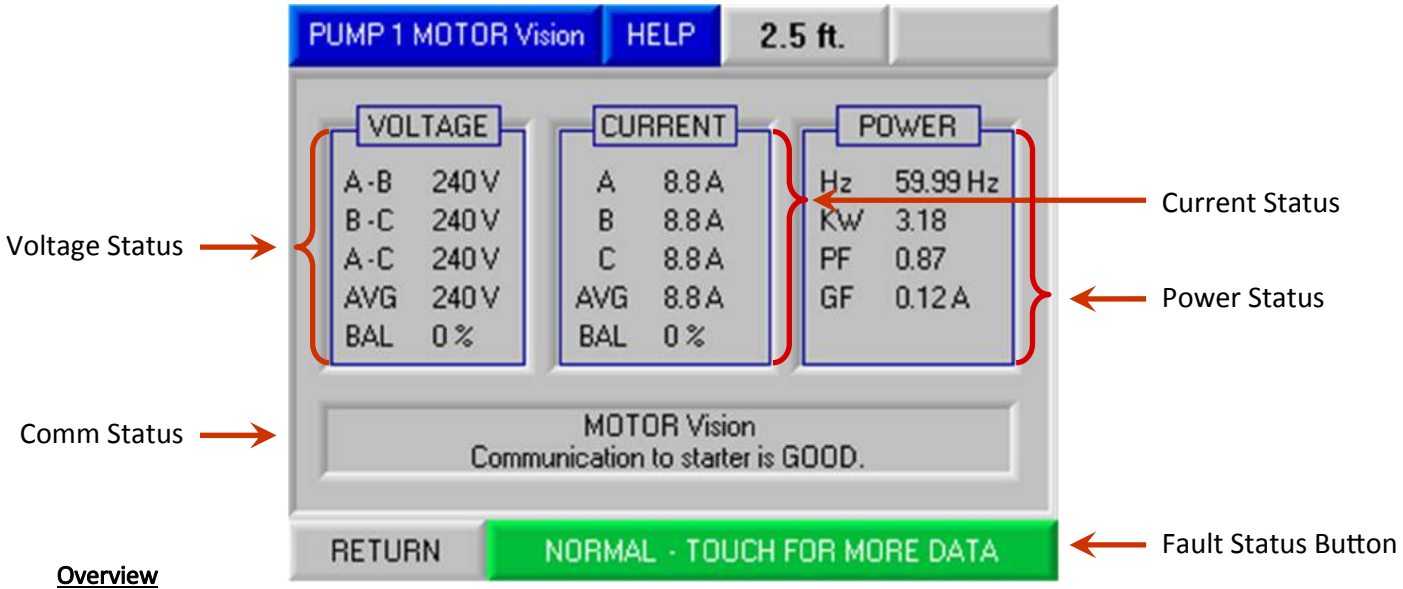
MOTOR Vision - Insight Dashboard

The PUMP Vision PV600 can be set to communicate with the Eaton Insight power monitor/overload relay via a Modbus connection that enables the PUMP Vision to display volts current, ground fault, power factor, and a variety of trip information.

Two monitoring screens are provided for each pump in the system that provide access to:

Current and voltage information

Trip and fault information



Overview

Voltage Status - Displays the voltage for each leg, including average and imbalance %.

Current Status - Displays the current for each leg, including average and imbalance %.

Power Status - Displays the power info for the pump, including frequency, total power, power factor, and ground fault.

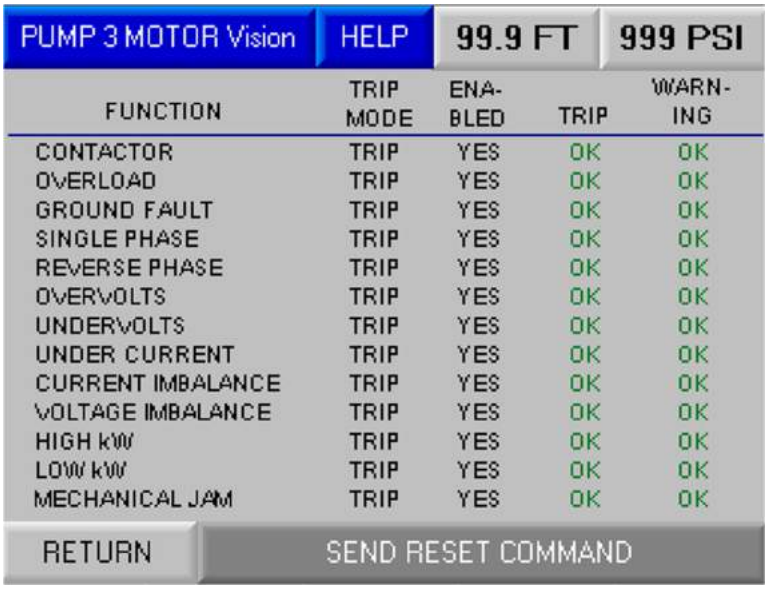
Communication Status - This field shows the communication status between the PV600 and the starter.

Fault Status Button - This field shows the fault status of the MOTOR Vision starter as:

NORMAL - Green
WARNING - Amber
FAULT - Red

Touch this button to access the MOTOR Vision Fault screen.

MOTOR Vision - Insight Fault Monitor



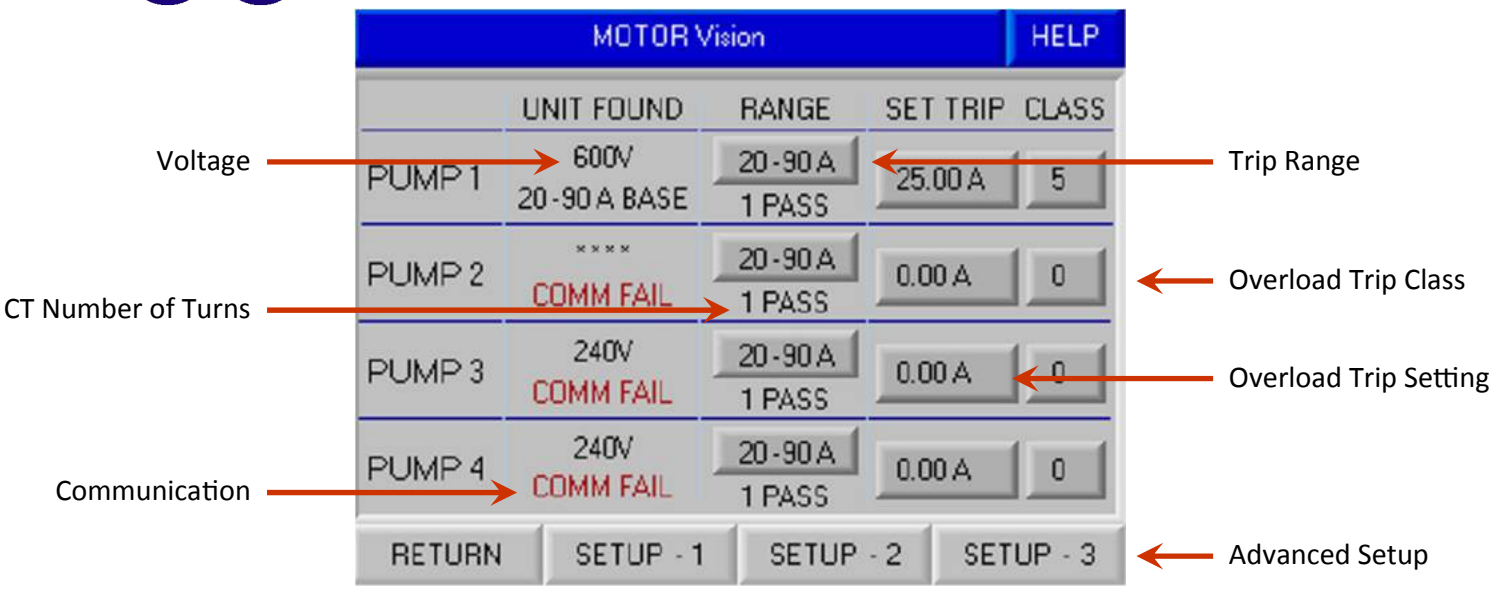
Overview

The MOTOR Vision Fault Status screen gives an overview of the pump motor's running conditions. Each of the monitored functions have a warning and trip status indicator The status indicator can display:

OK	STATUS NORMAL
WARN	FUNCTION IS OVER WARNING THRESHOLD
TRIP	FUNCTION IS OVER TRIPPED THRESHOLD
OK	FUNCTION IS NOT ENABLED

Fault Reset - Touch this button to send a fault reset command to the Insight overload. The button is disabled if there are no conditions to reset.

MOTOR Vision - Insight Overload Configuration



Overview

The MOTOR Vision Overload Configuration screen provides access to the thermal overload setting of the Insight overload. The changes made on this screen are written though the Modbus connection into the smart motor overload, making the overload configuration simple, without the need for opening the control cabinet door.

Voltage - Displays the voltage rating of the connect Insight unit connected. The PV600 reads the range automatically from the Insight overload.

Trip Range - Displays the current trip range for each pump. The possible trip ranges available will depend on the Insight unit connected.

Overload Trip Class - Touch this button to modify the thermal trip class. The setting must be entered as 5, 10, 15, 20, 25 , 30.

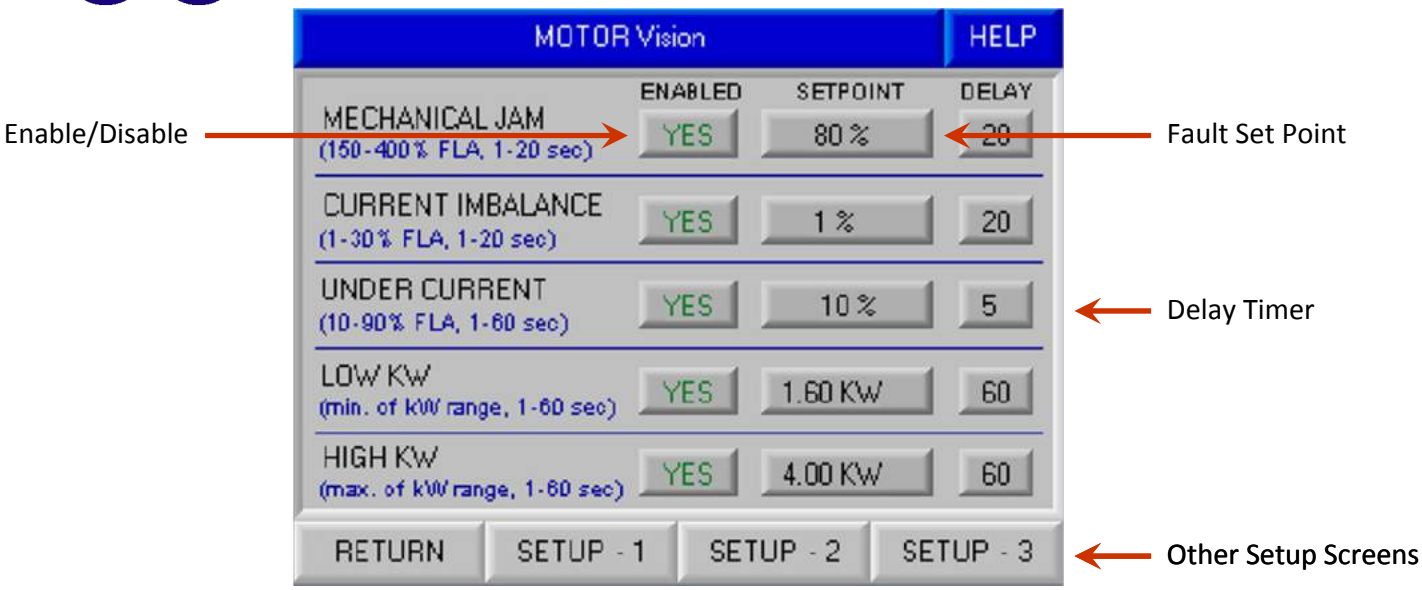
Overload Trip Setting - Touch this button to modify the full load amperage overload setting for each pump. The setting must be within the Trip Range.

Number of Turns - The number of passes needed through the current transducer is displayed here.

Communication - Displays 'COMM FAIL' , or if communication to the Insight is good, either '1-9 A BASE' or '10-20 A BASE', depending on what Insight unit is connected.

Advanced Setup - Touch these buttons to access the Motor Vision Advanced Configuration screens.

MOTOR Vision - Insight Advanced Configuration Setup 1



Overview

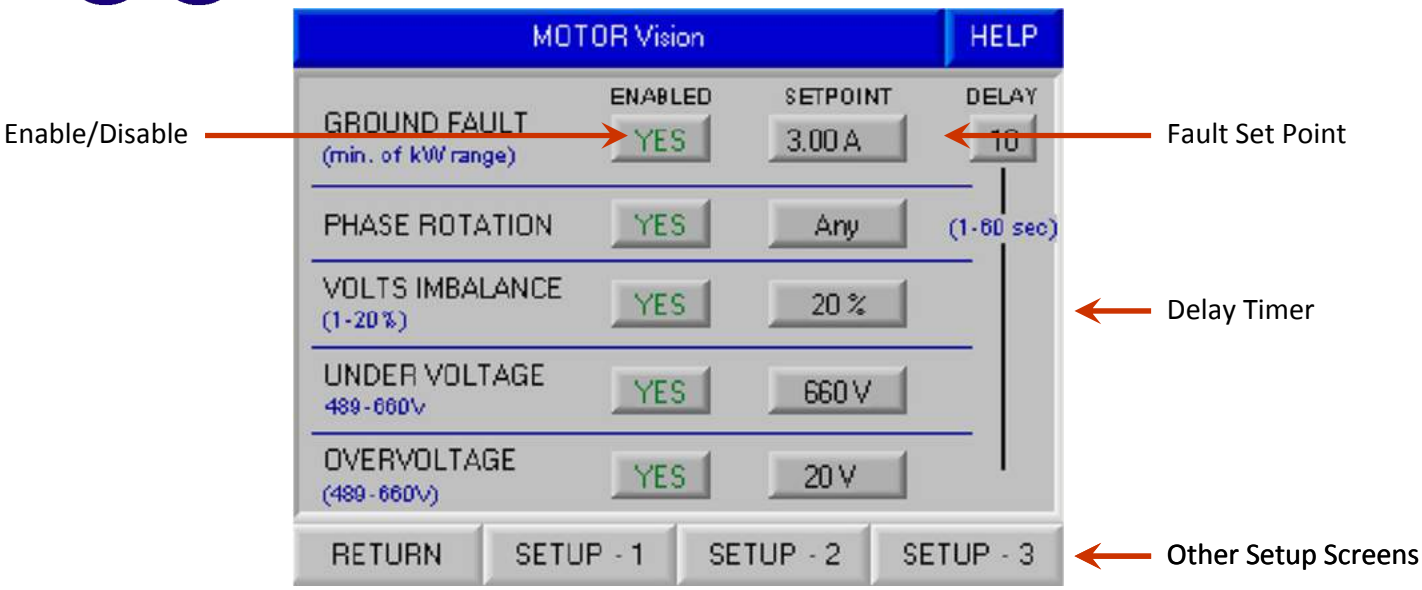
The MOTOR Vision Insight Advanced Configuration screens provide access to the detailed warning and trip settings of the Insight overload. The changes made on this screen are written though the Modbus connection into the smart motor starter, making the starter configuration simple, without the need for opening the control cabinet door.

Enable/Disable - Touch this button to enable or disable the trip fault condition.

Fault Set Point - Touch this button to set the fault condition value.

Delay Timer - Touch this button to set the delay timer for each fault condition.

MOTOR Vision - Insight Advanced Configuration Setup 2



Overview

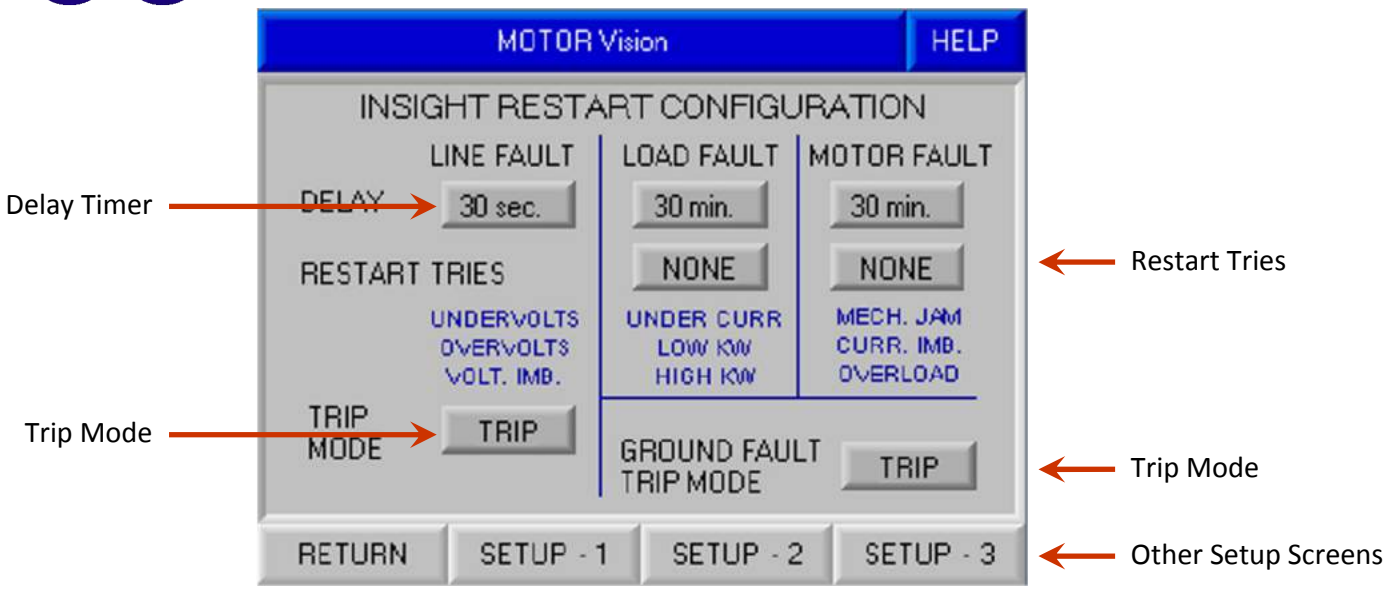
The MOTOR Vision Insight Advanced Configuration screens provide access to the detailed warning and trip settings of the Insight overload. The changes made on this screen are written though the Modbus connection into the smart motor starter, making the starter configuration simple, without the need for opening the control cabinet door.

Enable/Disable - Touch this button to enable or disable the trip fault condition.

Fault Set Point - Touch this button to set the fault condition value.

Delay Timer - Touch this button to set the delay timer for each fault condition.

MOTOR Vision - Insight Advanced Configuration Setup 3



Overview

The MOTOR Vision Insight Advanced Configuration screens provide access to the detailed warning and trip settings of the Insight overload. The changes made on this screen are written though the Modbus connection into the smart motor starter, making the starter configuration simple, without the need for opening the control cabinet door.

The Setup 3 page configures the restart delay timers and number of retry attempts.

Delay Timer - There are three separate alarm delay timer settings. Enter the restart time delay settings for each fault group:

Line Fault Timer—Delays under-voltage, over-voltage, and voltage imbalance restart attempt
Load Fault Timer—Delays under-current, low kW, and high kW restart attempt
Motor Fault—Delays thermal overload, mechanical jam and current imbalance restart attempts

Trip Mode - Select ALARM (only) or TRIP. A trip mode button is available for the Line Fault group, and another for ground fault.

Restart Tries - Enter the number of times that the Insight is to try resetting the fault condition before requiring external fault reset. Restart try settings are available for the Load Fault and Motor Fault groups.

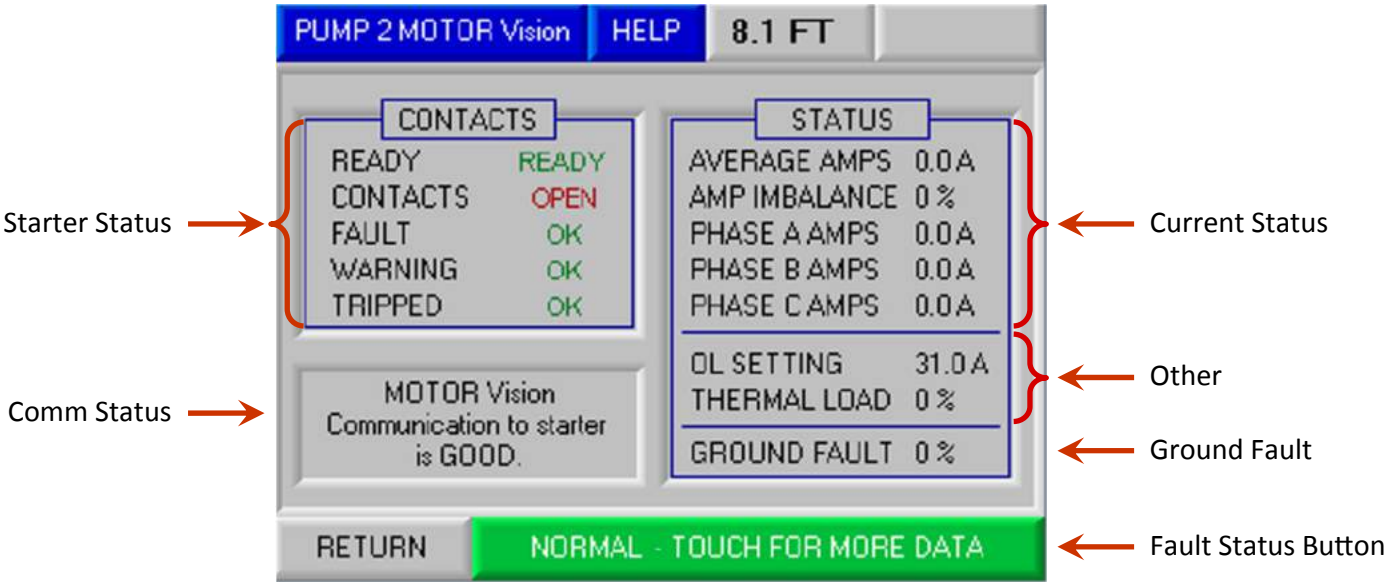
Other Setup Screens - Select one of the three possible MOTOR Vision Insight configuration screens.

MOTOR Vision - U-Line Dashboard

The PUMP Vision PV600 can be set to communicate with the Schneider (Square D) U-Line products via a Modbus connection that enables the PUMP Vision to display current, ground fault, and a variety of trip information.

Two monitoring screens are provided for each pump in the system that provide access to:

Current information
Trip and fault information



Starter Status - This field shows the position state and alarm status from the starter.

READY - Main disconnect switch is closed and starter is ready for operation
CONTACTS - Position of the contactor contacts
FAULT - Short-circuit trip, phase trip, and other starter faults
WARNING - Warning condition exists and trip may be immanent
TRIPPED - Overload trip condition

Current Status - This field shows the amperage for each leg, as well as average and load imbalance.

Communication Status - This field shows the communication status between the PV600 and the starter.

Other - Overload trip setting and the starter's present percentage of thermal load.

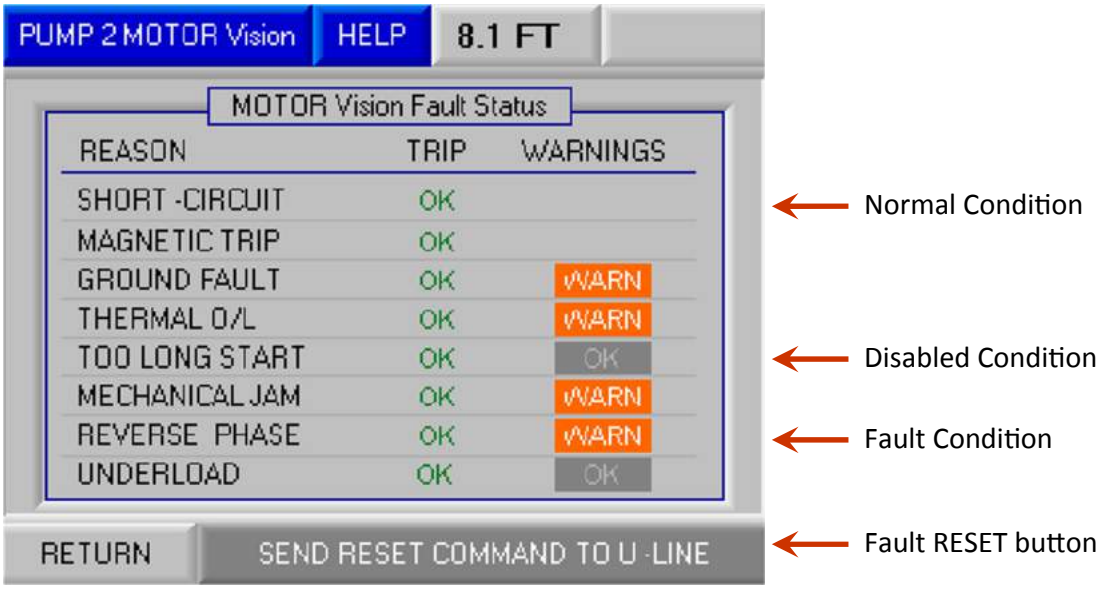
Ground Fault - This field shows the ground fault in % of full load amps.

Fault Status Button - This field shows the fault status of the MOTOR Vision starter as:

NORMAL - Green
WARNING - Amber
FAULT - Red

Touch this button to access the MOTOR Vision Fault screen.

MOTOR Vision - U-Line Fault Monitor



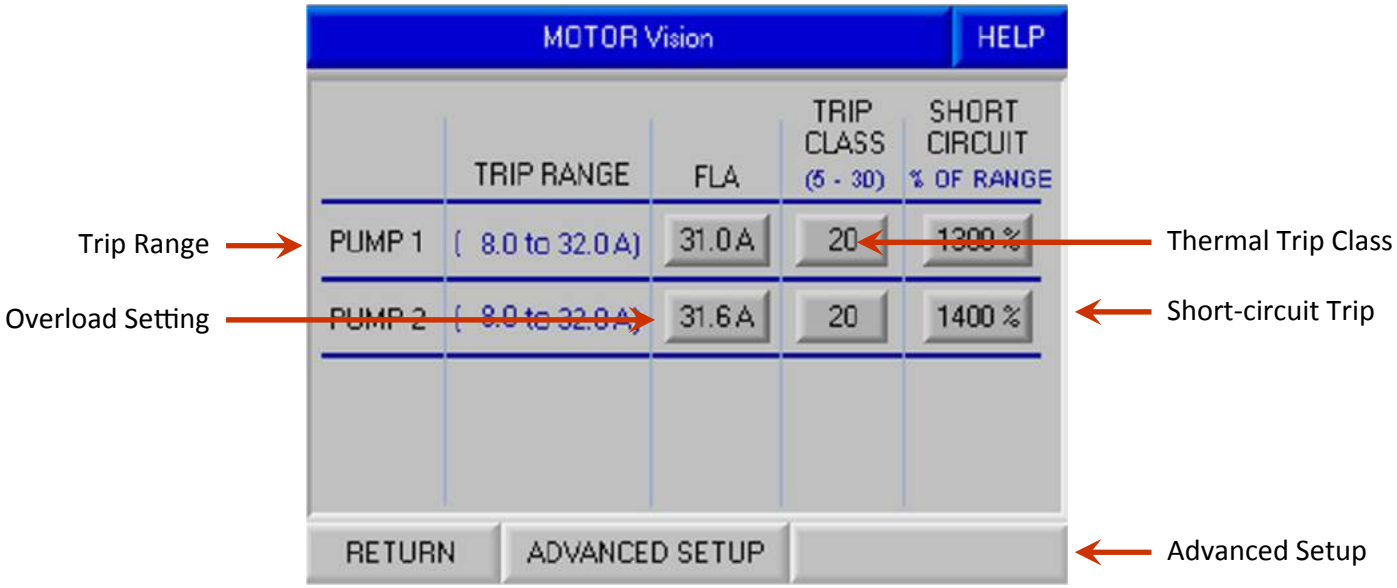
Overview

The MOTOR Vision Fault Status screen gives an overview of the pump motor's running conditions. Each of the monitored functions have a warning and trip status indicator (except short-circuit and mag-trip which have no warning). The status indicator can display:

OK	STATUS NORMAL
WARN	FUNCTION IS OVER WARNING THRESHOLD
TRIP	FUNCTION IS OVER TRIPPED THRESHOLD
OK	FUNCTION IS NOT ENABLED

Fault Reset - Touch this button to send a fault reset command to the Insight overload. The button is disabled if there are no conditions to reset.

MOTOR Vision - U-Line Overload Configuration



Overview

The MOTOR Vision Overload Configuration screen provides access to the thermal overload and short-circuit trip settings of the U-Line motor starter. The changes made on this screen are written though the Modbus connection into the smart motor starter, making the starter configuration simple, without the need for opening the control cabinet door.

Trip Range - Displays the current trip range for each pump. The PV600 reads the range automatically from the U-Line starter

Overload Settings - Touch this button to modify the full load amperage overload setting for each pump. The setting must be within the Trip Range.

Thermal Trip Class - Touch this button to modify the thermal trip class. The setting must be entered as 5, 10, 15, 20, 25 , 30.

Short-circuit Trip - Touch this button to modify the short-circuit trip percentage. The range is 300-1700%.

Advanced Setup - Touch this button to access the Motor Vision Advanced Configuration screen.

MOTOR Vision - U-Line Advance Configuration

Overview

The MOTOR Vision Advanced Configuration screen provides access to the detailed warning and trip settings of the U-Line motor starter. The changes made on this screen are written though the Modbus connection into the smart motor starter, making the starter configuration simple, without the need for opening the control cabinet door.

Warning - Touch these buttons to set and enable/disable the warning parameters for each fault condition for the pump.

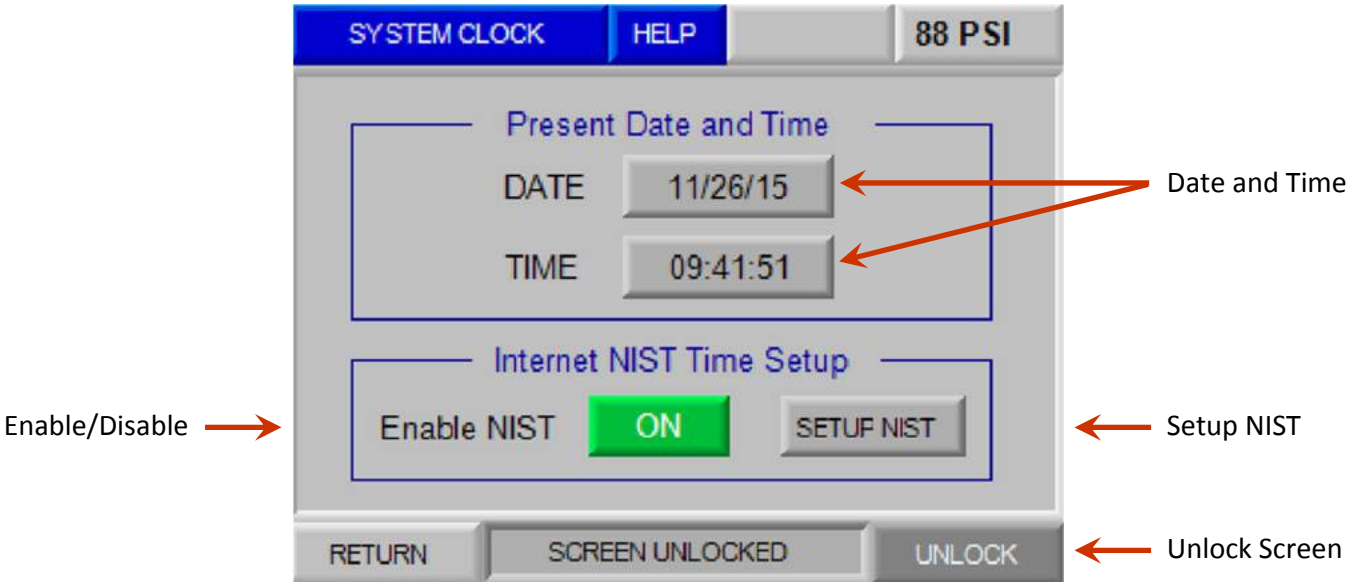
Trip - Touch these buttons to set and enable/disable the trip parameters for each fault condition for the pump.

Trip Delay Timer - Set the delay timer before each warning/trip fault condition is reached.

Reset @ - Allow the starter to reset when it has reached this percent of each fault condition.

Reset Attempts - Number of contiguous reset attempts before fault condition will not attempt another reset.

System Clock



Overview

The system clock setup is accessed by touching the date or time on any screen where they are displayed in the Status Bar. The system time and date provides the date and time stamp to the data and alarm logs, and is used for time clock related control functions.

The clock is battery backed by the PV600 user accessible backup battery so that the correct time is maintained through power failures or other system shutdowns.

When the PV600 is connected to the internet, the date and time can be automatically undated by connecting periodically to a NIST time server.

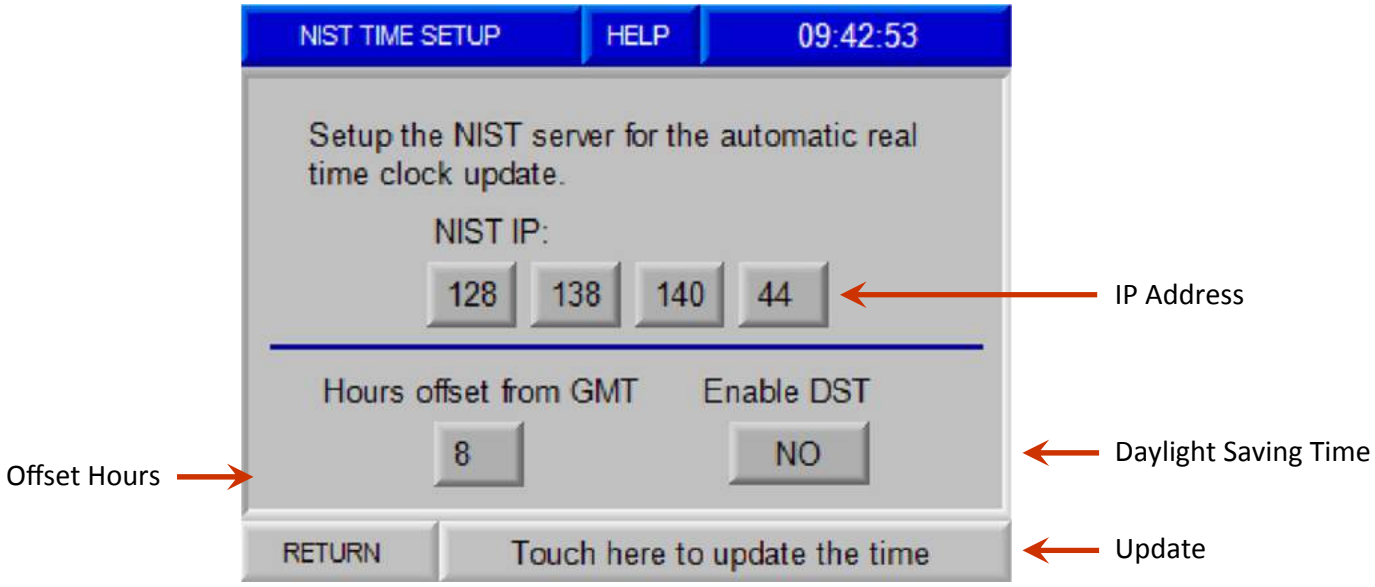
Date and Time - Manually enter the correct date and time by touching these buttons.

Enable/Disable - Touch here to enable or disable the NIST time update function.

Setup NIST - Touch here to access the NIST TIME SETUP screen. If the PV600 has the optional Ethernet card installed and is connected to the internet, the option to automatically update the time from an NIST time server is available.

Unlock Screen - The date and time can only be modified when the screen is unlocked by entering the level 1 password.

System Clock - NIST Server Setup



Overview

NIST Time Server Setup - it is necessary to enter the IP address of a NIST time server. The PV600 factory defaults to the server at the University of Colorado at Boulder. For a list of available servers in the U.S., see http://tf.nist.gov/tf-cgi/servers.cgi.

IP Address - Enter the NIST server IP address here.

Offset Hours - Enter the correct hours offset for the local time zone from Greenwich Mean Time.

Daylight Saving Time - Enable daylight saving time? This option will not automatically switch to Standard Time.

Text Entry Screen

Overview

When a data entry field is touched that requires an ASCII text entry, such as a email address, user login name, password, etc., the ASCII text entry screen will appear. By default the screen with all upper case letters is displayed.

Screen Scroll - Scrolls through the five keyboard screens which offer keyboards for upper case, lowercase, symbols and special characters.

Clear - Clears the data entry window.

Text Entry - Moves the cursor left or right in the data entry window.

Cursor Scroll - Moves the cursor left or right.

Return - Exits the screen without saving changes .

Delete and Backspace - Delete erased the character that the cursor is currently on. Backspace deletes the character to the left of the cursor.

Enter and Return - Accept the data entry and return to the previous screen.