ARMSTRONG

ARMPak Pumping pack- aged systems

Hot and chilled water

Installation and operating instructions

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CONTENTS

Storage: Make sure that all components are kept as clean as possible. Do not remove the crating or plastic wrapping until the unit is ready for installation.

Uncrating: After removal of the unit from the crate, check to see that the equipment is in good order and that all components are received as called for on the packing slip. Any shortages or damage should be reported immediately.

Handling: Use package wooden skid to move the unit with a forklift. Use lifting straps around pumps and panel to lift package.

Location: Locate the unit where it is easily accessible for inspection and servicing. Provide adequate room for pump withdrawal and also for access to the interior of the control panel.

Foundation: The foundation should be sufficiently substantial to absorb any vibration and to form a permanent rigid support for the base. A good concrete foundation should be approximately 2½ times the weight of the packaged unit. In building the foundation, make ample allowance for grouting.

Foundation bolts: Foundation bolts of the proper size should be arranged as shown in the sketch, with a pipe sleeve embedded in the concrete to permit adjustment of the bolts after the concrete has been poured. Use sleeves with a diameter 2½ times the diameter of bolts.
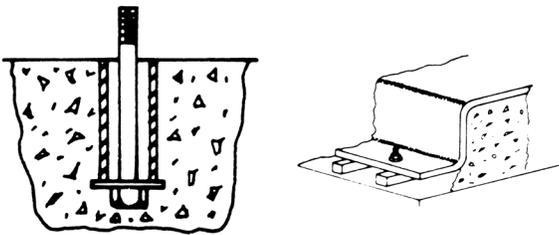
Leveling: When the unit has been placed on its foundation, insert metal wedges approximately 1" thick on either side of the foundation bolts under the base as shown in the sketch. Adjust the wedges until the suction and discharge headers are truly vertical. Check this by means of a spirit level on the suction and discharge flanges. When leveling is complete, the foundation bolts should be tightened evenly and firmly. Do not over-tighten the bolts at this stage.

Suction piping: Suction header of package should be connected to system return piping when package used for primary hot or chilled water system. Connect suction header to boiler or chiller supply piping when package used for secondary heating or cooling systems.

Discharge piping: Discharge header of package should be connected to chiller return piping when package used for primary hot or chilled water system. Connect discharge header to system supply piping when package used for secondary heating or cooling systems.

Both the suction and discharge pipes should be independently supported so that no strain is imposed on the packaged unit when the pipes are connected. All connecting pipe-work should be accurately located - do not attempt to force the suction and discharge pipes into position.

Electrical connections:
Note: All electrical wiring should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

Pre-wiring check: Read the control panel nameplate and make sure the power supply voltage matches that of the panel. Make sure the disconnect switch is in the OFF position when connecting the electrical power supply to the control panel.

Incoming supply – The incoming power supply should be brought in through the side or top of the panel adjacent to the main terminals of the disconnect switch. Note that this is the only electrical connection required at the panel.

Initial run: Open the main supply valve and also the isolating valves on the suction and discharge sides of the packaged unit. Turn all the pump selector switches to the OFF position and close the main disconnect switch. Switch the duty pump to the HAND position for a brief period and check the rotation of the motor. This should correspond to the directional arrow i.e. clockwise when looking down on top of the motor.

If the motor is running the wrong way, interchange two of the connections at the main supply terminals in the control panel. This will ensure proper rotation of the other pumps since all motors are phased for the same rotation on test before the unit is shipped.

After correct rotation has been established, switch the duty pump to the HAND position and run the pump for a few minutes to check for noise, vibration, etc., and any leaks in the pipework. Repeat this procedure for the other pump(s) in the package.

Note: For variable speed ARMPak packages, make sure that all zone differential pressure transmitters are installed as per the plans. Also, DP set point and transmitter range of each zone should be entered in the controller before starting the package. Instructions on how to enter those values in the controller is described later in this manual.

Local operation:

Constant speed - Turn all the isolating valves to fully open position and close the main disconnect. Turn the H-O-A switch of the duty pump to the **HAND** or **AUTO** setting to start the system locally.

Variable speed - Turn all the isolating valves to fully open position and close the main disconnect. Turn the VFD-OFF-BYPASS switch to VFD and set the virtual H-O-A switch of the duty pump in the touchscreen to the **HAND** or **AUTO** setting to start the system locally.

Remote operation: The duty pump of primary or secondary package can be started from a remote signal; this may be a signal from chiller or boiler, customer specified contact or Building Automation System (BAS).

Note: Remote start is enabled only when H-O-A switches are in **AUTO** position.

1.0 CONSTANT SPEED ARMPAK SYSTEMS

1.1 BASIC OPERATING FUNCTIONS

Armstrong Constant speed hot and Chilled water packaged System is supplied with either 1 duty and 1 stand-by pump, 2 duty pumps or 2 duty and 1 stand-by pump.

Single duty operation:

1 Lead duty pump gets a remote signal from either the chiller or the BAS system to start/stop only when H-O-A switch is in the Auto position. It will also start locally when the H-O-A switch is either on Auto or Hand position. The lead pump will run when chiller is on. Lead duty and stand-by are automatically alternated based on hours of operation or manually using Lead-Auto-Lag switch.

   Note: Automatic alternation is a standard feature in the controller and is set to 7 days.

Parallel duty operation:

2 In parallel operation when the lag chiller comes ON upon increase in demand, it will send a signal to start the lag pump. When the additional chiller is de-loading it will turn off its lag pump.

3 When constant speed ARMPak systems are used for secondary heating or cooling applications, pumps are brought on due to increase in load demands by the secondary system. Sequential starting and stopping of the pumps is achieved by means of current relays which sense the motor load current. In the diagram shown at the bottom, when the

pump reaches its design capacity (Q), the current drawn by the motor is x amps. This value, x amps, is the required setting on the current sensing relay.
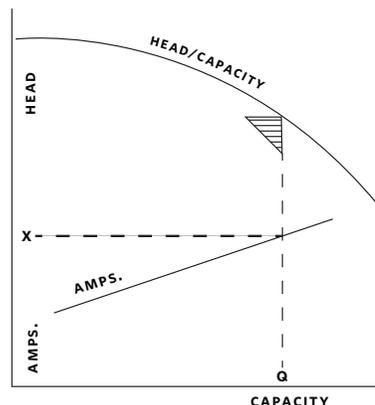
4 When a lag pump is started up, a time delay relay keeps it operating for a minimum time period to prevent the pump from cycling on and off if the demand is fluctuating.

5 Each individual pump has a selector switch to permit manual or automatic operation.

6 Should a motor overload and fail to operate, the stand-by pump will start up automatically.

1.2 VALVING

Butterfly valves are provided on the suction side of each individual pump to permit isolation for servicing. Each pump discharge line is fitted with triple duty valve, which is a combination shut-off, pressure balancing and check valve.

2.0 VARIABLE SPEED ARMPAK SYSTEMS

2.1 BASIC OPERATING FUNCTIONS

Armstrong Variable speed hot and Chilled water packaged system is supplied with either 1 duty and 1 stand-by pump, 2 duty pumps or 2 duty and 1 stand-by pump.

1 **single duty operation:** lead duty pump operates continuously at various speeds to maintain the differential pressure set point. A stand-by pump is alternated automatically based on hours of operation.

2 **Parallel duty operation:** When the system demand exceeds the Best Operating Point (BOP) of the lead pump or the zone differential pressure set point is not being satisfied, the second pump (lag pump) is automatically started. A similar sequence of events takes place in reverse on decreasing demand.

3   Pump RPM is controlled by a Variable Frequency Drive (VFD) connected directy to each individual pump motor. An analogue signal from the differential pressure transmitter is compared to a desired set point entered into the operator panel. The pump logic controller then instructs the VFD to either speed up or slow down in order to meet or maintain the zone differential pressure set point.

4   In multizone systems the PLC compares all analogue input signals from all differential pressure zone transmitters and the one that has deviated the most from its set point will be the controlling signal to the VFD.

5   Sequential starting and stopping of the pumps is achieved by a combination of pump BOP or set point differential pressure. The pump BOP is determined based on factory tests as well as pump operating differential pressure. The pump BOP values are factory set and can be accessed in the Set-Up screen of the operator panel. A default restore button is included in the set-up page to return settings to factory conditions at any time. A set point pressure control will bring on a lag pump if the lead pump(s) are operating at full speed and not maintaining set point differential pressure.

6   When a lag pump is started up, a timeclock in the pump controller keeps it operating for a minimum of a 5 minute period to prevent the pump from cycling on and off.

7   Lead pump status is alternated after every 7 days of operation. The first pump placed in the auto position is considered the lead pump. Virtual H-O-A switches are located in the individual pump overview control screens.

8   Run out protection on variable speed pumps is achieved based on differential pressure measured across the headers as well as using the speed of the pumps.

9   Should a motor or drive overload and fail to operate, the next pump in sequence starts up automatically.

10 Should a drive fails, the operator has the option of running this pump in the bypass mode across the line.

11 Should a zone DP transmitter fail, the operator has the option of setting the lead pump at manual speed using the display touchpad as described later in this manual.

12 Differential pressure transmitters should be installed before starting the variable speed ARMPak package. Please refer to drawing # IPS_4000_FLD_01 for instructions to connect to IPS Controller terminal block.

DP/Temp. Sensor zone 1 should be connected between terminals 3 & 4

DP/Temp. Sensor zone 2 should be connected between terminals 5 & 6

DP/Temp. Sensor zone 3 should be connected between terminals 7 & 8

DP/Temp. Sensor zone 4 should be connected between terminals 9 & 10

And so on...

3.0 OPERATOR INTERFACE

3.1 OVERVIEW

Operating concept

The screen is used to observe the operating status of the system and, at the same time, to intervene directly in the system operation if required.

Definition

Touch elements are contact-sensitive operating elements provided on the touch panel screen, such as buttons and input fields. Their operation is basically no different from pressing conventional keys. Touch elements are operated by touching them lightly with your finger or a suitable object.

Note: Never use pointed or sharp instruments to operate the Touch Panel to prevent damage to the plastic surface of the touch screen.

3.2 CLEANING THE SCREEN

Clean the operating unit screen at regular intervals using a damp cloth. Before starting, either switch off the unit or deactivate the screen. Only use water and washing up liquid or screen cleaning foam to dampen cloths. Never spray the cleaning agent directly onto the screen, but onto the cleaning cloth. Never use aggressive solvents or scouring powder.

CAUTION

⚠ Never touch more than one touch panel screen element at a time. If you do, an unintended action may be initiated. The unit must be brought to room temperature before it is commissioned. If condensation forms, do not switch the unit on until it absolutely dry.

Do not expose the operating unit to direct sunlight.

When the cabinet is opened, certain parts of the system that may conduct hazardous voltage are exposed.

4.0 IPS CONTROLLERS 4000

Incoming supply:

Stand-alone ips controllers (no rack) - The incoming power supply should be brought in through the bottom of the panel adjacent to the main terminals. Note that this is the only electrical connection required at the panel.

The power supply voltage is 115v/1/60 as standard. Please refer to drawing # IPS_4000_FLD_01 for instructions to connect to IPS Controller terminal block.

IPS Controller on ARMPak – The incoming power supply to the IPS Controller is achieved through a tranformer in the main enclosure of the variable speed panel. No power connection is required.

Note: All electrical wiring should be performed by a qualified electrician in accordance with the latest edition of the National Electrical Code, local codes and regulations.

4.1 FIELD DEVICES INSTALLATION INSTRUCTIONS

Before attempting to start configuring the IPS Controller using the Operator Interface (HMI – touch-screen), make sure all the field installed devices such as DP sensors and flow sensors are properly installed and wired to the IPS Controller as per wiring diagram # IPS_4000_FLD_01 to 04.

Note: Please fill in the IPS Commissioning Check Sheet (below) which will help you through the set-up procedure of the IPS Controller. The main information required would be the DP sensors set-point and range, the flow sensor range (if applicable) and pump design flow and head for run-out protection.

4.2 BUILDING AUTOMATION SYSTEM (BAS) CONNECTION

The IPS Controller is provided with an RS 485 serial port to communicate serially to the BAS. The standard communication protocol is Modbus or BACnet. IPS Controller can also communicate to the BAS by hard wired option. Please refer to drawing # IPS_4000_FLD_01 to 04 for wiring instructions..

5.0 IPS COMMISSIONING CHECK SHEET

The following data should be documented prior to setting up your new IPS controller. By collecting this information and documenting it, you will not only be prepared for the setup process, but you will also have a printed record of the data that was selected. If you have chosen to have an Armstrong Certified Controls Service Technician enter the data onto the IPS Controller, they will require that the Contractor(s) sign off that the mechanical connections and electrical connections are completed prior to visiting the site to commission the controller.

Project name: _____

Building address: _____

Contractor name: _____

Date of installation/Commissioning: _____

IPS Model number (eg. IPS controller 4000): _____

Armstrong service representative (if applicable): _____

SYSTEM CONFIGURATION

Number of pumps	_____
Is there a standby pump	_____
System design point flow	_____
System design point pressure head	_____
Pump selection point flow	_____
Pump selection point head	_____
Pump make, model, and size	_____
Pump end of curve flow rating	_____
Pump end of curve pressure head rating	_____
Pump motor rpm	_____
Differential pressure switch (flow switch)	☐ Yes ☐ No
Engineering units (psi, ft., m ...)	_____
Desired default speed (factory preset at 90%)	_____
Minimum drive speed (factory preset at 30%)	_____
Number of controller zones (process variables)	_____

MOTOR DATA

Horsepower	_____
Speed	_____
Voltage	_____
FLA rating	_____
Service factor	_____
FL efficiency	_____
FL slip	_____
Power factor	_____
Temperature class	_____

CONTROLLING DATA

Process variables / Controlling zones

ZONE #	1	2	3	4	5	6	7	8	9	10	11
ZONE LEGEND											
DP SENSOR RANGE											
ZONE SETPOINT											

Rate of speed change / ramp time (0 - Full speed) _____ factory default set at 5 seconds

Minimum speed (factory set 30%) _____

Maximum speed (factory set 100%) _____

PID control _____

Proportional gain setting (factory = 2000) _____

Integral time setting (factory = 1000) _____

OPERATOR FUNCTIONS

You are ready now to start configuring your IPS Controller using the HMI Operator Interface.

Note: When a value is needed to be entered in the system using the Display Touchpad, press on the feature field to enter the value in the controller. An alphanumeric keypad will be displayed, enter the value and then press the **Enter** button to save the input value in the controller.

6.0 OPERATION DISPLAYS

6.1.0   MAIN MENU
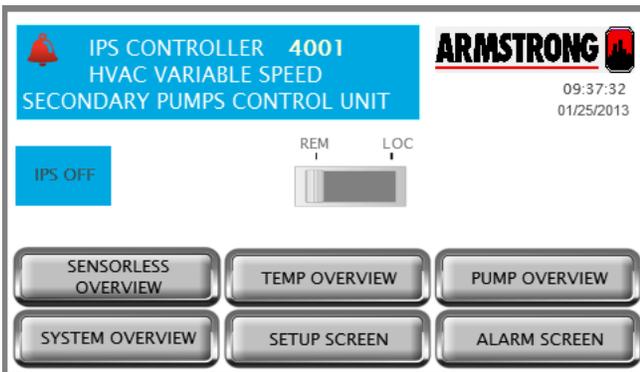
Description	
This is the screen the operator sees when powering up the unit. Offers status of system's most important variables and navigation to all system screens	
Data	
IPS status	Indicates if the IPS is on or off
Alarm	If there is an alarm in the sytem, a red bell appears at the top left corner
Buttons	
REM – LOC	Slider button that allows changing the IPS mode to Remote or Local. Local will turn on the IPS inmediately. Remote causes the IPS to follow the BAS signal (hardwired or serial communication) to turn on or off
ZONE OVERVIEW	Changes the screen to zone overview. Not available if the VFD type is IVS sensorless
SYSTEM OVERVIEW	Changes the current screen to system overview
TEMP OVERVIEW	Changes the current screen to temp overview. Only available if the temperature control is enabled
SETUP SCREEN	Navigates to the setup menu level 0 screen
PUMP OVERVIEW	Navigates to the pump overview screen
ALARM SCREEN	Shows the alarm screen. If there is an active alarm, this button turns red

6.1.1   SYSTEM OVERVIEW
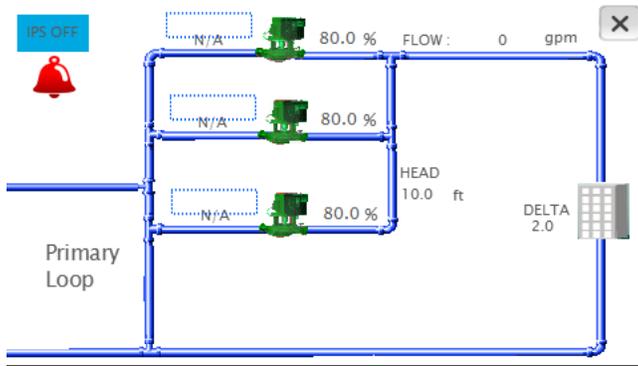
Description	
Shows an detailed view of the system. The screen adapts to the configuration of the system by showing the number of pumps, the zone PVs or head and flow. Press the x on the top right corner to go back to the previous screen	
Data	
Pump 1 to 6 status	The pump icon shows the pump status: grey – stopped green – running red - alarm
Pump 1 to 6 mode	Shows each pump mode: Hand, Off or Auto
Pump 1 to 6 duty	Shows each pump duty: Duty1, Duty2, Duty3, Duty4, Duty5, Duty6 or Stand-by
Pump 1 to 6 speed	Shows each pump speed in percentage
ACTIVE ZONE	Indicates which zone is assigned as active. Not visible if the VFD type is IVS sensorless
ERROR	Indicates the active zone error. Not visible if the VFD type is IVS sensorless
SETPOINT	Indicates the active zone setpoint in the chosen units. Not visible if the VFD type is IVS sensorless
MAX OPEN VLV	Indicates the opening of the driving system valve. Not visible if the VFD type is IVS sensorless and the system valves control is not enabled
FLOW	Indicates the total flow in the system. Only visible if the VFD type is IVS sensorless
HEAD	Indicates the total head in the system. Only visible if the VFD type is IVS sensorless
ERROR	Indicates how far the far from the control curve the pump(s) are operating. The IPS regulates the pump speed to achieve an error of zero
IPS STATUS	Indicates wether the IPS is ON or OFF
ALARM	A red bell indicates an alarm in the system
Buttons	
Pump 1 to 6 icon	Touching a pump icon brings up the corresponding pump control screen

6.1.2 ZONE OVERVIEW

Description

Shows an overview of the system zones. If there are more than 3 zones, use the grey arrows to scroll. This screen is not available if the VFD type is IVS sensorless

Data

ACTUAL	Inidcates the present value of the zone sensor in the selected units
SETPOINT	Inidcates the setpoint of the zone in the selected units
ERROR	Indicates the zone error in the selected units
STATUS	Indicates whether the zone is enabled or disabled
ACTIVE ZONE	Indicates which zone is assigned as active.
ACTIVE ZONE ERROR	Indicates the active zone error.

Buttons

MAIN MENU	Navigates to the main menu
SYSTM VIEW	Changes the current screen to system overview
PUMP VIEW	Changes the current screen to pump overview
ALARMS	Shows the alarm screen. If there is an active alarm, this button turns red

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6.1.3   PUMP OVERVIEW

Description
Allows monitoring pump information. If there are more than 3 pumps, scroll using the arrows on the top corners.

Data	
Pump 1 to 6 mode	Shows each pump mode: Hand, Off or Auto
Pump 1 to 6 status 1	Shows each pump duty: Duty1, Duty2, Duty3, Duty4, Duty5, Duty6 or Stand-by
Pump 1 to 6 status 2	Shows if the pump is running or stopped
Pump 1 to 6 speed%	Shows each pump speed in percentage
Pump 1 to 6 speed RPM	Shows each pump speed in RPM
Run HRS	Shows the total pump run time in hours
AUTO BYPASS ON	If the pumps are in auto bypass, the AUTO BYPASS ON label appears on the top left corner. Touching this label brings up the auto bypass reset screen

Buttons	
Pump 1 to 6	Touching a pump button brings up the corresponding pump control screen. If the corresponding pump is in alarm, this button changes to red color
MAIN MENU	Navigates to the main menu
SYSTM VIEW	Changes the current screen to system overview
SEN LES VIEW	Changes the current screen to sensor-less overview. Only available if the VFD type is IVS sensorless
ZONE OVERVIEW	Navigates to the zone overview screen. Not available if the VFD type is IVS sensorless
ALARMS	Shows the alarm screen. If there is an active alarm, this button turns red
Scroll arrows	If there are more than 3 pumps in the system, use the grey arrow buttons to scroll

6.1.4 SENSORLESS OVERVIEW

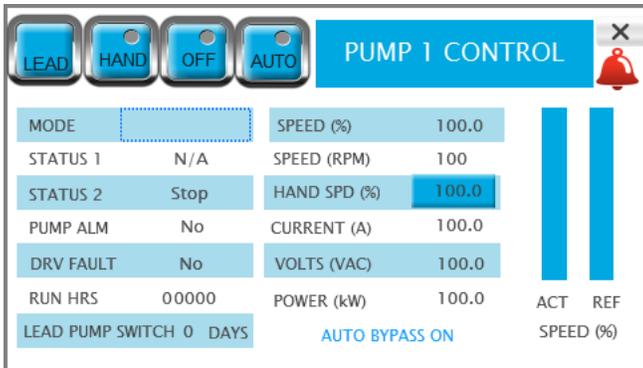| **Description**	
This screen is only available when the VFD type is IVS sensorless, it complements the pump overview screen. If there are more than 3 pumps, scroll using the arrows on the top corners	
Data	
Pump 1 to 6 mode	Shows each pump mode: Hand, Off or Auto
Pump 1 to 6 status 1	Shows each pump duty: Duty1, Duty2, Duty3, Duty4, Duty5, Duty6 or Stand-by
Pump 1 to 6 status 2	Shows if the pump is running or stopped
FLOW	Indicates the current flow of that pump in the selected units
HEAD	Indicates the current head of that pump in the selected units
TOTAL FLOW	Indicates the system flow in the selected units
TOTAL HEAD	Indicates the syetsm head in the selected units
Buttons	
Pump 1 to 6	Touching a pump button brings up the corresponding pump control screen. If the corresponding pump is in alarm, this button changes to red color
MAIN MENU	Navigates to the main menu
SYSTM VIEW	Changes the current screen to system overview
PUMP VIEW	Changes the current screen to pump overview
ALARMS	Shows the alarm screen. If there is an active alarm, this button turns red
Scroll arrows	If there are more than 3 pumps in the system, use the grey arrow buttons to scroll

6.1.5   PUMP 1 TO 6 CONTROL

Description

This screen allows control of each pump and shows more detailed information. Press the x on the top left corner to go back to the previous screen
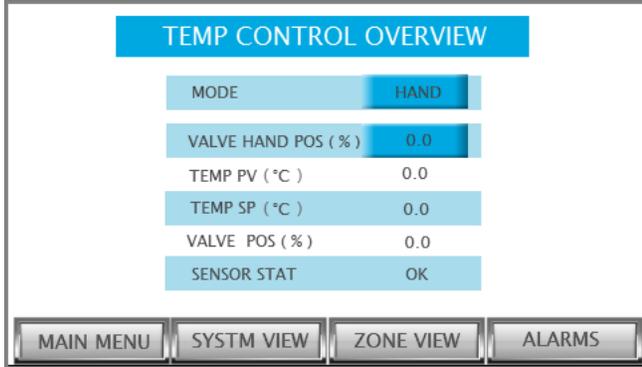
Data	
MODE	Shows pump mode: Hand, Off or Auto
STATUS 1	Shows pump duty: Duty1, Duty2, Duty3, Duty4, Duty5, Duty6 or Stand-by
STATUS 2	Shows if the pump is running or stopped
PUMP ALM	Indicates if the there is a pump alarm
DRV FAULT	Indicates if the VFD is reporting a fault
RUN HRS	Indicates the pump total run time in hours. Touching the RUN HRS label resets the total run hours
LEAD PUMP SWITCH	Indicates the remaining time in days or hours to switch the Duty1 (Lead) pump
SPEED (%)	Shows pump speed in percentage
SPEED (RPM)	Shows pump speed in RPM
CURRENT (A)	Shows the VFD current
VOLTS (VAC)	Shows the VFD AC voltage
POWER (KW)	Shows the VFD power in kWs
SPEED BARS	Show the pump speed referenece and actual speed in a graphical maner
AUTO BYPASS ON	If the pump is in auto bypass, the AUTO BYPASS ON label appears on the bottom of the screen. Touching this label brings up the auto bypass reset screen
Alarm	If there is a pump alarm, a red bell appears at the top right corner

Buttons	
LEAD	Assigns the pump as Duty 1 or Lead
HAND	Changes the pump mode to Hand. If the IPS is on, the pump will start inmediately and run at the hand speed (see below).
OFF	Changes the pump mode to Off. The pump will stop inmediatley and it will be excluded from the duty rotation
AUTO	Changes the pump mode to Auto. The pump will be assigned a duty status and it will run according to the IPS control algorithm
HAND SPEED	If the pump is placed in Hand, it will run at the hand speed entered

6.1.6 TEMP CONTROL OVERVIEW

TEMP CONTROL OVERVIEW	
MODE	HAND
VALVE HAND POS (%)	0.0
TEMP PV (°C)	0.0
TEMP SP (°C)	0.0
VALVE POS (%)	0.0
SENSOR STAT	OK

| MAIN MENU | SYSTM VIEW | ZONE VIEW | ALARMS |

Description

This screen allows monitoring and control of the temperature control feature

Data

MODE	Indicates the valve mode: HAND or AUTO
VALVE HAND POS (%)	Indicates the valve hand position in percentage
TEMP PV	Indicates the temperature sensor present value in the selected units
TEMP SP	Indicates the temperature setpoint in the selected units
VALVE POS (%)	Indicates the current position of the valve in percentage
SENSOR STAT	Indicates the status of the temperature sensor: OK or ALARM

Buttons

MODE	Allows changing the valve mode between HAND and AUTO
VALVE HAND POS (%)	Opens a keypad to enter the desired valve position
MAIN MENU	Navigates to the main menu
SYSTM VIEW	Changes the current screen to system overview
ZONE VIEW	Changes the current screen to zone overview
ALARMS	Shows the alarm screen. if there is an active alarm, this button turns red

6.1.7 AUTO BYPASS RESET

AUTO BYPASS RESET ✕

Press "YES" to Reset
the VFD Auto Bypass.

YES   NO

Description

This screen allows the operator to reset the pump auto bypass condition. Press the x on the top right corner to go back to the previous screen

Buttons	
YES	Resets the auto bypass. If the conditions that caused the auto bypass don't exist anymore, the pumps will resume normal operation
NO	Closes the auto bypass reset screen and returns to the previous screen

6.1.8 LOGIN SCREEN

PASSWORD: ✱✱✱✱

LOGIN   LOGOUT

Login Error : Password Entered is Incorrect.
Please Enter Correct Password and Try Again.

Description

This screen allows the operator to login to the desired level by providing the appropiate password

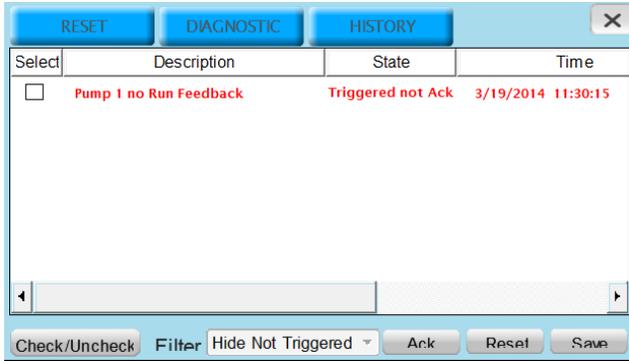| Data	
PASSWORD	Shows the encoded password. Touching it brings up a numeric keypad to enter the password

| Buttons	
LOGIN	If the password entered is valid, touching this button will change the screen to the setup menu of the corresponding level
LOGOUT	Changes the screen back to the main menu

6.1.9 ALARM SCREENS

Description

This screen shows the current alarms in the system. Press the x on the top right corner to go back to the previous screen

Data

Select	Select the alarm in order to be acknowledged and reset
Description	Shows the description of the alarm. The possible alarms are shown below in section 1.2.1.
State	Provides information about two alarm conditions: **1** Triggered or Not Triggered (triggered means that the condition that generates the alarm is still present, the alarm can be acknowledged but not reset). **2** Acknowledged or Not Acknowledged

Buttons

| RESET (upper case)	Resets the alarms. In order to clear from the list see **Reset** button below.
DIAGNOSTIC	Brings up the PLC diagnostics screen
HISTORY	Brings up the alarm history screen
Check/un-check	Selects/unselect the alamrs. Only selected alarms can be acknowledged and cleared from the list
FILTER	Not used
ACK	Acknowledges the selected alarms
Reset	Clears the selected alarms that are not triggered
Save	Not used
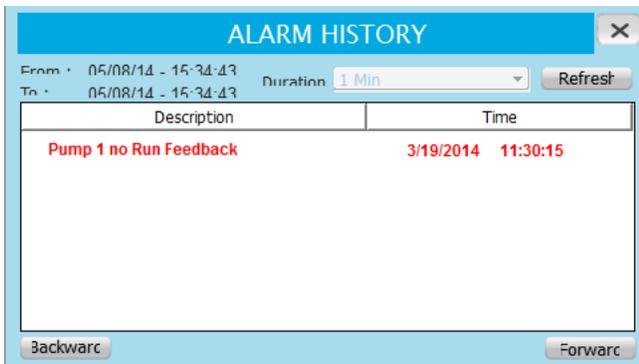
Description

This screen shows the alarms history. Press the x on the top right corner to go back to the previous screen

Data

Description	Shows the description of the alarm. The possible alarms are shown below in section 1.2.1.
Time	Shows the time of occurrence of each alarm

Buttons

REFRESH	Refreshes the alarm list
Duration	Drop down menu that allows to filter the list of alarms based on time of occurrence
Backward	Shows alarm history from the previous period selected in the duration dropdown menu
Forward	Shows alarm history from the next period selected in the duration dropdown menu

6.1.10 PLC DIAGNOSTIC
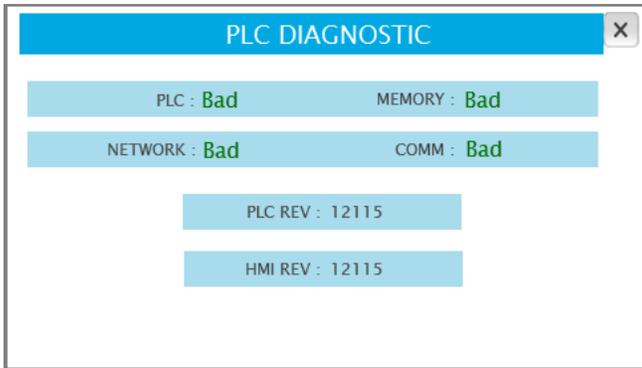
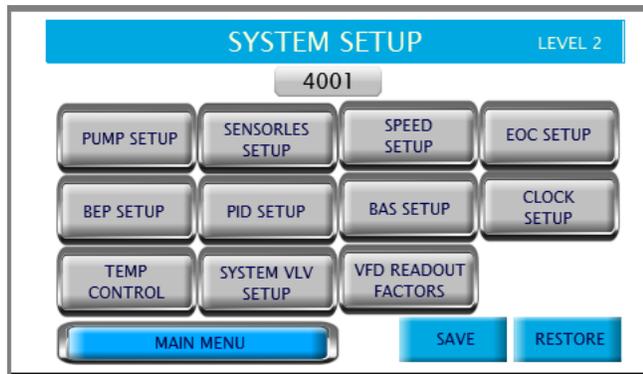| Description	
This screen shows the current state of the PLC and the software revisions installed. Press the x on the top right corner to go back to the previous screen	
Data	
PLC	Indicates if the PLC is working properly
NETWORK	Indicates if the PLC network is working properly
MEMORY	Indicates if the PLC memory is working properly
COMM	Indicates if the serial communication port of the PLC is working properly
PLC REV	Indicates the software revision installed on the PLC
HMI REV	Indicates the software revision installed on the HMI

6.2.1 ALARMS

Alarm	Description	Possible causes
Pump n alarm	Indicates that pump n is in alarm	Any pump alarm will trigger this alarm
Pump n run feedback alarm	Indicates that the PLC didn't detect the pump run feedback after commanding the pump to start	• VFD not configured for serial communication • Loose or broken wire from VFD • Incorrect VFD type selected on IPS • Impeller is stuck
Pump n no flow alarm	Indicates that the PLC didn't detect flow (DP switch not closed) after commanding the pump to start	• DP switch not correctly adjusted • Loose or broken wire • Damaged PLC digital input • Impeller is stuck
Pump n drive fault alarm	Indicates that the pump VFD is reporting a fault	VFD over current or other problem. Check VFD local display
Dp transmitter fail alarm	Indicates that the DP transmitter is out of range	• Connection to transmitter is short or open circuited • Damaged PLC analog input • Loose or broken wire from transmitter • Damaged transmitter
Flow transmitter fail alarm	Indicates that the Flow transmitter is out of range	• Connection to transmitter is short or open circuited • Damaged PLC analog input • Loose or broken wire from transmitter • Damaged transmitter
Zone n transmitter alarm	Indicates that the zone transmitter is out of range	• Connection to transmitter is short or open circuited • Damaged PLC analog input • Loose or broken wire from transmitter • Damaged transmitter
All zones transmitter alarm	Indicates that all zones transmitters are out of range	All zone sensors are in alarm
Pump n flow deviation alarm	Indicates that the sensorless flow of the pump is 20% off the average of the running pumps	• There is a problem with the sensorless mapping of the VFD • Air in the system • A manual valve is obstructing flow

7.0 SETUP DISPLAYS

The setup displays allow viewing, modifying, saving and restoring system parameters. There are 3 levels of password protected access:

| Level	Actions Allowed
Level 0	• View only
Level 1	• Modify all parameters • Restore previously saved default values (factory defaults); expect pump PID and BAS parameters
Level 2	• Modify all parameters • Save changes • Restore previously saved default values (factory defaults)

7.1.0 LEVEL 2 SETUP MENU

The following sections list and describe each setup screen. Only level 2 screens are shown, however each level has the same screens with their respective level restrictions.

Description	
This screen allows navigation to each of the setup screens.	
Button	
PUMP SETUP	Navigates to the pump setup screen
ZONE SETUP	Navigates to the zone setup screen. Not available if the VFD type on pump setup screen is IVS sensorless
SENSORLESS SETUP	Navigates to the sensorless setup screen. Not available only if the VFD type on pump setup screen is IVS sensorless
SPEED SETUP	Navigates to the pump speed setup screen
EOC SETUP	Navigates to the End Of Curve (EOC) protection screen
BEP SETUP	Navigates to the duty speed staging setup screen
PID SETUP	Navigates to the PID setup screen
BAS SETUP	Navigates to the BAS setup screen
CLOCK SETUP	Navigates to the clock setup screen
TEMP CONTROL	Navigates to the temperature control setup screen
SYSTEM VLV SETUP	Navigates to the system valves setup screen
VFD READOUT FACTORS	Navigates to the VFD readout factors setup screen
MAIN MENU	Returns to the main menu. User must login again to return to the level 1 & level 2 setup menu
SAVE	Saves all the current setup parameters as default. Only available in level 2
RESTORE	Restores all the default parameters as default. Only available in level 1 & 2
IPS Model	Selects the IPS model: 4001, 4002 or 4003. Only available in level 1 & 2

7.1.1   ZONE SETUP

ZONE SETUP

NO OF ZONES 10
ENG. UNIT psi

Z1 Z2 Z3 Z4 Z5 Z6
Z7 Z8 Z9 Z10 Z11 Z12

SAVE   RESTORE
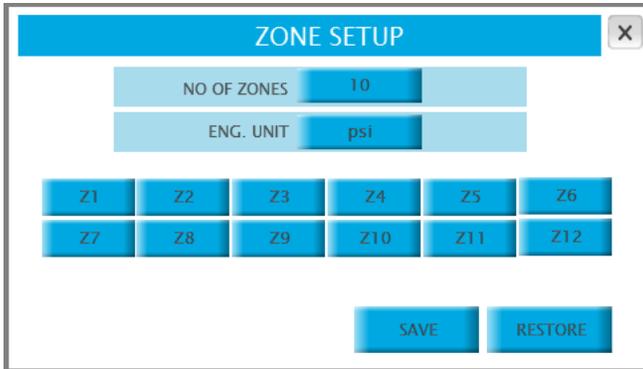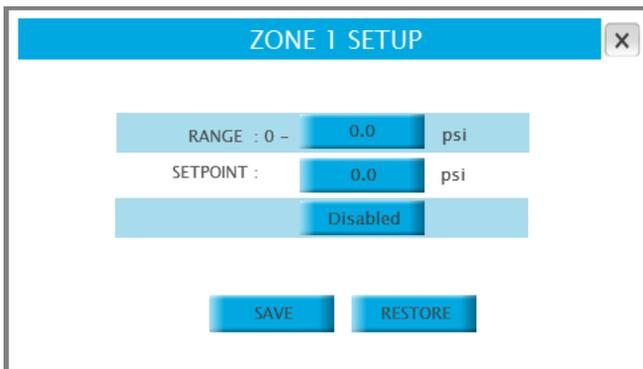
Parameter: NO OF ZONES	
Range:	Function:
1-11	Indicates how many zones will be used to control the system, typically one zone per area of the building

Parameter: ENG. UNIT	
Options:	Function:
PSI	DP sensors in psi are used
FT	DP sensors in ft are used
KPA	DP sensors kPa psi are used
M	DP sensors in m are used
BAR	DP sensors in bar are used
°F	Temperature sensors in °F are used
°C	Temperature sensors in °C are used

Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2

Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

7.1.2   ZONE 1 TO 12 SETUP

ZONE 1 SETUP

RANGE : 0 – 0.0 psi
SETPOINT : 0.0 psi
Disabled

SAVE   RESTORE

There is one screen per zone

Parameter: RANGE	
Range:	Function:
0.0-999.9 (PSI, FT, kPa, m, BAR, °F, °C)	Indicates the range of the DP or temperature sensor of the zone

Parameter: SETPOINT	
Range:	Function:
0.0-999.9 (PSI, FT, kPa, m, BAR, °F, °C)	Indicates the setpoint of the zone. The IPS uses this value to determine the pump speed

Parameter: SETPOINT	
Option:	Function:
Disable	The zone is disabled, it won't be used to determine the active zone and pump speed
Enable	The zone is enabled, it will be used to determine the active zone and pump speed

Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2

Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

7.1.3 PUMP SETUP

PUMP SETUP	✕
NO OF PUMPS 0	SWITCH TIME 0 Day
STNDBY PUMP NO	MIN RUN TIME 0 Min
AUTO BYPASS DISABLE	VFD COMM. DISABLE 60Hz
DP SWITCH DISABLE	DRIVE TYPE IVS
SAVE RESTORE	FBUS SOURCE FBUS1

Parameter: NO OF ZONES	
Range:	Function:
1-6	Indicates how many pumps are installed in the system

Parameter: STNDBY PUMP	
Options:	Function:
NO	All pumps in the system are duty
YES	One of the pumps in the system will be assigned as standby, it will only operate if a duty pump fails and there is no other duty pump to replace it

Parameter: AUTO BYPASS	
Options:	Function:
DISABLE	Auto bypass function is disabled
ENABLE	When a pump fails (due to no run feedback, VFD fault or communication), the IPS will determine if there is another pump available to replace the faulty pump. If there is no pump available, a digital output will mechanically bypass the VFD and energize the pump motor directly. All pumps running at that moment will be bypassed.

Parameter: DP SWITCH	
Options:	Function:
DISABLE	Pump DP switches are not installed. The IPS will use the drives' run feedback as confirmation that the pumps are operating
ENABLE	Pump DP switches are installed. The IPS will use them as confirmation that the pumps are operating

Parameter: SWITCH TIME	
Range:	Function:
1-999 (Days, Hours)	Indicates how often the lead (duty 1) pump will rotate among the duty pumps

Parameter: MIN RUN TIME	
Range:	Function:
1-999 minutes	Indicates what is the minimum time the lead (duty 1) pump will run once it is started

Parameter: VFD COMM.	
Options:	Function:
DISABLE	No serial communication to VFDs. The IPS will use hard wired connections
ENABLE	The IPS uses serial communication to the VFDs. Select if the VFD power is 50 or 60 Hz. The available VFDs are listed below

| Parameter: DRIVE TYPE	
Options:	Function:
IVS	Serial communication to Armstrong IVS drive
ACH 550	Serial communication to ABB ACH 550 drive
FC 102	Serial communication to Danfoss FC102 drive
E7	Serial communication to Yasgawa E7 drive
IVS (SEN-SORLESS)	Serial communication to Armstrong IVS drive configured for sensorless operation. By selecting this option the IPS4000 will operate in parallel sensorless mode.
*NOTE: The IPS4000 is configured to communicate to the drives with the following parameters: Modbus RTU, 19200 baud, no parity, 8 bits 1 stop bit	
Parameter: FBUS SOURCE	
Options:	Function:
FBUS1	This is the default. The PLC utilizes the field card in the FieldBus card slot to communicate with the VFDS
FBUS2	The PLC utilizes port J26 FBus2 to communicate with the VFDS. This option can be used if the field card is damaged (this option is not available for IPS4003)
Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2
Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

7.1.4 SPEED SETUP
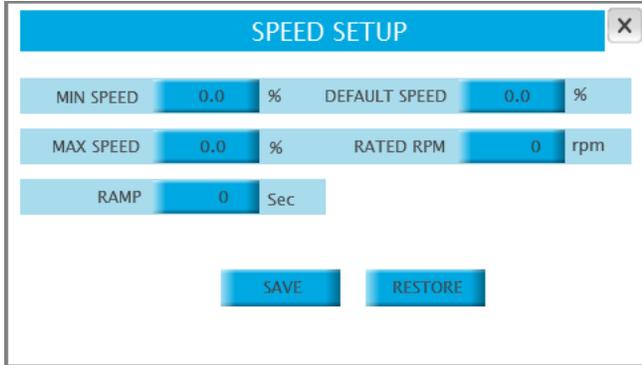
Parameter: MIN SPEED	
Range:	Function:
0.0–100.0 %	The minimum speed the pumps will be allowed to run in Auto or Hand mode

Parameter: MAX SPEED	
Range:	Function:
0.0–100.0 %	The maximum speed the pumps will be allowed to run in Auto or Hand mode

Parameter: DEFAULT SPEED	
Range:	Function:
0.0–100.0 %	Indicates the speed the pumps will run at if all zone sensors fail. It does not apply in sensorless mode

Parameter: RATED RPM	
Range:	Function:
0-9999 RPM	The pump rated RPM as indicated on the motor nameplate

Parameter: RAMP	
Range:	Function:
1-999 SEC	Indicates the amount of time it will take the pumps to increase their speed from 0% to 100% or to decrease their speed from 100% to 0%

Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2

Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

7.1.5   SENSORLESS SETUP

Parameter: FLOW BEP	
Range:	Function:
0–32767	Flow at BEP (Best Efficiency Point) for one pump. It is used in conjuction with HEAD BEP to stage pumps on and off in order to maintain the system operating efficiently. For more information please contact your local Armstrong representative

Parameter: HEAD BEP	
Range:	Function:
0.0–9999.9	Head at BEP (Best Efficiency Point) for one pump. It is used in conjuction with FLOW BEP to stage pumps on and off in order to maintain the system operating efficiently. For more information please contact your local Armstrong representative

Parameter: DEAD BAND	
Range:	Function:
0.0 to 1.0	It is used to prevent constant staging of pumps. For more information please contact your local Armstrong representative

Parameter: HEAD UNIT	
Options:	Function:
FT	The drive sensorless head is programmed in ft
PSI	The drive sensorless head is programmed in psi
kPa	The drive sensorless head is programmed in kPa
m	The drive sensorless head is programmed in m
BAR	The drive sensorless head is programmed in bar

| Parameter: SENS ADJ	
Range:	Function:
0 – 5 %	It is used to adjust the sensorless mapping of the VFD. For more information please contact your local Armstrong representative

Parameter: FLOW DESIGN	
Range:	Function:
0 – 32767	Pump design flow. It is used to determine the system control curve

Parameter: HEAD DESIGN	
Range:	Function:
0.0 – 9999.9	Pump Design Head. It is used to determine the system control curve
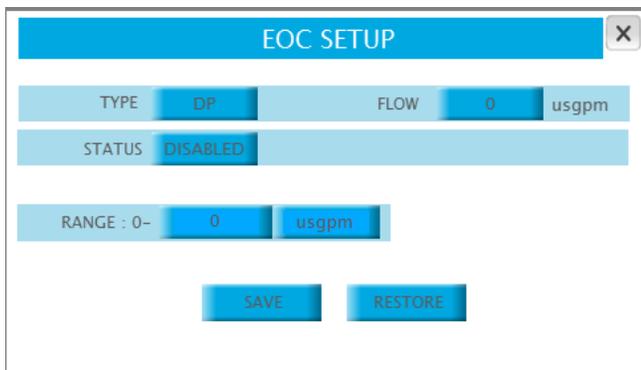
Parameter: ZERO FLOW HEAD	
Range:	Function:
0.0 – 9999.9	Pump Head at zero flow. It is used to determine the system control curve

Parameter: FLOW UNIT	
Options:	Function:
gpm	The drive sensorless flow is programmed in gpm
l/s	The drive sensorless flow is programmed in l/s
m³/h	The drive sensorless flow is programmed in m³/h

Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2

Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

7.1.6   EOC SETUP

Parameter: TYPE	
Options:	Function:
DP	EOC (End of Curve) protection is achieved with a DP sensor
FLOW	EOC protection is achieved with a flow sensor or with the sensorless flow if available

Parameter: STATUS	
Options:	Function:
DISABLED	EOC protection is disabled
ENABLED	EOC protection is enabled. If the DP or flow of one pump exceeds the EOC setpoint (see below), the next lag pump will be inmediately staged on

Parameter: RANGE	
Range:	Function:
0 – 32767	Indicates the range of the sensor (DP or flow) in engineering units. This value corresponds to the sensor's 20mA output. (Not available for IVS sensorless drives)

Parameter: FLOW	
Range:	Function:
0 – 32767	Indicates the pump's flow EOC setpoint. If the reading from the sensor exceeds this value, the next lag pump is staged on

Parameter: DP	
Range:	Function:
0 – 32767	Indicates the pump's DP EOC setpoint. If the reading from the sensor exceeds this value, the next lag pump is staged on

Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2

Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

7.1.7   STAGING SETUP

Parameter: STAGE UP DUTY2	
Range:	Function:
0.0 – 100.0 %	Determines the Duty1 pump speed at which the Duty2 pump will be staged on. (Not available for IVS sensorless drives)

Parameter: STAGE UP DUTY3	
Range:	Function:
0.0 – 100.0 %	Determines the Duty1 pump speed at which the Duty3 pump will be staged on. (Not available for IVS sensorless drives)

Parameter: STAGE UP DUTY4	
Range:	Function:
0.0 – 100.0 %	Determines the Duty1 pump speed at which the Duty4 pump will be staged on. (Not available for IVS sensorless drives)

Parameter: STAGE UP DUTY5	
Range:	Function:
0.0 – 100.0 %	Determines the Duty1 pump speed at which the Duty5 pump will be staged on. (Not available for IVS sensorless drives)

Parameter: STAGE UP DUTY6	
Range:	Function:
0.0 – 100.0 %	Determines the Duty1 pump speed at which the Duty6 pump will be staged on. (Not available for IVS sensorless drives)

Parameter: STAGE DOWN DUTY2	
Range:	Function:
0.0 – 100.0 %	Determines the Duty1 pump speed under which the Duty2 pump will be staged off. (Not available for IVS sensorless drives)

Parameter: STAGE DOWN DUTY3	
Range:	Function:
0.0 – 100.0 %	Determines the Duty1 pump speed under which the Duty3 pump will be staged off. (Not available for IVS sensorless drives)

Parameter: STAGE DOWN DUTY4	
Range:	Function:
0.0 – 100.0 %	Determines the Duty1 pump speed under which the Duty4 pump will be staged off. (Not available for IVS sensorless drives)

Parameter: STAGE DOWN DUTY5	
Range:	Function:
0.0 – 100.0 %	Determines the Duty1 pump speed under which the Duty5 pump will be staged off. (Not available for IVS sensorless drives)

Parameter: STAGE DOWN DUTY6	
Range:	Function:
0.0 – 100.0 %	Determines the Duty1 pump speed under which the Duty6 pump will be staged off. (Not available for IVS sensorless drives)

Parameter: STAGE ON DELAY	
Range:	Function:
0.0 – 999 sec	Determines the time delay before staging on the next lag pump once the conditions are met. It applies to all drives, including IVS sensorless

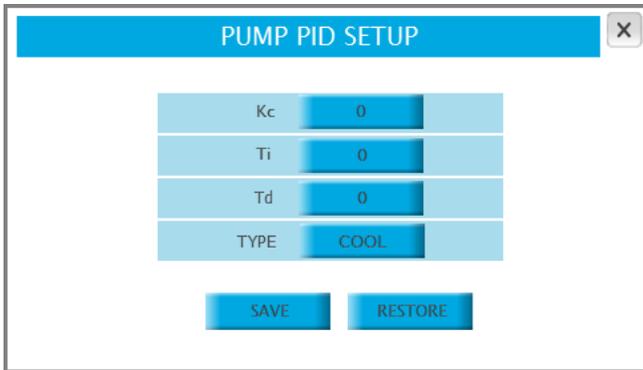| Parameter: STAGE OFF DELAY	
Range:	Function:
0.0 – 999 sec	Determines the time delay before staging off the last lag pump once the conditions are met. It applies to all drives, including IVS sensorless

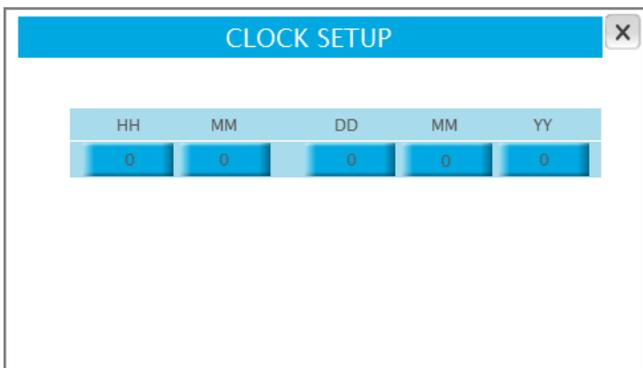| Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2

Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

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7.1.8 PID SETUP

PUMP PID SETUP

Kc	0
Ti	0
Td	0
TYPE	COOL

SAVE   RESTORE

Parameter: Kc	
Range:	Function:
0–9999	Determines the pump speed control PID loop gain. Smaller values correspond to a more responsive controller

Parameter: Ti	
Range:	Function:
0–999	Determines the pump speed control PID loop integral time. Larger values correspond to more iterations and reduction of steady state error

Parameter: Td	
Range:	Function:
0–999	Not used

Parameter: TYPE	
Options:	Function:
Cooling	The speed of the pumps will increase when the Active Zone present value is below the setpoint
Heating	The speed of the pumps will decrease when the Active Zone present value is below the setpoint

Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2

Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

7.1.9 CLOCK SETUP

CLOCK SETUP

| HH | MM | DD | MM | YY |
| 0 | 0 | 0 | 0 | 0 |

Parameter: HH	
Range:	Function:
0 – 24	Sytem clock hour

Parameter: MM	
Range:	Function:
0 – 60	Sytem clock minute

Parameter: DD	
Range:	Function:
1 – 31	Sytem clock day

Parameter: MM	
Range:	Function:
1 – 12	Sytem clock month

Parameter: YY	
Range:	Function:
00 - 99	Sytem clock year

7.1.10 TEMPERATURE CONTROL SETUP

Parameter: TEMP CONTROL	
Options:	Function:
DISABLE	The temperature control setup is disabled. The temperature control button on the main menu is not displayed
ENABLE	The temperature control setup is enabled. The PLC will control a modulating valve to maintain the temperature at setpoint. The temperature control button on the main menu is displayed

Parameter: DIRECTION	
Options:	Function:
FORWARD	The valve opens if the temperature is under the setpoint
REVERSE	The valve closes if the temperature is under the setpoint

Parameter: Kc	
Range:	Function:
0−9999	Determines the valve control PID loop gain. Smaller values correspond to a more responsive controller

Parameter: VALVE OUTPUT	
Options:	Function:
0 – 10 VDC	Selects 0 VDC as valve fully closed command
2 – 10 VDC	Selects 2 VDC as valve fully closed command

Parameter: RANGE	
Range:	Function:
0.0 – 999.9	Indicates the range of the temperature sensor in engineering units. This value corresponds to the sensor's 20mA output

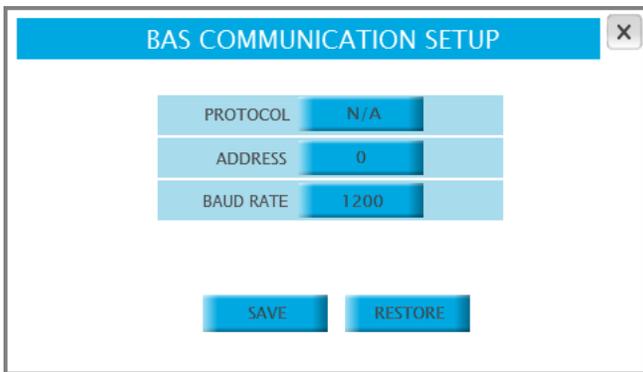| Parameter: ZERO	
Range:	Function:
0.0 – 999.9	Indicates the zero of the temperature sensor in engineering units. This value corresponds to the sensor's 4mA output

Parameter: UNITS	
Option:	Function:
°F	Temperature sensors in °F are used
°C	Temperature sensors in °C are used

Parameter: Ti	
Range:	Function:
0 – 999	Determines the valve control PID loop integral time. Larger values correspond to more iterations and reduction of steady state error

Parameter: MAX OPENING	
Range:	Function:
0.0 – 100.0 %	Determines the maximum allowable opening (in %) of the valve.

Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2

Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

7.1.11   BAS COMMUNICATION SETUP

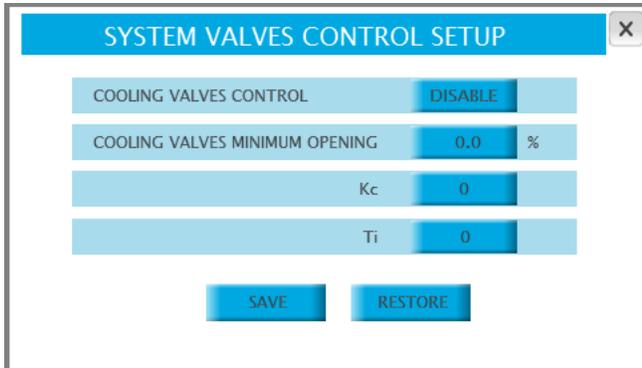| Parameter: PROTOCOL	
Options:	Function:
N/A	No BAS protocol is selected
Modbus	Selects Modbus RTU
Lonworks	Selects Lonworks
Metasys	Selects Metasys
BACnet	Selects BACnet

Parameter: ADDRESS	
Range:	Function:
0–127	Selects the IPS BAS address. Only applies to Modbus and Metasys protocols

Parameter: BAUD RATE	
Options:	Function:
1200	Selects 1200 as baud rate. Only applies to Modbus and Metasys protocols
2400	Selects 2400 as baud rate. Only applies to Modbus and Metasys protocols
4800	Selects 4800 as baud rate. Only applies to Modbus and Metasys protocols
9600	Selects 9600 as baud rate. Only applies to Modbus and Metasys protocols
19200	Selects 19200 as baud rate. Only applies to Modbus and Metasys protocols

Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2

Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

7.1.12   SYSTEM VALVES CONTROL SETUP

SYSTEM VALVES CONTROL SETUP   ☒

COOLING VALVES CONTROL   DISABLE

COOLING VALVES MINIMUM OPENING   0.0   %

Kc   0

Ti   0

SAVE   RESTORE

Parameter: COOLING VALVES CONTROL	
Options:	Function:
DISABLE	System valves control is disabled
ENABLE	System valves control is enabled. The PLC will modify the active zone setpoint in order to maintain the system valve with the maximum opening at setpoint

Parameter: COOLING VALVES MINIMUM OPENING	
Range:	Function:
0.0 – 100.0%	Indicates the setpoint for the minimum opening of the system valves

Parameter: Kc	
Range:	Function:
0–9999	Determines the system valves control PID loop gain. Smaller values correspond to a more responsive controller

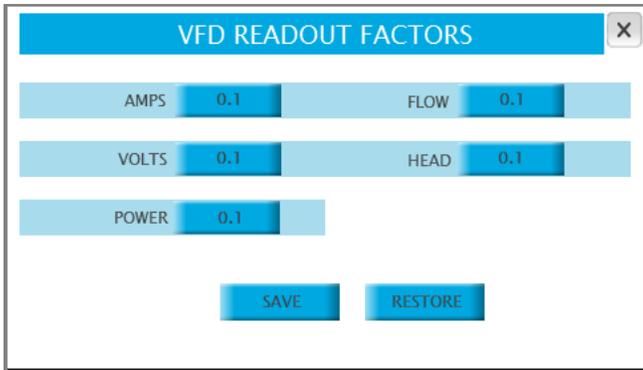| Parameter: Ti	
Range:	Function:
0 – 999	Determines the system valves control PID loop integral time. Larger values correspond to more iterations and reduction of steady state error

Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2

Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2

7.1.13 VFD READOUT SETUP

VFD READOUT FACTORS ✕

AMPS	0.1		FLOW	0.1
VOLTS	0.1		HEAD	0.1
POWER	0.1			

SAVE   RESTORE

Parameter: AMPS	
Options:	Function:
0.1	The current value read from the VFD is divided by 10
1	The current value read from the VFD is not scaled
10	The current value read from the VFD is multiplied by 10
Parameter: VOLTS	
Options:	Function:
0.1	The voltage value read from the VFD is divided by 10
1	The voltage value read from the VFD is not scaled
10	The voltage value read from the VFD is multiplied by 10
Parameter: POWER	
Options:	Function:
0.1	The kW value read from the VFD is divided by 10
1	The kW value read from the VFD is not scaled
10	The kW value read from the VFD is multiplied by 10
Parameter: FLOW	
Options:	Function:
0.1	The flow value read from the VFD is divided by 10
1	The flow value read from the VFD is not scaled
10	The flow value read from the VFD is multiplied by 10
Parameter: HEAD	
Options:	Function:
0.1	The head value read from the VFD is divided by 10
1	The head value read from the VFD is not scaled
10	The head value read from the VFD is multiplied by 10
Button: SAVE	
Range:	Function:
N/A	Saves current parameters as default. Only available in level 2
Button: RESTORE	
Range:	Function:
N/A	Restores default parameters. Only available in levels 1 & 2