ARMSTRONG

IPS 4000 controller

Integrated pumping systems variable speed controllers

Installation and operating instructions

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Armstrong Integrated Pumping System controllers, IPS 4000 controllers, are completely factory-assembled, tested, and shipped to the job site as integral units ready to receive incoming power supply. These instructions describe the procedures to be followed during installation, commissioning and operation to ensure optimum performance and reliability. When contacting the factory for assistance, please provide the unit serial number and other pertinent data, such as ips model number.

1.0 IPS 4000 CONTROLLERS

1.1   INSTALLATION INSTRUCTIONS

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 115VAC/1/60 (230VAC/1/50) as standard. Please refer to the wiring diagram supplied with the unit- for instructions to connect to IPS controller terminal block.

Incoming supply, IPS system on racks: The incoming power supply to the IPS controller is achieved through a transformer in the main enclosure of the whole IPS system rack. 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.

1.2   FIELD DEVICES INSTALLATION INSTRUCTIONS

Before starting to configure the IPS controller using the display keypad, make sure all the field installed devices such as DP sensors, flow sensors and DP switches are properly installed and wired to the IPS controller as per wiring diagram #IPS _ 4000 _ FLD _ 01 reference number 146.

NOTE: Please fill in the IPS commissioning check sheet (below) which will help you through the set-up procedure of the IPS controller.

1.3   BUILDING AUTOMATION SYSTEM (BAS) CONNECTION

When the IPS controller is provided with an RS 485 serial port to communicate serially to the BAS, the standard communication protocol is Modbus, LonWorks or BACnet. Refer to wiring diagram #IPS _ 4000 _ FLD _ 01 reference number 146 for wiring instructions supplied with the unit. The IPS controller can also communicate to the BAS by hard wired option. Please refer to the IPS controller generic terminal block (drawings: 4001, 4002 and 4003 terminal block sticker) for the different parameters and data points communicated to the BAS. For more information please contact your local Armstrong representative or Armstrong factory service department.

2.0 IPS COMMISSIONING CHECK SHEET (Used for inputting data in the IPS controller)

NOTE: 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: _____

IPS CONTROLLER SERIAL NUMBER: _____

DATE OF INSTALLATION/COMMISSIONING: _____

IPS MODEL NUMBER (E.G. IPS 4001 CONTROLLER): _____

ARMSTRONG SERVICE REPRESENTATIVE (IF APPLICABLE): _____

SYSTEM CONFIGURATION

Number of pumps: _____

Is there a standby pump: _____

Pump make, model, and size pump(s) legend: _____

System design point flow (with units): _____

System design point head (with units): _____

Pump selection point flow: _____

Pump selection point head: _____

Pump end of curve flow rating: _____

Pump end of curve pressure rating: _____

Differential pressure switch (flow switch): ☐ Yes ☐ No

Desired default speed (factory preset at 95%): _____

Minimum drive speed (factory preset at 30%): _____

Number of controller zones (process variables): _____

* If not known use pump selection point flow and head

MOTOR DATA

Horsepower: _____

Speed: _____

Voltage: _____

FLA rating: _____

Service factor: _____

FL efficiency: _____

FL slip: _____

Power factor: _____

Temperature class: _____

CONTROLLING DATA

PROCESS VARIABLES/CONTROLLING ZONES

Zone number	1	2	3	4	5	6	7	8	9	10	11
Zone legend											
DP sensor range											
Zone set-point											

Rate of speed change/ramp time (0 - full speed): 20 sec _____

Minimum speed (factory set 30%): _____

Maximum speed (factory set 100%): _____

Flow sensor range: _____

Temperature sensor type, range: _____

High temperature high alarm set-point: _____

Hours of operation before switching lead pump: _____

_____   _____
Date   Signature

3.0 OPERATOR FUNCTION DISPLAYS

The IPS 4001/4002/4003 controller displays are divided in three sets of displays: operation, setup and alarm management. The operation displays are used by the operators to view and control the IPS pumps. The setup screens are used to set, view, save, and restore the system specific settings (i.e. number of pumps, sensor range, etc.). The alarm management screens are used to display the current alarms.

The list of displays in each set is as follow:

OPERATION DISPLAYS:

- Main menu
- System overview
- Zone overview
- Pump overview
- Sensorless overview
- Alarm overview

SETUP DISPLAYS:

The setup displays are divided in three levels with each level having the same number of displays with different levels of access. Level 0 setup displays are for viewing only and no adjustments can be made. Level 1 setup displays can be used for changing the system setup and restoring the system factory defaults. Level 2 setup displays can be used for changing the system setup, and saving and restoring the system factory defaults. To access level 1 and 2 an operator needs to enter the proper password: level 1 password is 9393, level 2 please contact Armstrong factory service department.

The list of setup/default displays for every level is as follow:

- System setup
- Zone setup
- Zone 1 to 12 setup
- Sensorless setup
- Pump setup
- Speed setup
- Staging setup
- PID setup
- BAS setup
- Clock setup
- Temperature control setup
- System valves setup
- VFD readout setup

The level 1 setup screens also have a set of 'Restore default settings' to restore the default setup values on each screen. The level 2 setup screens have a set of 'Restore default settings' and 'Save default settings' to restore or save the default values on each screen.

4.0 SYSTEM FUNCTIONS

The system functions of the HMI operator interface include the operator displays, the installer displays, and the factory displays. To access the installer displays, the user requires a level 1 password. To access the factory displays, the user requires a level 2 password. There is no password required to access the operator displays.
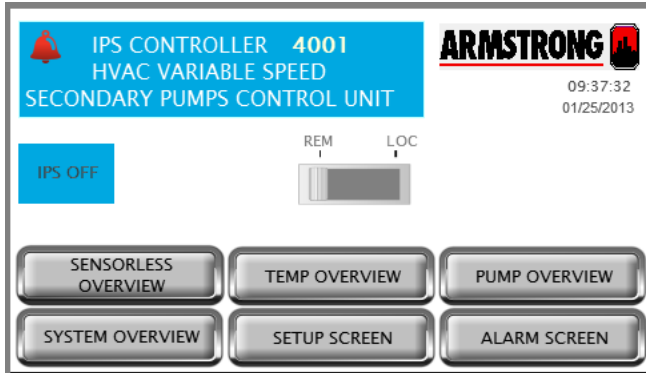
5.0 OPERATOR DISPLAYS

Operator displays include operation displays, alarm management displays and level 0 setup displays. These displays can be accessed without any password. Level 0 setup displays are for viewing only.

## 5.1   OPERATION DISPLAYS

See the following table

5.1.0   MAIN MENU

The screen the operator sees when powering up the unit.

1   Press **SYSTEM OVERVIEW** to view the layout of the system, zone error, active zone, pumps speed and status and if selected, system sensorless flow and head.
2   Press **PUMP OVERVIEW** to view pumps status, speed, run time and pump alarm.
3   Press **ALARM SCREEN** to view any alarm condition that might have occurred.
4   Press **SETUP SCREEN** for system setup (password protected).
5   Any alarm occurred in the system will pop up an alarm image on the top left corner and the color of **ALARM SCREEN** button becomes red.
6   Dragging the slider will select either **LOCAL** or **REMOTE** mode of operations.
7   IPS **ON** is displayed if the controller is ready to start.

5.1.1   SYSTEM OVERVIEW
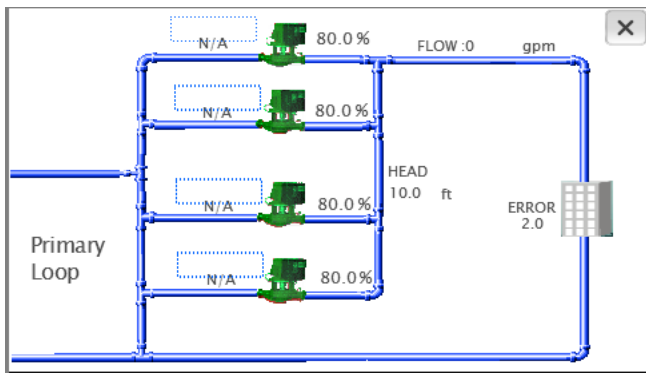
1   Touching the **SYSTEM OVERVIEW** button from main menu will call up this screen.
2   If the IPS is controlling zones, the active zone and active zone error are displayed beside building image. If IPS is in sensorless control mode, system head, flow and error (indicates how far from control curve) are displayed.
3   Pump image will turn on to red color if pump alarm exists.
4   Pump image will turn on to gray if the pump is idle.
5   Pump image will turn on to green if pump is running.
6   Pressing the pump icons will change current screen to pump control screen.
7   Pressing cross button will navigate the current screen to main menu.

5.1.2   PUMP OVERVIEW

1   **MODE** displays pump operation mode: Hand, Off, or Auto..
2   **STATUS 1** shows pump duty order (duty1, duty2, etc.) or standby.
3   **STATUS 2** shows whether the pump is running or stopped.
4   Speed is displayed in both % value of full speed and absolute RPM.
5   **RUN HOURS** are displayed and can be reset in pump control screen.
6   If there is a pump alarm, the corresponding pump button will change to red color.
7   Pressing **PUMP 1** button will bring up the 'pump 1 control' screen to view and control pump parameters. Same for the other pumps.
8   Press the buttons on the menu at the bottom to bring up the desired screen.
9   Pressing the right arrow button will change current screen to further pump overview screen.

5.1.3 SENSORLESS OVERVIEW

1 This screen is only available if the control mode is sensorless (drive type selected is IVS (SL)). (Parallel sensorless feature is available only when using Armstrong IVS sensorless pump)
2 **MODE** displays pump operation mode: Hand, Off, or Auto.
3 **STATUS 1** shows pump duty order (duty1, duty2, etc.) or standby.
4 **STATUS 2** shows whether the pump is running or stopped.
5 **FLOW** is displayed in the selected unit.
6 **HEAD** is displayed in the selected unit.
7 If there is a pump alarm, the corresponding pump button will change to red color.
8 Pressing **PUMP 1** button will bring up the 'pump 1 control' screen to view and control pump parameters. Same for the other pumps.
9 Press the buttons on the menu at the bottom to bring up the desired screen.
10 Pressing the right arrow button will change current screen to further pump overview screen.

5.1.4 PUMP 1 CONTROL

This screen is to control the pump, Hand, Off, Auto, Lead or Lag mode and hand speed

1 Press the **HAND**, **OFF**, **AUTO** buttons to select the desired mode. Illuminated button represents selected mode. Current mode is also displayed in the table.
2 The pump current mode is displayed under these buttons, nothing displayed means **N/A**.
3 Press **LEAD** button to set the pump as lead (duty1) pump (the other pumps will reorder accordingly).
4 When in **HAND** mode, enter the desired speed in the **HAND SPEED** box.
5 When in **AUTO** mode, the speed of the pump is automatically determined by the controller. Graphical bars display actual speed and speed reference.
6 Pump duty is displayed: Duty1(Lead), Duty2(Lag1), Duty3(Lag2), Duty4(Lag3), Duty5(Lag4),Duty6(Lag5) or Standby.
7 Pump status is displayed (running or stopped).
8 **RUN HOURS** indicates the pump total running time since the last reset and can be reset by pressing the displaying area.
9 Drive fault and fault number will be displayed if there is a problem with the VFD.
10 Alarm image will be displayed if there is an alarm in the system.
11 Controller output speed (reference speed sent to the VFD) is displayed in % value of pump full speed.
12 Pump actual speed (feedback from the VFD) is displayed in % value of pump full speed.
13 VFD amps, voltage and power are displayed.
14 If the pump is in auto bypass, and indication appears at the bottom of the screen. Touching this indication brings up the auto bypass reset screen.

5.1.4 LOGIN SCREEN
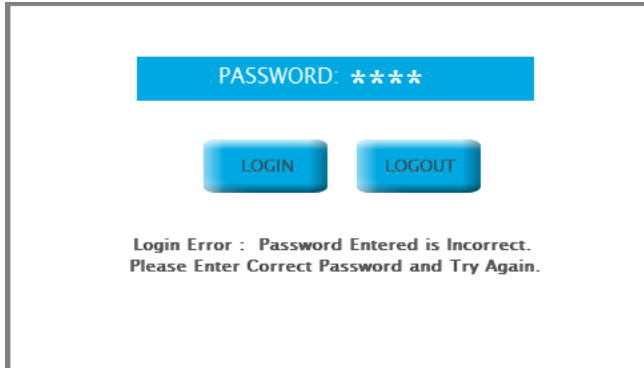

1   In order to be able to modify any of the setup parameters you must login with the proper password.
2   There are three level setup screens. Level 1 and level 2 require operator to input password. Level 0 will allow viewing only of the setup values. Level 1 will allow changes to setup values and to restore the system factory defaults except for the PID parameters. Level 2 will allow changes to all the setup values, and to save or restore all the system factory defaults. All the three levels will allow controlling the pumps.
3   From the system menu screen, pressing the **LOGIN** button will call up this screen.
4   Pressing the password area will pop-up a keypad, input the password through, press **ENT** and then touch the **LOGIN** button. Pressing the **LOGOUT** button will bring you back to the main menu.
5   Successful entry of the password will navigate present screen to the corresponding **SYSTEM SETUP** screen. Wrong entry of password will pop up a Login Error message.

5.2   ALARM MANAGEMENT DISPLAYS

See the following table

5.2.1   ALARMS SCREEN
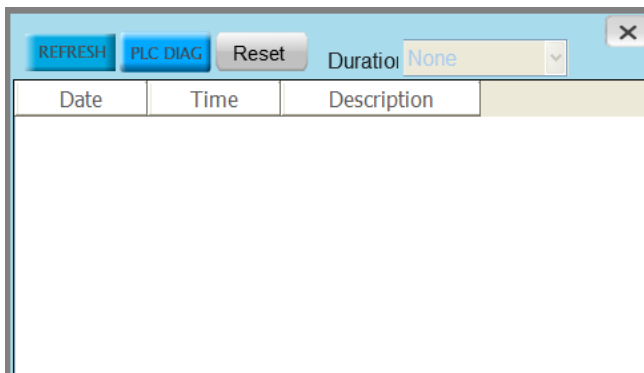
1   All alarms will be displayed in chronological order.
2   The last alarm will be at the bottom of the screen.
3   Press **RESET** to reset all active alarms.
4   Press **REFRESH** to check new arrival of alarms.
5   Press the up and down arrow buttons to view more alarms.
6   Press the left and right arrow buttons to view more content of alarms.
7   Press the cross button to navigate to main menu.
8   Types of alarms are listed below:
   • Interlock system pressure fault.
   • Pump 1 to 6 alarm.
   • Pump 1 to 6 run feedback alarm.
   • Pump 1 to 6 no flow alarm.
   • Pump 1 to 6 drive fault alarm.
   • End of Curve (EOC) dynamic pressure (DP) transmitter alarm.
   • End of Curve (EOC) flow transmitter alarm.
   • All zones transmitter alarm.
   • Zone 1 to 12 transmitter alarm.
   • Pump 1 to 6 sensorless flow deviations alarm.

5.3 PLC DIAGNOSIS DISPLAY

5.3.1 PLC DIAGNOSIS SCREEN
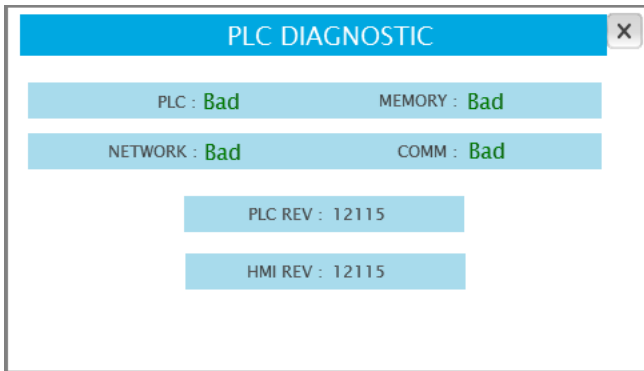
1 Touching the **PLC DIAG** button from the alarms screen will call up this screen.
2 The status of the PLC, memory, network and communication are displayed.
3 The PLC and HMI software revisions are displayed.
4 Touching cross button will navigate to alarms screen.

6.0 SETUP DISPLAYS

The setup displays allow viewing, modifying, saving and restoring system parameters.
There are three 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).

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.

6.1.0 LEVEL 2 SETUP MENU
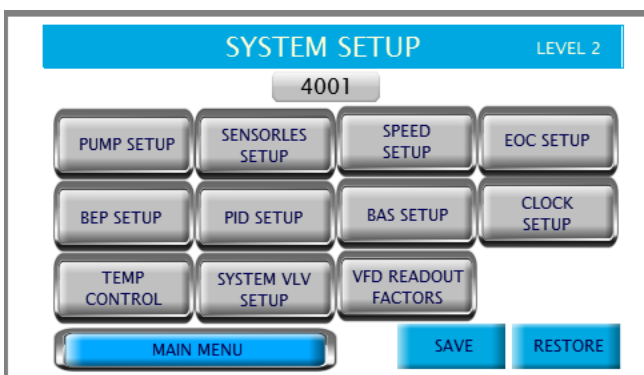
1 Pressing and inputting the proper password in the **LOGIN** screen will call up the Setup menu screen.
2 Pressing any of the **SETUP** button will call up its corresponding Setup display. These displays are for changing the system setup and restoring the system factory defaults.
3 Press **SAVE**, to save all current setup parameters as default.
4 After changing values in any setup screens, should you want to regain the previous saved values, press **RESTORE** button to retrieve all the setup values from the system factory defaults.
5 Below are the screens that the user sees when pressing on each of those buttons.

6.1.1   ZONE SETUP
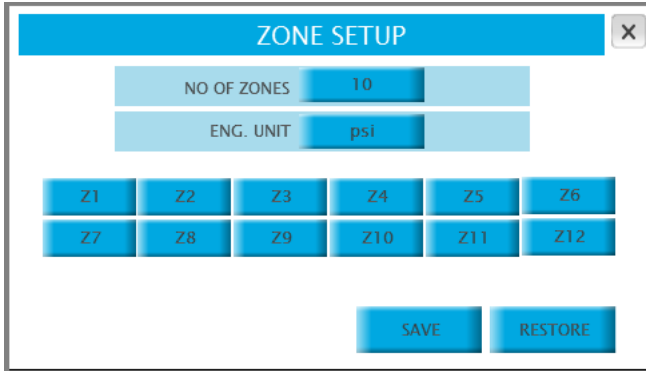
1 Press **ZONE SETUP** button to bring up this screen (this screen is available unless the drive type selected is IVS (SL) on the **PUMP SETUP** screen).
2 Enter the number of Zones.
3 Touching the field beside the **ENG. UNIT** will drop down a menu with engineering units; psi, ft, Kpa, m, and bar. Select appropriate unit for desired operations.
4 Touching the button of each zone will navigate to the corresponding zone setup screen.
5 Press **SAVE** to save the number of zones and engineering units as default.
6 Press the **RESTORE** button to retrieve zone setup values from the system factory defaults.

6.1.2   ZONE 1 TO 12 SETUP
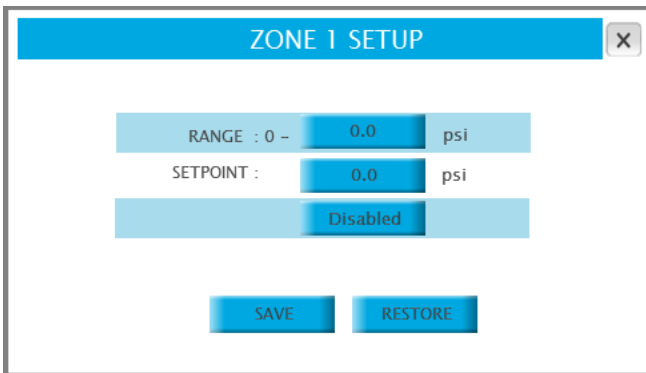
1 From **ZONE SETUP** pressing on any zone button call up its corresponding setup screen, **ZONE 1** is shown as example.
2 Enter the **RANGE** of the the sensor.
3 Depending on the zone demand, enter the **SETPOINT**.
4 Touching the button below the setpoint will drop down a menu with **ENABLE** and **DISABLE** options. Select appropriate option.
5 Press **SAVE** to save the current values as deafult.
6 Press **RESTORE** button to retrieve speed setup values from the system factory defaults.

6.1.3 PUMP SETUP

1. From the setup menu press on **PUMP SETUP** to call up this screen.
2. Enter the number of pumps.
3. Touching the field beside **STDBY PUMP** will drop down a menu **YES** and **NO**. Select appropriate option for desired operations.
4. Touching the field beside "**AUTO BYPASS**" will drop down a menu **ENABLE** and **DISABLE** . Select appropriate option for desired operations.
5. Touching the field beside "**DP SWITCH**" will drop down a menu **ENABLE** and **DISABLE** . Select appropriate option for desired operations.
6. Enter the switch time. Touching the button beside switch time will drop down a menu **DAY** and **HRS**. Select appropriate option for desired operations.
7. Enter the minimum run time in the white box beside the description.
8. Touching the field beside **VFD COMM.** will drop down a menu **ENABLE** and **DISABLE** . Select appropriate option for desired operations.
9. Touching the field beside **DRIVE TYPE** will drop down a menu IVS, FC102, ACH550, E7 and IVS (SL) (SL stands for sensorless, select this option for a sensorless operation). Select the appropriate drive. Touching the button beside the field will drop down a menu **50Hz** and **60Hz**. Select appropriate option for operations.
10. Press **SAVE** to save the current values as default.
11. Press **RESTORE** button to retrieve speed setup values from the system factory defaults.

6.1.4 SPEED SETUP

1. From the setup menu press on **SPEED SETUP** to call up this screen.
2. Enter the pump minimum speed in percentage (100% corresponds to 60Hz or 50Hz).
3. Enter the pump maximum speed in percentage.
4. Enter the pump speed ramp time (time to go from 0 to 100% speed).
5. Enter the pump default speed, speed the pumps will run at when all Zone sensors fail.
6. Enter the pump rated rpm.
7. Press **SAVE** to save the current values as default.
8. Press **RESTORE** button to retrieve pressure setup values from the system factory defaults.

6.1.5   SENSORLESS SETUP

1   From the setup menu press on **SENSORLESS SETUP** to call up this screen (this screen is only available when the drive type is IVS (SL) on the **PUMP SETUP** screen).
2   Enter the **FLOW BEP** (Best Efficiency Point), **HEAD BEP**, **DEAD BAND** and **SENSORLESS ADJUSTMENT**, these parameters determine the staging of pumps.
3   Enter **FLOW DESIGN**, **HEAD DESIGN** and **ZERO FLOW HEAD**, these parameters determine the system curve and control the pump speed.
4   Press **SAVE** to save the current values as default.
5   Press **RESTORE** button to retrieve pressure setup values from the system factory defaults.

6.1.6   EOC SETUP

1   From the setup menu press on **EOC SETUP** to call up this screen.
2   Touching the field beside **TYPE** will drop down a menu **DP** and **FLOW**. Select appropriate option for desired operations.
3   The **EOC** protection can be enabled or disabled by pressing the box beside the description **Status**.
4   Enter the pump end of curve in gpm or in psi.
5   Enter the Flow or DP sensor range based on Type.
6   Press **SAVE** to save the current values as default.
7   Press **RESTORE** button to retrieve pressure setup values from the system factory defaults.

6.1.7   STAGING SETUP

1   From the setup menu press on **BEP SETUP** to call up this screen.
2   Enter pump **STAGE UP** speed for all the Lag pumps in the boxes beside the description. When the speed of lead pump reaches the corresponding speed entered above for a specific time, the next lag pump will be staged up.
3   Enter the pump **STAGE OFF** speed for the lag pump. When the speed of the lead pump goes below this value and the running pumps are drawing 90% or less power for a specific time, the last running lag pump will be staged down.
4   Enter the delay time for staging up and staging down pumps.
5   Press **SAVE** to save the current values as default.
6   Press **RESTORE** button to retrieve staging setup values from the system factory defaults.

6.1.8 PID SETUP

PUMP PID SETUP

Kc	0
Ti	0
Td	0
TYPE	COOL

SAVE   RESTORE

1 From the setup menu press on **PID SETUP** to call up this screen.
2 Enter the PID proportional constant Kc.
3 Enter the PID integral time constant Ti.
4 Enter the PID differential time constant Td.
5 Type of the Heating/Cooling mode can be selected by pressing the button beside the description **TYPE**.
6 Press **SAVE** to save the current values as default.
7 Press **RESTORE** button to retrieve staging setup values from the system factory defaults.

6.1.9 CLOCK SETUP

CLOCK SETUP

HH	MM	DD	MM	YY
0	0	0	0	0

COPY   SET

1 From the setup menu press on **CLOCK SETUP** to call up this screen.
2 Adjust the time and date in the HMI and in the PLC.
3 Pressing **COPY** retrieves the current time and date from the PLC.
4 Pressing **SET** sets the time and date entered on the fields to the PLC.

6.1.10 TEMPERATURE CONTROL SETUP

TEMP. CONTROL SETUP

TEMP CONTROL	DISABLE	RANGE : 0–	0.0	°C
TYPE	COOL	SETPOINT	0.0	°C
Kc	0	Ti	0	
VALVE OUTPUT	0–10 VDC	MAX OPENING	0.0	%

SAVE   RESTORE

1 From the setup menu press on **TEMP. CONTROL SETUP** to call up this screen.
2 Touch the field beside **TEMP. CONTROL** to **DISABLE** or **ENABLE** the temperature control function. If enabled, the main menu will show an additional button.
3 Select the **TYPE** of control, **cool** or **heat**.
4 Enter the **RANGE** of the temperature sensor and its unit.
5 Enter the **SETPOINT**.
6 Enter the PID gain (Kc) and the integral time (Ti).
7 Select the valve output type: 0-10 VDC pr 2-10 VDC.
8 Select the valves's maximum opening allowable in percentage.
9 Press **SAVE** to save the current values as default.
10 Press **RESTORE** button to retrieve staging setup values from the system factory defaults.

6.1.11   BAS COMMUNICATION SETUP

BAS COMMUNICATION SETUP

PROTOCOL	N/A
ADDRESS	0
BAUD RATE	1200

SAVE   RESTORE

1   From the setup menu press on **BAS SETUP** to call up this screen.
2   Select the **PROTOCOL**, options are: Modbus, BACnet and LonWorks.
3   Enter **ADDRESS** (only for Modbus).
4   Select the **BAUD RATE** (only for Modbus).
5   Press **SAVE** to save the current values as default.
6   Press **RESTORE** button to retrieve staging setup values from the system factory defaults.

6.1.12   SYSTEM VALVES CONTROL SETUP

SYSTEM VALVES CONTROL SETUP

COOLING VALVES CONTROL	DISABLE	
COOLING VALVES MINIMUM OPENING	0.0	%
Kc	0	
Ti	0	

SAVE   RESTORE

1   From the setup menu press on **SYSTEM VALVES CONTROL SETUP** to call up this screen
2   Touch the field beside **COOLING VALVES CONTROL** to **DISABLE** or **ENABLE** the system valves control function. If enabled, the controller will maintain the system valve with the maximum opening at the minimum opening setpoint.
3   Enter the **COOLING VALVES MINIMUM OPENING** in percentage.
4   Enter the PID gain (Kc) and the integral time (Ti).
5   Press **SAVE** to save the current values as deafult.
6   Press **RESTORE** button to retrieve staging setup values from the system factory defaults.

6.1.13   VFD READOUT SETUP

VFD READOUT FACTORS

AMPS	0.1	FLOW	0.1
VOLTS	0.1	HEAD	0.1
POWER	0.1		

SAVE   RESTORE

1   From the setup menu press on **VFD READOUT FACTORS** to call up this screen.
2   Select the factor to adjust the respective value read from the VFDs, the options are: 0.1, 1 and 10
3   Press **SAVE** to save the current values as default.
4   Press **RESTORE** button to retrieve staging setup values from the system factory defaults.

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