ARMSTRONG

INSTALLATION AND OPERATING INSTRUCTIONS

Packaged Pressure Booster Systems

IVS Booster Systems with 7" Touch-screen HMI

Armstrong Packaged Pressure Booster Systems are completely factory-assembled, tested, adjusted, and shipped to the job site as integral units ready to receive suction and discharge piping and 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 motor amperage, voltage and suction and discharge pressures.

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## IVS Booster Systems Installation Instructions

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.

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 plate. A good concrete foundation should be approximately 2-1/2 times the weight of the packaged unit.

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 2-1/2 times the diameter of bolts.
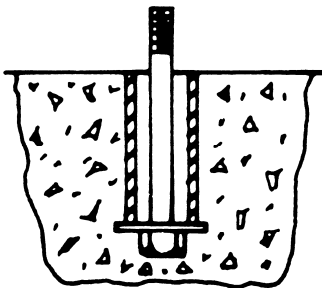
Leveling - When the unit has been placed on its foundation, insert metal wedges approximately 1" thick on either side of the foundation bolts under the base plate. Adjust the wedges until the suction and discharge headers are truly horizontal. Check this by means of a spirit level on the suction and discharge flanges. When leveling is complete, the foundation bolts should be tightened evenly and firmly. Do not over tighten the bolts at this stage.

Piping - 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.

Incoming Supply - The incoming power supply should be brought in through the top of the panel adjacent to the main terminals. 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 pump No. 1 to the "On" or "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 pump No. 1 to the "On" or "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.

Adjustments – The LCD Interface provides access for the adjustable set points, alarms and timers. No other devices require adjustments.

The operation and adjustment procedures for the set points, alarms and timers are described on pages 5 through 28.

Note carefully, however, that all devices are pre-set at the factory and will normally require no further adjustment.

Automatic Operation – To set the unit for automatic operation, turn all the isolating valves to the fully open position, close the main disconnect and switch all pumps to the "Auto" position.

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Intelligent Variable Speed Booster Systems: Basic Operating Function

Every Armstrong Intelligent Variable Speed (IVS) Packaged System – regardless of size or horse power rating – incorporates the twelve (12) basic operating functions as follows:

1. For Continous Run and Intermittent Systems - Sequential starting and stopping of the pumps is achieved by a combination of pump speed, power and set point pressure. 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 pressure. When the lead pump reaches 100% speed or maximum motor nameplate power and the system pressure is not being satisfied, the second pump (lag pump) is automatically started. When a lag pump is started up, a timeclock in the pump controller keeps it operating for a minimum of a 1 minute period to prevent the pump from cycling on and off. On a three, four or five pump system, the third, fourth and fifth pumps are brought on in the same way when the combined pumps reach 100% speed or maximum motor nameplate power and the system pressure is not being satisfied. A similar sequence of events takes place in reverse on decreasing demand.

2. Pump RPM is controlled by a Variable Frequency Drive (VFD) connected directy to each individual pump motor. An analog signal from the discharge pressure transmitter is compared to a desired set point entered in to 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 system set point pressure.

3. A low suction pressure or level shutdown alarm is included with every system to protect the pumps from a loss of suction pressure or water supply. If the water supply pressure, as measured by the suction pressure transmitter falls to 5 psi or the tank level switch (supplied by other) sends a signal to the panel, the pump controller will prevent the pumps from running. This condition is indicated by a "low suction pressure" or "low suction level" alarm description on the control panel alarm page.

4. Variable speed plumbing booster systems come with the following standard alarm functions in addition to the Low Suction Pressure/Level Protection;

   - High Suction Pressure Shutdown
   - Low Suction Pressure Shutdown
   - High System Pressure Shutdown
   - Low System Pressure Shutdown

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

6. Lead Pump status is alternated after every 24 hrs of operation, as a default. The first pump placed in the auto position is considered the lead pump. HOA switches are located in the individual pump control screens. Alternation includes all duty and optional standby pumps.

7. No-flow shut down is achieved through drive parameter control and pressure monitoring. Once a no-demand condition is achieved for a period of 5 minute, the controller will increase the pump speed and charge the drawdown tank or system an additional 5 psi before shutting down.

8. A 15 second delay is incorporated in every system restart. Once started, the pumps ramp up to meet the required set point pressure.

9. The Soft Fill Mode is enabled when the booster system is first powered and after any power disruption. Once started, the pumps ramp up slowly to meet the Soft Fill set point pressure or after a 5 minute operational period and return to normal operation.

10. The Pressure Setback Mode is enabled as standard. The system pressure set point is reduced linearly, as a percentage, as flow decreases.

11. When the Emergency Power Mode is enabled and upon receiving an Emergency Power digital signal, power and control will be restricted to the lead pump only, the Low System Pressure Shutdown will be disabled and the Emergency Power Low System Pressure alarm will be enabled. The one pump will operate for the duration of the Emergency Power Mode and the system will switch to Normal Mode when a signal is not present and the minimum run timer has expired.

12. Variable Speed Controllers are supplied with up to 7 Normally Open (NO) dry contacts for remote monitoring. The contacts are located on the upper left hand portion of the pump controller and indicate the following conditions:
    - 1, 2 – Discharge Pressure Sensor
    - 3, 4 – Suction Pressure Sensor
    - 5, 6 – Remote Start
    - 7, 8 – Level Switch 1 (Signal by Other)
    - 9, 10 – Emergency Power (Signal by Other)
    - 11, 12 – System Alarm
    - 13, 14 – Pump Running

1+	3+	5+	7+	9+	11+	13+
2-	4-	6-	8-	10-	12-	14-

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Variable Speed Booster Systems: General Arrangement Schematic Diagram
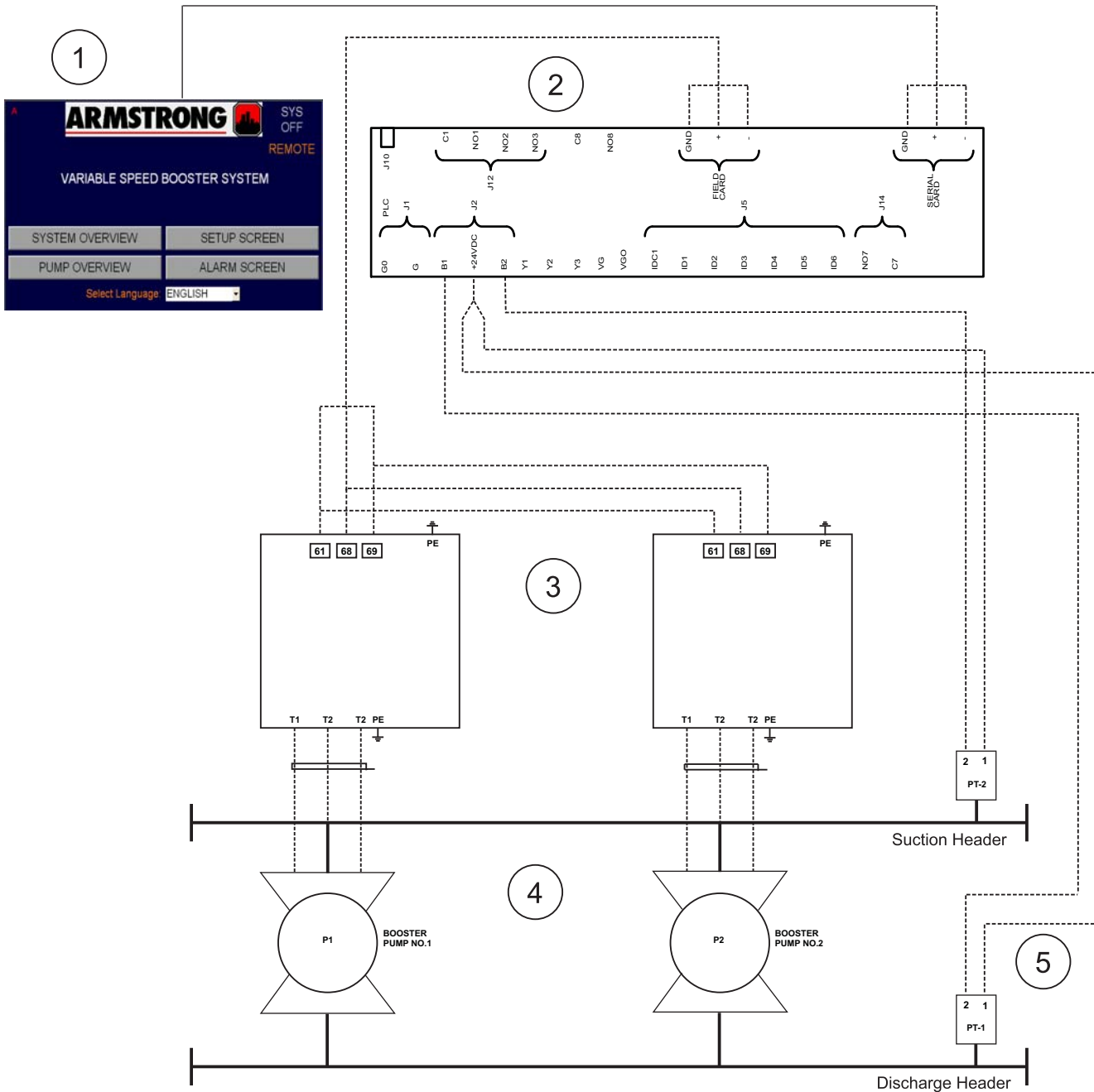
1. Operator Interface
2. Programmable Logic Controller (PLC)
3. Variable Frequency Drives (VFD)
4. Booster Pumps
5. Pressure Transmitters

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IVS Booster Package Commission Check Sheet

The following is a step-by-step guide to starting up and commissioning Armstrong fire pumps. **One check sheet is to be completed per system!** You must follow and fill out all fields below to ensure that all aspects of the booster is checked and set up for proper operation. Once complete, this sheet requires that end-user / general contractor sign off on the work rendered as final approval that the pump is functioning as intended. Please submit this commissioning check sheet along with your work invoice / startup claim in order to ensure prompt and timely payment of work rendered!

NO CHECK SHEET + STARTUP DATA SHEET = INCOMPLETE STARTUP!

UNLESS STATED OTHERWISE ALL FIELDS ARE MANDATORY!

Project Name: _____
Building Address: _____
Contractor Name: _____
Site Contact Name: _____ Site Contact Tel. #: _____
Your Company: _____ Your Name: _____
Pump Model: _____ Booster Serial #: _____
Pump Serial #(s): _____ Sales Order #: _____

<u>NOTES:</u>
- GC = General Contractor
- BAS = Building Automation System

Pre-Startup Package:

Yes	No	N/A	
☐	☐	☐	Do you have the Booster Order Annexe?
☐	☐	☐	Do you have a copy of the electrical wiring diagram?
☐	☐	☐	Do you have a copy of the IVS Booster Installation and Operation Manual?
☐	☐	☐	OPTIONAL: Do you have the pump-specific variable speed curve with duty point indicated?

Pre-Startup Arrangements:

Yes	No	N/A	
☐	☐	☐	Verify with GC that water and power is available and ready to the pump
☐	☐	☐	Verify with GC that pumps can be run without damage to system
☐	☐	☐	Verify with GC that BAS is wired to IVS Booster controller and ready to go (IF APPLICABLE)
☐	☐	☐	Verify with GC that BAS contractor will be there on site to meet you (IF APPLICABLE)

Before Power Up Checklist:

Done	
☐	Check booster installation for proper mounting as per Installation & Operation Manual instructions
☐	Check incoming voltage across the lines and record here: L1 _____ L2 _____ L3 _____ *Note: Voltage should be no more than +/- 10% of design voltage*
☐ ☐	Check if booster set is to be controlled remotely by BAS start / stop contact with BAS contractor: **YES:** Check if BAS dry contact is wired across terminals 5 & 6 inside control panel. **NO:** Move on to the next step. *Note: Contacts close = booster runs. Contacts open = booster stops.*
☐	Open up and bleed pump seal flush line to verify no air is locked inside seal / seal lines. If the pumps are Vertical Multi Stage (VMS) pumps, make sure the vertical column is bled for air by cracking open the bolt located at the top of the stages.
☐	Check alignment of pump (horizontally mounted pumps only)
☐	Record the actual suction pressure from the gauge here: Suction _____ Psi Verify if suction pressure is within range of design suction pressure on Order Annex.

Unit is now safe to turn power on. Once on, make sure all VFDs are in the "AUTO" position and place all pumps in the IVS panel are in the "Off" position to prevent pumps from running!

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Booster Panel Parameter Checklist:
Begin the commissioning by logging into the "Setup" screen with the Level 2 password. Go through all parameters, verify against the order annex and record below.

IMPORTANT: Each screen has a "Save" function on the bottom left corner. Make sure all changes are saved in each screen when made! Once setup is complete, make sure the "Save default" is performed!

Parameter Name	Entered Value
System Setup - No. Of Pumps	
System Setup – Standby Pump	
System Setup 2 - Pressure Units	
System Setup 2 - No. Of Lvl Sw	
Disch Press Setup – Sensor (Enabled default)	ENABLED / DISABLED (Circle one)
Disch Press Setup – Range (0-300psi default)	
Suc Press Setup – Sensor (Enabled default)	ENABLED / DISABLED (Circle one)
Suc Press Setup – Range (0-300psi default)	
System Pressure – Setpoint	
System Pressure – Update Limits*	DONE / NOT DONE (Circle one)
Disch Press Limits – High	
Disch Press Limits – Enabled? (Enabled default)	ENABLED / DISABLED (Circle one)
Disch Press Limits – Low	
Factory High System Shutdown Pressure	
Pump Stage Setup – Stage On Spd	
Pump Stage Setup - Stage Factor	
Staging Delays Setup – On Delay (60s default)	
Staging Delays Setup – Off Delay (60s default)	
Staging Setup – Min Run Time (1min default)	
Soft Fill Mode (Disabled default)	ENABLED / DISABLED (Circle one)
No Flow Shutdown – No Flow (Enabled default)	ENABLED / DISABLED (Circle one)
No Flow Shutdown – Delay (300s default)	ENABLED / DISABLED (Circle one)
No Flow Shutdown – Set Speed	
No Flow Shutdown – Wait Time	
No Flow Shutdown – Pressure Boost	
Speed Setup 1 – Min (30% default)	
Speed Setup 1 – Max (100% default)	
Speed Setup 1 – Ramp (30s default)	
Speed Setup 2 – Dflt Speed (70% default)**	
Speed Setup 2 – Rated RPM	
Pump Rated Power – Rated Power	
Emergency Power Mode	
Pump PID – Kc (8000 default)**	
Pump PID – Ti (50 default)**	
Pump PID – Td (0 default)	LEAVE AT ZERO
Lead Pump Switch Time Setup – Sw After (24h default)	
EOC Protection Setup – EOC Head (50% default)	
Pressure Setback (100% default)	
BAS Interface Setup – Protocol**	
BAS Interface Setup – Node**	
BAS Interface Setup – Baud**	

REMEMBER TO SAVE ALL AS DEFAULT AND SET ALL PUMPS BACK TO THE AUTO POSITION!

* This parameter needs to be changed when changing the setpoint. Once you change it to "OK" and press the return key, it will revert to "Yes" and take effect immediately.

**This parameter is based on site conditions / data. Please consult with appropriate parties (General contractor, BMS contract, etc.) and perform tests to see if system behavior is acceptable.

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PID Tuning:

Done

☐   Turn the system main disconnect OFF

☐   Wait for the discharge pressure to equalize with suction pressure

☐   Turn the system main disconnect ON

☐   Time how long system takes to reach within 95% of discharge pressure setpoint - _____ minutes

☐   If above time is greater than 2min, adjust PID values no more than 5% at a time and repeat test again

Final system ramp time from suction pressure to 95% of discharge pressure setpoint: _____ minutes

Notes on PID Tuning:
Kc controls the step size – decreasing this value will increase the reaction magnitude, increasing this value will decrease the reaction magnitude.
Ti controls the step rate – decreasing this value will speed up the reaction speed, increasing this value will slow down the reaction speed.
Td adds delay into the system. DO NOT USE THIS.

Remember – if in doubt, stick to factory PID default!

No Flow Shutdown (NFS) Test:

Done

☐   Check and make sure all pumps are in the AUTO position (on PLC and VFD)

☐   When system is running, isolate booster system from building loop (run it against a deadhead)

☐   Pumps should continue to maintain set point while ramping down and eventually shutting down to one pump only

☐   The single pump after 300s (default) will ramp up to your NFS Pressure Boost setpoint and then shut down

SIGNOFF:

By signing off on this startup checklist, both parties hereby accept that the equipment listed in this checklist has been properly verified to be fully operational and functioning as per the sales order for the equipment listed.

Startup Technician Name (Please print):	Customer Name (Please print):
Startup Technician Signature:	Customer Signature:
Date (mm/dd/yyyy): / /	Date (mm/dd/yyyy): / /

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Display Overview

The IVS integrated controller HMI is divided in three set of displays: Operation, Setup, and Alarm.

The Operation Displays are used by the users to view and control the Pumps. The Setup Screens are used to set, view, save, and restore the system specific settings (i.e. pressure set point and limits, soft fill mode, pumps parameters, etc.). The Alarm screens are used to display the current alarms, store and display history alarms, give helpful information on each alarm.

The list of displays in each set is as follow:

Operation Displays

- Main Menu
- System Overview
- Pump Overview
- Pump 1 Control
- Pump 2 Control
- Pump 3 Control
- Pump 4 Control
- Pump 5 Control
- Login

The System Displays can be accessed without any password.

Alarm Displays

- Alarm
- Alarm and Help
- Alarm History

The Alarm Displays can be accessed and operated (such as pressing a "reset" button) without any password.

Setup Displays

The Setup Displays are divided in three levels. All the three levels have the same number of displays with different level of access. Level 0 setup displays are for viewing only and no adjustment can be made. Level 1 setup displays can be used for changing the system setup, restoring the system factory defaults except for the PID parameters in the PID Setup Displays. 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

level 2 Setup Displays an operator need to enter the proper password.
The list of Setup Displays for every level is as follow:

- Setup Menu
- Booster Setup
- Sensor Setup
- Pressure Setup
- Pressure Limit Setup
- Staging Setup
- Soft Fill Setup
- No flow shutdown Setup
- Speed Setup

- PID Setup
- Clock 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.

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 is required a level 1 password. To access the Factory Displays, the user is required a level 2 password. There is no password requirement to access the Operator Displays.

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Operator Displays

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

1.1 Operation Displays

1.1.0 Main Menu

This is the screen the operator sees when powering up the unit.

1. Press "SYSTEM OVERVIEW" to view the layout of the system, system pressure setpoint, discharge pressure, remote pressure, suction pressure and boost pressure, pumps speed and status
2. Press "PUMP OVERVIEW" to view pumps status, speed, run time and alarm
3. Press "ALARM SCREEN " to view any alarm condition that might have occurred
4. Press "SETUP SCREEN" for pump, sensor, pressure, limit and soft fill setup (password protected)
5. Press the drop-down list beside "Select Language" to select other display language for all the displays
6. Any alarm occurred in the system will be displayed in scroll bar in the bottom area

1.1.1 System Overview
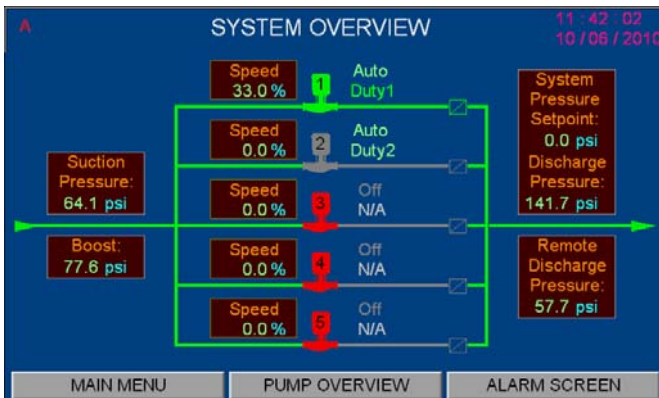
1. System pressure setpoint is displayed.
2. Discharge and suction pressure are displayed
3. Remote pressure are displayed if remote sensor is enabled in "sensor setup" screen
4. Boost pressure are displayed
5. Pumps' running status, duty/standby and speed are displayed
6. Pressing the pump icons will change current screen to pump control screen
7. Press the buttons on the menu at the bottom to bring up the desired screen

![ARMSTRONG logo]

1.1.2 Pump Overview

1. "Mode" displays pump operation mode: Hand, Off, or Auto
2. "Duty" shows pump duty order (Duty1, Duty2, etc.) or standby
3. "Run " 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. Alarm will be displayed if there is a problem with the pump
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

1.1.3 Pump 1 Control Screen

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
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
6. Pump duty is displayed: Duty1(Lead), Duty2(Lag1), Duty3(Lag2), Duty4(Lag3), Duty5(Lag4) 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 will be displayed if there is a problem with the pump
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. Press the buttons on the menu at the bottom to bring up the desired screen

1.1.4 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 3 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 MAIN MENU screen, pressing the "SETUP SCREEN" button will call up this screen
4. Pressing the password area to the right of "Log In:" will pop-up this keypad, input the password through the keypad, press "Ent" button in the keypad will return to this screen or go to the screen corresponding to the password

1.2 Alarm Management Displays
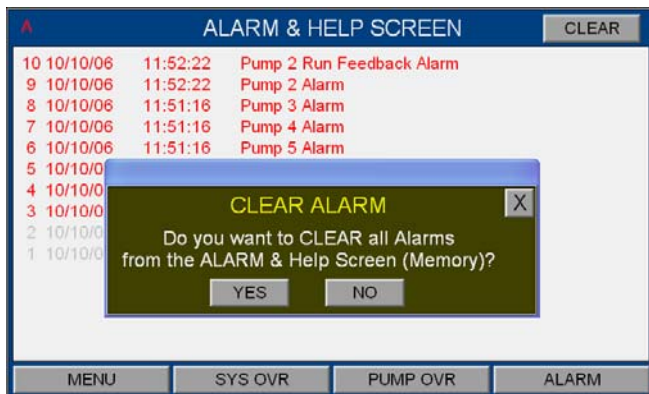
1.2.1 Alarm Screen
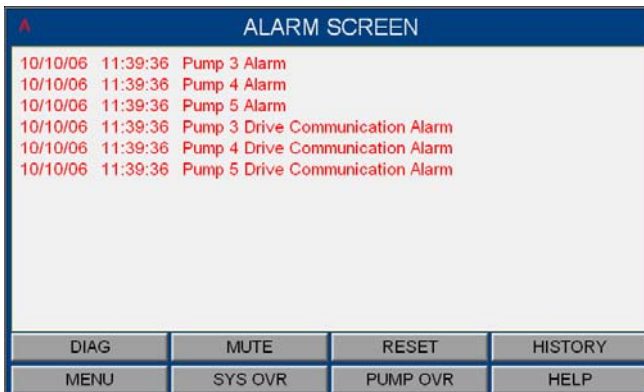
1. All alarms will be displayed in chronological order
2. The last alarm will be at the top of the screen
3. Press "DIAG" to pop up the PLC DIAGNOSTIC box
4. Press "RESET" to reset all active alarms
5. Pressing the "MUTE" button will silence the alarm Horn and stop the flashing of alarm light
6. Press the up and down arrow buttons to view more alarms
7. Press the left and right arrow buttons to view more content of alarms
8. Press the "HELP" button to bring up the Alarm and Help screen
9. Press the "HISTORY" button to bring up the Alarm History screen
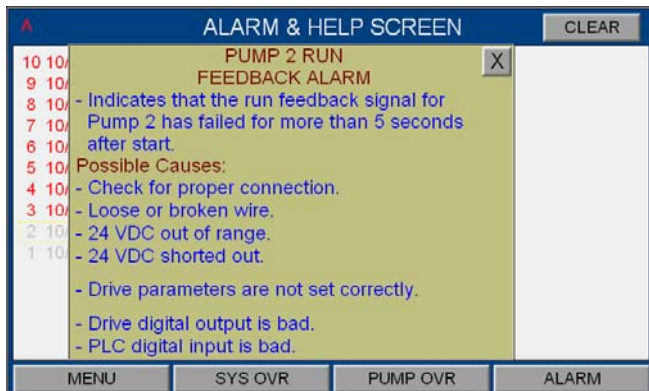10. Press the buttons on the menu at the bottom to bring up the desired screen
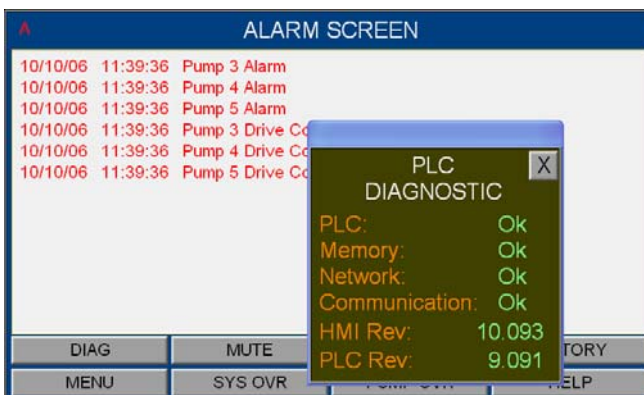
1.2.2 Alarm & Help Screen

1. The alarms saved in the internal memory of the HMI are displayed
2. Pressing the alarm displayed will bring up the alarm Information screen
3. Press the "CLEAR" button will pop up "CLEAR ALARM" box. The alarms in the internal memory of the HMI can be cleared by press "YES" button in this box
4. Press the up and down arrow buttons to view more alarms
5. Press the left and right arrow buttons to view more content of alarms
6. Press the buttons on the menu at the bottom to bring up the desired screen

1.2.3 Alarm Infomation Screen

1. Pressing any alarm in the Alarm & Help screen will pop up a corresponding alarm information box
2. The alarm description, the possible cause of alarm and the remedy for this alarm will be displayed in the alarm information box
3. Press the upper right cross button to close this box

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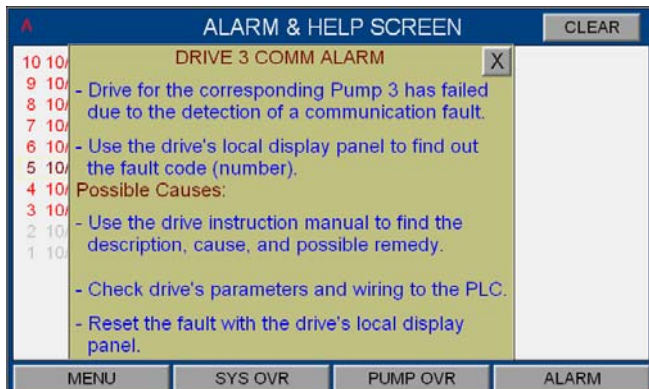
1.2.4 Alarm History Screen

1. The history alarms saved in the internal memory of the HMI are displayed
2. Press the top-right button (black arrow) to select the alarm history day to display. The selected number indicates the number of days before today. The history alarms will be displayed for that day
3. Press the up and down arrow buttons to view more alarms
4. Press the left and right arrow buttons to view more content of alarms
5. Press the buttons on the menu at the bottom to bring up the desired screen

1.3 Level 0 Setup Displays

1.3.0 Level 0 Setup Menu

1. Touching the "SETUP SCREEN" button from "Main Menu" will call up the Level 0 Setup screen
2. Pressing the password area to the right of "Log In:" will pop-up a keypad to log in to the installer level or factory level
3. The top left corner of the screen will flash "A" when there is a new alarm. The "A" will be solid when the alarm is acknowledged or muted. Pressing the "A" will call up the alarm screen
4. Pressing any of the "SETUP" button will call up its corresponding Setup display
5. These displays are for viewing only. No values can be modified on these displays
6. Below are the screens that the user sees when pressing on each of those buttons
7. Touch the buttons on the menu at the bottom to bring up the desired screen
8. Touching the "Right" and "Left" arrow will navigate between the viewing only Setup Screens

1.3.1 Booster Setup

BOOSTER SETUP

1) Number of Pumps: 5 Pumps
2) Standby Pump: One Standby Pump
3) Number of Level Switch: No Level Switch
4) Enter Lead Pump Switch Time (Hrs): 24 Hours
5) Enter Pump Rated Power: 10.0 kW
6) EOC Head: 85.0 %

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

1.3.2 Sensor Setup

SENSOR SETUP

	Zero		Range	Units	Enable
1) Suction pressure:	0.0	~	300.00	psi	Yes
2) Discharge pressure:	0.0	~	300.00	psi	Yes
3) Remote discharge pressure:	0.0	~	300.00	psi	No

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

1.3.3 Speed Setup

SPEED SETUP

1) Pump minimum speed: 33.0 %
2) Pump maximum speed: 100.0 %
3) Pump default speed when all zone sensors fail: 70.0 %
4) Rated RPM from motor nameplate: 1780 RPM
5) Speed maximum ramp time: 20 Sec

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

1.3.4 Pressure Setup

PRESSURE SETUP

1) (Local) discharge pressure setpoint: 150.00 psi
2) Remote discharge pressure setpoint: 130.00 psi
3) Choose the control sensor: Local
4) Auto set pressure limits: Auto Set

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

PRESSURE SETUP

1) System pressure setpoint: 150.00 psi
2) Auto set pressure limits: Auto Set

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

1.3.5 Staging Setup

STAGING SETUP

1) Pump stage on speed: `100.0` %

2) Low power pump stage off speed: `95.0` %

3) Pump stage on delay: `60` Sec

4) Pump stage off delay: `60` Sec

5) Lag pumps minimum run time: `1` Min

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

1.3.6 Pressure Limit Setup

PRESSURE LIMIT SETUP

1) High suction pressure shutdown limit: `140.00` psi `Enable`

2) High discharge pressure alarm/shutdown limit: `165.00` psi `Enable`

3) Low suction pressure alarm/shutdown limit: `5.00` psi

4) Low discharge pressure alarm/shutdown limit in normal mode: `117.50` psi

5) Low discharge pressure alarm/shutdown limit in emergency power mode: `0.00` psi

6) Factory high discharge alarm/shutdown pressure:

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

1.3.7 Soft Fill Setup

SOFT FILL SETUP

1) Soft Fill mode: `Disable`

2) Soft Fill setpoint percent: `0.0` %

3) Soft Fill pump speed ramp: `120` Sec

4) Pressure setback: `85.0` psi

5) Emergency power mode: `Disable`

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

1.3.8 No Flow Shutdown Setup

NO FLOW SHUTDOWN SETUP

1) No Flow shutdown: `Disable`

2) No Flow shutdown delay: `300` Sec

3) Lead pump No Flow shutdown speed setpoint: `95.0` %

4) No Flow shutdown wait time: `60` Sec

5) No Flow boost pressure: `5.00` psi

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

1.3.9 PID Setup

PID SETUP

1) PID Proportional Gain: `4000`

2) PID Integral Time: `15`

3) PID Derivative Time: `0`

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

1.3.10 Clock Setup

CLOCK SETUP

Real Time Clock	Time HH:MM:SS	Date MM/DD/YYYY
HMI Time:	12 : 35 : 12	10 / 6 / 2010
PLC Time:	7 : 20 : 21	6 / 4 / 2015

* FOR VIEWING ONLY.

MAIN MENU | SYSTEM OVERVIEW | MAIN SETUP

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Installer Displays

Installer Displays include operation displays, alarm management displays, and level 1 setup displays. To access level 1 setup displays the user is required to enter the level 1 password.

2.1 Operation Displays

See previously in the Operator Displays

2.2 Alarm Management Displays

See previously in the Operator Displays

2.3 Level 1 Setup Displays

Most of the level 1 setup displays are almost the same as the level 0 setup displays, except that the user can touch buttons and input areas to change the parameter, press "Restore" button to restore changed values to the system factory defaults on each setup display screen.

#### 2.3.0 Level 1 Setup Menu
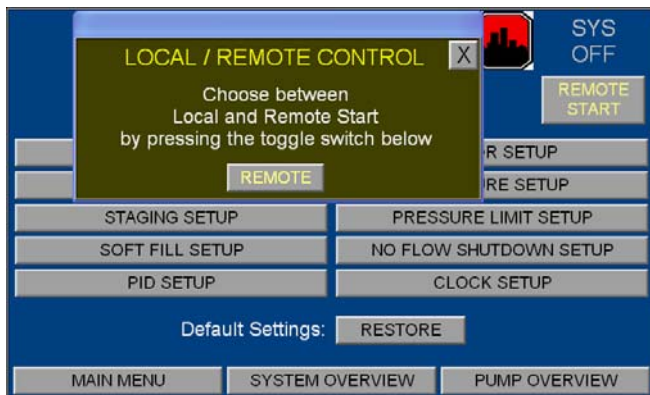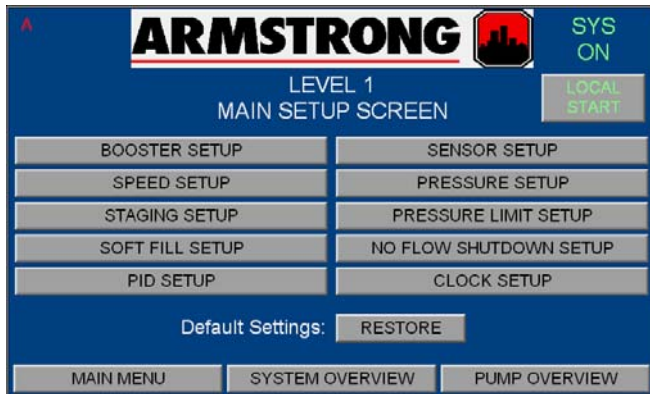
1. Pressing and inputting the proper password in "LEVEL 0 SETUP" screen will call up the Level 1 Setup screen
2. Pressing the "LOCAL/REMOTE START" button will pop-up a box to switch between "LOCAL" and "REMOTE" status (next picture). Under local status the booster set will be started immediately. Under remote status the booster set will be stopped, or started by BAS or the customer's hardwire contact
3. The top left corner of the screen will flash "A" when there is a new alarm. The "A" will be solid when the alarm is acknowledged or muted. Pressing the "A" will call up the alarm screen
4. 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
5. PID setup displays are for viewing only
6. 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
7. Below are the screens that the user sees when pressing on each of those buttons
8. Touch the buttons on the menu at the bottom to bring up the desired screen
9. Touching the "Right" and "Left" arrow will navigate between the Level 1 Setup Screens

2.3.1 Booster Setup
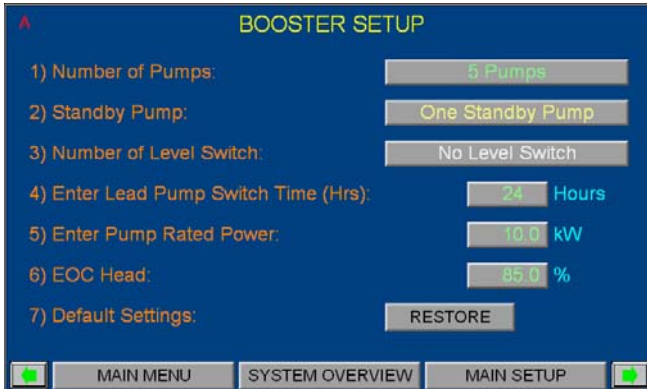
1. Press "BOOSTER SETUP" button from "LEVEL 1 MAIN SETUP" to bring up this screen
2. Touching the bar button beside the description of "number of pumps" will toggle between "0 Pump", "1 Pump", "2 Pumps", "3 Pumps" ", "4 Pumps" and "5 Pumps".
3. Touching the bar button beside the description of "Standby Pump" will toggle between "No Standby Pump" and "One Standby Pump".
4. Touching the bar button beside the description of "Number of Level Switch" will toggle between "No Level Switch" and "One Level Switch".
5. Enter the lead pump switch time. After the duty1 (lead) pump runs for the entered amount of hours, the duty2 (lag1) or standby pump will switch to lead
6. Enter the pump rated power as indicated on the motor
7. Enter the End of Curve Head (EOC Head). This is full speed EOC head in percent of design head
8. Press "Restore" button to retrieve booster setup values from the system factory defaults
9. Touch the buttons on the menu at the bottom to bring up the desired screen

2.3.2 Speed Setup
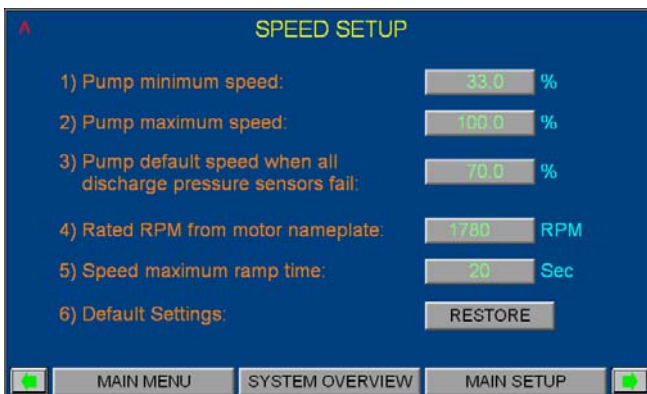
1. From "LEVEL 1 MAIN SETUP" press on "SPEED SETUP" to call up this screen
2. Enter the pump minimum speed. The minimum speed the pump will be allowed to run in Auto or Hand mode
3. Enter the pump maximum speed. The maximum speed the pump will be allowed to run in Auto or Hand mode
4. Enter the pump default speed. If discharge pressure sensor and remote pressure sensor fail, the running pump in Auto mode will have its speed set to the default speed
5. Enter the pump rated RPM as indicated on the motor
6. Enter the speed ramp time. The minimum amount of time it will take the pumps to increase the speed from 0% to 100% or to decrease the speed from 100% to 0%
7. Press "Restore" button to retrieve speed setup values from the system factory defaults
8. Touch the buttons on the menu at the bottom to bring up the desired screen

2.3.3 Sensor Setup
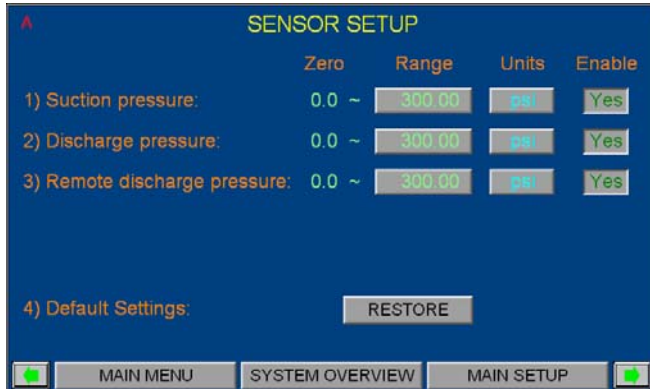
1. From "LEVEL 1 MAIN SETUP" press on "SENSOR SETUP" to call up this screen
2. Press the first box in column 1 to enter the range for system suction pressure sensor
3. Press the second box in column 1 to enter the range for system discharge pressure sensor
4. Press the third box in column 1 to enter the range for system remote pressure sensor
5. Press any box in column 2 to toggle the pressure unit among "psi", "ft", "KPa", "m" and "bar"
6. Press the first box in column 3 to enable or disable system suction pressure sensor
7. Press the second box in column 3 to enable or disable system discharge pressure sensor
8. Press the third box in column 3 to enable or disable system remote pressure sensor
9. Press "Restore" button to retrieve sensor setup values from the system factory defaults
10. Touch the buttons on the menu at the bottom to bring up the desired screen

2.3.4 Pressure Setup
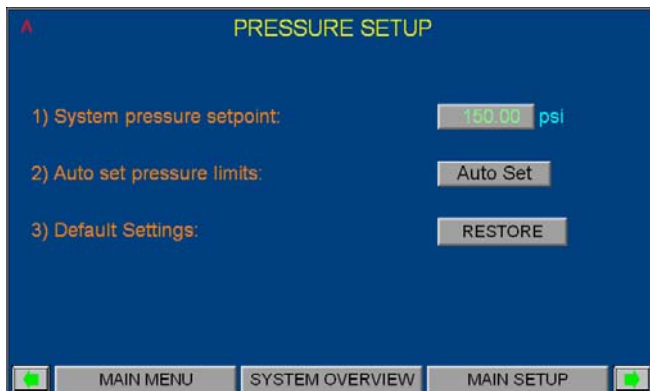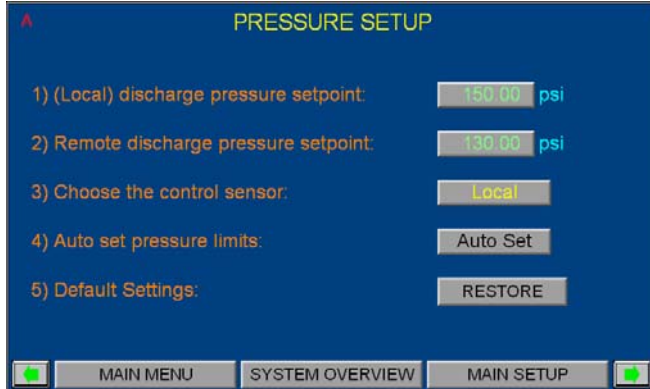
1. Touching the "PRESSURE SETUP" button from "LEVEL 1 MAIN SETUP" screen to call up this screen
2. The "PRESSURE SETUP" has different screens. With the remote pressure sensor enabled, the first screen will be displayed. With the remote pressure sensor disabled, the second screen will be displayed
3. Enter the discharge pressure setpoint or system pressure setpoint in the white box beside the description
4. Enter the remote discharge pressure setpoint in the white box beside the description
5. Pressing the button beside the description of "Choose the control sensor" will toggle between "Local" and "Remote". If "Local" is selected, the discharge pressure sensor will be the control sensor. If "Remote" is selected, the remote pressure sensor will be the control sensor
6. After entering the setpoint, press "Auto Set" button to automatically update the High and Low pressure limits for the discharge and suction pressure according to the pressure setpoint entered
7. Press "Restore" button to retrieve pressure setup values from the system factory defaults
8. Touch the buttons on the menu at the bottom to bring up the desired screen

![ARMSTRONG logo]

2.3.5 Pressure Limit Setup
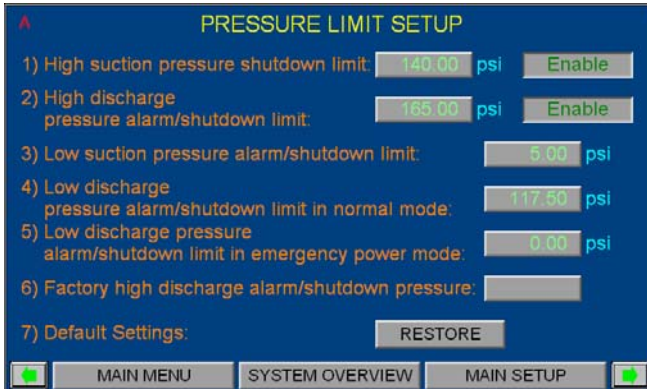
1. Touching the "PRESSURE LIMIT SETUP" button from "LEVEL 1 MAIN SETUP" screen to call up this screen
2. Enter high suction pressure shutdown limit by pressing the left box beside the description. By pressing the right box, this function can be enabled or disabled
3. Enter high discharge pressure shutdown and alarm limit by pressing the left box beside the description. By pressing the right box, this function can be enabled or disabled
4. Enter low suction pressure shutdown and alarm limit by pressing the box beside the description
5. Enter low discharge pressure shutdown and alarm limit in normal mode by pressing the box beside the description
6. Enter low discharge pressure shutdown and alarm limit in emergency power mode by pressing the box beside the description
7. Toggle factory high discharge pressure shutdown and alarm limit by pressing the box beside the description. For "psi", the value is among "200.0, 232.0, 370.0, 400.0". For "ft", the value is among "461.3, 535.1, 853.4, 922.6". For "kPa", the value is among "1378.9, 1599.5, 2551.0, 2757.9". For "m", the value is among "140.61, 163.11, 260.13, 281.22". For "bar", the value is among "13.78, 15.99, 25.51, 27.57".
8. Press "Restore" button to retrieve pressure limit setup values from the system factory defaults
9. Touch the buttons on the menu at the bottom to bring up the desired screen

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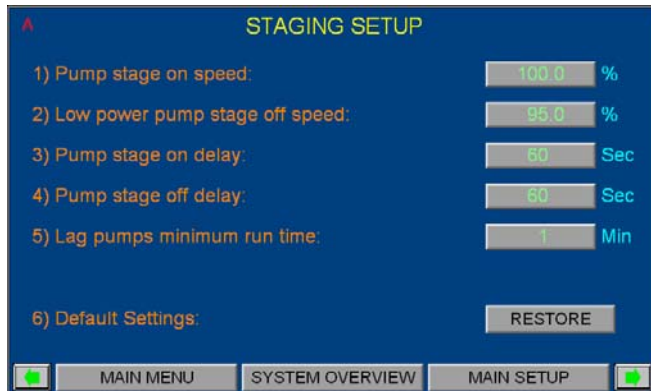
2.3.6 Staging Setup

1. Touching the "STAGING SETUP" button from "LEVEL 1 MAIN SETUP" screen to call up this screen
2. Enter pump stage on 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 low power 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. Enter the lag pump minimum run time. The minimum run time the pump is going to run after it is started
6. Press "Restore" button to retrieve staging setup values from the system factory defaults
7. Touch the buttons on the menu at the bottom to bring up the desired screen

2.3.7 Soft Fill Setup
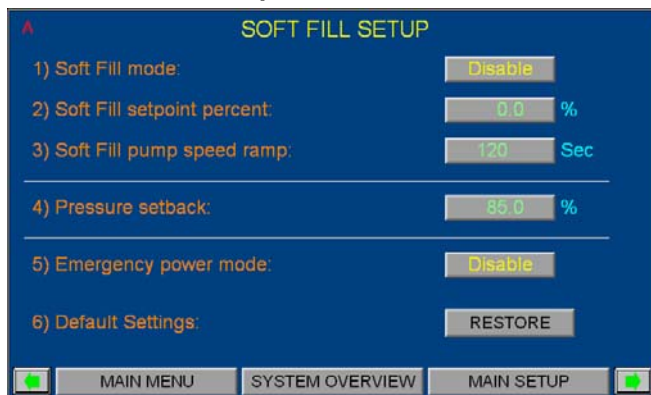
1. Press "SOFT FILL SETUP" button from "LEVEL 1 MAIN SETUP" to bring up this screen
2. Soft Fill mode can be enabled or disabled by pressing the box beside the description
3. Enter soft fill setpoint percent in the box beside the description. This is the percent of the pressure setpoint the booster set will maintain during soft fill mode
4. Enter soft fill pump speed ramp in the box beside the description. This is the minimum amount of time what will takes the pumps to increase the speed from 0% to 100% or to decrease the speed from 100% to 0% during soft fill mode
5. Enter pressure setback in the box beside the description. This is the adjustable reduction of the system pressure setpoint. This feature will decrease the system pressure setpoint proportional to the pumps power consumption
6. Emergency power mode can be enabled or disabled by pressing the box beside the description. If it's enabled, when Emergency Power occurs, the lead pump will be the only pump that will run, auto alternation and Low Discharge Pressure Shutdown will be disabled
7. Press "Restore" button to retrieve soft fill setup values from the system factory defaults
8. Touch the buttons on the menu at the bottom to bring up the desired screen

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2.3.8 No Flow Shutdown Setup
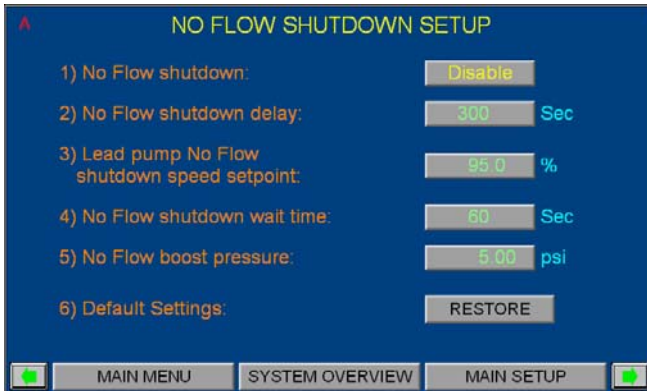
1. Press "NO FLOW SHUTDOWN SETUP" button from "LEVEL 1 MAIN SETUP" to bring up this screen
2. No flow shutdown can be enabled or disabled by pressing the box beside the description. This feature allows the booster set to be shutdown when the no flow condition is met
3. Enter no flow shot down delay in the box beside the description. This is the delay time to check if the discharge pressure changes less than 2psi or equivalent (no flow condition) after the speed of the lead pump is lower than "Lead pump No Flow shutdown speed setpoint"
4. Enter Lead pump No Flow shutdown speed setpoint in the box beside the description. This is the pump speed when only lead pump is running to start to check the no flow condition
5. Enter No Flow shutdown wait time in the box beside the description. This is the wait time to check if the discharge pressure changes less than 2psi or equivalent (no flow confirmation) after the speed of lead pump is reduced 5% from "Lead pump No Flow shutdown speed setpoint" when no flow condition is met
6. Enter No Flow boost pressure in the box beside the description. This is the pressure added to the pressure setpoint before the booster set is shutdown. The new pressure setpoint should be reached within 2 minutes before the booster set is shutdown, otherwise the booster returns to normal running. After the booster set is shutdown, the lead pump should be started when the discharge pressure drops 5psi or equivalent below the pressure setpoint
7. Press "Restore" button to retrieve no flow shutdown setup values from the system factory defaults
8. Touch the buttons on the menu at the bottom to bring up the desired screen
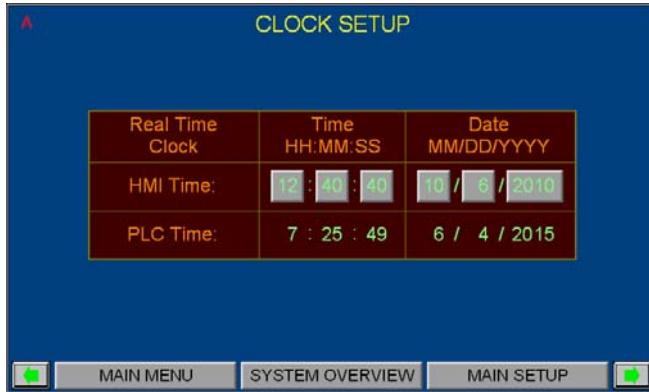
2.3.9 PID Setup
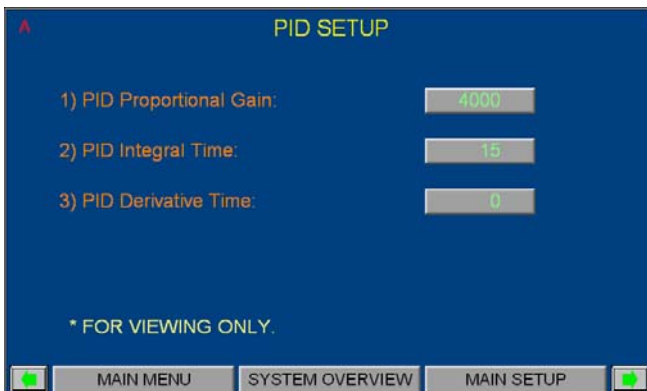
This screen is for viewing only

1. Press "PID SETUP" button from "LEVEL 1 MAIN SETUP" to bring up this screen
2. Touch the buttons on the menu at the bottom to bring up the desired screen

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2.3.10 Clock Setup

CLOCK SETUP

Real Time Clock	Time HH:MM:SS	Date MM/DD/YYYY
HMI Time:	12 : 40 : 40	10 / 6 / 2010
PLC Time:	7 : 25 : 49	6 / 4 / 2015

MAIN MENU   SYSTEM OVERVIEW   MAIN SETUP

1. From the "LEVEL 1 MAIN SETUP" press "Clock Setup" button to call up this screen to adjust the time in the HMI and display the time in the PLC
2. The HMI time and date can be adjusted by pressing the individual hour, minute, second, month, day, and year box and entering the corresponding value
3. Touch the buttons on the menu at the bottom to bring up the desired screen

Factory Displays

Factory Displays include operation displays, alarm management displays, and level 2 setup displays. To access level 2 setup displays the user is required a level 2 password.

3.1 Operation Displays

See previously in the Operator Displays

3.2 Alarm Management Displays

See previously in the Operator Displays

3.3 Level 2 Setup Displays

Most of the level 2 setup displays are almost the same as the level 1 setup displays, except that the user can press "Save" button to save changed values to the system factory defaults on each setup display screen. However, some different displays are listed in the following table

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3.3.0 Level 2 Setup Menu

1. Pressing and inputting the proper password in "LEVEL 0 SETUP" screen will call up the Level 2 Setup screen
2. Pressing the "LOCAL/REMOTE START" button will pop-up a box to switch between "LOCAL" and "REMOTE" status (next picture). Under local status the booster set will be started immediately. Under remote status the booster set will be closed, or started by BAS or the customer's hardwire contact
3. The top left corner of the screen will flash "A" when there is a new alarm. The "A" will be solid when the alarm is acknowledged or muted. Pressing the "A" will call up the alarm screen
4. Pressing any of the "SETUP" button will call up its corresponding Setup display. These displays are for changing the system setup, saving and restoring the system factory defaults
5. After changing values in any setup screens, press "Save" button to save all the changes as system factory defaults
6. 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
7. Below are the screens that the user sees when pressing on each of those buttons
8. Touch the buttons on the menu at the bottom to bring up the desired screen
9. Touching the "Right" and "Left" arrow will navigate between the Level 2 Setup Screens

3.3.1 PID Setup
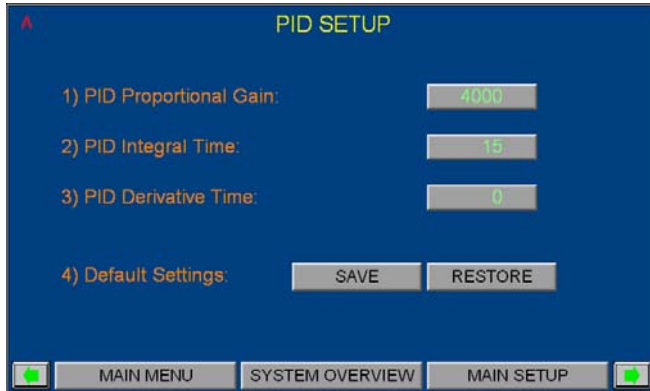
1. Press "PID SETUP" button from "LEVEL 2 MAIN SETUP" to bring up this screen
2. Enter the P proportional gain. Increasing the value will slow down the speed reaction to a system step change. Decreasing the value will increase the speed reaction to a system step change
3. Enter the Integral time. Increasing the value will slow down the speed reaction to a system step change. Decreasing the value will increase the speed reaction to a system step change
4. Enter the D derivative time. Increasing the value will increase the speed reaction to a system step change. Decreasing the value will decrease the speed reaction to a system step change
5. Press "Save" button to save changed values to the system factory defaults, press "Restore" button to retrieve pump PID setup value from the system factory defaults
6. Touch the buttons on the menu at the bottom to bring up the desired screen

NOTE: The D gain is rarely used in HVAC applications; this parameter is used only when the changes in the controlled variable are rapid

3.3.2 Clock Setup

1. From the "LEVEL 2 MAIN SETUP" press "Clock Setup" button to call up this screen to adjust the time in the HMI and the time in the PLC
2. The HMI time and date can be adjusted by pressing the individual hour, minute, second, month, day, and year box and entering the corresponding value
3. The system (PLC) time and date can be adjusted by pressing the individual hour, minute, month, day, and year box and entering the corresponding value
4. Press "Set PLC" button to write the displayed time and date to system
5. Touch the buttons on the menu at the bottom to bring up the desired screen

System Start-Up Procedure

1. Ensure the power supply to the IVS

2. Turn on the main power disconnect on the door of IVS

3. Touch the 'SETUP SCREEN' button in the main menu screen
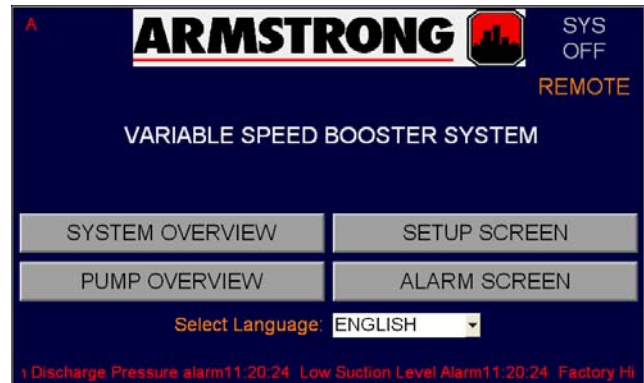
4. The screen changes to 'LEVEL 0 MAIN SETUP SCREEN'. Press the button beside the text of 'Log In:'

5. A keypad pops up. Touch the level 1 or level 2 password, then press 'Ent'

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6. The screen changes to 'LEVEL 1 MAIN SETUP SCREEN' or 'LEVEL 2 MAIN SETUP SCREEN'. Press the button on the top-right corner indicated as 'REMOTE START'
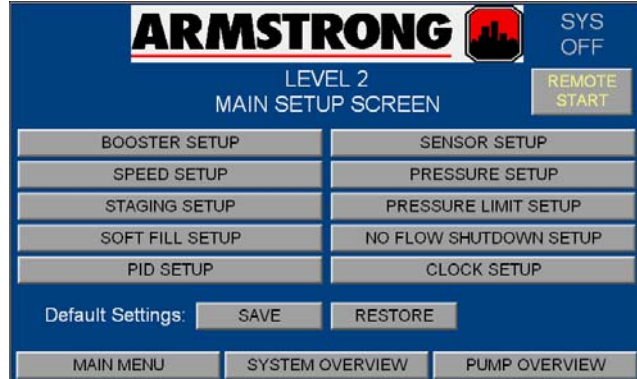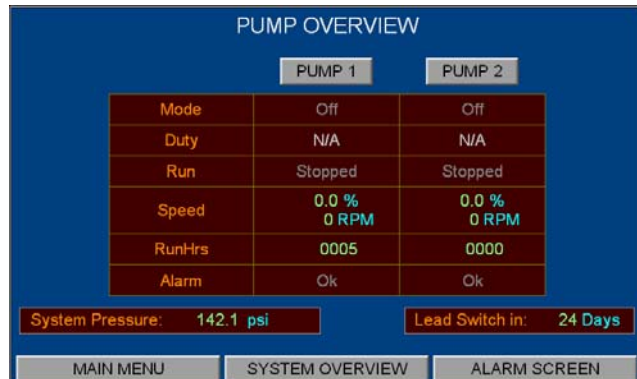
7. A pop-up window displays. Press the button indicated as 'Remote' and the button will show as 'Local'. Close the window by touching the crossing mark button

8. The screen changes back to 'LEVEL 2 SETUP SCREEN'. The top-right corner displays 'SYS ON'. Press the 'PUMP OVERVIEW' button in the bottom.
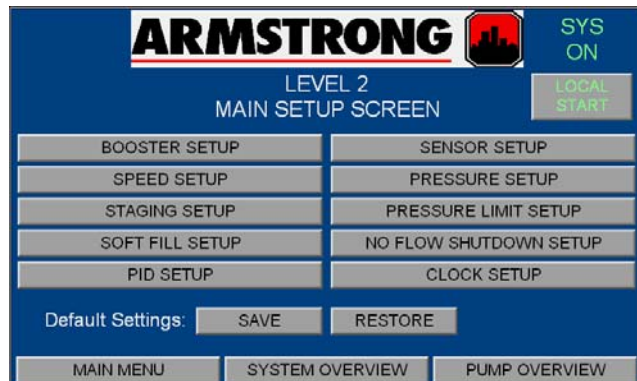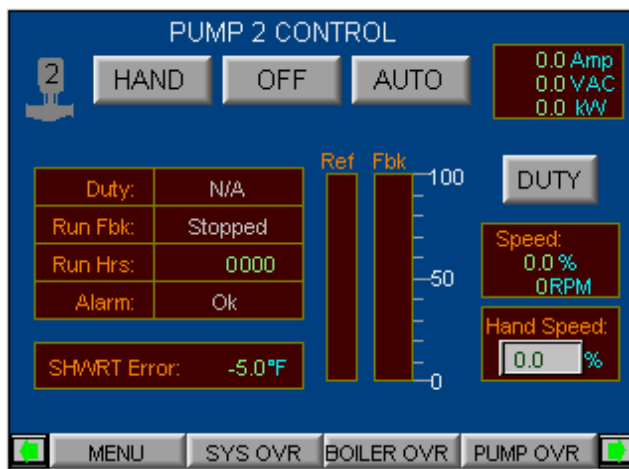
9. The screen changes to 'PUMP OVERVIEW'. Press 'PUMP 1' button

10. 'PUMP 1 CONTROL' is popped up. Press 'AUTO' button. Close the window by touching the crossing mark button, the screen changes to 'PUMP OVERVIEW' again

11. Press 'PUMP 2' button in 'PUMP OVERVIEW' screen. 'PUMP 2 CONTROL' is popped up. Press 'AUTO' button. Close the window by touching the crossing mark button.

12. Repeat the step 10. Set all the pumps in 'AUTO'

13. The IVS booster set will start up automatically