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INSTALLATION AND OPERATING INSTRUCTIONS

PACKAGED PRESSURE BOOSTER SYSTEMS

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.

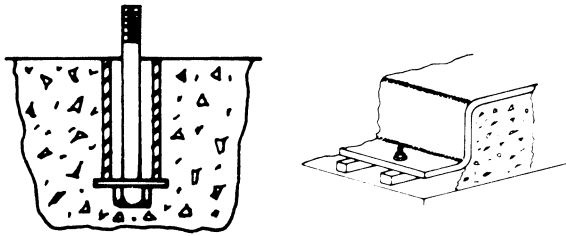
STORAGE - Make sure that all components are kept as clean as possible. Do not remove the crating or plastic wrapping until the unit is ready for installation.

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 baseplate. A good concrete foundation should be approximately 2-1/2 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 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 baseplate 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 overtighten the bolts at this stage.

GROUTING - Fill the baseplate completely with grout, allowing it to flow around the wedges under the baseplate. Allow 48 hours for the grout to set before final tightening of the foundation bolts.

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 pipework 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 side or 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 adjustable devices in the package are as follows:

- (a) Low pressure switch
- (b) Current sensing relay(s)
- (c) Time delay relay(s)
- (d) Pressure reducing valves
- (e) Aquastat

The operation and adjustment procedures for these controls are described on pages 3 and 4.

Note carefully, however, that all devices are pre-set at the factory and, with the possible exception of the pressure reducing valve, will normally require no further adjustment. A final adjustment should be made on the pressure reducing valve to match the output pressure to the exact system requirements.

THERMAL BLEED TEST - To test the thermal bleed circuit, switch pump No. 1 to the "On" or "hand" position and close the isolating valve on the pump discharge side. When the temperature in the pump rises to approx. 120°F, the thermostat will operate and open the solenoid valve, allowing the heated water to bleed to drain. Repeat this procedure with the other pump(s).

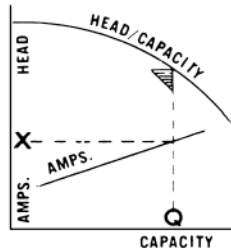
AUTOMATIC OPERATION - Setting the unit for automatic operation is very straightforward. Turn all the isolating valves to fully open position and close the main disconnect. Switch pump No. 1 to the "On" or "Auto" position and switch the other pump(s) to "Auto".

CONSTANT SPEED BOOSTER SYSTEMS

BASIC OPERATING FUNCTIONS

Every Armstrong Constant Speed Packaged System – regardless of size or type or horsepower rating – incorporates seven (7) basic operating functions as follows:

- 1) One pump (lead pump) operates continuously. ** When the system demand exceeds the capacity of the lead pump, the second pump (lag pump) is automatically started up to share the load. On a three-pump system, the third pump is brought on in the same way when demand exceeds the combined capacity of the two lead pumps. A similar sequence of events takes place in reverse on decreasing demand.
- 2) 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 right, 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.
- 3) 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.
- 4) During periods of low demand, the pumps are operating at, or near, shut-off and there is a tendency for the pumps to overheat. To prevent this, each package incorporates a thermal bleed circuit. A small quantity of water from each pump discharge is continuously circulated past the bulb of an aquastat and back to the suction header. Rising water temperature is sensed by the aquastat which operates a solenoid valve and allows a controlled quantity of water to bleed to drain.**
- 5) A pressure switch is connected into each package to protect against low suction pressure. If the city supply pressure falls to a dangerously low level, the switch operates and prevents the pumps from running. This condition is indicated by a red light on the control panel.



- 6) Each individual pump has a selector switch to permit manual or automatic operation.
- 7) Should a motor overload and fail to operate, the next pump in sequence starts up automatically.

** Except when no-flow shut-down is provided.

OPTIONAL FUNCTIONS

The following optional functions may be incorporated:

- a) Automatic (electrical) alternation featuring a time clock and transfer relay.
- b) Pressure switch to provide protection against high system pressure.
- c) Pressure switch to provide protection against low system pressure (burst main).
- d) Pressure switch to shut off the pumps when the city supply pressure is sufficient to supply the system without boosting.
- e) No-Flow Shut-Down replaces thermal bleed circuit. An Aquastat senses the water temperature in the lead pump casing (volute) and, on rising temperature, the Aquastat turns off the system. A system pressure switch, connected to the discharge header, re-energizes the lead pump. A draw down tank must be installed preferably on the top floor with any type shut-down.

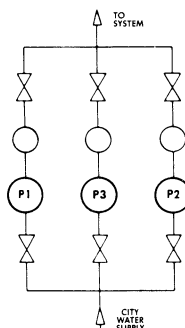
VALVING

Ball valves, or butterfly valves, are provided on the suction and discharge sides of each individual pump to permit isolation for servicing. Each pump discharge line is also fitted with either

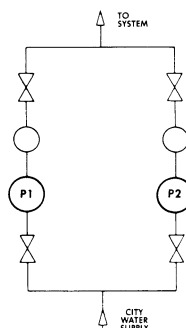
- (a) A non-slam check valve
- or
- (b) A combination pressure reducing and check valve which provides constant system pressure regardless of variations in city supply pressure.

PIPING ARRANGEMENTS

THREE-PUMP
PACKAGED SYSTEMS
SCHEMATIC LAYOUT

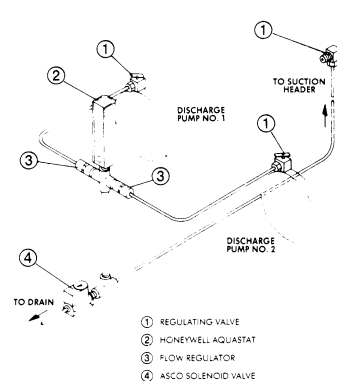


TWO-PUMP
PACKAGED SYSTEMS
SCHEMATIC LAYOUT



(*) ALTERNATIVELY NON-SLAM CHECK VALVES

THERMAL BLEED CIRCUIT



LOW PRESSURE SWITCH • ALLEN-BRADLEY



- 1-2 Normally closed. Open on increasing pressure.
- 3-4 Normally open, close on increasing pressure.

APPROXIMATE FACTORY SETTING

Operating Point.....5 psi
Differential.....10 psi

ELECTRONIC CURRENT SENSING RELAY



This device is factory preset for proper operation. No further adjustment should be required. The below procedure is to be followed should field adjustments be necessary.

ADJUSTMENT PROCEDURE

I Value - This adjusts the current setting (motor amperage) that trips the relay. Turning the knob clockwise increases the amount of current required to trip the relay. Turning the knob counterclockwise decreases the amount of current. The actual tripping amperage must be read from an amprobe or similar device attached to the motor power leads.

Time Value - This knob adjusts the built-in time delay to prevent nuisance starting of other pumps in the system. The delay is adjustable from 0 - 30 seconds. The time scale is selected from the Time Sector adjustment of 1 or 30 seconds.

Amber Light - This lamp illuminates at anytime the relay senses a current greater than the set point of the I value. It's function is to indicate the relay is operating.

Green Light - Indicates that the relay is powered.

EASY RELAY - TIME DELAY RELAY ADJUSTMENT



Electronic time delay relay(s) are used to prevent rapid on/off cycling of the pumps and other delayed control functions. To make changes to the timer values:

- 1) Move cursor to the PARAMETERS value
- 2) Press OK
- 3) Select the timer value that you wish to change, move cursor over to the value field and increase the value using the up arrow or decrease the value using the down arrow.
- 4) Press OK

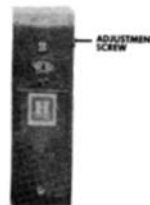
PRESSURE REDUCING & CHECK VALVE

Pressure adjustment is made by turning the adjustment screw to vary the spring pressure on the diaphragm. The greater the compression on the spring, the higher the pressure setting.



- 1) Remove the protective cap from the pressure reducing control.
- 2) Turn the adjustment screw in (clockwise) to increase delivery pressure.
- 3) Turn the adjustment screw out (counter-clockwise) to decrease delivery pressure.
- 4) Tighten jam nut on adjustment screw and replace protective cap.

AQUASTAT



The Aquastat is connected in series with the Asco solenoid valve and is arranged to operate when the water temperature rises to a predetermined value. A visible control point scale and external adjustment screw permit easy setting.

FACTORY ADJUSTMENT 120°F for continuously running systems

When no-flow shut-down is provided, the Asco solenoid valve is not supplied. The Aquastat is set at between 80-90°F and turns off the system.

VARIABLE SPEED BOOSTER SYSTEMS

BASIC OPERATING FUNCTIONS

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

1. Continuous Run Systems - One pump (lead pump) operates continuously at various speeds to maintain the set point pressure. When the system demand exceeds the Best Operating Point (BOP) of the lead pump or the system pressure is not being satisfied, the second pump (lag pump) is automatically started. On a three or four pump system, the third and fourth pumps are brought on in the same way when demand exceeds the BOP of the combined capacity of the prior pumps. A similar sequence of events takes place in reverse on decreasing demand.
2. Pump RPM is controlled by a Variable Frequency Drive (VFD) connected directly to each individual pump motor. An analogue 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. Sequential starting and stopping of the pumps is achieved by a combination of pump BOP or set point 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 pressure.
4. When a lag pump is started up, a timeclock in the pump controller keeps it operating for a minimum of a 2 minute period to prevent the pump from cycling on and off.
5. During periods of low demand, the lead pump is operating at or near shut-off and can cause the pump to overheat. To prevent this, each package incorporates a thermal bleed circuit. A small quantity of water from each pump discharge is continuously circulated past the bulb of an aquastat and back to the suction header. Rising water temperature is sensed by the aquastat which operates a solenoid valve and allows a controlled quantity of water to bleed to drain.
6. A low suction pressure alarm is included with every system to protect the pumps from a loss of suction pressure. If the city supply pressure as measured by the suction pressure transmitter falls to 5 psi, the pump controller will prevent the pumps from running. This condition is indicated by a "low suction pressure" alarm description on the control panel alarm page.
7. Lead Pump status is alternated after every 24 hrs of operation. The first pump placed in the auto position is

considered the lead pump. Virtual HOA switches are located in the individual pump/control screens.

8. Should a motor or drive overload and fail to operate, the next pump in sequence starts up automatically.
9. Variable speed plumbing booster systems come with the following standard alarm functions in addition to the Low Suction Pressure Protection;
 - High Suction Pressure Cut-Out
 - Low Discharge Pressure Cut-Out
 - High Discharge Pressure Cut-Out
 - Low System Pressure Next Pump Starts
 - No-Flow ShutDown**
 - Leap Pump Failure Protection
 - Motor and Drive Overload
 - Suction and Discharge Transmitter Failure

** No-Flow shutdown is enabled when system is supplied with a drawdown tank.

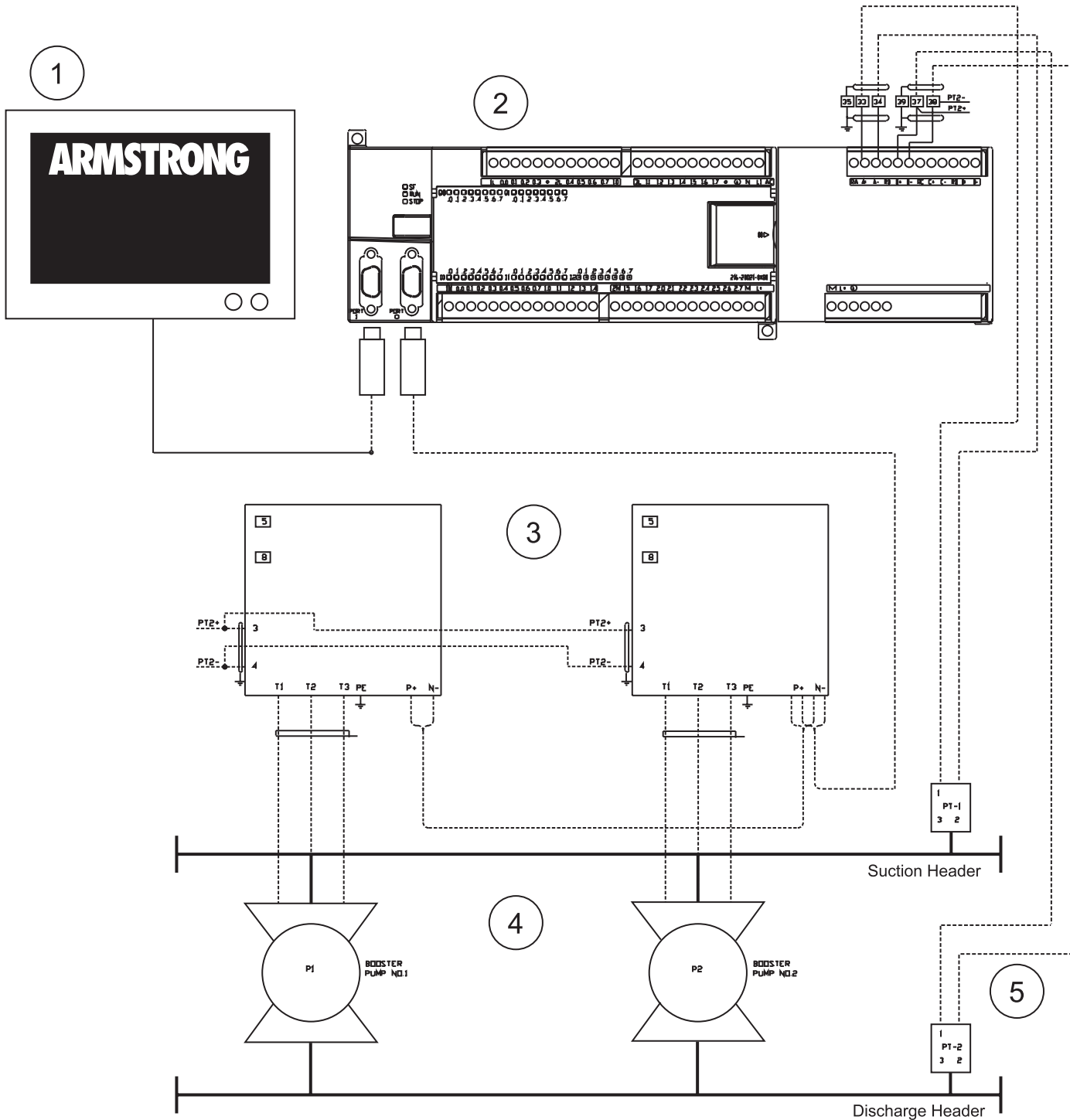
10. No-flow shut down is achieved through drive parameter control and pressure monitoring. Once a no-demand condition is achieved for a period of 120 seconds the controller will increase the pump speed and charge the drawdown tank an additional 5 psi before shutting down.
11. A 5 second delay is incorporated in every system restart. Once started the pumps ramp up slowly to meet the required set point pressure. Pumps will maintain speed within a 5 psi control band.
12. Variable Speed Controllers are supplied with 8 Normally Open (NO) dry contacts for remote monitoring. The contacts are located on the top right hand portion of the pump controller and indicate the following conditions:

- 1 - Motor/Drive Failure
- 2 - High System Pressure
- 3 - Low System Pressure
- 4 - Low Suction Pressure
- 5 - High Suction Pressure (Not included on 4 pump systems)
- 1 - Pump1 Status
- 2 - Pump2 Status
- 3 - Pump3 Status
- 4 - Pump4 Status

1	2	3	4	5	6	7	8

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

VARIABLE SPEED BOOSTER SYSTEMS

OPERATOR INTERFACE

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.

Deactivate Screen

Purpose

Soiling the touch screen cannot be avoided during normal operation. Therefore, the screen should be cleaned at regular intervals. Deactivate the screen prior to cleaning to prevent triggering a function unintentionally.

Conditions for deactivating the screen

In order to deactivate the screen on the operating unit, press the Clean Screen button shown on the Main menu. After touching the

relevant button, the screen is cleared and a bar graph appears. The screen is then deactivated for 30 seconds. The screen can then be cleaned without any functions being triggered inadvertently. The bar graph on the screen indicates the time remaining until the touch panel is reactivated.

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.

OPERATOR FUNCTIONS

Armstrong VFD booster controllers have operator accessible and password protected functions. Password protected functions can be accessed using Procedure 6 below (page 12 of this manual).

1. Setting Unit to Control Speed



Armstrong Pumps Inc.
Booster Pump System
MAIN MENU

LOG IN:
=0000

System Overview
Pump Status
Setup
Alarm
Sequence

1. Press the "Pump Status" Button

P1 Sys
Alarm Alarm

Pump/Drive 1 Status

Status: Ok RESET

Drive Fault Number: <00 <00.0 Volts

Operation: Stopped <00.0 Amps

Mode: Hand Off Auto <00.0 KW

Hours of Operation: <0000 RESET

Total Energy Consumption: <0000 kWh

Main Menu Pump 1 Control
System Overview Alarm

2. Press the "Pump 1 Control" Button

P1 Sys
Alarm Alarm

Pump 1 Control

Hand Off Auto <00.0 Volts
<00.0 Amps
<00.0 KW

Mode: Hand Off Auto

Status: Stopped

Lead Lag

Pressure Setpoint: <000.0 psi

Discharge Pressure: <000.0 psi

Pump 1 Status Hand Speed %: =00.0

System Overview Alarm

3. Press the "Auto" Button to place the system in automatic control.
4. Press the "System Overview" Button to return the controller to normal operation.
5. To change pump speed control to Manual press the "Hand" Button, then press the "Speed %" field and enter the value for the manual speed as a percentage of full motor speed. Press the "Return" Button to accept the newly entered value.

2. Setting Control Pressure and Alarm Pressure Set Points

Setpoint Screen

Discharge Pressure Setpoint (psi):	=000.0
High Press. Alarm/Shutdown Setpoint (psi):	=000.0
Low Press. Alarm/Shutdown Setpoint (psi):	=000.0
High Suction Press. Shutdown Setpoint (psi):	=000.0
Low Suction Press. Shutdown Setpoint (psi):	=000.0
Default All Settings To Factory Settings:	DEFAULT

Main Menu Alarm

1. From the Main Menu press the "Setup" Button
2. Press the "Pressure Setpoint" field and enter the desired set point pressure then press the "Return" Button.
3. In order to change the High Pressure Shutdown, Low Pressure Shutdown or High Suction Pressure Shutdown Alarm press the respective field location on the screen and enter the desired value and then press the "Return" Button.
4. To restore the pump controller to the factory test values press the "Default" Button

3. Viewing Alarm Possible Causes

Alarm Summary Screen 1 of 2

Drive No.1 Faulted	High System Pressure Shutdown
Drive No.1 Failure	Low System Pressure Shutdown
Drive No.2 Faulted	Low Suction Pressure Shutdown
Drive No.2 Failure	High Suction Pressure Shutdown
No Flow Shutdown	

System Overview

Reset Silence Alarm (Pg2)

Alarm Summary Screen 2 of 2

Suction Press.X-mitter Fail

Discharge Press.X-mitter Fail

PLC Stopped/Failure

System Overview

Reset Silence Alarm (Pg1)

1. The Alarm Summary Screen can be accessed from the Main Menu. The Alarm Summary Screen will indicate which alarm conditions if any are present.
2. To reset the unit following alarm conditions or shutdowns, press the "Reset" button.
3. To silence the alarm without resetting the alarm conditions, press the "Silence" button. It is advisable to log alarms before resetting them for service purposes.
4. All various alarm conditions are indicated on 1 alarm summary screens.

Alarm Help Screen

"Low System Pressure": Indicates that the discharge pressure is less than or equal to the modifiable setpoint for 10 sec's.

"High System Pressure": Indicates that the discharge pressure is greater than or equal to the modifiable setpoint for 10 sec's.

"Low Suction Pressure": Indicates that the suction pressure is less than the modifiable setpoint for 5 sec's.

"High Suction Pressure": Indicates that the suction pressure is greater than or equal to the modifiable setpoint.

Troubleshooting

Alarm Page 1

System Overview

5. To view the Help screen regarding alarms, touch the alarm text displayed on the screen. The Alarm help Screen will appear. There are three Alarm Help Screens to assist with identifying possible causes of alarms (shown to the left and below).

Alarm Help Screen

"Drive Faulted": Indicates that a fault has occurred on the drive indicated.

"Pump Failure": Indicates that the pump indicated has failed to produce discharge pressure when running.

"No Flow Shutdown" of the system is a normal condition based on discharge conditions of the system being satisfied for 5 min.

Troubleshooting

Alarm Page 1

System Overview

Alarm Help Screen

"Suction Pressure Transmitter Failure": Indicates that the suction pressure is out of range for 10 sec's.

"Discharge Pressure Transmitter Failure": Indicates that the discharge pressure is out of range for 10 sec's.

"PLC Stopped/Failure": Indicates that the PLC has faulted or is in a stopped mode.

Troubleshooting

Alarm Page 2

System Overview

6. To see the Troubleshooting information available in the controller, touch the Alarm Help text displayed on the screen. Once again, there are three Alarm Troubleshooting screens to assist with service of the unit (displayed to the left and below).

Alarm Troubleshooting

"Low System Pressure": Possible causes: setpoint out of range, discharge press. transmitter malfunction, leak in discharge pipin

"High System Pressure": Possible Causes: setpoint out of range, discharge press. transmitter malfunction, pump malfunction.

"Low Suction Pressure": Possible Causes: suction pressure transmitter malfunction, leak in discharge piping.

"High Suction Pressure": Possible vauses: suction pressure transmitter malfunction, setpoint out of range, drive/pump malfunction.

Alarm Page 1

System Overview

Alarm Troubleshooting

"Drive Faulted": verify and remedy fault code indicated on the pump status screen. Reset fault and alarm.

"Pump Failure": Possible Causes: loose or broken wire, impeller frozen, loose or blocked, drive failed to start.

"No Flow Shutdown": this is a normal shutdown function of the system.

Alarm Page 1

System Overview

Alarm Troubleshooting

"Suction Pressure Transmitter Failure": Possible Causes: loose or broken wire, 24VDC out of range, transmitter line plugged.

"Discharge Pressure Transmitter Failure": Possible Causes: loose or broken wire, 24VDC out of range, transmitter line plugged.

"PLC Stopped/Failure": Possible Causes: PLC faulted, PLC switch in TERM or STOP position. REMEDY: place PLC switch in RUN Position or cycle PLC power.

Alarm Page 2

System Overview

4. Viewing motor Voltage and Current or Resetting Elapsed Timer

P1 Sys Pump/Drive 1 Status
Alarm Alarm
Status: Ok RESET

Drive Fault Number: <00 <00.0 Volts
Operation: Stopped <00.0 Amps
Mode: Hand Off Auto <00.0 KW
Hours of Operation: <0000 RESET
Total Energy Consumption: <0000 kWh

Main Menu Pump 1 Control
System Overview Alarm

1. To View the Individual Motor Voltage and Current or Elapsed Run Time press the "Pump Status" Button from the Main Menu.
2. To Reset the counter, press the "Reset" Button on the Pump/Drive 1 Status Screen

5. Resetting Individual Motor Drive Faults

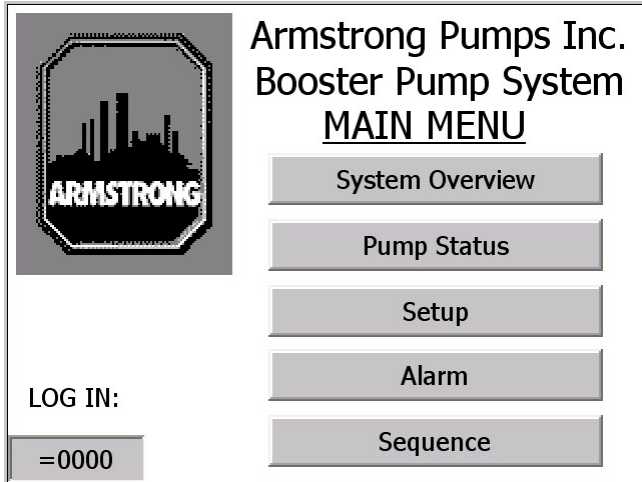
P1 Sys Pump/Drive 1 Status
Alarm Alarm
Status: Ok RESET

Drive Fault Number: <00 <00.0 Volts
Operation: Stopped <00.0 Amps
Mode: Hand Off Auto <00.0 KW
Hours of Operation: <0000 RESET
Total Energy Consumption: <0000 kWh

Main Menu Pump 1 Control
System Overview Alarm

1. To View the Individual Drive Reset Buttons, press the "Pump Status" Button from the Main Menu.
2. To Reset the drive, press the Drive Fault "Reset" Button on the Pump/Drive 1 Status screen
3. Before resetting drive faults, it is recommended to log the "Drive Fault Number". This code will indicate the cause of the drive fault (see page XXX for drive fault codes)

6. Sequencing Setup – Duplex Units



**Armstrong Pumps Inc.
Booster Pump System
MAIN MENU**

LOG IN:
=0000

System Overview
Pump Status
Setup
Alarm
Sequence

Sequence Setup Screen 1 of 3

Pressure to Speed Ratio: P/S <00.000

Sequence Lag Pump On (1-2): P/S <= =00.000

Sequence Lag Pump Off (2-1): P/S > =00.000

Sequence Lead Pump Off (1-0): P/S > =00.000

Sequence Lead Pump On (0-1): dp =00.000

Default Sequence To Factory Settings: DEFAULT

Main Menu Seq. Page 2

Sequence Setup Screen 2 of 3

Real Time Clock Set-Up

Set Clock HH : MM : SS DD / MM / YY

Actual Clock: <0 : <0 : <0 <0 / <0 / <0

Set Clock To: =0 : =0 : =0 =0 / =0 / =0

Main Menu Seq. Page 3

1. Depending on site conditions, adjustments may be required to the sequencing of the pumps.
2. To enter the "Sequence Setup" screen, a password must first be entered. The password is entered by touching the "Login" field on the Main Menu. The password can be obtained inside the control cabinet or by contacting your local Armstrong Authorized Service Provider.
3. Sequencing is based on a ratio of differential pressure (pressure difference between discharge and suction pressures), and the drive operating speed. The actual value of this parameter can be read off the "P/S" field to assist in making sequencing changes.
4. Each step of the sequence can be set independently, except the system call after a no-flow shutdown (step 0 to step 1 of the sequence). The no-flow shutdown call setting is factory set to 5psi below the design system pressure. This value can be adjusted as desired, but this is generally not recommended.
5. At any point, these values can be returned to their factory settings by touching the "Default" button.
6. Controllers are equipped with a real-time clock which governs the alternation. To set the clock, touch each field and type in the actual time and date as appropriate.
7. The real time clock uses "military time". For example, to set the time and date to 10:27pm on July 15, 2003, input the following values:

HH	MM	SS	DD	MM	YY
22	27	00	15	07	03

Sequence Setup Screen 3 of 3

Pump Alternation Time Set-Up


Actual Time: Hrs Min.
Switch Lead Pump at: Hrs Min.

Minimum Run Timer Set-Up

Timers: Enabled
Timer set at: Minutes

8. The automatic alternation occurs every 24 hours at a specified time. Units are factory set to alternate at 2:00am. Only the hour and minute (in military time) are settable.
9. For startup, sequencing adjustment, service, and troubleshooting purposes, minimum run timers on the unit can be disabled. To do so, touch the "Disable" button. When service is complete, remember to re-enable the timers by touching the "Enable" button.

7. Sequencing Setup – Triplex Units



Armstrong Pumps Inc. Booster Pump System MAIN MENU

LOG IN:

1. To access the sequencing setup, use the procedures outlined in section 6 of this manual. Real-time clock, alternation, and timer settings also follow the same procedure.

Sequence Setup Screen 1 of 3

Pressure to Speed Ratio: P/S
Sequence 1st Lag Pump On (1-2): P/S <=
Sequence 2nd Lag Pump On (2-3): P/S <=
Sequence 2nd Lag Pump Off (3-2): P/S >
Sequence 1st Lag Pump Off (2-1): P/S >
Default Sequence To Factory Settings:

2. For triplex units, you will note that there are now two values for the Pressure to Speed Ratio.
3. When setting the sequencing, the value of P/S on the left is used for steps 1 to 2, 2 to 1, and 1 to 0 of the sequence.
4. The value of P/S on the right is used for steps 2 to 3 and 3 to 2 of the sequence.

Sequence Setup Screen 2 of 3

Sequence Lead Pump Off (1-0): P/S > =0.000
 Sequence Lead Pump On (0-1): dp =0000

Real Time Clock Set-Up

Set Clock HH : MM : SS DD / MM / YY
 Actual Clock: <0 : <0 : <0 <0 / <0 / <0
 Set Clock To: =0 : =0 : =0 =0 / =0 / =0

Main Menu

Seq. Page 3

8. PID (Proportional, Integral, Derivative) Setup

Sequence Setup Screen 3 of 3

Pump Alternation Time Set-Up

Actual Time: <0 Hrs <0 Min.
 Switch Lead Pump at: =0 Hrs 0 Min.

Minimum Run Timer Set-Up

Timers: Enable Disable Enabled
 Timer set at: =0.0 Minutes SPEED CONTROL
 Main Menu Seq. Page 1

Speed Control Set-Up

Time In Seconds To Go From 0 To 100% PID Gain Kc and PID Integral Ti
 Setpoint Ramp: =0 Kc =0.000
 Speed Ramp: =0 Ti =0.000

Default Speed Control To Factory Settings: DEFAULT

Main Menu

System Overview

- Once again, the call setting to turn the unit on after no-flow (step 0 to 1 of the sequence) is set to 5psi below the design system discharge pressure.

- In the rare case where the PID in the unit needs to be tuned, the PID setup can be accessed from Screen 3 of the "Sequence Setup Screen".
- To adjust the PID, touch the "Speed Control" button.

WARNING: These settings should be changed only by factory authorized representatives as the settings can compromise the stable operation of the system.

- The ramp-up and ramp-down time (in seconds) can be adjusted to speed up or slow down the system's response on turning pumps on and off by inputting the appropriate value in seconds.
- The Proportional Gain (K_c) and Integral Gain (T_i) only are adjustable from the screen.

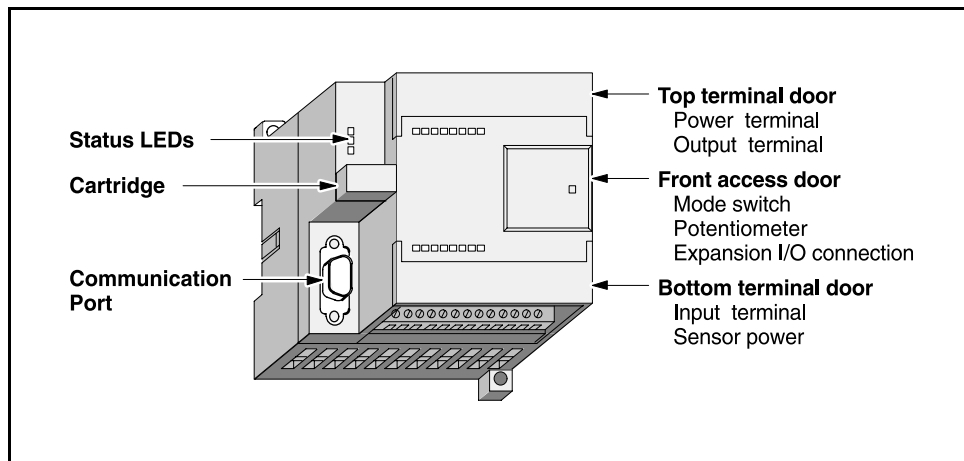
WARNING: These settings should be changed only by factory authorized representatives as the settings can compromise the stable operation of the system.

VARIABLE SPEED BOOSTER SYSTEMS

PROGRAMMABLE LOGIC CONTROLLER

Overview

- The S7-200 CPU combines a central processing unit (CPU), power supply, and discrete I/O points into a compact, stand-alone device.
- The CPU executes the program and stores the data for controlling the VFD drives and processes the requests from the operator interface.
- The digital inputs and outputs are the system control points: the inputs monitor the signals from the pressure transmitters and the outputs control the pumps.
- The power supply provides electrical power for the CPU and for any expansion module that is connected.
- The communications port(s) are connected to the operator interface as well as the VFD's using the USS communication protocol.
- Status lights provide visual information about the CPU mode (RUN or STOP), the current state of the local I/O, and whether a system fault has been detected



- In order to reset the PLC move the Mode switch from On to Off and back On again.

Troubleshooting

Problem	Possible Causes	Solution
Outputs stop working	<ul style="list-style-type: none"> • The device being controlled has caused an electrical surge that damaged the output. • User program error • Wiring loose or incorrect • Excessive load • Output forced points • Electrical noise <ul style="list-style-type: none"> – 0001 through 0009 • Component damage <ul style="list-style-type: none"> – 0001 through 0010 	<ul style="list-style-type: none"> • When connecting to an inductive load (such as a motor), verify that the suppression circuit used is adequate. Refer to Section 2.4 of S7-200 manual. • Correct user program • Check wiring and correct • Check load against point ratings • Check CPU for forced I/O • For electrical noise: <ul style="list-style-type: none"> – Refer to the wiring guidelines in Section 2.3 of S7-200 manual. It is very important that the control panel is connected to a good ground and that high voltage wiring is not run in parallel with low voltage wiring. – Connect the M terminal on the 24 VDC Sensor Power Supply to ground.
Power supply damaged	Over-voltage on the power lines coming to the unit.	Connect a line analyzer to the system to check the magnitude and duration of the over-voltage spikes. Based on this information, add the proper type arrestor device to your system. Refer to the wiring guidelines in Section 2.3 of S7-200 manual for information about installing the field wiring.
Electrical noise Problems	<ul style="list-style-type: none"> • Improper grounding • Routing on wiring within the control cabinet. • Input filters are configured for a speed that is too fast 	<p>Refer to the wiring guidelines in Section 2.3 of S7-200 manual. It is very important that the control panel is connected to a good ground and that high voltage wiring is not run in parallel with low voltage wiring.</p> <p>Connect the M terminal on the 24 VDC Sensor Power Supply to ground.</p> <p>Increase the input filter delay in the system data block. Refer to Section 5.2 of S7-200 manual information about installing the field wiring.</p>

! Warning

Attempts to install or remove CPUs or related equipment with power applied could cause electric shock or faulty operation of equipment. Failure to disable all power to the unit and related equipment during installation or removal procedures may result in death or serious personal injury, and/or damage to equipment. Always follow appropriate safety precautions and ensure that power to the unit is disabled before attempting to install or remove CPUs or related equipment.

Variable Frequency Drive Faults

P1

Sys

Alarm

Alarm

Pump/Drive 1 Status

Status:

Ok

RESET

Drive Fault Number:

<00

<00.0

Volts

Operation:

Stopped

<00.0

Amps

Mode:

Hand

Off

Auto

<00.0

KW

Hours of Operation:

<0000

RESET

Total Energy Consumption:

<0000

kWh

Main Menu

Pump 1 Control

System Overview

Alarm

Variable frequency drives protect motors and their internal circuitry against a wide range of abnormal operating conditions. The operator interface is designed to indicate these conditions with a simple "Drive Fault" alarm. If drive faults occur frequently, more detail may be required by the service person on the reason for the fault.

On the "Pump/Drive Status" screen, a drive fault code number is indicated. This code should be cross referenced to the Drive Manufacturer's Manual. See Drive Manufacturer's CD located inside Controller. All Drive Faults should be recorded prior to resetting or using the BOP to operate the drive. BOP inputs will override and reset the drive faults.

Changing Variable Frequency Drive Parameters Using the BOP

In the event of a CPU or interface failure, the drives can be operated using a basic operator panel (BOP) bypassing the operator interface and PLC. Below is an example of how to set parameter P0004 to the proper "parameter filter function". This will limit the number of parameters you can view and help you go quickly to parameter P2200. For this, as shown in figure 4, parameter P0004 need to be set to value 22. The next step is to go to parameter P2200 and change index 0001 to value 0. For a list of parameters, refer to the VFD manual supplied with this unit.

Figure 1

Changing parameters with the BOP

The procedure for changing the value of parameter P0004 is described below. Modifying the value of an indexed parameter is illustrated using the example of P0719. Follow exactly the same procedure to alter other parameters that you wish to set via the BOP.

Changing P0004 – parameter filter function







Step	Result on display
1 Press  to access parameters	r 0000
2 Press  until P0004 is displayed	P0004
3 Press  to access the parameter value level	0
4 Press  or  to the required value	7
5 Press  to confirm and store the value	P0004
6 Only the command parameters are visible to the user.	

Figure 2

Changing P0719 an indexed parameter Selection of command/setpoint source











Step	Result on display
1 Press  to access parameters	r 0000
2 Press  until P0719 is displayed	P0719
3 Press  to access the parameter value level	r 0000
4 Press  to display current set value	0
5 Press  or  to the required value	12
6 Press  to confirm and store the value	P0719
7 Press  until r0000 is displayed	r 0000
8 Press  to return the display to the standard drive display (as defined by the customer)	

Figure 3-6 Changing parameters via the BOP

Figure 3






NOTES

In some cases - when changing parameter values - the display on the BOP shows . This means the inverter is busy with tasks of higher priority.

Changing single digits in Parameter values

For changing the parameter value rapidly, the single digits of the display can be changed by performing the following actions:

Ensure you are in the parameter value changing level (see "Changing parameters with BOP").

1. Press , which causes the right hand digit to blink.
2. Change the value of this digit by pressing  / .
3. Press , again causes the next digit to blink.
4. Perform steps 2 to 4 until the required value is displayed.
5. Press the  to leave the parameter value changing level.

NOTES

The function button may also be used to acknowledge a fault condition

Figure 4

P0004 Parameter filter

Filters available parameters according to functionality to enable a more focussed approach to commissioning.

Parameter settings:	Min:	Def:	Max:	Unit:
	0	0	22	-

Further parameter data:

CStat:	CUT	P-Group:	ALWAYS
Datatype:	U16	QuickComm.	No
Active:	Y		

Dependency:

Parameters marked "Quick Comm: Yes" in the parameter header can only be set when P0010 = 1 (Quick Commissioning).

Possible Settings:

- 0 All parameters
- 2 Inverter
- 3 Motor
- 4 Speed sensor
- 5 Technol. application / units
- 7 Commands, binary I/O
- 8 ADC and DAC
- 10 Setpoint channel / RFG
- 12 Drive features
- 13 Motor control
- 20 Communication
- 21 Alarms / warnings / monitoring
- 22 Technology controller (e.g. PID)

Example:

P0004 = 22 specifies that only PID parameters will be visible.

! Caution

This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with **Warnings** or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property. Only suitable qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance. Risk of electric shock. The DC link capacitors remain charged for five minutes after power has been removed. **It is not permissible to open the equipment until 5 minutes after the power has been removed.** Children and the general public must be prevented from accessing or approaching the equipment!

General WARNING!

The inverter must always be grounded. If the inverter is not grounded correctly, extremely dangerous conditions may arise within the inverter which could prove potentially fatal.

Operation with ungrounded (IT) supplies

The VFD will operate from ungrounded supplies and will continue to operate if an input phase is shorted to ground. If an output phase is shorted to ground, the VFD will trip and indicate F0001.

For any additional information regarding the field servicing or operating the unit using a BOP display panel, please refer to the detailed information in the VFD Manual supplied.

Armstrong Pumps Inc.
93 East Avenue
North Tonawanda, New York
U.S.A. 14120-6594
Tel: (716) 693-8813
Fax: (716) 693-8970

www.armstrongpumps.com

S.A. Armstrong Limited
23 Bertrand Avenue
Toronto, Ontario
Canada, M1L 2P3
Tel: (416) 755-2291
Fax: (416) 759-9101



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Armstrong Pumps Limited
Peartree Road, Stanway
Colchester, Essex
United Kingdom, CO3 0LP
Tel: +44 (0) 1206 579491
Fax: +44 (0) 1206 760532

Armstrong Darling
9001 De L'Innovation, Suite 200
Montreal, Quebec
Canada, H1J 2X9
Tel: (514) 352-2424
Fax: (514) 352-2425

