

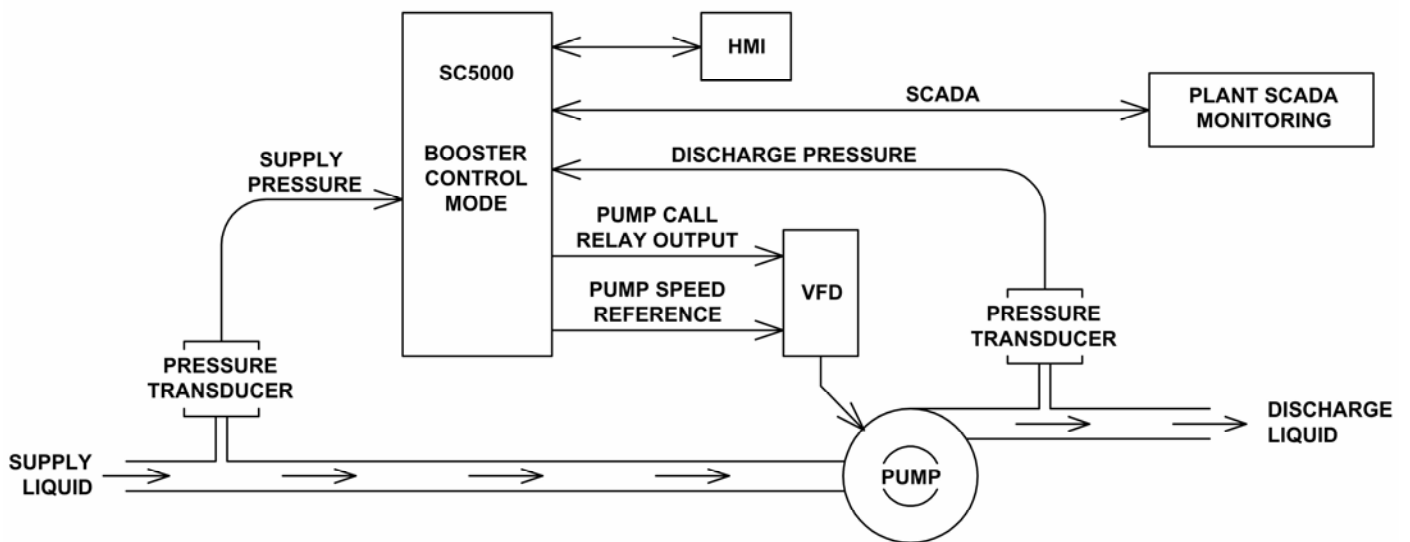
SC5000

INSTRUCTION MANUAL

SECTION 5

BOOSTER SUPPLY PRESSURE CONTROL

Booster Control that Maintains the Supply Pressure at a Supply Pressure Setpoint



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SECTION 5

BOOSTER SUPPLY PRESSURE CONTROL

TABLE OF CONTENTS	Page Number
DESCRIPTION OF FEATURES	
Description of Features Available in the Booster Supply Pressure Control Mode	5-3
CONTROL SETUP & DATA DISPLAY	
Master Control Mode	5-9
Pump Setup	5-9
Supply Pressure Input Setup and Status	5-10
Discharge Pressure Input Setup and Status	5-11
Pump Alternation Setup and Status	5-12
Supply Pressure Setpoint	5-13
Controlling Setpoint Ramp Rate	5-13
PID Controller Tuning	5-13
Starting Pumps	5-14
Stopping Pumps	5-15
Start Up Delay	5-16
Lag Pump Delay	5-16
Minimum & Maximum Pump Speed Limits	5-16
Pump Speed Acceleration / Deceleration Rate.....	5-17
Supply Pressure Alarms	5-17
Discharge Pressure Alarms	5-17
Number of Pumps Required at Startup	5-18
Pump Speed Reference Status	5-18
Starting & Stopping Pump Delays Status	5-19
Analog Pressure Meters APM1 and APM2	N-1
CONNECTION DIAGRAMS	
Booster Control Example	5-20
Analog Pressure Input Examples	N-3
HMI	
SC5000-CTS-HMI Screens used for Booster Supply Pressure Control	5-21

BOOSTER SUPPLY PRESSURE CONTROL

DESCRIPTION OF FEATURES

General Description

With the Master Control Mode (Parameter P.091) set for “Booster Supply Pressure Control” the SC5000 will function as a Booster Controller that controls the Supply Pressure. All logic pertaining to “Level Control”, “Flow Control”, “Pressure Control” and “Booster Discharge Pressure Control” will be disabled.

In the Booster Supply Pressure Control Mode, a PID Controller (Proportional, Integral, Derivative) regulates the pump speed in order to maintain the Supply Pressure at the Supply Pressure Setpoint.

The Booster Supply Pressure Control logic also determines the number of pumps required to run in order to maintain the Supply Pressure at the Supply Pressure Setpoint.

The Booster Discharge Pressure Control logic also alternates the pumps and provides Pump Start/Stop Parameters and Pump Start/Stop Delay Parameters for each pump call, Lag Pump Delay, Number of Pumps Required at Startup, Low Supply Pressure Alarm, High Supply Pressure Alarm, Low Discharge Pressure Alarm, and High Discharge Pressure Alarm. It also has parameters in the menu that allow the operator to set the Number of Pumps Present, the Maximum Number of Pumps Allowed to Run At the Same Time, and the Maximum Number of Pumps Allowed to Run While On a Generator.

The Booster Supply Pressure Control Mode requires that each pump have its own VFD.

The Booster Supply Pressure Control Mode also requires that the Controller be ordered with an optional Analog Output for each pump for the VFD speed reference (see Ordering Information).

HMI Features

The **SC5000-CTS-HMI** is a **Color Touch Screen** HMI programmed with screens that show the Supply Pressure, Discharge Pressure, Pump Speed Reference, Pump Run Status, Pump Available for Service indication, High Supply Pressure and Low Supply Pressure alarms, High Discharge Pressure and Low Discharge Pressure alarms, Supply Pressure Too Low For Pump Operation alarm, Elapsed Run Time meters for each pump, and any Fault Codes that may be present. All the control and alarm settings are made readily available to the operator for viewing or changing. An operator may also reset the Elapsed Run Time meters, and reset any Fault Codes.

Supply Pressure Input Select

The Booster Supply Pressure Control mode requires that an analog Supply Pressure Input be provided to the Controller to monitor the Supply Pressure. The Supply Pressure Input Select (Parameter P.701) is provided to allow for the selection of either Analog Pressure Meter APM1, or APM2. See Section N.

Discharge Pressure Input Select

The Booster Supply Pressure Control mode requires that an analog Discharge Pressure Input be provided to the Controller to monitor the Discharge Pressure. The Discharge Pressure Input Select (Parameter P.703) is provided to allow for the selection of either Analog Pressure Meter APM1, or APM2. See Section N.

Supply Pressure Too Low for Pump Operation Alarm Status

When Supply Pressure is too low for pump operation, based on Parameters P.730 and P.743, the “Supply Pressure Too Low for Pump Operation” alarm status bit will be set and may be read from Modbus Coil 259 (Register 40017 Bit 2).

BOOSTER SUPPLY PRESSURE CONTROL

Standard Pump Alternation

When standard “First On First Off” alternation is required, the Alternation Sequence Mode should be set for Standard Alternation (Parameter P.122 = 1).

The following describes the features that are available with Standard Pump Alternation:

Time Based Alternation

Time Based Alternation is available to automatically alternate the pumps. The Time Based Alternation logic may be triggered by an Internal Time Clock or from an External Time Clock.

If the Internal Time Clock is used to trigger alternation of the pumps, then the alternation period must be set on Parameter P.131.

If an External Time Clock is used to trigger alternation of the pump, then an External Time Clock must be connected to a Discrete Input on the Controller (assigned to Function 21), or it may be initiated remotely by setting Modbus Coil 95 (Register 40006 Bit 14).

Force Lead Pump Position

When manual control over the pump call sequence is required, the operator can use the Forced Lead Pump Position feature to set the Lead Pump Position. This is done by setting the lead pump's number into Parameter P.129. This sets the order that the pumps are called in. The Lead Pump Position may also be set using a Lead Pump Selector switch that is connected to Discrete Inputs assigned to Functions 31 -36.

Pump Disable Discrete Inputs

Discrete Inputs assigned the Function of “Pump Disable” (Functions 11-16) inputs may be used to disable one or more pumps so that they will not be called to run and will be skipped in the pump call sequence.

Fixed Order Sequence

When total control over the pump call sequence is desired, then the Alternation Sequence Mode should be set for the Fixed Order Sequence (Parameter P.122 = 2). In this mode each pump has its own parameter to fix its position in the pump call sequence.

The following Parameters are used to establish the Fixed Order Sequence:

- Parameter P.711 - Pump 1 Fixed Order Position
- Parameter P.712 - Pump 2 Fixed Order Position
- Parameter P.713 - Pump 3 Fixed Order Position
- Parameter P.714 - Pump 4 Fixed Order Position
- Parameter P.715 - Pump 5 Fixed Order Position
- Parameter P.716 - Pump 6 Fixed Order Position

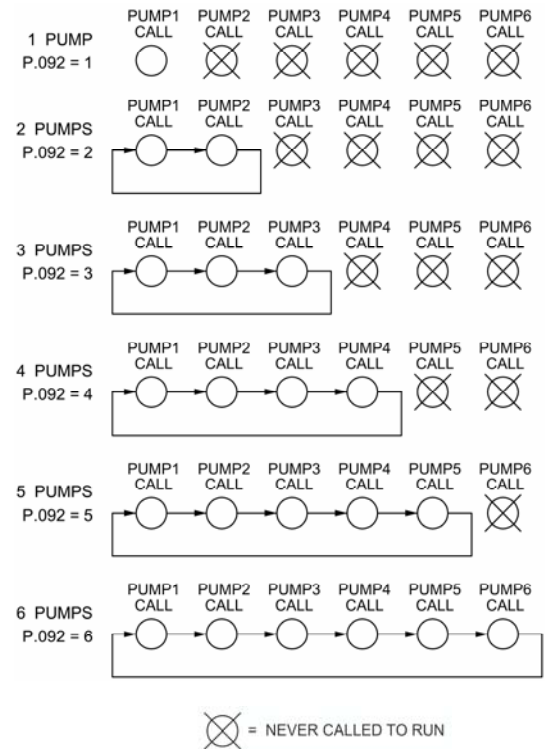
ETM Based Alternation

When it is required that the pump call sequence be established based on each of the pump's run times, then the Alternation Sequence Mode should be set for Elapsed Time Meter Based Alternation (Parameter P.122 = 3).

In this mode the Alternator logic selects the next pump to turn on based on which pump has the least time on its ETM among the pumps that are currently off.

Also, in this mode the Alternator logic selects the next pump to turn off based which pump has the most time on its ETM among the pumps that are currently on.

Movement of Lead Pump Upon Alternation



BOOSTER SUPPLY PRESSURE CONTROL

Supply Pressure Setpoint

The Supply Pressure Setpoint (Parameter P.720) must be set by the operator for the desired Supply Pressure that must be maintained by the pumping station.

At startup, if there is adequate Supply Pressure, the Booster Control logic will start one pump. If the one pump called at startup is unable to bring the Supply Pressure Down to the Supply Pressure Setpoint, then another pump will be started. If the setpoint is still not reached, then the control logic will call another pump to run and then another until the Supply Pressure Setpoint is met. Additionally, the logic will turn off any unneeded pumps. If only one pump is left on and the Supply Pressure is still too low then the control logic will turn off the last remaining pump.

Provided that the liquid flowing into the Booster Station has adequate pressure, the PID Controller will control the VFD speed reference to maintain the Supply Pressure at the Supply Pressure Setpoint.

Controlling Setpoint

The PID Controller is the part of the SC5000's control program that regulates the pump speed. In order to operate, the PID Controller requires two pieces of information, the value of the Supply Pressure Setpoint to follow and the value of the Supply Pressure which it uses as feedback.

To ensure the smooth stable control of the Supply Pressure while starting the first pump, the PID Controller is not initially fed the Supply Pressure Setpoint (Parameter P.720), but rather it is fed the Controlling Setpoint (Parameter Pd.31) which is carefully controlled.

It is assumed that the Start 1st Pump Pressure setpoint (Parameter P.731) will always be set higher than the Supply Pressure Setpoint (Parameter P.720).

Before the 1st pump is turned on a snap shot of the Supply Pressure is captured and then used as the initial Controlling Setpoint (Parameter Pd.31). After the 1st pump is turned on the value of the Controlling Setpoint is slowly decreased until it equals the Supply Pressure Setpoint (Parameter P.720).

After start up the Controlling Setpoint will be kept equal to the Supply Pressure Setpoint.

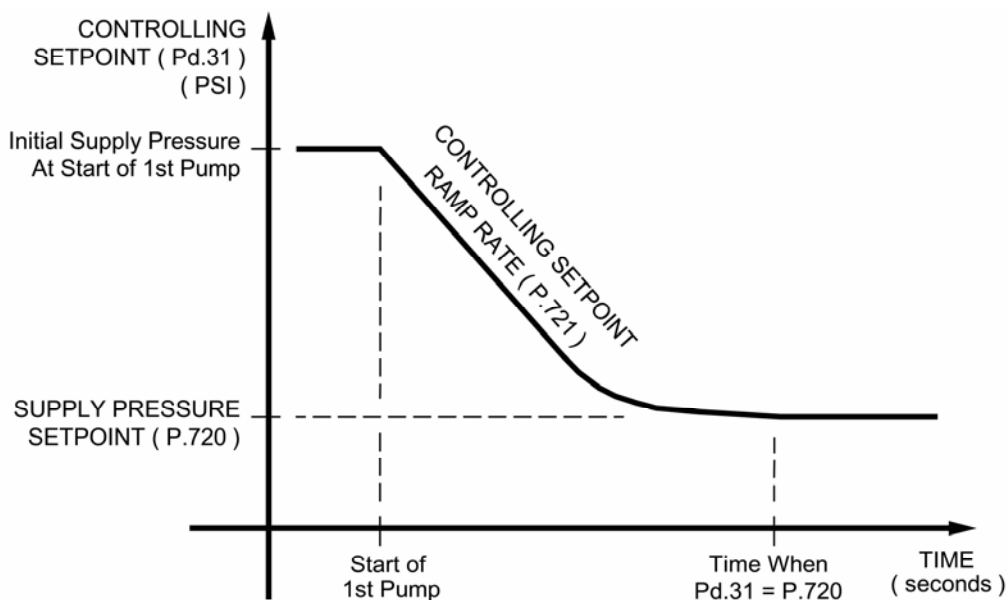
If the Supply Pressure Setpoint is changed by an operator, while the pumps are operating, then the Controlling Setpoint will be slowly ramped up or down to the new value of the Supply Pressure Setpoint.

While the Controlling Setpoint is being ramped up or down toward being equal to the Supply Pressure Setpoint, the "PID Controller Setpoint Override Active" status bit will be set and may be read from Modbus Coil 257 (Register 40017 Bit 0).

Controlling Setpoint Ramp Rate

The Controlling Setpoint Ramp Rate (Parameter P.721) is what sets the rate of change of the Controlling Setpoint (Parameter Pd.31) toward being equal to the Supply Pressure Setpoint (Parameter P.720).

Controlling Setpoint versus Time at Start Up of 1st Pump



BOOSTER SUPPLY PRESSURE CONTROL

Starting Pumps

Start 1st Pump

To allow the 1st pump to start, the Supply Pressure (Parameter Pd.11) must first rise up to or be above what is set on the Start 1st Pump Pressure (Parameter P.730), and the Start 1st Pump Delay (Parameter P.731) must have counted down to zero.

Starting Additional Pumps

If at some point conditions in the system require that the pump speed be increased in order to maintain the Supply Pressure at the Supply Pressure Setpoint, then the pump speed reference will be increased as needed. If the pump speed reference is increased to the point where it is equal to or greater than the next relevant Start Pump Speed parameter, then its corresponding Start Pump Delay parameter will start counting down and when it reaches zero one additional pump will be started. This may be repeated again and again until all the available pumps have been started. The next Start Pump Delay can not begin counting down until the speed of the previously called pump matches the Pump Speed Reference.

The following Parameters are used to determine when to start pumps:

- Parameter P.730 - Start 1st Pump Pressure (Supply Pressure)
- Parameter P.731 - Start 1st Pump Delay
- Parameter P.732 - Start 2nd Pump Speed
- Parameter P.733 - Start 2nd Pump Delay
- Parameter P.734 - Start 3rd Pump Speed
- Parameter P.735 - Start 3rd Pump Delay
- Parameter P.736 - Start 4th Pump Speed
- Parameter P.737 - Start 4th Pump Delay
- Parameter P.738 - Start 5th Pump Speed
- Parameter P.739 - Start 5th Pump Delay
- Parameter P.740 - Start 6th Pump Speed
- Parameter P.741 - Start 6th Pump Delay

Stopping Pumps

Stopping Unneeded Pumps

If at some point conditions in the system require that the pump speed be decreased in order to maintain the Supply Pressure at the Supply Pressure Setpoint, then the pump speed reference will be decreased as needed. If the pump speed reference is decreased to the point where it is equal to or less than the next relevant Stop Pump Speed parameter, then its corresponding Stop Pump Delay parameter will start counting down and when the delay reaches zero one unneeded pump will be turned off. This may be repeated again and again until only one pump is left running. The next Stop Pump Delay can not begin counting down until the speed of the previously stopped pump reaches zero.

Stop All Pumps

If the Supply Pressure (Parameter Pd.11) falls below what is set on the Stop All Pumps Pressure (Parameter P.743), and the Stop All Pumps Delay (Parameter P.744) has counted down to zero, then all pumps will be stopped immediately.

The following Parameters are used to determine when to stop pumps:

- Parameter P.743 - Stop All Pumps Pressure (Supply Pressure)
- Parameter P.744 - Stop All Pumps Delay
- Parameter P.745 - Stop 2nd Pump Speed
- Parameter P.746 - Stop 2nd Pump Delay
- Parameter P.747 - Stop 3rd Pump Speed
- Parameter P.748 - Stop 3rd Pump Delay
- Parameter P.749 - Stop 4th Pump Speed
- Parameter P.750 - Stop 4th Pump Delay
- Parameter P.751 - Stop 5th Pump Speed
- Parameter P.752 - Stop 5th Pump Delay
- Parameter P.753 - Stop 6th Pump Speed
- Parameter P.754 - Stop 6th Pump Delay

BOOSTER SUPPLY PRESSURE CONTROL

Start Up Delay

The Start Up Delay (Parameter P.755) is provided to delay pump operation after a power outage.

The Start Up Delay period starts when all the following conditions are met:

1. Power is applied to the Controller and it has completed its start up routine.
2. The “All Pump Disable” discrete input (Discrete Input Function 17) is open.

When the Start Up Delay expires the Controller will then verify that the Supply Pressure is at or above the Start 1st Pump Pressure (Parameter P.730) and if it is, the Controller will begin the count down delay set on the Start 1st Pump Delay (Parameter P.731).

If at any time the “All Pump Disable” Discrete Input (Discrete Input Function 17) closes the Start Up Delay will be reset and all pump operation will be suspended.

Lag Pump Delay

The Lag Pump Delay (Parameter P.756) establishes the minimum time period between the calling of pumps to run. It is used to delay the turning on of a replacement pump when an operating pump is suddenly disabled, or when a time based alternation of the pumps is performed.

The Lag Pump Delay should be set shorter than all of the Start Pump Delays, so that at start up the Lag Pump Delay will have already expired before each of the respective Start Pump Delays expire.

Number of Pumps Required at Startup

The Number of Pumps Required at Startup (Parameter P.769) sets the minimum number of pumps that are initially started in order to meet the Supply Pressure Setpoint. The default setting of Parameter P.769 is set to start only one pump at startup. By setting Parameter P.769 to start more than one pump, faster startup times will be achieved.

When Parameter P.769 is set to start more than one pump at startup, after the first pump is started each additional pump will only need to wait for the Lag Pump Delay (Parameter P.756) to expire. It will not need to wait for the Pump Speed Reference (Parameter Pd.41) to match or exceed the next relevant Start Pump Speed Parameter (P.732, P.734, P.736, P.738 or P.740) and for the next relevant Start Pump Delay Parameter (P.733, P.735, P.737, P.739 or P.741) to expire.

Pump Speed Limits

For each pumping application there is usually a minimum pump speed, below which pump operation is undesirable. Also, some pumping applications may require a maximum pump speed limit. Where there are mismatched pumps, the required minimum and maximum speed limits may not be the same for all of the pumps.

The following Parameters are used to set pump speed limits of each individual pump:

- Parameter P.757 - Pump 1 Maximum Speed Limit
- Parameter P.758 - Pump 1 Minimum Speed Limit
- Parameter P.759 - Pump 2 Maximum Speed Limit
- Parameter P.760 - Pump 2 Minimum Speed Limit
- Parameter P.761 - Pump 3 Maximum Speed Limit
- Parameter P.762 - Pump 3 Minimum Speed Limit
- Parameter P.763 - Pump 4 Maximum Speed Limit
- Parameter P.764 - Pump 4 Minimum Speed Limit
- Parameter P.765 - Pump 5 Maximum Speed Limit
- Parameter P.766 - Pump 5 Minimum Speed Limit
- Parameter P.767 - Pump 6 Maximum Speed Limit
- Parameter P.768 - Pump 6 Minimum Speed Limit

BOOSTER SUPPLY PRESSURE CONTROL

Discrete Inputs

30 Discrete Inputs (D1 - D30) that may be setup to perform the following Functions:

- Pump Disable Inputs
- All Pump Disable - Phase Monitor Input
- On Generator - Limits number of pumps allowed to run
- External Alternation - External Time Clock Input
- Sequence Inputs - Lead Pump Selector Switch Inputs
- Call Pump Last Inputs
- Collection of Discrete Input Data for SCADA

Relay Outputs

12 Relay Outputs (ROX1 - ROX12) that may be setup to perform the following Functions:

- Up to Six Pump Call to Run Outputs
- High or Low Supply Pressure Alarm Outputs
- High or Low Discharge Pressure Alarm Outputs
- SCADA Remote Control Outputs

Analog Inputs

2 Standard Analog Inputs (AIX1 - AIX2) and up to 8 more Optional Analog Inputs (A1 - A8).

The Analog Inputs may be setup to perform one of the following Functions:

- Analog Flow Meter AFM1, AFM2 or AFM3
- Analog Pressure Meter APM1 or APM2
- Analog Current Meter ACMA, ACMB or ACMC
- Collection of Analog Input Data for SCADA

Analog Outputs

1 Standard Analog Output (AOX1) and up to 6 more Optional Analog Outputs (AO1 - AO6).

The Analog Outputs may be setup to perform one of the following Functions:

- Analog Signal for Pumps 1 - 6 Speed Reference
- Analog Signal for Pumps Speed Reference any Pump (Always Active)

Pulse Counter Inputs

Option for up to 3 Pulse Counter Inputs (DPC1 - DPC3) that may be used to perform the following:

- Pulse Counter Input for Pulse Flow Meter PFM1, PFM2 or PFM3

BOOSTER SUPPLY PRESSURE CONTROL

User / Operator Info.			SCADA	Description of Parameters and SCADA Notes
Parameter	Default Value	Current Value	Register Address	
Master Control Mode				
P.091	1		40091	Master Control Mode 1 = Level Control 2 = Flow Control 3 = Pressure Control 4 = Booster Discharge Pressure Control 5 = Booster Supply Pressure Control Must Be Set On "5" for Booster Supply Pressure Control
Pump Setup				
P.092	6		40092	Number of Pumps Present 1 = 1 Pump 2 = 2 Pumps 3 = 3 Pumps 4 = 4 Pumps 5 = 5 Pumps 6 = 6 Pumps
P.093	6		40093	Maximum Number of Pumps Allowed to Run at the Same Time 1 = 1 Pump 2 = 2 Pumps 3 = 3 Pumps 4 = 4 Pumps 5 = 5 Pumps 6 = 6 Pumps
P.094	6		40094	Maximum Number of Pumps Allowed to Run While On Generator 1 = 1 Pump 2 = 2 Pumps 3 = 3 Pumps 4 = 4 Pumps 5 = 5 Pumps 6 = 6 Pumps Note: Must Connect Transfer Switch Contact to Discrete Input assigned to Function 18.

BOOSTER SUPPLY PRESSURE CONTROL

User / Operator Info.			SCADA	Description of Parameters and SCADA Notes
Parameter	Default Value	Current Value	Register Address	
Supply Pressure Input Setup				
P.701	1		40701	<p>Supply Pressure Input Select</p> <p>1 = Analog Pressure Meter APM1 2 = Analog Pressure Meter APM2 3 = Demo Mode (APM1 - APM2 / 4)</p> <p>Note: This parameter establishes which Analog Pressure Meter's status data will be used as the Supply Pressure. The Supply Pressure status data selected here is available to be read from Parameters Pd.11 and Pd.12. See Section N.</p> <p>The Demo Mode is for table top demonstrations of the Controller's features while it is not connected to an actual pumping station. With APM1 as the Supply Pressure Input and APM2 as the Discharge Pressure Input, this mode makes the simulated Supply Pressure equal to the Supply Pressure Input minus one fourth of the Discharge Pressure Input. A simulated Supply Pressure Input (a 4-20mA Signal Generator) must be connected to the Supply Pressure Input APM1. To simulate the Discharge Pressure the VFD speed reference Analog Outputs of all pumps must be summed together and connected to the Discharge Pressure Input APM2. Also, for the Demo Mode to operate Parameters P.701 and P.703 must both be set on the Demo Mode.</p>
P.702	300.0 psi		40702	<p>Supply Pressure Bar Graph Span</p> <p>Note: This parameter sets the span of the Supply Pressure Bar Graph for Parameter Pd.12.</p>
Supply Pressure Status				
Pd.11	-	-	42229	<p>Supply Pressure Status - For Numerical Display of Supply Pressure</p> <p>Note: This is the value of the Supply Pressure status data selected on Parameter P.701 scaled into psi for numerical display.</p>
Pd.12	-	-	42230	<p>Supply Pressure Status - For Bar Graph Display of Supply Pressure</p> <p>Note: This is the value of the Supply Pressure status data selected on Parameter P.701 scaled for display on a bar graph. It is scaled to a range of 0 - 4095 by using the "Supply Pressure Bar Graph Span" (Parameter P.702). The Bar Graph Display scaling setup on the HMI device must be set for 0 - 4095.</p>

BOOSTER SUPPLY PRESSURE CONTROL

User / Operator Info.		SCADA		Description of Parameters and SCADA Notes
Parameter	Default Value	Current Value	Register Address	
Discharge Pressure Input Setup				
P.703	2		40703	<p>Discharge Pressure Input Select</p> <p>1 = Analog Pressure Meter APM1 2 = Analog Pressure Meter APM2 3 = Demo Mode (APM1 + APM2 / 4)</p> <p>Note: This parameter establishes which Analog Pressure Meter's status data will be used as the Discharge Pressure. The Discharge Pressure status data selected here is available to be read from Parameters Pd.21 and Pd.22. See Section N.</p> <p>The Demo Mode is for table top demonstrations of the Controller's features while it is not connected to an actual pumping station. With APM1 as the Supply Pressure Input and APM2 as the Discharge Pressure Input, this mode makes the simulated Discharge Pressure equal to the Supply Pressure Input plus one fourth of the Discharge Pressure Input. A simulated Supply Pressure Input (a 4-20mA Signal Generator) must be connected to the Supply Pressure Input APM1. To simulate the Discharge Pressure the VFD speed reference Analog Outputs of all pumps must be summed together and connected to the Discharge Pressure Input APM2. Also, for the Demo Mode to operate Parameters P.701 and P.703 must both be set on the Demo Mode.</p>
P.704	300.0 psi		40704	<p>Discharge Pressure Bar Graph Span</p> <p>Note: This parameter sets the span of the Discharge Pressure Bar Graph for Parameter Pd.22.</p>
Discharge Pressure Input Status				
Pd.21	-	-	42231	<p>Discharge Pressure Status - For Numerical Display of Discharge Pressure</p> <p>Note: This is the value of the Discharge Pressure status data selected on Parameter P.703 scaled into psi for numerical display.</p>
Pd.22	-	-	42232	<p>Discharge Pressure Status - For Bar Graph Display of Discharge Pressure</p> <p>Note: This is the value of the Discharge Pressure status data selected on Parameter P.703 scaled for display on a bar graph. It is scaled to a range of 0 - 4095 by using the "Discharge Pressure Bar Graph Span" (Parameter P.704). The Bar Graph Display scaling setup on the HMI device must be set for 0 - 4095.</p>

BOOSTER SUPPLY PRESSURE CONTROL

User / Operator Info.		SCADA		Description of Parameters and SCADA Notes
Parameter	Default Value	Current Value	Register Address	
Supply Pressure Setpoint				
P.720	100.0 psi		40720	Supply Pressure Setpoint (SP) Range: 3.0 - 300.0 psi Note: This is the parameter that sets the desired Supply Pressure of the liquid being pumped.
Pd.31	-		42233	Controlling Setpoint Note: To ensure the smooth stable control of the Supply Pressure while starting the first pump the PID Controller is not initially fed the Supply Pressure Setpoint (Parameter P.720), but rather it is fed the Controlling Setpoint (Parameter Pd.31). Before the 1st pump is started, a snap shot of the Supply Pressure is captured and then used as the initial Controlling Setpoint (Parameter Pd.31). After the 1st pump is started the value of the Controlling Setpoint is slowly changed until it equals the Supply Pressure Setpoint (Parameter P.720). The rate of change is set by the operator on the Controlling Setpoint Ramp Rate (Parameter P.721).
Controlling Setpoint Ramp Rate				
P.721	3.00 psi /sec		40721	Controlling Setpoint Ramp Rate Range: 0.10 - 10.00 psi / sec Note: This parameter sets the rate at which the control logic is allowed to change the Controlling Setpoint (Parameter Pd.31) toward being equal to the Supply Pressure Setpoint (Parameter P.720).
At startup or at any time the Controlling Setpoint is not equal to the Supply Pressure Setpoint, the "PID Controller Setpoint Override Active" status bit will be set. Its status may be read from Modbus Coil 257 (Register 40017 Bit 0).				
PID Controller Tuning				
P.723	1.60		40723	Controller Gain (Kc) Range: 0.01 - 30.00 Note: This parameter is used to tune the proportional component of the PID Controller's Pump Speed Reference output.
P.724	0.02 minutes / repeat		40724	Integral Time (Ti) Range: 0.01 - 60.00 minutes / repeat Note: This parameter is used to tune the integral component of the PID Controller's Pump Speed Reference output. Changes to this parameter may result in significant changes to the Pump Speed Reference. Therefore, it is recommended that only small changes are made to this parameter while the system is in operation.
P.725	0.00 minutes		40725	Derivative Time (Td) Range: 0.00 - 2.00 minutes Note: This parameter is used to tune the derivative component of the PID Controller's Pump Speed Reference output.

BOOSTER SUPPLY PRESSURE CONTROL

User / Operator Info.			SCADA	Description of Parameters and SCADA Notes
Parameter	Default Value	Current Value	Register Address	
Starting Pumps				
P.730	120.0 psi		40730	Start 1st Pump Pressure (Supply Pressure) Range: 3.0 - 300.0 psi Note: For the 1st pump to start, the Supply Pressure must be equal to or higher than the Start 1st Pump Pressure for the delay set on the Start 1st Pump Delay .
P.731	10 sec.		40731	Start 1st Pump Delay Range: 1 - 600 seconds Note: The Start 1st Pump Delay starts to count down to zero when the Supply Pressure becomes equal to or higher than the Start 1st Pump Pressure .
P.732	98.0 %		40732	Start 2nd Pump Speed Range: 30.0% - 100.0% of Full Speed Note: For the 2nd pump to start, the Pump Speed Reference must be equal to or higher than the Start 2nd Pump Speed for the delay set on the Start 2nd Pump Delay .
P.733	10 sec.		40733	Start 2nd Pump Delay Range: 1 - 600 seconds Note: The Start 2nd Pump Delay starts to count down to zero when the Pump Speed Reference becomes equal to or higher than the Start 2nd Pump Speed .
P.734	98.0 %		40734	Start 3rd Pump Speed Range: 30.0% - 100.0% of Full Speed Note: For the 3rd pump to start, the Pump Speed Reference must be equal to or higher than the Start 3rd Pump Speed for the delay set on the Start 3rd Pump Delay .
P.735	10 sec.		40735	Start 3rd Pump Delay Range: 1 - 600 seconds Note: The Start 3rd Pump Delay starts to count down to zero when the Pump Speed Reference becomes equal to or higher than the Start 3rd Pump Speed .
P.736	98.0 %		40736	Start 4th Pump Speed Range: 30.0% - 100.0% of Full Speed Note: For the 4th pump to start, the Pump Speed Reference must be equal to or higher than the Start 4th Pump Speed for the delay set on the Start 4th Pump Delay .
P.737	10 sec.		40737	Start 4th Pump Delay Range: 1 - 600 seconds Note: The Start 4th Pump Delay starts to count down to zero when the Pump Speed Reference becomes equal to or higher than the Start 4th Pump Speed .
P.738	98.0 %		40738	Start 5th Pump Speed Range: 30.0% - 100.0% of Full Speed Note: For the 5th pump to start, the Pump Speed Reference must be equal to or higher than the Start 5th Pump Speed for the delay set on the Start 5th Pump Delay .
P.739	10 sec.		40739	Start 5th Pump Delay Range: 1 - 600 seconds Note: The Start 5th Pump Delay starts to count down to zero when the Pump Speed Reference becomes equal to or higher than the Start 5th Pump Speed .
P.740	98.0 %		40740	Start 6th Pump Speed Range: 30.0% - 100.0% of Full Speed Note: For the 6th pump to start, the Pump Speed Reference must be equal to or higher than the Start 6th Pump Speed for the delay set on the Start 6th Pump Delay .
P.741	10 sec.		40741	Start 6th Pump Delay Range: 1 - 600 seconds Note: The Start 6th Pump Delay starts to count down to zero when the Pump Speed Reference becomes equal to or higher than the Start 6th Pump Speed .

BOOSTER SUPPLY PRESSURE CONTROL

User / Operator Info.			SCADA	Description of Parameters and SCADA Notes
Parameter	Default Value	Current Value	Register Address	
Stopping Pumps				
P.743	80.0 psi		40743	Stop All Pumps Pressure (Supply Pressure) Range: 3.0 - 300.0 psi Note: For the 1st pump to stop, the Supply Pressure must be equal to or lower than the Stop All Pumps Pressure for the delay set on the Stop All Pumps Delay .
P.744	10 sec.		40744	Stop All Pumps Delay Range: 1 - 600 seconds Note: The Stop All Pumps Delay starts to count down to zero when the Supply Pressure becomes equal to or lower than the Stop All Pumps Pressure .
P.745	42.0 %		40745	Stop 2nd Pump Speed Range: 10.0% - 90.0% of Full Speed Note: For the 2nd pump to stop, the Pump Speed Reference must be equal to or lower than the Stop 2nd Pump Speed for the delay set on the Stop 2nd Pump Delay .
P.746	10 sec.		40746	Stop 2nd Pump Delay Range: 1 - 600 seconds Note: The Stop 2nd Pump Delay starts to count down to zero when the Pump Speed Reference becomes equal to or lower than the Stop 2nd Pump Speed .
P.747	42.0 %		40747	Stop 3rd Pump Speed Range: 10.0% - 90.0% of Full Speed Note: For the 3rd pump to stop, the Pump Speed Reference must be equal to or lower than the Stop 3rd Pump Speed for the delay set on the Stop 3rd Pump Delay .
P.748	10 sec.		40748	Stop 3rd Pump Delay Range: 1 - 600 seconds Note: The Stop 3rd Pump Delay starts to count down to zero when the Pump Speed Reference becomes equal to or lower than the Stop 3rd Pump Speed .
P.749	42.0 %		40749	Stop 4th Pump Speed Range: 10.0% - 90.0% of Full Speed Note: For the 4th pump to stop, the Pump Speed Reference must be equal to or lower than the Stop 4th Pump Speed for the delay set on the Stop 4th Pump Delay .
P.750	10 sec.		40750	Stop 4th Pump Delay Range: 1 - 600 seconds Note: The Stop 4th Pump Delay starts to count down to zero when the Pump Speed Reference becomes equal to or lower than the Stop 4th Pump Speed .
P.751	42.0 %		40751	Stop 5th Pump Speed Range: 10.0% - 90.0% of Full Speed Note: For the 5th pump to stop, the Pump Speed Reference must be equal to or lower than the Stop 5th Pump Speed for the delay set on the Stop 5th Pump Delay .
P.752	10 sec.		40752	Stop 5th Pump Delay Range: 1 - 600 seconds Note: The Stop 5th Pump Delay starts to count down to zero when the Pump Speed Reference becomes equal to or lower than the Stop 5th Pump Speed .
P.753	42.0 %		40753	Stop 6th Pump Speed Range: 10.0% - 90.0% of Full Speed Note: For the 6th pump to stop, the Pump Speed Reference must be equal to or lower than the Stop 6th Pump Speed for the delay set on the Stop 6th Pump Delay .
P.754	10 sec.		40754	Stop 6th Pump Delay Range: 1 - 600 seconds Note: The Stop 6th Pump Delay starts to count down to zero when the Pump Speed Reference becomes equal to or lower than the Stop 6th Pump Speed .

BOOSTER SUPPLY PRESSURE CONTROL

User / Operator Info.			SCADA	Description of Parameters and SCADA Notes
Parameter	Default Value	Current Value	Register Address	
Start Up Delay				
P.755	10 sec.		40755	Start Up Delay Range: 1 - 180 seconds Notes: The Start Up Delay period starts when all the following conditions are met: 1. Power is applied to the Controller and it has completed its start up routine. 2. The "All Pump Disable" discrete input (Discrete Input Function 17) is open.
Lag Pump Delay				
P.756	5 sec.		40756	Lag Pump Delay Range: 1 - 100 seconds Note: This is the minimum time period between the calling of pumps to run at startup. It is also used to delay the turning on of the replacement pump when an operating pump is suddenly disabled, or when a time based alternation of the pumps is performed. It should be set shorter than all of the Start Pump Delays, so that at start up the Lag Pump Delay will have already expired before each of the respective Start Pump Delays expire.
Minimum & Maximum Pump Speed Limits				
P.757	100.0 %		40757	Pump 1 Maximum Speed Limit Range: 70.0 - 100.0 %
P.758	40.0 %		40758	Pump 1 Minimum Speed Limit Range: 0.0 - 95.0 %
P.759	100.0 %		40759	Pump 2 Maximum Speed Limit Range: 70.0 - 100.0 %
P.760	40.0 %		40760	Pump 2 Minimum Speed Limit Range: 0.0 - 95.0 %
P.761	100.0 %		40761	Pump 3 Maximum Speed Limit Range: 70.0 - 100.0 %
P.762	40.0 %		40762	Pump 3 Minimum Speed Limit Range: 0.0 - 95.0 %
P.763	100.0 %		40763	Pump 4 Maximum Speed Limit Range: 70.0 - 100.0 %
P.764	40.0 %		40764	Pump 4 Minimum Speed Limit Range: 0.0 - 95.0 %
P.765	100.0 %		40765	Pump 5 Maximum Speed Limit Range: 70.0 - 100.0 %
P.766	40.0 %		40766	Pump 5 Minimum Speed Limit Range: 0.0 - 95.0 %
P.767	100.0 %		40767	Pump 6 Maximum Speed Limit Range: 70.0 - 100.0 %
P.768	40.0 %		40768	Pump 6 Minimum Speed Limit Range: 0.0 - 95.0 %

BOOSTER SUPPLY PRESSURE CONTROL

User / Operator Info.		SCADA		Description of Parameters and SCADA Notes
Parameter	Default Value	Current Value	Register Address	
Pump Speed Acceleration / Deceleration Rate				
P.166	30 sec.		40166	<p>Pump Speed Acceleration Rate Range: 1 - 100 seconds / 100% speed</p> <p>Notes:</p> <ol style="list-style-type: none"> When a pump is turned on, this is the rate at which the pump's Speed Reference will be increased until it matches the Pump Speed Reference produced by the PID Controller (Parameter Pd.41). This is also the rate at which a pump's Speed Reference will follow increases of the Pump Speed Reference produced by the PID Controller. The setting on Parameter P.166 is the time required for a pump's Speed Reference to go from 0% - 100%. The Controller performs the Acceleration of the pump speed of the individual pumps. Therefore, the Accel Parameter on the VFDs should be set to a value less than or equal to what is set on Parameter P.166.
P.167	30 sec.		40167	<p>Pump Speed Deceleration Rate Range: 1 - 100 seconds / 100% speed</p> <p>Notes:</p> <ol style="list-style-type: none"> When a pump is turned off, this is the rate at which the pump's Speed Reference will be decreased to 0% speed. This is also the rate at which a pump's Speed Reference will follow decreases of the Pump Speed Reference produced by the PID Controller. The setting on Parameter P.167 is the time required for a pump's Speed Reference to go from 100% - 0%. When a pump is turned off, the pump's Control Relay contact will be kept closed during the Deceleration of the pump to 0% speed, then the contact will be opened. The Controller performs the Deceleration of the pump speed of the individual pumps. Therefore, the Decel Parameter on the VFDs should be set to a value less than or equal to what is set on Parameter P.167.
Supply Pressure Alarms				
P.391	5.0 psi		40391	<p>Low Supply Pressure Alarm Range: 0.0 - 300.0 psi</p> <p>Note: Upon a Low Supply Pressure Alarm, the contacts of a relay assigned to Function 11 will close.</p>
The "Low Supply Pressure Alarm" status is available from Modbus Coil 265 (Register 40017 Bit 8).				
P.392	50.0 psi		40392	<p>High Supply Pressure Alarm Range: 0.1 - 300.0 psi</p> <p>Note: Upon a High Supply Pressure Alarm, the contacts of a relay assigned to Function 12 will close.</p>
The "High Supply Pressure Alarm" status is available from Modbus Coil 266 (Register 40017 Bit 9).				
Discharge Pressure Alarms				
P.393	20.0 psi		40393	<p>Low Discharge Pressure Alarm Range: 0.0 - 300.0 psi</p> <p>Note: Upon a Low Discharge Pressure Alarm, the contacts of a relay assigned to Function 13 will close.</p>
The "Low Discharge Pressure Alarm" status is available from Modbus Coil 267 (Register 40017 Bit 10).				
P.394	70.0 psi		40394	<p>High Discharge Pressure Alarm Range: 0.1 - 300.0 psi</p> <p>Note: Upon a High Discharge Pressure Alarm, the contacts of a relay assigned to Function 14 will close.</p>
The "High Discharge Pressure Alarm" status is available from Modbus Coil 268 (Register 40017 Bit 11).				

BOOSTER SUPPLY PRESSURE CONTROL

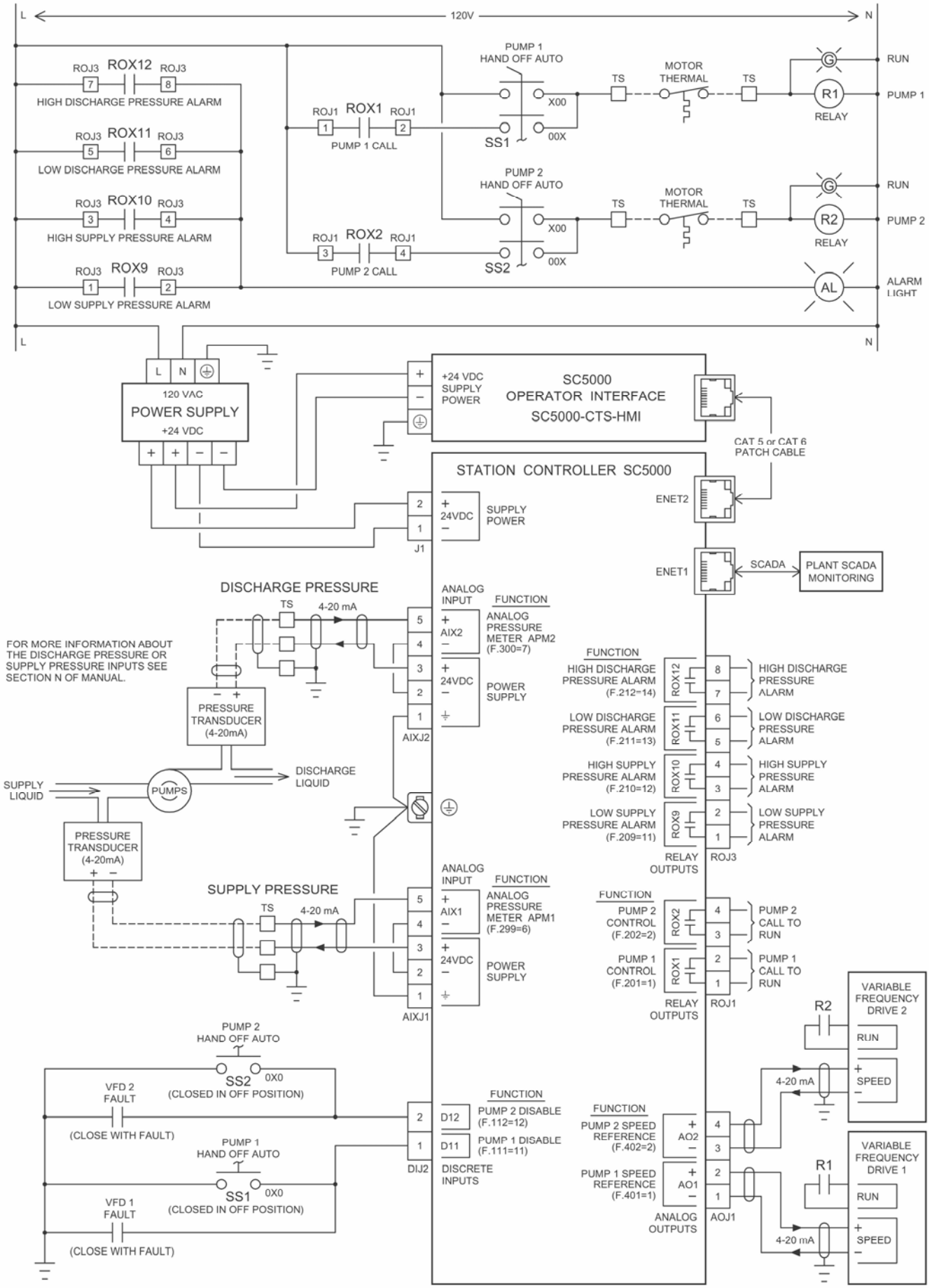
User / Operator Info.			SCADA	Description of Parameters and SCADA Notes
Parameter	Default Value	Current Value	Register Address	
Number of Pumps Required at Startup				
P.769	1		40769	<p>Number of Pumps Required at Startup Range: 1 - 6</p> <p>Note: The Number of Pumps Required at Startup (Parameter P.769) sets the minimum number of pumps that are initially started in order to meet the Supply Pressure Set-point. The default setting of Parameter P.769 is set to start only one pump at startup. By setting Parameter P.769 to start more than one pump, faster startup times will be achieved.</p> <p>When Parameter P.769 is set to start more than one pump at startup, after the first pump is started each additional pump will only need to wait for the Lag Pump Delay (Parameter P.756) to expire. It will not need to wait for the Pump Speed Reference (Parameter Pd.41) to match or exceed the next relevant Start Pump Speed Parameter (P.732, P.734, P.736, P.738 or P.740) and for the next relevant Start Pump Delay Parameter (P.733, P.735, P.737, P.739 or P.741) to expire.</p>

Parameter	Register Address	Description of Data	
Pump Speed Reference Status			
Pd.41	41877	Pump Speed Reference Status Range: 0.0 - 100.0 percent Notes: 1. This is the Pump Speed Reference that is determined by the PID Controller. It is a percentage of full speed (60 Hz). 2. This is the value of the Pump Speed Reference that is prepared to be sent to all of the VFDs, provided that the respective pump is turned on and that it is up to speed and its speed is not limited by either the Minimum or Maximum Pump Speed Limit settings (Parameters P.757 - P.768). 3. The Pump Speed Reference sent to each individual pump is shown below.	
Pump 1 - 6 Speed Reference Status			
Pd.61	42301	Pump 1 Speed Reference Status	Range: 0.0 - 100.0 percent
Pd.62	42302	Pump 2 Speed Reference Status	Range: 0.0 - 100.0 percent
Pd.63	42303	Pump 3 Speed Reference Status	Range: 0.0 - 100.0 percent
Pd.64	42304	Pump 4 Speed Reference Status	Range: 0.0 - 100.0 percent
Pd.65	42305	Pump 5 Speed Reference Status	Range: 0.0 - 100.0 percent
Pd.66	42306	Pump 6 Speed Reference Status	Range: 0.0 - 100.0 percent

BOOSTER SUPPLY PRESSURE CONTROL

Parameter	Register Address	Description of Data
Starting & Stopping Pumps Delay Status		
Pd.71	42307	Start 1st Pump Delay Status seconds
Pd.72	42308	Stop All Pumps Delay Status seconds
Pd.73	42309	Start 2nd Pump Delay Status seconds
Pd.74	42310	Stop 2nd Pump Delay Status seconds
Pd.75	42311	Start 3rd Pump Delay Status seconds
Pd.76	42312	Stop 3rd Pump Delay Status seconds
Pd.77	42313	Start 4th Pump Delay Status seconds
Pd.78	42314	Stop 4th Pump Delay Status seconds
Pd.79	42315	Start 5th Pump Delay Status seconds
Pd.80	42316	Stop 5th Pump Delay Status seconds
Pd.81	42317	Start 6th Pump Delay Status seconds
Pd.82	42318	Stop 6th Pump Delay Status seconds

BOOSTER SUPPLY PRESSURE CONTROL EXAMPLE



BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Main Screen

STATION CONTROLLER SC5000

<p>Fault Code</p> <p>FLC 1234</p> <p>LFC 1234</p> <p>Reset</p>	<p>Control Mode Select</p> <p>Pump Setup</p> <p>Security Setup</p> <p>SCADA Setup</p> <p>Backup / Restore</p>	<p>Parameter Security</p> <p>PARAMETERS UNLOCKED</p> <p>Security Code Entry</p>
<p>I / O</p> <p>Discrete Inputs</p> <p>Relay Outputs</p> <p>Analog Inputs</p> <p>Analog Outputs</p>	<p>Meters</p> <p>Level</p> <p>Pressure</p> <p>Flow</p> <p>Current</p>	<p>Station Status & Setup</p>

Control Mode Select

CONTROL MODE SELECT

Previous Screen

Master Control Mode

1	<ul style="list-style-type: none">1 = Level Control2 = Flow Control3 = Pressure Control4 = Booster Discharge Pressure Control5 = Booster Supply Pressure Control
---	--

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Pump Setup

PUMP SETUP

[Previous Screen](#)

Number of Pumps Present
Parameter: P.092

Maximum Number of Pumps Allowed To Run At The Same Time
Parameter: P.093

Maximum Number of Pumps Allowed To Run While On Generator
(See Discrete Input Function 18) Parameter: P.094

Booster Control Main Screen

SC5000 BOOSTER
SUPPLY PRESSURE CONTROL

[Main Screen](#)

<p>Fault Code</p> <p>FLC <input type="text" value="1234"/> <input type="button" value="Reset"/></p> <p>LFC <input type="text" value="1234"/></p>	<p>Start / Stop Setup & Status</p> <p>Speed Limits</p>	<p>Parameter Security</p> <p>PARAMETERS UNLOCKED</p> <p>Security Code Entry</p>
<p>Pressure Setup</p> <p>Alternation Setup</p> <p>Controller Info.</p>	<p>Control Setup</p> <p>Alarms Setup</p> <p>Pump Status</p>	<p>Station Status</p>

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Station Status - 1 Pump

Supply Pressure
High Alarm
123.4 psi
Low Alarm

Discharge Pressure
High Alarm
123.4 psi
Low Alarm

Pump 1
Not Available For Service
OFF
DISABLE FORCE
1234.5 123.4
ETM (hours) Speed (%)

Controlling Setpoint: 123.4 psi
Supply Pressure Setpoint Override Active
Supply Pressure Too Low for Pump Operation
Pressure Setpoint: 123.4 psi
All Pump Disable Active

Pump Speed Reference: 123.4 %
Fault Code
FLC 1234
LFC 1234
RESET

Previous Screen

Station Status - 2 Pumps

Supply Pressure
High Alarm
123.4 psi
Low Alarm

Discharge Pressure
High Alarm
123.4 psi
Low Alarm

Pump 1
Not Available For Service
OFF
DISABLE FORCE
1234.5 123.4
ETM (hours) Speed (%)

Pump 2
Not Available For Service
OFF
DISABLE FORCE
1234.5 123.4
ETM (hours) Speed (%)

Controlling Setpoint: 123.4 psi
Supply Pressure Setpoint Override Active
Supply Pressure Too Low for Pump Operation
Pressure Setpoint: 123.4 psi
All Pump Disable Active

Pump Speed Reference: 123.4 %
Fault Code
FLC 1234
LFC 1234
RESET

Previous Screen

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Station Status - 3 Pumps

Supply Pressure
High Alarm
123.4 psi
Low Alarm

Discharge Pressure
High Alarm
123.4 psi
Low Alarm

Pump 1
Not Available For Service
OFF
DISABLE FORCE
1234.5 123.4
ETM (hours) Speed (%)

Pump 2
Not Available For Service
OFF
DISABLE FORCE
1234.5 123.4
ETM (hours) Speed (%)

Pump 3
Not Available For Service
OFF
DISABLE FORCE
1234.5 123.4
ETM (hours) Speed (%)

Controlling Setpoint: 123.4 psi

Supply Pressure Setpoint Override Active

Supply Pressure Too Low for Pump Operation

All Pump Disable Active

Pump Speed Reference: 123.4 %

Pressure Setpoint: 123.4 psi

Fault Code
FLC 1234
LFC 1234
RESET

Previous Screen

Station Status - 4 Pumps

Supply Pressure
High Alarm
123.4 psi
Low Alarm

Discharge Pressure
High Alarm
123.4 psi
Low Alarm

Pump 1
Not Available For Service
OFF
DISABLE FORCE
1234.5
ETM (hours)
123.4
Speed (%)

Pump 2
Not Available For Service
OFF
DISABLE FORCE
1234.5
ETM (hours)
123.4
Speed (%)

Pump 3
Not Available For Service
OFF
DISABLE FORCE
1234.5
ETM (hours)
123.4
Speed (%)

Pump 4
Not Available For Service
OFF
DISABLE FORCE
1234.5
ETM (hours)
123.4
Speed (%)

Controlling Setpoint: 123.4 psi

Supply Pressure Setpoint Override Active

Supply Pressure Too Low for Pump Operation

All Pump Disable Active

Pump Speed Reference: 123.4 %

Pressure Setpoint: 123.4 psi

Fault Code
FLC 1234
LFC 1234
RESET

Previous Screen

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Station Status - 5 Pumps

Supply Pressure	Discharge Pressure	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5
		Not Available For Service	Not Available For Service	Not Available For Service	Not Available For Service	Not Available For Service
High Alarm	High Alarm	OFF	OFF	OFF	OFF	OFF
Low Alarm	Low Alarm	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE
123.4 psi	123.4 psi	FORCE	FORCE	FORCE	FORCE	FORCE
		1234.5	1234.5	1234.5	1234.5	1234.5
		ETM (hours)	ETM (hours)	ETM (hours)	ETM (hours)	ETM (hours)
		123.4	123.4	123.4	123.4	123.4
		Speed (%)	Speed (%)	Speed (%)	Speed (%)	Speed (%)
		Controlling Setpoint	Supply Pressure Setpoint Override Active		Previous Screen	
		123.4 psi	Supply Pressure Too Low for Pump Operation		Fault Code	
	Pump Speed Reference	Pressure Setpoint	All Pump Disable Active		FLC 1234	RESET
	123.4 %	123.4 psi			LFC 1234	

Station Status - 6 Pumps

Supply Pressure	Discharge Pressure	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6
		Not Available For Service	Not Available For Service	Not Available For Service	Not Available For Service	Not Available For Service	Not Available For Service
High Alarm	High Alarm	OFF	OFF	OFF	OFF	OFF	OFF
Low Alarm	Low Alarm	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE	DISABLE
123.4 psi	123.4 psi	FORCE	FORCE	FORCE	FORCE	FORCE	FORCE
		1234.5	1234.5	1234.5	1234.5	1234.5	1234.5
		ETM (hours)	ETM (hours)	ETM (hours)	ETM (hours)	ETM (hours)	ETM (hours)
		123.4	123.4	123.4	123.4	123.4	123.4
		Speed (%)	Speed (%)	Speed (%)	Speed (%)	Speed (%)	Speed (%)
		Controlling Setpoint	Supply Pressure Setpoint Override Active		Previous Screen		
		123.4 psi	Supply Pressure Too Low for Pump Operation		Fault Code		
	Pump Speed Reference	Pressure Setpoint	All Pump Disable Active		FLC 1234	RESET	
	123.4 %	123.4 psi			LFC 1234		

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Pressure Setup

PRESSURE SETUP

Previous Screen

Supply Pressure Setpoint

123.4

 psi
Parameter: P.720

Supply Pressure

123.4

 psi
Parameter: Pd.11

Controlling Setpoint Ramp Rate

12.34

 psi / sec
Parameter: P.721

Supply Pressure Input Setup

Discharge Pressure Input Setup

PID Controller Tuning

PID Controller Tuning

PID CONTROLLER TUNING

Previous Screen

Pump 1 OFF Pump 2 OFF Pump 3 OFF Pump 4 OFF Pump 5 OFF Pump 6 OFF

Supply Pressure

123.4

 psi
Parameter: Pd.11

Discharge Pressure

123.4

 psi
Parameter: Pd.21

Supply Pressure Setpoint

123.4

 psi
Parameter: P.720

Controlling Setpoint

123.4

 psi
Parameter: Pd.31

Pump Speed Reference

123.4

 %
Parameter: Pd.40

Controller Gain (Kc)

12.34

Parameter: P.723

Integral Time (Ti) (minutes / repeat)

12.34

Parameter: P.724

Derivative Time (Td) (minutes)

12.34

Parameter: P.725

Speed Reference Component Values

Proportional
+

12,345,123

-

12,345,123

Integral

12,345,123

Derivative
+

12,345,123

-

12,345,123

Supply Pressure Setpoint Override Active

Supply Pressure Too Low for Pump Operation

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Supply Pressure Input Setup

SUPPLY PRESSURE INPUT SETUP

[Previous Screen](#)

Supply Pressure Input Select

1

Parameter: P.701

1 = Pressure Meter APM1
2 = Pressure Meter APM2
3 = Demo Mode (APM1 - APM2 / 4)

The selected Analog Pressure Meter APM1 or APM2 must be setup before using. To Setup go to the Main Screen and select "Pressure".

Supply Pressure

Parameter: Pd.12

123.4 psi

Parameter: Pd.11

Supply Pressure Input Bar Graph Span

123.4

psi

Parameter: P.702

Discharge Pressure Input Setup

DISCHARGE PRESSURE INPUT SETUP

[Previous Screen](#)

Discharge Pressure Input Select

1

Parameter: P.703

1 = Pressure Meter APM1
2 = Pressure Meter APM2
3 = Demo Mode (APM1 + APM2 / 4)

The selected Analog Pressure Meter APM1 or APM2 must be setup before using. To Setup go to the Main Screen and select "Pressure".

Discharge Pressure

Parameter: Pd.22

123.4 psi

Parameter: Pd.21

Discharge Pressure Input Bar Graph Span

123.4

psi

Parameter: P.704

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Pump Start / Stop Setup & Status - 1 Pump

Supply Pressure 123.4 psi Discharge Pressure 123.4 psi Pump 1 OFF Speed Reference 123.4 % [Previous Screen](#)

PUMP START / STOP SETUP & STATUS

Start Pump Pressure (psi) 123.4
Parameter: P.730

Delay Status → 123
Start Pump Delay (sec.) 123
Parameter: P.731

Stop Pump Pressure (psi) 123.4
Parameter: P.742

Delay Status → 123
Stop Pump Delay (sec.) 123
Parameter: P.744

Pump Start / Stop Setup & Status - 2 Pumps

Supply Pressure 123.4 psi Discharge Pressure 123.4 psi Pump 1 OFF Pump 2 OFF Speed Reference 123.4 % [Previous Screen](#)

PUMP START / STOP SETUP & STATUS

Start 1st Pump Pressure (psi) 123.4 Parameter: P.730	Start Pump Speed (%) 123.4 Parameter: P.732
Delay Status → 123 Start 1st Pump Delay (sec.) 123 Parameter: P.731	Delay Status → 123 Start Pump Delay (sec.) 123 Parameter: P.733
Stop All Pumps Pressure (psi) 123.4 Parameter: P.742	Stop Pump Speed (%) 123.4 Parameter: P.745
Delay Status → 123 Stop All Pumps Delay (sec.) 123 Parameter: P.744	Delay Status → 123 Stop Pump Delay (sec.) 123 Parameter: P.746

2nd Pump

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Pump Start / Stop Setup & Status - 3 Pumps

Supply Pressure **123.4** psi Discharge Pressure **123.4** psi Pump 1 OFF Pump 2 OFF Pump 3 OFF Speed Reference **123.4** % [Previous Screen](#)

PUMP START / STOP SETUP & STATUS

	2nd Pump	3rd Pump
Start 1st Pump Pressure (psi) Parameter: P.730	123.4 Start Pump Speed (%) Parameter: P.732	123.4 Start Pump Speed (%) Parameter: P.734
Delay Status → 123 Start 1st Pump Delay (sec.) Parameter: P.731	Delay Status → 123 Start Pump Delay (sec.) Parameter: P.733	123 Start Pump Delay (sec.) Parameter: P.735
Stop All Pumps Pressure (psi) Parameter: P.743	123.4 Stop Pump Speed (%) Parameter: P.745	123.4 Stop Pump Speed (%) Parameter: P.747
Delay Status → 123 Stop All Pumps Delay (sec.) Parameter: P.744	Delay Status → 123 Stop Pump Delay (sec.) Parameter: P.746	123 Stop Pump Delay (sec.) Parameter: P.748

Pump Start / Stop Setup & Status - 4 Pumps

Supply Pressure **123.4** psi Discharge Pressure **123.4** psi Pump 1 OFF Pump 2 OFF Pump 3 OFF Pump 4 OFF Speed Reference **123.4** % [Previous Screen](#)

PUMP START / STOP SETUP & STATUS

	2nd Pump	3rd Pump	4th Pump
Start 1st Pump Pressure (psi) Parameter: P.730	123.4 Start Pump Speed (%) Parameter: P.732	123.4 Start Pump Speed (%) Parameter: P.734	123.4 Start Pump Speed (%) Parameter: P.736
Delay Status → 123 Start 1st Pump Delay (sec.) Parameter: P.731	Delay Status → 123 Start Pump Delay (sec.) Parameter: P.733	123 Start Pump Delay (sec.) Parameter: P.735	123 Start Pump Delay (sec.) Parameter: P.737
Stop All Pumps Pressure (psi) Parameter: P.743	123.4 Stop Pump Speed (%) Parameter: P.745	123.4 Stop Pump Speed (%) Parameter: P.747	123.4 Stop Pump Speed (%) Parameter: P.749
Delay Status → 123 Stop All Pumps Delay (sec.) Parameter: P.744	Delay Status → 123 Stop Pump Delay (sec.) Parameter: P.746	123 Stop Pump Delay (sec.) Parameter: P.748	123 Stop Pump Delay (sec.) Parameter: P.750

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Pump Start / Stop Setup & Status - 5 Pumps

Supply Press.	Discharge Press.	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Speed Ref.	Previous Screen
123.4 psi	123.4 psi	OFF	OFF	OFF	OFF	OFF	123.4 %	
PUMP START / STOP SETUP & STATUS		2nd Pump		3rd Pump		4th Pump		5th Pump
Start 1st Pump Pressure (psi)	123.4	Start Pump Speed (%)	123.4	123.4	123.4	123.4	123.4	123.4
Parameter:	P.730	Parameter:	P.732	P.734	P.736	P.738		
Delay Status →	123	Delay Status →	123	123	123	123	123	123
Start 1st Pump Delay (sec.)	123	Start Pump Delay (sec.)	123	123	123	123	123	123
Parameter:	P.731	Parameter:	P.733	P.735	P.737	P.739		
Stop All Pumps Pressure (psi)	123.4	Stop Pump Speed (%)	123.4	123.4	123.4	123.4	123.4	123.4
Parameter:	P.743	Parameter:	P.745	P.747	P.749	P.751		
Delay Status →	123	Delay Status →	123	123	123	123	123	123
Stop All Pumps Delay (sec.)	123	Stop Pump Delay (sec.)	123	123	123	123	123	123
Parameter:	P.744	Parameter:	P.746	P.748	P.750	P.752		

Pump Start / Stop Setup & Status - 6 Pumps

Supply Pressure	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6	Speed Reference	Previous Screen	
123.4 psi	OFF	OFF	OFF	OFF	OFF	OFF	123.4 %		
PUMP START / STOP SETUP & STATUS		2nd Pump		3rd Pump		4th Pump		5th Pump	6th Pump
Start 1st Pump Pressure (psi)	123.4	Start Pump Speed (%)	123.4	123.4	123.4	123.4	123.4	123.4	123.4
Parameter:	P.730	Parameter:	P.732	P.734	P.736	P.738	P.740		
Delay Status →	123	Delay Status →	123	123	123	123	123	123	123
Start 1st Pump Delay (sec.)	123	Start Pump Delay (sec.)	123	123	123	123	123	123	123
Parameter:	P.731	Parameter:	P.733	P.735	P.737	P.739	P.741		
Stop All Pumps Pressure (psi)	123.4	Stop Pump Speed (%)	123.4	123.4	123.4	123.4	123.4	123.4	123.4
Parameter:	P.743	Parameter:	P.745	P.747	P.749	P.751	P.753		
Delay Status →	123	Delay Status →	123	123	123	123	123	123	123
Stop All Pumps Delay (sec.)	123	Stop Pump Delay (sec.)	123	123	123	123	123	123	123
Parameter:	P.744	Parameter:	P.746	P.748	P.750	P.752	P.754		

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Pump Speed Limit Setup

[Previous Screen](#)

PUMP SPEED LIMIT SETUP

	Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6
Maximum Speed Limit (percent)	123.4	123.4	123.4	123.4	123.4	123.4
Parameter:	P.757	P.759	P.761	P.763	P.765	P.767
Minimum Speed Limit (percent)	123.4	123.4	123.4	123.4	123.4	123.4
Parameter:	P.758	P.760	P.762	P.764	P.766	P.768

Control Setup

[Previous Screen](#)

CONTROL SETUP

Pump Speed Acceleration Rate

123

 seconds / 100% speed
(The time required to go from 0% to 100% speed.)
Parameter: P.166

Pump Speed Deceleration Rate

123

 seconds / 100% speed
(The time required to go from 100% to 0% speed.)
Parameter: P.167

Start Up Delay

123

 seconds
Parameter: P.755

Lag Pump Delay

123

 seconds
Parameter: P.756

Number of Pumps Required at Startup

1

Parameter: P.769

Note:
The Controller performs the Acceleration and Deceleration of the pump speed.
The Accel and Decel Parameters on the VFDs should be set to values less than or equal to what is set above.

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Alternation Setup

Previous Screen

PUMP ALTERNATION SETUP

1 Alternation Sequence Mode
Parameter: P.122

1 = Standard Alternation
2 = Fixed Order Sequence
3 = Elapsed Time Meter Based Alternation

Next Screen

Screen Available with Standard Alternation (Parameter P.122 = 1)

Previous Screen

PUMP ALTERNATION SETUP

Forced Lead Pump Position **1**
Parameter: P.129

0 = Alternate
1 = Pump 1 Lead Pump
2 = Pump 2 Lead Pump
3 = Pump 3 Lead Pump
4 = Pump 4 Lead Pump
5 = Pump 5 Lead Pump
6 = Pump 6 Lead Pump

Force Alternation **1**
Parameter: Ad.01

Time Based Alternation
(Internal Time Clock)

0 = Disabled
60 = 1 hour
480 = 8 hour
1440 = 24 hour

Current Lead Pump **1**

12345 minutes
Parameter: P.131

BOOSTER SUPPLY PRESSURE CONTROL - Touchscreen HMI

Screen Available with Fixed Order Sequence (Parameter P.122 = 2)

[Previous Screen](#)

FIXED ORDER SEQUENCE SETUP

Fixed Order Position Setup

Pump 1	Pump 2	Pump 3	Pump 4	Pump 5	Pump 6
<input style="width: 40px; height: 30px; border: 1px solid blue;" type="text" value="1"/>	<input style="width: 40px; height: 30px; border: 1px solid blue;" type="text" value="1"/>	<input style="width: 40px; height: 30px; border: 1px solid blue;" type="text" value="1"/>	<input style="width: 40px; height: 30px; border: 1px solid blue;" type="text" value="1"/>	<input style="width: 40px; height: 30px; border: 1px solid blue;" type="text" value="1"/>	<input style="width: 40px; height: 30px; border: 1px solid blue;" type="text" value="1"/>
Parameter: P.711	P.712	P.713	P.714	P.715	P.716

Alarms Setup

[Previous Screen](#)

ALARMS SETUP

<p>High Supply Pressure Alarm</p> <div style="text-align: center;"><input style="width: 100px; height: 30px; border: 1px solid blue;" type="text" value="123.4"/> psi</div> <p style="text-align: center;">Parameter: P.392</p>	<p>High Discharge Pressure Alarm</p> <div style="text-align: center;"><input style="width: 100px; height: 30px; border: 1px solid blue;" type="text" value="123.4"/> psi</div> <p style="text-align: center;">Parameter: P.394</p>
<p>Low Supply Pressure Alarm</p> <div style="text-align: center;"><input style="width: 100px; height: 30px; border: 1px solid blue;" type="text" value="123.4"/> psi</div> <p style="text-align: center;">Parameter: P.391</p>	<p>Low Discharge Pressure Alarm</p> <div style="text-align: center;"><input style="width: 100px; height: 30px; border: 1px solid blue;" type="text" value="123.4"/> psi</div> <p style="text-align: center;">Parameter: P.393</p>