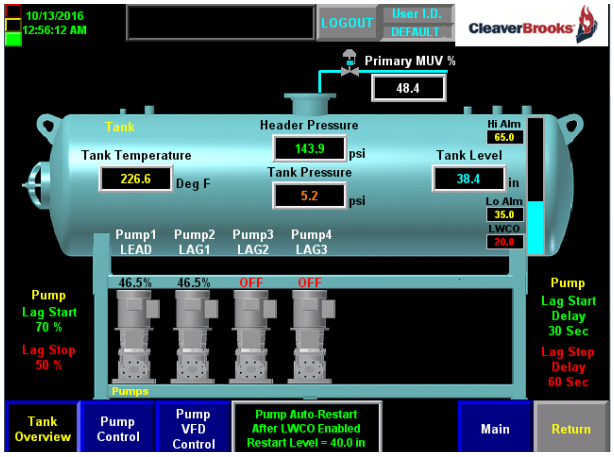
ADAC 1000

Deaerator Control

Operation Manual



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⚠ WARNING

DO NOT OPERATE, SERVICE, OR REPAIR THIS EQUIPMENT UNLESS YOU FULLY UNDERSTAND ALL APPLICABLE SECTIONS OF THIS MANUAL.

DO NOT ALLOW OTHERS TO OPERATE, SERVICE, OR REPAIR THIS EQUIPMENT UNLESS THEY FULLY UNDERSTAND ALL APPLICABLE SECTIONS OF THIS MANUAL. FAILURE TO FOLLOW ALL APPLICABLE WARNINGS AND INSTRUCTIONS MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH.

TO: Owners, Operators and/or Maintenance Personnel

This operating manual presents information that will help to properly operate and care for the equipment. Study its contents carefully. The unit will provide good service and continued operation if proper operating and maintenance instructions are followed. No attempt should be made to operate the unit until the principles of operation and all of the components are thoroughly understood. Failure to follow all applicable instructions and warnings may result in severe personal injury or death.

It is the responsibility of the owner to provide safety training not only to his or her personnel, but to any contractor's personnel who are servicing, repairing or operating the equipment.

Cleaver-Brooks equipment is designed and engineered to give long life and excellent service on the job. The electrical and mechanical devices supplied as part of the unit were chosen because of their known ability to perform; however, proper operating techniques and maintenance procedures must be followed at all times. Although these components afford a high degree of protection and safety, operation of equipment is not to be considered free from all dangers and hazards inherent in operating and maintaining this equipment.

Such "automatic" features as may be included in the design should not be understood as relieving the attendant of responsibilities. Such features merely take over certain repetitive chores, allowing more time for the proper upkeep of equipment.

It is solely the operator's responsibility to properly operate and maintain the equipment. No amount of written instructions can replace intelligent thinking and reasoning and this manual is not intended to relieve the operating personnel of the responsibility for proper operation. On the other hand, a thorough understanding of this manual is required before attempting to operate, maintain, service, or repair this equipment.

Operating controls will normally function for long periods of time and we have found that some operators become lax in their daily or monthly testing, assuming that normal operation will continue indefinitely. Malfunctions of controls lead to uneconomical operation and damage to the equipment. In most cases, these malfunctions can be traced directly to carelessness and deficiencies in testing and maintenance.

The operation of this equipment by the owner and the operating personnel must comply with all requirements or regulations of their insurance company and/or other authority having jurisdiction. In the event of any conflict or inconsistency between such requirements and the warnings or instructions contained herein, please contact Cleaver-Brooks before proceeding.

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Chapter 1
General

1.1-Introduction

The Cleaver-Brooks ADAC 1000 is an exclusive Deaerator and/or Surge Tank Management and Control System specifically designed to integrate the functions of a Programmable Controller with other operating and ancillary controls. The Programmable Controller (PLC) is a modular design providing flexibility for expansion with easily serviceable components. The ADAC 1000 system incorporates a user-friendly, graphical touch screen Human Machine Interface that displays tank parameters, fault annunciation and alarm history, as well as providing access to system configuration and control functions. The system provides a complete tank level, tank pressure, and pump control solution.

In addition to installation on new Deaerators and Surge tanks, the ADAC 1000 can be added as a retrofit to existing tanks. Call your local authorized Cleaver-Brooks representative for details.

1.2-Single Tank System Description

A single tank system can control up to 5 pumps, all of which can be run by contactors, combination starters, soft starters, or Variable Frequency Drives. All pumps on a tank must utilize the same type of starter/drive.

Pumps on a common header can be alternated on a customer defined schedule and be set up in a customer defined lead lag format.

When lead lag operation is in use, a pressure transmitter mounted in the common header sends a signal to the PLC. The customer sets the pressure point via the touch screen. If the first pump cannot achieve that set point, the PLC will start a second pump and so on. If the pressure rises above the set point, the PLC will shed the last pump and so on. During normal operation the lead pump will always run.

Pumps on a “one pump per boiler” installation can be controlled by a contact closure on the boiler. Variable Frequency Drives cannot be used in a one pump per boiler configuration where each pump is hard piped to individual boilers. VFDs are only available on common pump discharge header configurations.

Standard system is capable of using discrete level alarm switches (such as the McDonnell Miller 63 or 64) for fixed level alarms, or a level transmitter which can be configured from the touch screen.

OPC compliant Ethernet IP communications are included as standard. This feature can be used to connect the ADAC 1000 system to a boiler Master Panel or customer BAS.

1.2.1 - Standard Equipment

The PLC based control system for a single tank includes a base unit consisting of the processor and embedded I/O, power supply, I/O

cards, 7" color touch screen, and NEMA 4 control panel. Programming and I/O are provided for the following:

- 1-5 pumps using contactors, soft starters or combination starters; inputs and outputs which include pump Hand-Off-Auto selector switches, a pump motor running input, and pump run output.
- Low Water pump cut off
- Audible Alarm output
- Stack Light outputs and light (Green for all systems normal, Yellow for non-critical alarms such as High Water, Red for critical alarm such as Pump Failure)
- Recirc Bypass output
- Chemical Feed Relay output
- Boiler 1-5 feed water required inputs for one pump per boiler configuration
- Analog Tank Pressure Input
- Analog Tank Temperature Input
- Analog Tank Level Input
- Analog Discharge Header Pressure Input
- Tank primary and secondary makeup valve control
- Text/email
- Remote setpoint by communications
- Remote Lead Lag pump rotation by communications
- US or metric units

1.2.2 - Options

Programming and I/O cards for the following are optional (each option requires the preceding ones):

Option 1

- VFD Pump 1-3
- PRV or Overflow Valve

Option 2

- VFD Bypass or 1 Pump per Boiler 1-5
- Tank Discrete Level Switches

Option 3

- VFD Pump 4-5

Option 4

- User Configured Analog Inputs
- Tray Temp/Pressure Analog Inputs for Tray Deaerators

Note: Each ADAC 1000 programming option requires the corresponding hardware (drives, valves, transmitters, switches, etc.)

1.3-Two Tank System Description

Two Tank systems can control up to 4 boiler feed pumps and 3 transfer pumps (6 pumps total), all of which can be run by contactors, combination starters, soft starters, or Variable Frequency Drives. The pump control method selected must be the same for all pumps on a tank, but the Tank 1 method can be different from Tank 2. For example, Tank 1 may use Variable Frequency Drives, but Tank 2 may use contactors.

Pumps on a common header can be alternated on a customer defined schedule and be set up in a customer defined lead lag format.

When lead lag operation is in use, a pressure transmitter mounted in the common header sends a signal to the PLC. The customer sets the pressure point via the touch screen. If the first pump cannot achieve that set point, the PLC will start a second pump and so on. If the pressure rises above the set point, the PLC will shed the last pump and so on. During normal operation the lead pump will always run.

Pumps on a “one pump per boiler” installation can be controlled by the boiler. Variable Frequency Drives cannot be used in a one pump per boiler configuration where each pump is hard piped to individual boilers. VFDs are only available on common pump discharge header configurations.

Standard system is capable of using discrete level alarm switches (such as the McDonnell Miller 63 or 64) for fixed level alarms, or a level transmitter which can be configured from the touch screen.

1.3.1 - Standard Equipment

7 inch color touch screen is standard.

A three module stack light is standard with a light for each mode. Green for normal, Yellow for non critical alarms Red for critical alarms. An audible alarm is standard, either a bell, horn or electronic sounder

PLC based control system for a two tank starts with and includes a base unit consisting of the processor and embedded I/O, power supply, I/O cards, 7" color touch screen, and Nema 4 control panel to provide the following functions

Level control can be an independent mechanical system, or by using the above mentioned transmitter, control an electrical or I/P make-up valve.

Tank Pressure is monitored by a transmitter in steam space. PRV can be an independent mechanical system or an electrical or I/P pressure reducing valve.

The second tank will be treated as an atmospheric pressure tank and will not have a tank pressure sensor.

Communication options include OPC compliant Ethernet IP to Boiler master panel or customer BAS.

PLC based control system for a two tank starts with and includes a base unit consisting of the processor and embedded I/O, power supply, I/O cards, 7" color touch screen, and NEMA 4 control panel. Programming and I/O provided for the following:

- 1-3 pumps on the first tank, 1-2 pumps on the second tank using contactors, soft starters or combination starters; inputs and outputs which include pump Hand-Off-Auto selector switches, a pump motor running input, and pump run output.
- Low Water pump cut off on both tanks
- Audible Alarm output
- Stack Light outputs and light (Green for all systems normal, Yellow for non-critical alarm such as High Water, Red for critical alarms such as Pump Failure)
- Recirc Bypass output on DA tank only
- Chemical Feed Relay output on both tanks
- Analog Tank Pressure Input on DA tank only
- Analog Tank Temperature Input and transmitter on both tanks
- Analog Tank Level Input on both tanks
- Analog Discharge Header Pressure Input on both tanks using common headers
- Tray Temperature and Pressure analog inputs for Tray Deaerators - each uses one customer configured analog input
- 4 customer configured Analog Inputs
- 1-4 Feed Pump Proving Flow Switch Inputs
- Primary makeup valve control on both tanks

1.3.2 - Options

Programming and I/O cards for the following are optional (each option requires the preceding ones):

Option 1

- DA or Surge Tank Discrete Level Switches
- Feed Pump 4 or Transfer Pump 3
- Transfer Pump Flow/Pressure Switches
- DA Bypass

Option 2

- VFD on feed or transfer pumps
- 2nd MUV
- PRV or Overflow Valve

Option 3

- VFD Bypass or 1 Pump per Boiler 1-4

Note: Each ADAC 1000 programming option requires the corresponding hardware (drives, valves, transmitters, switches, etc.)

1.4-Specifications

Power	
Power Supply Voltage	120 VAC (102 VAC - 132 VAC)
Power Supply Frequency	50 or 60 Hz
Maximum Total Connected Load	500 VA
Fusing	
Controller Power	2A
DC Power Supply	3A
Touch Screen HMI	2A
Environmental	
Ambient Operating Temperature Limits	32° to 130°F.
Humidity	85% RH continuous, non-condensing
Vibration	Continuous to 0.5 G

1.5-ADAC Software (standard programs)

Single Tank

PLC - 98500592

HMI 7” - 98500631

10” - 98500630

Dual Tank

PLC - 98500594

HMI 7” - 98500633

10” - 98500632

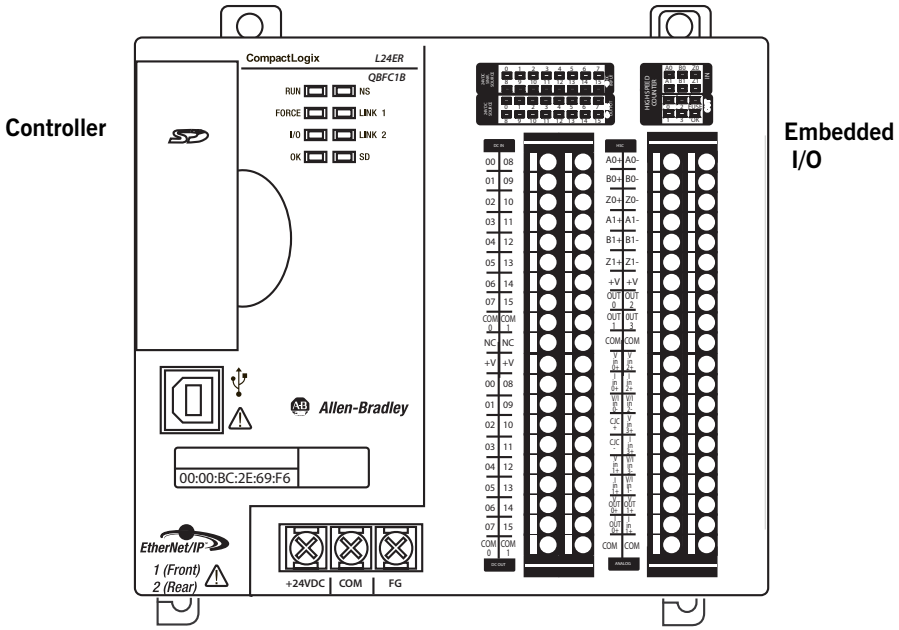
Chapter 2
System Components

2.1-Components

The ADAC control system consists primarily of a Programmable Controller (PLC), touch screen Human Machine Interface (HMI), 24VDC power supplies, stack light, and various relays. Optional components could include an EtherNet switch.

The ADAC controller is factory pre-programmed to work with most Cleaver-Brooks deaerator and surge tank systems, yet allows easy configuration for specific options. The controller program logic is password secured, ensuring tamper-proof operation. The touch screen HMI provides user-friendly access to pump and level control functions, diagnostics and alarm histories, and any connected operating parameters.

2.1.1 - Base Unit



The PLC and associated devices are mounted on a DIN rail in the ADAC control panel.

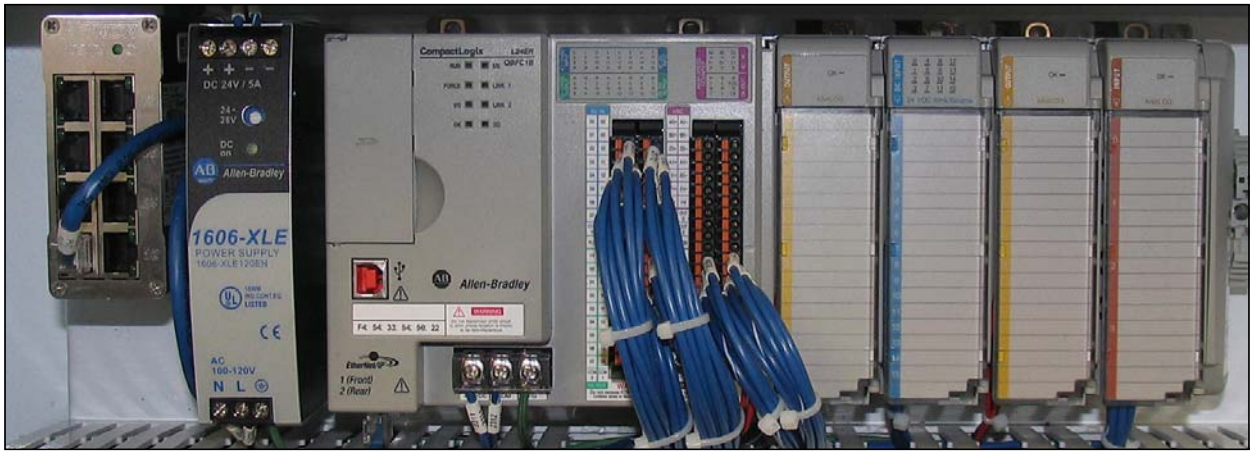


Figure 2-1 Single Tank PLC Layout

The PLC holds the program logic and configuration data for the ADAC controls. The program logic is password-secured at the factory. The included power supply powers all of the rack modules as well as the integrated communications bus.

The remaining control components vary according to the type of system and the options chosen. The base controller embedded I/O consists of 16 discrete (digital) inputs, 16 digital outputs, 4 analog inputs, and 2 analog outputs. A right end cap terminator is required in order to complete the controller communications bus. It attaches to the right side of the last module in the rack.

Optional modules can be added to the PLC to provide additional functionality (see below).

DISCRETE and **ANALOG** Signal Types
Discrete inputs/outputs are used for signals taking on only one of two possible states (on/off, open/ close, etc.). The input state is represented by a bit (0 or 1) in the control logic. Example: Pump Running (yes/no)
Analog signals can assume almost infinite values within the fixed analog input/ output current range of 4-20 mA. The ADAC 1000 PLC converts this current value to a range in engineering units. Example: Steam Header Pressure (0-150 PSI)

Note: The PLC expects each device to be in a specific slot location. The ADAC 1000 will not function unless all devices are properly installed and configured.

Single Tank PLC Layout (also see Chapter 5, **Input/Output Lists**)

Base System

1. Processor (Slot 0)
2. Slot 1 - Embedded Digital Inputs - 24VDC
3. Slot 1 - Embedded Digital Outputs - 24VDC
4. Slot 2 - Embedded Analog Inputs
5. Slot 2 - Embedded Analog Outputs

6. Slot 3 - Embedded High Speed Counter (not used)

Standard IO can accommodate:
Standard: 1-5 Pumps - without VFD
Common Header with Header Pressure Control
2 MUV's - One Primary - One Secondary

Optional Cards

7. Slot 4 - Analog Outputs 4 channel
8. Slot 5 - Digital Inputs - 24VDC
9. Slot 6 - Analog Outputs 2 channel
10. Slot 7 - Analog Inputs 4 channel

For specific input/output assignments see tables in Chapter 5.

Figure 2-2 Two Tank PLC Layout

Two Tank PLC Layout

Base System

1. Processor (Slot 0)
2. Slot 1 - Embedded Digital Inputs - 24VDC
3. Slot 1 - Embedded Digital Inputs - 24VDC
4. Slot 2 - Embedded Analog Inputs
5. Slot 2 - Embedded Analog Outputs
6. Slot 3 - Embedded High Speed Counter (not used)
7. Slot 4 - Analog Inputs

Standard IO can accommodate:
5 pumps total - without VFD
3 feed pumps and 2 transfer pumps
Common header with header pressure control
2 primary MUV's - one per tank
Tray temp and tray pressure analog inputs
User configurable analog inputs

Optional Cards

8. Slot 5 - Digital Inputs 24VDC
9. Slot 6 - Analog Outputs 8 channel
10. Slot 7 - Digital Inputs 24VDC

For specific input/output assignments see tables in Chapter 5.

2.1.2 - Operator Interface

A 7" touch screen HMI provides user-friendly access to ADAC control information and functions. The HMI not only displays numerous ADAC parameters at a glance, but in addition provides easy menu navigation for configuring control functions and troubleshooting alarms. A 10" touch screen is available as an option.

The HMI is powered by 120VAC supply voltage and communicates with the PLC using an Ethernet connection.

Figure 2-3 HMI

2.1.3 - Ethernet Communications

An Ethernet/IP port connects the ADAC controller to an Ethernet network. The ADAC utilizes OPC compliant Ethernet/IP for several communication functions:

- Communication between PLC and operator interface. The Ethernet cable connecting the PLC and HMI can be either a straight-through or crossover type.
- Connecting the ADAC system to an existing infrastructure, e.g. plant Local Area Network (LAN)
- Integration with a Building/Plant Automation System (BAS)
- Remote monitoring of the system via customer Wide Area Network (WAN) or via Internet

- Email or texting of ADAC alarms to plant or service personnel

Ethernet/IP is also used for certain control functions. With a C-B Master Panel, individual boiler controllers can be networked with the ADAC, providing a single BAS interface for multiple boilers and one ADAC system. Additional boiler room control functions can also be incorporated into the Master controller.

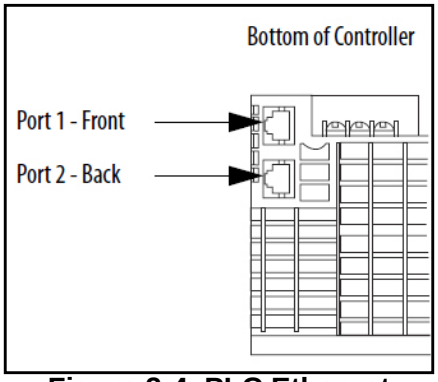


Figure 2-4 PLC Ethernet Connection

2.1.4 - USB

USB communications are used to connect a laptop computer to the PLC for diagnostic purposes. The HMI has 2 USB ports that may be used for file transfer.

The HMI USB ports also support keyboard and mouse input.

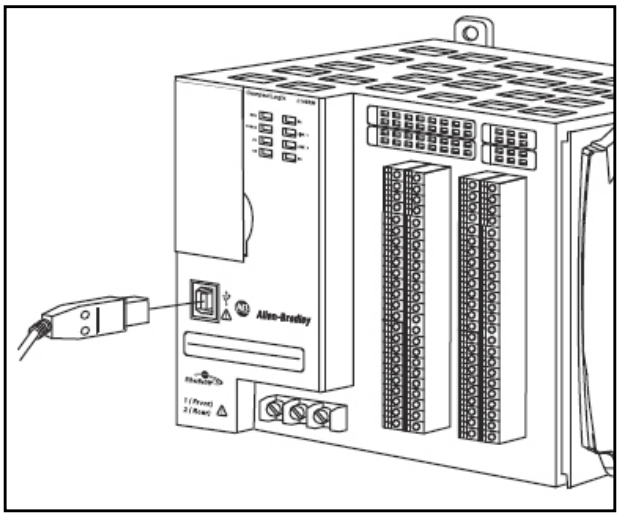


Figure 2-5 PLC USB connection

2.1.5 - Sensor Inputs

- Steam Pressure Transmitter for DA tanks (Fig. 2-4); mounted in steam space. This transmitter provides a sensor input to the ADAC

controller. It transmits a 4-20mA process variable signal to the controller for the purpose of displaying pressure inside the tank or to provide a process value for optional PRV control.

- Hot Water Temperature Transmitter (Fig. 2-5); one per tank. This transmitter provides a sensor input to the ADAC controller. The 4-20mA signal is used to display water temperature in the tank.

Figure 2-6

Figure 2-7

2.2-Control Panel

Prior to configuring and commissioning the system, it is necessary to confirm that all of the integral components and interconnecting wiring are in place and secure. Vibration and jarring from transport or installation may have loosened components or wiring terminals. It is good practice to check all system components for integrity and tightness prior to initial power-up of the system. Any external interlock and remote signal wiring should also be connected to the boiler controller.

⚠ Important

The PLC and rack modules do not support removal and insertion under power. While the PLC system is under power, any break in the connection between the base unit and the PLC rack (i.e. removing the base unit, PLC, or an expansion module) will clear processor memory including the user program. Ensure that the electrical power is OFF before removing or inserting any PLC device.

DIN Rail Latch and Expansion I/O Module Locking Levers

Before powering up the control system for the first time, check that all the DIN rail latches and expansion module locking levers are in place (see Figure 2-8 and Figure 2-9).

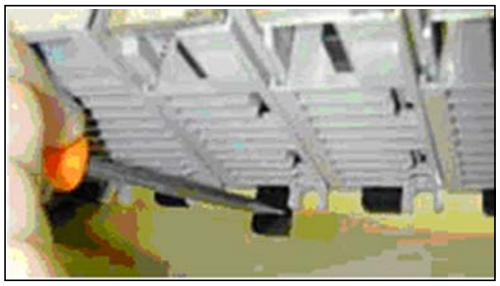


Figure 2-8. DIN rail latches

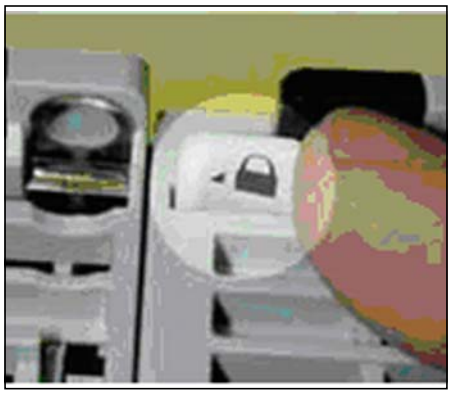


Figure 2-9. Expansion I/O Module locking levers

The module locking levers should all be securely seated to the left.

Panel and Field Wiring Terminations

Check that all factory wiring connections are tight and that field wiring terminations are completed and secure.

2.3-Optional Accessories

2.3.1 - Sensors

- Water Level, 4-20mA signal, one per tank (Fig. 2-10).
- Header Pressure Transmitter, 4-20 mA signal (used for pump lead/lag and alternation), one per tank for common headers (Fig. 2-11). Required on common headers; required for transfer header.

Figure 2-10

Figure 2-11

2.3.2 - Variable Frequency Drives for Pumps

An optional Variable Frequency Drive (VFD) controls the speed of the pump motor for enhanced pressure/flow control and reduced electrical energy consumption.

Drives are NEMA 1 and are supplied with line reactors.

Figure 2-12 Variable Frequency Drives

2.3.3 - Recirculation Valve Control

This option (standard on single tank systems) allows the ADAC system to close off the recirculation piping, sending all of the pump flow out to the boiler. When the system detects sufficient flow to protect the pump, the valve closes. When demand drops, the valve opens, allowing flow back to the tank and protecting the pump.

2.3.4 - Magnetic Level Transmitter

The level transmitter is made up of four components:

- Stainless steel chamber with 2 process connections
- Level indicator consisting of magnetically interlocked flags in a plastic housing strapped to the chamber.
- Transmitter junction box containing the circuit board and sensor tube.
- Magnetic float (shipped loose).

Sensor resolution is 3/8”.

NOTE: The float must be installed before the transmitter or level indicator will work. The float is laser etched with the word "TOP" and an arrow indicating the direction the float must be inserted into the chamber.

As with any level control device, regular maintenance to blow down and inspect the inner chamber should be performed to ensure proper operation.

2.3.5 - Differential Pressure Level Transmitter

Commissioning

This procedure applies only to differential pressure transmitters used for level measurement on pressurized closed pressure vessels (boiler drum or deaerator).

1. Make sure that power to the transmitter is "OFF".
2. With stop valves on the pressure vessel side closed, fill the impulse line going to the low-pressure side of transmitter with distilled water.
3. Open low and high pressure valves on the vessel side to fill impulse lines with water.
4. Slowly open the high pressure valve on the transmitter side (part of 3-valve manifold) to fill the transmitter pressure-detector section with water.
5. Slowly open the low pressure valve on the transmitter side (part of 3-valve manifold) to fill the transmitter pressure-detector section with water.
6. Check that there are no leaks in the impulse piping, 3-valve manifold, transmitter or other components.
7. To vent air from the impulse lines and transmitter, slowly open vent plug on the transmitter (one side at the time) until only liquid is coming from the plug orifice. Tighten vent plugs.
8. Turn on power to the transmitter.
9. Confirm transmitter operation.

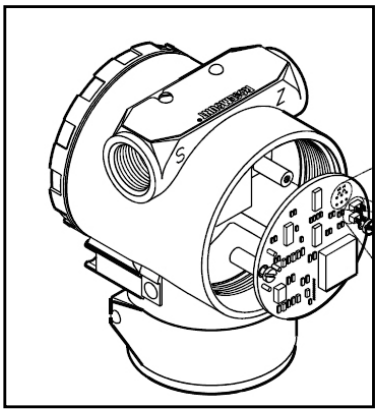


Figure 2-13 Transmitter

Setting Zero and Span - Rosemount 3051 Transmitter

1. On the top of the transmitter head locate Zero (Z) and Span (S) buttons.
2. Fill reference leg (low pressure side) with water.
3. On the three valve bypass manifold open high pressure side valve, close low pressure side valve and open bypass valve.
4. Loosen bleed nut on the high pressure side and wait until only water is coming out (no air). Repeat for the low pressure side.
5. Close bypass valve and open low pressure side valve.
6. Fill deaerator with water to the bottom of the gauge glass and press Zero button. Hold Zero button for at least 2 seconds.
7. Fill deaerator with water to the top of the gauge glass and press Span button. Hold Span button for at least 2 seconds.
8. Measure the length of the gauge glass.
9. On the PanelView screen for transmitter calibration. Zero = 0. Span = Length of the gauge glass.

Setting Zero and Span - E&H Transmitter

Follow steps 1-5 above.

6. Fill deaerator with water to the bottom of the gauge glass and select EMPTY CALIB. parameter. Enter the level value (0 eng. units) and confirm the value to assign the pressure value present to the lower level value. Note - to accept the value displayed, first switch to Edit mode and press the “E” button to save the value.
7. Fill deaerator with water to the top of the gauge glass and select FULL CALIB. parameter. Enter the level value and confirm the value to assign the pressure value present to the upper level value. Note - to accept the value displayed, first switch to Edit mode and press the “E” button to save the value.

Continue with steps 8&9 above.

Chapter 3
Commissioning

Note: Certain screen layouts may differ between single tank and two tank systems.

3.1-Main Menu

On system power-up, the Main Menu is displayed. This screen provides pushbutton access to the various Operator, Configuration, and Alarm screens.

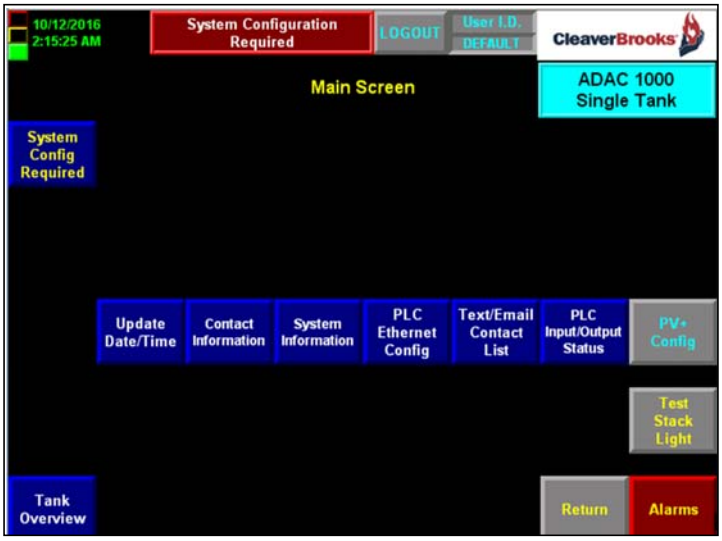


Figure 3-1 Main Menu

3.2-Begin System Configuration

If the system has not been configured, the <System Config Required> button will show on the Main Menu screen. Press here to begin system configuration.

The user must be logged in at the appropriate password level to change configuration data. If the user tries to change configuration data without having proper access rights, a pop-up window will appear and a password will be requested.

If a valid user name and password are entered, the operator will be allowed to change data.

The current user login status can be seen at the top right of each screen. The color of the pushbutton will also indicate if the user has proper access rights.

Pressing the button for the value that needs modifying will display a numeric keypad, allowing the operator to enter the new value. The range of valid entries as well as the currently entered value are shown above the keypad. An out-of-range entry will show up in red and require re-entering an acceptable value. Enter the desired value and press the ENTER key, If the entry is valid, the value will be accepted and the keypad will disappear.

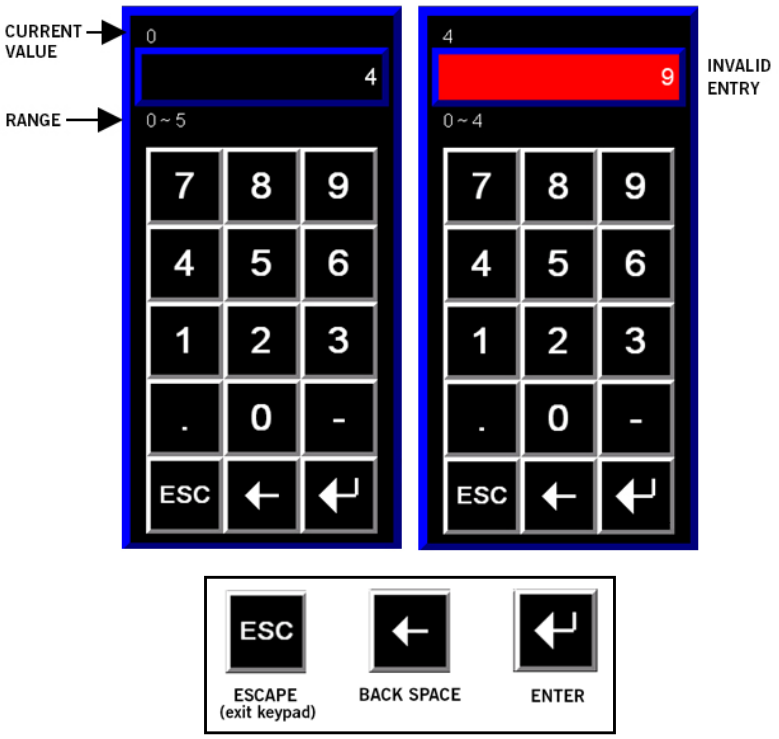


Figure 3-2 Numeric keypad

The ADAC 1000 uses three levels of password access: Operator, Service, and Factory. Passwords are available from your Cleaver-Brooks representative.

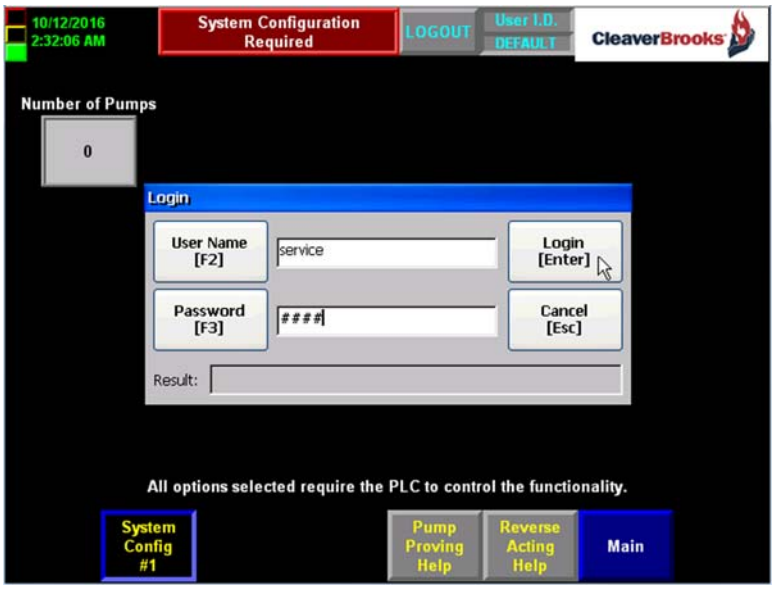


Figure 3-3 Login prompt

The first item to configure is the number of pumps (single tank systems) or boiler feed pumps (dual tank systems). Press <Number of [Boiler Feed] Pumps> for the numeric input keypad.

Enter the appropriate number of pumps and press the ENTER key. After entering the number of pumps, the rest of the configuration options will appear. Configure the System Type, Pump Control method, and remaining system options.

NOTE: System configuration can not continue until number of pumps is configured (the <Next> button will not be available).

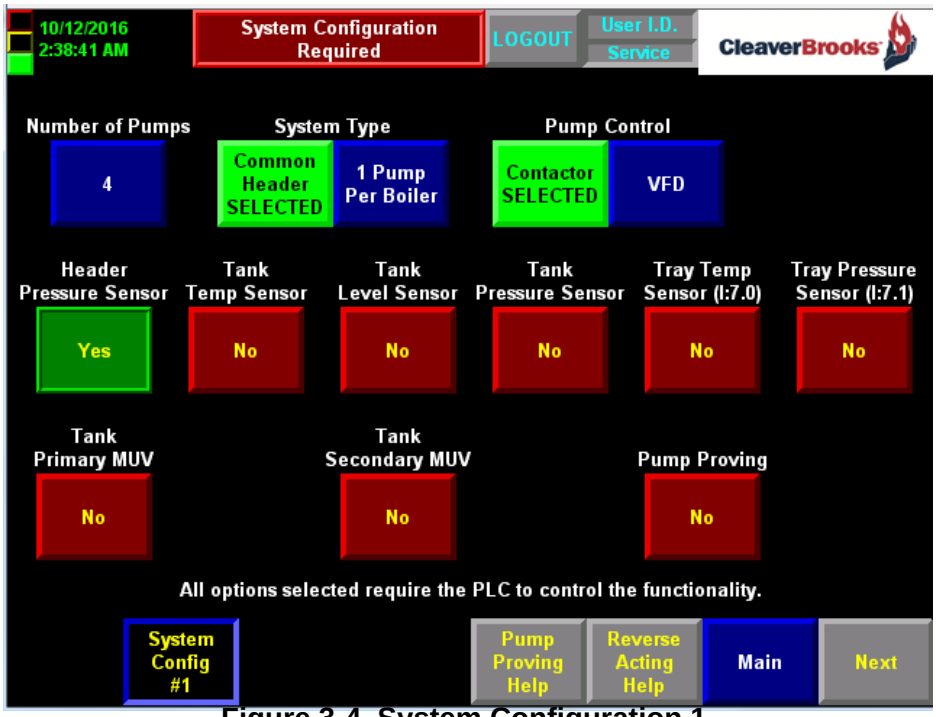


Figure 3-4 System Configuration 1

3.3-System Configuration Screen 1 - Single Tank

NOTE: All pumps must be OFF to change system configuration. If not, a warning will be displayed:

Figure 3-5 System config. warning

3.3.1 - Common Header

A header pressure sensor is required for common header systems.

Pump control method can be either contactor or VFD.

3.3.2 - One Pump per Boiler

Header pressure sensor not required; uses a discrete “Water Required” input for pump on/off control.

Auxiliary analog inputs required to view header pressure if desired (not required).

Pump control by contactor only; VFD pump control not available.

3.3.3 - System Options

After selecting System Type and Pump Control, a number of options remain to be configured on Configuration Screen 1.

Header Pressure Sensor

- Required for Common Header Pump Control (VFD or Contactor)
- Required for PLC controlled Recirculation Valve
- Required for Pump Lead Lag

Tank Temperature (monitor only) & alarm

Tank Level

- Required for Makeup Water Valve Control
- Overflow Valve Control
- Pump Auto Restart

Tank Pressure

- Required for PRV Valve Control

Variable Frequency Drive

- 4-20mA PLC analog output signal to command pump speed
- NO analog speed feedback signal
- VFD bypass available

Tray Sensors (monitor only) & alarm

- Temperature
- Pressure

Makeup Water Valves

- Two Valves Maximum (primary and secondary)
- To provide PID controlled makeup water to maintain tank level
- Reverse Acting Selection Available

  Direct Acting: 4mA = valve closed; 20mA = valve fully opened
  Reverse Acting: 4mA = valve fully opened; 20mA = valve closed

Pump Proving

- Verify pump operation by use of flow meter, pressure switch, or current toroid. The proving signal must be wired to a PLC discrete input and must be energized when the pump is running and de-energized when the pump is stopped.
- Alarms can be disabled during setup to prevent nuisance tripping.
- Help Screen Available

3.4-System Configuration Screen 1 - Dual Tank

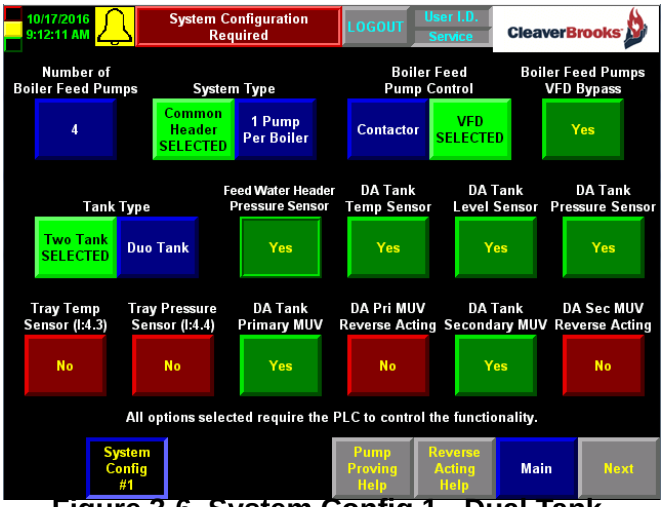


Figure 3-6 System Config 1 - Dual Tank

Tank Type must be specified for dual tank systems:

- Two Tank – Tanks are separate.
- Duo – DA and Surge are combined in one structure.

The HMI will have different displays for the Tank Overview Screen, based on selection.

Other selections for dual tank systems are:

Makeup Water Valves

- 2 Valves Maximum per Tank
- 3 Valves Maximum per System

To provide PID controlled makeup water to maintain tank level. Reverse acting selection available.

Direct Acting: 4mA = valve closed; 20mA = valve fully opened
Reverse Acting: 4mA = valve fully opened; 20mA = valve closed

VFD Bypass

- Available on both boiler feed and transfer pumps
- Allows the pump to run if VFD inactive
- Additional hardware required

3.5-System Configuration Screen 2 - Single Tank

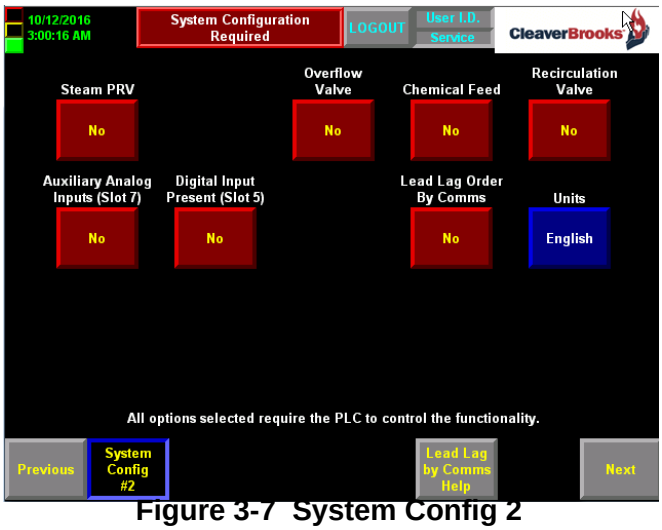


Figure 3-7 System Config 2

When finished on Configuration Screen 1, press <Next>. The following items are configured on Configuration Screen 2:

Steam PRV

- Provides PID control to maintain DA tank pressure
- If selected, Overflow Valve Control not available.
- Reverse Acting selection available.

Note: The Steam PRV Valve option requires a steam space pressure transmitter and PRV with a 4-20 mA positioner.

Overflow Valve

- Linear Analog Overflow Valve Control.
- If selected, PRV Valve Control not available.

Chemical Feed

- Discrete “Pump Running” Output Signal to Chemical Feed System.

Recirculation Valve

- Discrete Output Valve Control.
- Recirc valve open/close signal based on header pressure.

Auxiliary Analog Inputs

- 4 user configurable analog inputs.
- 1 input required if tray temperature is monitored.
- 1 input required if tray pressure is monitored.

Digital Input Present – Slot 5

- Required for Tank High/Low discrete level switches.
- VFD Bypass.
- One Pump per Boiler.
- If Slot 6 or Slot 7 is present.

Remote Set Point/Lead Lag Order by Comms

- Use Ethernet communications to change (write) lead lag pump order or header pressure set point (VFD must be selected)
- Requires Communication Watchdog.
- Not available on one pump per boiler applications

English/Metric Unit Display

Not “on the fly” - analog values do NOT automatically rescale.

3.6-System Configuration Screen 2 - Dual Tank

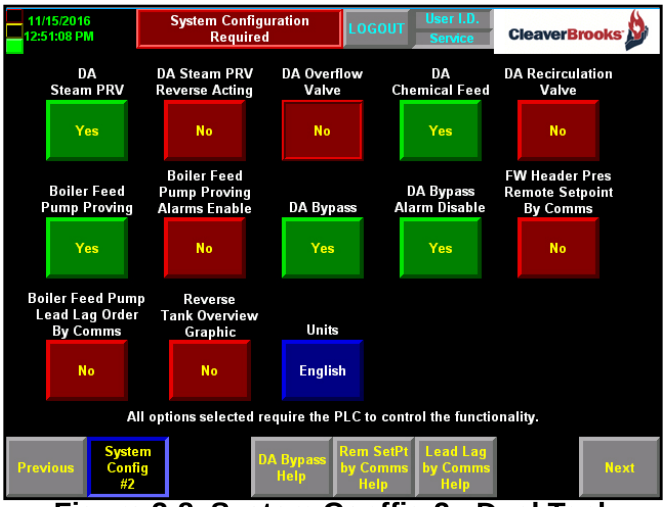


Figure 3-8 System Conffig 2 - Dual Tank

Steam PRV

- Tank Pressure PID Control.
- If selected, Overflow Valve Control not available.
- Reverse Acting selection available.

Overflow Valve

- Linear Analog Overflow Valve Control.
- If selected, PRV Valve Control not available.

Chemical Feed

- Discrete Pump Running Output Signal to Chemical Feed System.

Recirculation Valve

- Discrete Output Valve Control.
- Based on Header Pressure.

DA Bypass

- Bypass DA during tank inspection or maintenance.
- Boiler Feed Pumps draw water directly from Surge Tank.

DA Bypass Alarm Disable

- Used to disable Non-Critical Alarms in DA Bypass Mode.

Eliminates nuisance alarms while DA is bypassed

Remote Set Point/Lead Lag Order by Comms

- Use Ethernet communications to change (write) lead lag pump order or header pressure set point (VFD must be selected)
- Requires Communication Watchdog.
- Not available on one pump per boiler applications

English/Metric Unit Display

Not “on the fly”. Analog Values do NOT automatically rescale.

3.7-Transfer Pumps - Dual Tank Systems

Dual tank systems have a third configuration screen, accessed by entering the number of transfer pumps.

Three transfer pumps are allowed. The maximum on two tank systems is six pumps total including boiler feed pumps.

3.8-System Configuration Screen 3

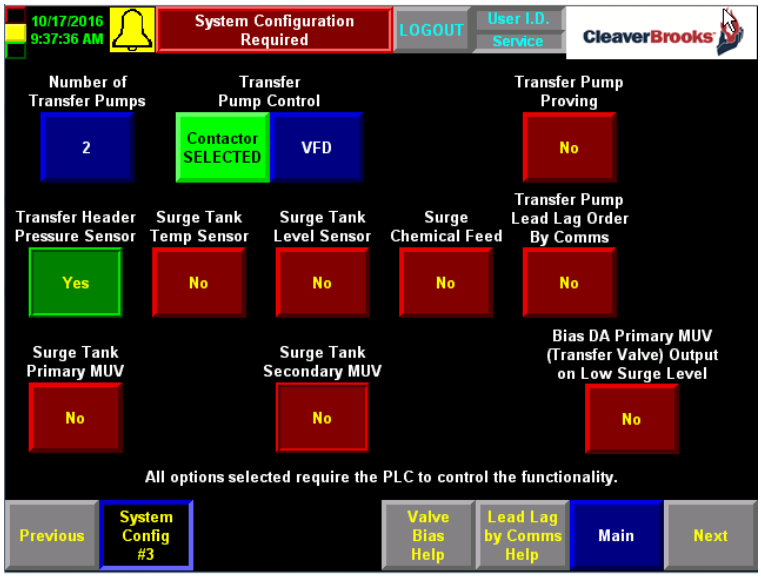


Figure 3-9 System Configuration 3

Transfer Pump Control

- Contactor or VFD.
- VFD Bypass Available.

Transfer Pump Proving

- Verify pump operation by use of flow meter, pressure switch, or current toroid.
- Can disable pump proving alarms to prevent nuisance tripping during setup.

Transfer Header Pressure

- Required for Transfer Pump Control (VFD or Contactor)
- Required for transfer pump lead lag

Surge Tank Temperature (monitor only) & alarm

Surge Tank Level

- Required for Surge Makeup Valve Control
- Transfer Pump Auto Restart

Surge Chemical Feed

- Discrete “Transfer Pump Running” Output Signal to Chemical Feed System.

Remote Lead Lag Order by Comms

- Use Ethernet Communications to change (write) Transfer Lead Lag Pump order

- Requires Communication Watchdog.

Makeup Water Valves

- 2 Valves maximum per tank
- 3 Valves maximum per system
- To provide PID controlled primary and secondary makeup water to tank(s).
- Reverse acting selection available

Bias DA Primary MUV

- Bias transfer valve (DA Primary MUV) toward close based on Low Surge Level.

Used to keep transfer pumps from shutting down on low surge tank water level.

3.9-System Configuration Summary

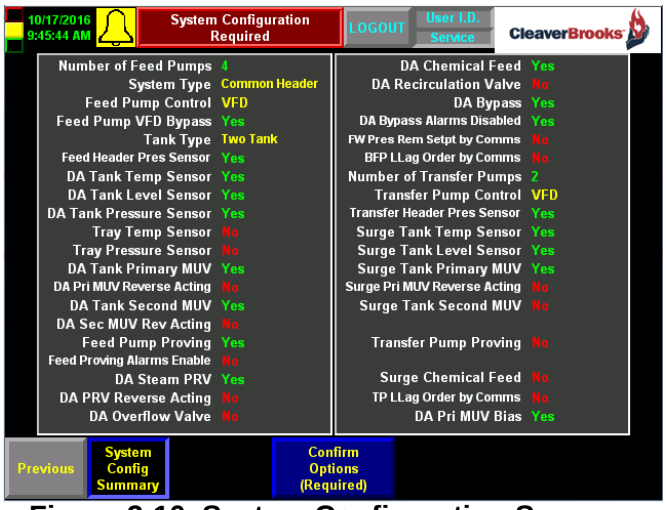


Figure 3-10 System Configuration Summary

This screen shows all system configuration settings at a glance. Upon initial configuration, and any time a critical system configuration setting (Number of Pumps, System Type, or Pump Control) is changed, the settings must be confirmed on this screen in order to continue operation. Press <Confirm Option> to confirm.

When options have been confirmed the <Main> screen button will be visible.

3.10-Analog Input Configuration

With system configuration completed the Main screen will appear as follows. Note the <Analog Input Config> button is now visible.

The button is visible ONLY if Pumps have been configured to a non-zero value.

Configuration is required if transmitter span value equals zero.

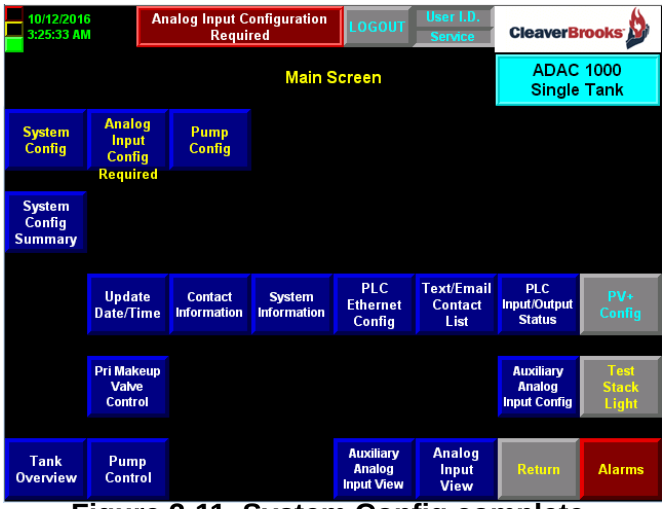


Figure 3-11 System Config complete

3.10.1 - Analog Input Config Select Screen

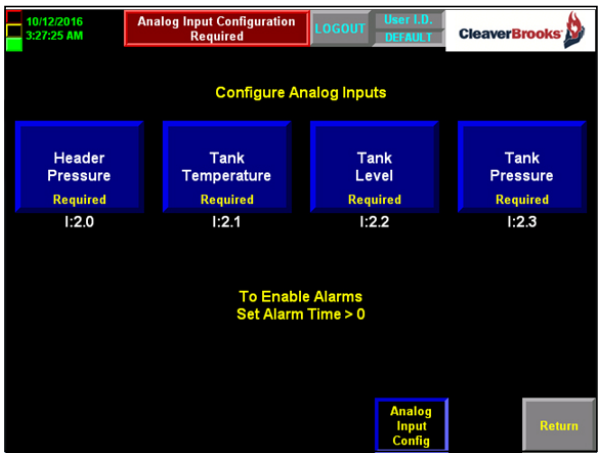


Figure 3-12 Analog Input Configuration select

"Required" text below a button indicates that input requires configuration. An operator level password will be required to modify the values on any Analog Input Configuration screen.

3.10.2 - Header Pressure

Selecting <Header Pressure> on the Input Config Select screen will show a screen like the following:

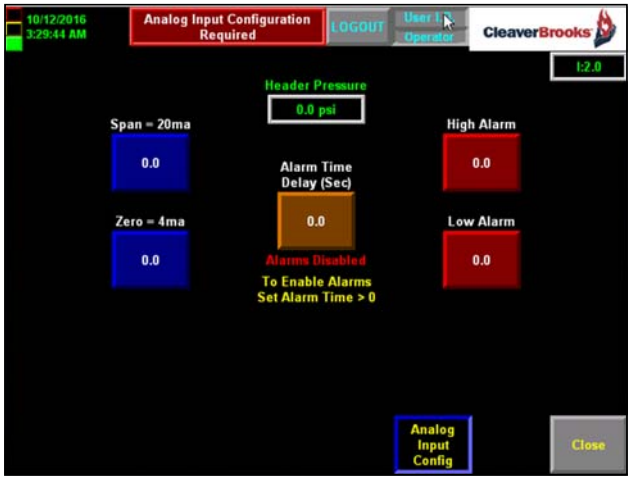


Figure 3-13 Configure Selected Input (Header Pressure)

The following should be configured:

Transmitter Span

- Corresponds to 20ma Signal.
- Entry cannot be greater than 99999.
- Entry cannot be less than Zero value.

Transmitter Zero

- Corresponds to 4ma signal.
- Entry cannot be less that -9999.
- Entry cannot be greater than Span value.

High Alarm

- Entry cannot be greater than Span value.
- Entry cannot be less than Low Alarm value.

Low Alarm

- Entry cannot be less than Zero value.
- Entry cannot be greater than High Alarm value.

Alarm Time Delay

- A non-zero entry enables both High and Low Alarm.
- A zero entry disables both High and Low Alarm.
- Enter Time Value 0-9999 Seconds

3.10.3 - Tank Level

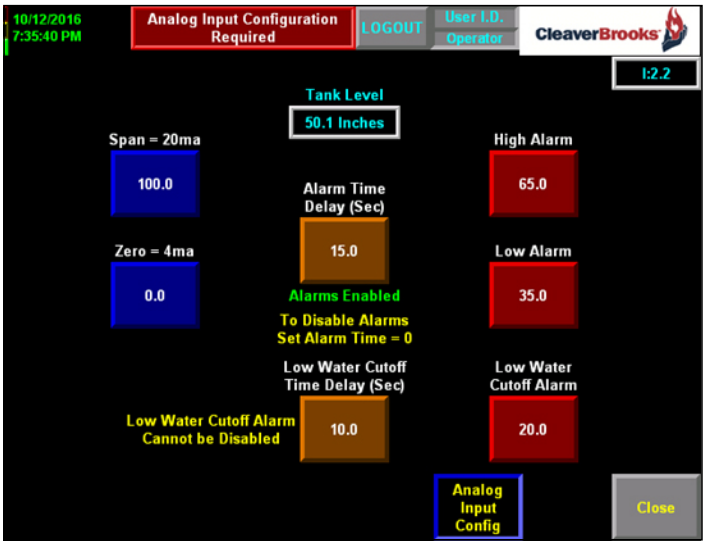


Figure 3-14 Configure Tank Level

Tank Level High Alarm

- Entry cannot be greater than Span value.
- Entry Cannot be less than Low Alarm value.

Tank Level Low Alarm

- Entry cannot be greater than High Alarm value.
- Entry Cannot be less than Low Water Cutoff value.

Tank Level Low Water Cutoff Time Delay

- Cannot be Disabled
- Enter a value for Low Water Cutoff Time Delay between 0-60 Seconds.
- Entry of 0 does NOT disable alarm.

Tank Level Low Water Cutoff

- Entry cannot be greater than Span value.
- Entry Cannot be less than Zero value.

3.11-Analog Input View

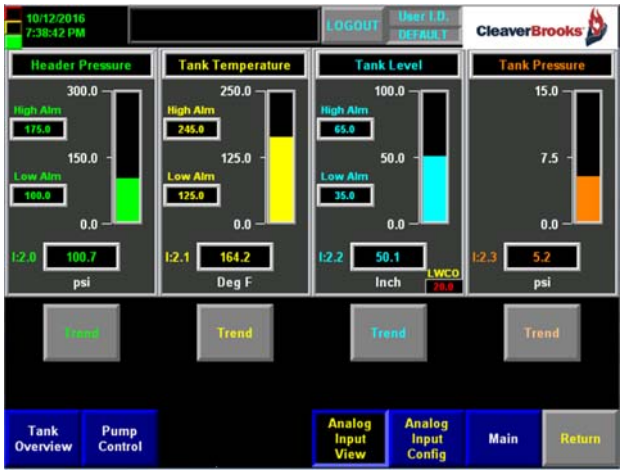


Figure 3-15 Analog Input View - single tank

Transmitter zero, span, midpoint and current reading are displayed for all configured inputs. If alarms are enabled for the input, the alarm limits will also be displayed.

A trending screen is available for each analog input.

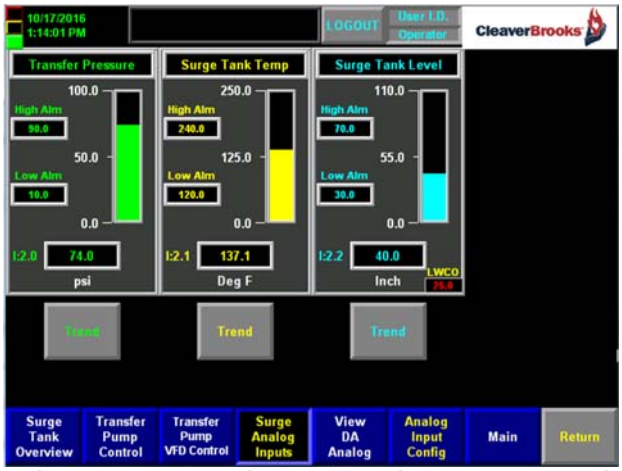


Figure 3-16 Analog Input View - surge tank

3.12-Analog Input Trending

The HMI can show a real time display of any configured analog input.

Use the arrow keys to move along the time axis.

In the example below:

- Header Pressure is taking too long to reach set point.
- If VFD is present, the gains on the control loop can be increased.

- The Lag Pump start time and start pressure/VFD% can be adjusted to achieve set point more quickly.

Screen displays 20 minute intervals at a time.

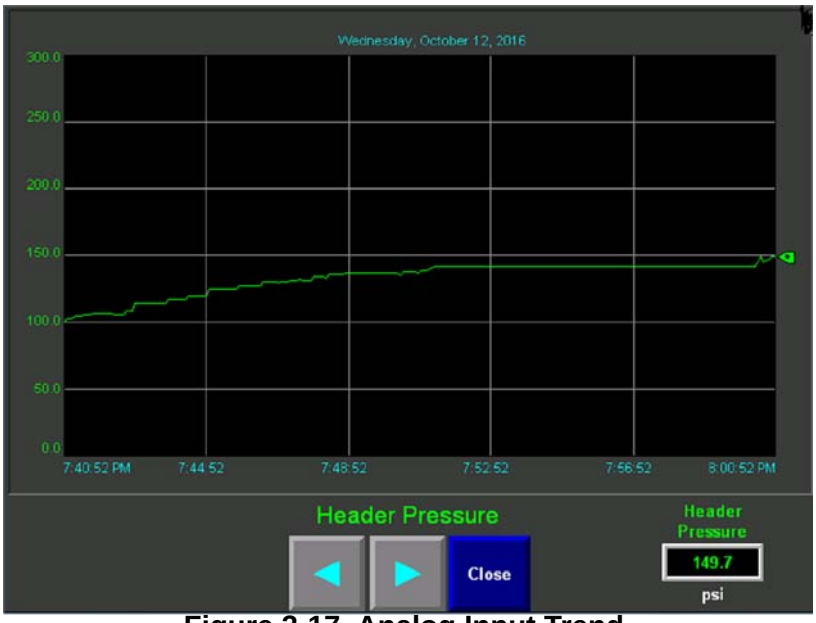
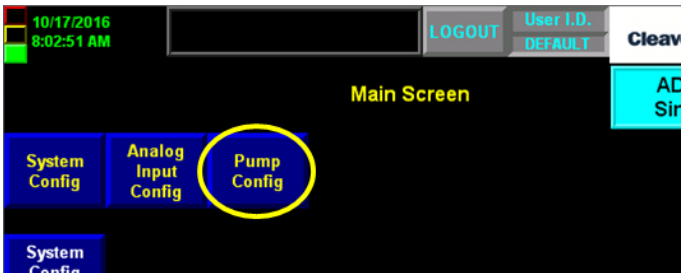


Figure 3-17 Analog Input Trend

3.13-Pump Configuration

Pump configuration should be performed after analog input configuration is complete. Press <Pump Config> on the Main Screen to access.



Operator-level login is required to set pump configuration values.

No login is required to enable/disable pump functions.

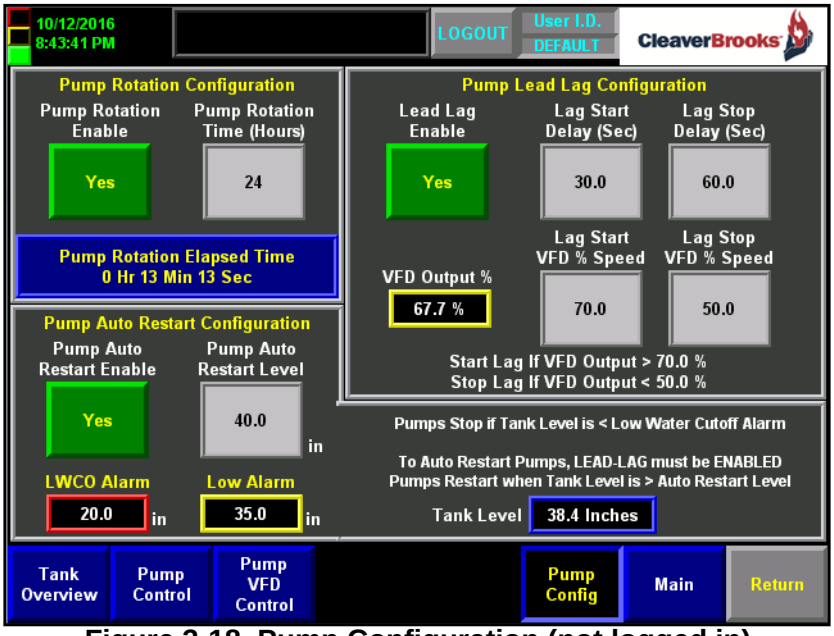


Figure 3-18 Pump Configuration (not logged in)

3.13.1 - Pump Rotation

Pump rotation is only available on common header applications. This feature allows for automatic pump Lead Lag order rotation based on pump rotation elapsed time.

Upon pump rotation:

- Lag 1 pump becomes Lead.
- Lead pump becomes last Lag pump.

Pump rotation time accumulates any time a pump selected as AUTO is running.

When Pump Rotation Elapsed Time is equal to the Pump Rotation Time hours the pump will automatically rotate and the Rotation Elapsed Time will be reset to 0.

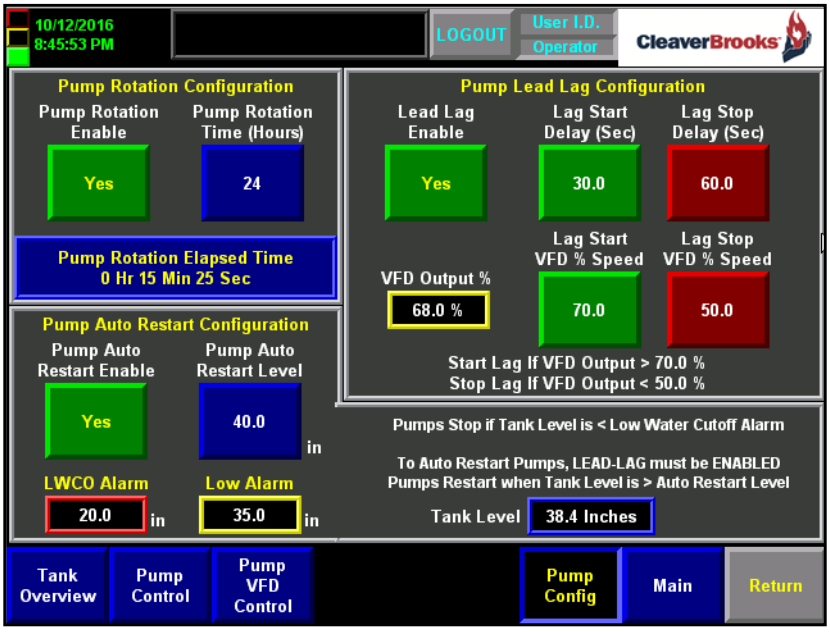


Figure 3-19 Pump Configuration (after login)

3.13.2 - Pump Auto Restart

This feature allows for Automatic Pump Restart after an Analog Low Water Cutoff Alarm.

- Requires tank level transmitter.
- Pump Lead Lag must be enabled to auto restart pumps.
- Pump Restart Level entry must be less than the tank level transmitter span value.
- Pump Restart level entry must be greater than the tank level low alarm value.

After an Analog Low Water Cutoff the pumps will automatically restart when the Tank Level rises above the Pump Auto Restart Level. If desired, the LWCO alarm may be acknowledged from the HMI; as long as tank level is above LWCO level the pump will restart even if tank water level is still below the auto restart level. Should an analog LWCO alarm occur with Pump Auto Restart disabled, Pump Lead Lag will be automatically disabled with manual intervention required to restart the pumps.

In most cases the analog LWCO level should be set above the discrete LWCO switch.

Should the discrete Low Water Cutoff Switch be tripped, Pump Lead Lag remains enabled but alarm acknowledgment is required to restart the pumps.

3.13.3 - Pump Lead Lag with VFD

Only available on common header applications.

Allows for automatic start and stop of Lag pumps based on VFD output%.

The Lead pump **always** runs.

Lag Start VFD% Speed

- If the VFD output% rises above the Lag Start VFD% Speed for the Lag Start Delay Time the next Lag Pump will be commanded to start.

Lag Stop VFD% Speed

- If VFD output% falls below the Lag Stop VFD% Speed for the Lag Stop Delay Time the last Lag Pump will be commanded to stop.

Pump Lead Lag is automatically **disabled** if:

- Pump Auto Restart is Disabled and an Analog Low Water Cutoff Alarm occurs.
- The number of pumps configured is changed.
- If the user enters an invalid Lead Lag order.
- 1 pump per boiler applications.

Lead Lag Start and Stop time delays:

With VFD Start = 0-300 sec
Stop = 0-900 sec

W/O VFD Start = 0-30 sec
Stop = 0-900 sec

3.13.4 - Pump Lead Lag with Contactor

Only available on common header applications.

Allows for automatic start and stop of Lag pumps based on Header Pressure

The Lead pump **always** runs.

Lag Start Pressure

- If Header Pressure falls below Lag Start Pressure for the Lag Start Delay Time the next Lag Pump will be commanded to start.

Lag Stop Pressure

- If Header Pressure rises above Lag Stop Pressure for the Lag Stop Delay Time the last Lag Pump will be commanded to stop.

Pump Lead Lag is automatically **disabled** if:

- Pump Auto Restart is Disabled and an Analog Low Water Cutoff Alarm occurs.
- The number of pumps configured is changed.

- If the user enters an invalid Lead Lag order.
- 1 pump per boiler applications.

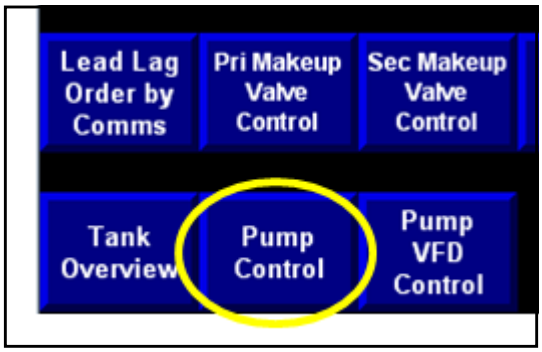
3.13.5 - One Pump per Boiler

Only the Pump Auto Restart feature is available.

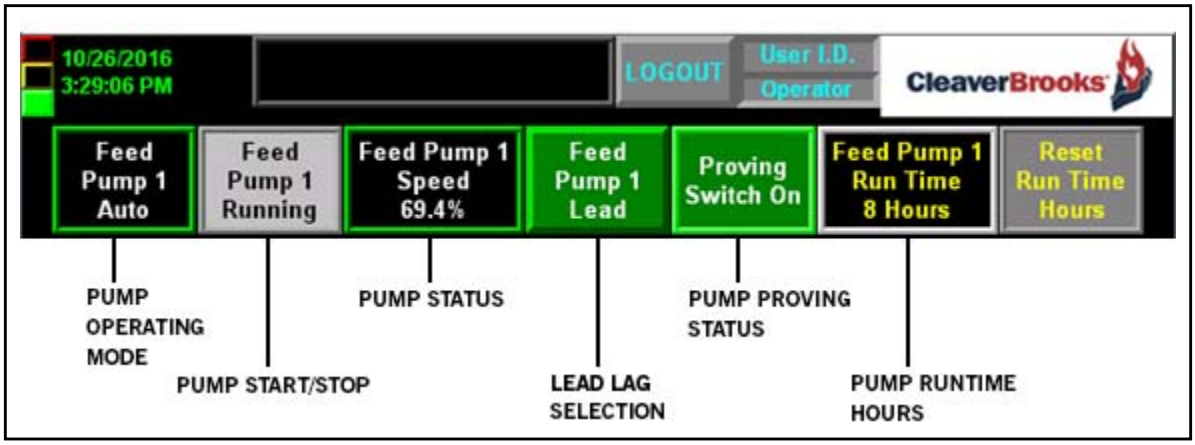
Transfer Pump Configuration is set up identically to feed pump configuration, with the exception that transfer pumps cannot be configured as One Pump per Boiler.

3.14-Pump Control

Select <Pump Control> (or choose between Feed Pump and Transfer Pump Control for a dual tank system) on the Main Screen.



3.14.1 - Pump Control - Pump Lead Lag Enabled, VFD Selected



Pump Operating Mode

Hand – Off – Auto - VFD Bypass

Pump Start/Stop

- When Lead Lag is Enabled status indication only. Running - Stopped
- When Lead Lag is Disabled push button becomes available to manually start/stop pump.

Pump Status

- Off = Pump not running
- On = Pump running in Hand mode.
- Pump Speed% = Pump running in Auto; % is the commanded output to the VFD.
- Fault = Either a pump run fault or pump proving fault is present.
- VFD Bypass = VFD is selected and in bypass mode.

Lead Lag Selection

Press the pump lead lag push buttons to change lead lag order manually. Lead Lag may only be enabled if the Lead Lag order is valid.

Lag pumps stage on and off based on VFD Output%.

Pump Proving Status

Only available if Pump Proving is selected.

Indicates status of Pump Proving switch.

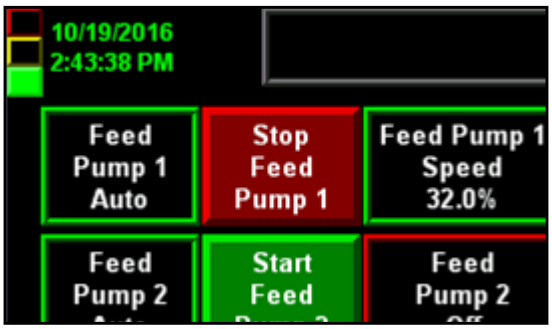
Feed Pump Runtime Hours

Service level password required to reset run time hours and rotation elapsed time.

3.14.2 - Pump Control - Pump Lead Lag Disabled

When Pump Lead Lag is disabled pumps that are running remain running and pumps that are stopped remain stopped.

Start/Stop push buttons become active to manually start and stop pumps.



3.14.3 - Pump Control - Pump Lead Lag Invalid

Pump Lead Lag Invalid mode is indicated on the HMI when an invalid pump lead lag sequence is entered.

- Manually changing the lead lag order will momentarily render the lead lag sequence invalid and will disable pump lead lag
- When Lead Lag is invalid pumps that are running remain running and pump that are stopped remain stopped.
- Start/Stop push buttons become active to manually start and stop pumps.

To change the Lead Lag Order the operator must press the Lead Lag Selection buttons to scroll through the selections.

When operator enters a valid lead lag order the Lead Lag enable button will become visible and operator can enable Lead Lag if desired.

3.14.4 - Pump Control - One Pump per Boiler

One Pump per Boiler control is strictly an On/Off control scheme.

- All Pumps are designated as Lead Pumps
- In Auto mode, pump On/Off is based solely on a “Water Required” discrete input to the ADAC PLC for that particular boiler.
- The Lead pump only runs *if Water Required Signal is ON*.

There are no Start/Stop push buttons on the HMI. Manual pump start/stop is by use of the Hand – Off – Auto selector switch located on the enclosure. In Hand mode the pump is commanded to run.

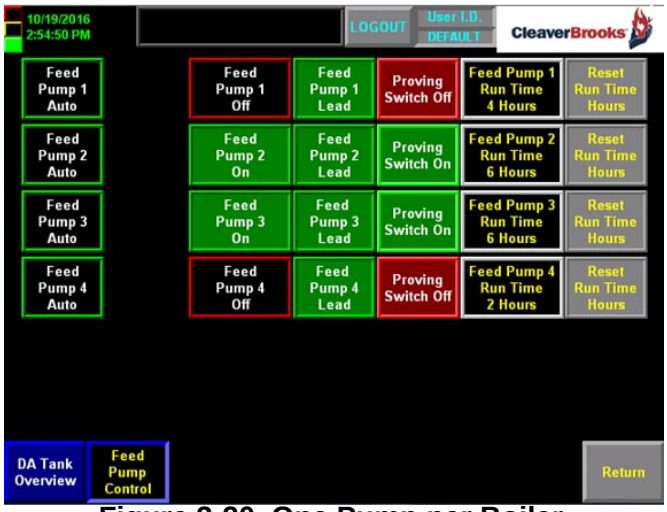
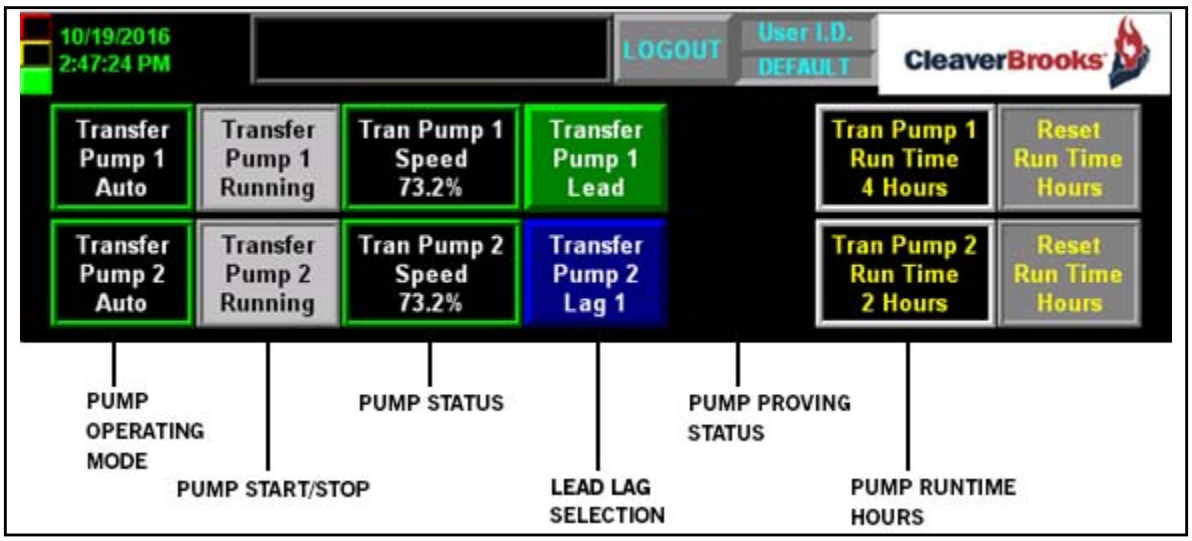


Figure 3-20 One Pump per Boiler

3.14.5 - Pump Control - Lead Lag Enabled (Transfer Pump, Dual Tank systems), VFD Selected



Pump Operating Mode

Hand – Off – Auto - VFD Bypass

Pump Start/Stop

- When Lead Lag is Enabled status indication only. Running - Stopped
- When Lead Lag is Disabled push button becomes available to manually start/stop pump.

Pump Status

- Off = Pump not running
- On = Pump running in Hand mode.
- Pump Speed% = Pump running in Auto; % is the commanded output to the VFD.
- Fault = Either a pump run fault or pump proving fault is present.
- VFD Bypass = VFD is in bypass mode.

Lead Lag Selection

Press the Pump Lead Lag push buttons to select or change the lead lag order manually. Pump Lead Lag may only be enabled if the lead lag order is valid. Lag pumps stage on and off based on the VFD output%.

Pump Proving Status

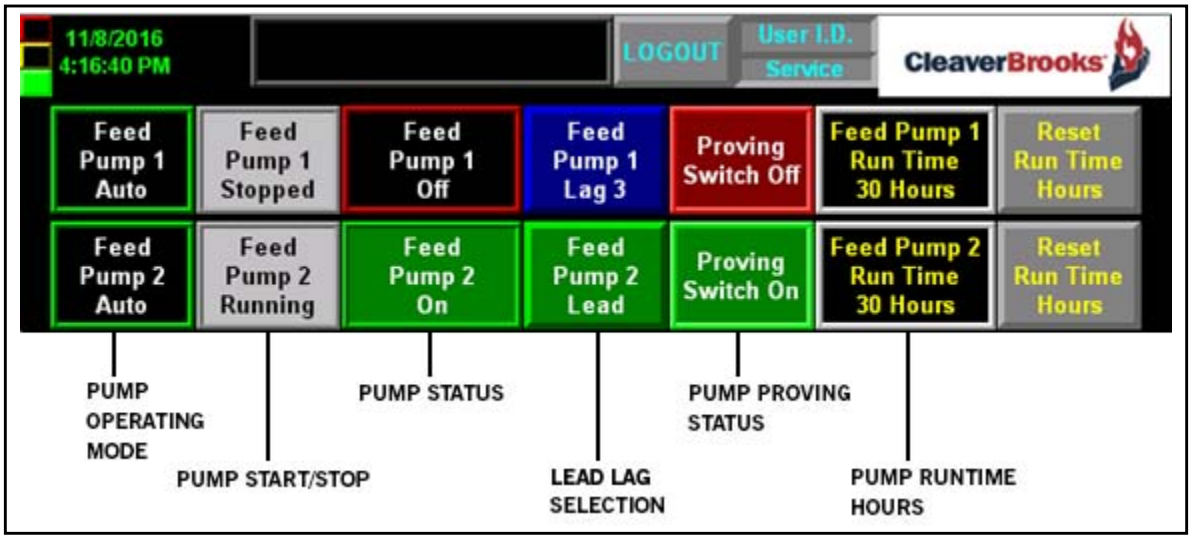
Only Available if Pump Proving is selected.

Indicates status of Pump Proving switch.

Transfer Pump Runtime Hours

Service level password required to reset run time hours and rotation elapsed time.

3.14.6 - Pump Control - Lead Lag Enabled, NO VFD Selected



Pump Operating Mode

Hand – Off – Auto

Pump Start/Stop

- When Lead Lag is Enabled status indication only. Running - Stopped
- When Lead Lag is Disabled push button becomes available to manually start/stop pump.

Pump Status

- Off = Pump not running
- On = Pump running when the VFD option is not selected.
- Fault = Either a pump run fault or pump proving fault is present.

Lead Lag Selection

Press the Pump Lead Lag push buttons to change lead lag order manually. Lead Lag may only be enabled if the Lead Lag order is valid.

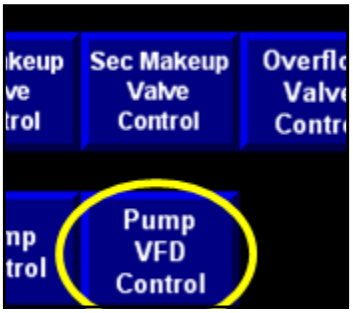
Lead Lag based on Header Pressure

Pump Proving Status

Only Available if Pump Proving is selected.

Indicates status of Pump Proving switch.

3.15-Pump VFD Control



The ADAC 1000 supports PowerFlex 400, 700, 70, and 753 drives. Other drives are not recommended.

Pump control with VFD is available on the boiler feed pumps and on the transfer pumps.

VFD not available for feed pumps on One Pump per Boiler applications.

Pump Hand mode uses VFD Preset Speed 1 to command pump frequency.

Preset Speed set at factory to 60Hz (PowerFlex 400, Parameter A144 Preset Freq 1 = 60.0 Hz).

VFD Interface Signals Required:

- Analog input 4-20mA for speed command
- Discrete input for pump start command
- Discrete output for pump running
- Discrete input for preset speed when pump is in Hand mode

3.15.1 - Pump VFD Control – Manual

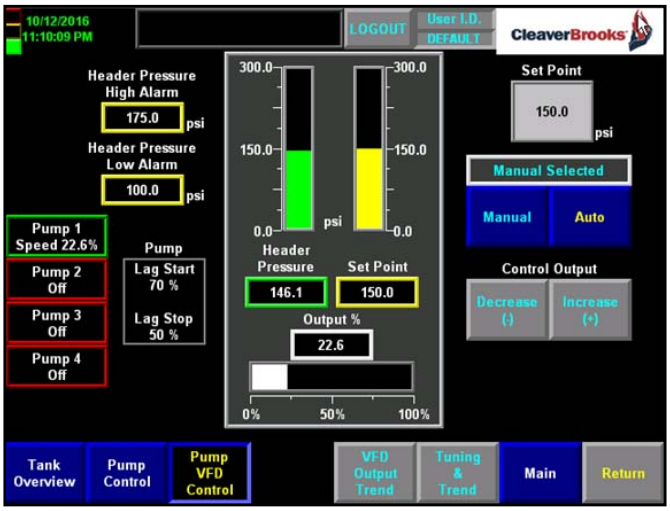


Figure 3-21 Pump VFD Control – Manual

When the pump control PID is in Manual, use the Control Output decrease/increase push buttons to manually adjust the VFD Control Output%.

Manual push buttons are only visible in Manual mode.

Pump Lead Lag settings are still active even if the Pump VFD Control is in Manual mode.

VFD minimum Speed is limited on the low end to 6.56ma which corresponds to 16% VFD output.

When Output% is between 0-16% the Pump Speed will be 16% and will increase linearly with the control output when the control output is greater than 16%

An operator level password is required to adjust Header Pressure Setpoint.

3.15.2 - Pump VFD Control – Auto

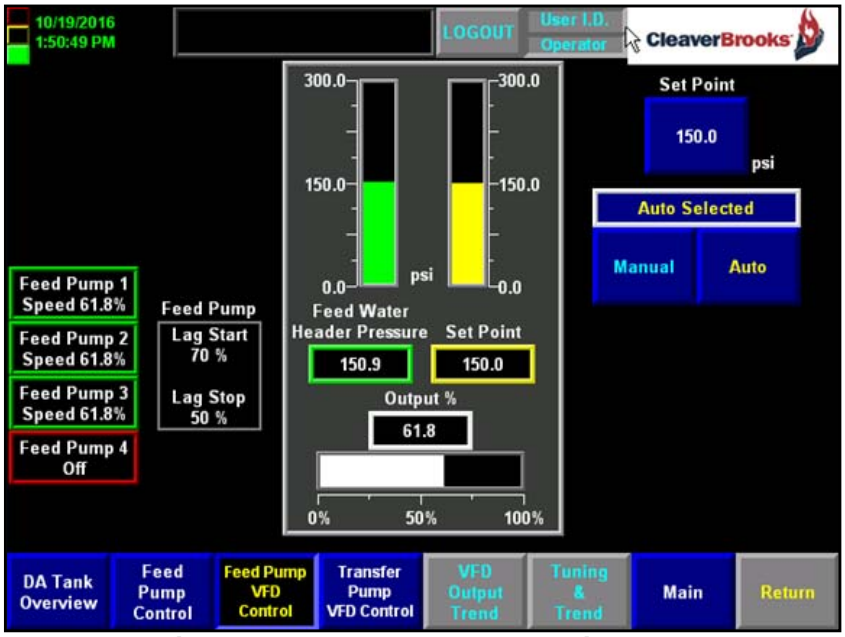


Figure 3-22 Pump VFD Control - Auto

When pump control PID is in Auto, the local set point is active.

Output% is based on demand.

Pump speed is modulated by the PID control analog output to maintain header pressure at setpoint.

Pump modulation is unison (all pumps modulate at the same output%).

In Auto mode the manual decrement/increment buttons are no longer available.

An operator level password is required to adjust the header pressure setpoint.

VFD Output Trend is available.

Tuning and header pressure trends are available. Use this screen to adjust PID tuning parameters.

3.15.3 - Feed Pump VFD Control – Remote Set Point by comms

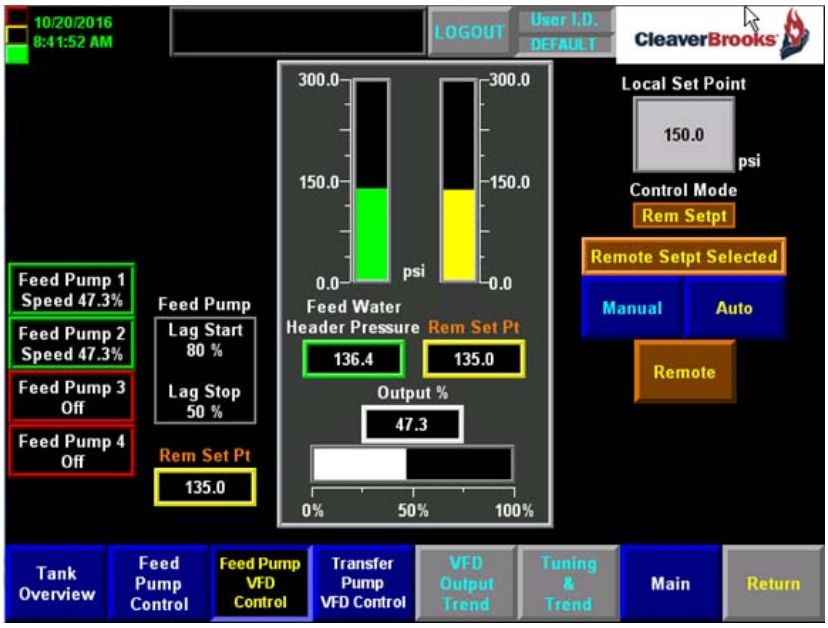
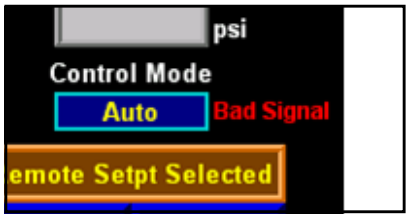


Figure 3-23 Remote SP by Comms

The ADAC 1000 can receive a remote feedwater header pressure setpoint signal by means of Ethernet communication. To use this feature select <Remote> setpoint mode by HMI pushbutton.

- Available only on feed pumps with VFD.
- Requires a BMS Heartbeat for Ethernet communication integrity. A “Bad Signal” indication means the communications heartbeat from the BMS has failed. Remote Mode is still selected but the control reverts to Auto and uses the local header pressure setpoint.



3.15.4 - Pump VFD Control Output Trend

Trending is available for all control outputs. Use arrow keys to move along the time axis.

Screen displays 20 minutes at a time.

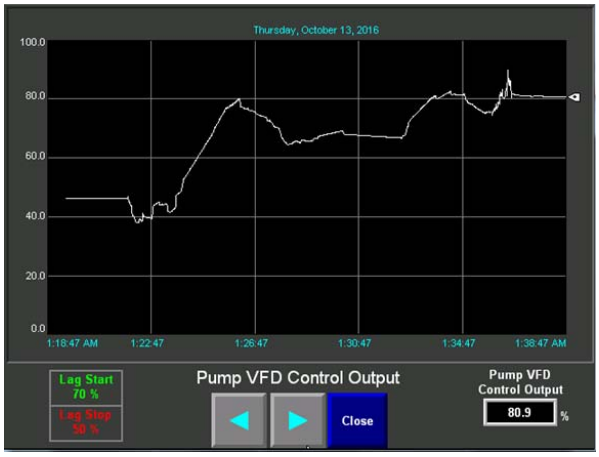


Figure 3-24 VFD Trend

3.15.5 - Pump VFD Tuning and Trend

PID adjustment requires operator level password. Use arrow keys to move along the time axis.

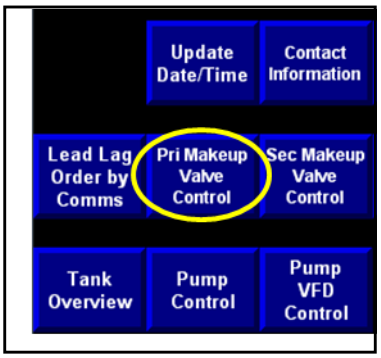
Trend Header Pressure vs. Set Point.

Trend Control Output.

Screen displays 20 minutes at a time.

Figure 3-25 Pump VFD Tune & Trend

3.16-Primary Makeup Valve Control



Single Tank - One primary makeup valve is allowed.

Dual Tank - Two primary makeup valves are allowed, one per tank.

In Auto mode the control output is modulated based on tank water level. As water level decreases. the control output increases. As water level increases, the control output decreases.

The makeup valve is adjusted by PID control output to maintain tank level at setpoint.

Manual decrement/increment buttons are only available in Manual mode.

Operator Level Password required to adjust Tank Level Set Point.

Output Trend Available.

Tuning and Tank Level Trend available. Use this screen to adjust PID tuning parameters.

A Help Screen is available.

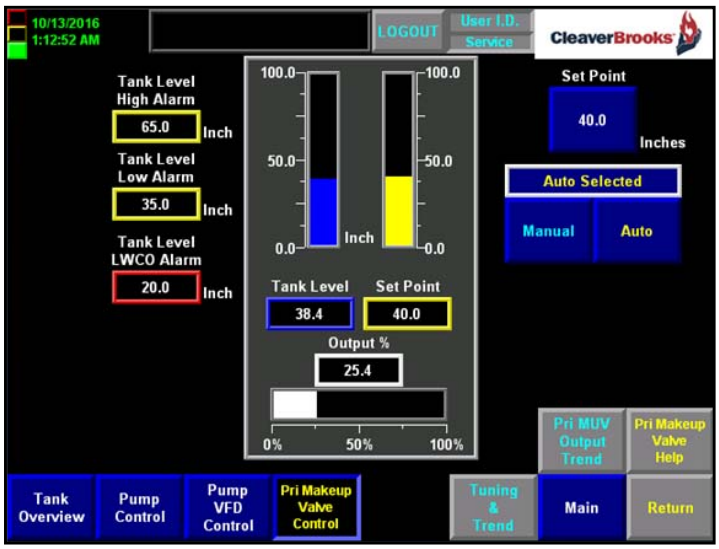


Figure 3-26 Primary Makeup Valve Control

3.16.1 - Primary Makeup Valve Control Output Trend

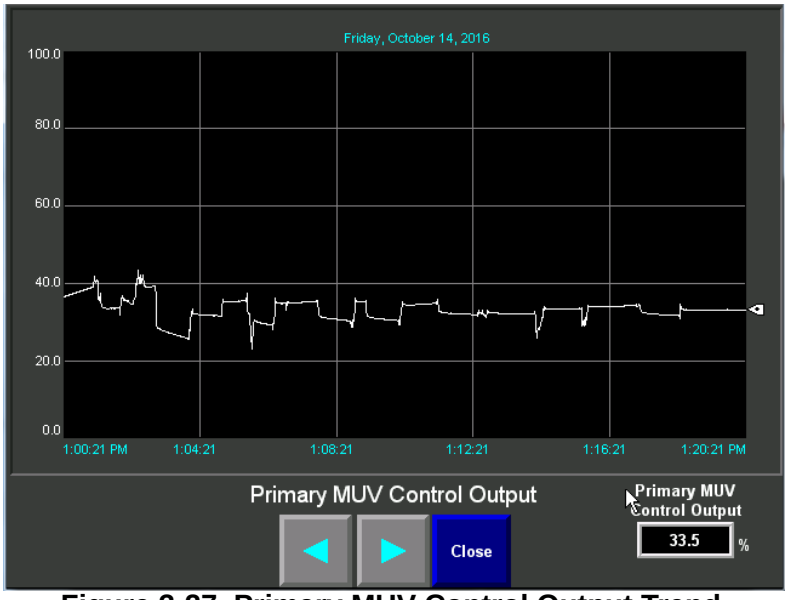


Figure 3-27 Primary MUV Control Output Trend

3.16.2 - Primary Makeup Valve Tuning and Trend

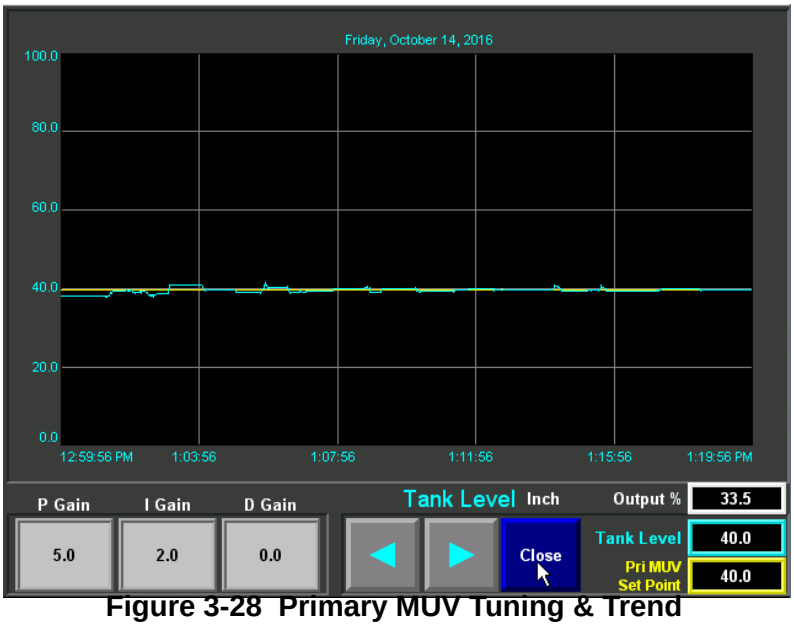


Figure 3-28 Primary MUV Tuning & Trend

PID adjustment requires operator level password.

Use arrow keys to move along the time axis.

Trend Tank Level vs. Tank Level Set Point.

Can actively view 20 minute slices

3.16.3 - Primary Makeup Valve Help Screen

A help screen is available for primary makeup valve control. Press <Pri Makeup Valve Help> from the PMUV Control Screen to access.

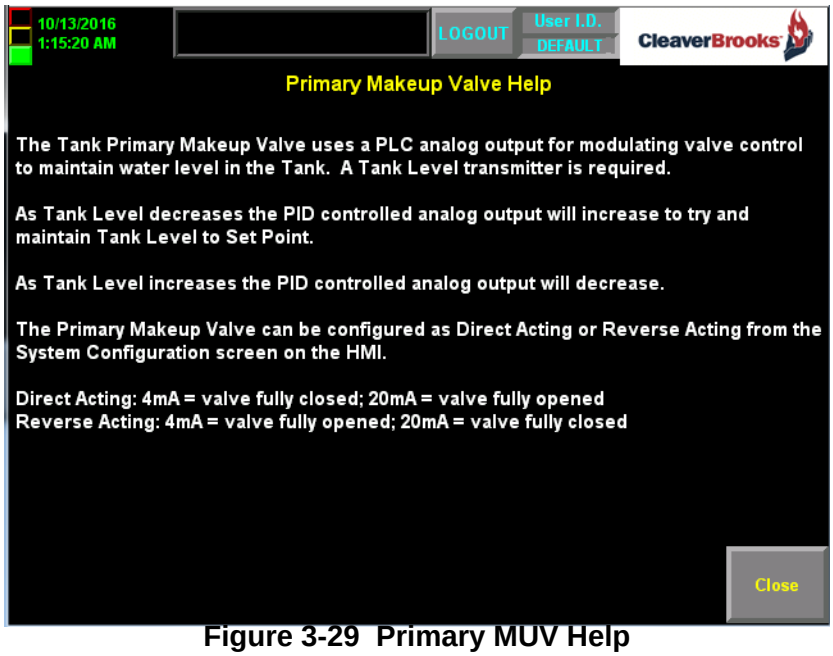


Figure 3-29 Primary MUV Help

3.17-DA Primary Makeup Valve Bias

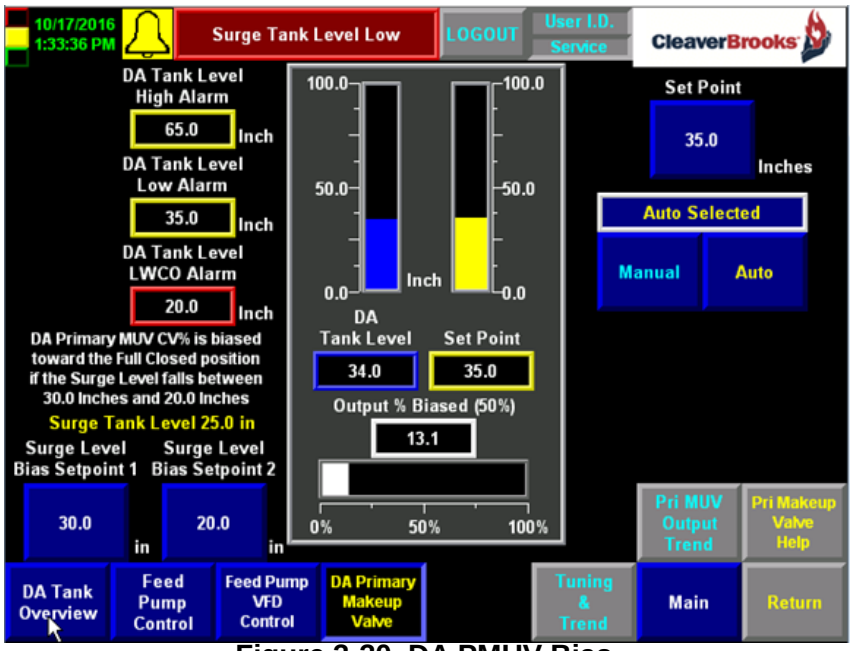


Figure 3-30 DA PMUV Bias

This feature is only available on dual tank systems.

The DA Primary Makeup Valve (Transfer Valve) may be biased toward the Full Closed position if the water level in the Surge Tank becomes too low.

Biasing the transfer valve will help prevent the Surge Tank water level from reaching a Low Water Cutoff level, disabling the Transfer Pumps.

Surge Level Bias Set Point 1: This is the Surge Tank level where biasing begins to be applied to the DA Primary Makeup Valve. Bias % = 0.

Surge Level Bias Set Point 2: This is the Surge Tank level where the DA Primary Makeup Valve is being biased at 100%. If the Surge Tank level reaches Bias Set Point 2 the DA Primary Makeup Valve will be biased Fully Closed.

During biasing, the DA Primary Makeup Valve control output is still being influenced by the water level in the DA Tank. The bias is simply a multiplier to the DA Primary Makeup Valve control output. The multiplier is linear between 0-100% as Surge Tank level decreases between Bias Set Point 1 and Bias Set Point 2.

A Help Screen is available.

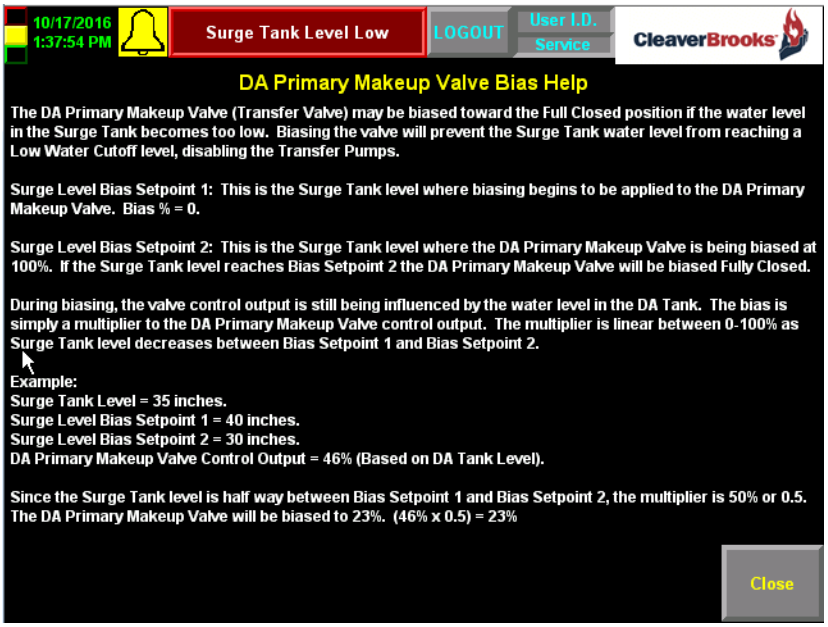


Figure 3-31 Valve Bias Help

3.18-Secondary Makeup Valve Control

Single Tank - One secondary makeup valve is allowed.

Dual Tank - One secondary makeup valve is allowed and can be for either the DA or surge tank.

Secondary makeup valve control has the same features as the primary makeup valve with the exception of valve biasing.

The secondary makeup valve tank level set point is typically set lower than the primary makeup valve tank level set point to allow the primary makeup valve to modulate first.

A Help Screen is available.

3.19-Steam PRV Valve Control

Steam PRV Control is only available on the DA tank. This feature is only available if the Overflow Valve option is NOT selected.

The steam PRV uses a PLC analog output for modulating valve control to maintain tank pressure. A tank pressure transmitter is required and must be mounted in steam space.

As tank pressure decreases, the PID controlled analog output will increase to maintain setpoint. As DA tank pressure increases, control output will decrease, closing the valve.

Manual decrement/increment buttons are only available in Manual mode.

An operator level password is required to adjust the tank pressure setpoint.

Output Trend, Tuning and Tank Pressure Trend, and a Help Screen are available.

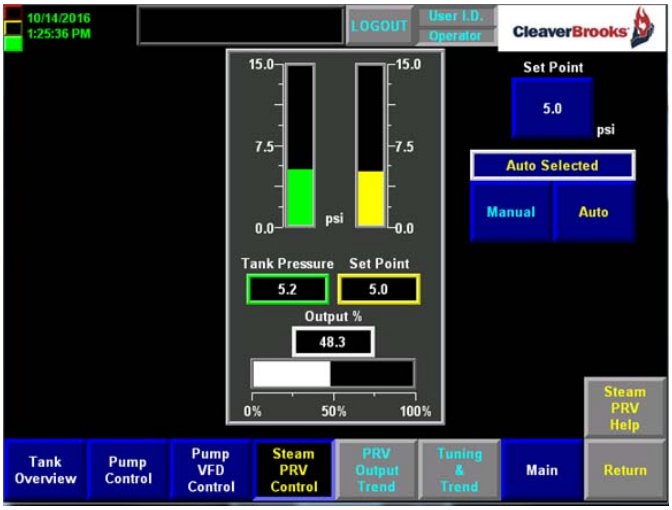


Figure 3-32 PRV Control

3.20-Overflow Valve Control

Available on single tank applications.

Only available on the DA tank in dual tank applications.

Only available if the Steam PRV Valve option is NOT selected.

In Auto mode the control output modulates linearly based on tank level.

As DA tank level increases above tank level setpoint, control output will increase linearly between the tank level setpoint and the tank level transmitter span value.

The Set Point minimum entry is the DA Primary MUV Set Point value.

The Set Point maximum entry is the Tank Level Transmitter span value.

Manual decrement/increment buttons are only available in Manual mode.

An operator level password is required to adjust tank level setpoint.

A Help Screen is available.

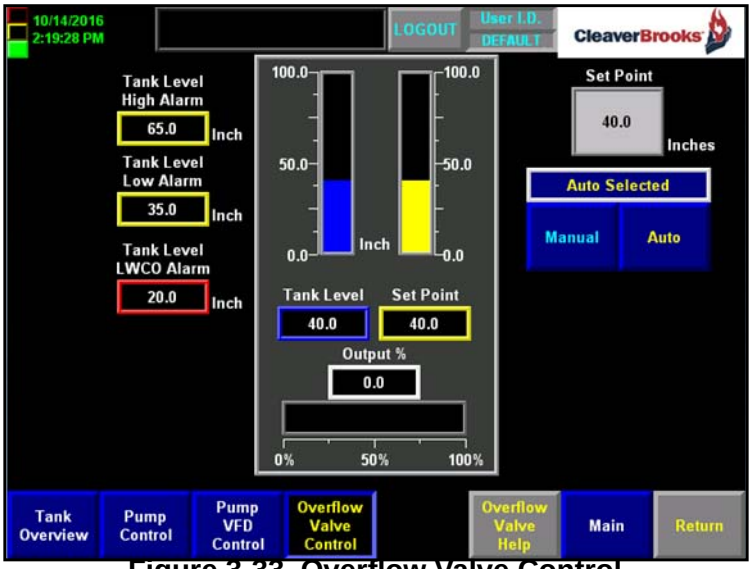
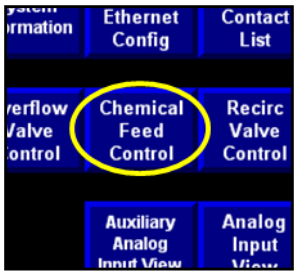


Figure 3-33 Overflow Valve Control

3.21-Chemical Feed Control



Available on single tank applications.

Available on both DA and Surge Tank on dual tank applications.

Discrete Output for On/Off control.

DA uses the Feed Pump Running chemical feed output for control.

Surge uses Transfer Pump Running chemical feed output for control.

The Chemical Feed Relay output will energize anytime a pump is running and the Start Delay has expired.

The Chemical Feed relay output will remain energized until all pumps are stopped and the Stop Delay has expired.

The Manual Chemical Feed pushbutton when pressed, will energized the Chemical Feed output relay and does not utilize the Start and Stop delays.

An operator level password is required to adjust the chem feed start and stop delay values.

A Help Screen is available.

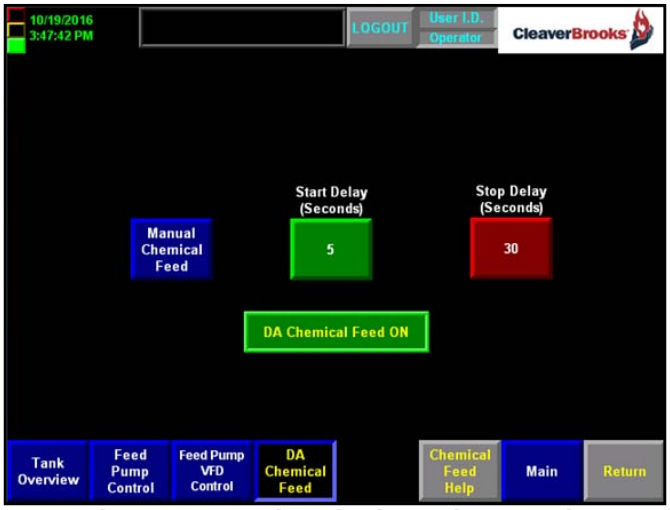
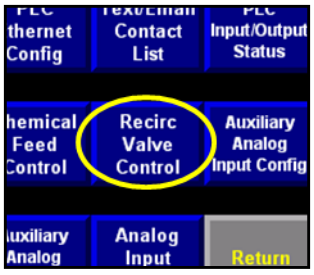


Figure 3-34 Chemical Feed Control

3.21.1 - Recirculation Valve Control



Recirculation valve control is available on single tank applications.

Only available on DA in dual tank applications.

Discrete Output for On/off control.

The Recirculation Valve will open when Header Pressure exceeds the Valve Open Pressure.

The valve will remain open until the Header Pressure drops below the Valve Close Pressure for the period of time defined by the Valve Close Time Delay.

The Recirculation Valve will be commanded open if no pumps are running in Auto Mode or if the Header Pressure sensor fails.

The Recirculation Valve is Spring Return Open.

A Help Screen is available.

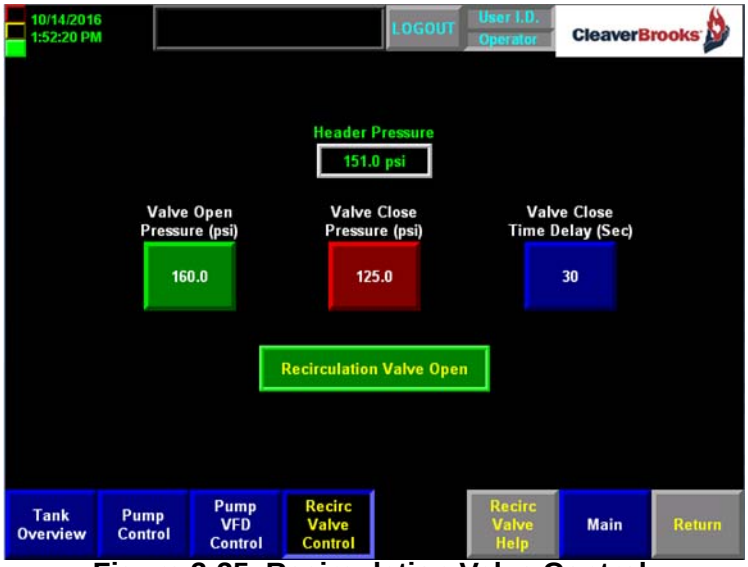


Figure 3-35 Recirculation Valve Control

3.22-DA Bypass

For dual tank systems only; this feature allows the DA to be bypassed for maintenance or inspection. In DA Bypass mode the boiler feed pumps draw water directly from the surge tank.

A Normal – Bypass selector switch and corresponding Low Water Cutoff wiring of the control panel is required for the DA Bypass function to operate correctly. All valving to allow the feed pumps to draw water from the surge tank is manual.

In DA Bypass Mode, the Transfer Pumps are disabled from starting automatically. The Surge Low Water Cutoff must be wired according to the wiring diagram to allow the Boiler Feed Pumps to be disabled should a Surge Tank Low Water Cutoff condition occur while in DA Bypass mode.

If the Feed Pump Auto Restart Pump feature is enabled, the Transfer Pump Auto-Restart Level and Surge Tank Low Water Cutoff levels are used to start and stop the feed pumps, based on the water level in the surge tank.

DA Bypass can operate with or without a Surge Primary Makeup Valve.

3.22.1 - DA Bypass - No Surge Primary MUV

The DA Secondary Makeup Valve is required and is used to provide makeup water to the Surge Tank in DA Bypass mode. The DA Secondary Makeup Valve will modulate based on Surge level not DA level. This makeup valve must be configured in both Normal operating mode and in DA Bypass mode.

From the HMI Main Screen either the “DA Second Makeup Valve” or “DA Second MUV DA Bypass” pushbutton will be enabled and the other pushbutton disabled and grayed out depending on which mode is active.

To allow the DA Secondary Makeup Valve to provide water to the Surge Tank, in DA Bypass mode, additional valving and piping is required. All valving is manual. The DA Primary MUV is automatically placed in Manual Mode and Closed when switched to DA Bypass. Switching to Normal operating mode the DA Primary MUV is automatically switched to Auto Mode and will begin to modulate based on DA Tank level.

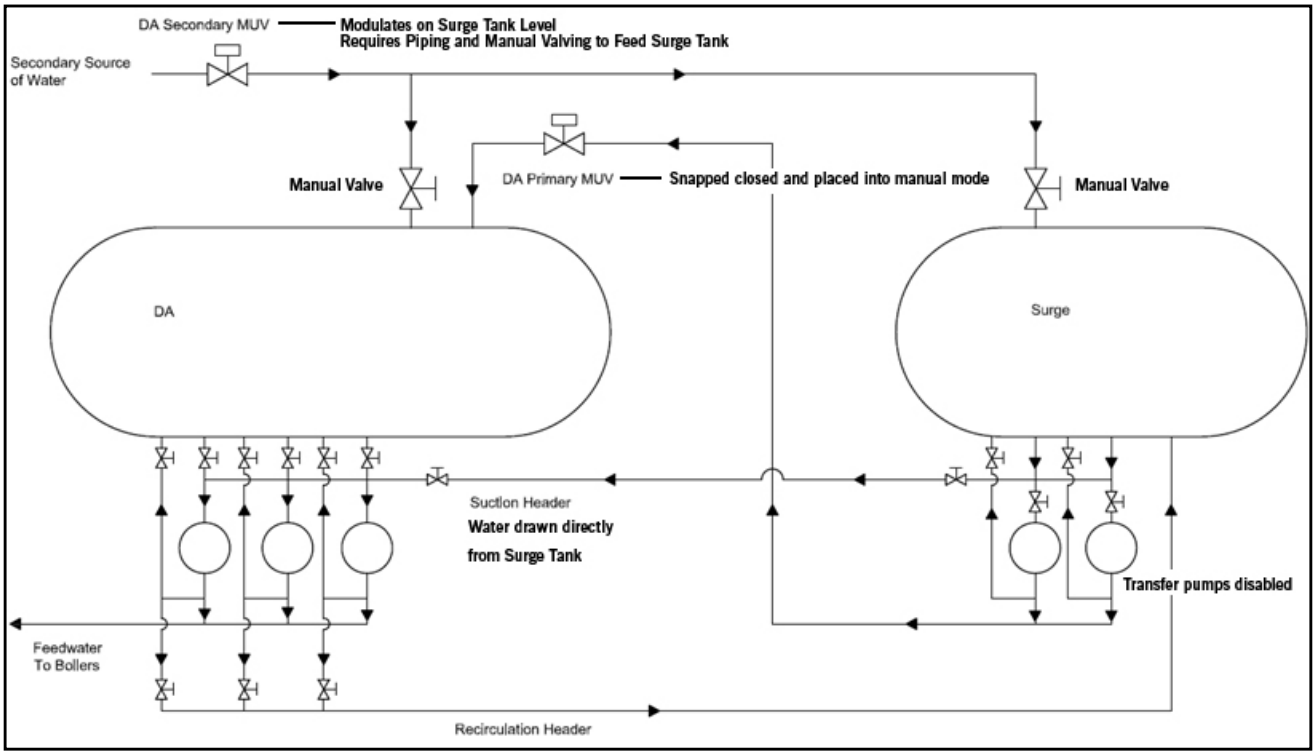
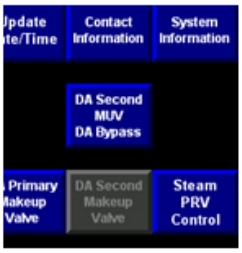


Figure 3-36 DA Bypass - No Surge MUV

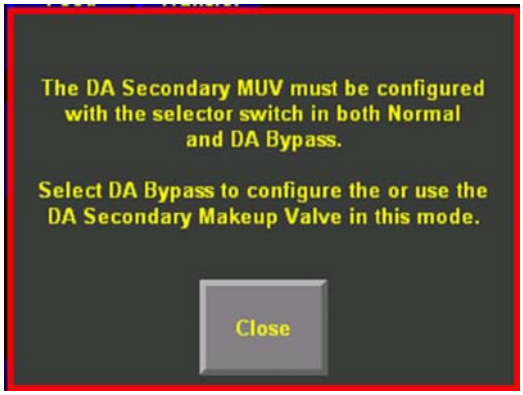
Normal Operating Mode



DA Bypass Mode

The DA Secondary MUV must be configured in both Normal and Bypass Mode

Pressing a “grayed out” push button will display an informational message.



In DA Bypass mode, no matter the makeup valve configuration the DA primary makeup valve control output is snapped to zero and the PID is snapped to manual mode.

The User can opt to put the DA primary makeup valve back into auto or manually drive the valve open or closed.

Upon entering Normal mode, the makeup valve is automatically put into auto and will modulate based on tank level.

3.22.2 - DA Bypass - With Surge Primary MUV

In this mode no additional control setup is required since the Surge Primary Makeup Valve will provide makeup water to the Surge Tank in both modes. No additional makeup water piping or valving is required.

Both the DA Primary and Secondary MUVs are automatically placed in Manual Mode and Closed when switched to DA Bypass.

Switching to Normal operating mode the DA Primary and Secondary MUVs are automatically switched to Auto Mode and will begin to modulate based on DA Tank level.

If the control system is configured with a PLC modulating controlled PRV valve it too is automatically placed in Manual Mode and Closed when switched to DA Bypass. This will occur regardless of the makeup valve configuration.

Switching to Normal operating mode the PRV valve is automatically switched to Auto Mode and will begin to modulate based on DA Tank pressure.

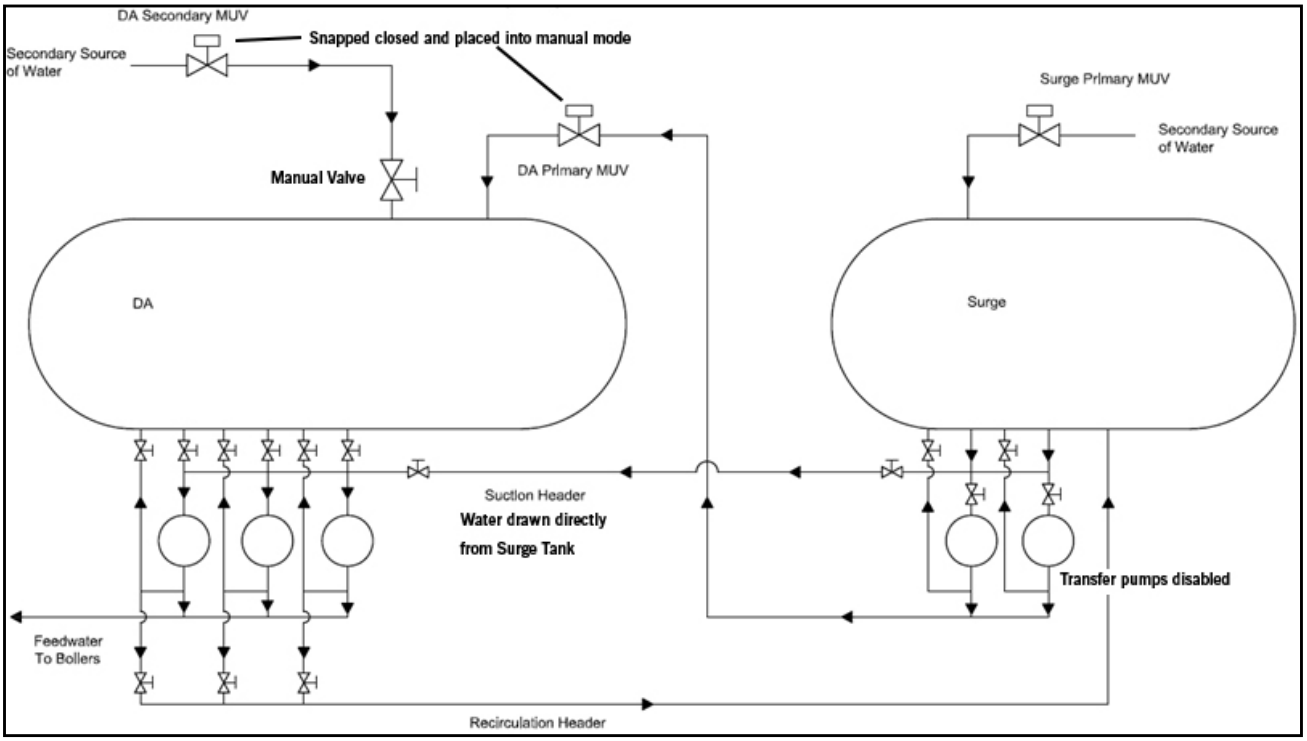


Figure 3-37 DA Bypass - With Surge MUV

3.22.3 - DA Bypass Typical Wiring

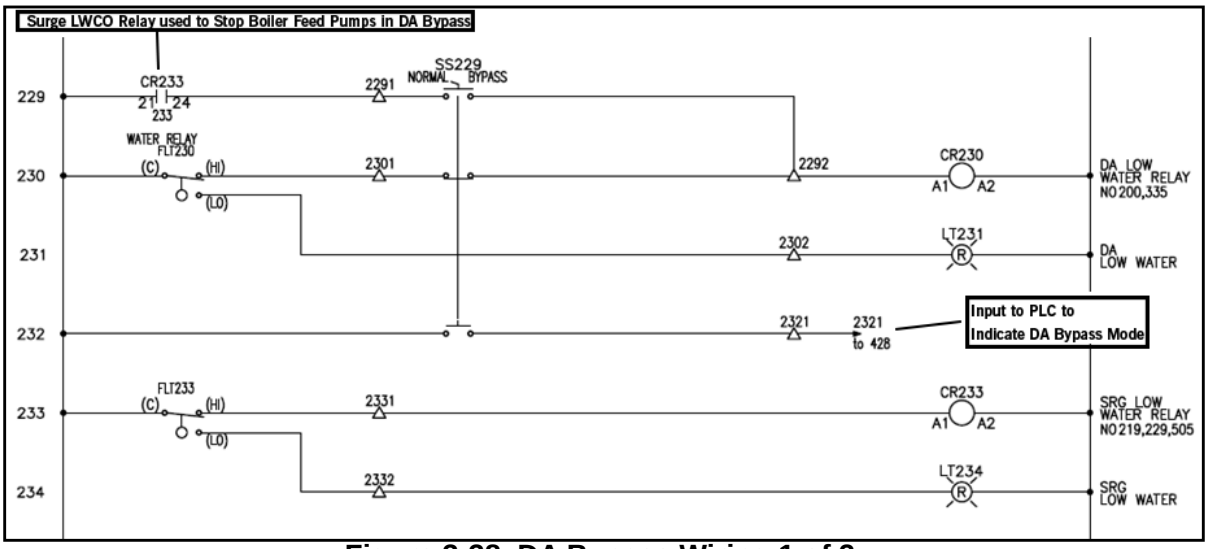


Figure 3-38 DA Bypass Wiring 1 of 2

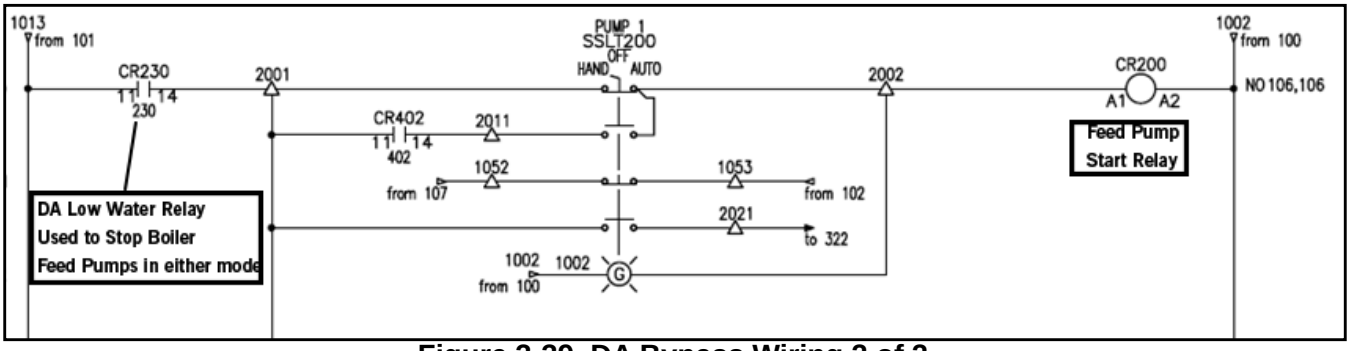
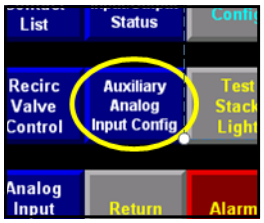


Figure 3-39 DA Bypass Wiring 2 of 2

3.23-Auxiliary Analog Inputs

Single and Dual Tank Systems can have up to 4 Auxiliary Analog inputs.



- This feature is standard on dual tank applications, uses I:4.3 – I:4.6
- Optional on single tank applications, uses I:7.0 – I:7.3

Single tank applications require an expansion module in Slot 7.

Tray temperature monitoring requires 1 of the 4 auxiliary analog inputs.

Tray pressure monitoring requires 1 of the 4 auxiliary analog inputs.

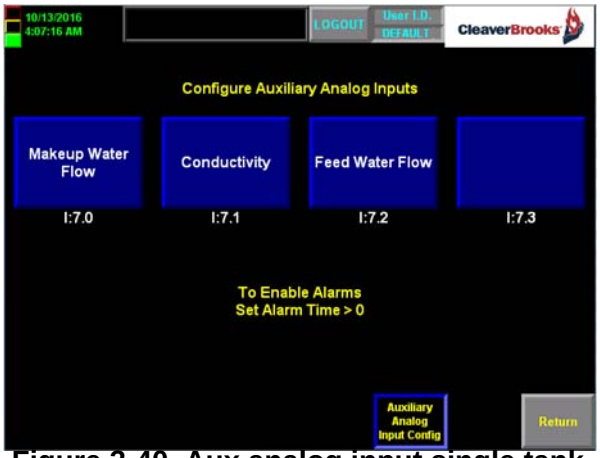


Figure 3-40 Aux analog input single tank

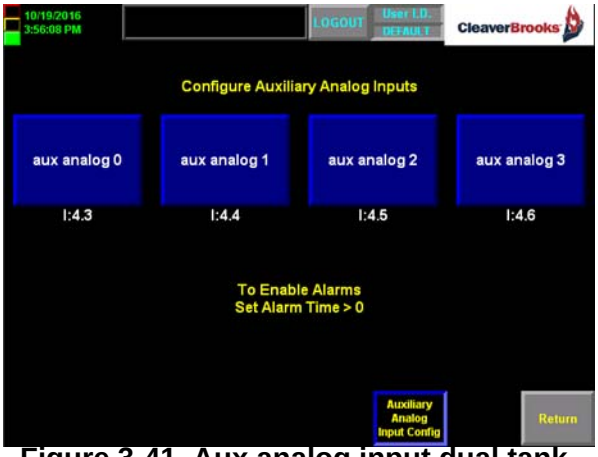


Figure 3-41 Aux analog input dual tank

An operator level password is required to modify any values. Configurable values are:

Name
Enter any name – 20 characters maximum

Units
Enter any unit – 8 characters maximum

Span
User defined 20ma scaling on analog input device.

Zero entry to 999999 entry limits

Zero
User defined 4ma scaling on analog input device.

-999999 to Span entry limits

Alarm Time Delay
The alarm must be active for this period of time before it is triggered.

A non-zero value will enable both the high and low alarms.

A value of zero will disable both the high and low alarms.

Flow Input
Yes – will totalize analog input.

Must set time base for totalizer:

0 = sec
1 = min
2 = hr

High Alarm
Low Alarm value to Span value entry limit

Low Alarm
Zero value to High Alarm value entry limit

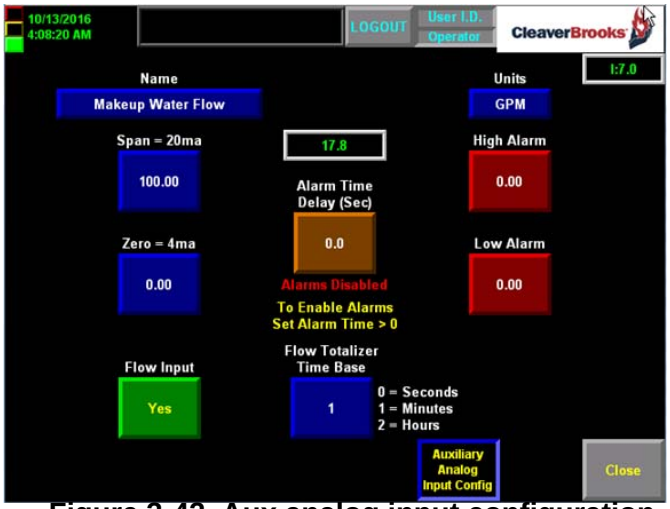
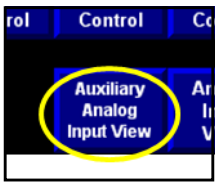


Figure 3-42 Aux analog input configuration (continued)

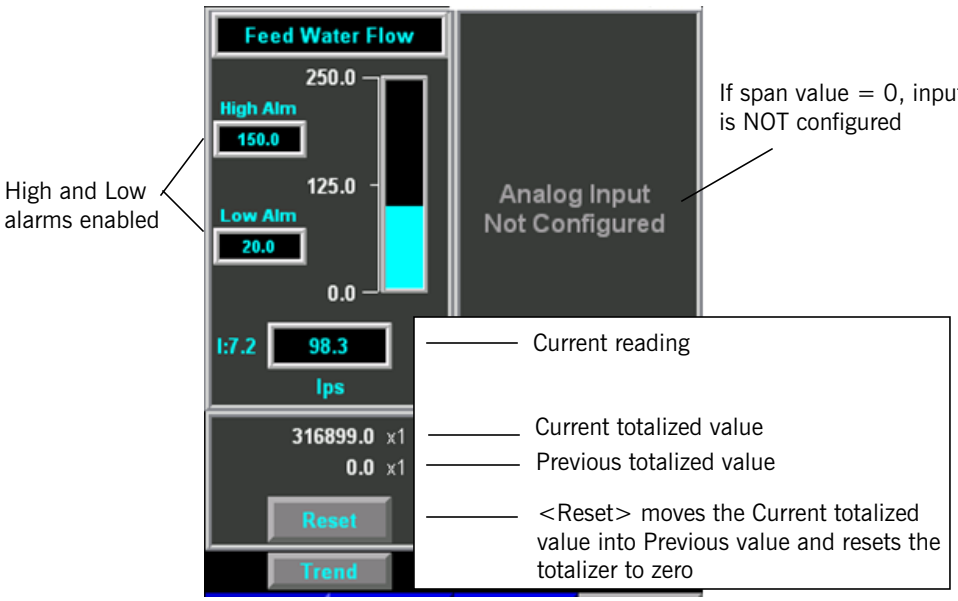
3.23.1 - Auxiliary Analog Input View

To view the status of the auxiliary analog inputs, press <Auxiliary Analog Input View> from the Main screen.



Alarm levels displayed only if alarms are enabled.

Can trend all analog inputs.



3.24-Lead Lag Order by Communications

This feature is available on common header applications for feed pumps or for transfer pumps. The pump lead lag order may be written directly to the ADAC PLC by Ethernet communications.

Lead lag values are integer values and are written to PLC registers DAWI[0] - DAWI[4] for pumps 1 - 5 respectively. A value of 0=Lead, 1=Lag1, 2=Lag2, 3=Lag3, 4=Lag4 in the DAWI registers.

In order for the BMS to write a new lead lag order, the Remote Lead Lag Order must be different from the Current Lead Lag Order and the Remote Lead Lag Order must be valid. The Lead Lag Order Write Permissive bit is available to the BMS in PLC register DAB1[2].12

Ethernet communication integrity is determined by a communication heartbeat signal between the Cleaver Brooks ADAC PLC and the Building Management System.

DAWB[0].0 is the heartbeat bit FROM the BMS. This bit must change states in the Cleaver Brooks PLC every 15 seconds or a communications failure occurs. If communications fail, an alarm message “Remote Communications Failed” is displayed on the HMI and the BMS will be unable to write to the Cleaver Brooks PLC.

The Cleaver Brooks PLC sends a heartbeat TO the BMS on bit DAB1[2].15. Every 30 Seconds this bit will toggle between ON and OFF.

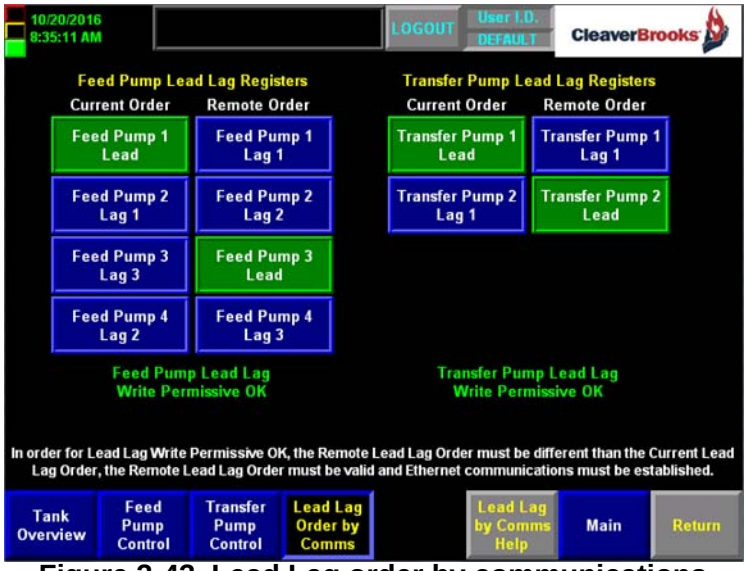
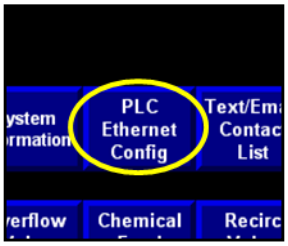


Figure 3-43 Lead Lag order by communications

3.25-PLC Ethernet Configuration



“View Current PLC Ethernet Configuration” shows the current Ethernet settings as read from the PLC.

PLC Factory IP Address = 192.168.1.150

HMI Factory IP Address = 192.168.1.152

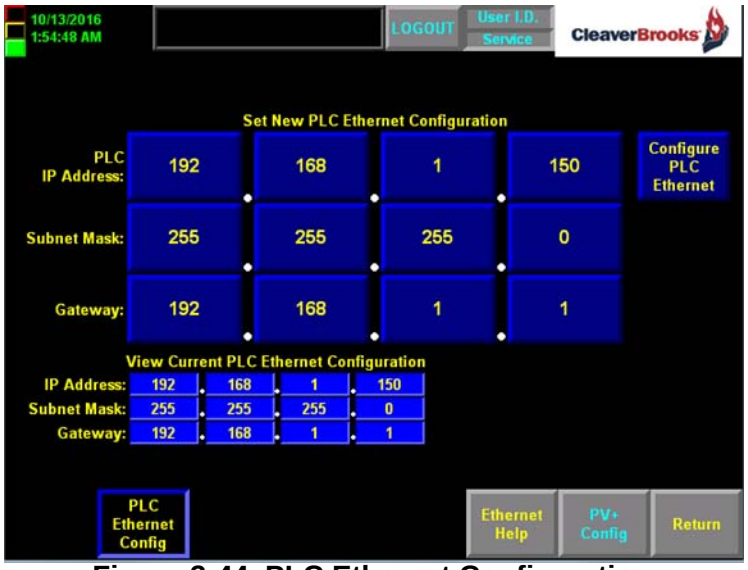
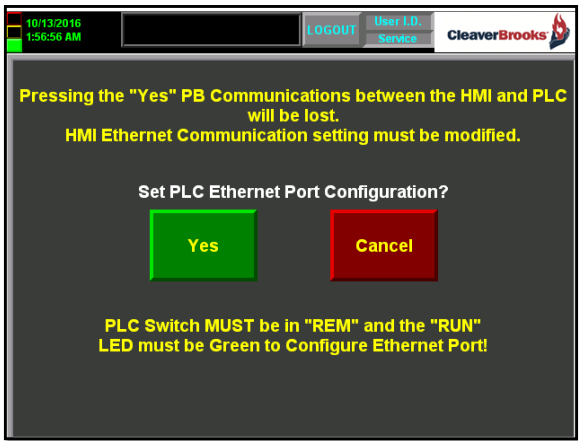


Figure 3-44 PLC Ethernet Configuration

A Service Level password is required to modify the Ethernet Configuration.

Enter new Ethernet Configuration under “Set New PLC Ethernet Configuration”

When new Configuration is entered press “Configure PLC Ethernet”. A pop-up will appear:

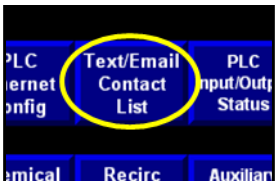


NOTE: The PLC must be in REM and the RUN LED must be GREEN to configure the Ethernet port.

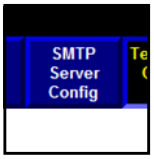
After setting a new Ethernet configuration, communication between the HMI and PLC will be lost and must be reestablished from the HMI.

A PLC Ethernet Help Screen is available.

3.26-Text/Email



SMTP* Server Configuration is required in order to use text and email functions. When configuration is complete, email or text messages can be sent directly from the PV+.



New systems shipped from Cleaver Brooks will have the latest revisions of firmware.

Prior to being able to configure or enable text/email the SMTP server must be configured. It will be the user's responsibility to determine the SMTP server information for configuration.

Contact facility IT personnel to assist in setting up the SMTP Server.

A help screen is available.

*SMTP = Simple Mail Transfer Protocol

3.26.1 - Contact List

The HMI will store up to six email addresses. Each can be receive enabled (WILL SEND) or disabled (DO NOT SEND). Enabled addresses will receive an email for every alarm activation.

Press <Email Help> for assistance in configuring this page, or consult the appropriate IT personnel.

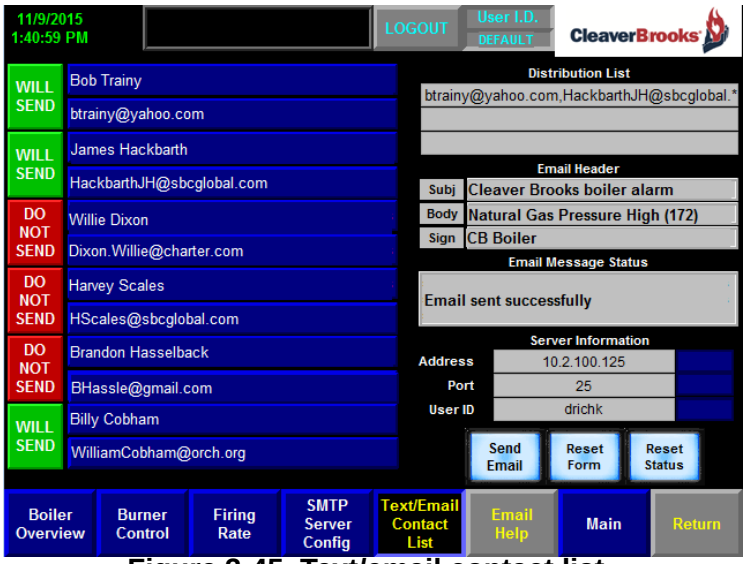
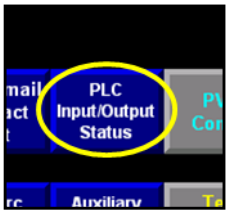


Figure 3-45 Text/email contact list

3.27-PLC Input/Output Status



This screen shows On/Off status of digital I/O, and for Analog I/O the following values:

Analog Input Raw

Analog signal in mA or volts that is the actual value on the PLC analog input module.

Analog Input Value

Analog Signal scaled value. Actual reading in engineering units.

Analog Output Raw

Analog signal in mA or volts that is the actual value on the PLC analog output module.

Analog Output CV%

Analog Output in percent. 4-20ma = 0-100%

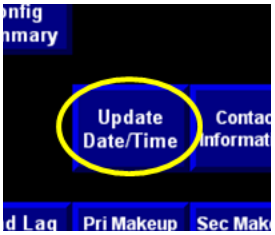
Slot 1 - Digital Input			Slot 1 - Digital Output			Slot 2 - Analog In	Raw	Value
I:1.0	Feed Pump 1 On	Off	O:1.0	Feed Pump 1 Start	Off	I:2.0	FW Header Pres	17.6	127.9
I:1.1	Feed Pump 1 Auto	Off	O:1.1	Feed Pump 2 Start	Off	I:2.1	DA Tank Temp	17.3	208.5
I:1.2	Feed Pump 2 On	Off	O:1.2	Feed Pump 3 Start	Off	I:2.2	DA Tank Level	10.3	39.1
I:1.3	Feed Pump 2 Auto	Off	O:1.3	Feed Pump 4 Start	On	I:2.3	DA Tank Pressure	9.4	5.1
I:1.4	Feed Pump 3 On	Off	O:1.4	Transfer Pump 1 Start	On		Slot 2 - Analog Out	Raw	CV%
I:1.5	Feed Pump 3 Auto	Off	O:1.5	Transfer Pump 2 Start	Off	O:2.0	DA Pri Makeup Valve	4.0	0.0
I:1.6	Transfer Pump 1 On	On	O:1.6	Spare	Off	O:2.1	Srg Pri Makeup Valve	4.0	0.0
I:1.7	Transfer Pump 1 Auto	On	O:1.7	Spare	Off		Slot 4 - Analog In	Raw	Value
I:1.8	Transfer Pump 2 On	Off	O:1.8	Spare	Off	I:4.0	Transfer Hdr Pres	15.8	74.0
I:1.9	Transfer Pump 2 Auto	On	O:1.9	Alarm Bell Off	On	I:4.1	Surge Tank Temp	12.8	137.1
I:1.10	BFP 1 Proving Sw OK	Off	O:1.10	Red Stack Light	Off	I:4.2	Surge Tank Level	9.8	40.0
I:1.11	BFP 2 Proving Sw OK	Off	O:1.11	Yelllow Stack Light	Off	I:4.3		12.0	0.0
I:1.12	BFP 3 Proving Sw OK	Off	O:1.12	Green Stack Light	On	I:4.4		12.1	0.0
I:1.13	BFP 4 Proving Sw OK	On	O:1.13	DA Chemical Feed	On	I:4.5		12.0	0.0
I:1.14	SRG LWCO (ON = OK)	On	O:1.14	SRG Chemical Feed	Off	I:4.6		12.0	0.0
I:1.15	DA LWCO (ON = OK)	On	O:1.15	Recirculation Valve	Off	I:4.7	Spare	6.9	

Slot 5 - Digital Input			Slot 6 - Analog Out	Raw	CV%	Slot 7 - Digital Input		
I:5.0	DA Tank Level High	Off	O:6.0	BFP 1 VFD Speed	4.0	0.0	I:7.0	BFP 1 VFD Bypass	Off
I:5.1	DA Tank Level Low	Off	O:6.1	BFP 2 VFD Speed	4.0	0.0	I:7.1	BFP 2 VFD Bypass	Off
I:5.2	Surge Tank Level High	Off	O:6.2	BFP 3 VFD Speed	4.0	0.0	I:7.2	BFP 3 VFD Bypass	Off
I:5.3	Surge Tank Level Low	Off	O:6.3	TP 1 VFD Speed	17.2	82.7	I:7.3	TP 1 VFD Bypass	Off
I:5.4	Feed Pump 4 On	On	O:6.4	TP 2 VFD Speed	4.0	0.0	I:7.4	TP 2 VFD Bypass	Off
I:5.5	Feed Pump 4 Auto	On	O:6.5	BFP 4 VFD Speed	13.9	61.7	I:7.5	BFP 4 VFD Bypass	Off
I:5.6	TP 1 Proving Sw OK	On	O:6.6	DA Sec Makeup Valve	4.0	0.0			
I:5.7	TP 2 Proving Sw OK	Off	O:6.7	Steam PRV	4.0	0.0			
I:5.8	DA Bypass Mode	Off							

PLC Input/Output Status | Return

Figure 3-46 PLC Input/Output Status

3.28-Update Date/Time



Requires Operator Level Password

Allows user to set the PV+ date and time without having to use the PV+ Terminal Configuration Settings.

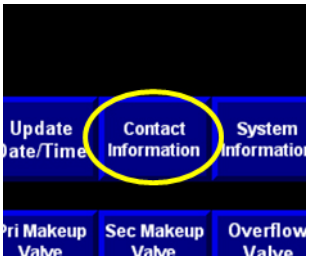
Enter correct date/time and press <Update Date & Time>.

Date and Time will be displayed on the HMI.

Figure 3-47 Update Date and Time

3.29-Contact Information

Requires Operator Level Password.



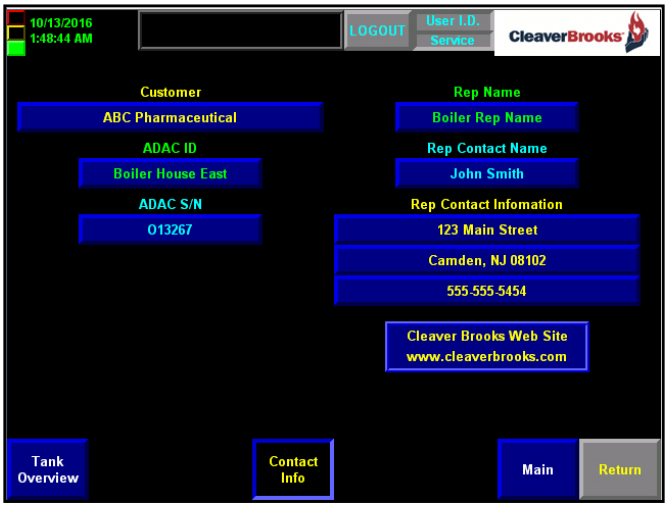
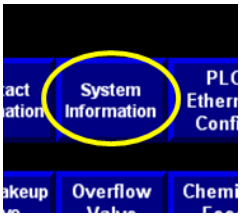


Figure 3-48 Contact Information

3.30-System Information

Displays customer and contact names and system ID, software, and network information



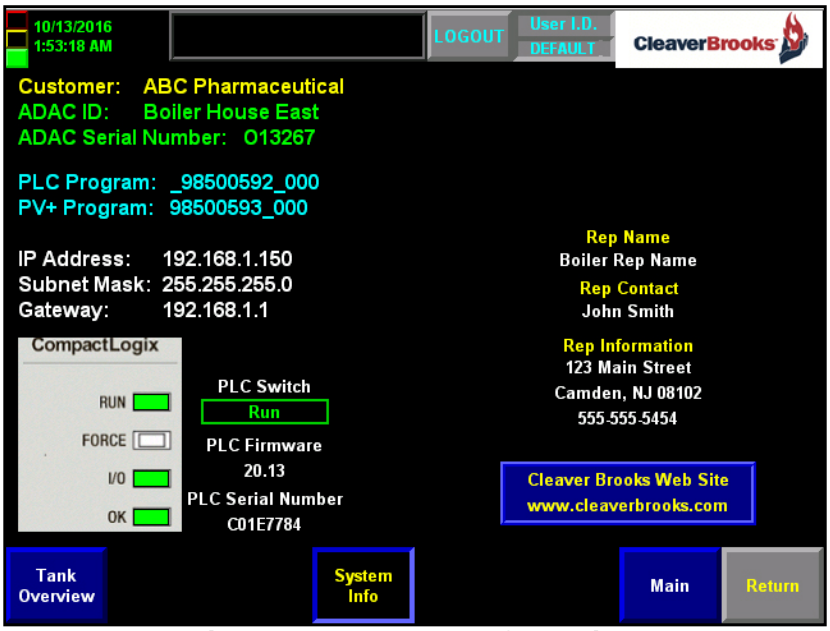


Figure 3-49 System Information

3.31-Display Configuration

Most of the PanelView parameters are preset and should not be changed. A few commonly used PV configuration features are described here.

3.31.1 - Date and Time

In addition to the procedure described in **3.28** above, the system date and time can be changed using PV configuration. Press <PanelView Config> from the Main Menu to access. You will be prompted for a password.

Note: For additional PanelView Plus setup information see "Procedure to Load and Set Up a PV+ Rev3.doc", available on the CB web site.

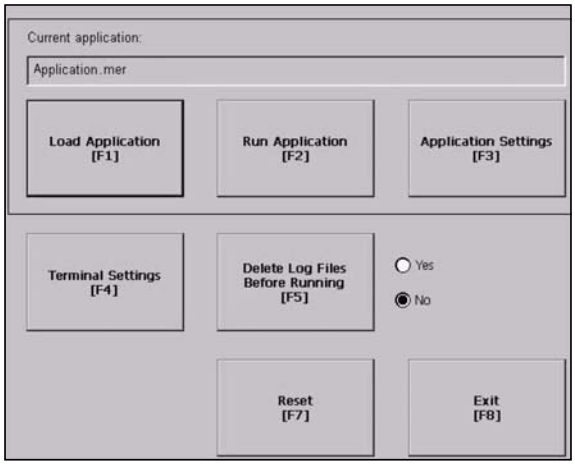


Figure 3-50. PanelView Plus Configuration Screen

To change the date, select Terminal Settings>Time/Date/Regional Settings>Date.

To change the time, select Terminal Settings>Time/Date/Regional Settings>Time.

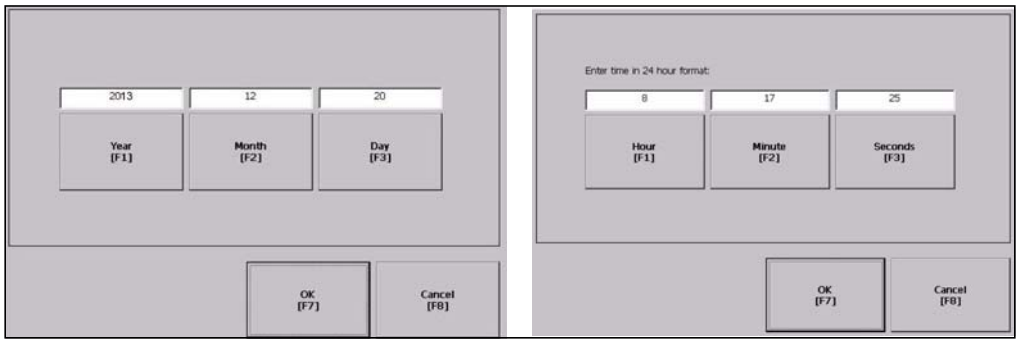


Figure 3-51. Date / Time Screens

Select the value to change. Enter the desired value in the numeric keypad and press return. When finished press the <EXIT> button.

3.31.2 - Screen Saver

The display has a screen saver feature. To enable and to adjust settings, go to Terminal Settings>Display>Screen Saver.

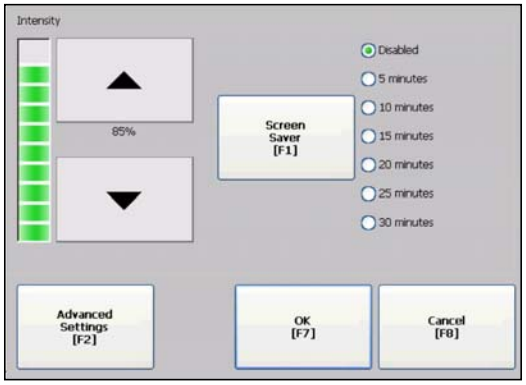


Figure 3-52. Screen Setup

3.31.3 - PV File Management

The Panel View software can be loaded or saved using a PCMCIA or SD memory card, depending on PV+ model. The card inserts into the side of the display. Go to Terminal Settings>File Management to access PV file management functions. “External Storage 1” refers to the memory card slot.

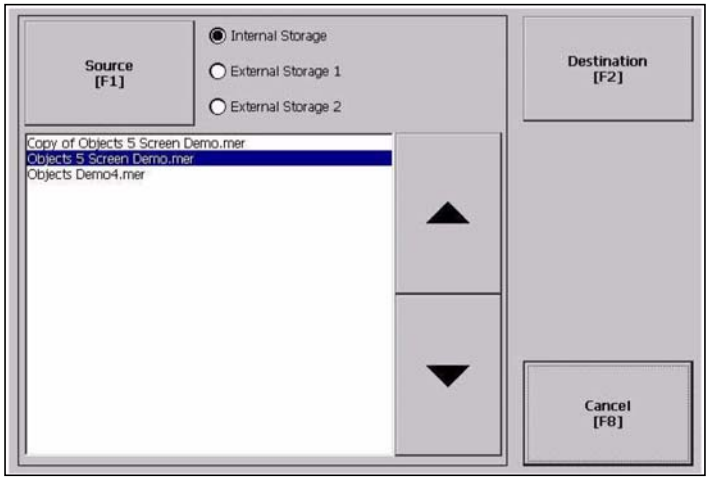


Figure 3-53. Panel View File Management.

If the memory card contains the proper applications for the display they will be listed on this screen. To load the program into memory:

1.Select Load Application from the main screen.

2.Press the Source button to select the storage location of the application file you want to load.

- Internal Storage - the internal CompactFlash in the terminal.
- External Storage 1 - the external SD card loaded in the card slot of the terminal.
- External Storage 2 - USB Flash Drive.

3.Select a .mer file from the list by using the up and down cursor keys.

4.Press the Load button to load the selected application.You will be asked if you want to replace the terminal's communication configuration with the configuration in the application.

5.Select Yes if this is the first time loading the application; otherwise select No.

If you select Yes, any changes to the device addresses or driver properties in the RSLinx Communications screen will be reset to the CB defaults 192.168.1.150 (PLC) and 192.168.1.152 (HMI).

Notice

The additional functions of the Display Configuration screen should only be changed by qualified personnel. Improper modification can render the display inactive.

Chapter 4
Operation

4.1-System Monitoring and Operation

4.1.1 - Screen Select

On system power-up, the Main Menu will be displayed. This screen allows access to all of the primary control, monitoring, and configuration sections of the ADAC system.

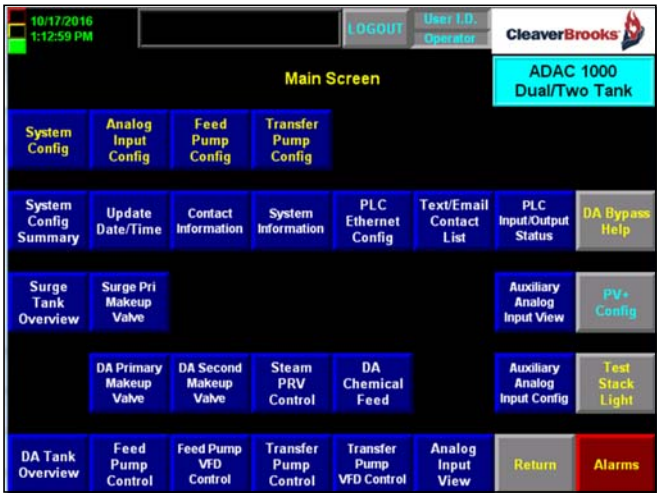


Figure 4-1 Main Menu

Graphic displays of the DA system are accessed by pressing <Tank Overview> (single tank systems) or <DA [Surge] Tank Overview> (two tank systems).

4.1.2 - DA Tank Overview

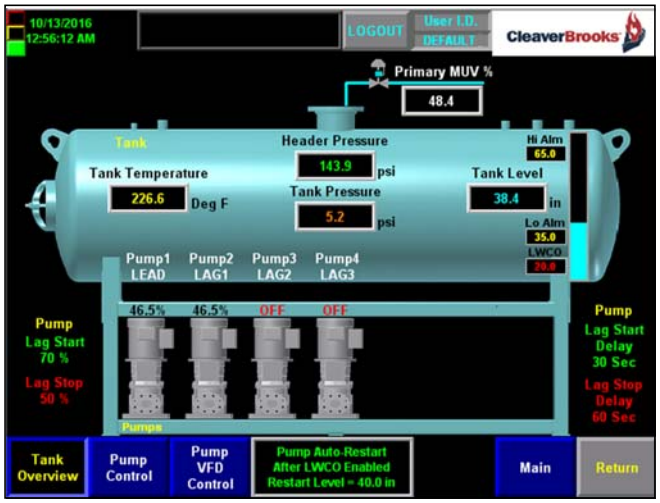


Figure 4-2 DA Tank Overview Screen

The Overview screen(s) allow the operator to monitor device status and certain data critical to system operation.

On-screen indication is provided for the following:

- DA Header Pressure
- DA Tank Temperature
- DA Tank Level
- DA Tank Pressure
- Lead-Lag status (Lead, Lag1, Lag2, etc.) for each of the Feed Pumps
- OFF/ON/FAULT status for each of the Feed Pumps
- Start LAG and Stop LAG data
- Primary and/or Secondary MUV Control Output %
- DA Recirc Valve status – OPEN/CLOSED
-

4.1.3 - Surge Tank Overview

A two-tank system will feature separate overview screens for the DA and Surge tanks. A <Surge Tank Overview> button will appear on the Screen Selection Menu.

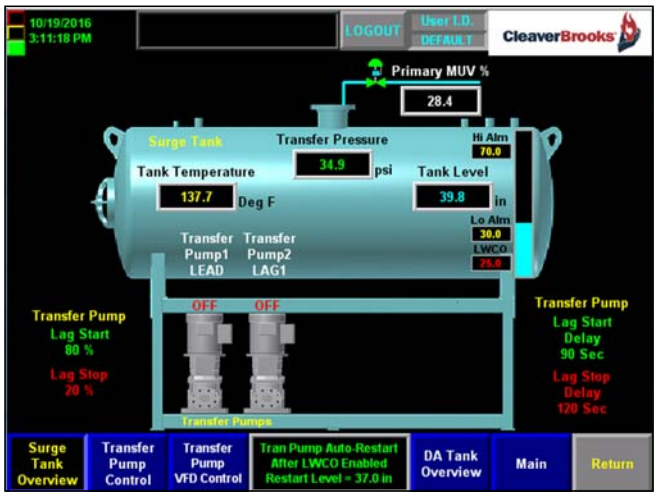


Figure 4-3 Surge Tank Overview Screen

The Surge Tank Overview Screen indicates the following:

- Surge Header Pressure
- Surge Tank Temperature
- Surge Tank Level
- Lead-Lag Status (Lead, Lag1, Lag2) for each of the transfer pumps
- ON/OFF/FAULT status for each of the transfer pumps
- Start Lag and Stop Lag data
- Primary and/or Secondary MUV Control Output %

4.1.4 - Duo Tank Overview

If a DUO TANK system has been selected in the Option Select screen, a <Tank Overview> button will be available on the Main Menu for access to the Duo Tank Overview screen. Features are similar to the DA/Surge Overview screens.

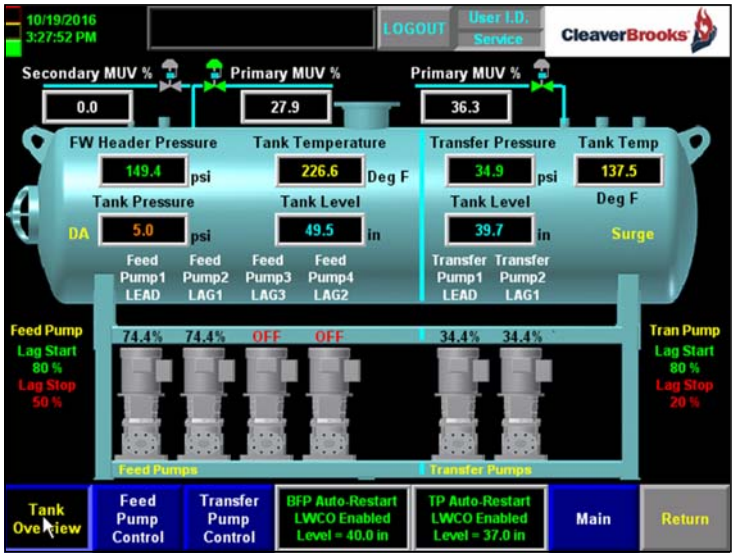


Figure 4-4 Duo Tank Overview Screen

4.1.5 - Feed Pump Control

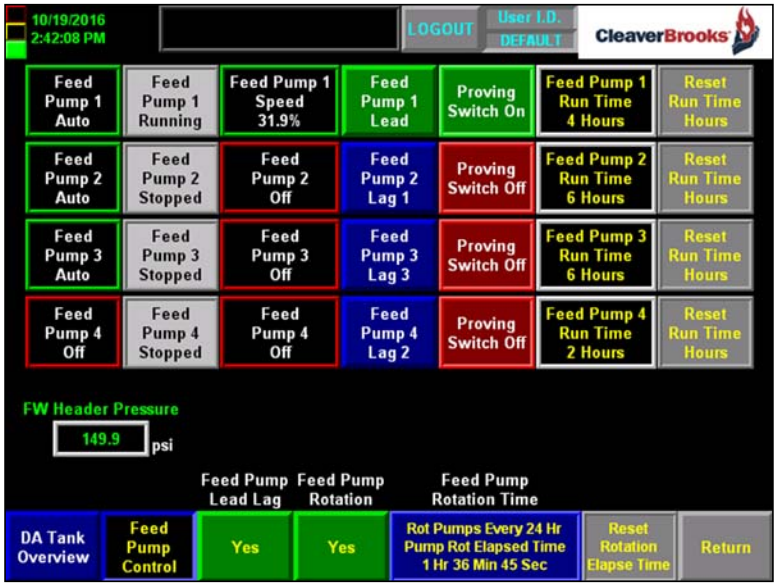


Figure 4-5 Feed Pump Control Screen

The Feed Pump Control Screen provides an indication of the following items:

- DA Header Pressure

- Status of the optional Flow Switches – OPEN/CLOSED
- Selector Switch Position HAND/OFF/AUTO
- OFF/ON/FAULT status for each of the Feed Pumps
- Lead-Lag status (Lead, Lag1, Lag2, etc.) for each of the Feed Pumps
- Elapsed Run Time for each Feed Pump
- Feed Pump Alternate Time increment
- Lead Pump Elapsed Time (when the Alternate function is active)

The Feed Pump Control Screen provides the following Control Functions:

- Individual Feed Pump START/STOP Push Buttons

  When the Selector Switch is in AUTO(PLC) and the LEAD/LAG is OFF, the START/STOP Push Button can be used to START/STOP the corresponding Feed Pump.

  If the LEAD/LAG is ON, the START/STOP Push Buttons are not active.

- Individual Feed Pump LEAD/LAG assignment Push Buttons

  These Push Buttons are used to assign the LEAD Pump and the LAG Pump Sequence. Each Feed Pump must have its own unique value or an “LEAD/LAG INVALID” indicator will appear on the screen. Once a valid Lead-Lag Configuration has been selected, the Lead/Lag button will become available for user to enable Lead/Lag.

- START LEAD/LAG Push Button. This button will START and STOP the Lead-Lag sequencing.

  To START the LEAD/LAG function: At least two Feed Pumps need to be Configured (present in the system) and have the Selector Switch in the AUTO position.

  When the Lead-Lag sequence is started, if a pump(s) has been started with the Individual Feed Pump START/STOP Push Button, if that pump is not the LEAD Pump, it will be shut off. The LEAD Pump will be Started.

  If one or more of the LAG Pumps is required, they will be Started.

  When the LEAD/LAG function is turned off (LEAD/LAG STOP Push Button), the Feed Pumps will be OFF.

- The <FEED PUMP ROTATION> Push Button. If a Feed Pump Rotation Time value has been entered (on the Feed Pump Config screen), The Feed Pump Rotation sequence can be Started and Stopped using the <FEED PUMP ROTATION> Push Button.

- The <RESET Hours> and the <RESET Elapsed Time> push buttons can be used to reset the corresponding elapsed time values to 0 (zero).

4.1.6 - Transfer Pump Control

Information and controls on this screen are similar to Feed Pump Control above.

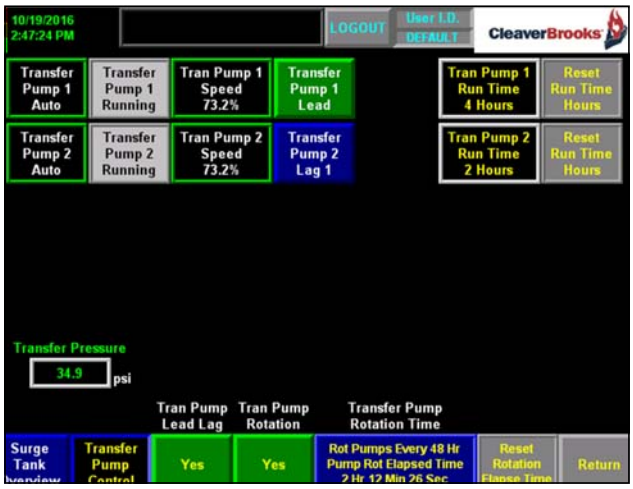


Figure 4-6 Transfer Pump Control Screen

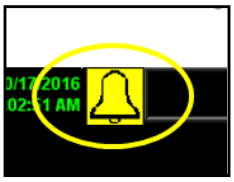
4.2-Remote Monitoring

The PanelView Plus HMI provides Web Server functionality, allowing for easy access to plant floor HMI applications. There is no need to install any additional Rockwell software on the browser computer.

Once you have an Ethernet connection between a computer and the PanelView Plus terminal, simply choose a web browser such as Internet Explorer or Google Chrome and type in the IP address of the HMI running the application you wish to view. Note there can only be one connection to an HMI at a time.

4.3-Alarms

4.3.1 - Alarm Bell



The alarm bell will appear when an active Alarm or Warning is present.

The alarm bell can be in one of four states:

- Yellow Flashing = Warning and alarm not silenced
- Yellow Solid= Warning and alarm silenced
- Red Flashing = Fault and alarm not silenced
- Red Solid= Fault and alarm silenced

To access alarm details press <Alarms> on the Main Screen.

On the alarm screen choose between <Active Alarms>, showing only those alarms currently active, or <Alarm History> for a record of all the most recent alarms (up to the last 200).

When an alarm occurs, the alarm relay will de-energize, sounding the alarm bell/horn. Acknowledging the alarm will silence the bell/horn.

The GREEN stack light indicates normal operation; no alarms are detected and at least one pump is set to AUTO (PLC).

The YELLOW stack light indicates a warning condition.

The RED stack light indicates equipment failure or a condition preventing pump operation.

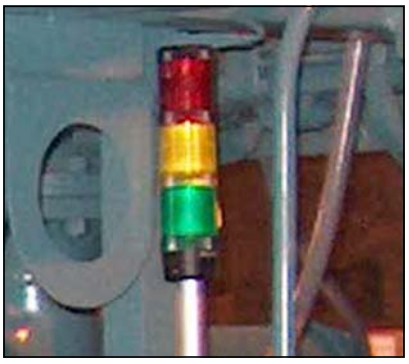


Figure 4-7 Stack Light

4.3.2 - Alarm History

The Active Alarms and Alarm History lists are color-coded as follows:

Red = Fault

Yellow = Warning

Blue = Currently Selected Alarm

Teal = Information

To clear the alarm history, the Factory level password is required.

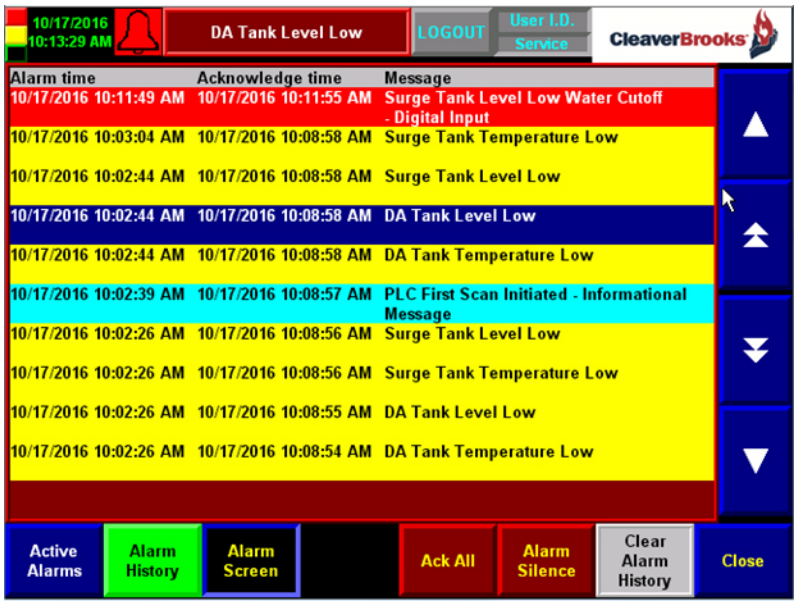


Figure 4-8 Alarm History

4.4-Troubleshooting

Fault Text	System Failure	Condition	Recommended Troubleshooting
Feed Pump # Run Fault Transfer Pump # Run Fault	Pump has not started or stopped in required time of 5 Seconds. (Manual Fault Reset Required)	Feed Pump 1: Pump Start Output O:2/0 is energized and Pump On Input I:1/0 is not energized. Pump Start Output O:2/0 is not energized and Pump On Input I:1/0 is energized.	1. Verify Pump I/O is energizing and deenergizing correctly and within 5 seconds. 2. Verify VFD Parameter Decel Time and verify it is not set longer than 5 Seconds. 3. Verify VFD Parameter Relay Output 1 is set for Fault/Ready 4. Verify VFD Parameter Relay Output 2 is set for Motor Running. 5. Verify Motor Starter Auxiliary Run Contact or VFD Relay Outputs are wired correctly.
Feed Pump x Flow Fault (Pump Proving) Transfer Pump x Flow Fault (Pump Proving)	Pump Proving sensor has not detected pump running in required time of 5 Seconds. (Sensor can be pressure sensor, flow sensor or current toroid) (Manual Fault Reset Required)	Feed Pump 1: Pump Start Output O:2/0 is energized and Pump Proving Input I:1/10 is not energized. Pump Start Output O:2/0 is not energized and Pump Proving Input I:1/0 is energized.	1. Verify Pump I/O is energizing and deenergizing correctly and within 5 seconds. 2. Verify proper setup of Pump Proving device. **NOTE**: Pump Proving Alarms may be disabled from the System Configuration Screen to eliminate nusiance tripping of alarms during setup.
DA Tank Level High (Digital Input) Surge Tank Level High (Digital Input)	Tank Level has reached the High Water Level Switch. (Manual Fault Reset Required on Dual Tank for DA Level High)	High Water Level Switch has energized the tank high water level digital input on the PLC for at least 10 seconds. I:5.0 = DA Tank Level High I:5.2 = Surge Tank Level High	1. Verify Tank Level Switch Wiring and proper mechanical operation. When PLC input is energized alarm will be generated. NOTE: On Dual Tank ADAC the DA High Level Alarm will disable the Transfer Pumps from Running.
DA Tank Level Low (Digital Input) Surge Tank Level Low (Digital Input)	Tank Level has reached the Low Water Level Switch.	Low Water Level Switch has energized the tank low water level digital input on the PLC for at least 10 seconds. I:5.1 = DA Tank Level Low I:5.3 = Surge Tank Level Low	1. Verify Tank Level Switch Wiring and proper mechanical operation. When PLC input is energized alarm will be generated.

DA Tank Level Low Water Cutoff (Digital Input) Surge Tank Level Low Water Cutoff (Digital Input)	Tank Level has reached the Low Water Cutoff Level Switch. (Manual Fault Reset Required)	Low Water Cutoff Level Switch has **deenergized** the tank low low digital input on the PLC for at least 4.5 seconds. I:1.15 = DA Tank Level LWCO I:1.14= Surge Tank Level LWCO	1. Verify Tank Level Switch Wiring and proper mechanical operation. When PLC input is **deenergized** alarm will be generated. 2. Set the Analog Tank Level Low Water Cutoff to a Higher value than the Discrete Tank Level Low Water Cutoff Switch. NOTE: The LWCO Switch is hardwired to a relay. The Relay must deenegize on LWCO condition and disable the Pumps from running via hardwiring.
DA Tank Discharge Header Pressure Sensor Failure Transfer Header Pressure Sensor Failure	Discharge Header Sensor Failure. (Manual Fault Reset Required)	Analog input is outside of range. Range > 3.3 ma Range < 20.5ma I:2.0 = DA Discharge Header Pressure I:4.0 = Transfer Header Pressure	1. Verify Analog Input Wiring. 2. L24ER Embedded I/O requires a jumper between I in 0+ and V in 0+ for slot 2 Analog. 3. Expansion I/O requires a jumper between V/I in 0- and Anlg Com for slot 4 Analog.
DA Tank Discharge Header Pressure High Transfer Header Pressure High	Discharge Header Pressure too High	Discharge Header Pressure is above High Alarm Setpoint for Time.	1. Verify Discharge Header Pressure. 2. Adjust Alarm Settings. 3. Alarms may be disabled by setting Alarm Time = 0 Seconds. Alarms should only be disabled for troubleshooting purposes.
DA Tank Discharge Header Pressure Low Transfer Header Pressure Low	Discharge Header Pressure too Low	Discharge Header Pressure is below Low Alarm Setpoint for Time.	1. Verify Discharge Header Pressure. 2. Adjust Alarm Settings. 3. Alarms may be disabled by setting Alarm Time = 0 Seconds. Alarms should only be disabled for troubleshooting purposes.
DA Tank Temperature Sensor Failure Surge Tank Temperature Sensor Failure	Tank Temperature Sensor Failure.	Analog input is outside of range. Range > 3.3 ma Range < 20.5ma I:2.1 = DA Tank Temperature I:4.1 = Surge tank Temperature	1. Verify Analog Input Wiring. 2. L24ER Embedded I/O requires a jumper between I in 0+ and V in 0+ for slot 2 Analog. 3. Expansion I/O requires a jumper between V/I in 0- and Anlg Com for slot 4 Analog.
DA Tank Temperature High Surge Tank Temperature High	Tank Temperature too High	Tank Temperature is above High Alarm Setpoint for Time.	1. Verify Tank Temperature. 2. Adjust Alarm Settings. 3. Alarms may be disabled by setting Alarm Time = 0 Seconds. Alarms should only be disabled for troubleshooting purposes.
DA Tank Temperature Low Surge Tank Temperature Low	Tank Temperature too Low	Tank Temperature is below Low Alarm Setpoint for Time.	1. Verify Tank Temperature. 2. Adjust Alarm Settings. 3. Alarms may be disabled by setting Alarm Time = 0 Seconds. Alarms should only be disabled for troubleshooting purposes.

DA Tank Level Sensor Failure Surge Tank Level Sensor Failure	Tank Level Sensor Failure.	Analog input is outside of range. Range > 3.3 ma Range < 20.5ma I:2.2 = DA Tank Level I:4.2 = Surge tank Level	1. Verify Analog Input Wiring. 2. L24ER Embedded I/O requires a jumper between I in 0+ and V in 0+ for slot 2 Analog. 3. Expansion I/O requires a jumper between V/I in 0- and Anlg Com for slot 4 Analog.
DA Tank Level High Surge Tank Level High	Tank Level too High	Tank Level is above High Alarm Setpoint for Time.	1. Verify Tank Level. 2. Adjust Alarm Settings. 3. Alarms may be disabled by setting Alarm Time = 0 Seconds. Alarms should only be disabled for troubleshooting purposes.
DA Tank Level Low Surge Tank Level Low	Tank Level too Low	Tank Level is below Low Alarm Setpoint for Time.	1. Verify Tank Level. 2. Adjust Alarm Settings. 3. Alarms may be disabled by setting Alarm Time = 0 Seconds. Alarms should only be disabled for troubleshooting purposes.
DA Tank Level Low Water Cutoff (Analog) Surge Tank Low Water Cutoff (Analog)	Tank Level has lowered to Low Water Cutoff Level. Pumps Disabled. Manual Fault Reset Required if Pump Auto Restart Feature is Disabled. If Pump Auto Restart is Enabled Pumps will Restart when Water Level rises above Auto Restart Level.	Tank Level is below Low Low Alarm Setpoint for Time.	1. Verify Tank Level. 2. Adjust Alarm Settings. 3. If LWCO is on Surge Tank, user can enable DA Primary MUV Bias based on Surge Level. This is done from System Configuration Screen. Two Tank Systems Only. NOTE: Low Water Cutoff Alarms Can Not be Disabled.
DA Tank Pressure Sensor Failure	DA Tank Pressure Sensor Failure.	Analog input is outside of range. Range > 3.3 ma Range < 20.5ma I:2.3 = DA Tank Pressure	1. Verify Analog Input Wiring. 2. L24ER Embedded I/O requires a jumper between I in 0+ and V in 0+ for slot 2 Analog.
DA Tank Pressure High	DA Tank Pressure too High	DA Tank Pressure is above High Alarm Setpoint for Time.	1. Verify DA Tank Pressure. 2. Adjust Alarm Settings. 3. Alarms may be disabled by setting Alarm Time = 0 Seconds. Alarms should only be disabled for troubleshooting purposes.
DA Tank Pressure Low	DA Tank Pressure too Low	DA Tank Pressure is below Low Alarm Setpoint for Time.	1. Verify DA Tank Pressure. 2. Adjust Alarm Settings. 3. Alarms may be disabled by setting Alarm Time = 0 Seconds. Alarms should only be disabled for troubleshooting purposes.
Auxiliary Analog Input 0-4 Sensor Failure	Auxiliary Analog Input Sensor Failure.		1. Verify Analog Input Wiring. 2. Expansion I/O requires a jumper between V/I in 0- and Anlg Com.

Auxiliary Analog Input 0-4 High	Auxiliary Analog Input too High	Analog Input is above High Alarm Setpoint for Time.	1. Verify Auxiliary Analog Input 2. Adjust Alarm Settings. 3. Alarms may be disabled by setting Alarm Time = 0 Seconds.
Auxiliary Analog Input 0-4 Low	Auxiliary Analog Input too Low	Analog Input is below Low Alarm Setpoint for Time.	1. Verify Auxiliary Analog Input 2. Adjust Alarm Settings. 3. Alarms may be disabled by setting Alarm Time = 0 Seconds.
Remote Communications Failure	BMS Heartbeat has timed out	he BMS Heartbeat must change states within 30 seconds or an Error is generated.	1. Verify Ethernet cabling 2. Verify ethernet communications to BMS 3. Verify BMS heartbeat
PLC I/O Module # Fault	PLC Module Faulted.		1. With power OFF check connection between modules. 2. Replace Defective Module 3. Fault will indicate the slot of the failed module

4.5-PLC Status

The PLC has a bank of multi-state LEDs to indicate the controller's operating status and communication activities. See tables below.

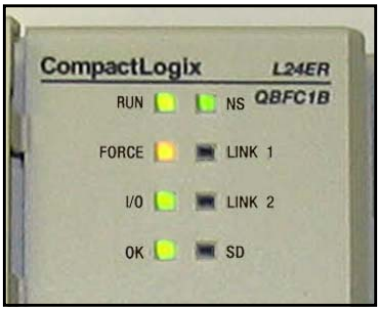


Table 4-1. PLC Status LEDs

Indicator	Status	Description
RUN	Off	The controller is in Program or Test mode.
	Green	The controller is in Run mode.
FORCE	Off	No tags contain I/O force values. I/O forces are inactive (disabled).
	Yellow	I/O forces are active (enabled). I/O force values may or may not exist.
	Flashing yellow	One or more input or output addresses have been forced to an On or Off condition, but the forces have not been enabled.
I/O	Off	The controller does not contain a project.
	Green	The controller is communicating with all of the devices in its I/O configuration.
	Flashing green	One or more devices in the I/O configuration of the controller are not responding.
	Flashing red	One of the following conditions exists: • The controller is not communicating with any devices. • A fault has occurred on the controller

Table 4-1. PLC Status LEDs (Continued)

OK	Off	No power is applied.
	Green	The controller is OK.
	Flashing green	The controller is storing a project to or loading a project from the SD card.
	Red	The controller detected a nonrecoverable major fault and cleared the project from memory.
	Flashing red	One of the following: • The controller requires a firmware update. • A major recoverable fault occurred on the controller. • A nonrecoverable major fault occurred on the controller and cleared the program from memory. • A controller firmware update is in process.
	Dim green to red	Save to Flash at power-down.

Table 4-2. PLC Communication LEDs

Indicator	Status	Description
NS (Ethernet Network Status0	Off	The port is not initialized; it does not have an IP address and is operating in BOOTP or DHCP mode.
	Green	The port has an IP address and CIP connections are established.
	Flashing green	The port has an IP address, but no CIP connections are established.
	Red	The port has detected that the assigned IP address is already in use.
	Flashing red/green	The port is performing its power-up self test.
LINK 1/LINK 2 (Ethernet Link Status)	Off	One of the following conditions exists: • No link. • Port administratively disabled. • Port disabled because rapid ring fault condition was detected (LINK2).
	Green	One of the following conditions exists: • A 100 Mbps link (half- or full-duplex) exists, no activity. • A 10 Mbps link (half- or full-duplex) exists, no activity. • Ring network is operating normally and the controller is the active supervisor. • Ring network has encountered a rare partial network fault and the controller is the active supervisor.
	Flashing green	One of the following conditions exists: • A 100 Mbps link exists and there is activity. • A 10 Mbps link exists and there is activity.
SD (SD Card activity status)	Off	There is no activity to the SD card.
	Flashing green	The controller is reading from or writing to the SD card.
	Flashing red	The SD card does not have a valid file system.

Chapter 5
Input/Output Lists

5.1-Single Tank PLC I/O Layout

5.1.1 - ADAC Single Tank STANDARD I/O

Slot 1 - Embedded Digital Inputs - 24VDC		Slot 1 - Embedded Digital Outputs	
Address	Name	Address	Name
I1/0	Pump 1 On / VFD Run Contact	O1/0	Pump 1 Start (PR1) / VFD Run
I1/1	Pump 1 in Auto	O1/1	Pump 2 Start (PR2) / VFD Run
I1/2	Pump 2 On / VFD Run Contact	O1/2	Pump 3 Start (PR3) / VFD Run
I1/3	Pump 2 in Auto	O1/3	Pump 4 Start (PR4) / VFD Run
I1/4	Pump 3 On / VFD Run Contact	O1/4	Pump 5 Start (PR5) / VFD Run
I1/5	Pump 3 in Auto	O1/5	
I1/6	Pump 4 On / VFD Run Contact	O1/6	
I1/7	Pump 4 in Auto	O1/7	
I1/8	Pump 5 On / VFD Run Contact	O1/8	
I1/9	Pump 5 in Auto	O1/9	No Alarms (AR)
I1/10	Pump 1 Flow/Pressure Switch	O1/10	Red Stack Light (RSL)
I1/11	Pump 2 Flow/Pressure Switch	O1/11	Yellow Stack Light (YSL)
I1/12	Pump 3 Flow/Pressure Switch	O1/12	Green Stack Light (GSL)
I1/13	Pump 4 Flow/Pressure Switch	O1/13	Chemical Feed Relay (CFR)
I1/14	Pump 5 Flow/Pressure Switch	O1/14	
I1/15	Tank Low-Low Water Level Sw (LWCO)	O1/15	Recirculation Valve

Slot 2 - Embedded Analog Inputs		Slot 2 - Embedded Analog Outputs	
Address	Name	Address	Name
I2/0	Header Pressure	O2/0	Tank Feedwater Valve (Pri MUV)
I2/1	Tank Temperature	O2/1	Tank Feedwater Valve (Sec MUV)
I2/2	Tank Level		
I2/3	Tank Pressure		

Slot 3 - High Speed Counter
NOT USED

5.1.2 - ADAC Single Tank OPTIONAL I/O

Option 1: VFD Pump 1-3
PRV or Overflow Valve

Slot 4 - Analog Outputs - 1769-OF4	
Address	Name
O4/0	Pump 1 VFD Speed Control
O4/1	Pump 2 VFD Speed Control
O4/2	Pump 3 VFD Speed Control
O4/3	PRV or Overflow Valve

Option 2: VFD Bypass or 1 Pump/Blr 1-5
Tank Discrete Level Switches

Slot 5 - Digital Inputs - 24Vdc 1769-IQ16	
Address	Name
I5/0	Tank High Water Level Switch
I5/1	Tank Low Water Level Switch
I5/2	VFD 1 Bypass / Boiler 1 ON
I5/3	VFD 2 Bypass / Boiler 2 ON
I5/4	VFD 3 Bypass / Boiler 3 ON
I5/5	VFD 4 Bypass / Boiler 4 ON
I5/6	VFD 5 Bypass / Boiler 5 ON

Option 3: VFD Pump 4-5

Slot 6 - Analog Outputs - 1769-OF2	
Address	Name
O6/0	Pump 4 VFD Speed Control
O6/1	Pump 5 VFD Speed Control

Option 4: User Config Analog Inputs
Tray Temp/Pressure Analog Inputs

Slot 7 - Analog Inputs - 1769-IF4	
Address	Name
I7/0	User Configurable/Tray Temperature
I7/1	User Configurable/Tray Pressure
I7/2	User Configurable
I7/3	User Configurable

5.2-Two Tank PLC I/O Layout

5.2.1 - ADAC Two Tank STANDARD I/O

Slot 1 - Embedded Digital Inputs - 24VDC		Slot 1 - Embedded Digital Outputs	
Address	Name	Address	Name
I1/0	Feed Pump 1 On / VFD Run Contact	O1/0	Feed Pump 1 Start (PR1) / VFD Run
I1/1	Feed Pump 1 in Auto	O1/1	Feed Pump 2 Start (PR2) / VFD Run
I1/2	Feed Pump 2 On / VFD Run Contact	O1/2	Feed Pump 3 Start (PR3) / VFD Run
I1/3	Feed Pump 2 in Auto	O1/3	Pump 4/TR Pump3 Start (PR4) / VFD Run
I1/4	Feed Pump 3 On / VFD Run Contact	O1/4	Transfer Pump 1 Start (TPR1) / VFD Run
I1/5	Feed Pump 3 in Auto	O1/5	Transfer Pump 2 Start (TPR1) / VFD Run
I1/6	Transfer Pump 1 On / VFD Run Contact	O1/6	
I1/7	Transfer Pump 1 in Auto	O1/7	
I1/8	Transfer Pump 2 On / VFD Run Contact	O1/8	
I1/9	Transfer Pump 2 in Auto	O1/9	No Alarms (AR)
I1/10	Feed Pump 1 Flow/Pressure Switch	O1/10	Red Stack Light (RSL)
I1/11	Feed Pump 2 Flow/Pressure Switch	O1/11	Yellow Stack Light (YSL)
I1/12	Feed Pump 3 Flow/Pressure Switch	O1/12	Green Stack Light (GSL)
I1/13	Pump 4/TR Pump3 Flow/Pressure Switch	O1/13	DA Chemical Feed Relay (CFR)
I1/14	SRG Low-Low Water Level Sw (SLWCO)	O1/14	Surge Chemical Feed Relay (SCFR)
I1/15	DA Low-Low Water Level Sw (LWCO)	O1/15	DA Recirculation Valve

Slot 2 - Embedded Analog Inputs		Slot 2 - Embedded Analog Outputs	
Address	Name	Address	Name
I2/0	Boiler Feedwater Header Pressure	O2/0	DA Tank Feedwater Valve (Pri MUV)
I2/1	DA Tank Temperature	O2/1	Surge Tank Feedwater Valve (Pri MUV)
I2/2	DA Tank Level		
I2/3	DA Tank Pressure		

Slot 3
NOT USED

Slot 4 - Analog Inputs - 1769-IF8	
Address	Name
I4/0	Surge Transfer Header Pressure
I4/1	Surge Tank Temperature
I4/2	Surge Tank Level
I4/3	User Configurable 0/Tray Temperature
I4/4	User Configurable 1/Tray Pressure
I4/5	User Configurable 2
I4/6	User Configurable 3
I4/7	Spare

5.2.2 - ADAC Two Tank OPTIONAL I/O

Option 1: DA or Surge Level Switches
Feed Pump 4 or Transfer Pump 3
Transfer Pump Flow/Pressure Switches
DA Bypass

Slot 5 - Digital Inputs - 24VDC 1769-IQ16	
Address	Name
I5/0	DA Tank High Water Level Switch
I5/1	DA Tank Low Water Level Switch
I5/2	Surge Tank High Water Level Switch
I5/3	Surge Tank Low Water Level Switch
I5/4	Pump 4/TR Pump3 On / VFD Run Contact
I5/5	Pump 4/TR Pump3 in Auto
I5/6	Transfer Pump 1 Flow/Pressure Switch
I5/7	Transfer Pump 2 Flow/Pressure Switch
I5/8	DA Bypass

Option 2: VFD, DA or Surge
2nd MUV
PRV or Overflow Valve

Slot 6 - Analog Outputs 1769-OF8C	
Address	Name
O6/0	Feed Pump 1 VFD Speed Control
O6/1	Feed Pump 2 VFD Speed Control
O6/2	Feed Pump 3 VFD Speed Control
O6/3	Transfer Pump 1 VFD Speed Control
O6/4	Transfer Pump 2 VFD Speed Control
O6/5	Pump 4/TR Pump3 VFD Speed Control
O6/6	DA Second MUV or Surge Second MUV
O6/7	DA PRV Valve or DA Overflow Valve

Option 3: VFD Bypass, 1 Pump/Blr 1-4

Slot 7 - Digital Inputs -24Vdc 1769-IQ16	
Address	Name
I7/0	Feed Pump 1 VFD Bypass / Boiler 1 ON
I7/1	Feed Pump 2 VFD Bypass / Boiler 2 ON
I7/2	Feed Pump 3 VFD Bypass / Boiler 3 ON
I7/3	TR Pump 1 VFD Bypass
I7/4	TR Pump 2 VFD Bypass
I7/5	Pump 4/TR Pump3 VFD Bypass
I7/6	Boiler 4 ON

Chapter 6
Parts

PLC Rack, Standard System

Qty	Description	Part Number	
	Single Tank		
1	COMPACTLOGIX 750KB DI/O AI/O CONTROLLER	833-10039-000	required
1	CONTROL,HMI,PANELVIEW PLUS 700, PVP7	833-11588-000	required
1	PLC, TERMINATION CAP,RIGHT END COMPACTLOGIX	833-02838-000	required
1	PLC, ANALOG OUTPUT MODULE COMPACTLOGIX, 4 CH	833-09946-000	optional
1	MODULE,COMPACTLOGIX,W/16 24VDC INPUT	817-04393-000	optional
1	PLC, ANALOG OUTPT MODULE COMPACTLOGIX, 2 CH	833-02844-000	optional
1	PLC, ANALOG INPUT MODULE COMPACTLOGIX, 4 CH	833-02835-000	optional

	Two/Dual Tank		
1	COMPACTLOGIX 750KB DI/O AI/O CONTROLLER	833-10039-000	required
1	CONTROL,HMI,PANELVIEW PLUS 700, PVP7	833-11588-000	required
1	PLC,COMPACTLOGIX,ANALOG INPUT MODULE, 8 CH	833-03106-000	required
1	PLC, TERMINATION CAP,RIGHT END COMPACTLOGIX	833-02838-000	required
2	MODULE,COMPACTLOGIX,W/16 24VDC INPUT	817-04393-000	optional
1	PLC, COMPACTLOGIX, ANALOG OUTPUT MODULE, 8 CH	833-03107-000	optional

	UPGRADE TO LARGER SIZE HMI		
1	10 INCH PVP7 PERFORMANCE COLOR TOUCH SCREEN 120VAC	833-10851-000	Upgrade

Stack Light

Qty	Description	Part Number
1	LAMP, AMBER, 24VDC	881-00744-000
1	LAMP, RED, 24VDC	881-00745-000
1	LAMP, GREEN, 24VDC	881-00746-000
1	BASE, STACK LIGHT	881-00408-000
1	POWER SUPPLY, 24VDC, 5 amp, 120 Watt	832-02404-000

Software

Description	Part Number
Single Tank	
PLC PROGRAM	985-00592-000
HMI PROGRAM 7”	985-00631-000
HMI PROGRAM 10”	985-00630-000
Dual Tank	
PLC PROGRAM	985-00594-000
HMI PROGRAM 7”	985-00633-000
HMI PROGRAM 10”	985-00632-000

Optional

Description	Part Number
CURRENT OVERLOAD	(sized for pump)
ELECTRIC ACTUATORS FOR PUMP WATER RE-CIRCULATION BYPASS	(sized for system)
VARIABLE SPEED DRIVE	(sized for pump)

APPENDIX A - Variable Frequency Drive Parameters

An asterisk * indicates the parameter needs to be changed from the factory default.

A.1 - PF 70

PF70 Enhanced Control - ADAC 1000

Set parameter 196 to Advanced first.

	Par. No.	Parameter Name	Raw Value	Real Value
	1	Output Freq	Read-Only	
	2	Commanded Freq	Read-Only	
	3	Output Current	Read-Only	
	4	Torque Current	Read-Only	
	5	Flux Current	Read-Only	
	6	Output Voltage	Read-Only	
	7	Output Power	Read-Only	
	8	Output Powr Fctr	Read-Only	
	9	Elapsed MWh	Read-Only	
	10	Elapsed Run Time	Read-Only	
	11	MOP Frequency	Read-Only	
	12	DC Bus Voltage	Read-Only	
	13	DC Bus Memory	Read-Only	
	14	Elapsed kWh	Read-Only	
	15	Torque Estimate	Read-Only	
	16	Analog In1 Value	Read-Only	
	17	Analog In2 Value	Read-Only	
	22	Ramped Speed	Read-Only	
	23	Speed Reference	Read-Only	
	24	Commanded Torque	Read-Only	
	25	Speed Feedback	Read-Only	
	26	Rated kW	Read-Only	
	27	Rated Volts	Read-Only	
	28	Rated Amps	Read-Only	
	29	Control SW Ver	Read-Only	
	40	Motor Type	0	Induction
*	***41***	***Motor NP Volts***		***Motor Nameplate***
*	***42***	***Motor NP FLA***		***Motor Nameplate***
*	***43***	***Motor NP Hertz***		***Motor Nameplate***
*	***44***	***Motor NP RPM***		***Motor Nameplate***
*	***45***	***Motor NP Power***		***Motor Nameplate***
	46	Mtr NP Pwr Units	0	Horsepower
	47	Motor OL Hertz	200	20.0 Hz
	48	Motor OL Factor	100	1.0
	49	Motor Poles	4	Depending on Motor
	50	Motor OL Mode	0	XXXXXXXX XXXXXXX0
	53	Motor Cntl Sel	0	Sensrls Vect
	54	Maximum Voltage		From Drive Nameplate
	55	Maximum Freq	600	60.0
	56	Compensation	3	XXXXXXXX XXXXXX11
	57	Flux Up Mode	0	Manual
	58	Flux Up Time	0	0.00 Secs
	59	SV Boost Filter	500	500

	61	Autotune	3	Calculate
	62	IR Voltage Drop	24	Based on Drive Rating
	63	Flux Current Ref	750	Based on Drive Rating
	64	Ixo Voltage Drop	Read-Only	Based on Drive Rating
	66	Autotune Torque	500	50%
	67	Autotune Inertia	0	Ready
	69	Start/Acc Boost	24	Based on Drive Rating
	70	Run Boost	24	Based on Drive Rating
	71	Break Voltage	1150	115.0 VAC
	72	Break Frequency	150	15.0 Hz
	80	Feedback Select	0	Open Loop
	81	Minimum Speed	0	0.0 Hz
*	***82***	***Maximum Speed***	***600***	***60.0 Hz***
	83	Overspeed Limit	0	0.0 Hz
	84	Skip Frequency 1	0	0.0 Hz
	85	Skip Frequency 2	0	0.0 Hz
	86	Skip Frequency 3	0	0.0 Hz
	87	Skip Freq Band	0	0.0 Hz
	88	Speed/Torque Mode	1	Speed Reg
	90	Speed Ref A Sel	2	Analog In 2
*	***91***	***Speed Ref A Hi***	***600***	***60.0 Hz***
	92	Speed Ref A Lo	0	0.0 Hz
	93	Speed Ref B Sel	11	Preset Spd1
	94	Speed Ref B Hi	600	60.0 Hz
	95	Speed Ref B Lo	0	0.0 Hz
	96	TB Man Ref Sel	1	Analog In 1
	97	TB Man Ref Hi	600	60.0 Hz
	98	TB Man Ref Lo	0	0.0 Hz
	100	Jog Speed 1	100	10.0 Hz
*	***101***	***Preset Speed 1***	***600***	***60.0 Hz***
	102	Preset Speed 2	100	10.0 Hz
	103	Preset Speed 3	200	20.0 Hz
	104	Preset Speed 4	300	30.0 Hz
	105	Preset Speed 5	400	40.0 Hz
	106	Preset Speed 6	500	50.0 Hz
	107	Preset Speed 7	600	60.0 Hz
	108	Jog Speed 2	100	10.0 Hz
	116	Trim % Setpoint	0	0.00%
	117	Trim In Select	2	Analog In 2
	118	Trim Out Select	0	XXXXXXXX XXXXX000
	119	Trim Hi	600	60.0 Hz
	120	Trim Lo	0	0.0 Hz
	121	Slip RPM @ FLA	1000	100.0 RPM
	122	Slip Comp Gain	400	40
	123	Slip RPM Meter	Read-Only	
	124	PI Configuration	0	XXXXXX00 0000 0000
	125	PI Control	0	XXXXXXXX XXXXX000
	126	PI Reference Sel	0	PI Setpoint
	127	PI Setpoint	500	50.00%
	128	PI Feedback Sel	2	Analog In 2
	129	PI Integral Time	200	2.00 Secs
	130	PI Prop Gain	100	1.00

	131	PI Lower Limit	-1000	-100.0%
	132	PI Upper Limit	1000	100.0%
	133	PI Preload	0	0.0 Hz
	134	PI Status	Read-Only	xxxx 0000
	135	PI Ref Meter	Read-Only	
	136	PI Fdback Meter	Read-Only	
	137	PI Error Meter	Read-Only	
	138	PI Output Meter	Read-Only	
	139	PI BW Filter	0	0.0 Radians
*	***140***	***Accel Time 1***	***30***	***3.0 Secs***
	141	Accel Time 2	100	10.0 Secs
*	***142***	***Decel Time 1***	***30***	***3.0 Secs***
	143	Decel Time 2	100	10.0 Secs
	145	DB While Stopped	0	Disabled
	146	S Curve	0	0%
	147	Current Lmt Sel	0	Cur Lim Val
	148	Current Lmt Val		Motor FLA x 1.5
	149	Current Lmt Gain	250	250
	150	Drive OL Mode	3	Both-PWM 1st
	151	PWM Frequency	2	2
	152	Droop RPM @ FLA	0.0	0.0 RPM
	153	Regen Power Lim	-500	-50.0%
	154	Current Rate Lim	4000	400.00%
	155	Stop/Brk Mode A	1	Ramp
	156	Stop/Brk Mode B	0	Coast
	157	DC Brake Lvl Sel	0	DC Brake Lvl
	158	DC Brake Level	270	27.0 Amps
	159	DC Brake Time	0	0.0 Secs
	160	Bus Reg Ki	450	450
	161	Bus Reg Mode A	1	Adjust Freq
	162	Bus Reg Mode B	4	Both-Frq 1st
	163	DB Resistor Type	2	None
	164	Bus Reg Kp	1500	1500
	165	Bus Reg Kd	1000	1000
	166	Flux Braking	0	Disabled
	167	Powerup Delay	0	0.0 Secs
*	***168***	***Start At PowerUp***	***1***	***Enabled***
*	***169***	***Flying Start En***	***1***	***Enabled***
	170	Flying StartGain	4000	4000
	171	Reserved	Read-Only	
	172	Reserved	Read-Only	
	173	Reserved	Read-Only	
*	***174***	***Auto Rstrt Tries***	0	***1***
	175	Auto Rstrt Delay	10	1.0 Secs
	176	Reserved	Read-Only	
	177	Gnd Warn Level	30	3.0 Amps
	178	Sleep Wake Mode	0	Disabled
	179	Sleep Wake Ref	2	Analog In 2
	180	Wake Level	6000	6.0mA,6.0V
	181	Wake Time	10	1.0 Secs
	182	Sleep Level	5000	5.0mA,5.0V
	183	Sleep Time	0	0.0 Secs

	184	Power Loss Mode	0	Coast
	185	Power Loss Time	5	0.5 Secs
	186	Power Loss Level	Read-Only	
	187	Load Loss Level	2000	200.0%
	188	Load Loss Time	0	0 Secs
	189	Shear Pin Time	0	0 Secs
*	***190***	***Direction Mode***	***2***	***Reverse Dis***
	191	Reserved	Read-Only	
	192	AutoMan Cnfg	1	XXXXXXXX XXXXXXX1
	193	Man Ref Preload	0	Disabled
	194	Save MOP Ref	0	XXXXXXXX XXXXXX00
	195	MOP Rate	10	1.0 Hz/s
*	***196***	***Param Access Lvl***	***1***	***Advanced***
	197	Reset To Defaults	0	Ready
	198	Load Frm Usr Set	0	Ready
	199	Save To User Set	0	Ready
	200	Reset Meters	0	Ready
	201	Language	1	English
	202	Voltage Class	3	Based on Drive Cat No.
	203	Drive Checksum	Read-Only	
	204	Dyn UsrSet Cnfg	0	XXXXXXXX XXXXXX00
	205	Dyn UsrSet Sel	0	XXXXXXXX XXXXXX00
	206	Dyn UserSet Actv	0	XXXXXXXX XXXXXX00
	207	Reserved	Read-Only	
	208	Reserved	Read-Only	
	209	Drive Status 1	Read-Only	
	210	Drive Status 2	Read-Only	
	211	Drive Alarm 1	Read-Only	
	212	Drive Alarm 2	Read-Only	
	213	Speed Ref Source	Read-Only	
	214	Start Inhibits	Read-Only	
	215	Last Stop Source	Read-Only	
	216	Dig In Status	Read-Only	
	217	Dig Out Status	Read-Only	
	218	Drive Temp	Read-Only	
	219	Drive OL Count	Read-Only	
	220	Motor OL Count	Read-Only	
	221	Mtr OL Trip Time	Read-Only	
	222	Drive Status 3	Read-Only	
	223	Status 3 @ Fault	Read-Only	
	224	Fault Frequency	Read-Only	
	225	Fault Amps	Read-Only	
	226	Fault Bus Volts	Read-Only	
	227	Status 1 @ Fault	Read-Only	
	228	Status 2 @ Fault	Read-Only	
	229	Alarm 1 @ Fault	Read-Only	
	230	Alarm 2 @ Fault	Read-Only	
	231	Reserved	Read-Only	
	232	Reserved	Read-Only	
	233	Reserved	Read-Only	
	234	Testpoint 1 Sel	499	499
	235	Testpoint 1 Data	Read-Only	

	236	Testpoint 2 Sel	499	499
	237	Testpoint 2 Data	Read-Only	
	238	Fault Config 1	74	XXXXXXXX X1001X10
	239	Reserved	Read-Only	
	240	Fault Clear	0	Ready
	241	Fault Clear Mode	1	Enabled
	242	Power Up Marker	Read-Only	
	243	Fault 1 Code	Read-Only	
	244	Fault 1 Time	Read-Only	
	245	Fault 2 Code	Read-Only	
	246	Fault 2 Time	Read-Only	
	247	Fault 3 Code	Read-Only	
	248	Fault 3 Time	Read-Only	
	249	Fault 4 Code	Read-Only	
	250	Fault 4 Time	Read-Only	
	251	Reserved	Read-Only	
	252	Reserved	Read-Only	
	253	Reserved	Read-Only	
	254	Reserved	Read-Only	
	255	Reserved	Read-Only	
	256	Reserved	Read-Only	
	257	Reserved	Read-Only	
	258	Reserved	Read-Only	
	259	Alarm Config 1	959	XXXXXX11 1X111111
	260	Reserved	Read-Only	
	261	Reserved	Read-Only	
	262	Reserved	Read-Only	
	263	Reserved	Read-Only	
	264	Reserved	Read-Only	
	265	Reserved	Read-Only	
	266	Reserved	Read-Only	
	267	Reserved	Read-Only	
	268	Reserved	Read-Only	
	269	Reserved	Read-Only	
	270	DPI Data Rate	0	125 kbps
	271	Drive Logic Rslt	Read-Only	
	272	Drive Ref Rslt	Read-Only	
	273	Drive Ramp Rslt	Read-Only	
	274	DPI Port Select	0	Not Used
	275	DPI Port Value	Read-Only	
	276	Logic Mask	47	XXXXXXXX XX101111
	277	Start Mask	47	XXXXXXXX XX101111
	278	Jog Mask	47	XXXXXXXX XX101111
*	***279***	***Direction Mask***	***0***	***XXXXXXXX XX000000***
	280	Reference Mask	47	XXXXXXXX XX101111
	281	Accel Mask	47	XXXXXXXX XX101111
	282	Decel Mask	47	XXXXXXXX XX101111
	283	Fault Clr Mask	47	XXXXXXXX XX101111
	284	MOP Mask	47	XXXXXXXX XX101111
	285	Local Mask	47	XXXXXXXX XX101111
	286	Reserved	Read-Only	
	287	Reserved	Read-Only	

	288	Stop Owner	Read-Only	
	289	Start Owner	Read-Only	
	290	Jog Owner	Read-Only	
	291	Direction Owner	Read-Only	
	292	Reference Owner	Read-Only	
	293	Accel Owner	Read-Only	
	294	Decel Owner	Read-Only	
	295	Fault Clr Owner	Read-Only	
	296	MOP Owner	Read-Only	
	297	Local Owner	Read-Only	
	298	DPI Ref Select	0	Max Freq
	299	Reserved	Reserved	Reference
	300	Data In A1	0	0
	301	Data In A2	0	0
	302	Data In B1	0	0
	303	Data In B2	0	0
	304	Data In C1	0	0
	305	Data In C2	0	0
	306	Data In D1	0	0
	307	Data In D2	0	0
	308	HighRes Ref	0	0
	309	Reserved	Read-Only	0
	310	Data Out A1	0	0
	311	Data Out A2	0	0
	312	Data Out B1	0	0
	313	Data Out B2	0	0
	314	Data Out C1	0	0
	315	Data Out C2	0	0
	316	Data Out D1	0	0
	317	Data Out D2	0	0
	318	Reserved	Read-Only	
	319	Reserved	Read-Only	
*	***320***	***Anlg In Config***	***3***	***XXXXXXXX XXXXXX11***
	321	Anlg In Sqr Root	0	XXXXXXXX XXXXXX00
*	***322***	***Analog In 1 Hi***	***20000***	***20.000***
*	***323***	***Analog In 1 Lo***	***4000***	***4.000***
	324	Analog In 1 Loss	0	Disabled
*	***325***	***Analog In 2 Hi***	***20000***	***20.000***
*	***326***	***Analog In 2 Lo***	***4000***	***4.000***
*	***327***	***Analog In 2 Loss***	***5***	***Goto Preset1***
	328	Reserved	Read-Only	0
	329	Reserved	Read-Only	0
	330	Reserved	Read-Only	0
	331	Reserved	Read-Only	0
	332	Reserved	Read-Only	0
	333	Reserved	Read-Only	0
	334	Reserved	Read-Only	0
	335	Reserved	Read-Only	0
	336	Reserved	Read-Only	0
	337	Reserved	Read-Only	0
	338	Reserved	Read-Only	0
	339	Reserved	Read-Only	0

	340	Anlg Out Config	0	XXXXXXXX XXXXXXX0
	341	Anlg Out Absolut	1	XXXXXXXX XXXXXXX1
	342	Analog Out1 Sel	0	Output Freq
	343	Analog Out1 Hi	10	10
	344	Analog Out1 Lo	0	0
	345	Reserved	Read-Only	0
	346	Reserved	Read-Only	0
	347	Reserved	Read-Only	0
	348	Reserved	Read-Only	0
	349	Reserved	Read-Only	0
	350	Reserved	Read-Only	0
	351	Reserved	Read-Only	0
	352	Reserved	Read-Only	0
	353	Reserved	Read-Only	0
	354	Anlg Out1 Scale	0	0.0
	355	Reserved	Read-Only	0
	356	Reserved	Read-Only	0
	357	Reserved	Read-Only	0
	358	Reserved	Read-Only	0
	359	Reserved	Read-Only	0
	360	Reserved	Read-Only	0
*	***361***	***Digital In1 Sel***	***2***	***Clear Faults***
*	***362***	***Digital In2 Sel***	***7***	***Run***
*	***363***	***Digital In3 Sel***	***0***	***Not Used***
	364	Digital In4 Sel	15	Speed Sel 1
	365	Digital In5 Sel	16	Speed Sel 2
	366	Digital In6 Sel	17	Speed Sel 3
	367	Reserved	Read-Only	0
	368	Reserved	Read-Only	0
	369	Reserved	Read-Only	0
	370	Reserved	Read-Only	0
	371	Reserved	Read-Only	0
	372	Reserved	Read-Only	0
	373	Reserved	Read-Only	0
	374	Reserved	Read-Only	0
	375	Reserved	Read-Only	0
	376	Reserved	Read-Only	0
	377	Anlg Out1 Setpt	0	0.00 Volts
	378	Reserved	Read-Only	
	379	Dig Out Setpt	Read-Only	XXXXXXXX XXXXX000
*	***380***	***Digital Out1 Sel***	***2***	***Alarm***
	381	Dig Out1 Level	0	0.0
	382	Dig Out1 OnTime	0	0.00 Secs
	383	Dig Out1 OffTime	0	0.00 Secs
	384	Digital Out2 Sel	4	Run
	385	Dig Out2 Level	0	0
	386	Dig Out2 OnTime	0	0.00 Secs
	387	Dig Out2 OffTime	0	0.00 Secs
	411	DigIn DataLogic	0	XX000000 XX000000
	412	Motor Fdbk Type	0	Quadrature
	413	Encoder PPR	1024	1024 PPR
	414	Enc Pos Feedback	Read-Only	

415	Encoder Speed	Read-Only	
416	Fdbk Filter Sel	0	None
419	Notch FilterFreq	0	0.0 Hz
420	Notch Filter K	0.3	0.3 Hz
427	Torque Ref A Sel	0	Torque SetPt
428	Torque Ref A Hi	1000	100.0%
429	Torque Ref A Lo	0	0.0%
435	Torque Setpoint1	0	0.00%
436	Pos Torque Limit	2000	200.0%
437	Neg Torque Limit	-2000	–200.0%
440	Control Status	Read-Only	
441	Torq Current Ref	Read-Only	
445	Ki Speed Loop	78	7.8
446	Kp Speed Loop	63	6.3
447	Kf Speed Loop	0	0
448	Spd Err Filt BW	2000	200.0 R/s
449	Speed Desired BW	0	0.0 Radians/Sec
450	Total Inertia	0.10	0.10
451	Speed Loop Meter	Read-Only	0.0
454	Rev Speed Limit	0	0.0 Hz
459	PI Deriv Time	0	0 Secs
460	PI Reference Hi	100	100%
461	PI Reference Lo	-100	-100%
462	PI Feedback Hi	100	100%
463	PI Feedback Lo	0	0%
476	Scale1 In Value	0	0.0
477	Scale1 In Hi	0	0.0
478	Scale1 In Lo	0	0.0
482	Scale2 In Value	0	0
483	Scale2 In Hi	0	0
484	Scale2 In Lo	0	0
595	Port Mask Act	Read-Only	
596	Write Mask Cfg	Read-Only	XXXXXXXX XX11111X
597	Write Mask Act	Read-Only	
598	Logic Mask Act	Read-Only	XXXXXXXX XX111111
599 - end	Parameters NOT USED		

A.2 - PF 400

Note: Set switches AO1 & AO2 to 20mA.
Note: Set switches AI1 & AI2 to 20mA.
Note: Set switch SNK/SRC to SRC.

PowerFlex 400 - **ADAC 1000**

	Par. No.	Parameter Name	Default Value		
Basic Display					
	b1	Output Freq	Read Only		
	b2	Commanded Freq	Read Only		
	b3	Output Current	Read Only		
	b4	Output Voltage	Read Only		
	b5	DC Bus Voltage	Read Only		
	b6	Drive Status	Read Only		
	b7	Fault 1 Code	Read Only		
	b8	Process Display	Read Only		
	b9	Not Used			
	b10	Output Power	Read Only		
	b11	Elapsed MWh	Read Only		
	b12	Elapsed Run Time	Read Only		
	b13	Torque Current	Read Only		
	b14	Drive Temp	Read Only		
	b15	Elapsed kWh	Read Only		
Basic Program					
*	***P31***	***Motor NP Volts***	***Rated Volts***	***Motor NPL Volts***	
*	***P32***	***Motor NP Hertz***	***60 Hz***	***Motor NPL Hertz***	
*	***P33***	***Motor OL Current***	***Rated Amps***	***Motor NPL F.L. Amps***	
	P34	Minimum Freq	0.0 Hz	OK	
	P35	Maximum Freq	60 Hz	OK	
*	**P36**	**Start Source**	**2-W Lvl Sens**	**2 Wire, 002**	
	P37	Stop Mode	Coast,CF	OK	
*	***P38***	***Speed Reference***	***Analog In1***	***Analog In 2 - 003***	
*	***P39***	***Accel Time 1***	***20.00 Secs***	***3 Secs***	
*	***P40***	***Decel Time 1***	***20.00 Secs***	***3 Secs***	
	P41	Reset to Defaults	Ready/Idle	OK	1 = Reset
	P42	***Auto Mode***	***Hnd-Off-Auto***	***No Funtion - 000***	
	P43	Motor OL Ret	Disabled	OK	
Terminal Block					
*	***T51***	***Digital In 1 Sel***	***Purge***	***Preset Freq - 008***	
	T52	Digital In 2 Sel	Local	OK	
	T53	Digital In 3 Sel	Clear Fault	OK	
	T54	Digital In 4 Sel	Comm Port	OK	
	T55	Relay Out 1 Sel	Ready/Fault	OK	
	T56	Relay Out 1 Level	0.0	OK	
	T57	Not Used			
	T58	Relay 1 On Time	0.0 Secs	OK	
	T59	Relay 1 Off Time	0.0 Secs	OK	
	T60	Relay Out 2 Sel	MotorRunning	OK	
	T61	Relay Out 2 Level	0.0	OK	
	T62	Not Used			
	T63	Relay 2 On Time	0.0 Secs	OK	
	T64	Relay 2 Off Time	0.0 Secs	OK	
	T65	Opto Out Sel	At Frequency	OK	
	T66	Opto Out Level	0.0	OK	
	T67	Not Used			

	T68	Opto Out Logic	0	OK	
*	***T69***	***Analog In 1 Sel***	***2***	***4-20 mA, 001***	DIP Switch AI1 = 20MA
	T70	Analog In 1 Lo	0.0%	OK	
	T71	Analog In 1 Hi	100.0%	OK	
	T72	Analog In 1 Loss	Disabled	OK	
*	***T73***	***Analog In 2 Sel***	***2***	***4-20 mA, 001***	DIP Switch AI2 = 20MA
	T74	Analog In 2 Lo	0.0%	OK	
	T75	Analog In 2 Hi	100.0%	OK	
	T76	Analog In 2 Loss	Disabled	OK	
	T77	Sleep-Wake Sel	Disabled	OK	
	T78	Sleep Level	10.0%	OK	
	T79	Sleep Time	0.0 Secs	OK	
	T80	Wake Level	15.0%	OK	
	T81	Wake Time	0.0 Secs	OK	
*	***T82***	***Analog Out1 Sel***	***0***	***4-20 mA, 014***	DIP Switch AO1 = 20MA
	T83	Analog Out1 High	100.0%	OK	
	T84	Analog Out1 Setpt	0.0%	OK	
	T85	Analog Out2 Sel	1	OK	
	T86	Analog Out2 High	100.0%	OK	
	T87	Analog Out2 Setpt	0.0%	OK	
	T88	Anlg Loss Delay	0.0 Secs	OK	
	T89	Analog In Filter	0	OK	

Communications

C101	Language	English	OK
C102	Comm Format	RTU 8-N-1	OK
C103	Comm Data Rate	9600	OK
C104	Comm Node Addr	100	OK
C105	Comm Loss Action	Fault	OK
C106	Comm Loss Time	5.0 Secs	OK
C107	Comm Write Mode	Save	OK
C108	Start Source 2	2-W Lvl Sens	OK
C109	Speed Ref 2	Analog In 1	OK

Advanced Program

	A141	Purge Frequency	5.0 Hz	OK
	A142	Internal Freq	60.00 Hz	OK
	A143	Preset Freq 0	0.0 Hz	OK
*	***A144***	***Preset Freq 1***	5.0 Hz	***60.0 Hz***
	A145	Preset Freq 2	10.0 Hz	OK
	A146	Preset Freq 3	20.0 Hz	OK
	A147	Accel Time 2	30.00 Secs	OK
	A148	Decel Time 2	30.00 Secs	OK
	A149	S Curve %	20% Disabled	OK
	A150	PID Trim Hi	60.00 Hz	OK
	A151	PID Trim Lo	0.0 Hz	OK
	A152	PID Ref Sel	PID Disabled	OK
	A153	PID Feedback Sel	Analog In 1	OK
	A154	PID Prop Gain	0.01	OK
	A155	PID Integ Time	2.0 Secs	OK
	A156	PID Diff Rate	0.00	OK
	A157	PID Setpoint	0.0%	OK
	A158	PID Deadband	0.0%	OK
	A159	PID Preload	0.0 Hz	OK
	A160	Process Factor	30.0	OK
	A161	Not Used		
	A162	Not Used		

*	***A163***	***Auto Restart Tries***	***0***	***1***
*	***A164***	***Auto Restart Delay***	***1.0 Secs***	**5.0 (5 sec)**
*	***A165***	***Start At Power Up***	***Disabled***	**Enabled, 001**
	A166	Reverse Disable	Rev Disabled	OK
	A167	Flying Start Enable	Disabled	OK
	A168	PWM Frequency	4.0 kHz	OK
	A169	PWM Mode	2-Phase	OK
	A170	Boost Select	45.0, VT	OK
	A171	Start Boost	2.5%	OK
	A172	Break Voltage	25.0%	OK
	A173	Break Frequency	15.0 Hz	OK
	A174	Maximum Voltage	Rated Volts	OK
	A175	Slip Hertz @ FLA	2.0 Hz	OK
	A176	DC Brake Time	0.0 Secs	OK
	A177	DC Brake Level	Rated Amps x 0.05	OK
	A178	DC Brk Time @Strt	0.0 Secs	OK
	A179	Current Limit 1	Rated Amps x 1.1	OK
	A180	Current Limit 2	Rated Amps x 1.1	OK
	A181	Motor OL Select	No Derate	OK
	A182	Drive OL Mode	Both-PWM 1st	OK
	A183	SW Current Trip	0.0 Disabled	OK
	A184	Load Loss Level	0.0 Disabled	OK
	A185	Load Loss Time	0 Secs	OK
	A186	Stall Fault Time	60 Seconds	OK
	A187	Bus Reg Mode	Enabled	OK
	A188	Skip Frequency 1	0 Hz	OK
	A189	Skip Freq Band 1	0.0 Hz	OK
	A190	Skip Frequency 2	0 Hz	OK
	A191	Skip Freq Band 2	0.0 Hz	OK
	A192	Skip Frequency 3	0 Hz	OK
	A193	Skip Freq Band 3	0.0 Hz	OK
	A194	Compensation	Electrical	OK
	A195	Reset Meters	Ready/Idle	OK
	A196	Testpoint Select	1024	OK
	A197	Fault Clear	Ready/Idle	OK
	A198	Program Lock	Unlocked	OK
	A199	Motor NP Poles	4	OK
*	**A200**	**Motor NP Amps**	**Drive Rated Amps**	**Per Motor Nameplate**
	A201	PID Invert Error	Not Inverted	OK
	A202	MOP Reset Sel	Save MOP Ref	OK

Advanced Display

d301	Control Source	Read Only	
d302	Contrl In Status	Read Only	
d303	Comm Status	Read Only	
d304	PID Setpnt Displ	0.0%	
d305	Analog In 1	0.0%	
d306	Analog In 2	0.0%	
d307	Fault 1 Code	Read Only	
d308	Fault 2 Code	Read Only	
d309	Fault 3 Code	Read Only	
d310	Fault 1 Time-hr	Read Only	
d311	Fault 1 Time-min	Read Only	
d312	Fault 2 Time-hr	Read Only	
d313	Fault 2 Time-min	Read Only	
d314	Fault 3 Time-hr	Read Only	
d315	Fault 3 Time-min	Read Only	

d316	Elapsed Time-hr	Read Only
d317	Elapsed Time-min	Read Only
d318	Output Powr Fctr	Read Only
d319	Testpoint Data	Read Only
d320	Control SW Ver	Read Only
d321	Drive Type	Read Only
d322	Output Speed	Read Only
d323	Output RPM	Read Only
d324	Fault Frequency	Read Only
d325	Fault Current	Read Only
d326	Fault Bus Volts	Read Only
d327	Status @ Fault	Read Only

A.3 - PF 700

PF700 - ADAC 1000

Note - Set parameter 196 to advanced first.

	Par. No.	Parameter Name	Raw Value	Real Value
	1	Output Freq	Read-Only	
	2	Commanded Freq	Read-Only	
	3	Output Current	Read-Only	
	4	Torque Current	Read-Only	
	5	Flux Current	Read-Only	
	6	Output Voltage	Read-Only	
	7	Output Power	Read-Only	
	8	Output Powr Fctr	Read-Only	
	9	Elapsed MWh	Read-Only	
	10	Elapsed Run Time	Read-Only	
	11	MOP Frequency	Read-Only	
	12	DC Bus Voltage	Read-Only	
	13	DC Bus Memory	Read-Only	
	14	Elapsed kWh	Read-Only	
	16	Analog In1 Value	Read-Only	
	17	Analog In2 Value	Read-Only	
	18	PTC HW Value	Read-Only	
	21	Spd Fdbk No Filt	Read-Only	
	22	Ramped Speed	Read-Only	
	23	Speed Reference	Read-Only	
	24	Commanded Torque	Read-Only	
	25	Speed Feedback	Read-Only	
	26	Rated kW	Read-Only	
	27	Rated Volts	Read-Only	
	28	Rated Amps	Read-Only	
	29	Control SW Ver	Read-Only	
	40	Motor Type	0	Induction
*	***41***	***Motor NP Volts***		***Motor Nameplate***
*	***42***	***Motor NP FLA***		***Motor Nameplate***
*	***43***	***Motor NP Hertz***		***Motor Nameplate***
*	***44***	***Motor NP RPM***		***Motor Nameplate***
*	***45***	***Motor NP Power***		***Motor Nameplate***
	46	Mtr NP Pwr Units	0	Horsepower
	47	Motor OL Hertz		Motor NP Hz/3
	48	Motor OL Factor	100	1.0
	49	Motor Poles	4	Depending on Motor
	50	Motor OL Mode	0	XXXXXXXX XXXXXXX0
	53	Motor Cntl Sel	0	Sensrls Vect
	54	Maximum Voltage		From Drive Nameplate
	55	Maximum Freq	600	60.0
	56	Compensation	3	XXXXXXXX XXXXX011
	57	Flux Up Mode	0	Manual
	58	Flux Up Time	0	0.00 Secs
	59	SV Boost Filter	500	500
	61	Autotune	3	Calculate
	62	IR Voltage Drop	24	Based on Drive Rating

	63	Flux Current Ref	750	Based on Drive Rating
	64	Ixo Voltage Drop	Read-Only	Based on Drive Rating
	66	Autotune Torque	500	50.0%
	67	Inertia Autotune	0	Ready
	69	Start/Acc Boost	46	Based on Drive Rating
	70	Run Boost	46	Based on Drive Rating
	71	Break Voltage	1150	[Motor NP Volts] × 0.25
	72	Break Frequency	150	[Motor NP Volts] × 0.25
	79	Speed Units	0	Hz
	80	Feedback Select	0	Open Loop
	81	Minimum Speed	0	0.0 Hz
*	***82***	***Maximum Speed***	***600***	***60.0 Hz***
	83	Overspeed Limit	0	0.0 Hz
	84	Skip Frequency 1	0	0.0 Hz
	85	Skip Frequency 2	0	0.0 Hz
	86	Skip Frequency 3	0	0.0 Hz
	87	Skip Freq Band	0	0.0 Hz
	88	Speed/Torque Mode	1	Speed Reg
	90	Speed Ref A Sel	2	Analog In 2
*	***91***	***Speed Ref A Hi***	***600***	***60.0 Hz***
	92	Speed Ref A Lo	0	0.0 Hz
	93	Speed Ref B Sel	11	Preset Spd1
	94	Speed Ref B Hi	600	60.0 Hz
	95	Speed Ref B Lo	0	0.0 Hz
	96	TB Man Ref Sel	1	Analog In 1
	97	TB Man Ref Hi	600	60.0 Hz
	98	TB Man Ref Lo	0	0.0 Hz
	99	Pulse Input Ref	Read-Only	
	100	Jog Speed 1	100	10.0 Hz
*	***101***	***Preset Speed 1***	***600***	***60.0 Hz***
	102	Preset Speed 2	100	10.0 Hz
	103	Preset Speed 3	200	20.0 Hz
	104	Preset Speed 4	300	30.0 Hz
	105	Preset Speed 5	400	40.0 Hz
	106	Preset Speed 6	500	50.0 Hz
	107	Preset Speed 7	600	60.0 Hz
	108	Jog Speed 2	100	10.0 Hz
	116	Trim % Setpoint	0	0.0%
	117	Trim In Select	2	Analog In 2
	118	Trim Out Select	0	XXXXXXXX XXXXXX00
	119	Trim Hi	600	60.0 Hz
	120	Trim Lo	0	0.0 Hz
	121	Slip RPM @ FLA	360	Based on [Motor NP RPM
	122	Slip Comp Gain	400	40
	123	Slip RPM Meter	Read-Only	
	124	PI Configuration	0	XXXXXXXX 00000000
	125	PI Control	0	XXXXXXXX XXXXX000
	126	PI Reference Sel	0	PI Setpoint
	127	PI Setpoint	500	50.0%
	128	PI Feedback Sel	0	PI Setpoint
	129	PI Integral Time	200	2.00 Secs
	130	PI Prop Gain	100	1.00

	131	PI Lower Limit	-100	-100.0%
	132	PI Upper Limit	100	100.0%
	133	PI Preload	0	0.0 Hz
	134	PI Status	Read-Only	
	135	PI Ref Meter	Read-Only	
	136	PI Fdback Meter	Read-Only	
	137	PI Error Meter	Read-Only	
	138	PI Output Meter	Read-Only	
	139	PI BW Filter	0	0.0 Radians
*	***140***	***Accel Time 1***	***30***	***3.0 Secs***
	141	Accel Time 2	100	10.0 Secs
*	***142***	***Decel Time 1***	***30***	***3.0 Secs***
	143	Decel Time 2	100	10.0 Secs
	145	DB While Stopped	0	Disabled
	146	S Curve	0	0%
	147	Current Lmt Sel	0	Cur Lim Val
	148	Current Lmt Val		Rated amps x 1.5
	149	Current Lmt Gain	250	250
	150	Drive OL Mode	3	Both-PWM 1st
	151	PWM Frequency	4	4
	152	Droop RPM @ FLA	0.0	0.0 RPM
	153	Regen Power Lim	-500	-50.0%
	154	Current Rate Lim	4000	400.0%
	155	Stop/Brk Mode A	1	Ramp
	156	Stop/Brk Mode B	0	Coast
	157	DC Brake Lvl Sel	0	DC Brake Lvl
	158	DC Brake Level		[Rated Amps]
	159	DC Brake Time	0	0.0 Secs
	160	Bus Reg Ki	450	450
	161	Bus Reg Mode A	1	Adjust Freq
	162	Bus Reg Mode B	4	Both-Frq 1st
	163	DB Resistor Type	2	None
	164	Bus Reg Kp	1500	1500
	165	Bus Reg Kd	1000	1000
	166	Flux Braking	0	Disabled
	167	Powerup Delay	0	0.0 Sec
*	***168***	***Start At PowerUp***	***1***	***Enabled***
*	***169***	***Flying Start En***	***1***	***Enabled***
	170	Flying StartGain	4000	4000
*	***174***	***Auto Rstrt Tries***	0	***1***
	175	Auto Rstrt Delay	10	1.0 Secs
	176	Reserved	Read-Only	
	177	Gnd Warn Level	30	3.0 Amps
	178	Sleep Wake Mode	0	Disabled
	179	Sleep Wake Ref	2	Analog In 2
	180	Wake Level		6.000 mA, 6.000 Volts
	181	Wake Time	1	1.0 Secs
	182	Sleep Level		5.000 mA, 5.000 Volts
	183	Sleep Time	0	1.0 Secs
	184	Power Loss Mode	0	Coast
	185	Power Loss Time	5	0.5 Secs
	186	Power Loss Level	Read-Only	Drive Rated Volts

	187	Load Loss Level	2000	200.0%
	188	Load Loss Time	0	0.0 Sec
	189	Shear Pin Time	0	0.0 Sec
*	***190***	***Direction Mode***	***2***	***Reverse Dis***
	191	Reserved	Read-Only	
	192	Save HIM Ref	1	XXXXXXXX XXXXXXX1
	193	Man Ref Preload	0	Disabled
	194	Save MOP Ref	0	XXXXXXXX XXXXXX00
	195	MOP Rate	10	1.0 Hz/s
*	***196***	***Param Access Lvl***	***1***	***Advanced***
	197	Reset To Defaults	0	Ready
	198	Load Frm Usr Set	0	Ready
	199	Save To User Set	0	Ready
	200	Reset Meters	0	Ready
	201	Language	1	English
	202	Voltage Class	3	Based on Drive Cat. No.
	203	Drive Checksum	Read-Only	
	204	Dyn UsrSet Cnfg		XXXXXXXX XXXXXX00
	205	Dyn UsrSet Sel		XXXXXXXX XXXXXX00
	206	Dyn UserSet Actv	Read-Only	XXXXXXXX XXXXXX00
	207	Reserved	Read-Only	
	208	Reserved	Read-Only	
	209	Drive Status 1	Read-Only	
	210	Drive Status 2	Read-Only	
	211	Drive Alarm 1	Read-Only	
	212	Drive Alarm 2	Read-Only	
	213	Speed Ref Source	Read-Only	
	214	Start Inhibits	Read-Only	
	215	Last Stop Source	Read-Only	
	216	Dig In Status	Read-Only	
	217	Dig Out Status	Read-Only	
	218	Drive Temp	Read-Only	
	219	Drive OL Count	Read-Only	
	220	Motor OL Count	Read-Only	
	221	Mtr OL Trip Time	Read-Only	
	222	Drive Status 3	Read-Only	
	223	Status 3 @ Fault	Read-Only	
	224	Fault Speed	Read-Only	
	225	Fault Amps	Read-Only	
	226	Fault Bus Volts	Read-Only	
	227	Status 1 @ Fault	Read-Only	
	228	Status 2 @ Fault	Read-Only	
	229	Alarm 1 @ Fault	Read-Only	
	230	Alarm 2 @ Fault	Read-Only	
	231	Reserved	Read-Only	
	232	Reserved	Read-Only	
	233	Reserved	Read-Only	
	234	Testpoint 1 Sel	499	499
	235	Testpoint 1 Data	Read-Only	
	236	Testpoint 2 Sel	499	499
	237	Testpoint 2 Data	Read-Only	
	238	Fault Config 1	74	XXXXXXXX X1001010

	239	Reserved	Read-Only	
	240	Fault Clear	0	Ready
	241	Fault Clear Mode	1	Enabled
	242	Power Up Marker	Read-Only	
	243	Fault 1 Code	Read-Only	
	244	Fault 1 Time	Read-Only	
	245	Fault 2 Code	Read-Only	
	246	Fault 2 Time	Read-Only	
	247	Fault 3 Code	Read-Only	
	248	Fault 3 Time	Read-Only	
	249	Fault 4 Code	Read-Only	
	250	Fault 4 Time	Read-Only	
	251	Fault 5 Code	Read-Only	
	252	Fault 5 Time	Read-Only	
	253	Fault 6 Code	Read-Only	
	254	Fault 6 Time	Read-Only	
	255	Fault 7 Code	Read-Only	
	256	Fault 7 Time	Read-Only	
	257	Fault 8 Code	Read-Only	
	258	Fault 8 Time	Read-Only	
	259	Alarm Config 1	959	XXXXXX00 0X000000
	260	Reserved	Read-Only	
	261	Alarm Clear	0	Ready
	262	Alarm 1 Code	Read-Only	
	263	Alarm 2 Code	Read-Only	
	264	Alarm 3 Code	Read-Only	
	265	Alarm 4 Code	Read-Only	
	266	Alarm 5 Code	Read-Only	
	267	Alarm 6 Code	Read-Only	
	268	Alarm 7 Code	Read-Only	
	269	Alarm 8 Code	Read-Only	
	270	DPI Data Rate	1	500 kbps
	271	Drive Logic Rslt	Read-Only	
	272	Drive Ref Rslt	Read-Only	
	273	Drive Ramp Rslt	Read-Only	
	274	DPI Port Select	1	DPI Port 1
	275	DPI Port Value	Read-Only	
	276	Logic Mask	63	XXXXXXXX XX111111
	277	Start Mask	63	XXXXXXXX XX111111
	278	Jog Mask	63	XXXXXXXX XX111111
*	***279***	***Direction Mask***	***0***	***XXXXXXXX XX000000***
	280	Reference Mask	63	XXXXXXXX XX111111
	281	Accel Mask	63	XXXXXXXX XX111111
	282	Decel Mask	63	XXXXXXXX XX111111
	283	Fault Clr Mask	63	XXXXXXXX XX111111
	284	MOP Mask	63	XXXXXXXX XX111111
	285	Local Mask	63	XXXXXXXX XX111111
	286	Reserved	Read-Only	
	287	Reserved	Read-Only	
	288	Stop Owner	Read-Only	
	289	Start Owner	Read-Only	
	290	Jog Owner	Read-Only	

	291	Direction Owner	Read-Only	
	292	Reference Owner	Read-Only	
	293	Accel Owner	Read-Only	
	294	Decel Owner	Read-Only	
	295	Fault Clr Owner	Read-Only	
	296	MOP Owner	Read-Only	
	297	Local Owner	Read-Only	
	298	DPI Ref Select	0	Max Freq
	299	DPI Fdbk Select	17	Speed Fdbk
	300	Data In A1	0	
	301	Data In A2	0	
	302	Data In B1	0	
	303	Data In B2	0	
	304	Data In C1	0	
	305	Data In C2	0	
	306	Data In D1	0	
	307	Data In D2	0	
	308	HighRes Ref	0	0
	309	Reserved	Read-Only	
	310	Data Out A1	0	Disabled
	311	Data Out A2	0	Disabled
	312	Data Out B1	0	Disabled
	313	Data Out B2	0	Disabled
	314	Data Out C1	0	Disabled
	315	Data Out C2	0	Disabled
	316	Data Out D1	0	Disabled
	317	Data Out D2	0	Disabled
	318	Reserved	Read-Only	
	319	Reserved	Read-Only	
*	***320***	***Anlg In Config***	***3***	***XXXXXXXX XXXXXX11***
	321	Anlg In Sqr Root	0	XXXXXXXX XXXXXX00
*	***322***	***Analog In 1 Hi***	***20000***	***20.000***
*	***323***	***Analog In 1 Lo***	***4000***	***4.000***
	324	Analog In 1 Loss	0	Disabled
*	***325***	***Analog In 2 Hi***	***20000***	***20.000***
*	***326***	***Analog In 2 Lo***	***4000***	***4.000***
*	***327***	***Analog In 2 Loss***	***5***	***Goto Preset1***
	340	Anlg Out Config	3	XXXXXXXX XXXXXX11
	341	Anlg Out Absolut	3	XXXXXXXX XXXXXX10
	342	Analog Out1 Sel	0	Output Freq
	343	Analog Out1 Hi	20000	20.00 mA
	344	Analog Out1 Lo	4000	4.00 mA
	345	Analog Out2 Sel	0	Output Freq
	346	Analog Out2 Hi	1000	10.000
	347	Analog Out2 Lo	0	0.000
	348	Reserved	Read-Only	
	349	Reserved	Read-Only	
	350	Reserved	Read-Only	
	351	Reserved	Read-Only	
	352	Reserved	Read-Only	
	353	Reserved	Read-Only	
	354	Anlg Out1 Scale	0	0.0

	355	Anlg Out2 Scale	0	0.0
	356	Reserved	Read-Only	
	357	Reserved	Read-Only	
	358	Reserved	Read-Only	
	359	Reserved	Read-Only	
	360	Reserved	Read-Only	
*	***361***	***Digital In1 Sel***	***2***	***Clear Faults***
*	***362***	***Digital In2 Sel***	***7***	***Run***
*	***363***	***Digital In3 Sel***	***0***	***Not Used***
	364	Digital In4 Sel	15	Speed Sel 1
	365	Digital In5 Sel	16	Speed Sel 2
	366	Digital In6 Sel	17	Speed Sel 3
	367	Reserved	Read-Only	
	368	Reserved	Read-Only	
	369	Reserved	Read-Only	
	370	Reserved	Read-Only	
	371	Reserved	Read-Only	
	372	Reserved	Read-Only	
	373	Reserved	Read-Only	
	374	Reserved	Read-Only	
	375	Reserved	Read-Only	
	376	Reserved	Read-Only	
	377	Anlg Out1 Setpt	0	20.000 mA, 10.000 Volts
	378	Anlg Out2 Setpt	0	20.000 mA, 10.000 Volts
	379	Dig Out Setpt	Read-Only	XXXXXXXX XXXXX000
*	***380***	***Digital Out1 Sel***	***2***	***Alarm***
	381	Dig Out1 Level	0	0.0
	382	Dig Out1 OnTime	0	0.00 Secs
	383	Dig Out1 OffTime	0	0.00 Secs
	384	Digital Out2 Sel	4	Run
	385	Dig Out2 Level	0	0
	386	Dig Out2 OnTime	0	0.00 Secs
	387	Dig Out2 OffTime	0	0.00 Secs
	388	Digital Out3 Sel	4	Run
	389	Dig Out3 Level	0	0
	390	Dig Out3 OnTime	0	0.00 Secs
	391	Dig Out3 OffTime	0	0.00 Secs
	392	Dig Out Invert	0	XXXXXXXX XXXXX000
	393	Dig Out Param	0	PI Config
	394	Dig Out Mask	0	00000000 00000000
	411	DigIn DataLogic	0	XX000000 XX000000
	412	Motor Fdbk Type	0	Quadrature
	413	Encoder PPR	1024	1024 PPR
	414	Enc Pos Feedback	Read-Only	
	415	Encoder Speed	Read-Only	
	416	Fdbk Filter Sel	0	None
	419	Notch FilterFreq	0	0.0Hz
	420	Notch Filter K	0.3	0.3 Hz
	421	Marker Pulse	Read-Only	
	422	Pulse In Scale	64	64
	423	Encoder Z Chan	0	Pulse Input
	427	Torque Ref A Sel	0	Torque Stpt1

428	Torque Ref A Hi	1000	100.0%
429	Torque Ref A Lo	0	0.0%
430	Torq Ref A Div	1	1.0
431	Torque Ref B Sel	24	Disabled
432	Torque Ref B Hi	1000	100.0%
433	Torque Ref B Lo	0	0.0%
434	Torque Ref B Mult	10	1.0
435	Torque Setpoint1	0	0.0%
436	Pos Torque Limit	2000	200.0%
437	Neg Torque Limit	-2000	–200.0%
438	Torque Setpoint2	0	0.0%
440	Control Status	Read-Only	
441	Mtr Tor Cur Ref	Read-Only	
445	Ki Speed Loop	70	7.0
446	Kp Speed Loop	63	6.3
447	Kf Speed Loop	0	0
448	Spd Err Filt BW	2000	200.0 R/s
449	Speed Desired BW	0	0.0 Radians/Sec
450	Total Inertia	0.10	0.10
451	Speed Loop Meter	Read-Only	
454	Rev Speed Limit	0	0.0 RPM
459	PI Deriv Time	0	0.00 Secs
460	PI Reference Hi	1000	100.0%
461	PI Reference Lo	-1000	-100.0%
462	PI Feedback Hi	1000	100.0%
463	PI Feedback Lo	0	0.0%
464	PI Output Gain	1000	1.000
476	Scale1 In Value	0	0.0
477	Scale1 In Hi	0	0.0
478	Scale1 In Lo	0	0.0
479	Scale1 Out Hi	0	0.0
480	Scale1 Out Lo	0	0.0
481	Scale1 Out Value	Read-Only	
482	Scale2 In Value	0	0.0
483	Scale2 In Hi	0	0.0
484	Scale2 In Lo	0	0.0
485	Scale2 Out Hi	0	0.0
486	Scale2 Out Lo	0	0.0
487	Scale2 Out Value	Read-Only	
488	Scale3 In Value	0	0.0
489	Scale3 In Hi	0	0.0
490	Scale3 In Lo	0	0.0
491	Scale3 Out Hi	0	0.0
492	Scale3 Out Lo	0	0.0
493	Scale3 Out Value	Read-Only	
494	Scale4 In Value	0	0.0
495	Scale4 In Hi	0	0.0
496	Scale4 In Lo	0	0.0
497	Scale4 Out Hi	0	0.0
498	Scale4 Out Lo	0	0.0
499	Scale4 Out Value	Read-Only	
595	Port Mask Act	Read-Only	

596	Write Mask Cfg	Read-Only	XXXXXXXX XX11111X
597	Write Mask Act	Read-Only	
598	Logic Mask Act	Read-Only	XXXXXXXX XX111111

PARAMETERS 600 and above NOT applicable

A.4 - PF 753

All IO wiring to module in Port 5 24V IO Module - 20-750-2262C-2R = Port 5

Set Input mode jmpers Ai0 & Ai1 to Current Mode (Port 5)

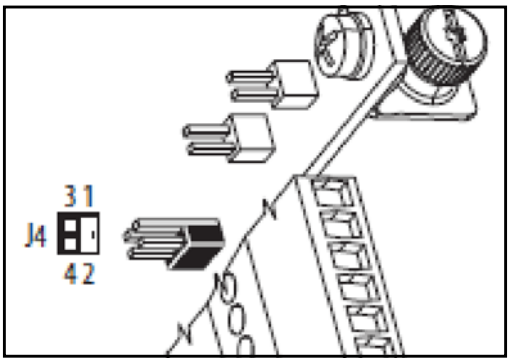
PowerFlex 753 Drive - ADAC 1000

	Par. No.	Parameter Name	Raw Value	Real Value	NOTES
		Drive (Port 0) Monitor File			
	1	Output Freq	Read-Only		
	2	Commanded SpdRef	Read-Only		
	3	Mtr Vel Fdbk	Read-Only		
	4	Commanded Trq	Read-Only		
	5	Torque Cur Fdbk	Read-Only		
	6	Flux Cur Fdbk	Read-Only		
	7	Output Current	Read-Only		
	8	Output Voltage	Read-Only		
	9	Output Power	Read-Only		
	10	Output Powr Fctr	Read-Only		
	11	DC Bus Volts	Read-Only		
	12	DC Bus Memory	Read-Only		
	13	Elapsed MWH	Read-Only		
	14	Elapsed KWH	Read-Only		
	15	Elapsed Run Time	Read-Only		
	16	Elpsd Mtr MWHrs	Read-Only		
	17	Elpsd Rgn MWHrs	Read-Only		
	18	Elpsd Mtr kWHrs	Read-Only		
	19	Elpsd Rgn kWHrs	Read-Only		
	20	Rated Volts	Read-Only		
	21	Rated Amps	Read-Only		
	22	Rated kW	Read-Only		
		Drive (Port 0) Motor Control			
*	***25***	***Motor NP Volts***	***Drive Rating***	***Motor Nameplate***	
*	***26***	***Motor NP Amps***	***Drive Rating***	***Motor Nameplate***	
*	***27***	***Motor NP Hertz***	***Drive Rating***	***Motor Nameplate***	
*	***28***	***Motor NP RPM***	***Drive Rating***	***Motor Nameplate***	
*	***29***	***Mtr NP Pwr Units***	***0***	***Horsepower***	
*	***30***	***Motor NP Power***	***Drive Rating***	***Motor Nameplate***	
*	***31***	***Motor Poles***	***4***	***2***	If motor RPM =3600 Motor Poles = 2
	35	Motor Ctrl Mode	Induction SV	1	If motor RPM =1750 Motor Poles = 4
	36	Maximum Voltage	Drive Rating	From Drive Nameplate	
*	***37***	***Maximum Freq***		***60***	
	38	PWM Frequency	Drive Rating	2	
	40	Mtr Options Cfg			
	42	Bus Utilization	95%		
	43	Flux Up Enable	1	Automatic	
	44	Flux Up Time	0.0000	Secs	
	45	Flux Down Ki	0.20		
	46	Flux Down Kp	150.0		
	47	Econ At Ref Ki	305.0		
	48	Econ AccDec Ki	200.0		
	49	Econ AccDec Kp	100.0	V/A	
	50	Stability Filter	5162.22	Secs	
	51	Stab Volt Gain	5322.22		

52	Stab Angle Gain	790.43	
1648	IPM V FB HP Filt	15.0	
1649	IPM SpdEst Filt	1000.0	R/S
1650	IPM SpdEst Kp	30.0	
1651	IPM SpdEst Ki	2500.0	
1652	IPM SpdEst KiAdj	75.0	
1653	IPM Tran PWM	8.0	Hz
1654	IPMTran PWM Hyst	2.0	Hz
1655	IPM Tran Mode	4.0	Hz
1656	IPM TranMod Hyst	3.0	Hz
1657	IPM Tran Filt Lo	35.0	R/S
1658	IPM Tran Filt Hi	1000.0	R/S
1659	IPM Tran Angle	100.0	Cnts
1660	IPM Stc OfsTst K	1.0	
1661	IPM Lq Cmd BW	10.0	R/S
60	Start Acc Boost	Drive Rating	VAC
61	Run Boost	Drive Rating	VAC
62	Break Voltage	Drive Rating	VAC
63	Break Frequency	NP Hz x 0.25	Hz
64	SVC Boost Filter	0.1000	Secs
65	VHz Curve	0	Custom V/Hz
70	Autotune	1	Calculate
71	Autotune Torque	50.00	%
73	IR Voltage Drop	Drive Rating	Volt
74	Ixo Voltage Drop	Drive Rating	VAC
75	Flux Current Ref	NP Amp x .35	Amps
76	Total Inertia	2.00	Secs
77	Inertia Test Lmt	0.0	Revs
78	Encdrlss AngComp	0.0000	Rad
79	Encdrlss VltComp	Drive Rating	VAC
80	PM Cfg		
81	PM PriEnc Offset	0	
82	PM AltEnc Offset	0	
83	PM OfstTst Cur	40.00	%
84-93	Parameters Not Modified Leave as Default		
1630-1636	Parameters Not Modified Leave as Default		
1646-1647	Parameters Not Modified Leave as Default		
95-120	Parameters Not Modified Leave as Default		
1629-1645	Parameters Not Modified Leave as Default		
Drive (Port 0) Feedback & I/O			
125-149	Parameters Not Used Leave as Default		
150	Digital In Cfg	0	Run Edge
155	DI Enable	0.00	
156	DI Clear Fault	0.00	
157	DI Aux Fault	0.00	
158	DI Stop	0.00	
159	DI Cur Lmt Stop	0.00	
160	DI Coast Stop	0.00	
161	DI Start - (3-wire control)	0.00	
162	DI Fwd Reverse	0.00	
* ***163***	***DI Run - (2-wire control)***	***0.00***	***Port 5 I/O Module 24V - Dig Status - Input 0***
164	DI Run Forward	0.00	

	165	DI Run Reverse	0.00	
	166	DI Jog 1	0.00	
	167	DI Jog 1 Forward	0.00	
	168	DI Jog 1 Reverse	0.00	
	169	DI Jog 2	0.00	
	170	DI Jog 2 Forward	0.00	
	171	DI Jog 2 Reverse	0.00	
	172	DI Manual Ctrl	0.00	
	173	DI Speed Sel 0	0.00	
*	***174***	***DI Speed Sel 1***		***Port 5 I/O Module 24V - Dig Status - Input 1***
	175	DI Speed Sel 2	0.00	
	176	DI HOA Start	0.00	
	177	DI MOP Inc	0.00	
	178	DI MOP Dec	0.00	
	179	DI Accel 2	0.00	
	180	DI Decel 2	0.00	
	181	DI SpTqPs Sel 0	0.00	
	182	DI SpTqPs Sel 1	0.00	
	185	DI Stop Mode B	0.00	
	186	DI BusReg Mode B	0.00	
	187	DI PwrLoss ModeB	0.00	
	188	DI Pwr Loss	0.00	
	189	DI Precharge	0.00	
	190	DI Prchrg Seal	0.00	
	191	DI PID Enable	0.00	
	192	DI PID Hold	0.00	
	193	DI PID Reset	0.00	
	194	DI PID Invert	0.00	
	195	DI Torque StptA	0.00	
	196	DI Fwd End Limit	0.00	
	197	DI Fwd Dec Limit	0.00	
	198	DI Rev End Limit	0.00	
	199	DI Rev Dec Limit	0.00	
	200	DI PHdwr OvrTrvl	0.00	
	201	DI NHdwr OvrTrvl	0.00	
	220-292	Parameters Not Modified Leave as Default		
		Drive (Port 0) CFG File		
*	***301***	***Access Level***	***1***	***Advanced***
*	***302***	***Language***		***English***
	305-306	Parameters Not Modified Leave as Default		
*	***308***	***Direction Mode***	***2***	***Rev Disable***
	309-347	Parameters Not Modified Leave as Default		
*	***348***	***Auto Rstrt Tries***	***2***	
*	***349***	***Auto Rstrt Delay***	***3.00***	***Secs***
	350-355	Parameters Not Modified Leave as Default		
*	***356***	***FlyingStart Mode***	***1***	***Enhanced***
	357-364	Parameters Not Modified Leave as Default		
*	***370***	***Stop Mode A***	***0***	***Coast***
	371-409	Parameters Not Modified Leave as Default		
		Drive (Port 0) Protection File		
	410-519	Parameters Not Modified Leave as Default		
		Drive (Port 0) Speed Control		

*	520	Max Fwd Speed	60.00	Hz	
	521-523	Parameters Not Modified Leave as Default			
*	524	Overspeed Limit	0.00	Hz	
	525-529	Parameters Not Modified Leave as Default			
*	535	Accel Time 1	3.00	Secs	
	536	Parameters Not Modified Leave as Default			J4 Jumper - Jumper Pins 1 and 2 (see illustration)
*	537	Decel Time 1	3.00	Secs	
	538-541	Parameters Not Modified Leave as Default			24VDC Input/Output Module - Slot5
*	545	Spd Ref A Sel		Port 05 - Analog In0 Value	
	546-572	Parameters Not Used Leave as Default			
*	550	Spd Ref B Sel		Port 0 - Preset Speed 1	
*	571	Preset Speed 1	60.0	Hz	
	574-END	Parameters Not Used Leave as Default			
		Optional Module Port 5 - I/O Module Parameters			
*	6	Dig Out Invert		xxxxxxxxxxxxxx01	Note: To adjust these parameters must use the < > arrow keys to access port 5
*	10	RO0 Sel		Port 0 -P935 Drive Status 1 - Bit 7 (faulted)	Note: To adjust these parameters must use the < > arrow keys to access port 5
*	20	RO1 Sel		Port 0 -P935 Drive Status 1 - Bit 16 (running)	
*	45	Anlg In Type		xxxxxxxxxxxxxx11	Determined by Jumper Ai0 and Ai1 both set to Current
*	52	Anlg In0 Lo	4.000	mA	
*	53	Anlg In0 LssActn	8	"Set Input Hi"	
*	70	Anlg Out Type		0000000000000011	
*	71	Anlg Out Abs		0000000000000011	
*	75	Anlg Out0 Sel		Port 0 - Output Frequency	
	78	Anlg Out0 DataHi	60.00	Hz	
*	79	Anlg Out0 DataLo	0.00	Hz	
*	81	Anlg Out0 Lo	4.000	mA	



APPENDIX B - ADAC 1000 ProtoNode Tags

Tag list for use with the Cleaver-Brooks ProtoNode protocol translator.

A-B					BACnet			Modbus
Address	Description	Origin	Data Type	Units	Obj ID	Data Type		Address
	Alarms							
	Deareator Status							
DAB1[0].0	Deaerator Level BAD QUALITY	ADAC 1000	Boolean		1	DI		10001
DAB1[0].1	Deaerator Level HIGH	ADAC 1000	Boolean		2	DI		10002
DAB1[0].2	Deaerator Level LOW	ADAC 1000	Boolean		3	DI		10003
DAB1[0].3	Deaerator Level LOW-LOW (LWCO)	ADAC 1000	Boolean		4	DI		10004
DAB1[0].4	Feed Pump 1 FAULT	ADAC 1000	Boolean		5	DI		10005
DAB1[0].5	Feed Pump 2 FAULT	ADAC 1000	Boolean		6	DI		10006
DAB1[0].6	Feed Pump 3 FAULT	ADAC 1000	Boolean		7	DI		10007
DAB1[0].7	Feed Pump 4 FAULT	ADAC 1000	Boolean		8	DI		10008
DAB1[0].8	Feed Pump 5 FAULT	ADAC 1000	Boolean		9	DI		10009
DAB1[0].9	Feed Pump 6 FAULT	ADAC 1000	Boolean		10	DI		10010
DAB1[0].10	Feed Pump 1 OVERLOAD	ADAC 1000	Boolean		11	DI		10011
DAB1[0].11	Feed Pump 2 OVERLOAD	ADAC 1000	Boolean		12	DI		10012
DAB1[0].12	Feed Pump 3 OVERLOAD	ADAC 1000	Boolean		13	DI		10013
DAB1[0].13	Feed Pump 4 OVERLOAD	ADAC 1000	Boolean		14	DI		10014
DAB1[0].14	Feed Pump 5 OVERLOAD	ADAC 1000	Boolean		15	DI		10015
DAB1[0].15	Feed Pump 6 OVERLOAD	ADAC 1000	Boolean		16	DI		10016
DAB1[1].0	Spare	ADAC 1000	Boolean		17	DI		10017
DAB1[1].1	Spare	ADAC 1000	Boolean		18	DI		10018
DAB1[1].2	Spare	ADAC 1000	Boolean		19	DI		10019
DAB1[1].3	Deaerator Temperature BAD QUALITY	ADAC 1000	Boolean		20	DI		10020
DAB1[1].4	Deaerator Temperature LOW	ADAC 1000	Boolean		21	DI		10021
DAB1[1].5	Deaerator Temperature HIGH	ADAC 1000	Boolean		22	DI		10022
DAB1[1].6	Deaerator Pressure BAD QUALITY	ADAC 1000	Boolean		23	DI		10023
DAB1[1].7	Deaerator Pressure LOW	ADAC 1000	Boolean		24	DI		10024
DAB1[1].8	Deaerator Pressure HIGH	ADAC 1000	Boolean		25	DI		10025
DAB1[1].9	Boiler Feed Water Header Pressure BQ	ADAC 1000	Boolean		26	DI		10026
DAB1[1].10	Boiler Feed Water Header Pressure LOW	ADAC 1000	Boolean		27	DI		10027
DAB1[1].11	Boiler Feed Water Header Pressure HIGH	ADAC 1000	Boolean		28	DI		10028
DAB1[1].12	Tray Temperature/User Def 0 Bad Quality	ADAC 1000	Boolean		29	DI		10029
DAB1[1].13	Tray Temperature/User Def 0 LOW	ADAC 1000	Boolean		30	DI		10030
DAB1[1].14	Tray Temperature/User Def 0 HIGH	ADAC 1000	Boolean		31	DI		10031
DAB1[1].15	Reserved for CB - ADAC 1000 Single	ADAC 1000	Boolean		32	DI		10032
DAB1[2].0	Feed Pump 1 VSD Bypass	ADAC 1000	Boolean		33	DI		10033
DAB1[2].1	Feed Pump 2 VSD Bypass	ADAC 1000	Boolean		34	DI		10034
DAB1[2].2	Feed Pump 3 VSD Bypass	ADAC 1000	Boolean		35	DI		10035
DAB1[2].3	Feed Pump 4 VSD Bypass	ADAC 1000	Boolean		36	DI		10036
DAB1[2].4	Feed Pump 5 VSD Bypass	ADAC 1000	Boolean		37	DI		10037
DAB1[2].5	Feed Pump 6 VSD Bypass	ADAC 1000	Boolean		38	DI		10038
DAB1[2].6	Tray Pressure/User Def 1 Bad Quality	ADAC 1000	Boolean		39	DI		10039
DAB1[2].7	Tray Pressure/User Def 1 LOW	ADAC 1000	Boolean		40	DI		10040
DAB1[2].8	Tray Pressure/User Def 1 HIGH	ADAC 1000	Boolean		41	DI		10041
DAB1[2].9	Transfer Pump 1 VSD Bypass	ADAC 1000	Boolean		42	DI		10042

DAB1[2].10	Transfer Pump 2 VSD Bypass	ADAC 1000	Boolean		43	DI		10043
DAB1[2].11	Transfer Pump 3 VSD Bypass	ADAC 1000	Boolean		44	DI		10044
DAB1[2].12	Feed Pump Lead Lag Write Permissive	ADAC 1000	Boolean		45	DI		10045
DAB1[2].13		ADAC 1000	Boolean		46	DI		10046
DAB1[2].14	BMS Heartbeat Fault	ADAC 1000	Boolean		47	DI		10047
DAB1[2].15	ADAC PLC Heartbeat to BMS	ADAC 1000	Boolean		48	DI		10048
DAB1[3].0	Feed Pump 1 ON	ADAC 1000	Boolean		49	DI		10049
DAB1[3].1	Feed Pump 2 ON	ADAC 1000	Boolean		50	DI		10050
DAB1[3].2	Feed Pump 3 ON	ADAC 1000	Boolean		51	DI		10051
DAB1[3].3	Feed Pump 4 ON	ADAC 1000	Boolean		52	DI		10052
DAB1[3].4	Feed Pump 5 ON	ADAC 1000	Boolean		53	DI		10053
DAB1[3].5	Feed Pump 6 ON/DA Bypass	ADAC 1000	Boolean		54	DI		10054
DAB1[3].6	Feed Pump 1 In AUTO	ADAC 1000	Boolean		55	DI		10055
DAB1[3].7	Feed Pump 2 In AUTO	ADAC 1000	Boolean		56	DI		10056
DAB1[3].8	Feed Pump 3 In AUTO	ADAC 1000	Boolean		57	DI		10057
DAB1[3].9	Feed Pump 4 In AUTO	ADAC 1000	Boolean		58	DI		10058
DAB1[3].10	Feed Pump 5 In AUTO	ADAC 1000	Boolean		59	DI		10059
DAB1[3].11	Feed Pump 6 In AUTO	ADAC 1000	Boolean		60	DI		10060
DAB1[3].12	Deaerator No Alarms Relay OK	ADAC 1000	Boolean		61	DI		10061
DAB1[3].13	Yellow Stack Light ON	ADAC 1000	Boolean		62	DI		10062
DAB1[3].14	Green Stack Light ON	ADAC 1000	Boolean		63	DI		10063
DAB1[3].15	Red Stack Light ON	ADAC 1000	Boolean		64	DI		10064
DAB1[4].0	Chemical Feed ON	ADAC 1000	Boolean		65	DI		10065
DAB1[4].1	Deaerator Feed Water Valve Open	ADAC 1000	Boolean		66	DI		10066
DAB1[4].2	Feed Pumps ALT MODE ON	ADAC 1000	Boolean		67	DI		10067
DAB1[4].3	DA Low-Low Water Cutoff Relay Energized	ADAC 1000	Boolean		68	DI		10068
DAB1[4].4	Deaerator 2nd Feed Water Valve Open	ADAC 1000	Boolean		69	DI		10069
DAB1[4].5	Boiler Feed Pump 1 Flow Fault	ADAC 1000	Boolean		70	DI		10070
DAB1[4].6	Boiler Feed Pump 2 Flow Fault	ADAC 1000	Boolean		71	DI		10071
DAB1[4].7	Boiler Feed Pump 3 Flow Fault	ADAC 1000	Boolean		72	DI		10072
DAB1[4].8	Boiler Feed Pump 4 Flow Fault	ADAC 1000	Boolean		73	DI		10073
DAB1[4].9	Boiler Feed Pump 5 Flow Fault	ADAC 1000	Boolean		74	DI		10074
DAB1[4].10	Boiler Feed Pump 6 Flow Fault	ADAC 1000	Boolean		75	DI		10075
DAB1[4].11	PLC Battery Low. Replace Battery	ADAC 1000	Boolean		76	DI		10076
DAB1[4].12	Feed Pump 1 VSD Speed Feedback Bad Q	ADAC 1000	Boolean		77	DI		10077
DAB1[4].13	Feed Pump 2 VSD Speed Feedback Bad Q	ADAC 1000	Boolean		78	DI		10078
DAB1[4].14	Feed Pump 3 VSD Speed Feedback Bad Q	ADAC 1000	Boolean		79	DI		10079
DAB1[4].15	Feed Pump 4 VSD Speed Feedback Bad Q	ADAC 1000	Boolean		80	DI		10080
DAB1[5].0	Feed Pump 5 VSD Speed Feedback Bad Q	ADAC 1000	Boolean		81	DI		10081
DAB1[5].1	Feed Pump 6 VSD Speed Feedback Bad Q	ADAC 1000	Boolean		82	DI		10082
DAB1[5].2	Recirculation Valve Close	ADAC 1000	Boolean		83	DI		10083
DAB1[5].3	Feed Pumps Lead Lag Enabled	ADAC 1000	Boolean		84	DI		10084
DAB1[5].4	Feed Pumps Auto Restart Enabled	ADAC 1000	Boolean		85	DI		10085
DAB1[5].5	Remote Set Point Active	ADAC 1000	Boolean		86	DI		10086
DAB1[5].6	User Def Ch2 Bad Quality	ADAC 1000	Boolean		87	DI		10087
DAB1[5].7	User Def Ch2 LOW	ADAC 1000	Boolean		88	DI		10088
DAB1[5].8	User Def Ch2 HIGH	ADAC 1000	Boolean		89	DI		10089
DAB1[5].9	User Def Ch3 Bad Quality	ADAC 1000	Boolean		90	DI		10090
DAB1[5].10	User Def Ch3 LOW	ADAC 1000	Boolean		91	DI		10091
DAB1[5].11	User Def Ch3 HIGH	ADAC 1000	Boolean		92	DI		10092
DAB1[5].12	Spare45	ADAC 1000	Boolean		93	DI		10093
DAB1[5].13	Spare46	ADAC 1000	Boolean		94	DI		10094

DAB1[5].14	Spare47	ADAC 1000	Boolean		95	DI		10095
DAB1[5].15	Reserved for CB - ADAC 1000 Dual	ADAC 1000	Boolean		96	DI		10096
DAB1[6].0	Surge Tank Level BAD QUALITY	ADAC 1000	Boolean		97	DI		10097
DAB1[6].1	Surge Tank Level HIGH	ADAC 1000	Boolean		98	DI		10098
DAB1[6].2	Surge Tank Level LOW	ADAC 1000	Boolean		99	DI		10099
DAB1[6].3	Surge Tank Temperature BAD QUALITY	ADAC 1000	Boolean		100	DI		10100
DAB1[6].4	Surge Tank Temperature LOW	ADAC 1000	Boolean		101	DI		10101
DAB1[6].5	Surge Tank Temperature HIGH	ADAC 1000	Boolean		102	DI		10102
DAB1[6].6	Transfer Pump 1 FAULT	ADAC 1000	Boolean		103	DI		10103
DAB1[6].7	Transfer Pump 2 FAULT	ADAC 1000	Boolean		104	DI		10104
DAB1[6].8	Transfer Pump 3 FAULT	ADAC 1000	Boolean		105	DI		10105
DAB1[6].9	Transfer Pump 1 OVERLOAD	ADAC 1000	Boolean		106	DI		10106
DAB1[6].10	Transfer Pump 2OVERLOAD	ADAC 1000	Boolean		107	DI		10107
DAB1[6].11	Transfer Pump 3OVERLOAD	ADAC 1000	Boolean		108	DI		10108
DAB1[6].12	Surge Tank LOW-LOW (LWCO)	ADAC 1000	Boolean		109	DI		10109
DAB1[6].13	Surge Tank Header Pressure HIGH	ADAC 1000	Boolean		110	DI		10110
DAB1[6].14	Surge Tank Header Pressure LOW	ADAC 1000	Boolean		111	DI		10111
DAB1[6].15	Surge Tank Header Pressure BAD QUALITY	ADAC 1000	Boolean		112	DI		10112
DAB1[7].0	Transfer Pump Lead Lag Write Permissive	ADAC 1000	Boolean		113	DI		10113
DAB1[7].1	PLC IO Module Fault	ADAC 1000	Boolean		114	DI		10114
DAB1[7].2	Spare	ADAC 1000	Boolean		115	DI		10115
DAB1[7].3	Surge 2nd Feed Water Valve Open	ADAC 1000	Boolean		116	DI		10116
DAB1[7].4	Transfer Pump 1 Flow Fault	ADAC 1000	Boolean		117	DI		10117
DAB1[7].5	Transfer Pump 2 Flow Fault	ADAC 1000	Boolean		118	DI		10118
DAB1[7].6	Transfer Pump 3 Flow Fault	ADAC 1000	Boolean		119	DI		10119
DAB1[7].7	Transfer Pump 1 VSD Speed Feedback BQ	ADAC 1000	Boolean		120	DI		10120
DAB1[7].8	Transfer Pump 2 VSD Speed Feedback BQ	ADAC 1000	Boolean		121	DI		10121
DAB1[7].9	Transfer Pump 3 VSD Speed Feedback BQ	ADAC 1000	Boolean		122	DI		10122
DAB1[7].10	Spare62	ADAC 1000	Boolean		123	DI		10123
DAB1[7].11	Spare63	ADAC 1000	Boolean		124	DI		10124
DAB1[7].12	Spare64	ADAC 1000	Boolean		125	DI		10125
DAB1[7].13	Transfer Pump 1 VSD Bypass	ADAC 1000	Boolean		126	DI		10126
DAB1[7].14	Transfer Pump 2 VSD Bypass	ADAC 1000	Boolean		127	DI		10127
DAB1[7].15	Transfer Pump 3 VSD Bypass	ADAC 1000	Boolean		128	DI		10128
DAB1[8].0	Surge Tank No Alarms Relay OK	ADAC 1000	Boolean		129	DI		10129
DAB1[8].1	Yellow Stack Light ON	ADAC 1000	Boolean		130	DI		10130
DAB1[8].2	Green Stack Light ON	ADAC 1000	Boolean		131	DI		10131
DAB1[8].3	RED Stack Light ON	ADAC 1000	Boolean		132	DI		10132
DAB1[8].4	Surge Tank Feed Water Valve Open	ADAC 1000	Boolean		133	DI		10133
DAB1[8].5	ST Low Low Water Cutoff Relay Energized	ADAC 1000	Boolean		134	DI		10134
DAB1[8].6	Transfer Pump 1 ON	ADAC 1000	Boolean		135	DI		10135
DAB1[8].7	Transfer Pump 2 ON	ADAC 1000	Boolean		136	DI		10136
DAB1[8].8	Transfer Pump 3 ON	ADAC 1000	Boolean		137	DI		10137
DAB1[8].9	Transfer Pump 1 In AUTO	ADAC 1000	Boolean		138	DI		10138
DAB1[8].10	Transfer Pump 2 In AUTO	ADAC 1000	Boolean		139	DI		10139
DAB1[8].11	Transfer Pump 3 In AUTO	ADAC 1000	Boolean		140	DI		10140
DAB1[8].12	Transfer Pumps ALT MODE ON	ADAC 1000	Boolean		141	DI		10141
DAB1[8].13	Transfer Pumps Lead Lag Enabled	ADAC 1000	Boolean		142	DI		10142
DAB1[8].14	Transfer Pumps Auto Restart Enabled	ADAC 1000	Boolean		143	DI		10143
DAB1[8].15	Spare70	ADAC 1000	Boolean		144	DI		10144
DAB1[9].0	Spare71	ADAC 1000	Boolean		145	DI		10145

DAB1[9].1	Spare72	ADAC 1000	Boolean		146	DI		10146
DAB1[9].2	Spare73	ADAC 1000	Boolean		147	DI		10147
DAB1[9].3	Spare74	ADAC 1000	Boolean		148	DI		10148
DAB1[9].4	Spare75	ADAC 1000	Boolean		149	DI		10149
DAB1[9].5	Spare76	ADAC 1000	Boolean		150	DI		10150
DAB1[9].6	Spare77	ADAC 1000	Boolean		151	DI		10151
DAB1[9].7	Spare78	ADAC 1000	Boolean		152	DI		10152
DAB1[9].8	Spare79	ADAC 1000	Boolean		153	DI		10153
DAB1[9].9	Spare80	ADAC 1000	Boolean		154	DI		10154
DAB1[9].10	Spare81	ADAC 1000	Boolean		155	DI		10155
DAB1[9].11	Spare82	ADAC 1000	Boolean		156	DI		10156
DAB1[9].12	Spare83	ADAC 1000	Boolean		157	DI		10157
DAB1[9].13	Spare84	ADAC 1000	Boolean		158	DI		10158
DAB1[9].14	Spare85	ADAC 1000	Boolean		159	DI		10159
DAB1[9].15	Spare86	ADAC 1000	Boolean		160	DI		10160
	Deaerator Values							
DAR1[0]	Feed Pump 1 Run Time	ADAC 1000	Real	Hours	1	AI		30001
DAR1[1]	Feed Pump 2 Run Time	ADAC 1000	Real	Hours	2	AI		30003
DAR1[2]	Feed Pump 3 Run Time	ADAC 1000	Real	Hours	3	AI		30005
DAR1[3]	Feed Pump 4 Run Time	ADAC 1000	Real	Hours	4	AI		30007
DAR1[4]	Feed Pump 5 Run Time	ADAC 1000	Real	Hours	5	AI		30009
DAR1[5]	Feed Pump 6 Run Time	ADAC 1000	Real	Hours	6	AI		30011
DAR1[6]	Spare	ADAC 1000	Real		7	AI		30013
DAR1[7]	Spare	ADAC 1000	Real		8	AI		30015
DAR1[8]	Spare	ADAC 1000	Real		9	AI		30017
DAR1[9]	Spare	ADAC 1000	Real		9	AI		30017
DAR1[10]	Stop Lag Feed Pump Limit	ADAC 1000	Real	PSI or %VSD	10	AI		30019
DAR1[11]	Alternate Feed Pumps	ADAC 1000	Real	Hours	11	AI		30021
DAR1[12]	Start DA Chemical Feed Time Delay	ADAC 1000	Real	Seconds	12	AI		30023
DAR1[13]	Stop DA Chemical Feed Time Delay	ADAC 1000	Real	Seconds	13	AI		30025
DAR1[14]	Spare	ADAC 1000	Real		14	AI		30027
DAR1[15]	Deaerator Temperature	ADAC 1000	Real	Degrees F	15	AI		30029
DAR1[16]	Deaerator Tank Pressure	ADAC 1000	Real	PSI	16	AI		30031
DAR1[17]	Deaerator Tank Water Level	ADAC 1000	Real	Inches	17	AI		30033
DAR1[18]	Deaerator Feed Water (MUV) Signal	ADAC 1000	Real	%	18	AI		30035
DAR1[19]	Deaerator Steam PRValve Signal	ADAC 1000	Real	%	19	AI		30037
DAR1[20]	Boiler Feed Water Header Pressure	ADAC 1000	Real	PSI	20	AI		30039
DAR1[21]	2nd Feed Water (MUV) Signal	ADAC 1000	Real	%	21	AI		30041
DAR1[22]	Start Lag Feed Pump Limit	ADAC 1000	Real	PSI or %VSD	22	AI		30043
DAR1[23]	DA Level - Pump Auto-Restart Level	ADAC 1000	Real	Inches	23	AI		30045
DAR1[24]	Boiler Feed Water Header Pressure SetPt	ADAC 1000	Real	PSI	24	AI		30047
DAR1[25]	Over Flow Valve Signal	ADAC 1000	Real	%	25	AI		30049
DAR1[26]	User Cfg 0 EU/Tray Temperature	ADAC 1000	Real	User Cfg/Deg F	26	AI		30051
DAR1[27]	User Cfg 1 EU/Tray Pressure	ADAC 1000	Real	User Cfg/PSI	27	AI		30053
DAR1[28]	User Cfg 2 EU	ADAC 1000	Real	User Cfg	28	AI		30055
DAR1[29]	User Cfg 3 EU	ADAC 1000	Real	User Cfg	29	AI		30057
DAR1[30]	Spare	ADAC 1000	Real	User Cfg	30	AI		30059
DAR1[31]	User Cfg 0 Flow Total	ADAC 1000	Real	User Cfg	31	AI		30061
DAR1[32]	User Cfg 1 Flow Total	ADAC 1000	Real	User Cfg	32	AI		30063
DAR1[33]	User Cfg 2 Flow Total	ADAC 1000	Real	User Cfg	33	AI		30065
DAR1[34]	User Cfg 3 Flow Total	ADAC 1000	Real		34	AI		30067
DAR1[35]	Spare	ADAC 1000	Real		35	AI		30069
DAR1[36]	Spare102	ADAC 1000	Real		36	AI		30071
DAR1[37]	Spare103	ADAC 1000	Real		37	AI		30073
DAR1[38]	Spare104	ADAC 1000	Real		38	AI		30075

DAR1[39]	Surge Header Pressure	ADAC 1000	Real	PSI	39	AI		30077
DAR1[40]	Surge Tank Temperature	ADAC 1000	Real	Degrees F	40	AI		30079
DAR1[41]	Surge Tank Water Level	ADAC 1000	Real	Inches	41	AI		30081
DAR1[42]	Surge Tank Feed Water (MUV) Signal	ADAC 1000	Real	%	42	AI		30083
DAR1[43]	Transfer Pump 1 Run Time	ADAC 1000	Real	Hours	43	AI		30085
DAR1[44]	Transfer Pump 2 Run Time	ADAC 1000	Real	Hours	44	AI		30087
DAR1[45]	Transfer Pump 3 Run Time	ADAC 1000	Real	Hours	45	AI		30089
DAR1[46]	Alternate Transfer Pumps	ADAC 1000	Real	Hours	46	AI		30091
DAR1[47]	Stop Lag Transfer Pump Limit	ADAC 1000	Real	PSI or %VSD	47	AI		30093
DAR1[48]	Surge Tank 2nd Feed Water (MUV) Signal	ADAC 1000	Real	%	48	AI		30095
DAR1[49]	Start Lag Transfer Pump Limit	ADAC 1000	Real	PSI or %VSD	49	AI		30097
DAR1[50]	Surge Level - Tr Pump Auto-Restart Level	ADAC 1000	Real	Inches	50	AI		30099
DAR1[51]	Start Surge Chemical Feed Time Delay	ADAC 1000	Real		51	AI		30101
DAR1[52]	Stop Surge Chemical Feed Time Delay	ADAC 1000	Real		52	AI		30103
DAR1[53]	Transfer Header Pressure SetPt	ADAC 1000	Real		53	AI		30105
DAR1[54]	Surge Level - Transfer Valve Bias Setpoint 1	ADAC 1000	Real		54	AI		30107
DAR1[55]	Surge Level - Transfer Valve Bias Setpoint 2	ADAC 1000	Real		55	AI		30109
DAR1[56]	Spare114	ADAC 1000	Real		56	AI		30111
DAR1[57]	Spare115	ADAC 1000	Real		57	AI		30113
DAR1[58]	Spare116	ADAC 1000	Real		58	AI		30115
DAR1[59]	Spare117	ADAC 1000	Real		59	AI		30117
DAR1[60]	Spare118	ADAC 1000	Real		60	AI		30119
DAR1[61]	Spare119	ADAC 1000	Real		61	AI		30121
DAR1[62]	Spare120	ADAC 1000	Real		62	AI		30123
DAR1[63]	Spare121	ADAC 1000	Real		63	AI		30125
DAR1[64]	Spare122	ADAC 1000	Real		64	AI		30127
DAR1[65]	Spare123	ADAC 1000	Real		65	AI		30129
DAI1[0]	Feed Pump 1 LEAD/LAG Status	ADAC 1000	Integer	Misc Tab	66	AI		30131
DAI1[1]	Feed Pump 2 LEAD/LAG Status	ADAC 1000	Integer	Misc Tab	67	AI		30132
DAI1[2]	Feed Pump 3 LEAD/LAG Status	ADAC 1000	Integer	Misc Tab	68	AI		30133
DAI1[3]	Feed Pump 4 LEAD/LAG Status	ADAC 1000	Integer	Misc Tab	69	AI		30134
DAI1[4]	Feed Pump 5 LEAD/LAG Status	ADAC 1000	Integer	Misc Tab	70	AI		30135
DAI1[5]	Feed Pump 6 LEAD/LAG Status	ADAC 1000	Integer	Misc Tab	71	AI		30136
DAI1[6]	Spare124	ADAC 1000	Integer		72	AI		30137
DAI1[7]	Spare125	ADAC 1000	Integer		73	AI		30138
DAI1[8]	Spare126	ADAC 1000	Integer		74	AI		30139
DAI1[9]	Spare127	ADAC 1000	Integer		75	AI		30140
DAI1[10]	Spare128	ADAC 1000	Integer		76	AI		30141
DAI1[11]	Spare129	ADAC 1000	Integer		77	AI		30142
DAI1[12]	Spare130	ADAC 1000	Integer		78	AI		30143
DAI1[13]	Spare131	ADAC 1000	Integer		79	AI		30144
DAI1[14]	Spare132	ADAC 1000	Integer		80	AI		30145
DAI1[15]	Spare133	ADAC 1000	Integer		81	AI		30146
DAI1[16]	Spare134	ADAC 1000	Integer		82	AI		30147
DAI1[17]	Spare135	ADAC 1000	Integer		83	AI		30148
DAI1[18]	Spare136	ADAC 1000	Integer		84	AI		30149
DAI1[19]	Spare137	ADAC 1000	Integer		85	AI		30150
DAI1[20]	Transfer Pump 1 LEAD/LAG Status	ADAC 1000	Integer	Misc Tab	86	AI		30151
DAI1[21]	Transfer Pump 2 LEAD/LAG Status	ADAC 1000	Integer	Misc Tab	87	AI		30152
DAI1[22]	Transfer Pump 3 LEAD/LAG Status	ADAC 1000	Integer	Misc Tab	88	AI		30153
DAI1[23]	Spare138	ADAC 1000	Integer		89	AI		30154
DAI1[24]	Spare139	ADAC 1000	Integer		90	AI		30155
DAI1[25]	Spare140	ADAC 1000	Integer		91	AI		30156
DAI1[26]	Spare141	ADAC 1000	Integer		92	AI		30157

DAI1[27]	Spare142	ADAC 1000	Integer		93	AI		30158
DAI1[28]	Spare143	ADAC 1000	Integer		94	AI		30159
DAI1[29]	Spare144	ADAC 1000	Integer		95	AI		30160
DAI1[30]	Spare145	ADAC 1000	Integer		96	AI		30161
DAI1[31]	Spare146	ADAC 1000	Integer		97	AI		30162
DAI1[32]	Spare147	ADAC 1000	Integer		98	AI		30163
DAI1[33]	Spare148	ADAC 1000	Integer		99	AI		30164
DAI1[34]	Spare149	ADAC 1000	Integer		100	AI		30165
DAI1[35]	Spare150	ADAC 1000	Integer		101	AI		30166
DAI1[36]	Spare151	ADAC 1000	Integer		102	AI		30167
DAI1[37]	Spare152	ADAC 1000	Integer		103	AI		30168
DAI1[38]	Spare153	ADAC 1000	Integer		104	AI		30169
DAI1[39]	Spare154	ADAC 1000	Integer		105	AI		30170
DAWB[0].0	BMS Heartbeat bit (transitions from 0 to 1)	BMS	Boolean		1	BV		00001
DAWB[0].1	Enter BFP LEAD/LAG Order PB	BMS	Boolean		2	BV		00002
DAWB[0].2	Enter TP LEAD/LAG Order PB	BMS	Boolean		3	BV		00003
DAWB[0].3		BMS	Boolean		4	BV		00004
DAWB[0].4		BMS	Boolean		5	BV		00005
DAWB[0].5		BMS	Boolean		6	BV		00006
DAWB[0].6		BMS	Boolean		7	BV		00007
DAWB[0].7		BMS	Boolean		8	BV		00008
DAWB[0].8		BMS	Boolean		9	BV		00009
DAWB[0].9		BMS	Boolean		10	BV		00010
DAWB[0].10		BMS	Boolean		11	BV		00011
DAWB[0].11		BMS	Boolean		12	BV		00012
DAWB[0].12		BMS	Boolean		13	BV		00013
DAWB[0].13		BMS	Boolean		14	BV		00014
DAWB[0].14		BMS	Boolean		15	BV		00015
DAWB[0].15		BMS	Boolean		16	BV		00016
DAWB[1].0		BMS	Boolean		17	BV		00017
DAWB[1].1		BMS	Boolean		18	BV		00018
DAWB[1].2		BMS	Boolean		19	BV		00019
DAWB[1].3		BMS	Boolean		20	BV		00020
DAWB[1].4		BMS	Boolean		21	BV		00021
DAWB[1].5		BMS	Boolean		22	BV		00022
DAWB[1].6		BMS	Boolean		23	BV		00023
DAWB[1].7		BMS	Boolean		24	BV		00024
DAWB[1].8		BMS	Boolean		25	BV		00025
DAWB[1].9		BMS	Boolean		26	BV		00026
DAWB[1].10		BMS	Boolean		27	BV		00027
DAWB[1].11		BMS	Boolean		28	BV		00028
DAWB[1].12		BMS	Boolean		29	BV		00029
DAWB[1].13		BMS	Boolean		30	BV		00030
DAWB[1].14		BMS	Boolean		31	BV		00031
DAWB[1].15		BMS	Boolean		32	BV		00032
DAWI[0]	BFP 1 LEAD/LAG Order	BMS	Integer		1	AV		40001
DAWI[1]	BFP 2 LEAD/LAG Order	BMS	Integer		2	AV		40002
DAWI[2]	BFP 3 LEAD/LAG Order	BMS	Integer		3	AV		40003
DAWI[3]	BFP 4 LEAD/LAG Order	BMS	Integer		4	AV		40004
DAWI[4]	BFP 5 LEAD/LAG Order	BMS	Integer		5	AV		40005
DAWI[5]		BMS	Integer		6	AV		40006
DAWI[6]	TP 1 LEAD/LAG Order	BMS	Integer		7	AV		40007

DAWI[7]	TP 2 LEAD/LAG Order	BMS	Integer		8	AV		40008
DAWI[8]	TP 2 LEAD/LAG Order	BMS	Integer		9	AV		40009
DAWI[9]		BMS	Integer		10	AV		40010
DAWI[10]		BMS	Integer		11	AV		40011
DAWI[11]		BMS	Integer		12	AV		40012
DAWI[12]		BMS	Integer		13	AV		40013
DAWI[13]		BMS	Integer		14	AV		40014
DAWI[14]		BMS	Integer		15	AV		40015
DAWI[15]		BMS	Integer		16	AV		40016
DAWI[16]		BMS	Integer		17	AV		40017
DAWI[17]		BMS	Integer		18	AV		40018
DAWI[18]		BMS	Integer		19	AV		40019
DAWI[19]		BMS	Integer		20	AV		40020
DAWR[0]	FW Header Pressure Setpoint	BMS	Real		21	AV		40030
DAWR[1]		BMS	Real		22	AV		40032
DAWR[2]		BMS	Real		23	AV		40034
DAWR[3]		BMS	Real		24	AV		40036
DAWR[4]		BMS	Real		25	AV		40038
DAWR[5]		BMS	Real		26	AV		40040
DAWR[6]		BMS	Real		27	AV		40042
DAWR[7]		BMS	Real		28	AV		40044
DAWR[8]		BMS	Real		29	AV		40046
DAWR[9]		BMS	Real		30	AV		40048

APPENDIX C - Loading a PLC Program

Loading a PLC program from an SD card to an L33ER or L24ER processor.

Required Hardware:

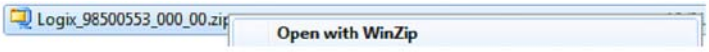
- SD card: Every PLC processor should come with an SD card from Rockwell Automation.
- SD Card Reader
- Laptop Computer

1.If the PLC program file is in .zip format it must be extracted.

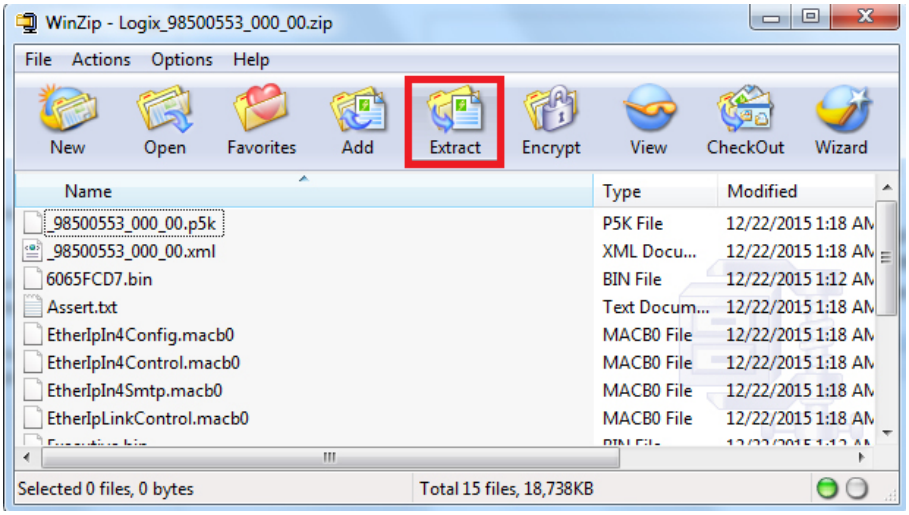
2.Use your computer SD card reader or connect an external SD card reader to the computer.

3.Select the Logix .zip file and Right mouse click.

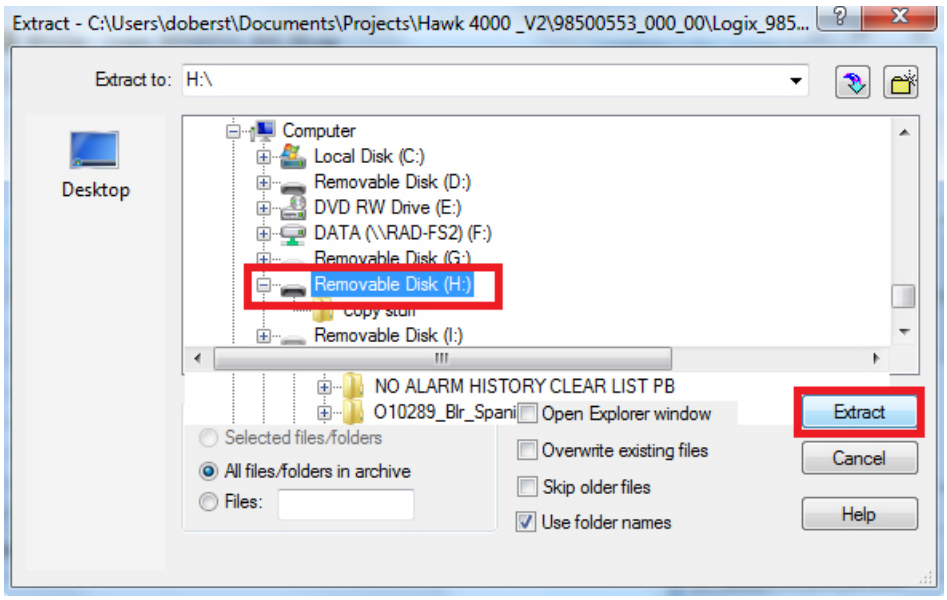
4.Select Open with WinZip (or another extraction program)



5.From WinZip select Extract.



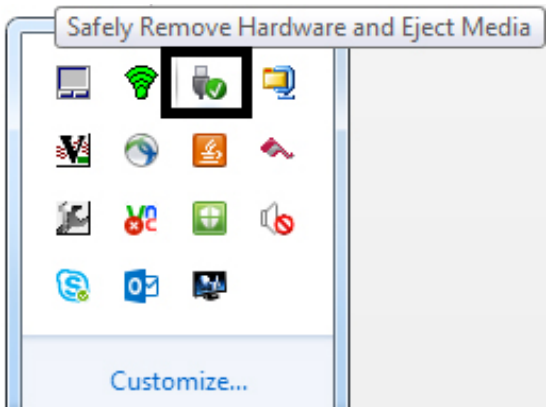
6.Navigate to the location of the SD card that will be used to transfer the Logix folder to the PLC. Select Extract.

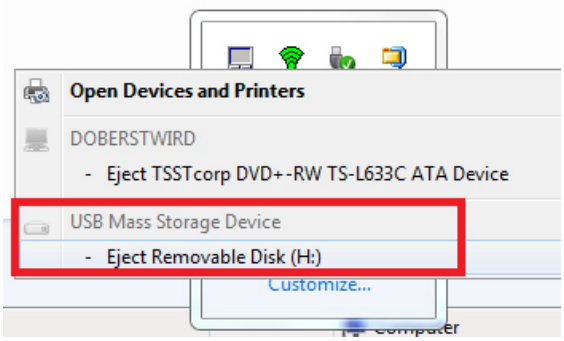


7.Close the WinZip program.

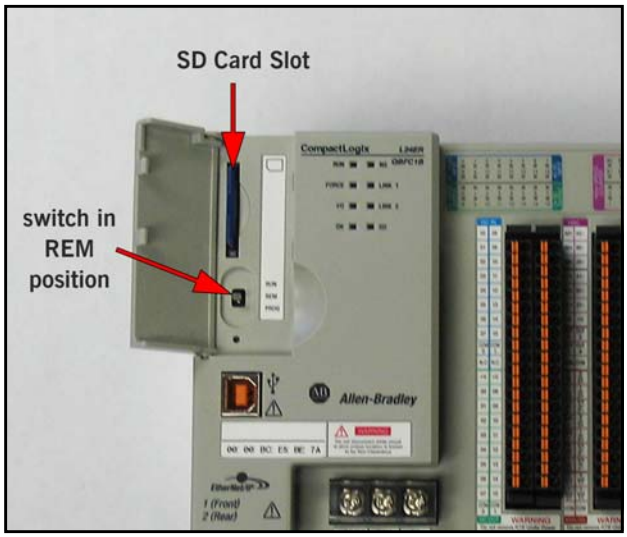
8.The Logix folder should now be extracted to the SD card. The logix folder must be at the root directory of the SD card. No other files should be present on the SD card. Use Windows Explorer to verify the Logix folder on the SD card.

9.Use the Remove Hardware tool to safely eject the SD card from the computer.



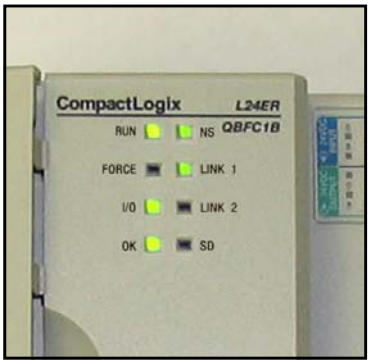


10. Install the SD card into the PLC SD card slot. The PLC switch should be in REM.



11.Cycle power to the PLC.

12.The transfer from the SD card to the PLC processor will begin. Please be patient while the installation is in progress, the whole process from power up to completion may take up to 3 Minutes. Prematurely ending the SD card load process *may render the PLC unusable!*



13.During the transfer process the OK Led on the PLC will be solid RED. The SD Led will begin to flash GREEN indicating that the PLC is reading from the SD card. Upon completion, the RUN and OK Led's should be solid GREEN. If run Led is NOT Solid Green put PLC switch to RUN.

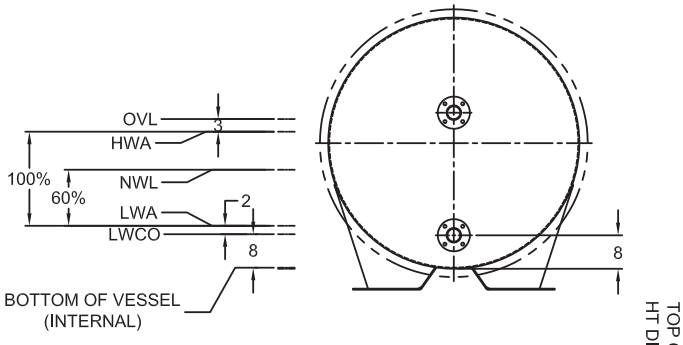
14.Remove the SD card from the PLC SD card slot.

15.If the SD card has come from the factory or if the program was taken from the CB Portal, loading from the SD card will install PLC firmware, the PLC program, and set the IP address of the PLC to 192.168.1.150.

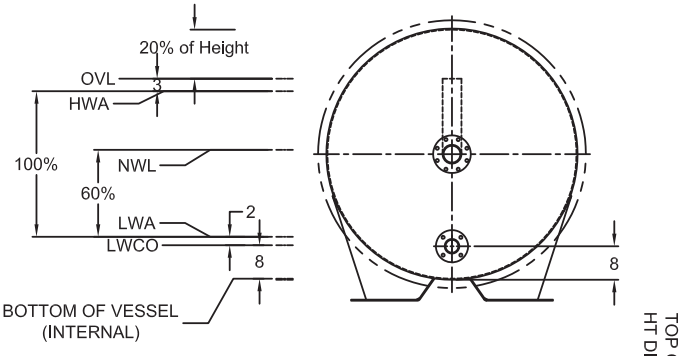
APPENDIX D - Deaerator Reference Drawings

Water Levels

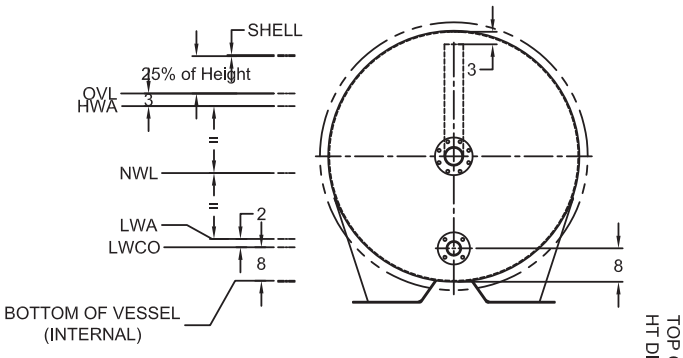
SPRAYMASTER



TRAYMASTER / BOILERMATE



SURGE



NOTE:

1. ALL DIMENSIONS SHOWN ARE CALCULATED FROM THE INSIDE SURFACE OF VESSEL

2. DIMENSIONS FOR HWA NWL LWA AND LWCO SHOWN ON DIMENSIONAL DIAGRAMS AND PIPING FABRICATION DRAWINGS ARE ROUNDED UP TO THE NEAREST INTEGER FOR EASE OF PRODUCTION

3. ACCORDING TO INDUSTRY CONVENTIONS:
   THE CAPACITY OF SURGE AND BFS VESSELS ARE REPORTED AS "GALLONS FLOODED"
   THE CAPACITY ALL OTHER VESSELS ARE REPORTED AS "GALLONS TO OVERFLOW"

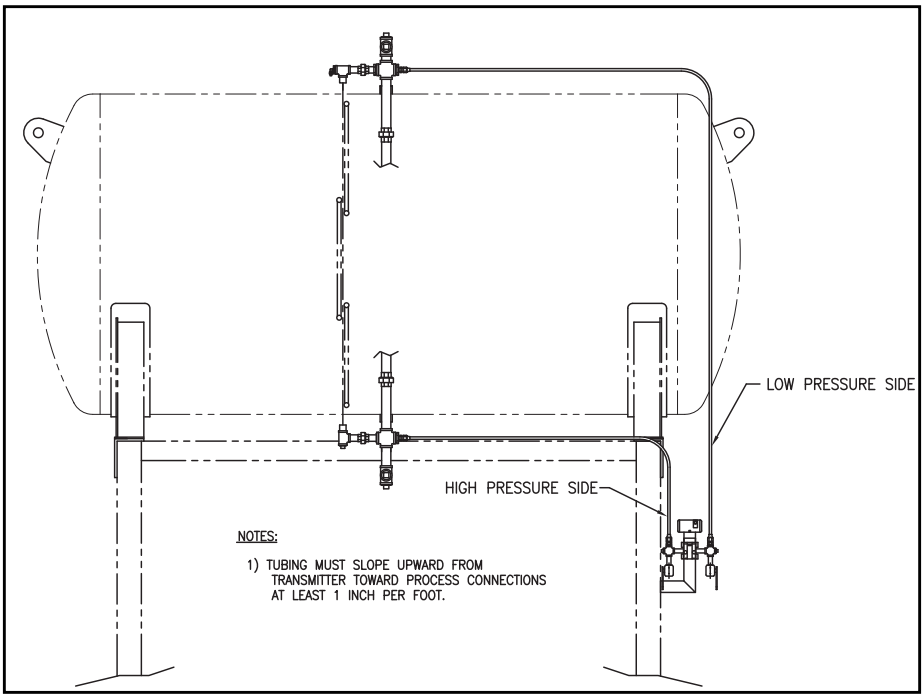
4. OVERFLOW LEVEL IS DEFINED AS THE BOTTON DEAD CENTRE OF THE INTERNAL DIAMETER OF THE OVERFLOW PIPE. THE ONLY EXCEPTIONS ARE VESSELS WITH AN INTERNAL OVERFLOW PIPE

5. LWA ALARM IS NOW SET TO TRIGGER WHEN THE WATER REACHES THE HIGH TEMPERATURE DIFFUSER. LWCO IS SET TO TRIGGER 2" BELOW THAT

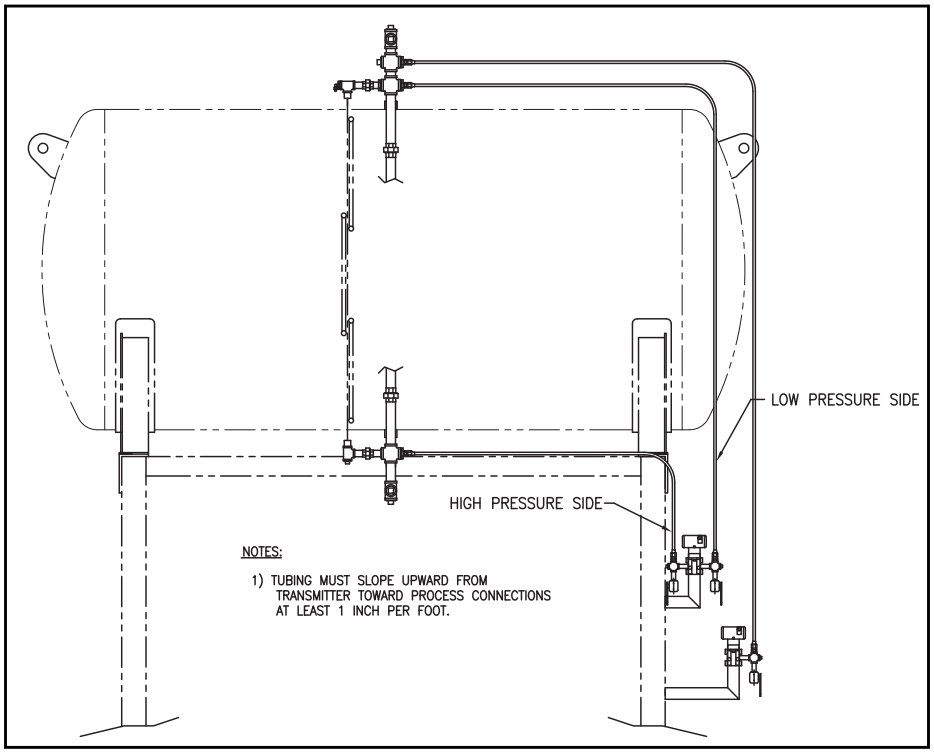
ABBREVIATIONS:

- GEM: ADDITION LEVEL POSITION FOR THE MID-POINT OF GEMS MINI-SURESITE INDICATORS. THIS IS ONLY REQUIRED WHEN THE NWL POSITION DOES NOT ALLOW THE GEM TO COVER THE DISTANCE BETWEEN THE OVL AND LWCO POSITIONS, OTHERWISE, NWL IS THE GEM MID-POINT POSITION
- HWA: HIGH WATER ALARM
- LWA: LOW WATER ALARM
- LWCO: LOW WATER CUTOFF
- NWL: NORMAL WATER LEVEL
- OVL: OVERFLOW

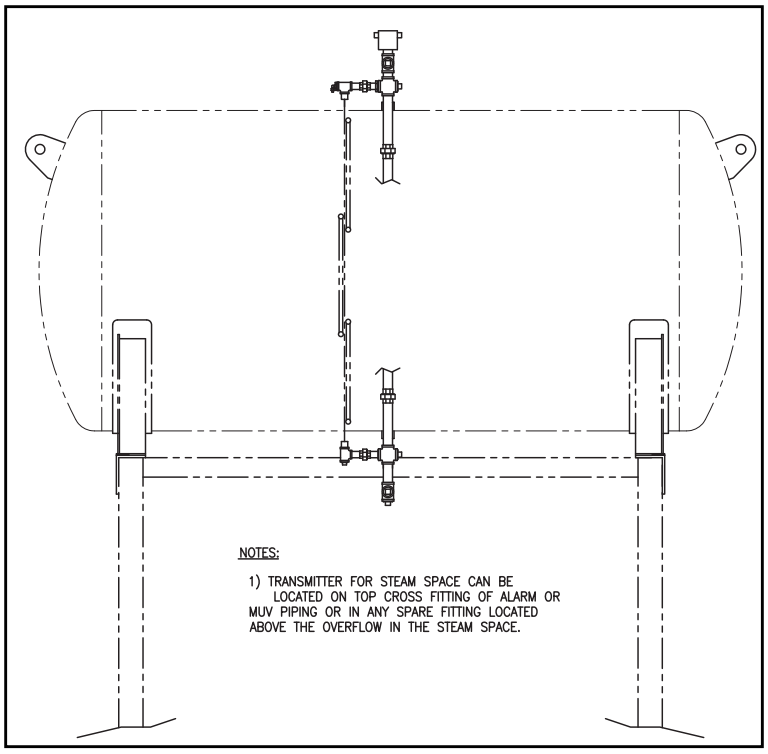
Differential Pressure Level Control



Differential Pressure Level Control and DA Tank Pressure Control (1 of 2)

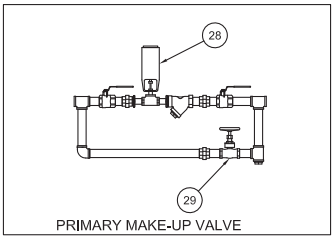


Differential Pressure Level Control and DA Tank Pressure Control (2 of 2)

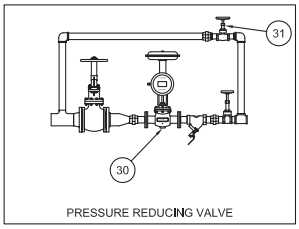


Major Components, DA with ADAC [typical]

ITEM	MAJOR COMPONENTS
1	PUMPS
2	MOTORS
3	SUCTION PIPING, STRAINER, BALL VALVE
4	DISCHARGE PIPING, STRAINER, BALL VALVE
5	DISCHARGE PRESSURE TRANSMITTER
6	RECIRCULATION PIPING, W/RECIRC ORIFICE AND BALL VALVES
7	DISCHARGE MANIFOLD
8	VSD PANEL
9	ENTRANCE PANEL
10	MAIN POWER FUSED DISCONNECT
11	ADAC PANEL
12	STACK LIGHT
13	THERMOMETER
14	PRESSURE GAUGE
15	GEM SURESITE, WITH 4-20 mA TRANSMITTER, MAGNETIC SWITCHES
16	LOW WATER CUTOFF SWITCH
17	TEMPERATURE TRANSMITTER, WATER
18	OVERFLOW DRAINER
19	PRESSURE TRANSMITTER, STEAM
20	HIGH TEMPERATURE RETURN DIFFUSER TUBE
21	CHEMICAL FEED QUILL
22	MAGNESIUM ANODE
23	RELIEF VALVE@ 50 PSI PSIG
24	TANK DRAIN VALVE
25	PUMP PROVING SWITCH
26	MAKE UP TEE AND TWO CHECK VALVES
27	MANWAY 20" DIAMETER, WITH OUT DAVIT ARM, WITH SEPCO 200 GASKET
28	PRIMARY MAKE-UP VALVE
29	PRIMARY MAKE-UP VALVE BY-PASS
30	PRESSURE REDUCING VALVE
31	PRV 3-VALVE BYPASS AND STRAINER

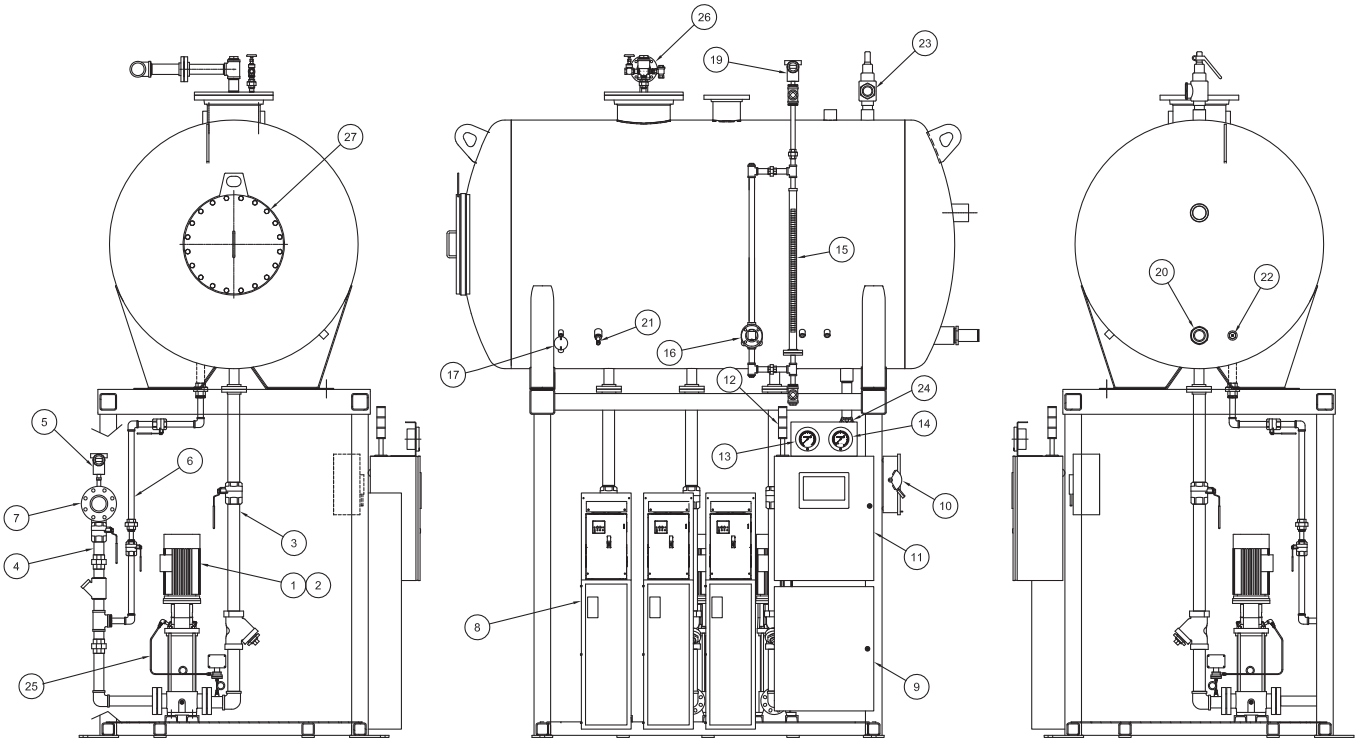


PRIMARY MAKE-UP VALVE



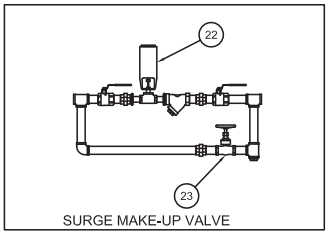
PRESSURE REDUCING VALVE

OVERFLOW DRAINER

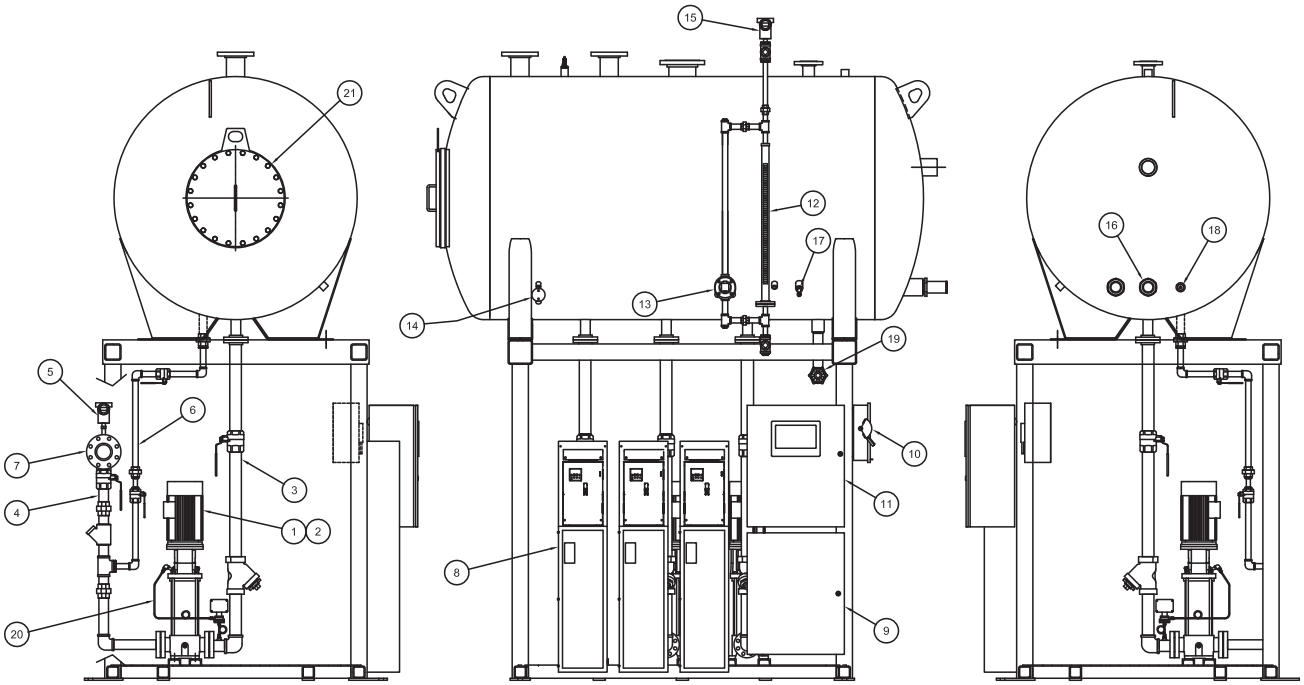


Major Components, Surge Tank with ADAC [typical]

ITEM	MAJOR COMPONENTS
1	PUMPS
2	MOTORS
3	SUCTION PIPING, STRAINER, BALL VALVE
4	DISCHARGE PIPING, STRAINER, BALL VALVE
5	DISCHARGE PRESSURE TRANSMITTER
6	RECIRCULATION PIPING, W/RECIRC ORIFICE AND BALL VALVES
7	DISCHARGE MANIFOLD
8	VSD PANEL
9	ENTRANCE PANEL
10	MAIN POWER FUSED DISCONNECT
11	ADAC PANEL
12	GEM SURESITE, WITH 4-20 mA TRANSMITTER, MAGNETIC SWITCHES
13	LOW WATER CUTOFF SWITCH
14	TEMPERATURE TRANSMITTER, WATER
15	PRESSURE TRANSMITTER, STEAM
16	HIGH TEMPERATURE RETURN DIFFUSER TUBE
17	CHEMICAL FEED QUILL
18	MAGNESIUM ANODE
19	TANK DRAIN VALVE
20	PUMP PROVING SWITCH
21	MANWAY 20" DIAMETER, WITH OUT DAVIT ARM, WITH SEPCO 200 GASKET
22	PRIMARY MAKE-UP VALVE
23	PRIMARY MAKE-UP VALVE BY-PASS



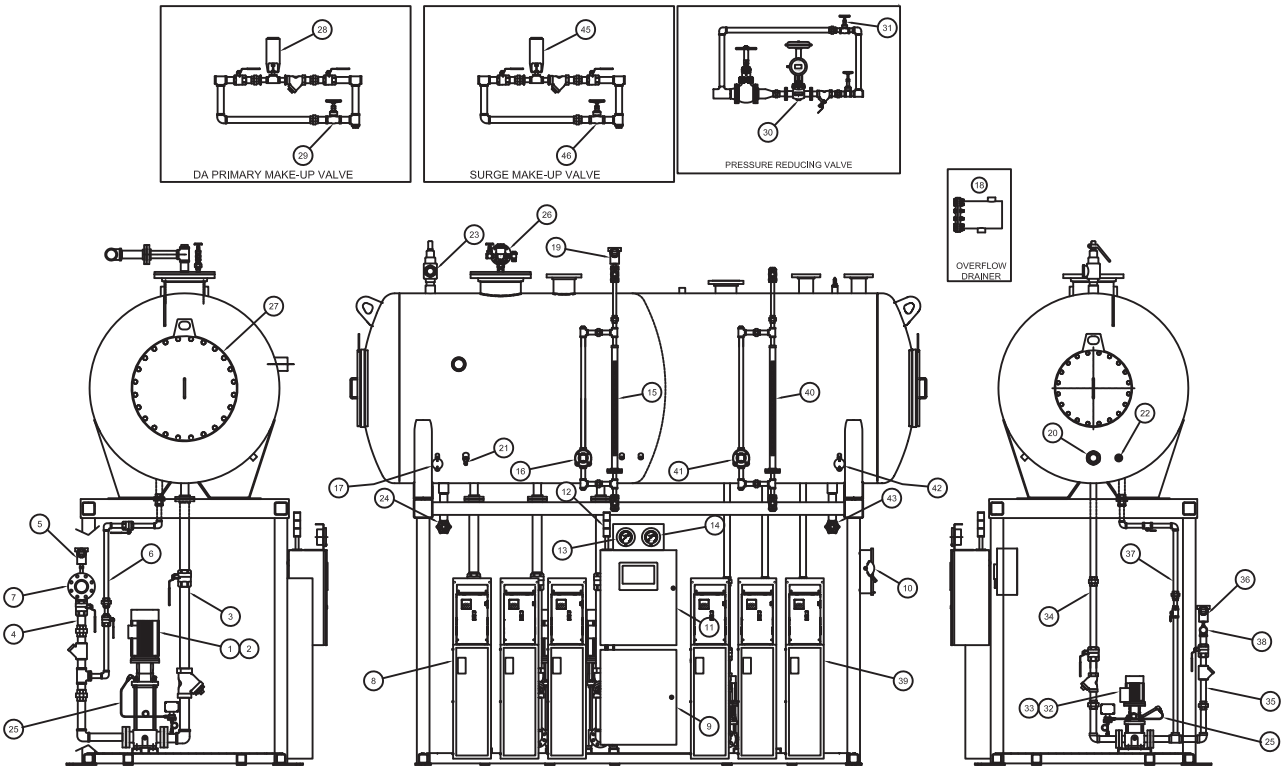
SURGE MAKE-UP VALVE



Duo Tank Components [typical]

ITEM	MAJOR COMPONENTS
1	FEEDWATER PUMPS
2	FEEDWATER MOTORS
3	FEEDWATER SUCTION PIPING, STRAINER, BALL VALVE
4	FEEDWATER DISCHARGE PIPING, STRAINER, BALL VALVE
5	FEEDWATER DISCHARGE PRESSURE TRANSMITTER
6	FEEDWATER RECIRCULATION PIPING, W/RECIRC ORIFICE AND BALL VALVES
7	FEEDWATER DISCHARGE MANIFOLD
8	FEEDWATER VSD PANEL
9	ENTRANCE PANEL
10	MAIN POWER FUSED DISCONNECT
11	ADAC PANEL
12	STACK LIGHT
13	THERMOMETER
14	PRESSURE GAUGE
15	DA GEM SURESITE, WITH 4-20 mA TRANSMITTER, MAGNETIC SWITCHES
16	DA LOW WATER CUTOFF SWITCH
17	DA TEMPERATURE TRANSMITTER, WATER
18	DA OVERFLOW DRAINER
19	DA PRESSURE TRANSMITTER, STEAM
20	HIGH TEMPERATURE RETURN DIFFUSER TUBE
21	CHEMICAL FEED QUILL
22	MAGNESIUM ANODE
23	DA RELIEF VALVE@ 50 PSI PSIG
24	DA TANK DRAIN VALVE
25	FEEDWATER PUMP PROVING SWITCH
26	DA MAKE UP TEE AND TWO CHECK VALVES
27	DA MANWAY 28" DIAMETER, WITH OUT DAVIT ARM, WITH SEPCO 200 GASKET
28	DA PRIMARY MAKE-UP VALVE
29	DA PRIMARY MAKE-UP VALVE BY-PASS
30	DA PRESSURE REDUCING VALVE
31	DA PRV 3-VALVE BYPASS AND STRAINER

ITEM	MAJOR COMPONENTS cont.
32	SURGE PUMPS
33	SURGE MOTORS
34	SURGE SUCTION PIPING, STRAINER, BALL VALVE
35	SURGE DISCHARGE PIPING, STRAINER, BALL VALVE
36	SURGE DISCHARGE PRESSURE TRANSMITTER
37	SURGE RECIRCULATION PIPING, W/RECIRC ORIFICE AND BALL VALVES
38	SURGE DISCHARGE MANIFOLD
39	SURGE VSD PANEL
40	SURGE GEM SURESITE, WITH 4-20 mA TRANSMITTER, MAGNETIC SWITCHES
41	SURGE LOW WATER CUTOFF SWITCH
42	SURGE TEMPERATURE TRANSMITTER, WATER
43	SURGE TANK DRAIN VALVE
44	SURGE PUMP PROVING SWITCH
45	SURGE MAKE-UP VALVE
46	SURGE MAKE-UP VALVE BY-PASS



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