PENTAIR

AURORA

380 SERIES

VERTICAL INLINE PUMP WITH VARIABLE FREQUENCY DRIVE (VFD)

MODEL 382-VFD

WWW.AURORAPUMP.COM

AURORA® 380 SERIES

Single Stage Vertical Inline Pump

Capacities to 4500 G.P.M. (1,020 m3/hr)
Heads to 370 Feet (78 m)
Temperatures to 250°F (120°C)

380 Series Pumps.

Vertical Inline Close Coupled Pumps are specifically designed for mounting directly in a pipe line. The suction and discharge nozzles are located on the same centerline 180º apart. Vertical pumps significantly reduce the space required; two pumps fit in the space of one. They are easy to maintain; simply remove the capscrews and the motor and bracket assembly is easily removed from the casing without disturbing the piping.

The impeller is direct coupled to the motor shaft for easy maintenance to minimize impeller runout and reduce noise. Most pump parts, except for the casing, are 100% interchangeable with Aurora Pump's high quality, high production 340 and 360 Series pumps for speedy spare parts service. The inline casing has provisions for mounting an optional support base should the pump sit on the floor. Mechanical seals are provided as standard to prevent leakage around the shaft. A relief line is provided from the seal faces to the pump discharge for flushing and venting purposes.

Suction Branch Design on Model 382A pumps prerotates suction liquid in the direction of pump impeller rotation. This concept minimizes pumping noise that is otherwise associated with more common short radius suction inlet designs. Each pump has been engineered and assurance tested to arrive at the proper velocities and entrance angles to ensure quiet operation. Aurora 380 Series pumps are available in 31 sizes, offering a size and model precisely fitted to a wide range of head and capacity requirements. Look through this bulletin for additional details and specifications.

Standard Features

- Bronze Fitted Construction
- Bronze Shaft Sleeve
- Carbon Steel Shaft
- Dynamically Balanced Cast Impeller
- Casing Wearing Rings
- 303 Stainless Mechanical Seal with Buna-N, Ceramic and Carbon Parts
- Factory Hydro Test

Optional Features

- All Iron Construction
- 316 Stainless Steel Shaft Sleeve
- Impeller Wearing Ring(s)
- Suction and Discharge Companion Flanges
- Pump Base
- Certified Performance Test Data Consisting of Head Capacity and Power Readings Taken over the Full Operating Range of the Pump
- Split Mechanical Seal

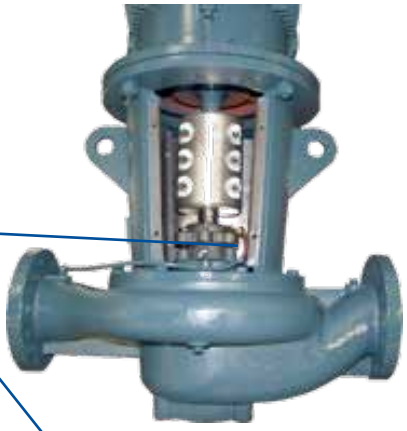
382A-SC Series Pumps

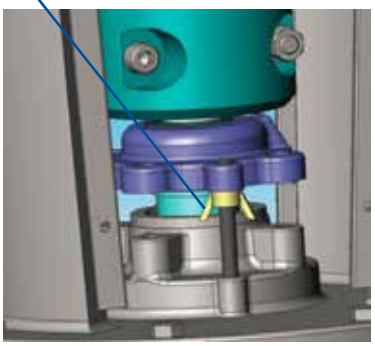
382-A Split Coupled Inline Pump.

Aurora® 382A-SC Vertical Inline Split Coupled Pumps are specifically designed for mounting directly in a pipe line. The High Strength Aluminum Split Coupling allows for the mechanical seal to be replaced without removing the motor. The patented Integral Jacking Gland eases the changing of the mechanical seal making this repair chore faster and easier for the maintenance specialist. A carbon throttle bushing controls the flow of mechanical seal flushing while providing additional support for the stainless steel pump shaft. The Aurora 382A-SC Inline Pump comes in 31 sizes, offering a size and model precisely fitted for a wide range of head and capacity requirements.

Standard Features

- Bronze Fitted Construction
- Stainless Steel Shaft
- High Strength Aluminum Coupling
- Dynamically Balanced Cast Impeller
- Casing Wear Rings
- 303 Stainless Steel Mechanical Seal with Buna-N, Ceramic and Carbon Parts
- Factory Hydro Test
- Patented Integral Jacking Gland
  - Easier & faster serviceability of the seal & re-coupling the shaft versus the competition
  - Simple 1 step by hand operation (no tools required)
  - Accessible without removing VFD
  - 4-20mA transducer installed and wired to VFD
  - Aegis grounding ring





Optional Features

- All Iron Construction
- Impeller Wear Rings
- Pump Base
- High Temperature Mechanical Seal
- Certified Performance Testing over the Full Operating Range of the Pump

The Aurora Variable Frequency Drive controlled 382 Vertical In-line pumps

Globally, buildings consume 40% of the total world's energy and emit 21% of the total greenhouse gases. Many facilities across the U.S. and the globe are dealing with rising energy costs, electricity as a top five expense item and heating, ventilation and air conditioning (HVAC) accounting for 40-60% of total energy use. Businesses could save thousands of dollars every year (collectively, billions), simply by using less electricity. This strategy would have far reaching effects on profits, the overall economy as well as the environment.

According to the U.S. Department of Energy:

The U.S. spends $400 billion annually powering its homes and commercial buildings.

- Buildings consume 70% of all U.S. electricity, accounting for 40% of all energy use.
- Nearly 40% of carbon dioxide emissions come from energy use in buildings.
- Cutting energy use in U.S. buildings by even 20% can save $80 billion a year.
- Electricity is a top 5 expense item.
- Energy costs are not projected to go down.

A growing number of system designers, specifying engineers, maintenance professionals and end users are turning to variable speed motor control systems that can save up to 60 percent in energy costs as well as significantly reduce maintenance and equipment costs, improve process control and enhance system reliability.

Rather than constantly run the motor at full speed, variable frequency drive (VFD) systems-also referred to as adjustable frequency drives, variable speed drives, AC drives or simply "drives"-monitor system characteristics like pressure and control the motor speed to match the system requirements only as needed, often at lower speeds. By modulating the power delivered to the motor (pulse width modulation or PWM), VFDs provide continuous control, smoothly adjusting motor speed to directly control pressure, flow and fluid levels. The Aegis grounding ring prevents bearing failures due to transient voltage.

VFDs also improve electrical power factor and significantly reduce motor starting current typically by a factor of 4:1 to further reduce power demand from the local power utility. Aurora's 382 Vertical In-Line, Variable Frequency Drive, pumps adjust in response to changes in actual [not assumed] demand and in combination with a NEMA premium motor in turn leads to astonishing energy savings meeting ASHRAE 90.1.

The Science behind the Savings

When a VFD starts a motor, it initially applies a low voltage at a low frequency to the motor. Starting at a low frequency and voltage avoids the high inrush current (typically 600 percent of its rated current) that occurs when a motor is started by turning on a switch or contactor to apply across-the-line voltage. The VFD then increases the applied frequency and voltage at a controlled rate to accelerate the load without drawing excessive current. This starting method typically allows a motor to develop rated torque while drawing rated current. For smoothest starting, The Aurora 382VFD incorporates S-ramp acceleration and deceleration functions that provide the least amount of mechanical shock loading on the pump, motor and system.

The key to maximizing energy savings is continuous control of the motor voltage and frequency commonly referred to as the Volts-to-Hertz ratio. VFDs provide selectable V/Hz control modes to provide the highest level of savings for single motor and multiple motor applications. For single motor control, dynamic V/Hz control uses the least amount of energy and a square law characteristic mode is best for multi-motor variable torque loads.

Variable frequency drives application and use

In the early days of variable frequency drive (VFD) technology, the typical application was in process control for manufacturing synthetic fiber, steel bars, and aluminum foil. Because VFDs improved process performance and reduced maintenance costs, they replaced motor generator sets and DC drives. When the energy crisis occurred in the early 1970s, saving energy became a critical goal, and the use of VFDs quickly spread into large pump applications and eventually into HVAC fan systems.

Variable frequency drives compared to throttling devices

In many flow applications, a mechanical throttling device is used to limit flow. Although this is an effective means of control, it wastes mechanical and electrical energy. **Figure 1** represents a pumping system using a mechanical throttling valve and he same system using a VFD.

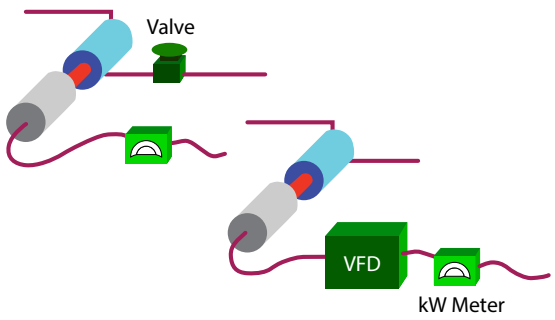


Figure 1. A mechanical throttling device versus a VFD

If a throttling device is employed to control flow, energy usage is shown as the curve in **Figure 2**, while the lower curve demonstrates energy usage when using a VFD. Because a VFD alters the frequency of an AC motor, speed, flow, and energy consumption are reduced in the system. The energy saved is represented by the green shaded area.

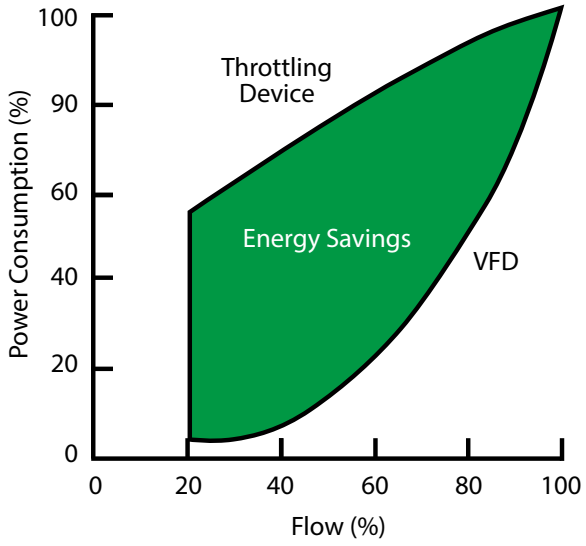


Figure 2. The amount of energy saved by using a variable frequency drive (versus a valve) to control flow

Capital Cost Savings

When designing and installing a new pumping system, the capital cost of a VFD can often be offset by eliminating control valves, bypass lines, and conventional starters, as explained below.

Elimination of Control Valves

Control valves are used to adjust pump output to suit varying system requirements. Usually a constant-speed pump is pumping against a control valve, which is partially closed for most of the time. Even at maximum flow conditions, a control valve is normally designed to be 10% shut, for control purposes. Hence, a considerable frictional resistance is applied. Energy is therefore wasted overcoming the added frictional loss through the valve. Using a VFD to control flow can eliminate the control valve.

Elimination of Bypass Lines

All fixed-speed pumps have a minimum flow requirement. If the pump is operated at flow rates below the minimum for extended periods, various mechanical problems can occur. If the flow requirements in a system can drop below this minimum flow capacity, it is necessary to install a constant or switched bypass to protect the pump. The use of a VFD greatly reduces the volume to be bypassed.

Maintenance Cost Reductions

Programmable soft starting and stopping reduces shock loads. S-ramp functions provide great reduction, resulting in less stress on system components such as valves and pipe joints. Variable speed control operates the pump at its BEP to greatly reduce vibration when compared to other process control methods. This reduction in vibration significantly extends the life of the pump seals and the time between costly and, in many cases, unscheduled maintenance events. Skip frequencies avoid natural system resonances that may cause high levels of vibration, an enemy of every pumping application.

Variable frequency drives application in a pump system

Applying a VFD to the pump allows control of the pump's speed electrically while using only the energy needed to produce a given flow. This is similar to applying a new pump with a smaller impeller. **Figure 3** demonstrates the new pump curve and the energy consumed by this method. Also, the pressure is reduced, which helps reduce the mechanical stresses generated by throttling devices.

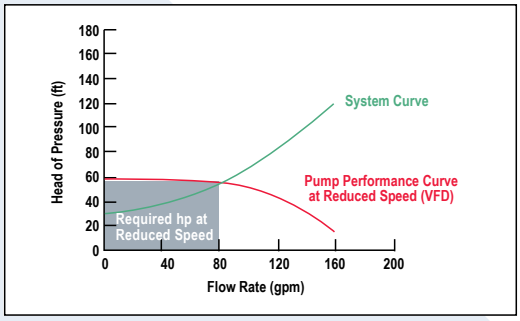


Figure 3. System characteristics using a variable frequency drive

Overlaying the two previous graphs, the difference is obvious in **Figure 4**. The blue shaded area is the energy saved by using a VFD instead of a throttling device.

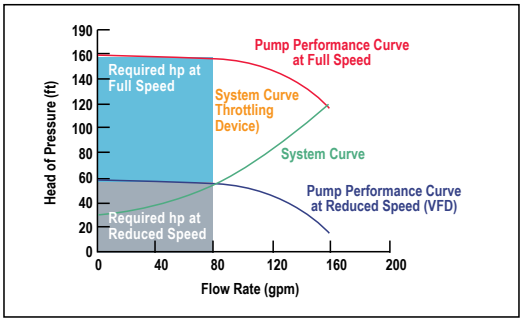


Figure 4. The difference in energy consumption using a throttling device versus a variable frequency drive

VFD Available on the following pump models

Pentair's line of Aurora Variable Frequency Drive pumping systems are available on our Closed-Coupled and Split-Coupled 382 Vertical In-line pump models.

- 382 Vertical In-line C.C sizes from 1.5x1.5x9B to 8x8x12
- 382 Vertical In-line S.C sizes from 1.5x1.5x9B to 10x10x15
- 200/208/230, 460/480, and 575 VAC
- ODP or TEFC motors up to 60HP
- Supported with Aurora's E.2 pump sizing software

Standard Product Feature Sets:

- NEMA 1/IP21
- Built-in fusible disconnect – 100K AIC @ 600V
- Basic Cascade control (single drive in multi-pump applications) for across-the-line starting
- Up to two VFD's without separate controller
- Built-in DC link reactors with EMC filters to minimize RFI interface to reduce harmonic noise
- Dry pump & end of curve detection
- 2-Step S-ramps (initial ramp)
- BMS compatible- analogue / digital /I/O and RS485 port with Modbus RTU, BACnet, N2 Metasys
- Native BACnet standard
- Fire Mode
- 2 analog inputs, 1 analog outputs
- 4 digital inputs, 2 digital outputs
- 2 programmable relays
- Graphical user interface
- Built-in Disconnects For Each VFD

Optional Adder Features:

- VFD Bypass (fused or circuit breaker)
- NEMA12IP, NEMA 4X/IP66 enclosure rating available
- Touch screen controller for up to 4 pumps
- Liquid Filled Pressure Gauges (Suction & Discharge)

Environmental Ratings:

- Temperature: 0-50 degree C
- Maximum Relative Humidity: 93% +2%, -3%

Pump Features

380 Series Specifications

The contractor shall furnish (and install as shown on the plans) Aurora® Models 382A/382A-SC vertical close coupled inline back pull-out centrifugal pumps size ___ x ___ x ___ of (bronze fitted) (all bronze) (all iron) construction.

The suction and discharge flanges shall be located on a common CL 180º apart for mounting inline. Each pump shall have a capacity of ___GPM at ___ft. total head, with a temperature of ___ºF, ___specific gravity.

Each pump is to be furnished with a mechanical seal with all metal parts to be 303 stainless steel with Buna-N elastomers, Ceramic seat and carbon washer. A bypass line must be provided between the seal faces and the discharge flange to assure adequate venting of the seal chamber and to provide lubrication. Impellers are to be dynamically balanced and keylocked to the shaft. Model 382A/382A-SC pumps to include a volute type casing suction branch to minimize pumping noise.

The unit must be equipped with (bronze) (stainless steel) shaft sleeve, keylocked, that extends the length of the seal box. Pump shaft extension shall be O-ring sealed from the pumped liquid. Pump casing shall have a case wearing ring (impeller wearing rings). Each pump is to be close coupled to a standard NEMA-JM ___HP ___phase ___Hertz ___volt ___ RPM (drip-proof) (total enclosure) (hazardous location) motor up to 60 HP and special TCZ frame motor for HP above 60.

Limitations

Maximum Limitation Based on Standard Materials and Pumping Clear Water	
Speed	3500 RPM
Horsepower	1150 RPM – 30 1750 RPM – 50 3500 RPM – 60 TCZ FRAME MOTORS – RTF
Temperature ºF	Standard 225/Optional 250
Hydrostatic Test Pressure PSI	265
Case Working Pressure PSI (All or Any Part Can Be Suction Free)	175

Materials of Construction

Description	Material of Construction
Pump Part	Bronze Fitted
Casing	Cast Iron ASTM A48
Impeller	Bronze ASTM B584
Shaft (382A)	Carbon Steel Per Motor Mfg.
Shaft (382A-SC)	Stainless Steel ASTM A582 Type 416
Case Wearing Rings	Bronze ASTM B62
Bushing (382A-SC Only)	Carbon Graphite Matrix
Sleeve (382A Only)	Bronze ASTM B62
Bracket	Cast Iron ASTM A48
Mechanical Seal (STD) Washer Seat Elastomer Metal Parts Spring	 Carbon Ceramic Buna-N 303 SS 303 SS

For applications that require more than two pumps

For the larger ever-increasing needs and complexity of today's water systems that require more than two pumps, Pentair Aurora offers a PLC touch screen control panel with a PID Loop to stage up to four pumps.

This system offers a state of the art combination of the Pentair Variable Frequency Drive for each pump, and a Programmable Logic Controller (PLC) with a Proportional Integral Derivative (PID) Loop to stage up to four pumps based on pressure and flow needs of the building. Pumps are the Pentair PVM multistage and end suction pumps.

Each system is fully assembled, wired and tested for ease of installation providing reliable service and meeting all specification requirements out of the box.

Touch Screen Color Display - 5.7"

- Audible/Visible Panel Alarm (Configured to Relay Output 1)
- Single Information and Status Screen - Default
- Two to Four Pump Operation
- Constant Pressure Control - PSI
- Constant Flow Control* - GPM (Requires external Flow x-ducer)
- System Modification while in Operation through Touch Screen
- VFD Remote Hand Control through PLC
- VFD Hand Control Screen includes Complete Control of VFD and Monitoring
- Auto-Detect System Parameters for Pump Operation - Default
- Sequence of Operation: Timed Rotation/Same Lead Pump/1st On-1st Off
- Four Relay Outputs Configurable through Touch Screen with 27 Options for each Relay - System Operation, Alarms, Faults, Digital Inputs, Maintenance
- Maintenance Screen Setup - On Screen Alarm and/or Relay Output
- Faults and Alarm History
- Password Protection for Basic and Advanced Setup (Enable/Disable)
- Password(s) Disable/Enable Bypass
- Screen Saver Option and Settings
- Four Screen Basic Setup for Operation
- Summary Screen Review of Basic Settings
  Maximum and Minimum Speeds Allowed for Controller and VFD
- Discharge: Transducer Settings, Setpoint, Alarms and Faults
- Suction: Transducer Settings, Alarms and Faults
- Flow: Transducer Settings, Setpoint, Alarms and Faults
- Real Time Operation and Control
- Built-in Disconnects For Each VFD

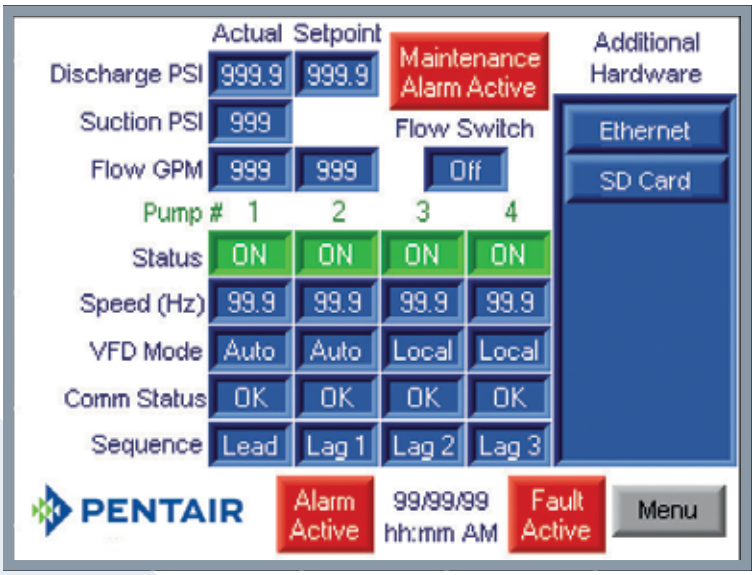
Complete Control with IntelliManager™

Customize, Monitor, Maintain

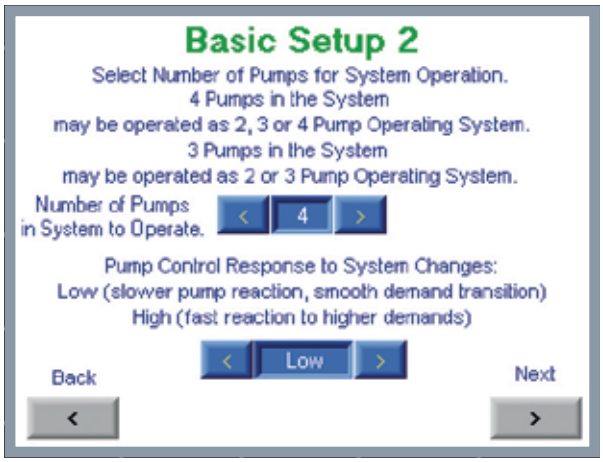
The IntelliBoost™ Variable Speed Constant Pressure Booster System is controlled using our latest technology, IntelliManager. Configure the system settings to your exact needs and tolerances.

Monitor your system from anywhere in the world when it is connected using the built in Ethernet connection. Use your computer, or mobile device to access the built in web page, giving you the statistics and information needed to properly monitor a booster system.

IntellManager will continually monitor performance and sound an alarm if any of your pre-determined tolerances are reached. System faults protect your investment by automatically shutting down the system when tolerances are exceeded.



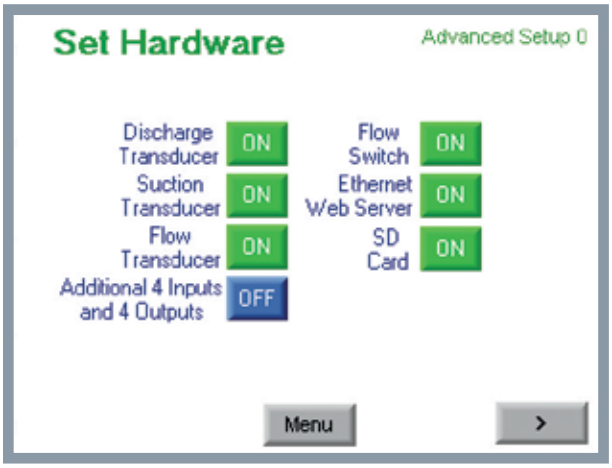
Realtime system operation, status, settings and hardware. Alarms, faults and maintenance indicators are active when set by operator.



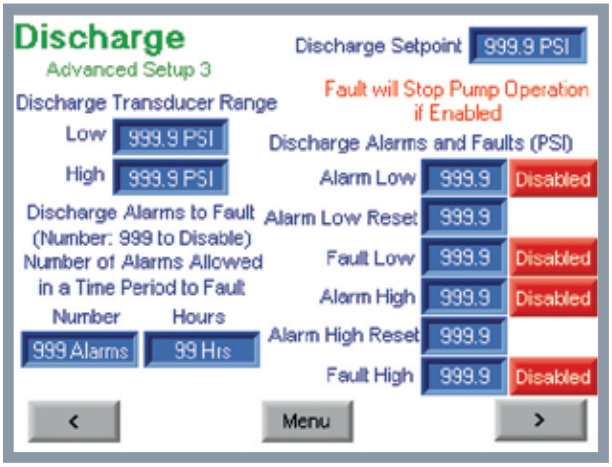
Easily configure the number of pumps in operation.

Customizable settings can be entered throughout the software to configure the system to your exact needs.

Some examples of actual screens you will find in the IntelliBoost Variable Speed Constant Pressure Booster System, IntelliManager.



Hardware settings are factory set to match the exact hardware in your system.

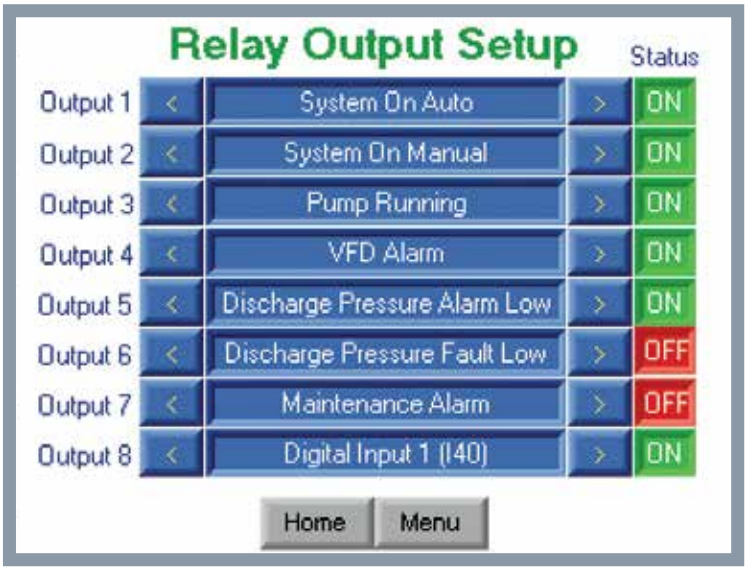


Determine your Alarm and Fault tolerances. Alarms will reset once operating conditions return to normal. Faults will cause the system to stop operating, resulting in operator assistance.

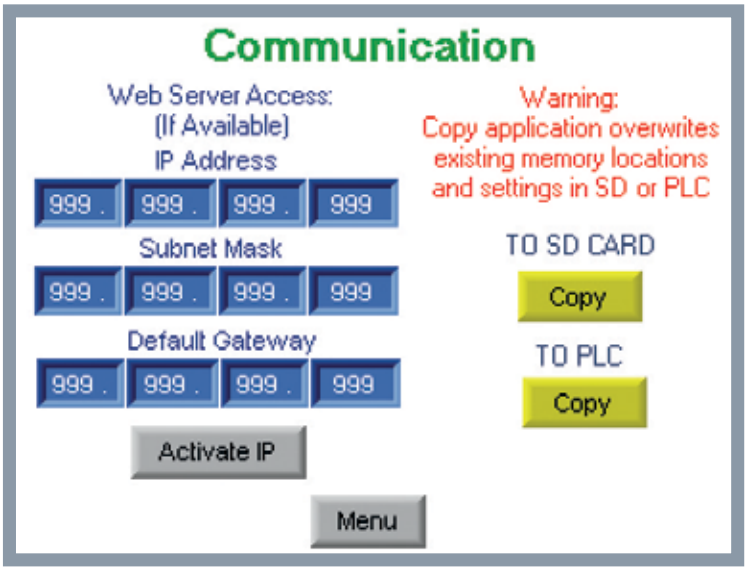
Alarm Setting	Pump 1	Pump 2	Pump 3	Pump 4
Starts	999999	999999	999999	999999
Default	999999	999999	999999	999999
# of Starts	999999	999999	999999	999999
Pump Hours	999999	999999	999999	999999
Default	999999	999999	999999	999999
Total Hours	999999	999999	999999	999999
Motor Hours	999999	999999	999999	999999
Default	999999	999999	999999	999999
Total Hours	999999	999999	999999	999999
VFD Hours	999999	999999	999999	999999
Default	999999	999999	999999	999999
Total Hours	999999	999999	999999	999999

Set Default to -1 to Disable Alarm >

Maintenance alarm screen provides the operator with complete statistics, helping determine what maintenance is needed.



Monitor the system through the use of four standard relays. An additional four relays may be added to the system as an option.

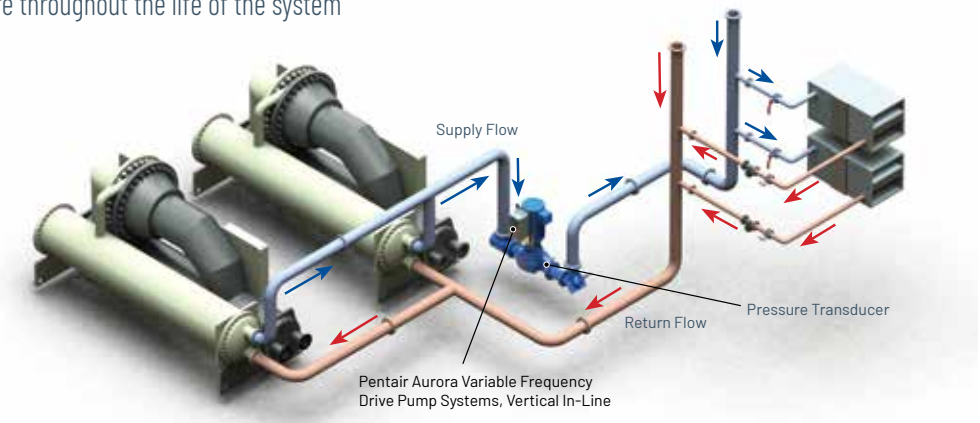


Use the available SD card to transfer information, or connect the system to your network using the built-in Ethernet port. When connected using Ethernet, you are able to view the system performance and operation from any computer or mobile device with web access.

Single Loop Chiller Flow

Heating and Chiller water systems with Aurora Vertical In-Line pump integrated with Variable Frequency Drives

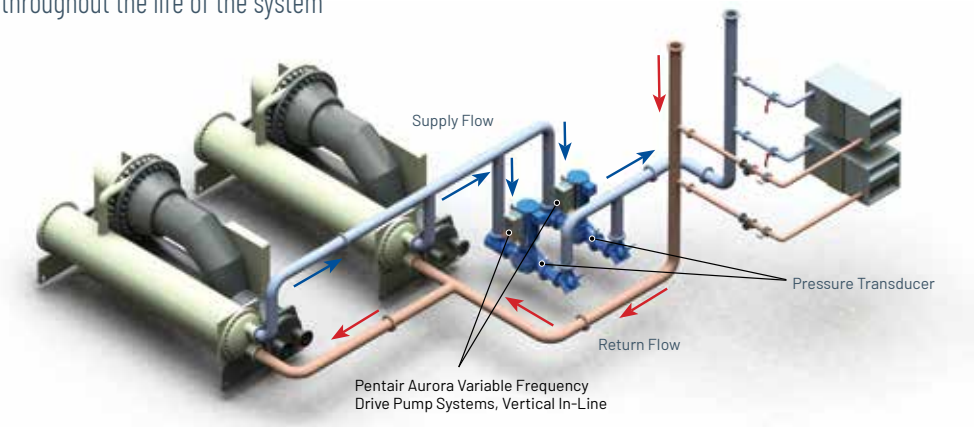
- Aurora 382 Vertical In-Line with Integrated VFD
- Pre-programmed from factory to match VFD to motor parameters
- Standard integrated communication specific to the HVAC market
- Aurora provides precise (no guessing) feedback signal to provide required pressure throughout the life of the system
- VFD's capable to withstand today's jobsite environment without the need for additional enclosure or derate for ambient temperature. Options available for NEMA 4 X / IP66 protection and standard 50 degree C rated
- Standard built-in fusible disconnect with 100K short circuit rating



Double Loop Chiller Flow

Heating and Chiller water systems with Aurora Vertical In-Line pumps integrated with Variable Frequency Drives

- Aurora 382 Vertical In-Line with Integrated VFD
- Pre-programmed from factory to match VFD to motor parameters
- Standard integrated communication specific to the HVAC market
- Aurora provides precise (no guessing) feedback signal to provide required pressure throughout the life of the system
- VFD's capable to withstand today's jobsite environment without the need for additional enclosure or derate for ambient temperature. Options available for NEMA 4 X / IP66 protection and standard 50 degree C rated
- Standard built-in fusible disconnect with 100K short circuit rating



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800 Airport Road | North Aurora, Illinois 60542 | www.AuroraPump.com