G&L Pumps

AQUAVAR™
AQUAVAR™ 56
HYDROVIEW™

Pumping System Controllers

Goulds Pumps

ITT Industries

Contents

Control Systems Overview

It's where we're going

G&L Pumps, the world leader in stainless steel pump technology, now brings you the most complete line of pump specific variable frequency drive control systems available today. Both our AQUAVAR™ and HydroView™ controller product families are designed to meet the rigid requirements of pumps and pump systems, while providing you with lower investment and operating costs when compared to traditional methods.

AQUAVAR CONTROLLER

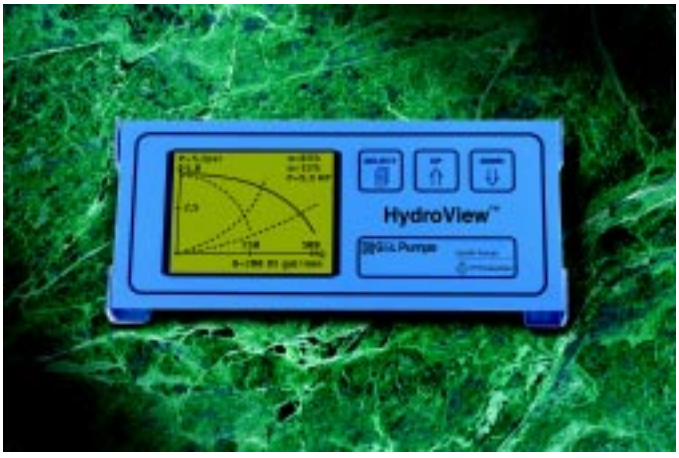
The AQUAVAR controller is a combination of a variable frequency motor drive (VFD) and a programmable logic controller (PLC) in one compact package, which can be either mounted on the fan cover of the pump motor, or on a wall or panel near the pump. Each AQUAVAR controller is pre-programmed with patented pump specific software. Wall mounted units enable the AQUAVAR controllers to be used with either surface or submersible pumps. AQUAVAR controllers are specifically designed to work with all configurations of centrifugal pumps, so they will match pump output to a wide range of varying system conditions while protecting the pump, the motor and the pumping system.

AQUAVAR MODEL 56 CONTROLLER

The AQUAVAR Model 56 controller combines many of the most popular features of the larger units, but in a smaller size to meet the requirements of NEMA 56 and 48 frame size motors. A removable programming pad is used which reduces the investment cost to the user. Half to three horsepower motors can be used.

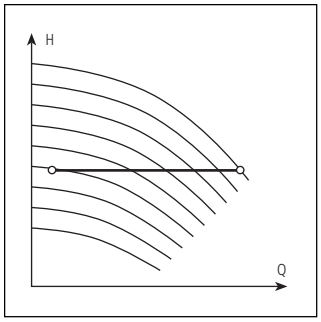
HydroView Controller

The HydroView controller displays pump operating conditions for up to six pumps on a real time basis. It can work with any standard variable frequency drive, and brings all the hydraulic control features of the AQUAVAR controller to pumps above 60 HP. The display shows the pump curve for each pump in the system and the actual system pressure and flow as a real time, constantly changing graphic.



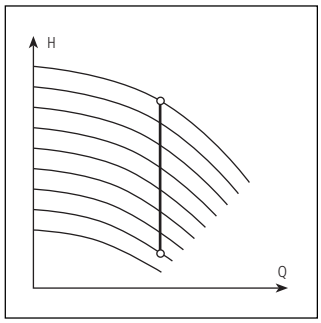
The AQUAVAR Controller meets these standard system requirements . . .

The G&L Pumps AQUAVAR controllers work with your pump to produce:



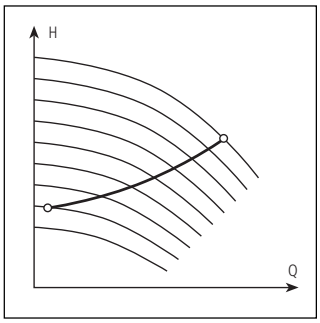
control for constant pressure . . .

or



control for constant flow . . .

or



control to match a system curve.

While eliminating the need for. . .

Jockey pumps and specialized motors

Separate control panels and inverters

Separately purchased pressure sensors

Bypass lines and metering valves

Separate microprocessor sequencing systems

Large supply tanks

Eliminate problems with the AQUAVAR™ Controller

Eliminate Run Out Cavitation

When centrifugal pumps are asked to produce more flow than their design allows, they will eventually destroy themselves through cavitation. The AQUAVAR controller prevents this by automatically starting the next pump of a multi-pump system, or shutting the pump down before damage can occur. No mechanical metering valves or flow restrictors are required.

Eliminate Shut Off Damage

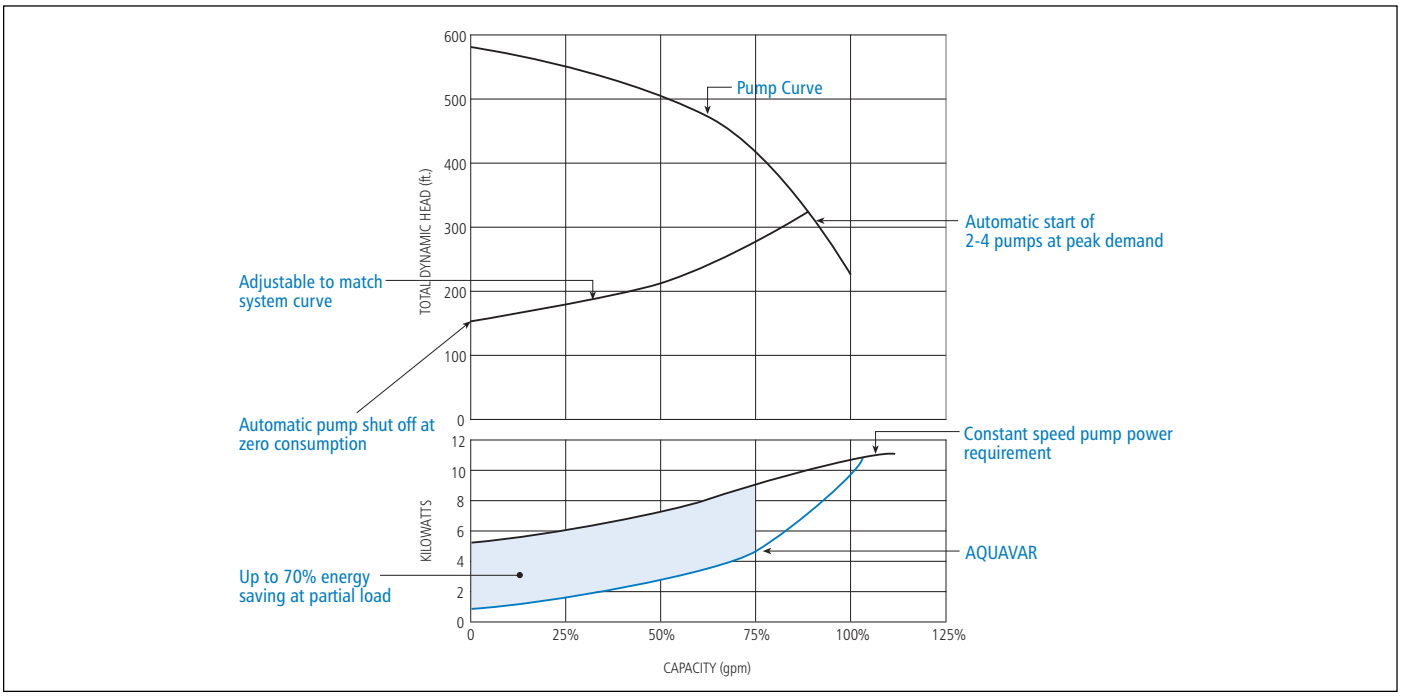
Running a centrifugal pump with no flow will eventually heat the pumpage and may create seal failure or other damage. The AQUAVAR controller prevents this by automatically shutting down the pump when there is no demand in the system. No pressure regulation valve, mechanical by-pass lines and orifice plates are required.

Eliminate Wasted Energy

The chart below shows the amount of energy that is typically wasted when a single speed pump runs at low flows. The extra energy needed to create higher heads than the system requires is wasted. The AQUAVAR controller prevents this by automatically reducing motor speed at lower flow to match the requirements of the system. No large supply tanks are required.

Eliminate Control Panels

Most systems have an electrical panel with starters, protection against voltage fluctuation, faults, shorts and overloads. In a multi-pump system, relays, switches and other controls are also needed to sequence the pumps. The AQUAVAR controller eliminates this by providing soft start, complete electrical protection, and automatic sequencing without the need for a separate panel.



Example of Energy Savings on 15 HP Pump

% Capacity	Constant Speed KW	AQUAVAR Controller KW (System Curve)	Savings X	⅓ Year (2,920 hours)
25%	5.8 KW	1.8 KW	4.0 KW	11,680 KWH
50%	7.6 KW	3.2 KW	4.4 KW	12,848 KWH
75%	9.2 KW	5.7 KW	3.5 KW	10,220 KWH
				34,748 KWH

First Year Energy Savings (constant running)

The additional investment in an AQUAVAR controller over a standard pump could be returned in energy savings by the first year!

The AQUAVAR™ Controller is easy to use.

Single Pump System

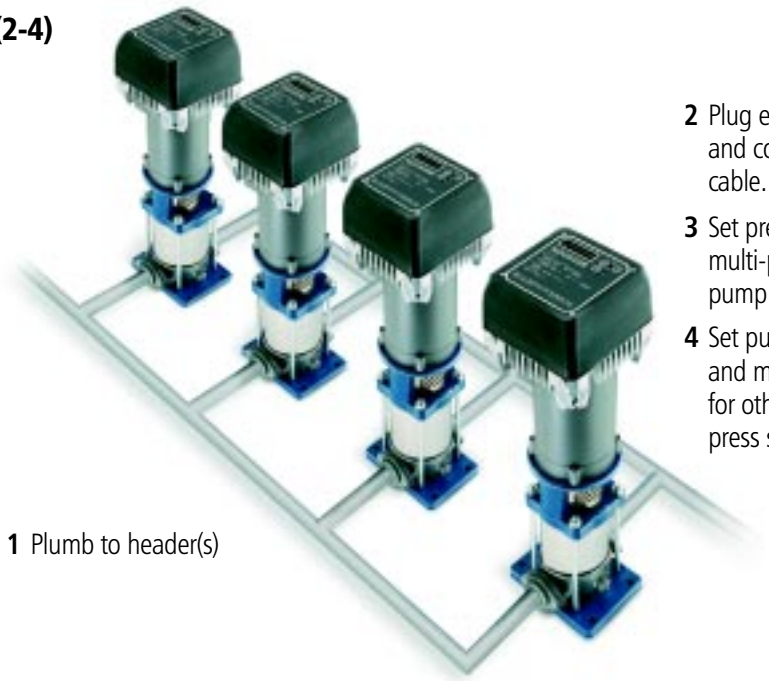
2 Wire it in.
(standard fuse box)

1 Pipe it up.
(standard piping)

3 Set pressure (psi).

4 Press start.

Multi-pump System (2-4)



1 Plumb to header(s)

2 Plug each to fuse box and connect RS-485 cable.

3 Set pressure (psi) and multi-pump mode on pump #1.

4 Set pump address and multi-pump mode for other pumps and press start.

- ☑ Automatically starts and stops lead and lag pumps to meet demand.
- ☑ Automatically alternates lead pump position for even use.
- ☑ Automatically stops all pumps when system demand is zero.
- ☑ Can be integrated into central control systems via special monitoring terminals.

Available Configurations

Horsepower Range	Electrical Requirement
2 and 3	1 phase, 230 V
5, 7.5, 10, 15, 20, 25 and 30	3 phase,460 V
40, 50 and 60	3 phase, 460 V

Technical Data

Single Phase Version: up to 3 hp
Motor Rating: 3 phase, 230 V, 0 to 60 Hz, Class F
Power Supply: 1 phase, 230 V, ±15%, 40 to 70 Hz

Three Phase Version: 5 to 60 hp.
Motor Rating: 3 phase, 460 V, 0 to 60 Hz, Class F.
Power Supply: 3 phase, 380 – 460 V, ±15%, 40 to 70 Hz.

Pressure Transducer: 316L stainless steel body with Viton gasket standard up to 360 psi (25 bar). Operating temperature for -13° to 175°F (-25° to 80°C) standard. Optional mount for temperature to 250°F (120°C). 4-20 MA signal.

Differential Pressure Transducer (option): 316L stainless steel body with elastomeric gasket. Used with an orifice plate to measure flow in constant flow applications or by itself in circulation applications. Differential pressure measurement 0 to 150 psi (0 to 10 bar).

Display: Two line LCD display, on, run, and fault display lights. LCD display is selectable for English, Spanish or French.

Motor Speed: Variable between 0 to 3600 rpm, 1800 rpm or other speeds, depending on motor rating at 60 hz.

Ambient Temperature: 41°F to 105°F (5 to 40°C). Optional to 125°F with de-rated controller.

Humidity: Maximum 90% at 105°F.

Motor Requirement: All motors must be three phase with class F insulation in standard NEMA sizes. Pump mounted models require TEFC motors.

Design: Pump motor speed varies by an incorporated static frequency inverter based on input from pressure or differential pressure transducer. (4-20 MA)

Enclosure: NEMA 4, IP 54. Avoid excessive dust, acids and salts.

Agency Listings: UL, ULC, CE

Protection: Short circuit, ground fault, under voltage, overheating, overload, over voltage, motor over temperature, programmable low/no water (secondary protection with external switch), radio emission.

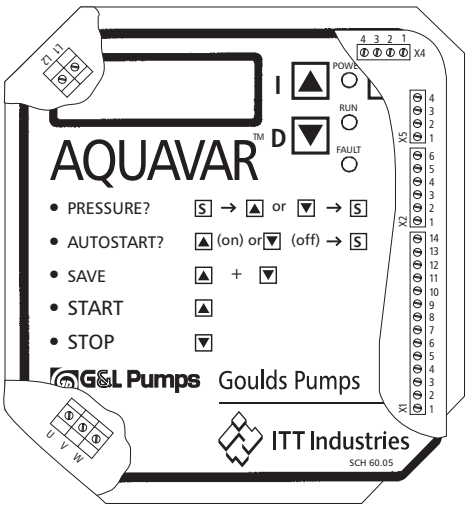
Control: Modified PID with two point control.

Input/Output: Analog and SIO via RS-485.

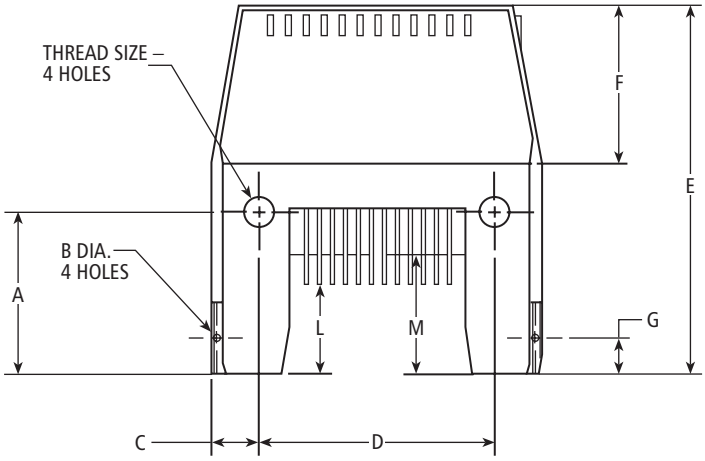
Up to 30 HP Pump Mounted

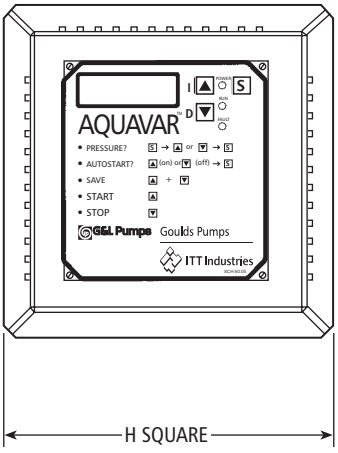
Up to 30 HP Wall Mounted

40 – 60 HP Wall Mount Only

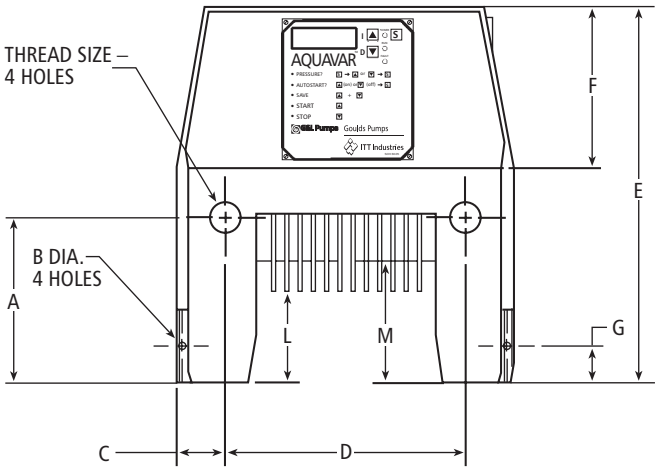


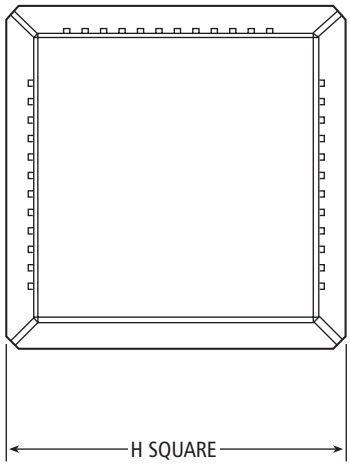
2-15 HP:





20-30 HP:

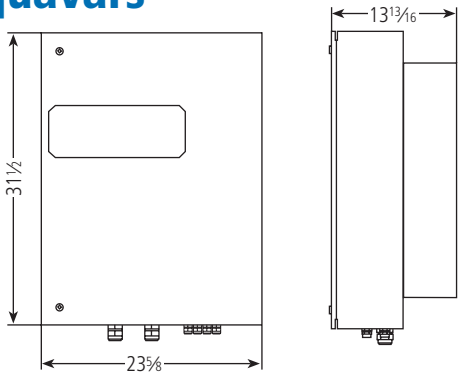


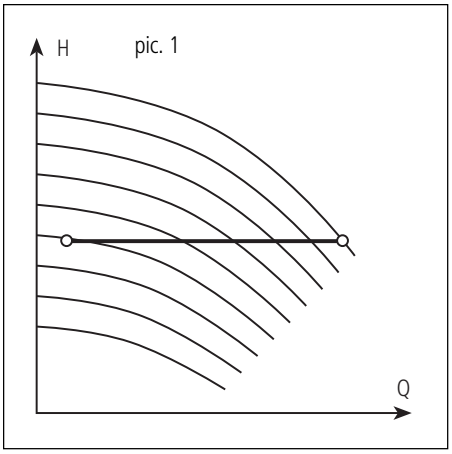


HP	A	B	C	D	E	F	G	H	J	K	L	M	Connector Hole Thread Size	Weight
2, 3	2¾	¼	1	6	8⅜	4½	¾	8⅜	7⅞	7	1¼	2	PG 13.5 mm	11
5, 7½, 10, 15	4¾	¼	1	8	11	6	1⅜	10¼	9¾	8⅜	2½	3¼	PG 16 mm	21
20, 25, 30	5¾	⅜	2½	9	14	8¾	1¼	14	12¾	12¼	3	3½	(2) PG 16 mm (2) PG 29 mm	63

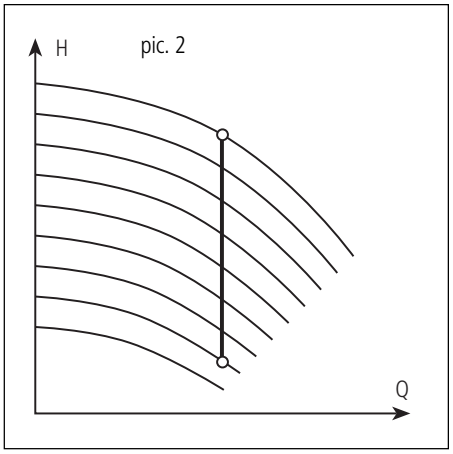
Panel Mounted Aquavars

Type	Weight
40 HP	126 lbs.
50 HP	126 lbs.
60 HP	126 lbs.

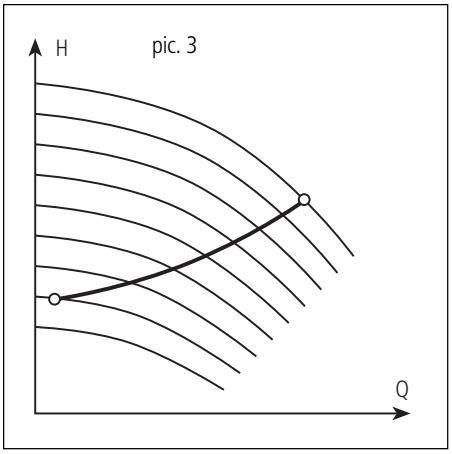




Control for constant pressure



Control for constant flow



Control to match a system curve

Control

The built in frequency inverter and microprocessor provides pump control based on pressure, differential pressure, or flow (pic. 1, 2). The pressure control version stops the pump at zero consumption. The discharge of the pump is being calculated via the speed indirectly and may be programmed to compensate for varying friction losses following a programmable system curve (pic. 3).

The AQUAVAR controller may be controlled externally with the required speed fed in by an external control system.

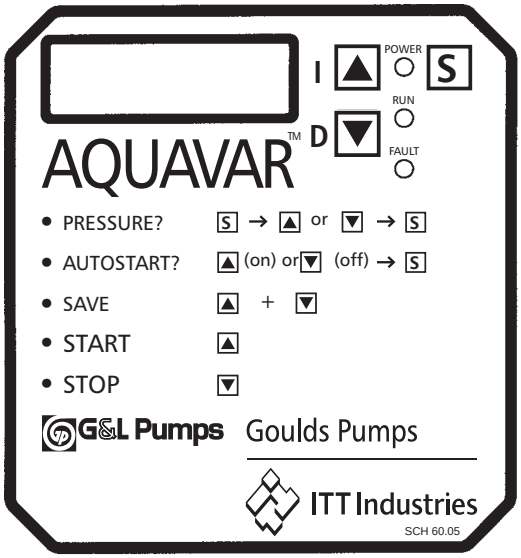
To prevent unauthorized personnel from changing operating data, a password may be set up. The starting and stopping of the pump as well as setting of control parameters is done at the keyboard and shown at the LCD display of the drive head. The display is 2-lined and programmed for English, Spanish or French. There are also 3 diodes to indicate "PUMP READY", "PUMP RUNNING" and "FAULT" (pic. 4).

There are also terminals for remote start and stop as well as to signal "running" and "fault". An analog signal to monitor speed or settings and communicate with a central control system is also possible.

Each AQUAVAR controller contains an individual microprocessor which controls the automatic operation of lead and lag pumps according to demand, alternation of lead and lag pumps, automatic start, and startup of the next pump when a pump gets out of order. No external controls are necessary. Each controller uses the same control logic. Therefore, different horsepowers and pump configurations may communicate together in the pumping system.

The voltage controlled (IGBT) frequency inverter supplies a sinus valuated pulse width modulated output voltage. It works with controlled sinusoidal current synthesis and a dynamic overcurrent limitation. The high switching frequency of 8 kHz prevents undesired noise from driving motors. Reactions to the feeder are prevented by a filter. Inverter cooling is enhanced by the motor fan.

There is also a memory for "fault" signals, operating hour counter, and an automatic start up of the pump as a test run.



Overview

The AQUAVAR Model 56 controller features all of the same control methods just described for the standard AQUAVAR controllers, but in a smaller package for use with ½ to 3 horsepower pumps. Differences are as follows. (For other specifications refer to the previous pages on the standard sizes.)

Motor Mount
In the motor mounted version, the AQUAVAR Model 56 controller uses a single bolt to attach to the fan cover of a NEMA 56 or 48 frame TEFC motor.

Programming Pad
On the AQUAVAR Model 56 controller, programming is completed with a removable pad, which is normally not sold with the controller. This pad is used by the installing technician, but would seldom be used afterwards. It is possible for the user to change the set pressure of the system and correct faults without the programming capability. The control pad is available separately.

Slave Mode
The AQUAVAR Model 56 controller may be connected to a second pump in two ways. The first is as a part of a multi-pump system where each pump has a controller. This was described earlier in this brochure. In addition, the AQUAVAR Model 56 controller can be programmed to turn a standard full speed pump on and off when system demands exceed single pump capacity.

Technical Data

Motor: Standard sizes are 1½, 2, or 3 hp (smaller motors may be used).
Motor Rating: 3 phase, 230 V, 0 to 60 Hz, Class F
Power Supply: 1 phase, 230 V, ±15%, 40 to 70 Hz

Pressure Transducer: Standard 316L stainless steel body with Viton gasket up to 100 psi. Operating temperature for -13° to 175°F (-25° to 80°C). 0-5 Volt signal. Optional pressure ratings available.

Display: On, run and fault light. Removable programming pad with two line LCD display optional.

Motor Speed: Variable speed from 0 to 3600 rpm, 1800 rpm or other speeds, depending on motor rating at 60 hz.

Ambient Temperature: 41°F to 105°F (5 to 40°C). Optional to 125°F with de-rated controller.

Humidity: Maximum 60% at 105°F or 90% at 68°F, 75% average per year.

Design: Pump speed varies by an incorporated static frequency inverter based on input from pressure or differential pressure transducer. (0-5 V)

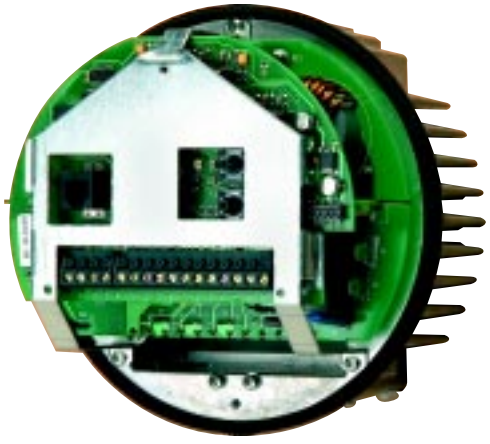
Enclosure: NEMA 4, IP 54. Avoid excessive dust, acids and salts.

Protection: Short circuit, ground fault, under voltage, overheating, overload, over voltage, motor over temperature, programmable low/no water (secondary protection with external switch), radio emission.

Agency Listings: UL, ULC, CE

Control: Modified PID with two point control.

Input/Output: Analog and SIO via RS-485 and programming pad.



Overview

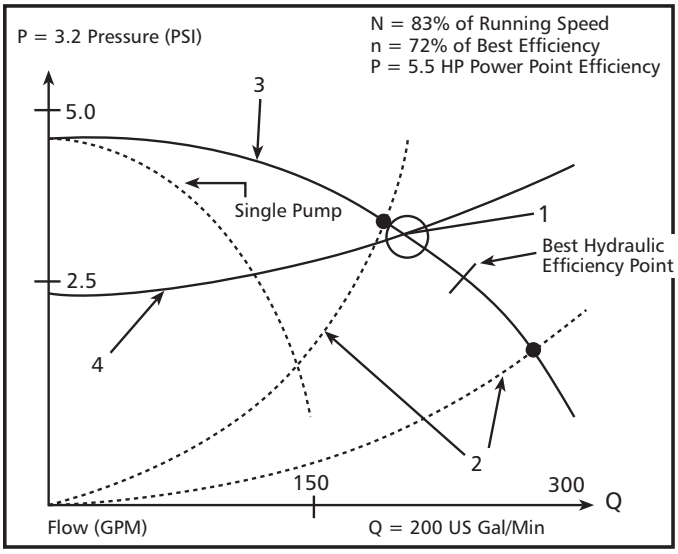
The HydroView controller is a unique pump specific PLC which can be used with up to six variable frequency drives/pumps to form a packaged system. In function, the HydroView controller is similar to the top control board of the AQUAVAR controller. This means that it needs separate VFD drive units for the various pumps it is controlling. These drives can be of any size and from any manufacturer. This makes the HydroView controller ideal for larger pump stations.

Pump Specific Programming

The biggest advantage of the HydroView controller over traditional PID controllers is that it is specifically designed with the pump professional in mind. Simply enter the system requirements in PSI or GPM, and the HydroView controller will automatically set the speed and sequence of your pump station to meet the system needs. This includes turning the pumps on and off, ramping the speed up and down, and automatic lead/lag sequencing.

Real Time Graphic Display

The most unique part of the HydroView controller is the graphic display. It gives you a real time window on your pumping system by displaying the actual pump curves as the system operates. As there is demand in the system, pump number one turns on and you can visually see the curve ramp up to meet the set point. When pump two is called for, both curves are displayed and you can see what each pump is doing. In addition to the curves, you get a numeric readout of pressure in psi, flow in gpm, percentage of maximum pump speed, percentage of best efficiency, and horsepower actually being used.



1: Pump(s) Working point
2: Best Efficiency Point +/- 10%
3: Pump(s) Curve (2 pumps in parallel shown)
4: System Curve

Controller Panel

Graphic Display Panel

Control: The HydroView controller can be programmed for constant pressure, increasing pressure with increasing flow (system curve) or constant flow.

Failure Protection: Motor overheating, pump dry running, VFD failure and line voltage

Program Input: Actual pump performance characteristics, system requirements, number of pumps, sequence time, automatic test run, transducer type, transducer range and reaction time to system change. Programming and display languages are available in English, Spanish or German.

Specifications:

Power supply: 230 V, single phase
Panel dimensions: 18.5" x 7" x 2"
Display unit dimensions: 11" x 5" x 1"

Weight: 8.5 pounds

Inputs: Pressure: 0-20 or 4-20 mA up to 24 VDC

Flow: 0-20 or 4-20 mA up to 24 VDC

Motor thermal switch: 6

Inverter failure switch: 6

Pump pressure or flow switch: 6

Outputs: External pump on/off: 6

Inverter speed control: 1 (0-10 V) Inverters may be standard manufactured brands or Goulds Pumps AQUAVAR Controller

Flow control: 1 (0-10 V)

External failure warning: 4

Description: Single board computer with Fuzzy Logic control using plain English programming and hydraulic display to control multiple pumps in a constant pressure, constant flow, or system curve pumping system. Consists of a display panel with LCD real time pumping system data, and a patch panel for connection to VFD drives, motors, transducers, flow meters and other hydraulic system components.

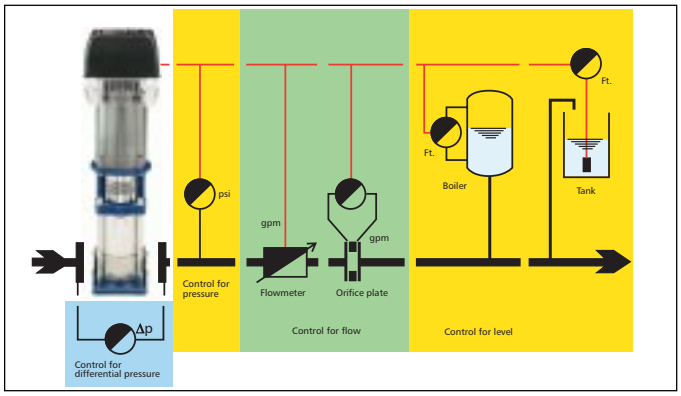
Display: Real time pump performance curves
Flow or system requirements (up to 6 System pressure)
Curve requirements
Maximum required system head and flow
Best efficiency zone
Actual real time pressure
Actual real time horsepower
Actual real time hydraulic efficiency
System faults
Programming information

Application: Control of centrifugal pump(s) in systems with variable flow rates and constant pressure or variable pressure based on system requirements. Ideal for heating systems with multi-branch pipe systems, air conditioning and pressure boosting systems.

Typical Pump Sensor Types and Locations

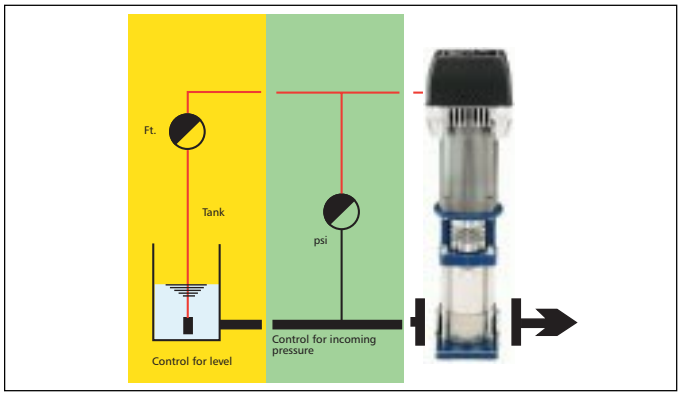
Pump Discharge

1. **Differential Pressure –** Compensation for friction losses in closed loop systems.
2. **Pressure –** Constant pressure or system curve.
3. **Flow meter or orifice plate –** Constant flow
4. **Level control –** Sensors for tank filling.



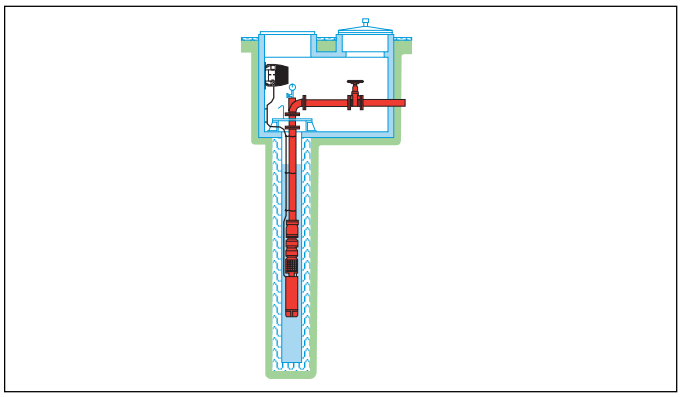
Pump Suction

1. **Pressure –** Compensation for changes in suction pressure or system curve. Tank or basin draining applications.
2. **Level control –** Suction side tank draining sensor.



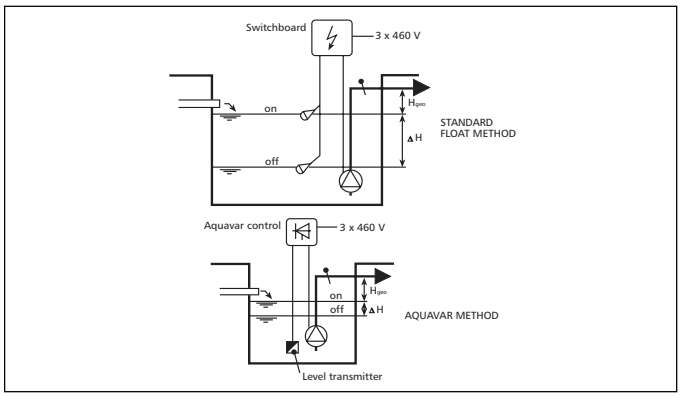
Submersible and Turbine Pump Applications

- Submersible well, turbine, effluent or sewage pumps.
- Operates with motor lead lengths up to 60 feet as standard.
- Wall mounted AQUAVAR controller.
- Optional filter is used for up to 1000 feet of motor lead lengths.



Effluent and Sewage Pump Applications

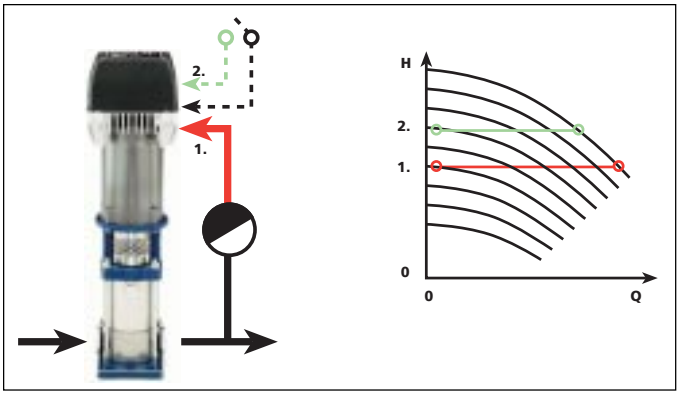
- Standard systems use full speed pumps with level switches for start and stop.
- Large basins are used to reduce number of starts.
- AQUAVAR controllers save energy with low pump speed to match incoming flow.
- System basins can be up to 80% smaller.
- Constant flow reduces build-up of pipe sediment.

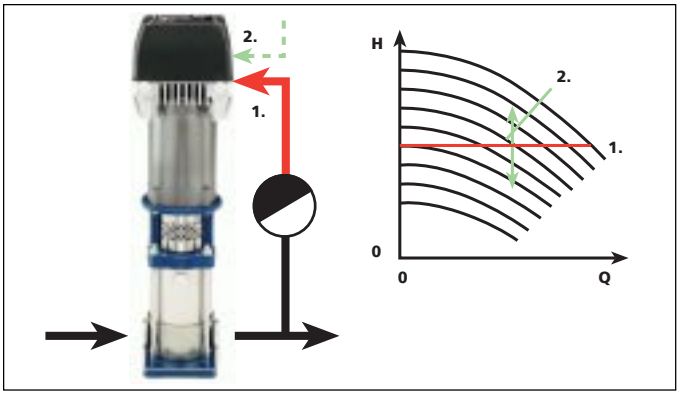


Typical Pump Sensor Types and Locations

Change Pressure or Flow Set Point

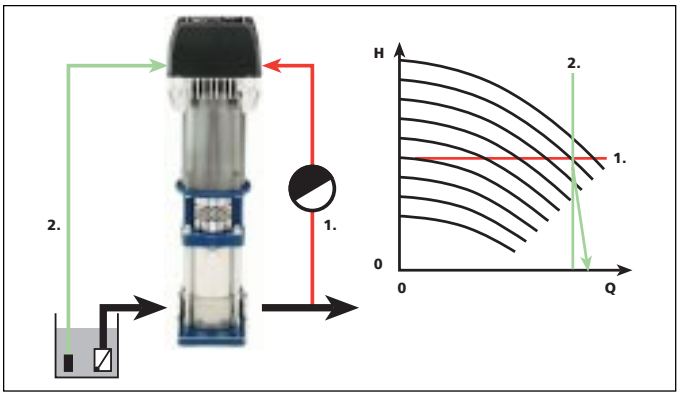
- The AQUAVAR controller has the capability to receive input from two analog (4-20 ma) devices at the same time.
- Input #1 from pressure transducer regulates pressure.
- Input #2 from external source changes set point with system changes.
- Input #2 can be for a fixed set point with external contact or variable with an actual value.





Change Pressure Based on Suction Condition

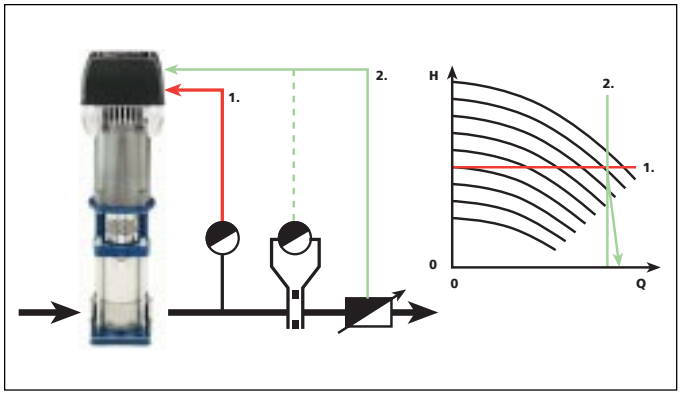
- Input #1 from pressure transducer regulates pressure.
- Input #2 from suction reduces pump speed as suction pressure drops.

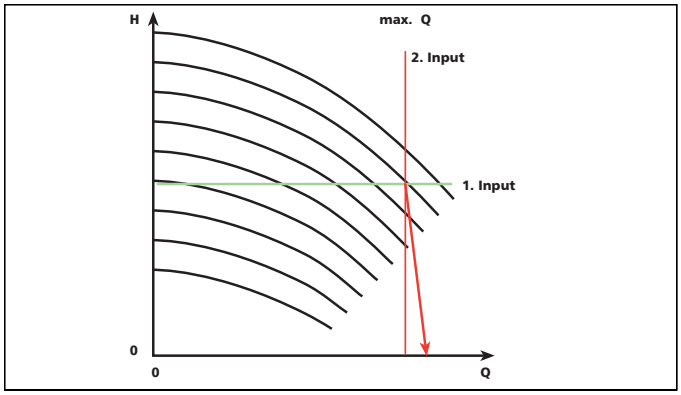


Pump Control Applications

Change Pressure Based on Flow

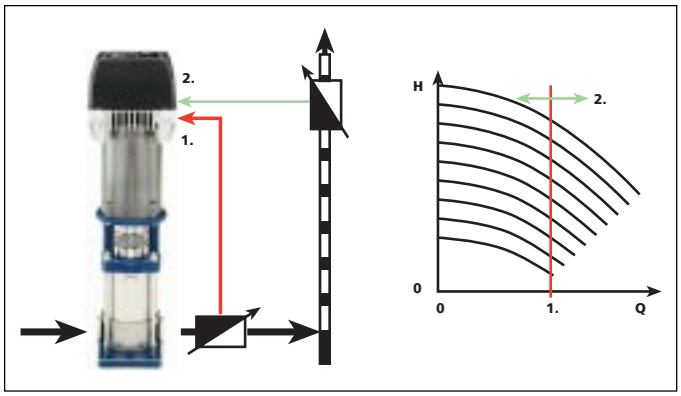
- When flow reaches maximum load or pump capacity.
- Pump slows down to maintain flow but reduced pressure.





Mixing of Two Fluids Based on Flow

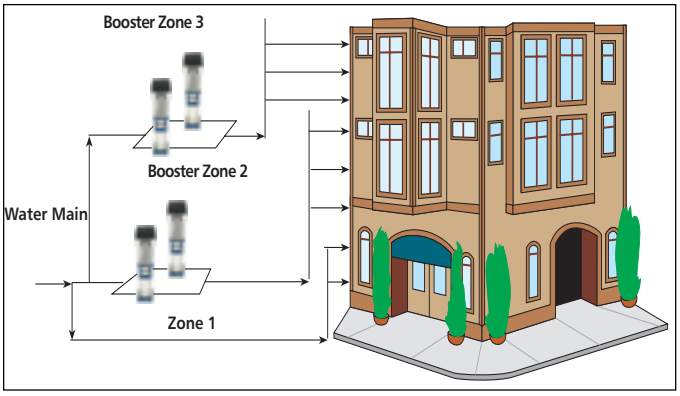
- Flow sensor on #1 measures flow of fluid #1.
- Flow sensor #2 adjusts speed of pump to mix a set percentage of fluid #2.



Pump Control Applications

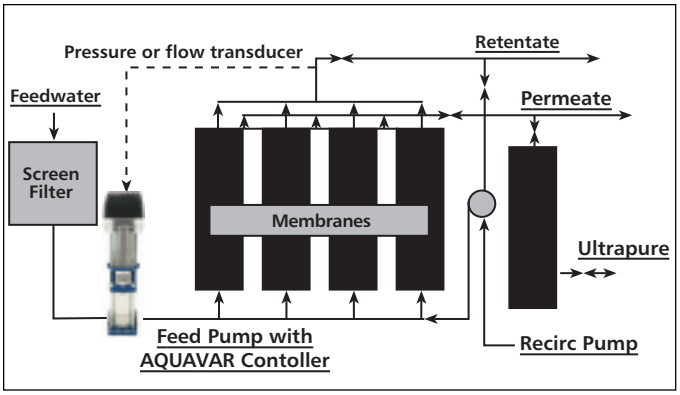
Multi-Story Building Water Supply

- An AQUAVAR controller system offers independent zone control.
- Automatic lead/lag for even pump wear.
- Automatic friction loss compensation for higher floors.
- Constant pressure with varying demands.
- Automatic pump shut off at zero demand.
- Eliminates the need for large supply tanks.



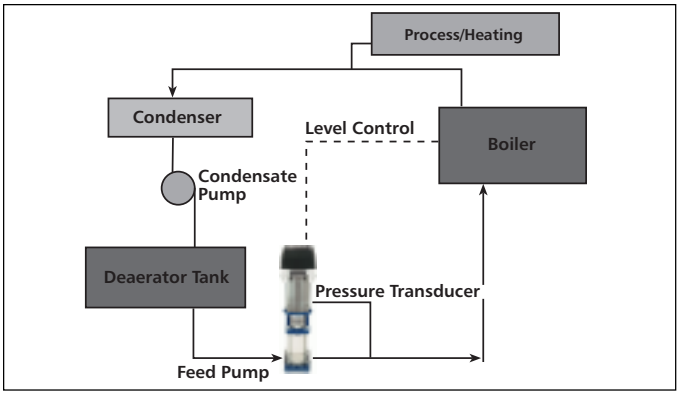
Reverse Osmosis Filtration Systems

- An AQUAVAR controller system can be set up for either constant pressure or constant flow through the filtration system.
- The pump is protected from low flow damage when the filter becomes clogged.
- Automatic system shut off signals operator to change filters.
- Automatic pump speed change to increase pressure for additional banks of filters for higher demand rates.



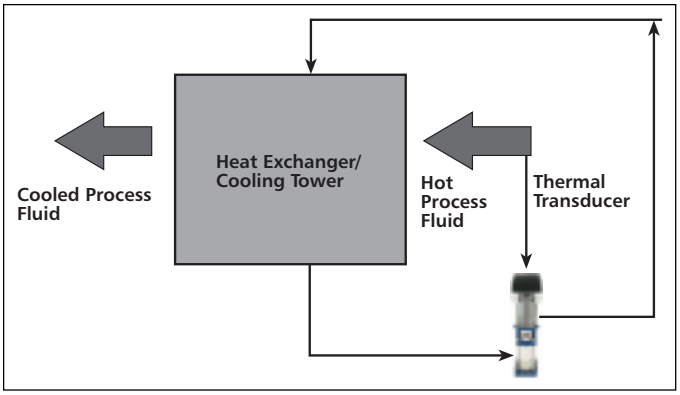
Boiler Feed Systems

- An AQUAVAR controller maintains constant pressure to the boiler at varying demand rates.
- The boiler level control switch can be connected directly to the controller.
- No by-pass lines, metering valves or automatic "Clayton" type valves are required.
- The AQUAVAR controller automatically protects the pump from damage in low NPSH or run out conditions.



Cooling Tower Circuits

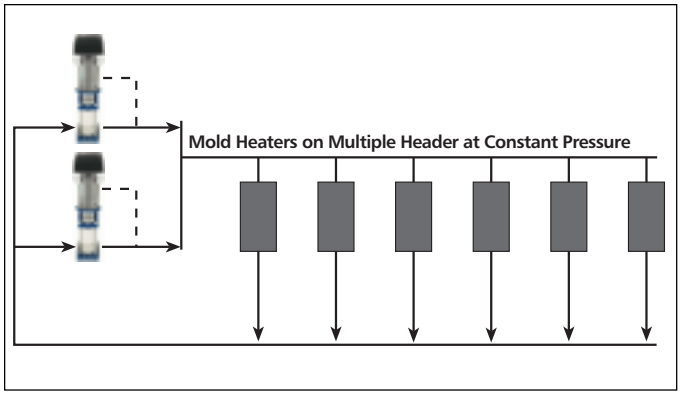
- A thermal sensor can be used as an option to a constant pressure system.
- Temperature can be measured at either side of cooling tower or heat exchanger.
- The AQUAVAR controller can be programmed to increase pump speed to compensate for higher demand with higher temperature input.



Pump Control Applications

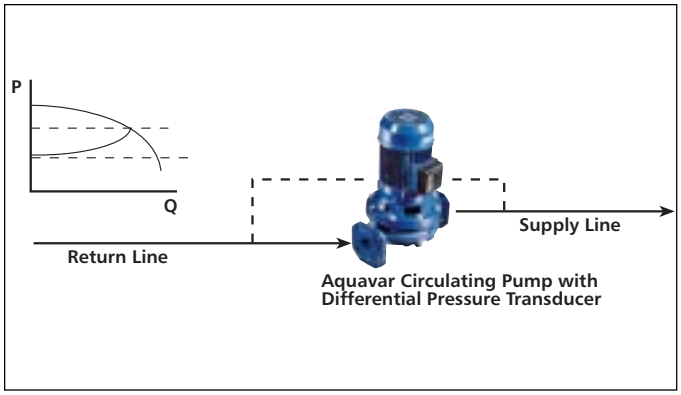
Plastic Injection Molding Machines

- Mold heaters are arranged on multiple headers with the molding machines.
- As each molding machine is turned on, the AQUAVAR controller speeds up the pump(s) to maintain constant pressure in the system.
- The AQUAVAR controller system protects the pump systems from water hammer surges as molds are heated and purged.



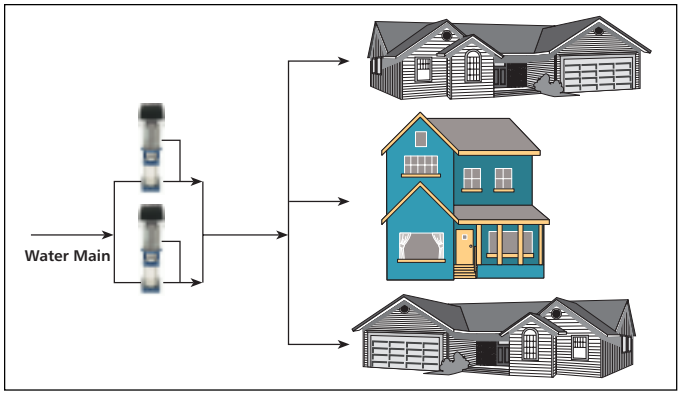
HVAC Circulating Systems

- Automatically adjusts speed to meet demand from additional heating/cooling zones.
- Automatically compensates for system piping losses at higher flows.
- Maintains constant system pressure.
- Reduces energy wasted at low flow conditions.



Constant Pressure Municipal Water Supply

- Multi-pump constant pressure booster sets for residential or commercial water supply.
- Ideal for new developments, end of main line service, or higher elevations.
- Automatic reaction to changes in demand for constant point of use water pressure.
- The AQUAVAR controller system provides automatic lead/lag of pumps for even wear.



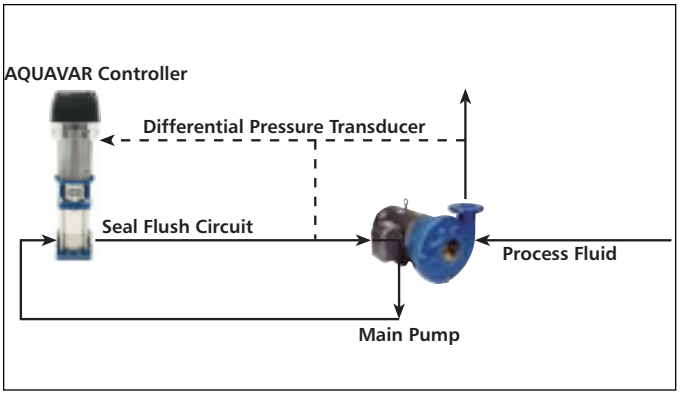
Landscape, Turf and Agricultural Irrigation

- Constant pressure matched to sprinkler head requirements.
- Automatic compensation for number of zones in use.
- Automatic system curve compensation for friction losses at higher flows.
- Automatic start and stop of multiple pumps to keep energy costs low.

Pump Control Applications

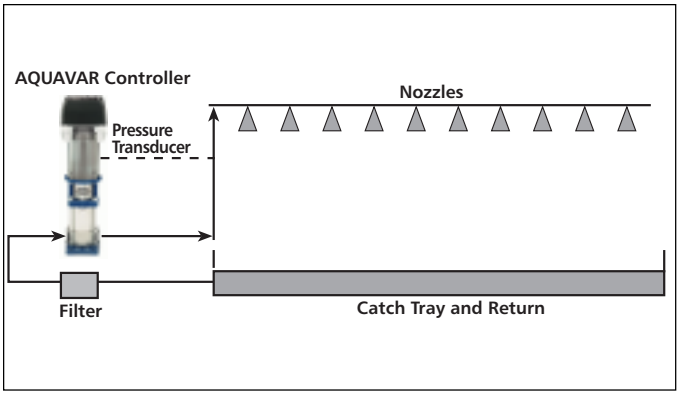
Seal Flush Barrier Fluid

- Seal flush circuit can be hooked up to multiple pumps in a process. The AQUAVAR controller automatically compensates for the number of pumps in use.
- Barrier fluid pressure can be set to maintain at 15 PSI over pump pressure.
- Automatically shuts down the pump at zero demand.



Spray Wash Systems

- Maintains constant pressure at each nozzle.
- Automatic shut off at zero demand to eliminate pump damage.
- Automatic friction loss compensation at highers flows.
- Eliminates by-pass lines, holding tanks and metering valves.

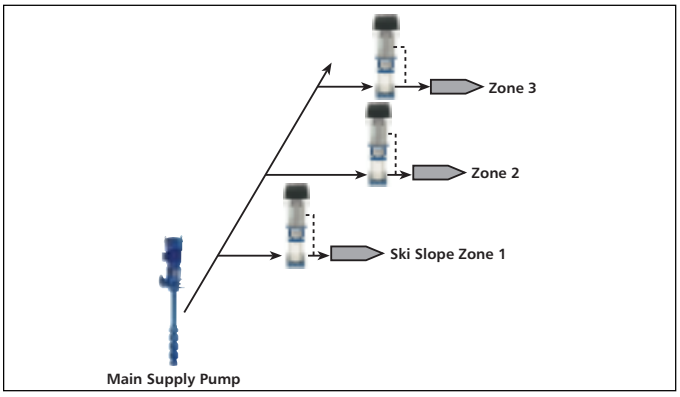


Water Fountain Control

- Uses 4-20 mA anemometer (wind speed indicator) to regulate pump speed. As wind speed increases, fountain spray height decreases to keep water in the fountain.
- Automatically regulates display height to weather conditions.
- Keeps pedestrians dry.

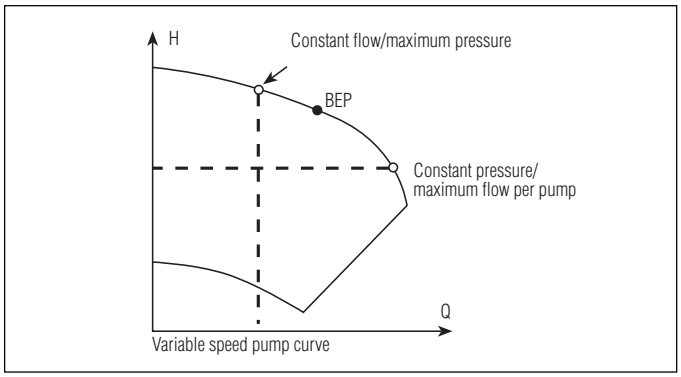
Snow Making Systems

- Snow guns have a specific operating pressure to optimize their effectiveness. Booster sets for each zone of the mountain can match these requirements better than one pump at the bottom of the mountain.
- Zones can be turned on or off independently to meet ski requirements.
- The main supply pump can be reduced in size since it no longer has to provide snow gun pressure. It can also be equipped with an AQUAVAR controller.



Pump Selection for VFD Operation

Performance: Locate the pressure (TDH) you wish to maintain and the maximum flow you need. Select the pump which meets or exceeds this rating at full speed (the top line of the range curve). For multi-pump systems, the total capacity of all pumps should meet or exceed the total demand. For constant flow applications, find the flow you wish to maintain and then select the pump size which can meet or exceed the maximum required pressure at full speed. Best results are obtained when the maximum pressure or flow is within ten points of the best pump efficiency. This diagram can be used as a reference in selecting proper pump curves for operation with the AQUAVAR controller.



Typical System Design

The following diagrams show typical single pump and multi-pump systems using the AQUAVAR controller. Connection can be made directly to a water supply or water can be drawn from a supply tank or well. In the case of supply tanks and wells, float valves (item 10) can be used to shut down the pumps when water is low. In the direct connection, a pressure switch on the suction side (item 8) can be used.

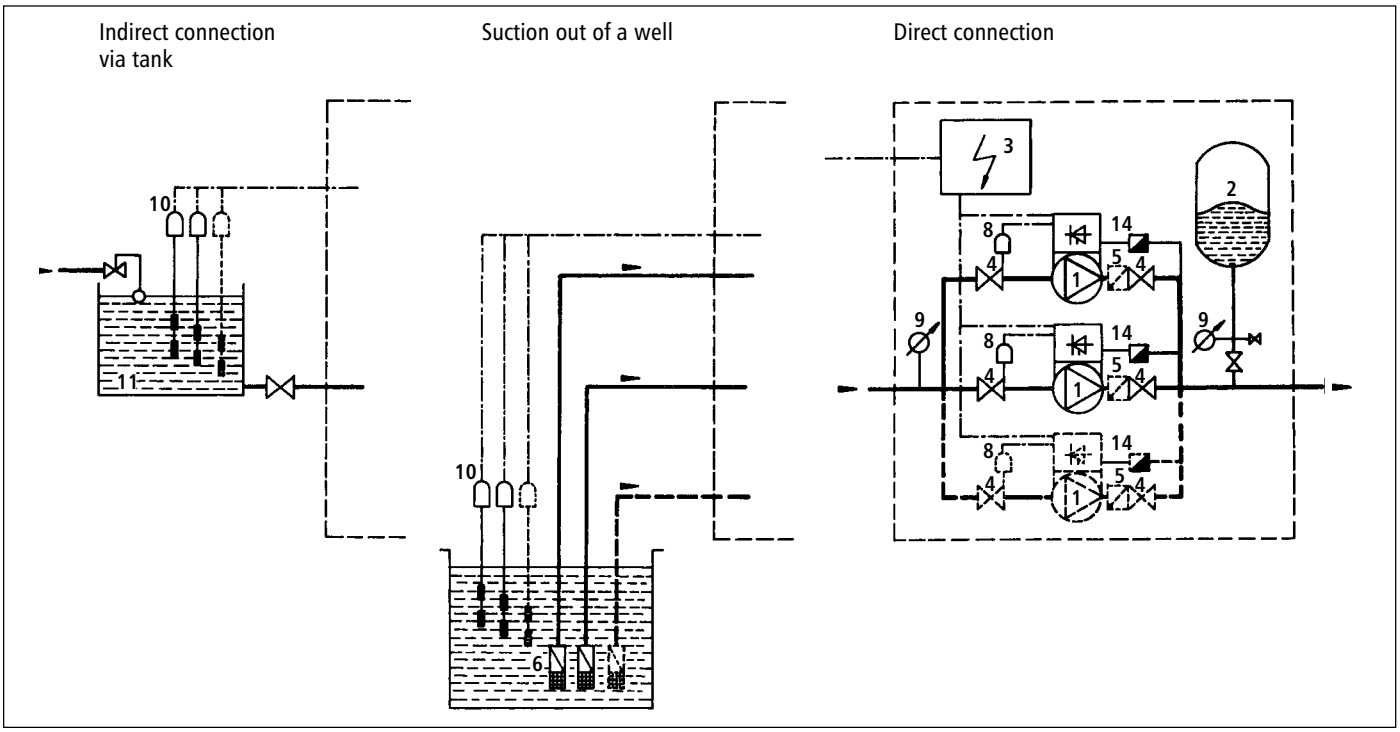


Diagram 2 Multiple Pump Layout

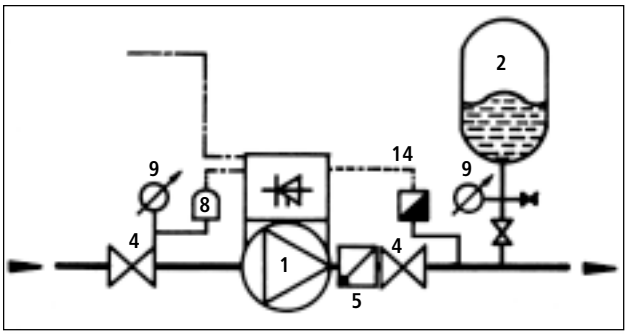


Diagram 3 Single Pump Layout

1 Pump with AQUAVAR controller
2 Diaphragm tank
3 Distribution panel
4 Gate valves
5 Check valves
6 Foot valves
8 Incoming pressure switch
9 Pressure gauges
10 Level switches
11 Supply tank
14 Pressure Transmitter

A diaphragm pressure tank is used on the discharge side of the pump or pumps to maintain pressure in the line when there is no demand. This will keep the pumps from continuing to run. With the AQUAVAR controller, it is not necessary to have a large tank for supply purposes. In selecting a tank, make sure it can withstand maximum system pressure. The tank should have a total volume of about 10% of the maximum single pump flow rate in gpm. Pre-charge the tank based on required system pressure. Please refer to the chart located in the Installation Programming and Operation manual.

NOTE: Closed loop circulator systems may not require a pressure tank.

Notes

G&L Pumps

Typical Applications

The AQUAVAR controller is specifically designed to control systems using Centrifugal pumps in applications such as:

- Booster systems
- Municipal water supply
- Water treatment
- HVAC
- Irrigation
- OEM packages
- Boiler feed
- Circulation systems
- Fluid level control
- Filtration systems
- Wash systems
- Temperature control

AQUAVAR and HydroView are trademarks of ITT Industries or its subsidiary.

www.goulds.com

Printed in USA
GLAQUA2

Printed on recycled paper.

Goulds Pumps
1 Goulds Drive
Auburn, NY 13021

Goulds Pumps
ITT Industries