

Series 180

Commercial/Industrial Control System Installation, Operation and Maintenance Manual

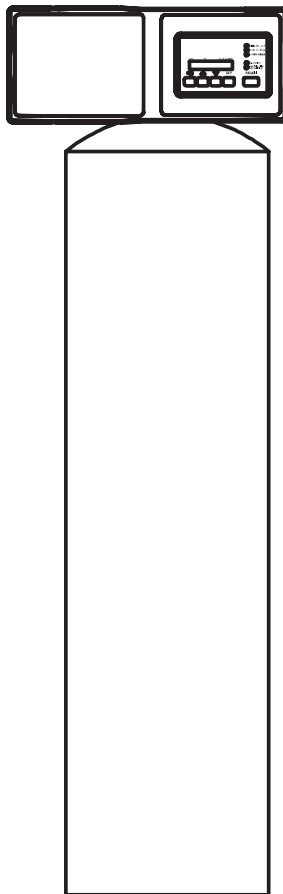


Table of Contents

Installation	3	Capacity Based Regeneration Start Options . 12	
Plumbing		P15 = 0 or 2 Variable Reserve	
Inlet and Outlet Piping		P15 = 1 or 3 Fixed Reserve	
Drain Line Piping		P15 = 0 or 1 Delayed Regeneration Only	
Brine Line Piping		P15=2 or 3 Immediate Regeneration Override	
Electrical	4	Immediate Regeneration Only Option	
Installing the Tank Adapter and Valve	4	Parallel Operation.	16
Conditioner Start-Up	5	Remote Regeneration	16
Regeneration Cycle Time Instructions.	6	Flow Sensor Connections	17
Pin Time Chart		Final Check Out	17
Set Backwash Timing		Injector and Backwash Control Sizing.	17
Valve Positions.	7	Injector Flow Rate Chart	21
Series 962 Electronic Control	8	Pressure Drop Vs. Flow	21
Programming the Series 962 Control	9	Flow Diagrams	22
Factory Default Values		Replacement Parts.	23
Program Levels		Parts List	24
Level I Programming		Specifications.	25
Setting Time of Day			
Level II Programming			
Changing a Program Value			
Level III Programming			
Level IV Programming			
Manual Regeneration			
Entering "d" Values (Regeneration Days)			
Viewing a Program Value			
Lock-out Feature			
Flow Sensor Select Options	11		
Advance Cycle Function	11		
Cancel Regeneration Function	11		

Installation

The control system may be shipped as a subassembly to avoid damage in transit. The water conditioner should be assembled, piped and wired according to the manufacturer's recommendations. The following instructions are provided as a general guide.

Plumbing

Valve Installation

Reference Figures 1 and 2

Inlet and Outlet Piping

All inlet and outlet piping should be anchored or supported adequately to avoid stress on the control system. Follow good plumbing practices and conform to local codes. Figures 1 and 2 illustrate the use of separate inlet, outlet and bypass valves. Provide shut-offs and emergency bypass of unconditioned water in the event the unit requires servicing.

The inlet, outlet, top of tank, and bottom of tank connections are 1-1/2 inch female NPT or BSPT.

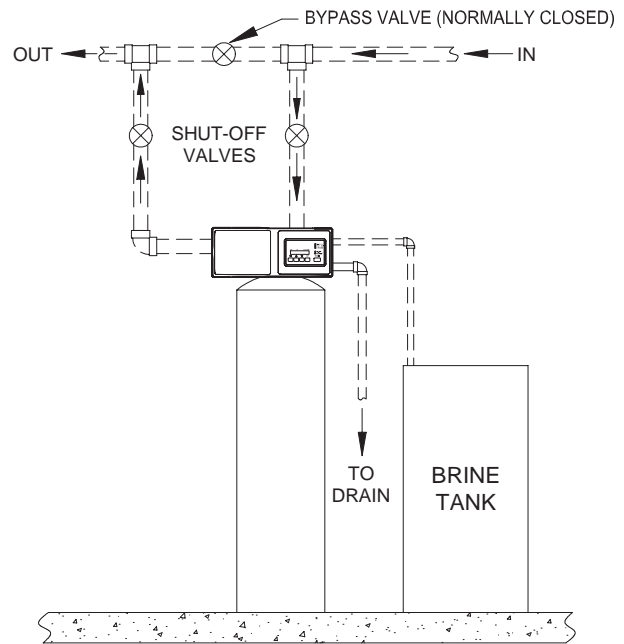


Figure 1

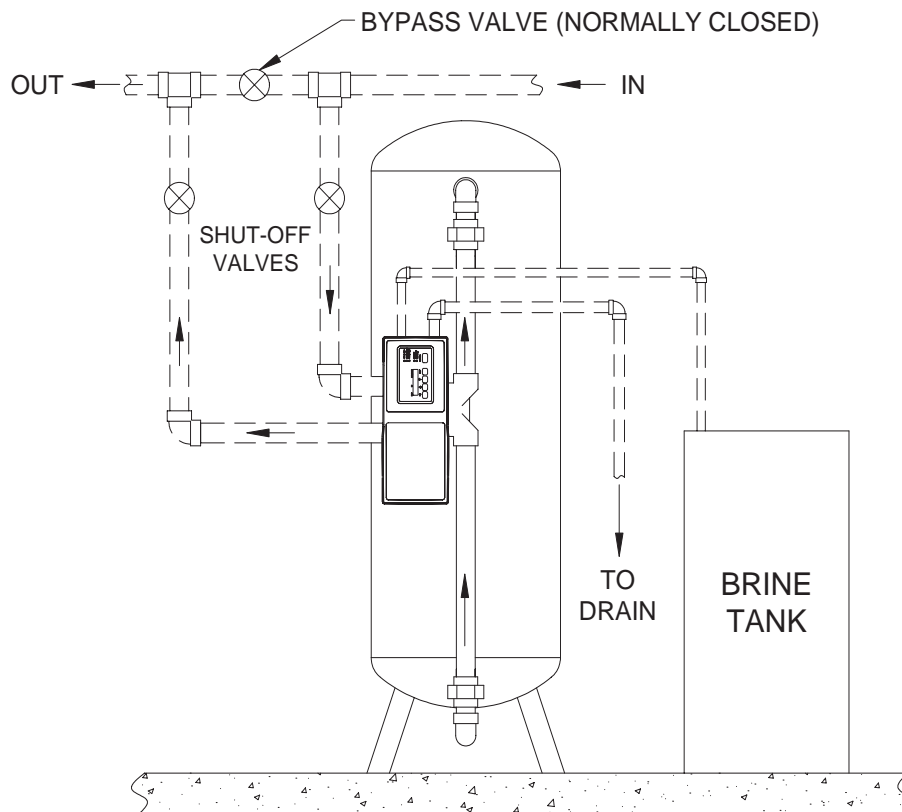


Figure 2

Drain Line Piping

Reference Figures 1, 2 and 3.

The 3/4 inch NPT of BSPT drain fitting contains a flow control to accommodate backwash and fast rinse rates up to 25 gpm (94.6 lpm). Should higher flow rates be needed, an external flow control will be required.

To avoid regeneration problems, the following drain line precautions should be observed:

- Piping 3/4 inch or larger
- Overall length less than 30 feet (6.1 m)
- Not elevated higher than valve
- Not restricted
- No shut-off valves
- Minimum number of elbows and fittings
- Piping must be self-supporting without strain on valve drain fitting
- Open end termination to provide a siphon break

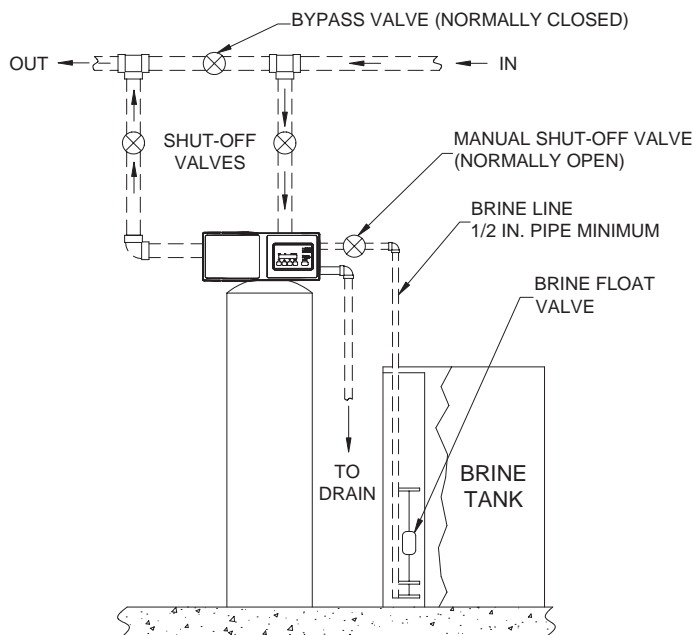


Figure 3

Brine Line Piping

Reference Figure 3.

The 1/2 inch NPT or BSPT brine connection is located between the inlet and outlet pipe connections of the control valve.

The brine tank should be located as close as possible to the conditioner tank. A float type brine valve must be used in the brine tank. Since the brine line is normally

pressurized, a manual shut-off valve should be installed to facilitate brine system servicing.

Brine line size should be no smaller than 1/2 inch. The brine line should be self-supporting. Use a minimum of fittings to assure unrestricted brine draw.

Electrical

100VAC, 120VAC and 230VAC Units:

Remove the plastic cover, complete the wiring to terminals 2, 4 and 7 of the terminal block (Figure 22) for 440 Timers or to terminals 1, 2, 4 and 7 (Figure 23) for 450 Impulse Timers, and terminals 1, 4 and 8 (Figure 24) for 962 controllers. Reinstall the plastic cover.

Note: Conduit is recommended.

24VAC Units (Not valid for 962 Control):

The power supply transformer should have a minimum rating of 200 volt-amperes to run the drive motor and timer motor. If additional electrical components, such as solenoid valves are connected to the terminal block, the volt-amp rating of the transformer must be increased to accommodate the load.

Remove the plastic cover, complete the wiring to terminals 2 and 4 of the terminal block (Figure 22) for 440 Timers or to terminals 1, 2 and 4 (Figure 23) for 450 Impulse Timers and reinstall the cover.

Installing the Tank Adapter and Valve-Top Mount

1. Clean residual mineral from top of the tank and threads.
2. Apply silicone grease to all O-rings (Figure 4), the bevel on top of the tank and to the top 1 inch of the riser pipe.

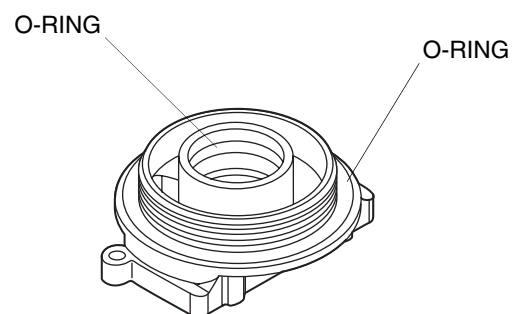


Figure 4

3. Install the tank adapter O-ring. Make sure the riser pipe is 1/8 to 1/4 inch below the top of the tank, Figure 5.

4. Position the tank adapter in the opening of the tank with the riser pipe in the riser pipe seal. Thread the tank adapter into the tank and tighten until the tank adapter bottoms out on the tank.
5. Place the gasket on the tank adapter and position the valve.
6. Mount the valve using the five Allen head screws and tighten evenly.

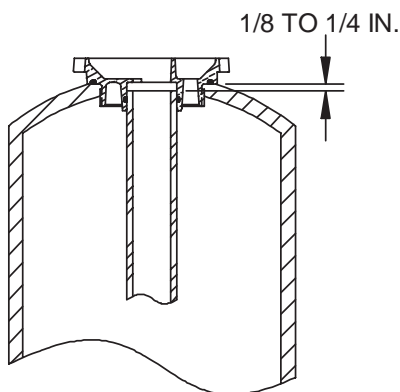


Figure 5

Installing Valve - Side Mount

1. Position the valve body on the side mount adapter with the gasket in place, Figure 6.
2. Mount the valve using the five Allen screws provided and tighten evenly.

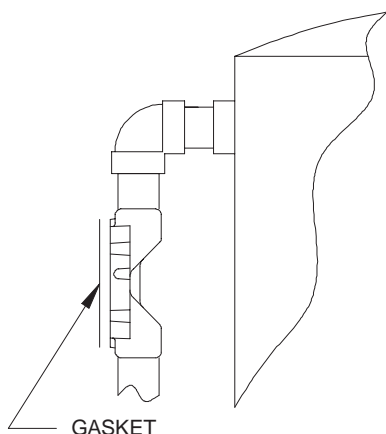


Figure 6

Conditioner Start Up

1. Close inlet and outlet valves.
2. Close brine line valve if used.
3. Supply electrical power to unit(s). Fill brine tank(s) with water to a point 1 inch (2.5 cm) above grid using a hose or bucket. Do not add salt to brine tank at this time.

Caution: Keep hands away from drive linkage area when operating.

4. Push in red knob on timer, turn **COUNTERCLOCKWISE** until arrow points to **START** position. This will move the piston to the **BACKWASH** position.
5. Partially open inlet valve until a steady stream of water, free of air, flows from the drain. Open inlet valve fully.

Note: If top cover of conditioner tank can be removed to vent air, the tank may be filled more quickly

6. Open brine line valve. Allow the unit to **BACKWASH** until the timer moves the piston to the next position in approximately 12 minutes.
7. After the timer has moved the piston out of the **BACKWASH** position, it will move to the **BRINE/ SLOW RINSE** position. Watch the level of water in the brine tank, it should move down at a steady rate. A drawdown of 2 to 3 inches is sufficient for checkout.
8. As in step 4, manually rotate the red knob **COUNTERCLOCKWISE**, slowly, until the piston moves into the **FAST RINSE** position.
9. Allow the valve to remain in the **FAST RINSE** position until the timer automatically moves the piston to the **SERVICE** position in approximately 11 minutes.

The unit is now ready to be put on line. Open the outlet valve, close the bypass valve and load the brine tanks.

Note: If installation consists of multiple tanks, use steps 1 through 9 for each conditioner.

Note: If using the 962 electronic demand controller, simply press and hold the **REGEN** button for 3 seconds to start a regeneration. To step through each regeneration cycle, press and hold the LEFT (←) arrow button for 3 seconds. This allows you to step through a quick regeneration.

Loading the Brine Tank (Grid System)

1. The brine valve (located in the brine tank) will automatically fill and maintain the water level in the brine tank. The water level must be 1 to 2 inches above the salt platform. If that level is not achieved, remove the brine valve (after shutting off the manual brine line valve) and adjust the float on the float rod.
2. Fill the brine tank with salt to a level even with the top of the brine well. Use a clean grade of softener salt, (pellet salt or equivalent). Rock salt is not recommended. Rock salt contains impurities that can cause malfunction of the brine valve.

Setting Series 440 Timers

Determine a regeneration schedule for the conditioner and adjust the automatic timer as follows (see Figures 7 and 8):

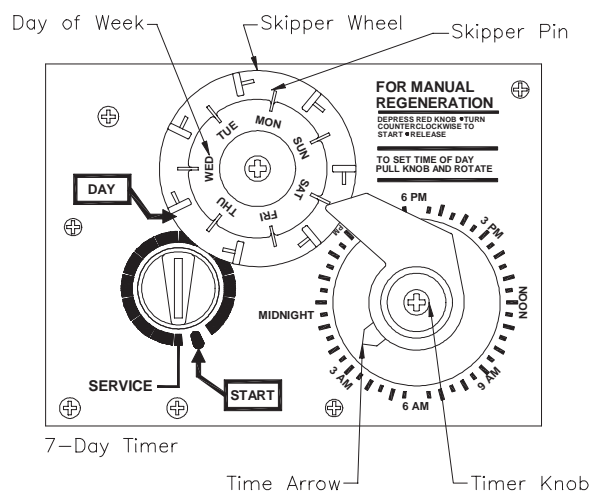


Figure 7

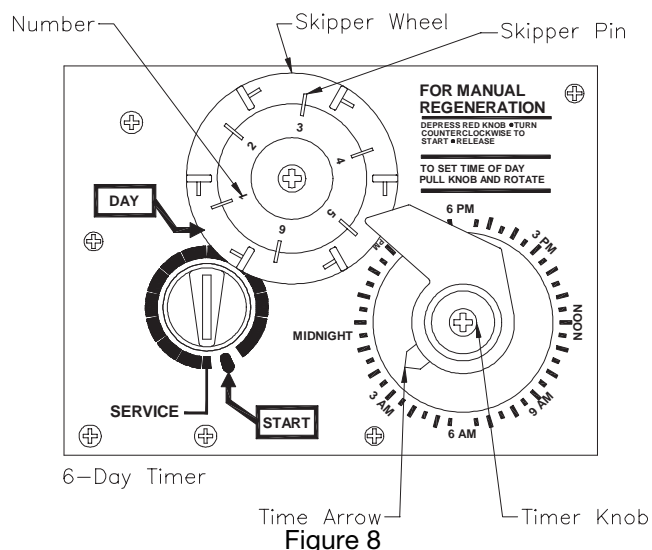


Figure 8

1. Pull all the skipper pins out (away from control).
2. Rotate skipper wheel until day arrow points to day of week or number 1.
3. Push in skipper pin(s) for day(s) regeneration is required.
4. Pull timer knob out (away from the timer face) and rotate until time arrow on timer knob points to correct time of day on face plate.
5. Timer will automatically initiate regeneration on preset days at 2:30 A.M. To alter time, simply reset timer knob to an earlier or later time which will change the time of regeneration by the same number of hours. (Time indicated at time arrow will no longer be correct).

Regeneration Cycle Time Instructions (440 and 450 Timers)

Pin Time Chart

Backwash or Fast Rinse		Brine/Rinse	
No. of Pins OUT	Time	No. of Pins IN	Time
1	8 min.	2	1.5 min.
2	11 min.	3	4.5 min.
3	14 min.	4	7.5 min.
4	17 min.	5	10.5 min.
5	20 min.	6	13.5 min.
6	23 min.	7	16.5 min.
7	26 min.	8	19.5 min.
8	29 min.	9	22.5 min.
9	32 min.	10	25.5 min.
10	35 min.	11	28.5 min.
11	38 min.	12	31.5 min.
12	41 min.	13	34.5 min.
13	44 min.	14	37.5 min.
14	47 min.	15	40.5 min.
15	50 min.	16	43.5 min.
*		*	

*Each additional pin either pulled out or pushed in equals 3 minutes.

Set Backwash Timing

Pull pins as shown for desired backwash time. Reference Pin Time Chart.

Set Brine/Rinse Timing

Depress pins as shown for desired brine/rinse time, minimum of two pins down. Reference Pin Time Chart.

Set Fast Rinse Timing

Pull pins as shown for desired fast rinse time. Reference Pin time Chart.

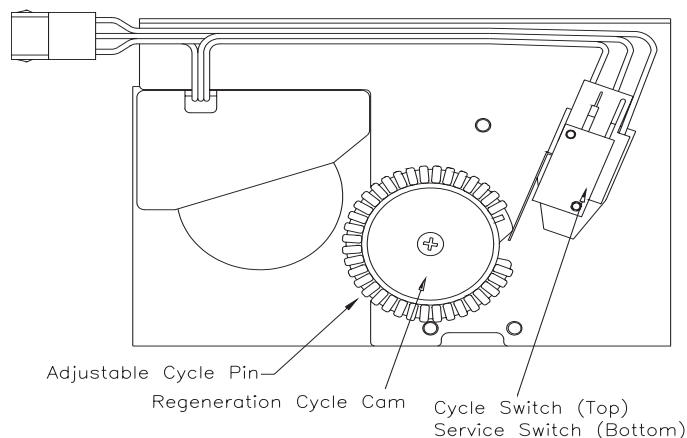
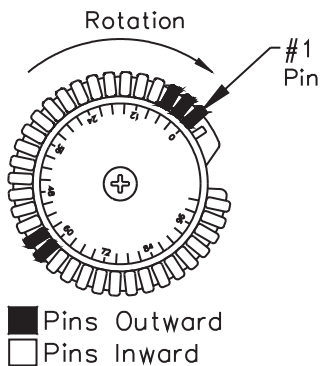


Figure 9 Timer, Rear View

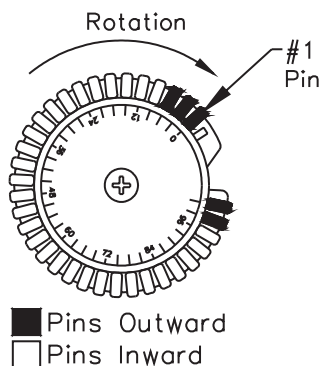
Typical Water Conditioning Cycle

Backwash	14 min.	3 pins outward
Brine/Rinse	40.5 min.	15 pins outward
Fast Rinse	11 min.	2 pins outward
		Remaining pins in



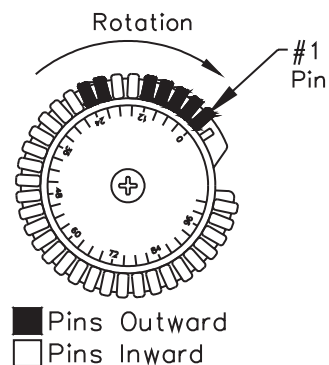
Variation Water Conditioning Cycle

Backwash	14 min.	3 pins outward
Brine/Rinse	85.5 min.	30 pins outward
Fast Rinse	11 min.	2 pins outward



Typical Filter Application Cycle

Backwash	20 min.	5 pins outward
Pause	1.5 min.	2 pins inward
Fast Rinse	11 min.	2 pins outward



Valve Positions

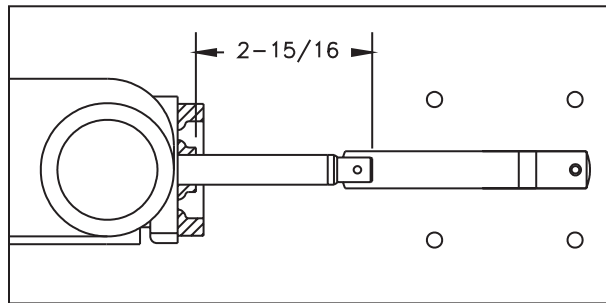


Figure 10 - Backwash Position

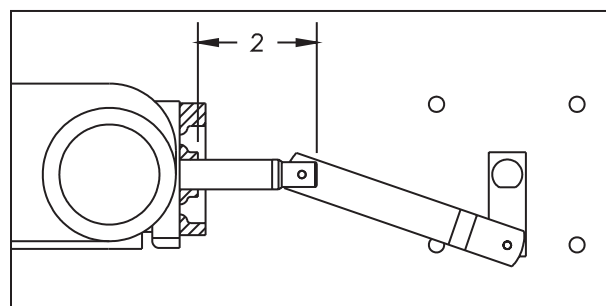


Figure 11 - Brine and Slow Rinse Position

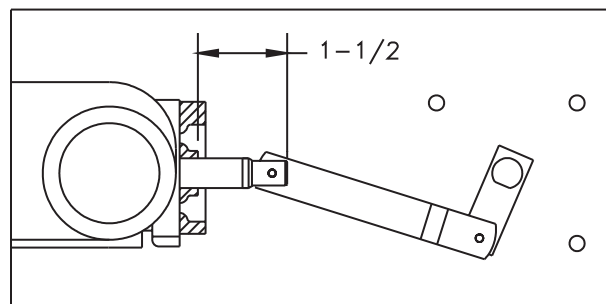


Figure 12 - Fast Rinse Position

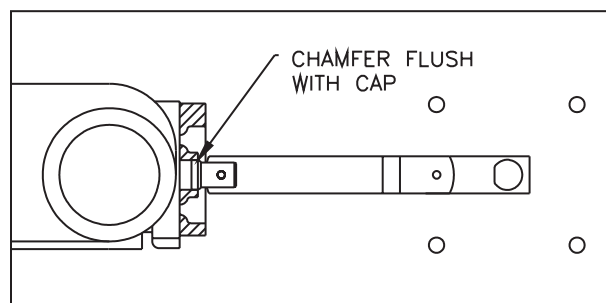


Figure 13 - Service Position

Series 962 Electronic Control

The Series 962 Electronic Control provides sophisticated, demand-based water conditioning by combining a microprocessor with a flow meter to electronically monitor the amount of water used. This fully programmable series of controls provide the ability to fine-tune the operation to meet the application requirements.

Special Features of the Series 962 Control

Memory Retention

During a power outage, critical operating information is stored in nonvolatile memory. This information includes the time of day, water usage, all programming data and the number of days since the last regeneration. When power is restored, the information is returned to the microprocessor and operation resumes as if an outage never occurred. The time of day will be late by the length of the power outage. The time of day should be reset after an extended power outage. No other reprogramming is necessary. The addition of an optional rechargeable backup battery will allow the control to keep track of time and water usage for up to 8 hours during a power outage. **The control will not initiate a regeneration while on battery backup.**

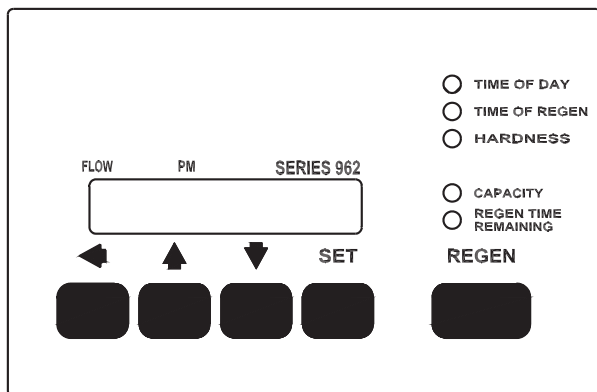


Figure 14

Double Regeneration

For single tank applications, the control automatically calls for a second regeneration the following day if the current operation cycle exceeds the programmed capacity by 150% or more.

Capacity Setting Lockout

The control can be programmed to lock the capacity so it cannot be altered after installation.

Selectable Reserve Options

To meet the application requirements, the control allows selection of one of two reserve types:

Fixed Reserve - The reserve is fixed at a programmable percentage (30% factory preset) of the total capacity.

Variable Reserve - The controller monitors the daily water usage and at the programmed time of regeneration, calculates the average water used for each day of the week. The reserve capacity is set to 120% of the average water usage for the next day.

U.S. or Metric Units of Measure

To meet your display and programming requirements, the 962 control uses grains per gallon of hardness and kilograins of capacity for U.S. units; or parts per million of hardness and kilograms of capacity as gallons or cubic meters.

Calendar Override

If the volume of water used has not caused a regeneration, the 962 control can be set to regenerate every one to thirty days.

Manual Regeneration

A separate **REGEN** button is provided for manual regenerations. A double manual regeneration feature is included that allows back-to-back regenerations.

Operating Histories

Important operating data is stored in memory and is retrievable upon demand.

The historical data includes peak flow data as well as average daily water usage for each day of the week.

Remote Regeneration

A set of input terminals with a programmable delay are provided as a standard feature of the 962 control that allows regeneration to be initiated from a remote location. This feature can be used to facilitate remote manual regeneration requirements or assist in further automating the control system such as the use of a differential pressure switch.

Selectable Automatic Regenerations

There are four automatic regeneration methods; "delayed with immediate override", "delayed only", "day of week", and "calendar override". Immediate regeneration is used to start an automatic regeneration immediately when the capacity remaining in a tank is reduced to zero. Delayed regeneration is used to start an automatic regeneration at a predetermined time of

day when the capacity remaining is below a defined reserve. The reserve capacity may be fixed or variable. The variable reserve is determined by past usage history. Regeneration can be accomplished based on the day of the week at a specific time of day or after programmable number of days since the last regeneration.

Optional Battery Backup

An optional battery backup can be provided so that the Time of Day and water usage will be maintained for up to 8 hours during a power outage. All 180/962 control valves are provided as “Battery Backup Capable”. Batteries can be purchased separately. The control has a trickle charge circuit that will recharge the battery in the event it is depleted by a power outage. If the optional battery backup is provided with the Series 962, make sure that it is properly connected.

Note: A standard 9V alkaline battery may be used as a substitute, but will not be rechargeable.

BATTERY BACKUP CONNECTIONS

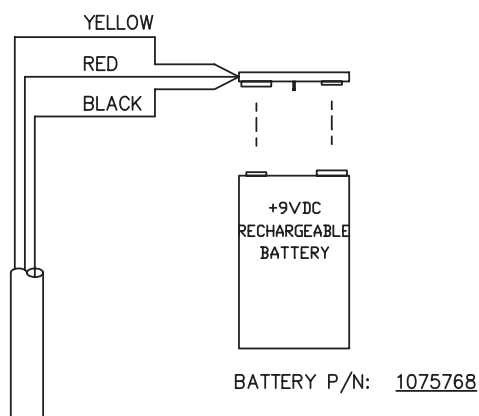


Figure 15

Flow Rate Display

In the normal operating mode the series 962 control will alternate between Capacity Remaining (gallons or m^3) and Flow Rate (gallons per minute or m^3/hr). In the event of power loss, (including battery power) the display will alternate between Time of Day and Capacity Remaining once power has been restored. The control will remain in this display mode until the Time of Day is reset or until any button is pressed.

Programming the Series 962 Control

This section contains common aspects of programming the 962 control and retrieving historical operating data. A label provided with the control should be filled out with programming parameters on system start-up.

Factory Default Values

The control is shipped from the factory pre-programmed with the correct operation type.

Capacity and Hardness values are set to 0 and must be changed to appropriate values before the control will operate. “Err 4” will be displayed until a valid number is entered for each of these items. Program variable P12 is set to U.S. units of measure or metric units at the factory to match geographical shipping locations.

Program Levels

The Series 962 controls have been designed to facilitate different levels of programming requirements. Level I includes program variables that are frequently referenced by users, operators, installers and service personnel. They are accessible without the requirement of codes. Level II includes variables that are most typically used at the time of installation and initial setup. These are accessible with only access codes. Level III locations are used primarily for accessing operation history information. Level IV locations are used to set the regeneration days of the week. Level III and IV parameters also require access codes. Programming levels are further defined in Tables I, II, and III.

Levels	Access Code
I	None Required
II	Press and hold the (↑) and (↓) arrow buttons for 3 seconds
III	Press and hold the (←) and (↑) arrow buttons for 3 seconds
IV	Press and hold the (←) and (↓) arrow buttons for 3 seconds

Level I Programming

Level I Program values are identified by the legend on the faceplate of the control. A green LED that is illuminated when a Level I "P" value is displayed. Following are the Level I "P" values:

- Time of Day P1
- Time of Regeneration P2
- Hardness P3
- Capacity P5

P4 is used to program the salt amount. The 962/180 does not require a salt amount.

Setting Time of Day

Press the **SET** button. The display will show the time of day with the minutes digit blinking. Press the UP (↑) arrow button to increase the number or the DOWN (↓) arrow button to decrease the number. To skip the number without changing, press the LEFT (←) arrow button. The first digit will stop flashing and the next digit will start flashing. When the far left digit is reached, pressing the LEFT (←) arrow button returns the flashing to the far right digit. Continue changing numbers until the desired Time of Day is obtained. Press the **SET** button to enter the value. The PM indicator will toggle when the "tens digit" of the hours is increased. The far left digit is used to indicate the day of week. Number 1 being Sunday and number 7 being Saturday.

The time of Regeneration, Hardness, and Capacity are set in a similar manner.

The control will automatically enter Level II programming if P19 or P20 have not been set.

Level II Programming

Press and hold the (↑) and (↓) arrow buttons for 3 seconds to enter the Level II programming mode. The display will show the letter "P" in the far left display digit. The parameter "P-number" is displayed in the far right display digit. See Table 1 for Level I and II programming values.

Changing a Program Value

Once the P value you want to change is displayed, press the (←) arrow button to display the current entry for that value. To change or modify the value, press the **SET** button. The digit on the right hand side of the display will begin to flash. Use the (↑) or (↓) arrow buttons to select the desired entry. Once the desired entry is obtained, press the (←) button to move to the next digit and change as needed. Once you have completed the appropriate changes, press the **SET** button. When you press the **SET** button the new entry is stored and the control automatically scrolls to the next P value. If a beep sounds, the new entry was not

accepted. Table 1 lists the range available for a specific program value.

Level III Programming

Press and hold the (←) and (↑) arrow buttons for 3 seconds to enter the Level III programming mode. The display will show the letter "L" in the far left display digit. The parameter "L-number" is displayed in the far right display digit. The **SET** button is inactive except for L4. If **SET** is pressed when L4 is displayed, Peak Flow is reset to zero. If **SET** is pressed when any other location is displayed the control will beep.

Level IV Programming

Press and hold the (←) and (↓) arrow buttons for 3 seconds to enter the Level IV programming mode. Level IV programming is used to enter the day of week regeneration settings.

Manual Regeneration

To initiate a manual regeneration, simply press and hold the **REGEN** button for 3 seconds. If an immediate second regeneration is desired, wait for at least **one minute** after the first regeneration begins and then press and hold the **REGEN** button for 3 seconds. A second regeneration will be performed immediately following the first. The display will freeze and only show the regeneration Time Remaining as an indication that the second regeneration will be initiated. When the first regeneration is complete, the second regeneration will begin and the display will alternate between Flow Rate and Regeneration Time Remaining.

Entering "d" Values (Regeneration Days)

"d" values are used to start a regeneration on a certain day of the week. There are seven "d" values numbered from 1 to 7, with 1 representing Sunday and 7 representing Saturday. Set a 1 in "d7" to initiate an automatic regeneration every Saturday at the Time of Regeneration (P2). The automatic regenerations will occur at the time set in P2 regardless of the capacity remaining in the system. A value of "0" indicates no regeneration on that day. The default value is "0" for all "d" values.

Viewing a Program Value

Programmed values may be viewed at any time. Program values may not be changed during a regeneration.

Level I - To locate and display a P value in Level I press the (↑) or (↓) arrow button until the desired value is displayed. Level I parameters are indicated by the legend on the face plate of the control.

Level II - To locate and display a P value in Level II, simultaneously press the (↑) and (↓) arrow buttons for 3 seconds to gain access. Press the (↑) or (↓) arrow buttons until the desired location is displayed. Press (←) to display the value in the P location.

Level III - To locate and display an L value in Level III, simultaneously press the (←) and (↑) arrow buttons for 3 seconds to gain access and then press the (↑) or (↓) arrow buttons until the desired location is displayed. Press (←) to display the value in the L location.

Level IV - To locate and display a “d” value in Level IV, simultaneously press the (←) and (↓) arrow buttons for 3 seconds to gain access and then press the (↑) or (↓) arrow buttons until the desired location is displayed. Press (←) to display the value in the location.

Lock-Out Feature

The lock-out feature may also be used to prevent regenerations when a signal is present at the lock-out terminals. Two or more 962 controls can be connected together (see Figure 16) to prevent one from regenerating while another is in regeneration. This signal can also come from external equipment that can provide a dry contact closure. (CONNECTION MUST BE A DRY CONTACT).

Flow Sensor Select Options

P19 is used to select the flow sensor type. Numbers 1 and 2 are for the Autotrol 1 inch and 2 inch turbine type flow sensors. The number in P20 will be ignored when P19 is programmed with a 1 or 2.

Other flow sensors can be used by entering a “3” in P19 and entering the correct “K-factor” in P20. The K-factor is defined as pulses per gallon for U.S. units or pulses per liter for metric units. The K-factor can be obtained from the flow sensor manufacturer.

If a “4” is entered in P19 then the definition of the number in P20 becomes gallons or liters per pulse depending on the units of measure selected.

Advance Cycle Function

While in a regeneration cycle, you can advance the 180 valve to the next cycle by pressing and holding the left arrow key (←) for 3 seconds. The 180 valve and controller will then advance to the next regeneration cycle.

Cancel Regeneration Function

To cancel (abort) a regeneration, press and hold the left arrow (←) and **SET** keys for 3 seconds. The control will display an ERROR 3 and return the 180 valve to the service (Home) position. Once in the service position, ERROR 3 will be cleared.

Capacity Based Regeneration Start Options

The following is an explanation of the regeneration start options for single tank 962 controls.

At the time of regeneration (time set in P2) the control will check to see if a regeneration should start. This check depends on the value programmed in P15.

P15 = 0 or 2 Variable Reserve

The control calculates an average water usage for each day of the week when it is using variable reserve. A regeneration will start if the capacity remaining is less than 1.2 times the average water usage for the next day.

P15 = 1 or 3 Fixed Reserve

The reserve capacity is calculated using the fixed reserve capacity programmed in P16. The value in P16 is the percentage of the calculated system capacity used for the reserve.

Example: If the programmed capacity is 10,000 grains and the hardness is 10 grains/gallon the calculated system capacity is 1000 gallons. The reserve capacity is 300 gallons if the fixed reserve is set to 30%. A regeneration will start if the capacity remaining at the time of regeneration is less than 300 gallons.

The parameter P15 is also used to select immediate regenerations or delayed regenerations only.

P15 = 0 or 1 Delayed Regeneration Only

Automatic regenerations will occur at the time of regeneration only. The control will delay the start of regeneration until the time of regeneration even if the capacity remaining is reduced to zero gallons.

P15 = 2 or 3 Immediate Regeneration Override

In addition to delayed regenerations automatic regenerations will occur at any time during the day if the capacity remaining reaches zero.

Immediate Regeneration Only Option

Automatic regenerations performed at the time of regeneration (P2) can be eliminated by setting the control for fixed reserve with immediate regeneration override (P15 = 3) and setting the reserve capacity percentage (P16) to 0%. This will create a reserve capacity of zero gallons. These are the preferred settings for a twin alternating softener system.

Table 1 - Level I and II Parameters

Parameter		Range of Values	Minimum Increments	Default	Units of Measure	Notes
Name	Description					
P1	Day of week and time of day	(1-7) 1:00-12:59 AM or PM (1-7) 0:00 - 23:59	(1 day) 1 minute	None	hour:minute	Range depends on value selected for P13 For day of week, SUN=1, MON=2, TUE=3, WED=4, THU=5, FRI=6, SAT=7
P2	Time of day to start regeneration	1:00-12:59 AM or PM 0:00-23:59	1 minute	2:00 AM	Hour:minute	Range depends on value selected for P13. Use only if P15 = 1
P3	Hardness of water	3-250 30-2500	1 10	0 0	grains/gallon ppm	Unit of measure depends on value selected for P12
P4						Not Used
P5	Capacity of unit	1-5100 .1-510.0	1 .1	0	kilograins* kilograms*	Unit of measure depends on value selected for P12
P6						Not Used
P7						Not Used
P8						Not Used
P9	Backwash time	1-30	1	14	minutes	
P10	Rinse/Draw time	1-125	1	40	minutes	
P11	Rinse time	1-19	1	4	minutes	
P12	Units of measure	0-1	1	0		0 = US 1 = Metric
P13	Clock mode	0-1	1	0		0 = 12 hour clock 1 = 24 hour clock
P14	Calendar override	0-30	1	0	days	0 = no calendar override
P15	Reserve Type	0-3	1	0		0 = Variable reserve 1 = fixed reserve 2 = variable reserve with immediate regeneration 3 = fixed reserve with immediate regen
P16	Initial average usage or fixed reserve	0-70	1	30	% of capacity	Description depends on value entered for P15
P17	Operation type	3-9	1	4		5 = 4 cycle 180 valve (Butterfly configuration)
P18	Capacity change lock-out	0-1	1	0		0 = none 1 = capacity change locked-out
P19	Flow sensor select	1-4	1	3		1 = 1.0" Autotrol turbine 2 = 2.0" Autotrol turbine 3 = User defined K-factor (PPG) 4 = User defined pulse equivalent (GPP)
P20	K-factor or pulse equivalent	0.01-255.00	.01	0.01		Number used for meter K-factor or pulse equivalent
P21	Remote regeneration switch delay	1-254	1	60	seconds	Time remote switch must be active to start a regeneration
P22	Do not use P 22. Factory use only.					

*See Table 1A for conversions.

Table 1A Conversion

To Convert Capacity in	Into Capacity in	Multiply by
kilograms (kg)	kilograins (kgr)	15.43
kilograins (kgr)	kilograms (kg)	0.0648
moles of CaCO ₃	kilograms (kg)	0.10
equivalents of CaCO ₃	kilograms (kg)	0.05

Table 2 Level III History Data

Location	Range	Description
L 1	1-7	Day of week (Sun=1, Sat=7)
L 2	0-255	Days since last regeneration
L 3	1:00-12:59/0:00-23:59	Time that peak flow occurred
L4	0-200/0-50.0	Peak flow gallons per minute/cubic meters (M ³) per hour since location reset
L 5	0-655360/0-6553.6	Water used today in gallons/M ³ since time of regeneration
L 6	0-655360/0-6553.6	Water used since last regeneration in gallons/M ³
L 7	0-655360/0-6553.6	Average water usage for Sunday in gallons/M ³
L 8	0-655360/0-6553.6	Average water usage for Monday in gallons/M ³
L 9	0-655360/0-6553.6	Average water usage for Tuesday in gallons/M ³
L 10	0-655360/0-6553.6	Average water usage for Wednesday in gallons/M ³
L 11	0-655360/0-6553.6	Average water usage for Thursday in gallons/M ³
L 12	0-655360/0-6553.6	Average water usage for Friday in gallons/M ³
L 13	0-655360/0-6553.6	Average water usage for Saturday in gallons/M ³
L 14	0-999990/0-99999.9	Total water used since NOVRAM test in gallons/M ³ (LSD)
L 15	0-167/0-16	Total water used since NOVRAM test in gallons/M ³ x 106 (MSD)

Table 3 Level IV Parameters

#	Description of Parameter	Range of Values	Minimum Increment	Default	Notes
d1	Sunday	0-1	1	0	0 = no day of week regen this day
d2	Monday	0-1	1	0	0 = no day of week regen this day
d3	Tuesday	0-1	1	0	0 = no day of week regen this day
d4	Wednesday	0-1	1	0	0 = no day of week regen this day
d5	Thursday	0-1	1	0	0 = no day of week regen this day
d6	Friday	0-1	1	0	0 = no day of week regen this day
d7	Saturday	0-1	1	0	0 = no day of week regen this day

Table 4 Error Code Identification

Error Code	Description
1	Data stored in NOVRAM has been corrupted and is incorrect
2	Home switch (SW 2) closed when it should be open
3	Home switch (SW 2) open when it should be closed
4	One or more parameters are below the minimum value in Table I
5	System capacity less than 10 gallons or 0.1 m3 (Capacity is set too low or Hardness is set too high)

Installation Programmed Values Chart

Installation Date:					
"P" Value	Description	Install Values	"d" Value	Description	Install Values
P1	Day of week/Time of day		d1	Regenerate on Sunday	
P2	Time of regeneration		d2	Regenerate on Monday	
P3	Hardness of water		d3	Regenerate on Tuesday	
P4	Not used		d4	Regenerate on Wednesday	
P5	Capacity of unit		d5	Regenerate on Thursday	
P6	Not used		d6	Regenerate on Friday	
P7	Not used		d7	Regenerate on Saturday	
P8	Not used				
P9	Backwash time				
P10	Rinse/Draw time				
P11	Purge time				
P12	Units of measure				
P13	Clock Mode				
P14	Calendar override				
P15	Reserve type				
P16	Initial average value of fixed reserve capacity				
P17	Operation type				
P18	Capacity change lock out				
P19	Turbine select				
P20	K-factor or pulse equivalent				
P21	Remote regeneration switch delay				

Parallel Operation

The 962 control can be used for twin and triple tank applications, operating in a parallel mode. Parallel systems can be implemented with up to three individual controls by using the lock-out feature. Each control will provide a lock-out signal when it is in regeneration. This lock-out signal will prevent other controls from starting a regeneration when the controls are connected as in Figure 16.

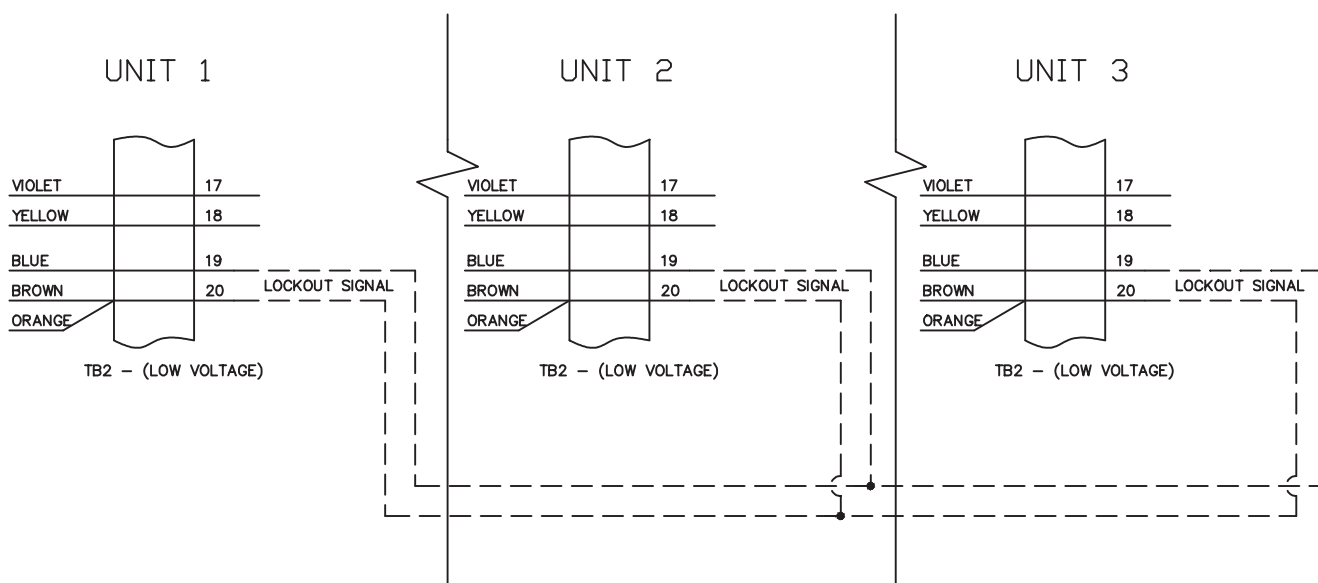


Figure 16

Remote Regeneration

A set of terminals with a programmable delay (P21) are provided as a standard feature of the 962 control, Figure 17. This feature allows for a regeneration to be initiated from a remote location. This feature can also be used to accommodate a differential pressure switch input or any dry contact closure from external equipment. Programmable value "P21" is used to monitor this input for the amount of time that is programmed (in seconds).

P21 is the length of time (in seconds) that the remote input signal will be ignored before starting a regeneration. (CONNECTION MUST BE A DRY CONTACT).

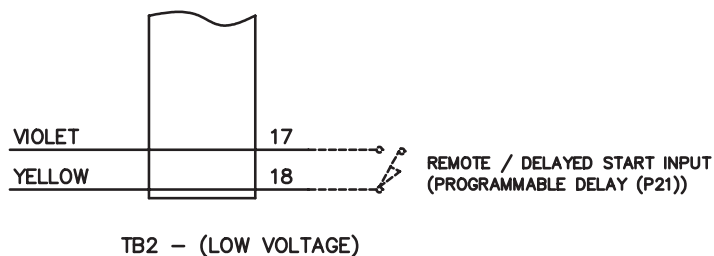


Figure 17

Flow Sensor Connections

The 962 control may be connected to a number of different flow sensing devices. Figure 18 shows the connections for the Autotrol turbine type flow sensor. Figure 19 shows the connections for the Signet flow sensor. Most of the flow sensors that are used will be wired similarly, though the wire colors may vary.

Note: The 962 may also be used with two-wire “Contacting Head” meters (Pulse Equivalent, P19 set to a 4) by connecting the meter leads to terminals 12 and 13 respectively.

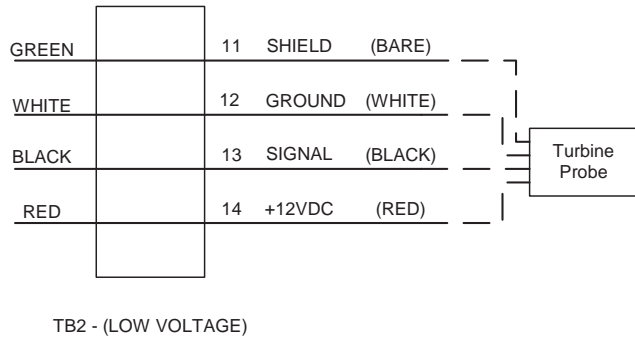


Figure 18 Autotrol Turbine Meter

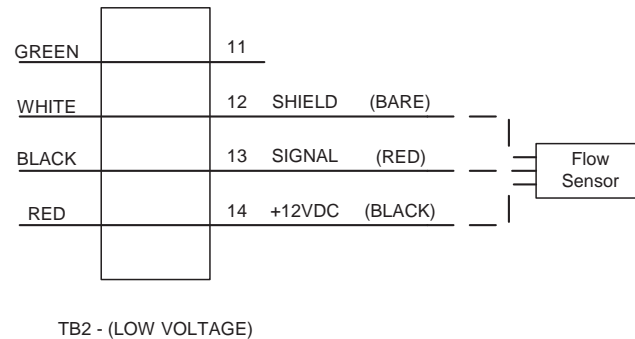


Figure 19 Signet Flow Sensor

Injector and Backwash Control Sizing

Suggested Injector Size

A size injector (yellow)	12 in (30.5 cm) thru 14 in (35.6 cm) tank
B size injector (orange)	16 in (40.6 cm) thru 18 in (45.7 cm) tank
C size injector (gold)	20 in (50.8 cm) thru 24 in (61.0 cm) tank

Suggested Backwash Control Size

4.0 gpm NPT or BSPT	12 in (30.5 cm) thru 13 in (33.09 cm) tank
5.0 gpm NPT or BSPT	14 in (35.6 cm) tank
6.0 gpm NPT or BSPT	16 in (40.6 cm) thru 18 in (45.7 cm) tank
10.0 gpm NPT or BSPT	20 in (50.8 cm) tank
15.0 gpm NPT or BSPT	For filter applications only
Open NPT or BSPT	For filter applications only, external flow control required

Final Check Out

1. Test for soft water from a convenient soft water tap.
2. Manual bypass valve must be closed, reference Figures 1 and 2.
3. Manual inlet and outlet valves open, reference Figures 1 and 2.
4. Brine line shut-off valve open, reference Figure 3.
5. Drain line clear and unobstructed.
6. Electrical power to timer (not controlled by switch).
7. Time of day, frequency of regeneration, backwash time and brine/rinse time set properly.
8. Proper liquid level in brine tank.
9. Salt in brine tank.

Manual Initiation of Regeneration (TIMER)

Push in red knob and turn **COUNTERCLOCKWISE** to **START** position. Release. Unit will go through a complete regeneration as programmed.

Manual Initiation of Regeneration (962 Control)

Press and hold the **REGEN** key on the keypad for 3 seconds. Unit will go through a complete regeneration as programmed.

Note: You can advance through each regeneration cycle quickly by pressing the (←) left arrow key for 3 seconds. This will advance the controller and valve to the next regeneration cycle.

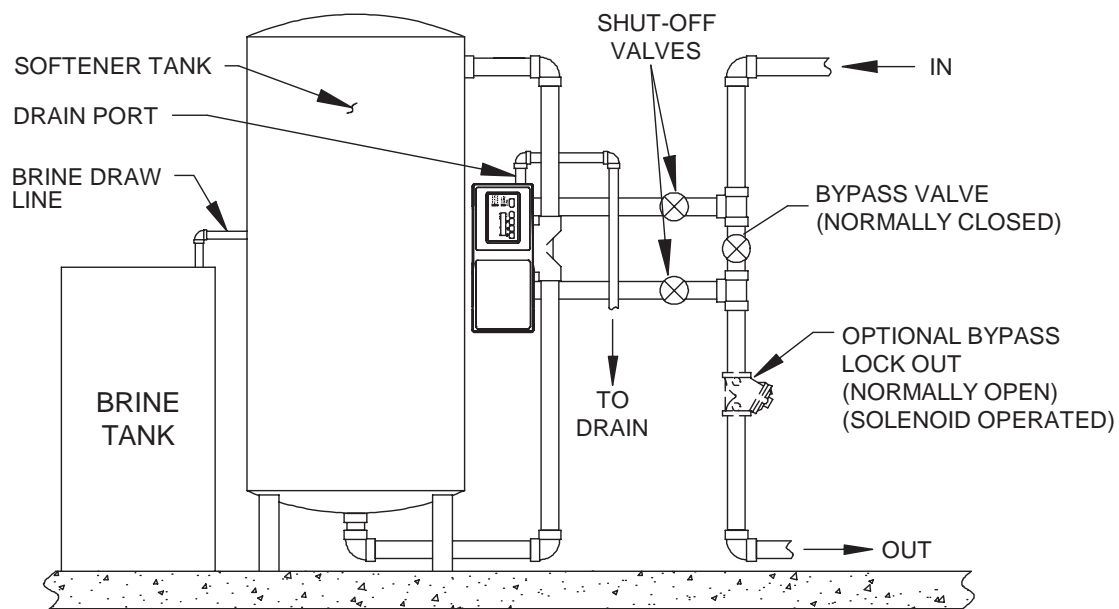


Figure 20 Normal Installation

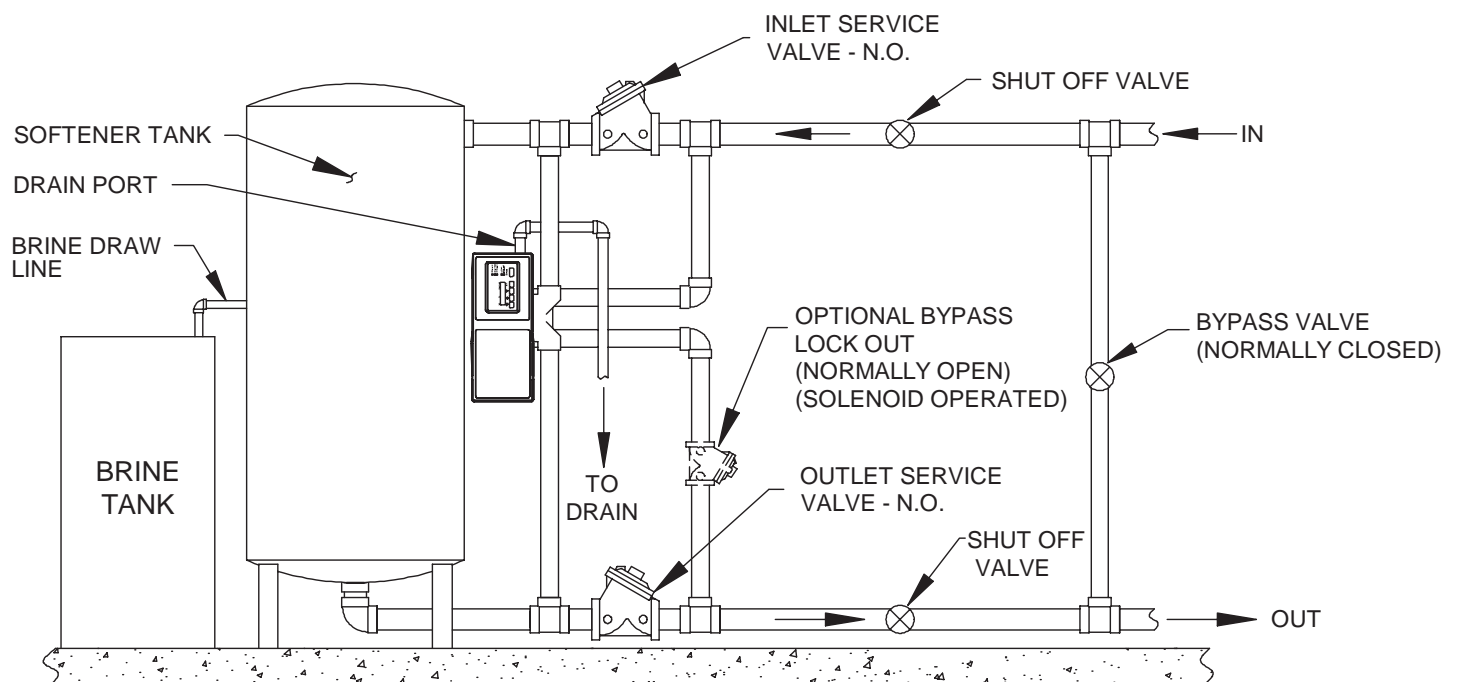
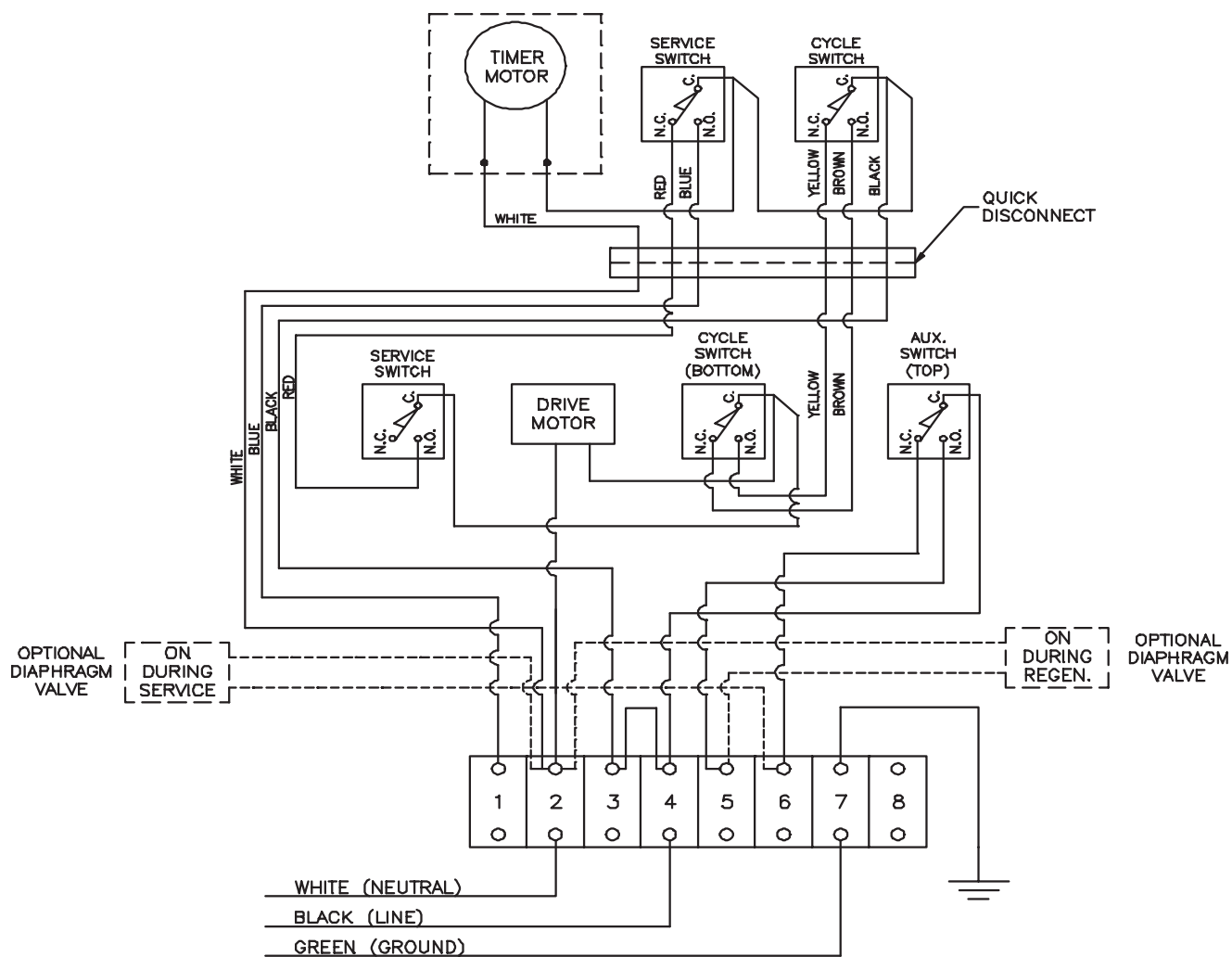


Figure 21 Installation with Service Valves, With or Without Hardwater Bypass



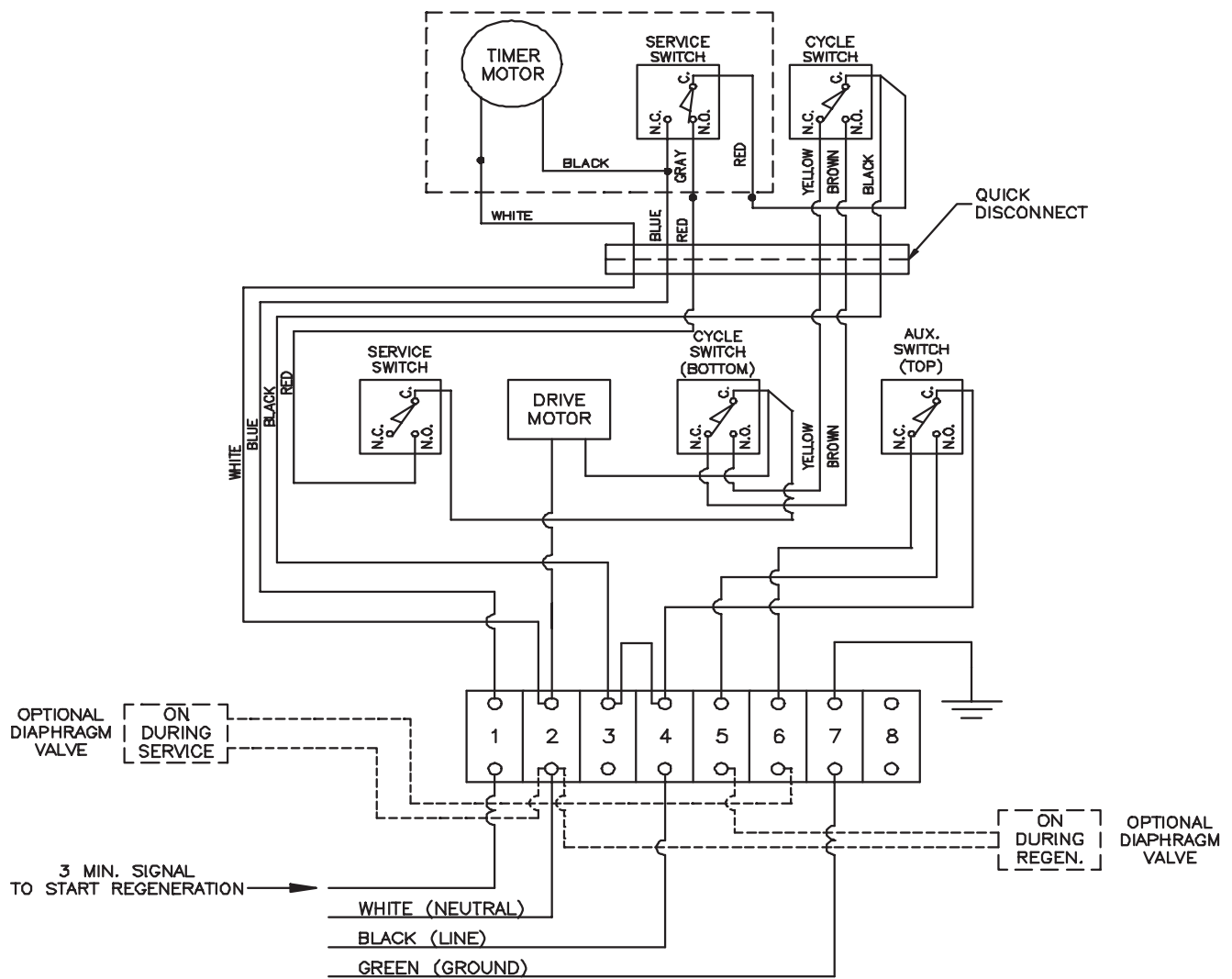
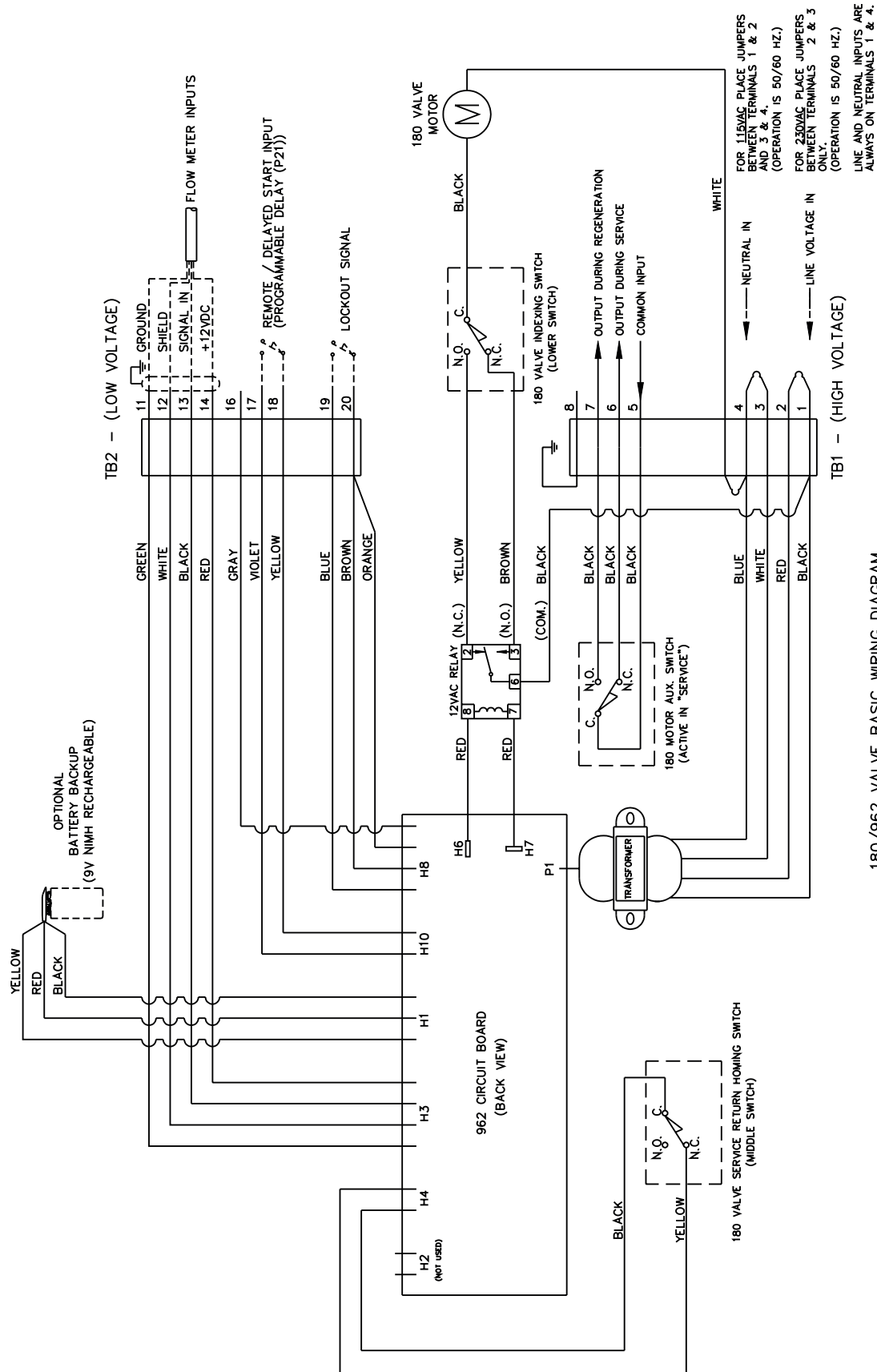


Figure 23 Wiring Diagram - 450 Impulse Timer



180/962 VALVE BASIC WIRING DIAGRAM

Figure 24

Injector Flow Rate Chart

PSI (Kg/cm)	A Injector		B Injector		C Injector	
	Draw	Rinse	Draw	Rinse	Draw	Rinse
	gpm (Lpm)	gpm (Lpm)	gpm (Lpm)	gpm (Lpm)	gpm (Lpm)	gpm (Lpm)
20 (1.4)	0.7 (2.6)	.8 (3.0)	8 (3.0)	1.2 (4.5)	.8 (3.0)	2.2 (8.3)
30 (2.1)	1.1 (4.1)	1.0 (3.8)	1.2 (4.5)	1.6 (6.0)	1.2 (4.5)	2.8 (10.6)
60 (4.2)	1.3 (4.9)	1.2 (4.5)	1.3 (4.9)	1.7 (6.4)	1.5 (5.7)	3.3 (12.5)
80 (5.6)	1.4 (5.3)	1.4 (5.3)	1.5 (5.7)	2.0 (7.6)	1.7 (6.4)	3.8 (14.4)
100 (7.0)	1.4 (5.3)	1.5 (5.7)	1.5 (5.7)	2.2 (8.3)	1.8 (6.8)	4.1 (15.5)

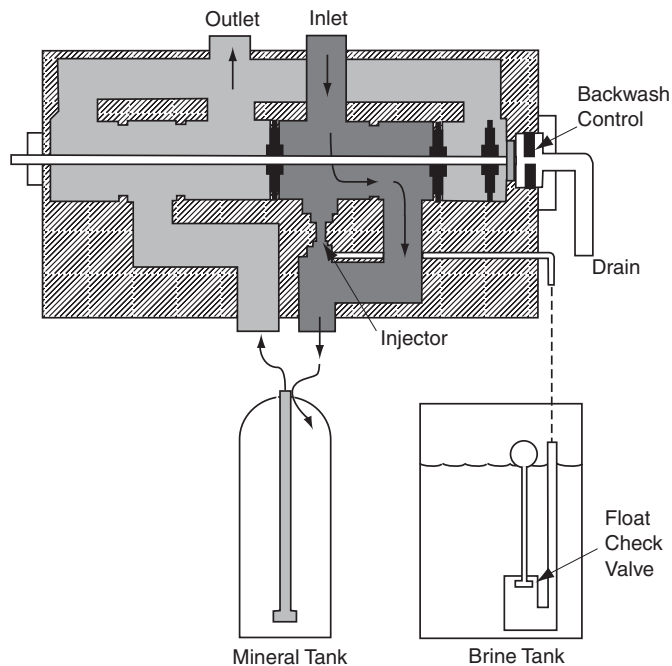
Pressure Drop vs Flow

PSI (Kg/cm)	Service (Cv 12.9)	Fast Rinse (Cv 6.1)	Backwash (Cv 9.6)
	gpm (Lpm)	gpm (Lpm)	gpm (Lpm)
5 (0.35)	29 (110)	13 (49)	20 (76)
10 (0.70)	40 (151)	19 (72)	30 (114)
15 (1.00)	50 (189)	23 (86)	37 (140)
20 (1.40)	58 (220)	26 (98)	44 (167)
25 (1.70)	64 (242)	30 (114)	48 (182)
30 (2.10)	70 (265)	32 (121)	53 (201)

Flow Diagrams

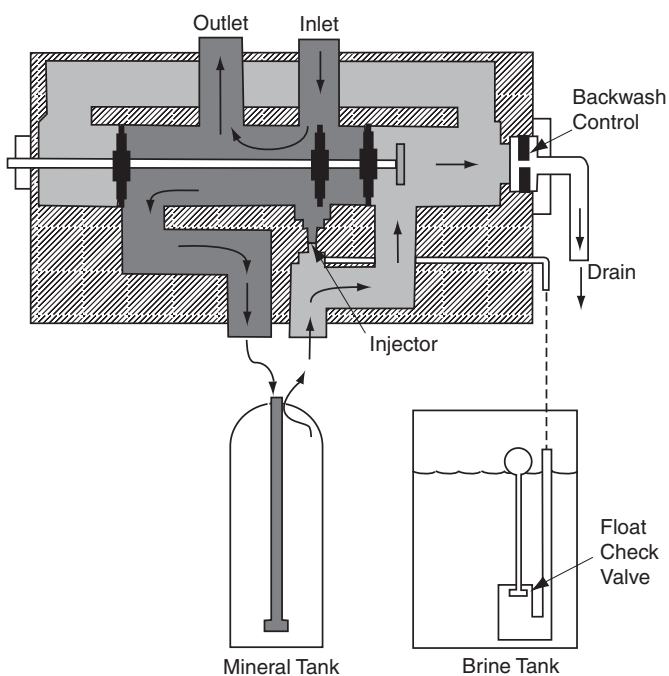
1 Service Position

- Hard Water
- Soft Water



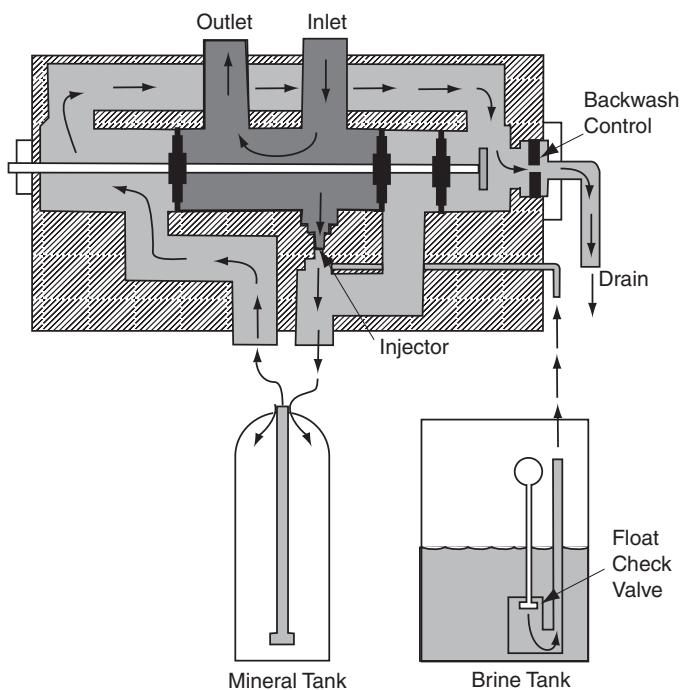
2 Backwash

- Hard Water
- Backwash Water



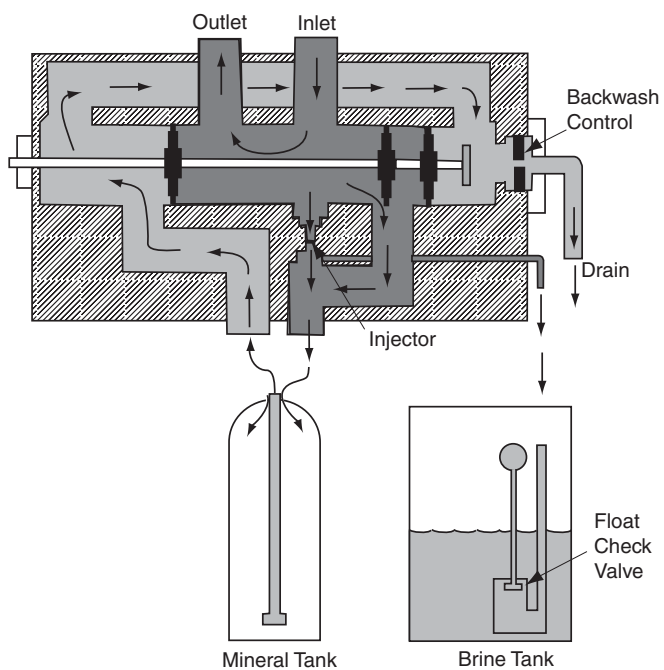
3 Brine and Slow Rinse

- Hard Water
- Brine

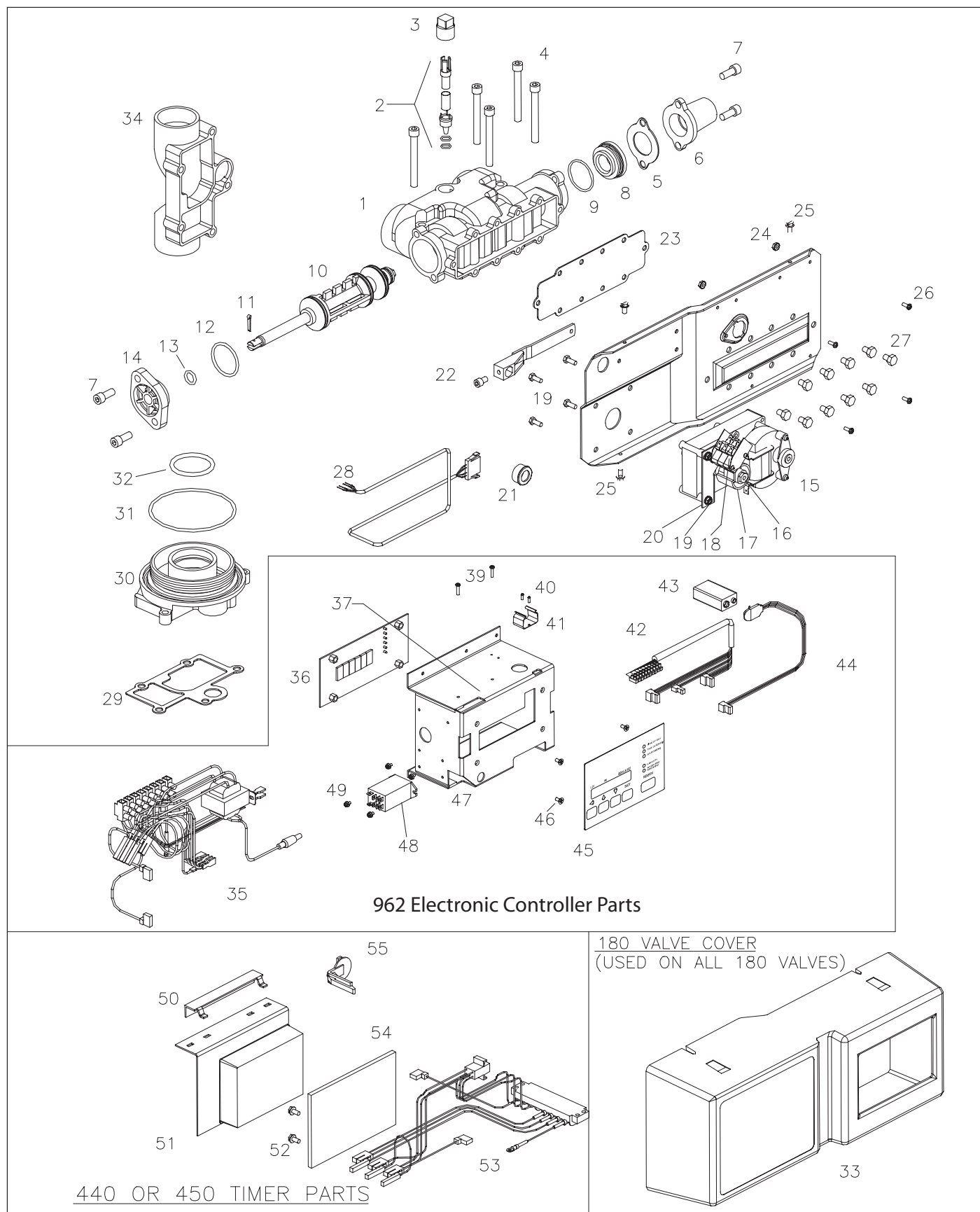


4 Fast Rinse and Refill

- Hard Water
- Rinse Water



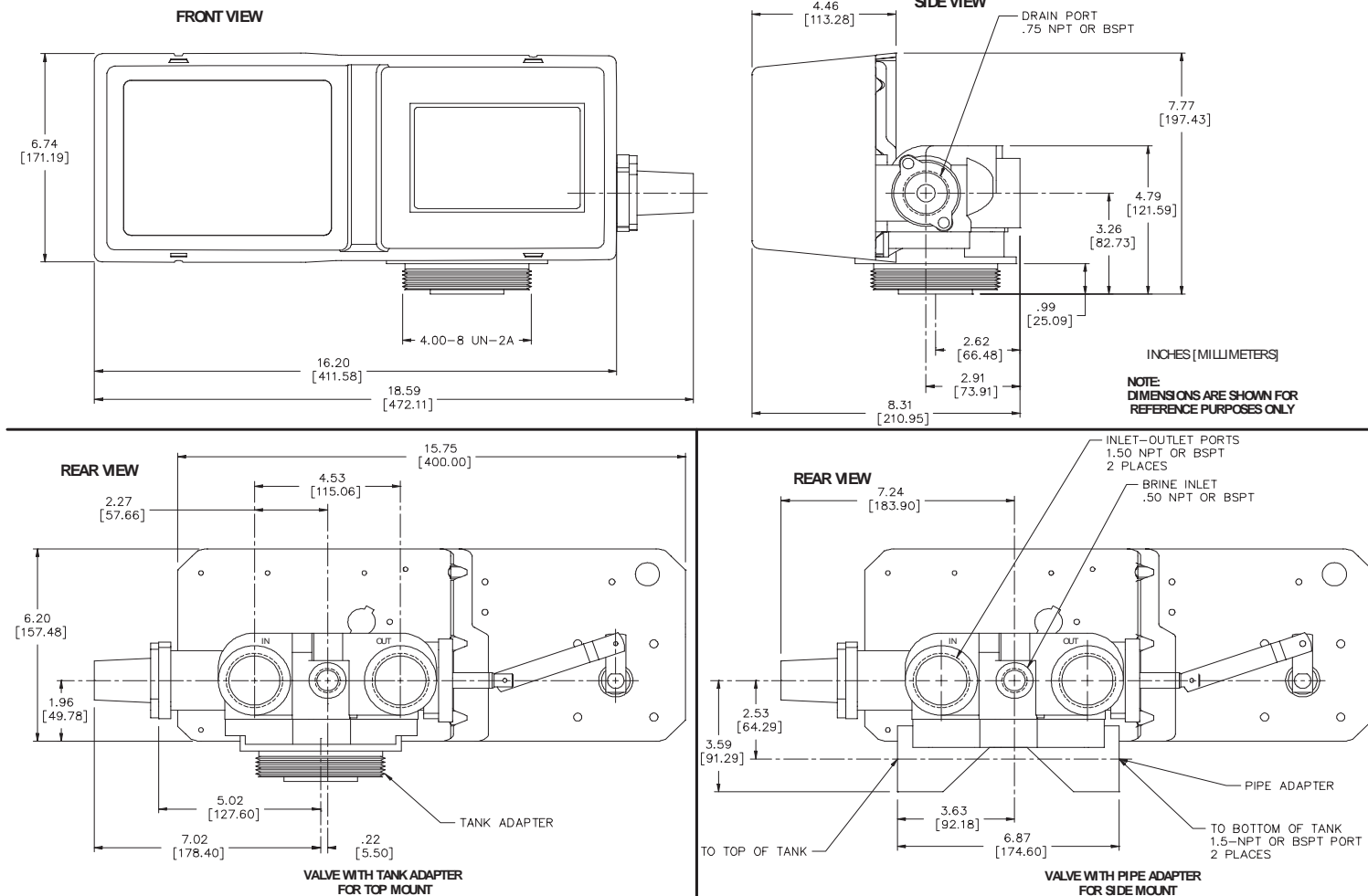
Replacement Parts - Valve



Parts List

Ref. #	Part No.	Description	Ref. #	Part No.	Description
1		Valve body:	21	1077710	Wire guide bushing, .875
	1034502	NPT	22	1035085	Drive link assembly
	1034506	BSPT	23	1035041	Gasket (valve to motor plate)
2		Injector Assembly:	24	1077699	Nut, Keps, 6-32, plated steel (4 reqd.)
	1034936	"A" (yellow)	25	1078196	Screw, hex head, 10-32 x 3/8 (3 reqd.)
	1034931	"B" (orange)	26	SCS-0070	Screw, 6-32 x 3/8 round head (4 reqd.)
	1034934	"C" (gold)	27	1005585	Screw, hex head, 1/4-20 x 3/8 (10 reqd.)
	1034170	Blank (undrilled)	28	1077798	962-180 turbine meter cable
	1034173	Injector screen	29	1035042	Gasket (valve to adapter)
	1010301	Injector O-ring (2 required)	30	1034851	Adapter kit, top mount
3	1003062	Injector plug, 1/2 in. NPT	31	ORE-347	O-ring
4	1006285	Cap screw, 5/16-18 x 2-3/4 (5 reqd.)	32	ORE-225	O-ring
5	1035018	Gasket, upper cap	33	1077721	Cover
6		Backwash Assembly:	34	1034733	Side mount adapter (NPT)
	1034704	4 gpm, NPT		1034735	Side mount adapter (BSPT)
	1034705	4 gpm, BSPT	962 Electronic Control Parts, 120 Vac (Sub-Assy. P/N: 1077719)		
	1034706	5 gpm, NPT	230 Vac (P/N 1078440)		
	1034707	5 gpm, BSPT	35	1077713	Wire harness assembly
	1034708	6 gpm, NPT	36	1076297	PWA assembly 962
	1034709	6 gpm, BSPT	37	ZHDW4152	Marker strip, 11-20
	1034710	10 gpm, NPT	39	SCS-0064	Screw, 4-40 x 5/8 round head (2 reqd.)
	1034711	10 gpm, BSPT	40	SCS-0054	Screw, 2-56 x 1/4 ph/pnhd (2 reqd.)
	1034712	15 gpm, NPT	41	1075767	Battery Clip, 962
	1034713	15 gpm, BSPT	42	1078528	Wire harness, 10 cond., 962, w/Term Block
	1034714	25 gpm, NPT	43	1075768	Battery, NiMH, 9V, 962 (optional)
	1034715	25 gpm, BSPT	44	1075764	Wire harness, battery, 9V
	1034700	Open, NPT	45	1070488	Keypad, membrane, 962
	1034701	Open, BSPT	46	1075766	Screw, 8-32 x 1/4 ph/flhd (4 reqd.)
7	1006266	Cap screw, 5/16-18 x 3/4 (4 reqd.)	47	1077706	PWA mounting bracket 962
8	1035159	Drain shut-off	48	1070491	Relay, SPDT, 12 VAC, 962
9	1010130	O-ring	49	1077915	Screw, 4-40 x 1/4 ph/pnhd, stl, SEMS (4 reqd.)
10	1035069	Piston Assembly	440 or 450 Timer Parts		
11	1005222	Cotter Pin	50	1035047	Timer mounting bracket
12	1010144	O-ring	51		Timer assembly
13	1010136	O-ring	52		Screw, 8-32 x 1/4 (4 reqd.)
14	1035022	Cap	53	1035479	Wire harness assembly
15	1034940	24VAC drive motor assembly	54	1077751	Window
	1034961	120VAC drive motor assembly	55	1035431	Timer lock
	1034962	230VAC drive motor assembly			
16	1005580	Screw, hex head 8-32 x 3/4			
17	1033889	Cam assembly			
18	1008332	Switch (3 required) Included with item 15			
19	1005850	Screw, hex head 10-24 x 1/2 (6 reqd.)			
20	1035156	Bracket switch			

Specifications



Hydrostatic test pressure	250 psi (17.2 bar)
Working pressure	20-100 psi (1.28-6.89 bar)
Standard electrical rating	120V/60Hz
Optional electrical ratings (timers)	.24V/50 Hz, 24V/60Hz, 120V/50Hz, 100V/60Hz, 100V/50Hz, 230V/50Hz
Optional electrical ratings (962 controller)	230V 50/60Hz
Electrical Cord (when furnished, with standard rating)	6ft, 3 wire with plug
Electrical connection	Terminal strip
Standard plumbing connections	1-1/2 in NPT inlet, outlet top and bottom of tank 1/2 in NPT brine/ 3/4 in NPT drain
Rubber parts	Compounded for cold water service
Valve body	Brass
Injector	3 sizes available: A, B, C, (refer to Injector Flow Rate Chart)
Program clock	6-or 7-day English language or international symbols inscription
	Microprocessor demand systems and impulse timers also available
Backwash cycle	Adjustable
Brine/Rinse cycle	Adjustable
Fast Rinse cycle	Adjustable
Total regeneration time	Adjustable
External backwash controller required (over 25 gpm)	Sized to media requirement
External brine valve required	Must have positive shut-off on refill and draw down
Ambient temperature	34°F (1°C) to 120°F (49°C). Valve to be drained if freezing may occur
Riser pipe diameter required	1-1/2 in schedule 40 PVC (42.16 mm O.D. x 3.81 mm wall)
