

Autotrol® Performa™ Valve Series

Water Conditioning Control System
Installation, Operation and Maintenance Manual

Table of Contents

Special Valve Features	3	900 ProSeries Control Settings	9
Installation	3	940 ProSet	
Location Selection		Programming	
Water Line Connection		Adjustment of Brine Control	
Drain Line Connection		Manual Regeneration	
Brine Line		960 ProSoft	
Overflow Line Connection		Programming	
Placing Conditioner into Operation	5	Level I Features	
Electrical Connection		Level II Features	
400 Series Control Settings	6	Manual Regeneration	
440i		Automatic Regeneration	
Programming		Removing the Valve Assembly for Servicing .	15
460i		Removing 440i or 460i for Servicing	16
Programming		Preventive Maintenance	16
Time of Day Setting		Brine Tank	
Hardness Setting		Injector Screw and Injector	
Capacity Setting		Water Meter	
Calendar Override Setting		Specifications	18
Common Features	7	Pressure Graphs	19
Salt Dial Adjustment		Identification of Control Valving	20
Guest Cycle		Valve Disc Principle of Operation	20
Manual Regeneration		Flow Diagrams	20
		Replacement Parts	22
		Troubleshooting	25
		Disinfection of Water Conditioners	30

Special Valve Features

Soft Water Brine Refill*: Maintains a clean brine tank while virtually eliminating injector fouling.

Noryl Construction:** The valve body is made of lightweight, high strength Noryl plastic which will not corrode.

Identification Marks: Each of the external port locations has a label molded on the valve body for easy recognition. They are labeled as follows: SCR (Screen), BRN (Brine), BKW (Backwash), and INJ (Injector).

Common Parts: The Performa valve uses the same injector, injector cap, backwash control, injector screen, and salt dial as other Autotrol residential valves.

Installation

All plumbing and electrical connections must conform to local codes.

Inspect unit carefully for carrier shortage or shipping damage.

Location Selection

1. The distance between the unit and a drain should be as short as possible.
2. If it is likely that supplementary water treatment equipment will be required, make certain adequate additional space is available.
3. Since salt must be added periodically to the brine tank, the location should be easily accessible.
4. Do not install any unit closer to a water heater than a total run of 10 feet (3 m) of piping between the outlet of the conditioner and the inlet to the heater. Water heaters can sometimes overheat to the extent they will transmit heat back down the cold pipe into the unit control valve.

Hot water can severely damage the conditioner. A 10-foot (3-m) total pipe run, including bends, elbows, etc., is a reasonable distance to help prevent this possibility. A positive way to prevent hot water flowing from heat source to the conditioner, in the event of a negative pressure situation, is to install a check valve in the soft water piping from the conditioner. **If a check valve is installed, make certain the water heating unit is equipped with a properly rated temperature and pressure safety relief valve. Also, be certain that local codes are not violated.**

5. Do not locate unit where it or its connections (including the drain and overflow lines) will ever be subjected to room temperatures under 34°F (1°C) or over 120°F (49°C).
6. Do not install unit near acid or acid fumes.

7. The use of resin cleaners in an unvented enclosure is not recommended.

Water Line Connection

The installation of a bypass valve system is recommended to provide for occasions when the water conditioner must be bypassed for hard water or for servicing.

The most common bypass systems are the Autotrol Series 1265 bypass valve (Figure 1) and plumbed-in globe valves (Figure 2). Though both are similar in function, the Autotrol Series 1265 bypass offers simplicity and ease of operation.

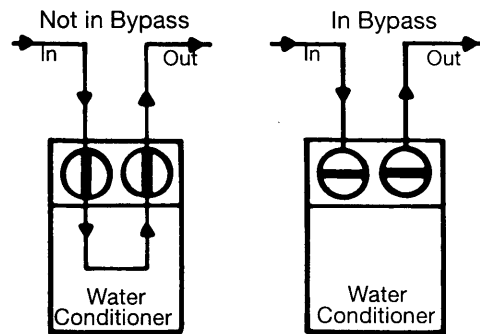


Figure 1 - Autotrol Series 1265 Bypass Valve

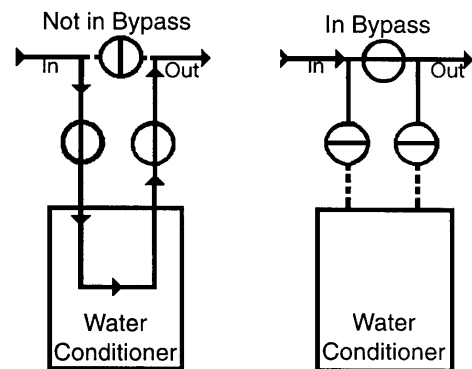


Figure 2 - Typical Globe Valve Bypass System

Drain Line Connection

Note: Standard commercial practices are expressed here. Local codes may require changes to the following suggestions.

1. Ideally located, the unit will be above and not more than 20 feet (6.1 m) from the drain. For such installations, using an appropriate adapter fitting, connect 1/2-inch (1.3-cm) plastic tubing to the drain line connection of the control valve.

*Not available with the extra salt cam.

**Noryl is a trademark of General Electric Company.

2. If the backwash flow rate exceeds 5 gpm (22.7 Lpm) or if the unit is located more than 20 feet (6.1 m) from drain, use 3/4-inch (1.9-cm) tubing for runs up to 40 feet (12.2 m). Also, purchase appropriate fitting to connect the 3/4-inch tubing to the 3/4-inch NPT drain connection.
3. If the unit is located where the drain line must be elevated, you may elevate the line up to 6 feet (1.8 m) providing the run does not exceed 15 feet (4.6 m) and water pressure at conditioner is not less than 40 psi (2.76 bar). You may elevate an additional 2 feet (61 cm) for each additional 10 psi (0.69 bar).
4. Where the drain line is elevated but empties into a drain below the level of the control valve, form a 7-inch (18-cm) loop at the far end of the line so that the bottom of the loop is level with the drain line connection. This will provide an adequate siphon trap.
5. Where the drain empties into an overhead sewer line, a sink-type trap must be used.

IMPORTANT: Never insert drain line into a drain, sewer line or trap. Always allow an air gap between the drain line and the wastewater to prevent the possibility of sewage being back-siphoned into the conditioner.

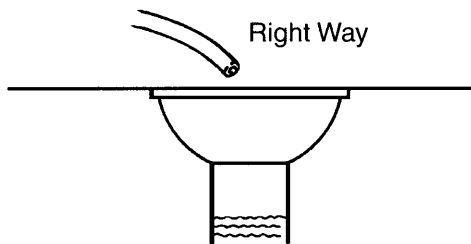


Figure 3

Note: Standard commercial practices have been expressed here. Local codes may require changes to these suggestions.

Brine Line Connection

It will be necessary to install the brine line to the brine fitting on the valve (3/8-inch NPT).

Be sure all fittings and connections are tight.

Overflow Line Connection

In the absence of a safety overflow and in the event of a malfunction, the BRINE TANK OVERFLOW will direct “overflow” to the drain instead of spilling on the floor where it could cause considerable damage. This fitting should be on the side of the cabinet or brine tank.

To connect overflow, locate hole on side of brine tank. Insert overflow fitting (not supplied) into tank and tighten with plastic thumb nut and gasket as shown (Figure 4). Attach length of 1/2-inch (1.3-cm) I.D. tubing (not supplied) to fitting and run to drain. Do not elevate overflow line higher than 3 inches (7.6 cm) below bottom of overflow fitting. Do not tie into drain line of control unit. Overflow line must be a direct, separate line from overflow fitting to drain, sewer or tub. Allow an air gap as per drain line instructions (Figure 3).

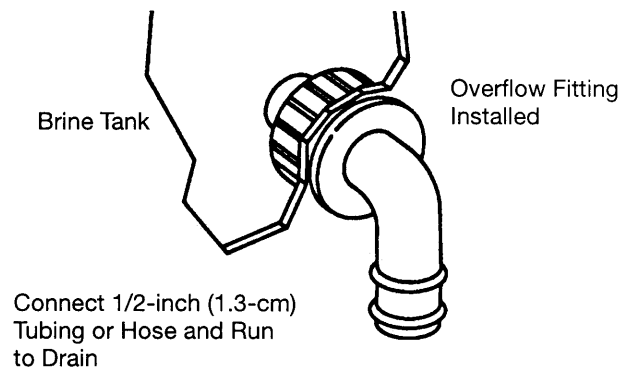


Figure 4

Placing Conditioner into Operation

After all previous steps have been completed, the unit is ready to be placed into operation. Follow these steps carefully.

1. Remove control valve cover by first releasing the plastic clip from the back of the cover. Pull back of cover slightly outward and lift up.
Note: The following steps will require turning the indicator knob (Figures 5, 6, 11, and 13) to various positions. Manually rotate the camshaft **COUNTERCLOCKWISE** only until indicator knob points to desired position. (See manual regeneration sections for each control's manual operation.)
2. Rotate indicator knob **COUNTERCLOCKWISE** until it points directly to the word **BACKWASH**.
3. Fill media tank with water.
 - A. With water supply off, place the bypass valve(s) into the "service" position.
 - B. Open water supply valve very slowly to approximately the 1/4 open position.

IMPORTANT: If opened too rapidly or too far, media may be lost. In the 1/4 open position, you should hear air escaping slowly from the drain line.

- C. When all of the air has been purged from the tank (water begins to flow steadily from the drain), open the main supply valve all the way.
 - D. Allow water to run to drain until clear.
 - E. Turn off water supply and let the unit stand for about five minutes. This will allow all trapped air to escape from the tank.
4. Add water to brine tank (initial fill).

With a bucket or hose, add approximately 4 gallons (15 liters) of water to brine tank. If the tank has a salt platform above the bottom of the tank, add water until the level is approximately

1 inch (25 mm) above the platform.

5. Place the conditioner into operation.
 - A. With the water supply valve completely open, carefully advance the indicator knob **COUNTERCLOCKWISE** to the center of the **BRINE REFILL** position. Hold at this position until water starts to flow through the brine line into the brine tank. Do not run for more than one or two minutes.
 - B. Advance the indicator knob **COUNTERCLOCKWISE** until it points to the center of the **BRINE/SLOW RINSE** position.
 - C. With the conditioner in this position, check to see if water is being drawn from the brine tank. The water level in the brine tank will recede very slowly. Observe water level for at least three minutes. If the water level does not recede, or if it goes up, reference the **Troubleshooting** section.
 - D. Advance the indicator knob **COUNTERCLOCKWISE** to the **SERVICE** position and run water from a nearby faucet until the water is clear and soft.

Electrical Connection

100 VAC, 115 VAC, and 230 VAC units: Remove twist tie from the power cord and extend cord to its full length. Make sure power source matches the rating printed on the control. Be certain a wall switch does not control the outlet.

12 VAC: Connect the plug of the transformer (supplied) secondary cable to the mating socket at the rear or bottom of the timer housing. Be certain the transformer is secure and is plugged into a power source of correct voltage that is not controlled by a wall switch.

400 Series Control Settings

440i Control

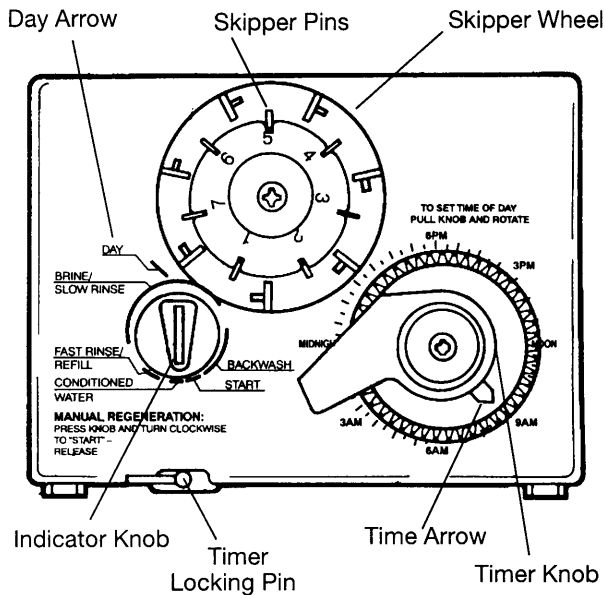


Figure 5

Programming

- Set days of regeneration on skipper wheel (Figure 5).
 - Pull all skipper pins outward (away from control).
 - Rotate skipper wheel until day arrow points to current day or number 1.
 - Depress skipper pin(s) at day(s) for which regeneration is desired.
- Set the time of day.
 - Grasp timer knob and pull outward.
 - Rotate in either direction until the timer arrow points to the actual time of day.
 - Release timer knob.

Note: With the time of day properly set, the conditioner will regenerate at about 2:30 a.m. If you prefer to have the unit regenerate at an earlier or later time, simply set current time-of-day accordingly (e.g., to have the unit regenerate at 4:30 a.m. — two hours later — set the clock two hours earlier than the actual time of day.)

Note: The Timer Locking Pin should always be horizontal (Figure 5) during operation.

460i Control

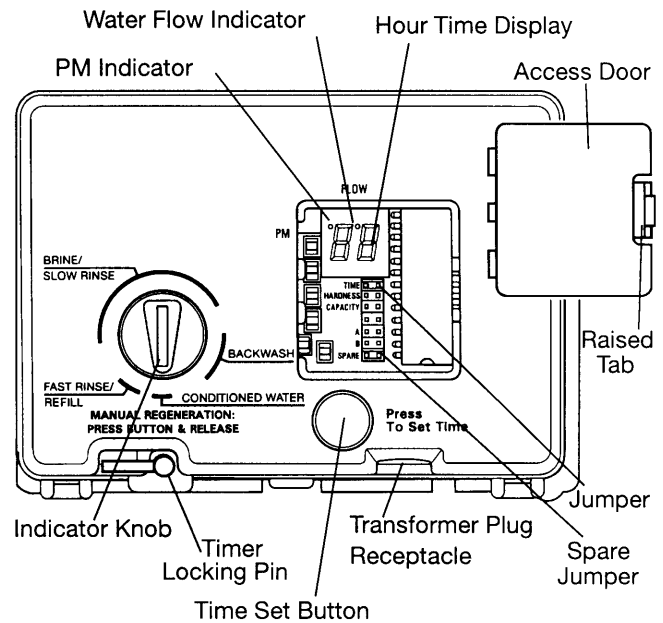


Figure 6

Programming

Plug the wall-mount transformer into a functioning electrical outlet that is not controlled by a switch. Plug the transformer into the transformer plug receptacle on the control.

Open the access door by pushing the raised tab on the door toward the left while pulling the tab out (Figure 6).

Time of Day Setting

With the jumper on the set of pins next to the word TIME (Figure 7), set the time of day to the closest hour by pressing the black TIME SET button. PM hours are indicated by a light next to the letters PM on the display window.

Note: The use of a small needle-nose pliers will aid in moving the jumper.

Note: The unit is factory set to regenerate at 2:00 a.m. If you prefer to have the unit regenerate at an earlier or later time, simply set the current time of day accordingly (e.g., to have the unit regenerate at 4:00 a.m. — two hours later — set the clock two hours earlier than the actual time of day).

Note: The Timer Locking Pin should always be horizontal (Figure 6) during operation.

Hardness Setting

Move the jumper to the set of pins next to the word **HARDNESS** (Figure 8). Press the black TIME SET button until the hardness of the incoming water supply is displayed. The hardness range is from 1 to 99 grains per gallon.

To change water hardness stated in parts per million (PPM) to grains per gallon (GPG) use this formula:

$$\frac{\text{Parts per Million}}{17.1} = \text{Grains per Gallon}$$

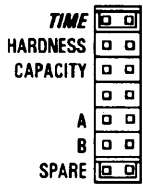


Figure 7

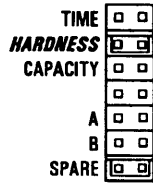


Figure 8

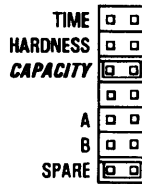


Figure 9

Capacity Setting

Move the jumper to the set of pins next to the word **CAPACITY** (Figure 9). Press the black TIME SET button until the correct capacity value is displayed. The capacity range is 1 to 99 kilograins. Refer to the Suggested Salt Dial Settings table (page 8).

Return the jumper to the top set of pins next to the word **TIME** and replace the access door. **The jumper must NOT be left on any pins other than the top pair next to the word TIME.** Otherwise, the unit may show a blank display.

Note: A spare jumper is located on the bottom set of pins.

In the event that the hardness or capacity setting must be changed, simply follow the appropriate steps described above.

Calendar Override Setting

1. Disconnect power.
2. Place jumper on Pin A and reconnect power.
3. Move jumper to Pin B. A zero will appear, indicating zero days of calendar override. All 460i controllers are preprogrammed in this manner at the manufacturer.

4. Depress the black TIME SET button. The numbers will roll from "0" to "15." Release the switch at the desired number of days for the calendar override. For example, releasing the switch at "10" would program a 10-day calendar override.
5. Disconnect power.
6. Place jumper back on TIME and reconnect power.
7. The calendar override program is maintained during power outages by the NOVRAM circuitry.
8. To remove the calendar override, follow the same steps above and program back to "0."

Common Features

When using the Performa valve with the 440i or 460i controls, there are several features and procedures that are unique to the 400 series controls. They are as follows:

Salt Dial Adjustment

These models may be adjusted to produce maximum to minimum conditioning capacities by setting the salt dial, which controls the amount of salt used per regeneration. When desired, the minimum setting may be used on installations if the frequency of regeneration is increased to compensate for lower regenerated conditioning capacity. The installing dealer will set the unit for proper salt usage. Further adjustments are needed only if the hardness of the water supply changes or if water use changes dramatically. Capacity will need to be adjusted accordingly.

To adjust salt dosage, insert a small screwdriver into the white indicator knob and move pointer to proper salt setting (Figure 10).

Note: To convert the salt settings from English to metric, divide by 2.2 (e.g., 12 pounds ÷ 2.2 = 5.5 kg of salt).

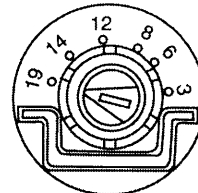


Figure 10

Table 1 – Suggested Salt Dial Settings (Pounds of Salt) For Various Size Softeners

Capacity Setting (Kilograins)	0.5 Ft ³	0.75 Ft ³	1.0 Ft ³	1.25 Ft ³	1.5 Ft ³	1.75 Ft ³	2.0 Ft ³	2.5 Ft ³
12	4.5 ¹	—	—	—	—	—	—	—
16	9.0	5.5	—	—	—	—	—	—
20	—	8.5 ¹	6.0	—	—	—	—	—
24	—	14.0	8.5 ¹	7.0	—	—	—	—
30	—	—	15.0	11.0	9.0	—	—	—
32	—	—	18.5 ¹	12.5 ¹	10.0	9.0	—	—
35	—	—	—	16.0	12.0	10.0	9.0	—
40	—	—	—	23.0 ^{2*}	17.0	14.0	12.0	—
48	—	—	—	—	28.0 ^{2*}	21.0 ^{2*}	17.0	14.0
60	—	—	—	—	—	—	30.0 ^{2*}	21.0 ^{2*}

¹ When using the 940 you must round up to the nearest whole number because the 940 does not have the option of selecting decimals.

² When using the 440i or 460i you must use Extra Salt cam and divide the suggested setting by 2 to accomplish these settings.

*When using the 940 you must have the Extra Salt main drive gear and divide the suggested setting by 2 to accomplish these settings.

The amount of salt placed in the brine tank has nothing to do with the amount of salt used during the regeneration cycle. Water will dissolve and absorb salt only until it becomes saturated. A given amount of brine (salt-saturated water) contains a specific amount of salt. The salt dial controls the amount of brine used during the regeneration cycle (e.g., when set at 15 pounds (6.8 kg) the amount of brine the conditioner will use for each regeneration will contain 15 pounds (6.8 kg) of salt, etc.)

Never let the amount of salt in the brine tank be lower than the normal liquid level. Do not overload the brine tank with salt.

Guest Cycle

When abnormally high water usage exhausts your water conditioner's capacity ahead of schedule, an extra regeneration can be achieved. Depress the indicator knob on the 440i (Figure 5) with a wide-blade screwdriver and turn **COUNTERCLOCKWISE** to **START** to initiate a regeneration. For the 460i, simply depress the indicator knob (Figure 6). It will take a few minutes for regeneration to start. A normal regeneration will take approximately two hours.

Manual Regeneration

Electricity is used only to run the control and to rotate the camshaft. All other functions are operated by water pressure. Therefore, in the event of a power outage, all the regeneration positions may be dialed manually by depressing the indicator knob and turning **COUNTERCLOCKWISE** (Figures 5 and 6). The following cycle times should be used for proper regeneration:

- BACKWASH**—14 minutes
- BRINE/SLOW RINSE**—52 minutes
- FAST RINSE/REFILL**—10 minutes
- PURGE**—6 minutes

Do not exceed 10 minutes for the **FAST RINSE/REFILL** cycle as this will cause excessive salt usage during the next regeneration and possibly a salt residue in the softened water.

900 ProSeries Control Settings

940 ProSet Control

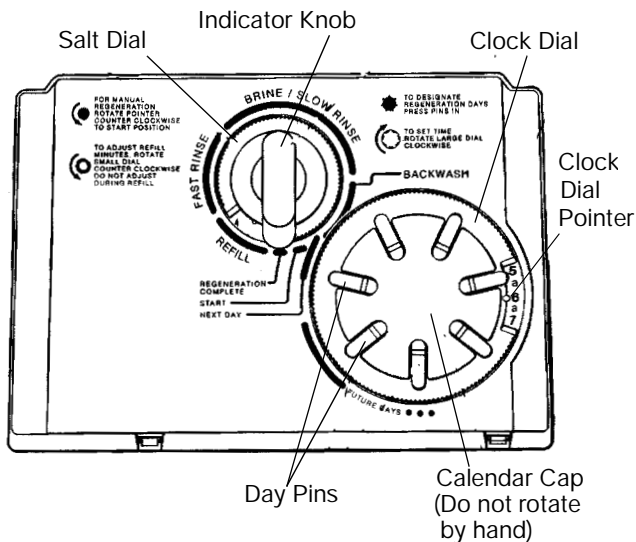


Figure 11

Programming

1. **Set days of regeneration** (Figure 11).
 - Pull all day pins outward (away from control).
 - Depress day pin(s) for which regeneration is desired.

Note: The NEXT DAY day pin is noted on the timer face. Depressing this pin will insure a regeneration the next day at approximately 2:00 a.m. Since the calendar cap progresses CLOCKWISE, depressing the day pin immediately COUNTERCLOCKWISE will insure a regeneration the following day at 2:00 a.m. This progression is noted on the timer face as "FUTURE DAYS".

2. **Set the time of day.**
 - Rotate Clock Dial CLOCKWISE until the pointer is directed at the current time.

Note: With the time of day properly set, the conditioner will regenerate at about 2:00 a.m. If you prefer to have the unit regenerate at an earlier or later time, simply set the current time-of-day accordingly (e.g., to have the unit REGENERATE at 4:00 a.m.—two hours later—set the clock two hours later than the actual current time).

Note: Do not rotate the Calendar Cap by hand; the clock dial indexes it daily. To manually index the Calendar Cap, rotate the Clock Dial CLOCKWISE one complete turn for every day to be indexed.

Adjustment of Salt Dial

All models may be adjusted to produce maximum to minimum conditioning capacities by setting the salt dial (Figure 12) which controls the amount of salt used per regeneration. When desired, the minimum setting may be used on installations if the frequency of regeneration is increased to compensate for the lower regenerated conditioning capacity. Your installing dealer will set your unit for proper salt usage. Further adjustments are needed only if water supply changes or if water use changes dramatically.

With the Indicator Knob in the REGENERATION COMPLETE position (Figure 11), rotate the Salt Dial COUNTERCLOCKWISE at least one full turn to cancel out the previous setting. A light clicking will be replaced by a heavier clicking when the previous setting is cancelled. Then, rotate the Salt Dial to the proper salt setting.

Reference **Table 1** on page 8 for common settings.

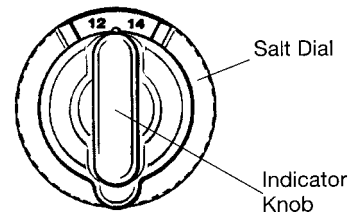


Figure 12

Manual Regeneration

Electricity is used only to run the control and to rotate the camshaft. All other functions are operated by water pressure. Therefore, in the event of a power outage, all regeneration positions may be dialed manually. Grasp the indicator knob and turn **COUNTERCLOCKWISE** to each regeneration cycle (rotation is much easier if you grasp the camshaft with your free hand and turn it at the same time). The following cycle times should be used for proper regeneration:

- BACKWASH**—14 minutes
- BRINE/SLOW RINSE**—52 minutes
- FAST RINSE/REFILL**—10 minutes
- PURGE**—6 minutes

Do not exceed 10 minutes for the **FAST RINSE/REFILL** cycle as this will cause excessive salt usage during the next regeneration and possibly a salt residue in the softened water.

960 ProSoft Control

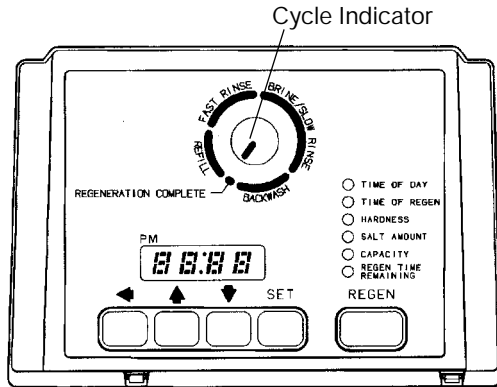


Figure 13

Programming

This section covers all aspects of programming the control. The control is shipped from the factory with default values for Hardness and Capacity. These default values will result in a system capacity of 100 gallons (1 cubic meter). While the control will operate with these values, they should be changed to meet the actual operating conditions.

Note that some parameters have a single unit of measure option such as the Rinse Time which is only entered in minutes. Other parameters have dual units such as Salt Amount which can be entered in pounds or kilograms. To select which units are active, look for a comment in the NOTES column of Tables 2 and 3. It will reference another parameter that selects which units are active. For example, Parameter P12 (Table 3) selects U.S. units if it is set to "0" and metric if it is set to "1."

Level I Parameters (Table 2)

Level I Parameters are identified as those that have an LED indicator on the front panel. The green indicator illuminates next to the name of the active control setting. The end user has access to all of these parameters which are explained in the Series 960 Operation and Maintenance Manual, (P/N 1017934). In general, pressing the down arrow (↓) button displays the Level I Parameters in the following order:

- Time of Day
- Time of Regeneration
- Hardness
- Salt Amount
- Capacity

If you continue to press the down arrow (↓) button, the parameters start over with Time of Day. Pressing the up arrow (↑) button displays the parameters in reverse order. Refer to Table 2 for a description of these parameters and the available ranges for each parameter.

Press the **SET** button and the far right number on the display starts flashing. If you want to change this number, 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. When you reach the far left digit, pressing the left arrow (←) button will return you to the far right digit.

Note: If you press and hold either the up arrow (↑) button or the down arrow (↓) button for more than one second, the flashing number will increment or decrement at the rate of 10 counts per second.

When the number is correct, press the left arrow (←) button. The first number stops flashing and the next number starts flashing. You can only change the flashing number. Continue changing numbers until you reach the desired setting. Press the **SET** button. The numbers stop flashing and the control accepts the new setting. After approximately 30 seconds, the control starts alternating the display between Time of Day and Capacity.

Note: If a beep sounds, the new setting is not accepted because it was outside the allowable range. The old value will be displayed.

Time of Day

Press the **SET** button. The display will show the Time of Day with the minutes digit blinking. If you want to change this number, 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 number stops flashing and the next number starts flashing. You can only change the flashing number. When you have reached the far left digit, pressing the left arrow (←) button returns you to the far right digit. Continue changing numbers until you reach the desired setting. Press the **SET** button to enter the value.

Time of Regeneration

The next value displayed is the Time of Regeneration. It has a default value of 2:00 a.m. If this is not acceptable, press the **SET** button and change the number. Press the **SET** button to enter the value. If 2:00 a.m. is acceptable, press the down arrow (↓) button.

Hardness

Hardness is the next value displayed. This value is the water hardness expressed in grains per gallon (milligrams per liter). The default value is 10 grains/gallon (100 mg/L). If this is not acceptable, press the **SET** button and enter a new value. Any value between 3 and 250 grains per gallon (30 and 2500 milligrams per liter) is allowed. Press the **SET** button to enter the new value.

Salt Amount

Salt Amount is the next value displayed. The default value for Salt Amount is 6 pounds (2.7 kilograms) of salt; refer to Table 1 for suggested salt settings.

Note: This is the total amount of salt for a regeneration, not pounds per cubic foot. If 6 pounds is not acceptable, press the **SET** button and change the numbers. If 6 pounds is acceptable, press the down arrow (↓) button (see Table 1).

Capacity

Capacity is the next value displayed and is expressed in kilograins (kilograms). Refer to Table 1 for the capacity setting that corresponds to the resin bed volume and salt amount. The default value is 1.0 kilograin (0.1 kilogram). If this is not acceptable, press the **SET** button and enter a new value. Any value between 0.1 and 140 kilograins (.01 and 14.00 kilograms) is allowed.

Note: If the calculation for the system capacity exceeds 9999 gallons (99.99 cubic meters)

(P5, Capacity, divided by P3, Hardness,) the control will display 9999 (99.99) for capacity until the water usage has dropped the remaining capacity below that number. When water is flowing through the system, the colon in the Time of Day display will blink.

At this time, all of the mandatory parameters are filled and the control is ready for operation. To further increase the efficiency of the system see P6 and P7 in the Level II Parameters Section. The display will alternate between the Time of Day and Capacity if no keys are pressed for 30 seconds. The Capacity value is the volume remaining in gallons (cubic meters for metric) before a regeneration is needed.

Verify proper power outage operation by briefly removing power to the control. The unit will beep and show the time of day when power is turned on.

If you wish to fine-tune the operation of this control, refer to Tables 2 and 3 for details concerning allowable values, defaults, and parameter descriptions. The programming procedure is the same for all of these parameters.

Table 2 - Programming Parameters

Parameter		Range of Values	Minimum Increments	Default	Units of Measure	Notes
Name	Description					
P1	Time of day AM or PM	1:00 to 12:59 00:00 to 23:59	1	None	Hour:minute	Range depends on value selected for P13. Enter the current time.
P2	Time of day of regeneration	1:00 to 12:59 AM or PM 00:00 to 23:59	1	2:00 AM	Hour:minute	Range depends on value selected for P13. Skip this parameter to accept the default or enter a new time.
P3	Hardness of water	3 to 250 30 to 2500	1 10	10 100	Grains/gallon mg/L	Unit of measure depends on value selected for P12. Test water hardness and enter that value.
P4	Salt amount	0.5 to 99.5 0.1 to 25.5	0.5 0.1	6 2.5	Pounds Kilograms	Unit of measure and default depends on value selected for P12. Refer to Table 2.
P5	Capacity of unit	0.1 to 140.0 0.01 to 14.00	0.1 0.01	1.0 0.1	Kilograins Kilograms	Unit of measure depends on value selected for P12. Enter the unit capacity.

Level II Parameters (Table 3)

The Level II Parameters are P6 through P19 in Table 3. The Operation and Maintenance Manual for this product does not mention these parameters, so the end user does not normally have access to these values. To access Level II Parameters, simultaneously press and hold the down arrow (↓) and up arrow (↑) buttons for three seconds.

If the control was alternating between Time of Day and Capacity when the above button sequence is entered, the display shows P1. If a different Level I Parameter was displayed, the display shows the "P" number for that parameter. Refer to Table 3 to find the "P" number associated with each parameter. Use the up arrow (↑) button or the down arrow (↓) button to move from one parameter to the next. The display cycles through the "P" numbers shown in Tables 2 and 3. When you reach P19, the next P number will go back to P1.

When the parameter number you want to change is on the display, press the left arrow (←) button to display the data assigned to that parameter. Press the **SET** button and the far right number on the display starts flashing. If you want to change this number, press the up arrow (↑) button or the down arrow (↓) button. To skip the number without changing, press the left arrow (←) button. When the number is correct, press the **SET** button. The numbers stop flashing and the control accepts the new setting. If a beep sounds, the new setting was not accepted. Refer to Table 3 for allowable values for that parameter.

To change or view other parameters, press the left arrow (←) button to have the display show "P" numbers. Now use the up arrow (↑) button or the down arrow (↓) button to move to the parameter number you wish to change.

To exit the Level II programming mode, simultaneously press and hold the down arrow (↓) and up arrow (↑) buttons for three seconds, or wait 30 seconds without pressing a button. The control starts alternating the display between Time of Day and Capacity.

Settings for all parameters can be written on the label provided with the control. The label has an adhesive backing so it can be attached to the inside rear cover for future service reference.

Special Notes for Level II Parameters

The programming parameters in Level II can be used to increase the efficiency of this conditioner. Especially note the Brine Draw Value parameter. This was set at the factory to meet the needs of a system with low water pressure. If an installation has higher water pressure or uses a large injector the efficiency of the system can be improved by changing P6 and P7.

Refill Control Value

The Refill control valve must be set to 33. The valve is molded into the end of the refill control as shown in Figure 14. Verify that the setting is 33 and move on to the next parameter.

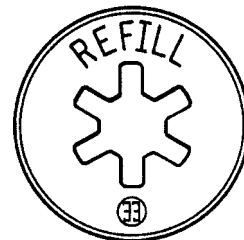


Figure 14 - Refill Control

Table 3 - Programming Parameters

Parameter						
Name	Description	Range of Values	Minimum Increments	Default	Units of Measure	Notes
P6	Refill controller	1 to 99	1	33		Enter the value molded into the end of the refill controller.
P7	Brine draw value	1 to 99	1	25		Select number from Table 4 and enter that number.
P8	Not used	NA	NA	NA	NA	NA
P9	Backwash time	3 to 30	1	14	Minutes	Skip this parameter to accept the default or enter a value.
P10	Slow rinse time	8 to 125	1	40	Minutes	Skip this parameter to accept the default or enter a value.
P11	Fast rinse time	2 to 19	1	4	Minutes	Skip this parameter to accept the default or enter a value.
P12	Units of Measure	0 to 1	1	0		0 = U.S., 1 = metric. Skip this parameter to accept U.S. or enter 1 for metric.
P13	Clock mode	0 to 1	1	0		0 = 12-hour clock. 1 = 24-hour clock. Skip this parameter for a 12-hour clock or enter 1 for a 24-hour clock.
P14	Calendar override	0 to 30	1	0	Days	0 = no calendar override. Skip this parameter for no calendar override or enter a value.
P15	Reserve type	0 to 3	1	0		0 = variable reserve, 1 = fixed reserve, 2 = variable reserve with immediate regen, 3 = fixed reserve with immediate regen. Skip this parameter to accept the default or enter a different reserve type.
P16	Fixed reserve capacity or initial average value	0 to 70	1	30	Percent of capacity	Description depends on the value entered for P15. Skip this parameter to accept the default or enter a different value.
P17	Operation type	0 to 1	1	0		0 = 5-cycle counter or cocurrent conditioner, 1 = reserved for future use.
P18	Salt/capacity change lockout	0 to 1	1	0		0 = none, 1 = salt/capacity change locked out. Skip this parameter to accept the default or enter 1 to lock out salt/capacity change.
P19	Factory defaults	0 to 3	1	9		Loads in a set of default values. Refer to the Special Notes for Level II Parameters section in this manual.

Brine Draw Value

Parameter P7 is used by the control to calculate the brine draw time. The default value of 25 was selected for a “B” injector with low water pressure or an “A” injector with moderate water pressure. If this does not match your installation, press the **SET** button and enter a new value. Refer to Table 4 for the correct value. Find the injector used in the 255 valve. The injector cap is labeled with the injector letter and the injector is color coded for easy identification. Next, determine the typical water pressure for this installation. The Brine Draw Value is an estimate of the flow rate of brine through the injector. This rate varies with water pressure and injector type as shown in Table 4. The control calculates the brine draw time using this value and the salt amount. The brine draw time is added to the Rinse Time (P10) to determine the total Brine Draw/Slow Rinse Time.

- This control does not use Parameter P8. No entry is needed for this parameter.
- Parameter P12 selects the units of measure. Be sure that this is set to the correct value before entering any data for Parameters P3, P4 or P5.
- Parameter P13 selects the clock display mode. If the 12-hour mode is selected, a PM indicator is used. If the 24-hour mode is selected, the PM indicator is not used.
- Parameter P15 has four allowable values. Values 0 or 1 will cause the control to wait for Parameter P2, time of day of regeneration, to begin the regeneration. Values 2 or 3 will cause the control to start the regeneration as soon as the capacity is exhausted.

Table 4 - Brine Draw Value

Injector	Color	Brine Draw Value at 30 psi	Brine Draw Value at 50 psi	Brine Draw Value at 70 psi
A	White	19	26	31
B	Blue	24	30	37
C	Red	29	37	40
D	Green	-	-	-

- When Parameter P15 selects a variable reserve type, 0 or 2, Parameter P16 is used to calculate the initial seven average daily water usage values. The control multiplies the total capacity by the percentage entered for Parameter P16 and uses that value as the initial average daily usage for each day of the week until water usage establishes new averages.
- Parameter 17 has two allowable values, 0 or 1, however, the 1 is reserved for future options and thus should not be used. Improper regenerations will occur if P17 is set to 1.

- Parameter P18 allows the installer to lock the Salt Amount and Capacity values so they cannot be changed. When Parameter 18 is set to 1, those two settings can only be viewed when the control is in the Level II mode. The settings will be skipped when the control is in the Level I mode. When Parameter 18 is set to zero, the Salt Amount and Capacity can be viewed and changed in either Level I or Level II.
- Parameter P19 is used at the factory to enter default values. **This parameter does not need to be changed.** Using this parameter will erase the values for all other parameters and replace them with default values. **Improper regenerations will occur if P19 is set to a 1 or 3.**

Manual Regeneration

Electricity is used only to run the timer and to rotate the camshaft. All other functions are operated by water pressure. Therefore, in the event of a power outage, all regeneration positions may be dialed manually. Manual regeneration can be accomplished by removing the cover and turning the camshaft

COUNTERCLOCKWISE to each regeneration cycle. Rotating the camshaft **COUNTERCLOCKWISE** by hand changes the cycles of operation. Each cycle position can be identified by viewing the cycle indicator on the front of the control. The following cycle times should be used for proper regeneration:

BACKWASH—14 minutes
BRINE/SLOW RINSE—52 minutes
FAST RINSE/REFILL—10 minutes
PURGE—6 minutes

Do not exceed 10 minutes for the **FAST RINSE/REFILL** cycle as this will cause excessive salt usage during the next regeneration and possibly a salt residue in the softened water.

Guest Cycle

To force the control to perform a regeneration, press the **REGEN** button (Figure 13). This button is located on the front of the control. When you press the **REGEN** button, the control performs a full regeneration of the conditioner.

If you press this button again more than one minute after regeneration begins, but before the regeneration is complete, a second regeneration will start when the first regeneration is finished. The display will freeze and only show the Regen Time Remaining as an indication that the second regeneration will be performed. When the first regeneration is complete, the second one will begin and the display will alternate between Time of Day and Regen Time Remaining.

Automatic Regeneration

There are two ways to have the control automatically start a regeneration: calendar override or having the control monitor the water usage.

Calendar Override

This feature is set in Parameter P14. It can be set for one to 30 days. If it is set to zero, this feature is disabled. When this feature is active, the control keeps track of the number of days since the last regeneration and when that number equals the value set in P14, a regeneration is automatically started at the Time of Regeneration set in P2.

Control Monitors the Water Usage

The control compares the water usage to the calculated volume capacity of the system. The control uses the Capacity Parameter P5 divided by the Hardness Parameter P3 to calculate the volume capacity of the system. It also uses a reserve value to determine if a regeneration is necessary. If the water usage since the last regeneration is greater than the system capacity minus the reserve, a regeneration is needed.

Note: If the water usage exceeds 150% of the system capacity between regenerations, the control will automatically call for a second regeneration the next day even if no water is used. This feature is included to make sure that an exhausted resin bed is completely recharged.

Reserve Options

There are two types of reserve options for this control: fixed reserve and historical water usage pattern. They are selected with Parameter P15.

Fixed Reserve

When the fixed reserve is selected, the control multiplies the maximum system capacity by the percent value set in Parameter P16 and uses the result as a reserve.

Water Usage Pattern

The other reserve option allows the control to adjust the reserve based upon the historical water usage pattern of the system. The control keeps track of the water usage for each day of the week and uses that day's average usage multiplied by 1.2 as the reserve for that day. Every day at the Time of Regeneration, the control recalculates the day's average water usage. If less than 10% of a day's average water usage is used, the control will not change the day's average. If more than twice the day's average is used, the control uses the actual usage in the reserve calculation.

Since a new installation has no history of water usage, the control multiplies the percent of capacity value set in Parameter P16 by the total system capacity to determine starting average for each day of the week. The factory set default value for P16 is 30 which means that 30% of the total system capacity is used for the starting average for each day.

Program Parameter P15 is also used to select whether the control waits until the Time of Regeneration set in Parameter P2 to start a regeneration, or if the control should begin a regeneration immediately when the capacity remaining is less than the reserve.

Removing the Valve Assembly for Servicing

1. Unplug the power cord.
2. Shut off water supply or put bypass valve(s) into bypass position.
3. Remove cover and with screwdriver, relieve tank pressure by pushing open valve No. 7 (rear flapper) on control as shown (Figure 15).

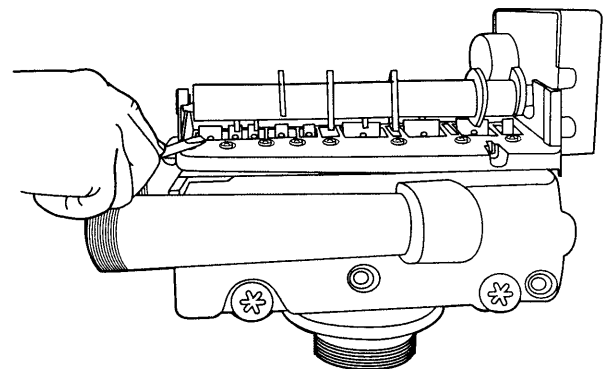


Figure 15

4. When used with a globe valve bypass, loosen and detach the inlet, outlet, brine and drain lines from the valve. If using the 1265 bypass, loosen and remove valve from bypass as well as loosening and removing the brine and drain lines.
5. Unscrew (counterclockwise) and remove valve from tank.
6. To replace the control valve, reverse the above procedure.

Removing 440i or 460i for Servicing

1. Unplug the power cord.
2. Remove cover.
3. Align the indicator arrow on the rear of the camshaft with the top of the rear hoop of the top plate (Figure 16).

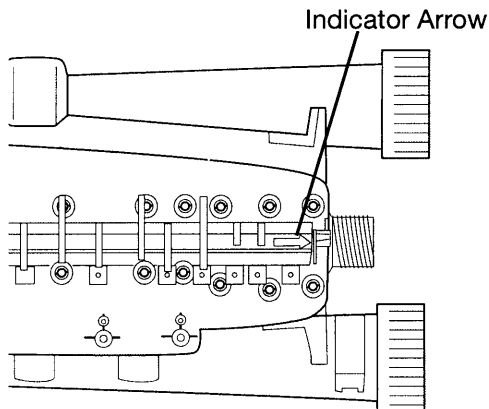


Figure 16

4. Remove the camshaft by carefully pushing the securing tab, located at the rear of the camshaft, away from the camshaft until the tab disengages from the camshaft. Push the back of the camshaft down and out to the inlet side of the valve (Figure 17).

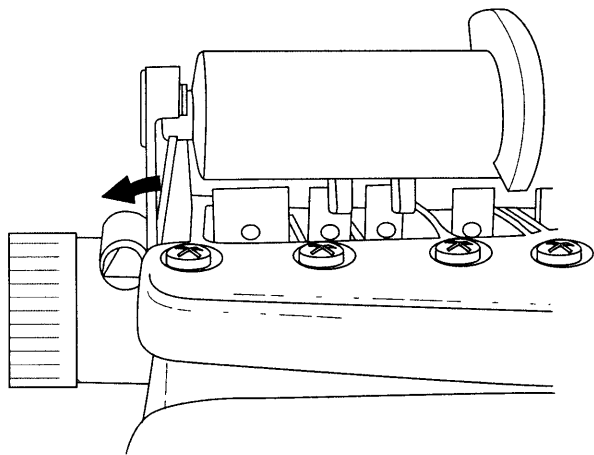


Figure 17

5. Disengage the front of the camshaft from the output gear of the control.
6. Remove the timer locking pin and lift the control straight up and off of the valve.
7. To reinstall the camshaft and control, reverse the above procedures.

Preventive Maintenance

Injector Screen and Injector

Inspect and clean brine tank and screen filter on end of brine pickup tube once a year or when sediment appears in the bottom of the brine tank.

Clean injector screen and injector once a year:

1. Unplug the wall-mount transformer.
 2. Shut off water supply or put bypass valve(s) into bypass position.
 3. Relieve system pressure by opening valve No. 7 (at rear) with a screwdriver (Figure 15).
 4. Using a screwdriver, remove injector screen and injector cap (Figure 18).
 5. Clean screen using a fine brush. Flush until clean.
 6. Using a needle-nose pliers, pull injector straight out.
 7. Flush water into the injector screen recess of the valve body to flush debris out through the injector recess.
 8. Clean and flush the injector.
 9. Lubricate the O-rings on the injector, injector cap and injector screen with silicone lubricant **only!**
 10. Reinstall the injector, injector cap and injector screen.
- IMPORTANT:** Do not overtighten the plastic cap. Seat the cap lightly into position. Overtightening may cause breakage of the plastic cap that may not be immediately evident.
11. Plug the wall-mount transformer into outlet; reset clock if necessary.
 12. Slowly open water supply valve or return bypass valve(s) to the "service" position.

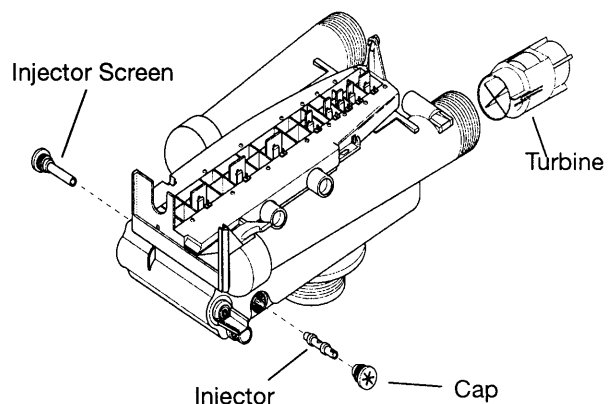


Figure 18

Water Meter Maintenance

Note: A water meter is used only with the 460i and 960 controls. If you are using the 440i or 940 control, this section does not pertain to your conditioner.

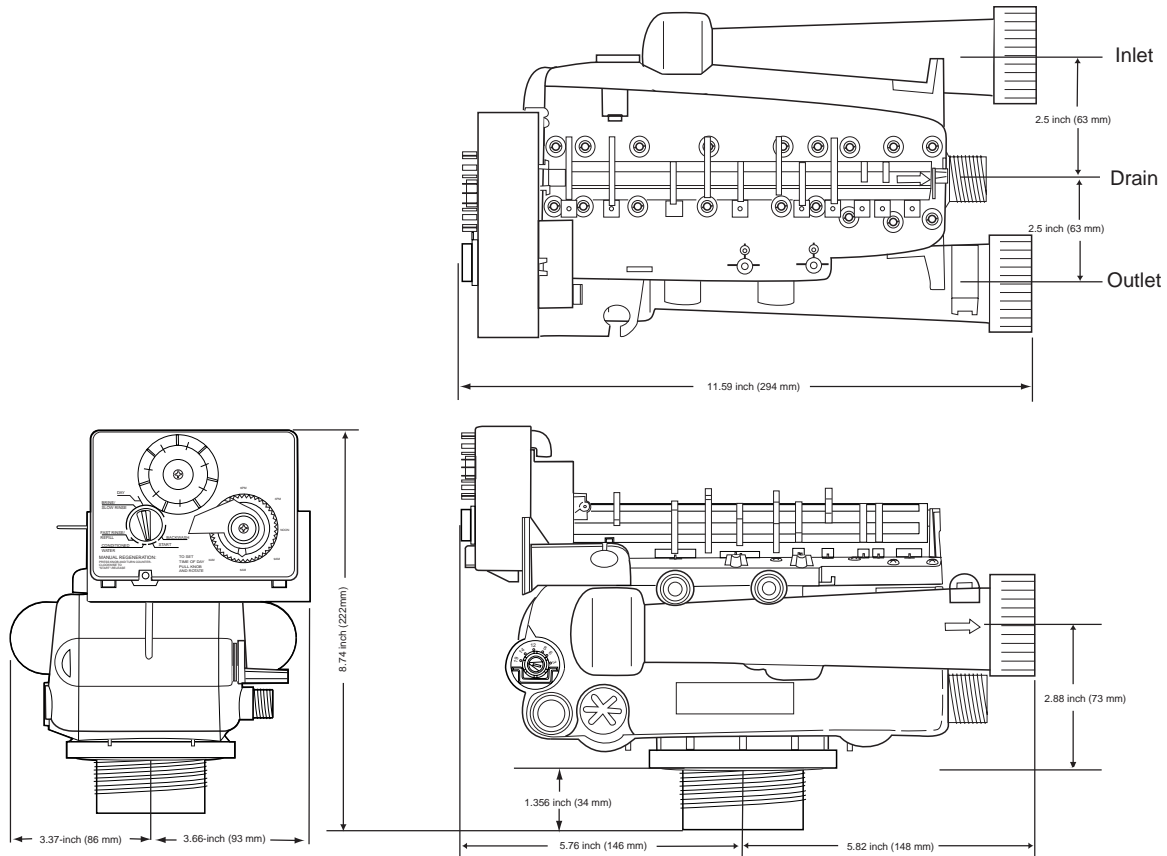
The metering device used with the 960 and 460i demand controls may require simple maintenance. In rare instances, the turbine wheel of the water meter can collect small particles of oxidized iron, eventually preventing the wheel from turning.

1. Shut off the water supply or put the bypass valve(s) into the bypass position.
2. Relieve pressure by opening the Backwash Drain Valve (the seventh back from the control) with a screwdriver (Figure 15).
3. Loosen and remove the pipe/tube adapters or 1265 bypass from the inlet and outlet of the valve body.
4. Using a needle-nose pliers, remove the turbine from the outlet housing. Grasp one of the four vanes of the outer gland and pull straight out to remove turbine assembly from the outlet of the valve (Figure 18).
5. Carefully remove the turbine wheel from the housing. Use a toothbrush to lightly scrub the iron off the magnet. Iron buildup on the surfaces can be removed by soaking the wheel in a mild sodium hydrosulfite (such as RoVer*) solution for a few minutes. Flush thoroughly with water.
6. Carefully reinstall the turbine wheel into the turbine cage housing. Make sure that the shaft of the wheel seats into the bearing of the cage. Reassemble the turbine cage and check that the wheel rotates freely.
7. Reinstall the turbine cage into the outlet of the valve.
8. Reinstall the pipe/tube adapters or 1265 bypass to the inlet and outlet of the valve.
9. Turn on the water supply or put the bypass valve(s) into the service position and purge the air out of the system.

To check for proper meter operation, open a downstream faucet and observe the water flow indication on the control display.

*RoVer is a trademark of Hach Chemical Company.

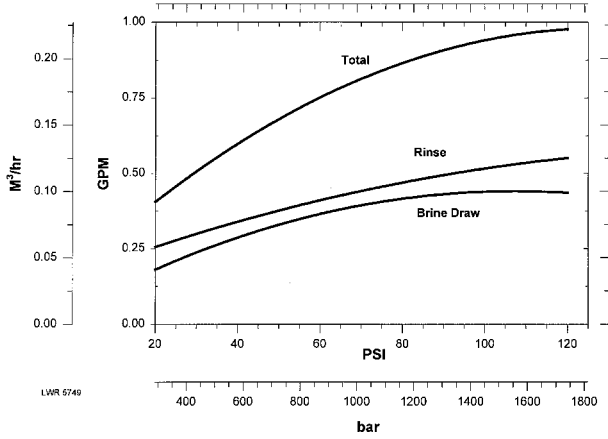
Specifications



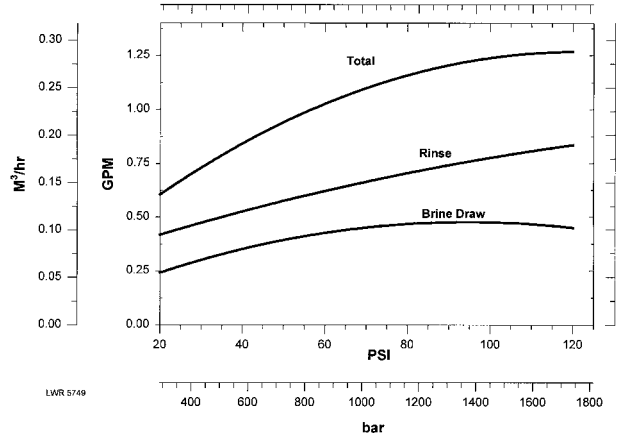
Hydrostatic Test Pressure	300 psi (20.69 bar)
Working Pressure	20-125 psi (1.38 - 8.62 bar)
Standard Electrical Rating	115V 60 Hz
Optional Electrical Rating	115V 50 Hz, 230V 50 Hz, 200V 60 Hz, 24V 60 Hz, 24V 50 Hz, 100V 60 Hz, 100V 50 Hz, 12V 50 Hz/transformer, 12V 60 Hz/transformer
Electrical Cord (standard rating)	60 inch (1.5 m) 3-wire with plug
Pressure Tank Thread	2 1/2 inch-8 male
Riser Pipe Diameter Required	1.050 inch OD (26.7 mm)
Riser Pipe Length	1-1/8 ±1/8 inches (31.8 mm) higher than the top of mineral tank
Standard Connection	.1-inch (25.4-mm) copper tube adapters
Optional Connections	.3/4-inch, 22-mm, and 28-mm copper tube adapters 3/4-inch BSPT, 1-inch BSPT, 1-inch NPT brass pipe adapters 3/4-inch, 1-inch, 25-mm CPVC tube adapters
Brine Line Connection	3/8-inch NPT male
Drain Line Connection	3/4-inch NPT male
Optional Bypass Valve	Rotating handles, full 1-inch porting, reinforced Noryl
Control Module, Tank Adapter	Reinforced Noryl
Rubber Goods	Compounded for cold water service
Program Clock (Timer)	440i: Available in 6- or 7-day English, German, French, Italian, Spanish, Japanese 940: Available in 7- or 12-day English, German, French, Italian, Spanish, Japanese 460i and 960: Available in English, German, French, Italian, Spanish, Japanese
Brine Refill Control	1 to 10 lbs (0.45 to 4.5 kg) of salt or 3 to 19 lbs (1.4 to 8.6 kg) of salt
Injector Size "A" White	Nozzle .042-inch (1.1-mm) diameter, Throat .089-inch (2.3-mm) diameter
Injector Size "B" Blue	Nozzle .052-inch (1.3-mm) diameter, Throat .099-inch (2.5-mm) diameter
Injector Size "C" Red	Nozzle .059-inch (1.5-mm) diameter, Throat .099-inch (2.5-mm) diameter
Internal Backwash Controllers	7- through 14-inch (17.8- though 35.6-cm) diameter media tanks All sizes to flow 4.5 gpm/sq ft (183 L/m ²) of bed area. For tank sizes above 14 inches in diameter, use an external flow control.

Pressure Graphs

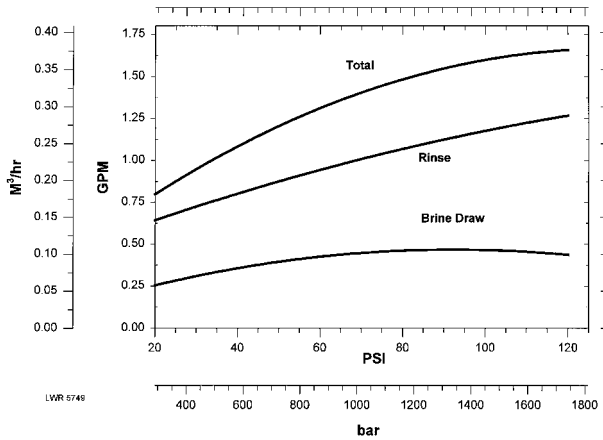
Injector # 1031363
"A" in a 268 Valve



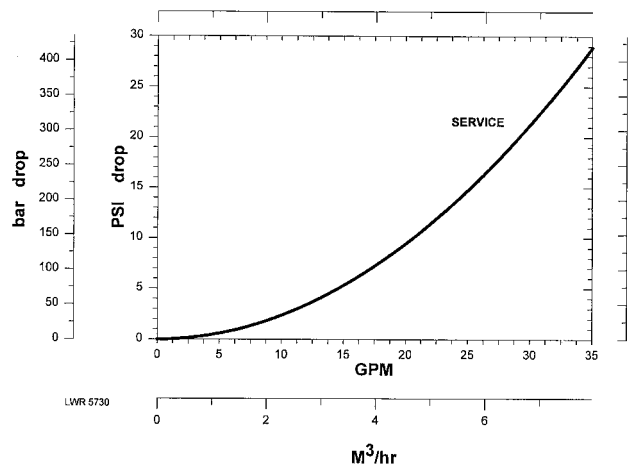
Injector # 1031364
"B" in a 268 Valve



Injector # 1031365
"C" in a 268 Valve



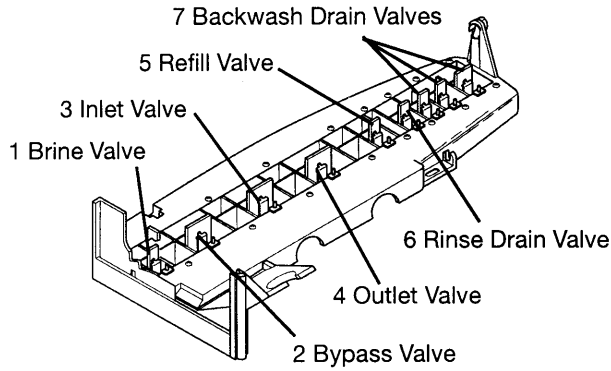
Performa 268 Valve
Flow vs Pressure Drop



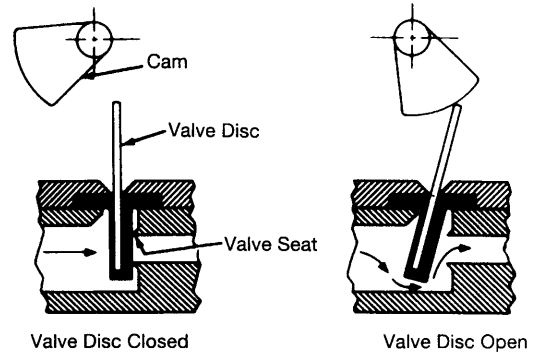
Backwash Number	7	8	9	10	12	13	14
Flow (GPM*)	1.2	1.6	2.0	2.5	3.5	4.1	4.8
Flow (LPM*)	4.5	6.0	7.6	9.5	13.2	15.5	18.2

*Approximate flow rates at 60 psi (414 kPa)

Identification of Control Valving

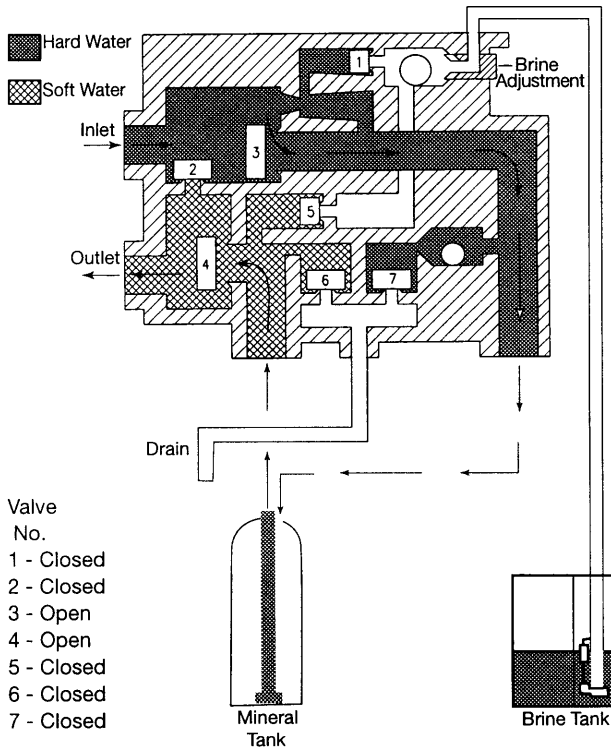


Valve Disc Principle of Operation

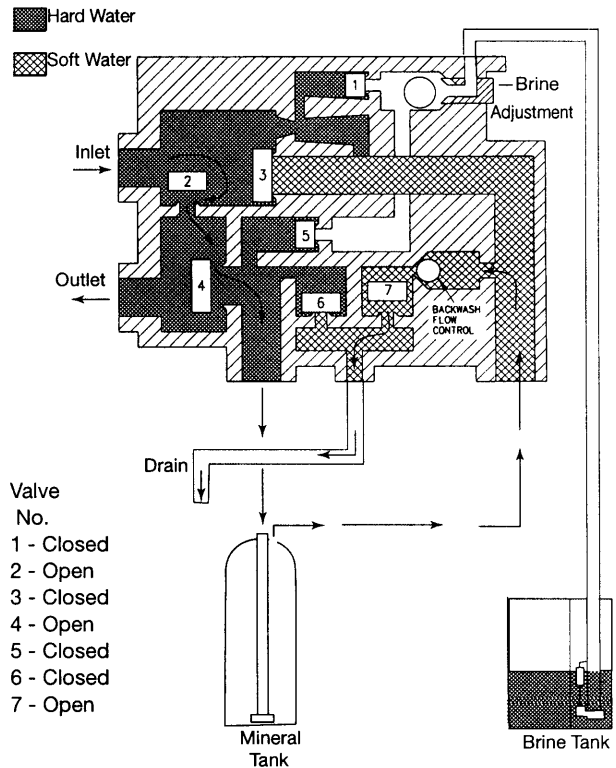


Flow Diagrams

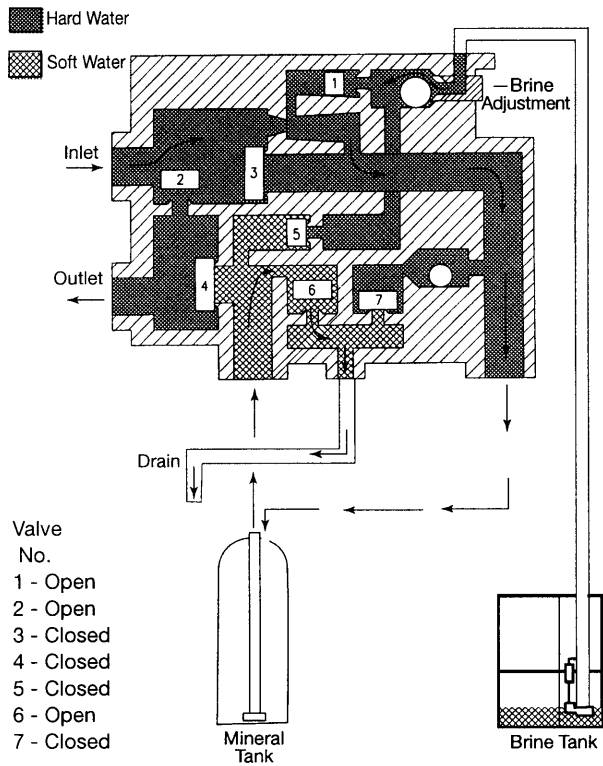
1 Service Position



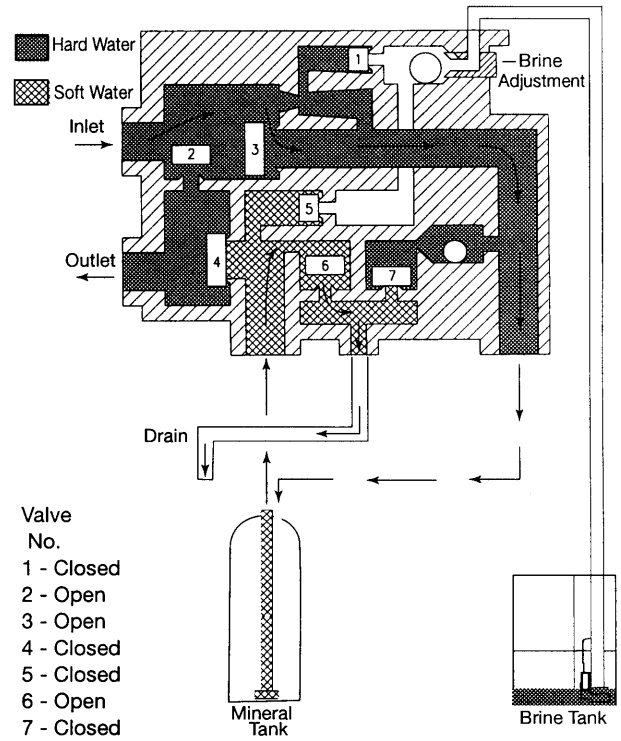
2 Backwash Position



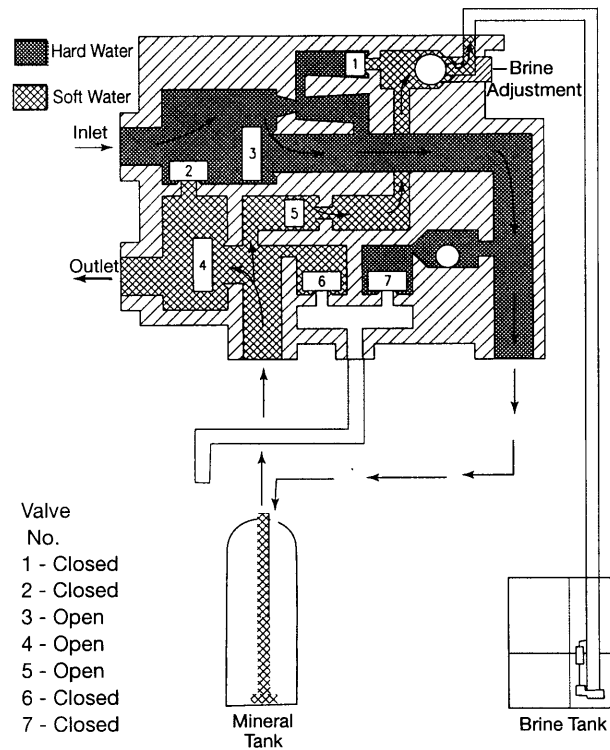
3 Brining/Slow Rinse Position



4 Purge Position

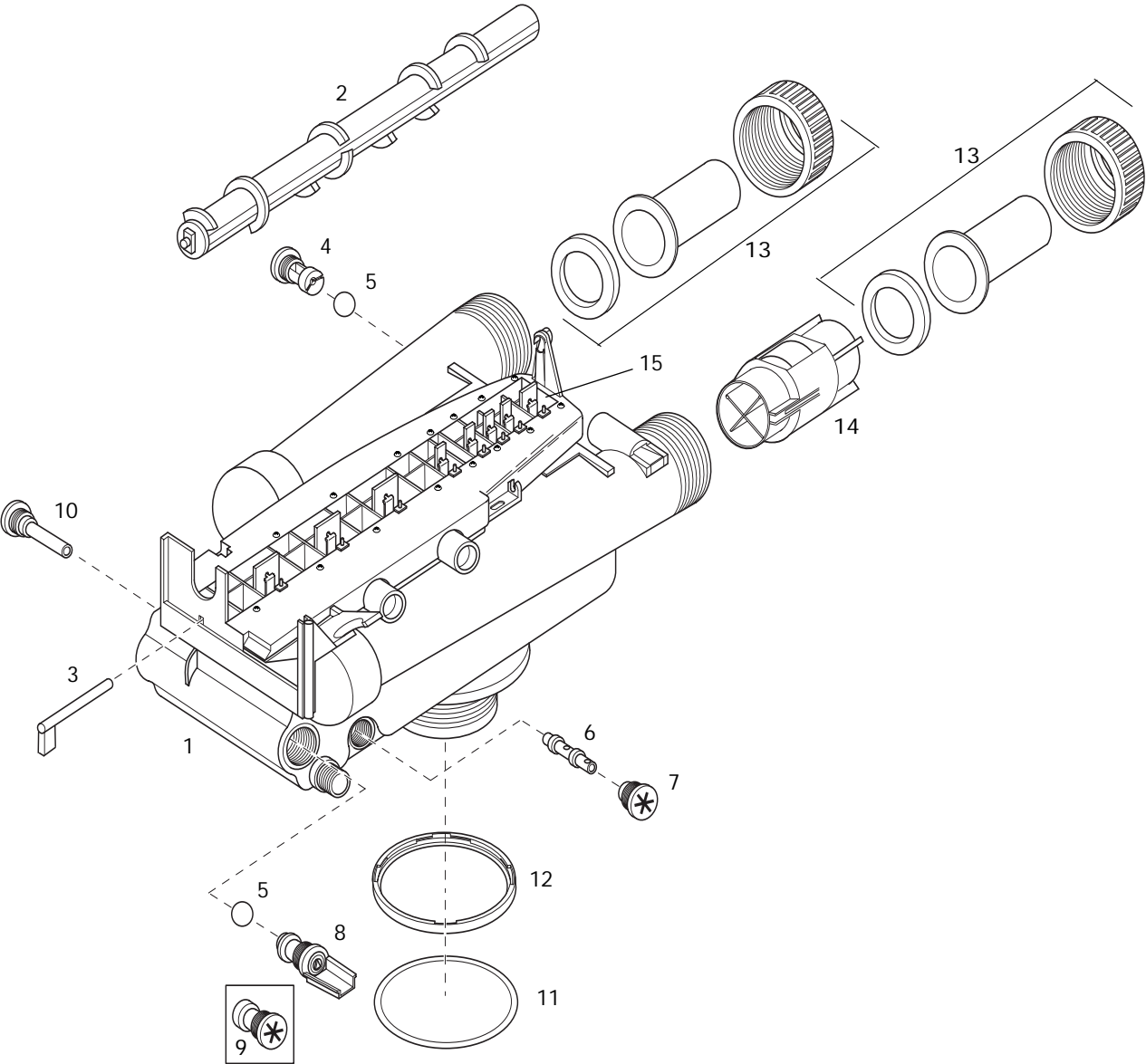


5 Brine Refill Position



Replacement Parts

Performa Valve



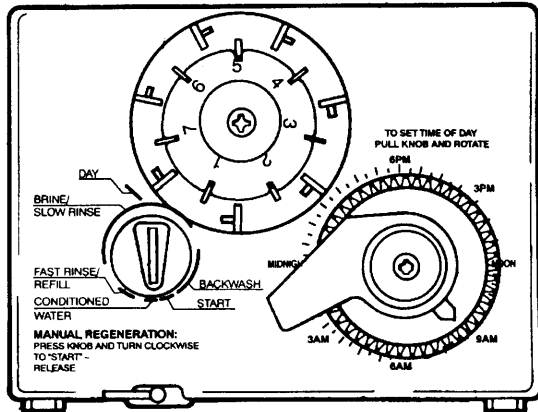
Parts List

Part				Part			
Code	No.	Description	Qty.	Code	No.	Description	Qty.
1	1035606	Valve Assembly, w/o Flow Controls (440i, 460i)	1	8		Brine Refill Control (440i and 460i):	1
		Valve Assembly, w/o Flow Controls (940, 960)	1	1034261		1 to 10 Pounds Salt	
2		Camshaft:	1	1034263		3 to 19 Pounds Salt	
	1035625	440i, 460i Standard		1034262		3 to 16 Pounds Salt (940 Adjustable Backwash Only)	
	1035627	440i, 460i Extra Salt 940, 960 Standard		9		Brine Refill Control (940 and 960):	1
3	1031391	Timer Locking Pin	1	1000222		.33 gpm	
4		Drain Control Assembly:	1	10	1000226	Screen/Cap Assembly	1
	1000209	No. 7 (1.2 gpm; 4.5 Lpm)		11	1010429	O-Ring	1
	1000210	No. 8 (1.6 gpm; 6.1 Lpm)		12	1035622	Tank Ring	1
	1000211	No. 9 (2.0 gpm; 7.6 Lpm)		13		Plumbing Adapter Kits:	1
	1000212	No. 10 (2.5 gpm; 9.5 Lpm)		1001606		3/4-inch Copper Tube Adapter Kit	
	1000213	No. 12 (3.5 gpm; 13.2 Lpm)		1001670		1-inch Copper Tube Adapter Kit	
	1000214	No. 13 (4.1 gpm; 15.5 Lpm)		1001608		22-mm Copper Tube Adapter Kit	
	1000215	No. 14 (4.8 gpm; 18.2 Lpm)		1001609		28-mm Copper Tube Adapter Kit	
5	1030502	Ball, Flow Control	2	1001613		3/4-inch CPVC Tube Adapter Kit	
6		Injector Assembly:	1	1001614		1-inch CPVC Tube Adapter Kit	
	1032970	"A" Injector - White		1001615		25-mm CPVC Tube Adapter Kit	
	1032971	"B" Injector - Blue		1001769		3/4-inch NPT Plastic Pipe Adapter Kit	
	1032972	"C" Injector - Red		1001603		1-inch NPT Plastic Pipe Adapter Kit	
	1030272	"D" Injector - Green**		1001604		3/4-inch BSPT Plastic Pipe Adapter Kit	
7		Injector Cap Assembly:	1	1001605		1-inch BSPT Plastic Pipe Adapter Kit	
	1000217	"A" Cap		1001611		3/4-inch BSPT Brass Pipe Adapter Kit	
	1000218	"B" Cap		1001610		1-inch NPT Brass Pipe Adapter Kit	
	1000219	"C" Cap		1001612		1-inch BSPT Brass Pipe Adapter Kit	
	1030303	"D" Cap **		14	1033444	Turbine Assembly	1
				15	1001580	Spring, Flapper Valve	
				*		Valve Disc Kit:	
				1041174		Standard	
				1041175		Severe Service	
				*	1000062	I-Lid Cover	1

* Not Shown

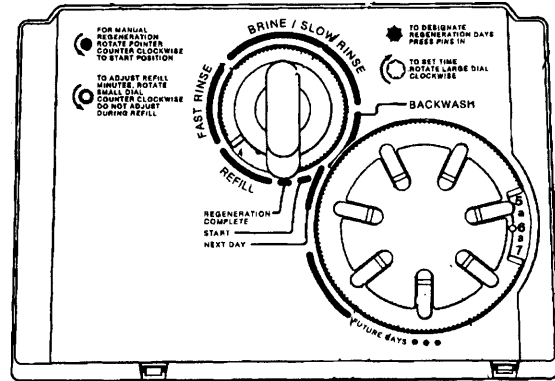
** Available late 2000

440i Control



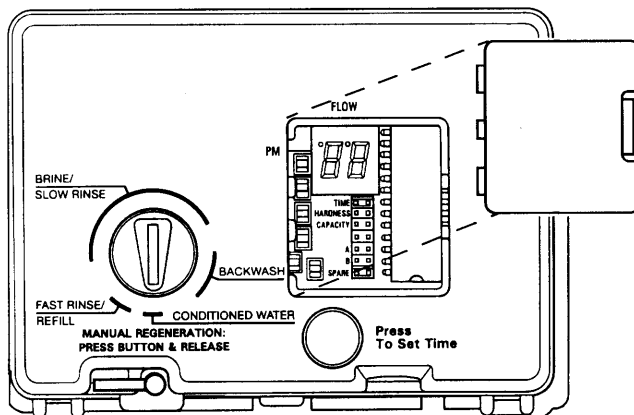
1

940 ProSet Control



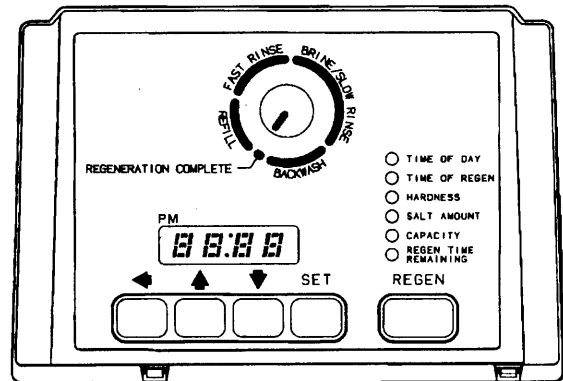
3

460i Control



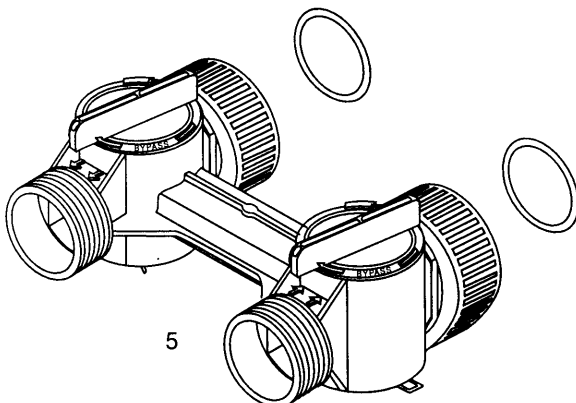
2

960 ProSoft Control



4

1265 Bypass



5

Code	Part No.	Description	Qty.
1		440i Control (6 day or 7 day)	1
2		460i Control	1
3		940 Control (7 day or 12 day)	1
4		960 Control	1
5	1040930	1265 Bypass	1
*	1000811	Transformer (440i, 460i, 960):	1
*	1000907	Transformer Extension Cord 15 feet (4.6 m)	1
*	1034264	Y-Splitter (run 2 units from 1 transformer)	1

* Not Shown

Troubleshooting

The technology upon which the Autotrol Performa control valve is based is well established and proven in service over many years. However, should a problem or question arise regarding the operation of the system, the control can very easily be serviced. For parts mentioned, refer to exploded views in the **Replacement Parts** section of this manual.

IMPORTANT: Service procedures that require the water pressure to be removed from the system are marked with a **!** after the possible cause. To remove water pressure from the system, put the bypass valve or three-valve bypass into the bypass position and open the backwash drain valve (the seventh valve back from the control) with a screwdriver. Restore system water pressure when the service work is completed.

Valve Troubleshooting

Problem	Possible Cause	Solution
1. Control will not draw brine.	<ul style="list-style-type: none"> a. Low water pressure. b. Restricted drain line. c. Injector plugged ! d. Injector defective ! e. Valve (2 and/or 4) not closed. 	<ul style="list-style-type: none"> a. Set pump to maintain 30 psi at conditioner. b. Remove restriction. c. Clean injector and screen. d. Replace injector. e. Remove foreign matter from disc and check disc for closing by pushing in on stem. Replace if needed.
2. Brine tank overflow.	<ul style="list-style-type: none"> a. Brine valve (1) being held open. b. Uncontrolled brine refill flow rate ! c. Valve (3 or 4) not closed during brine draw causing refill. d. Air leak in brine line. 	<ul style="list-style-type: none"> a. Manually operate valve stem to flush away obstruction. b. Remove variable salt controller to clean. c. Flush out foreign matter by holding disc open and manually operating valve stem. d. Check all connections in brine line for leaks. Refer to instructions.
3. System using more or less salt than salt control is set for.	<ul style="list-style-type: none"> a. Inaccurate setting. b. Foreign matter in controller causing incorrect flow rates ! c. Defective controller. 	<ul style="list-style-type: none"> a. Correct setting. b. Remove variable salt controller and flush out foreign matter. Manually position control to brine draw to clean controller (after so doing, position control to "purge" to remove brine from tank). c. Replace controller.
4. Intermittent or irregular brine draw.	<ul style="list-style-type: none"> a. Low water pressure. b. Defective injector ! 	<ul style="list-style-type: none"> a. Set pump to maintain 30 psi at conditioner. b. Replace both injector and injector cap.
5. No conditioned water after regeneration.	<ul style="list-style-type: none"> a. Unit did not regenerate. b. No salt in brine tank. c. Plugged injector ! 	<ul style="list-style-type: none"> a. Check for power. b. Add salt. c. Clean injector. Flush with water.
6. Control backwashes at excessively low or high rate.	<ul style="list-style-type: none"> a. Incorrect backwash controller used. b. Foreign matter affecting controller operation ! 	<ul style="list-style-type: none"> a. Replace with correct size controller. b. Remove controller and ball. Flush with water.
7. Flowing or dripping water at drain or brine line after regeneration.	<ul style="list-style-type: none"> a. Drain valve (5 or 6) or brine valve (1) held open by foreign matter or particle. b. Valve stem return spring on top plate weak. 	<ul style="list-style-type: none"> a. Manually operate valve stem to flush away obstruction. b. Replace spring.
8. Hard water leakage during service.	<ul style="list-style-type: none"> a. Improper regeneration. b. Leaking of bypass valve ! c. O-ring around riser tube damaged ! 	<ul style="list-style-type: none"> a. Repeat regeneration making certain that the correct salt dosage is set. b. Replace O-ring. c. Replace O-ring.

440i and 940 Control Troubleshooting

Problem	Possible Cause	Solution
1. Control will not regenerate automatically.	<ul style="list-style-type: none"> a. Transformer or motor not connected. b. Defective timer motor. c. Skipper pins not down on timer skipper wheel. d. Binding in gear train of timer. 	<ul style="list-style-type: none"> a. Connect power. b. Replace motor. c. Depress pins for days regeneration required. d. Replace timer.
2. Control regenerates at wrong time of day.	<ul style="list-style-type: none"> a. Time set incorrectly. 	<ul style="list-style-type: none"> a. Correct time setting according to instructions.

460i Control Troubleshooting

Problem	Possible Cause	Solution
1. Clock does not display time of day.	<ul style="list-style-type: none"> a. Transformer cord unplugged. b. No electric power at outlet. c. Defective transformer. d. Defective circuit board. 	<ul style="list-style-type: none"> a. Connect power. b. Repair outlet or use working outlet. c. Replace transformer. d. Replace timer.
2. Clock does not display correct time of day.	<ul style="list-style-type: none"> a. Outlet operated by switch. b. Incorrect voltage or frequency (Hz). c. Power outages. 	<ul style="list-style-type: none"> a. Use outlet not controlled by switch. b. Replace timer with one of correct voltage and frequency (Hz). c. Reset clock.
3. Time display continues to advance.	<ul style="list-style-type: none"> a. Defective time set switch. 	<ul style="list-style-type: none"> a. Replace timer.
4. Time display shows something other than time of day.	<ul style="list-style-type: none"> a. Electrical interference. b. Defective circuit board. 	<ul style="list-style-type: none"> a. Disconnect power to unit. Restore power and reset time of day. b. Replace timer.
5. No water flow display when water is flowing.	<ul style="list-style-type: none"> a. Bypass valve in bypass. b. Meter probe disconnected or not fully connected to meter housing. c. Restricted meter turbine rotation due to foreign matter in meter. d. Defective meter probe. e. Defective circuit board. 	<ul style="list-style-type: none"> a. Shift bypass valve to not-in-bypass position. b. Fully insert probe into meter housing. c. Remove meter housing, free up turbine and flush with clean water. Do not disassemble turbine from meter housing. Turbine should spin freely. If not, replace meter ! d. Replace timer. e. Replace timer.
6. Control regenerates at wrong time of day.	<ul style="list-style-type: none"> a. Power outages. b. Clock set incorrectly. 	<ul style="list-style-type: none"> a. Reset clock to correct time of day. b. Reset clock to correct time of day.
7. Timer stalled in regeneration cycle.	<ul style="list-style-type: none"> a. Motor dead. b. Motor runs backward. c. No electric power at outlet. d. Broken gear. e. Defective switch. f. Air leak in brine connections. g. Binding of camshaft. h. Water pressure greater than 125 psi during regeneration. i. Defective circuit board. 	<ul style="list-style-type: none"> a. Replace timer. b. Replace timer. c. Repair outlet or use working outlet. d. Replace timer. e. Replace timer. f. Check all junction points and make appropriate corrections. g. Remove foreign object obstruction from valve discs or camshaft. h. Install pressure regulator ! i. Replace timer.

Problem	Possible Cause	Solution
8. Continuous regeneration. Camshaft does not stop at the end of regeneration.	<ul style="list-style-type: none"> a. Broken switch activator on gear. b. Defective switch. 	<ul style="list-style-type: none"> a. Replace timer. b. Replace timer.
9. Control will not regenerate automatically or when button is pressed.	<ul style="list-style-type: none"> a. Electric cord unplugged. b. No electric power at outlet. c. Defective motor. d. Broken gear. e. Binding in gear train. f. Defective switch. 	<ul style="list-style-type: none"> a. Connect power. b. Repair outlet or use working outlet. c. Replace timer. d. Replace timer. e. Replace timer. f. Replace timer.
10. Control will not regenerate automatically but will regenerate when button is pressed.	<ul style="list-style-type: none"> a. If water flow display is not operative, refer to Item 5. b. Defective circuit board. c. Incorrect hardness and capacity settings. 	<ul style="list-style-type: none"> a. Same as Item 5. b. Replace timer. c. Set to correct values. See Programming section.
11. Run out of soft water between regenerations.	<ul style="list-style-type: none"> a. Improper regeneration. b. Fouled softener resin. c. Incorrect salt setting. d. Incorrect harness or capacity settings. e. Water hardness has increased. f. Restricted meter turbine rotation due to foreign material in meter housing. g. Excessive water usage below 1/5 gallon per minute. 	<ul style="list-style-type: none"> a. Repeat regeneration, making certain that correct salt dosage is used. b. Use resin cleaner. See Note 1. c. Set salt control to proper level. See Salt Setting chart. d. Set to correct values. See Programming section. e. Set hardness to new value. See Programming section. f. Remove meter housing, free us turbine and flush with clean water. DO NOT DISASSEMBLE TURBINE FROM METER HOUSING. Turbine should spin freely, if not, replace meter ! g. Repair leaky plumbing and/or fixtures !

Note: 1: Use of resin cleaners in an unvented enclosure is not recommended.

960 Control Troubleshooting

Alarms

The Model 960 continuously monitors itself and sounds an alarm if it detects something wrong. The alarm is a beep that is on for one second and then off for nine seconds.

When the alarm sounds, the display shows the letters "Err" with a number from 1 to 4. The table below lists the Err numbers, a description of each error, the cause of the error, and the solutions. To silence the alarm, press any button on the control. If the error still exists, the control will go back to the alarm condition after 30 seconds.

Model 960 Alarms

Indication	Description	Cause	Solution
Err1	Electronics Failure	Control settings need reprogramming.	Press any key to load default values. Refer to "Programming the Model 960 Control".
Err2	Improper start of regeneration (limit switch closed when it should be open).	Valve camshaft has been manually rotated during a regeneration. Valve camshaft has been manually rotated out of "regeneration complete" position. Faulty motor. Faulty motor drive. Faulty switch.	Press any key to silence the alarm. (Note: Alarm automatically clears at "TIME OF REGEN".) The control will turn the motor on and drive the camshaft to the proper location. Replace the control. Replace the control. Replace the control.
Err3	Improper finish of regeneration (limit switch open when it should be closed).	Valve camshaft has been manually rotated out of "regeneration complete" position. Faulty motor. Faulty motor drive. Faulty switch.	The control will turn the motor on and drive the camshaft to the proper location. Replace the control. Replace the control. Replace the control.
Err4	Improper control settings (one or more settings out of the allowable range).	One or more settings out of the allowable range.	Hardness: Adjust range: 3 to 250. Capacity: Adjust range: 0.1 to 140.0. Refill control: Adjust range: 1 to 99. Brine draw value: Adjust range per Table 4.

Problem	Possible Cause	Solution
1. Capacity display stays at 9999 even though there is water usage.	a. Total system capacity was calculated to be a value greater than 9999.	a. As the water usage continues, the remaining capacity will drop below 9999 and then other values will be shown.
2. Timer beeps when left arrow button is pressed.	a. Button is only active in the programming mode.	a. Refer to the Programming section.
3. Timer does not respond to REGEN button.	a. Button is not active in the programming mode.	a. Refer to the Regeneration section.
4. Timer does not display time of day.	a. Transformer is unplugged. b. No electric power at outlet. c. Defective transformer. d. Defective circuit board.	a. Connect power. b. Repair outlet or use working outlet. c. Replace transformer. d. Replace control.
5. Timer does not display correct time of day.	a. Outlet operated by a switch. b. Power outages.	a. Use outlet not controlled by switch. b. Reset Time of Day.

<p>6. No water flow display when water is flowing (colon does not blink).</p>	<p>a. Bypass valve in bypass position. b. Meter probe disconnected or not fully connected to meter housing. c. Restricted meter turbine rotation due to foreign material in meter ! d. Defective meter probe. e. Defective circuit board.</p>	<p>a. Shift bypass valve into service position. b. Fully insert probe into meter housing. c. Remove meter housing, free up turbine and flush with clean water. Turbine should spin freely. If not, refer to the Water Meter Maintenance section. d. Replace control. e. Replace control.</p>
<p>7. Control display is frozen at Regen Time Remaining.</p>	<p>a. Back to back regenerations were requested.</p>	<p>a. Refer to the Manual Regeneration section.</p>
<p>8. Control regenerates at the wrong time of day.</p>	<p>a. Power outages. b. Time of day set incorrectly. c. Time of regeneration set incorrectly.</p>	<p>a. Reset time of day to correct time of day. b. Reset time of day to correct time of day. c. Reset time of regeneration.</p>
<p>9. Timer stalled in regeneration cycle.</p>	<p>a. Motor not operating. b. Motor runs backwards. c. No electric power at outlet. d. Incorrect voltage or frequency (Hz). e. Broken gear. f. Defective switch. g. Air leak in brine connections (pressure locked flapper). h. Binding of camshaft. i. Water pressure greater than 125 psi during regeneration. j. Defective circuit board.</p>	<p>a. Replace control. b. Replace control. c. Repair outlet or use working outlet. d. Replace timer and/or transformer with one of correct voltage and frequency (Hz). e. Replace control. f. Replace control. g. Check all junction points and make appropriate corrections. h. Remove foreign object obstruction from valve discs or camshaft. i. Install pressure regulator to reduce pressure. j. Replace control.</p>
<p>10. Continuous regeneration. Camshaft does not stop at the end of regeneration.</p>	<p>a. Broken projection on drive gear. b. Defective switch.</p>	<p>a. Replace control. b. Replace control.</p>
<p>11. Control does not regenerate automatically or when REGEN button is depressed.</p>	<p>a. Transformer unplugged. b. No electric power at outlet. c. Defective motor. d. Broken gear. e. Binding in gear train. f. Defective switch.</p>	<p>a. Connect power. b. Repair outlet or use working outlet. c. Replace control. d. Replace control. e. Replace control. f. Replace control.</p>
<p>12. Control does not regenerate automatically but does regenerate when REGEN button is depressed.</p>	<p>a. If water flow display is not operative, refer to item 5 in this table. b. Incorrect hardness and capacity settings. c. Defective circuit board.</p>	<p>a. Refer to item 5 in this table. b. Set new control values. Refer to the Programming section. c. Replace control.</p>
<p>13. Run out of soft water between regenerations.</p>	<p>a. Improper regeneration. b. Fouled resin bed. c. Incorrect salt setting. d. Incorrect hardness or capacity settings. e. Water hardness has increased. f. Restricted meter turbine rotation due to foreign material in meter housing ! g. Excessive water usage below 1/5 gallon per minute.</p>	<p>a. Repeat regeneration making certain that correct salt dosage is used. b. Use resin cleaner. c. Set salt control to proper level. Refer to the Programming section in this manual. d. Set to correct values. Refer to the Programming section in this manual. e. Set to new value. Refer to the Programming section in this manual. f. Remove meter housing, free up turbine, and flush with clean water. Turbine should spin freely, if not, replace meter. g. Repair leaky plumbing and/or fixtures.</p>

Disinfection of Water Conditioners

The materials of construction of the modern water conditioner will not support bacterial growth, nor will these materials contaminate a water supply. However, the normal conditions existing during shipping, storage and installation indicate the advisability of disinfecting a conditioner after installation, before the conditioner is used to treat potable water. In addition, during normal use, a conditioner may become fouled with organic matter or in some cases with bacteria from the water supply.

Thus every conditioner should be disinfected after installation, some will require periodic disinfection during their normal life, and in a few cases disinfection with every regeneration would be recommended.

Depending upon the conditions of use, the style of conditioner, the type of ion exchanger, and the disinfectant available, a choice can be made among the following methods.

Sodium or Calcium Hypochlorite

Application

These materials are satisfactory for use with polystyrene resins, synthetic gel zeolite, greensand and bentonites.

5.25% Sodium Hypochlorite

These solutions are available under trade names such as Clorox Bleach*. If stronger solutions are used, such as those sold for commercial laundries, adjust the dosage accordingly.

1. Dosage
 - a. Polystyrene resin: 1.2 fluid ounces per cubic foot.
 - b. Non-resinous exchangers: 0.8 fluid ounce per cubic foot.

*Clorox is a registered trademark of The Clorox Company.

2. Brine tank conditioners
 - a. Backwash the conditioner and add the required amount of hypochlorite solution to the brine well of the brine tank. (The brine tank should have water in it to permit the solution to be carried into the conditioner.)
 - b. Proceed with the normal regeneration.

Calcium Hypochlorite

Calcium hypochlorite, 70% available chlorine, is available in several forms including tablets and granules. These solid materials may be used directly without dissolving before use.

1. Dosage
 - a. Two grains (approximately 0.1 ounce) per cubic foot.
2. Brine tank conditioners
 - a. Backwash the conditioner and add the required amount of hypochlorite to the brine well of the brine tank. (The brine tank should have water in it to permit the chlorine solution to be carried into the conditioner.)
 - b. Proceed with the normal regeneration.



