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**460i**

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**The 460i Electronic Control System  
Operation and Maintenance Manual**



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## 460i Electronic Demand System

The 460i electronic demand system is available as an option on automatic controls for water conditioning equipment. Retrofitting of existing water treatment installations is easily accomplished, and the cost is amortized over a short period of time by the home owner in salt and water savings.

The two key components of the 460i electronic demand system are the microprocessor, a miniature computer located on the circuit board, and a water meter located at the valve outlet. The flow of conditioned water through the meter generates electrical impulses that tell the computer the amount of water being used.

Every day, at 2:00 a.m., the past seven days' water usage is statistically averaged to anticipate the amount of water to be used the next day. The computer then determines if the water conditioner has enough remaining capacity to supply the next day's needs. If not, the unit will regenerate.

If the water usage pattern changes, the computer automatically compensates for the change and regenerates only when needed. This results in higher operating efficiency and lower salt usage than a conventional conditioner operating on a fixed regeneration schedule.

## Special Features

### Memory Retention

During a power outage, all of the data in the microprocessor's memory is stored in a special electronic chip called NOVRAM, Nonvolatile Random Access Memory. This data includes the time of day, water usage amounts, and the number of days since the last regeneration. The NOVRAM will maintain the data in its memory. When power is restored, the NOVRAM returns the data 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. Most power outages are less than one minute in duration. Therefore, it may be months or years before the time display would require resetting. If an outage of one or more hours occurs, the time of day should be reset. No other reprogramming is necessary.

### Self-Adjusting Reserve

"Reserve" refers to the amount of soft water that may be needed for the next 24 hours. The microprocessor calculates how much soft water was used and adjusts the reserve capacity accordingly at the end of each day. As a result, the reserve is kept at a minimum for optimum economy. The reserve amount is calculated by multiplying the average past seven days' usage

by 1.20. Regeneration decisions are based on the calculated reserve.

In the event of unusually high water usage (twice or more than the current daily average), the high usage amount will be used as the reserve when the computer performs its regeneration computation at 2:00 a.m. This is done in anticipation of a second day of very high usage.

### High Water Usage

The 460i is programmed to react to a sudden increase in water usage. If a day's usage is more than double the current average, the computer anticipates that a second day of high usage is likely to occur. The high usage amount will be used as the reserve when the 460i performs its regeneration computation.

### Low or No Water Usage

The 460i is programmed to recognize a day of very little or no water usage as an abnormality. It will not use data from such a day to compute the average usage. For example, if the family is on vacation for a week, the prior average will be maintained. When household activity resumes, the 460i will operate as if the vacation had not occurred.

### Design Reliability

Solid-state electronics assure many years of trouble-free performance. And, the metering system has only one moving part, that is the rotating turbine that measures water usage and creates magnetic pulses that are continually counted by the microprocessor to determine the need to regenerate.

## Programming the 460i

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

**Note:** If the included transformer cord is not long enough, a 15-foot (4.6-m) extension is available or reference page 5 for splicing directions.

Open the access door by pushing the raised tab on the door toward the left while pulling the tab out (Figure 1).

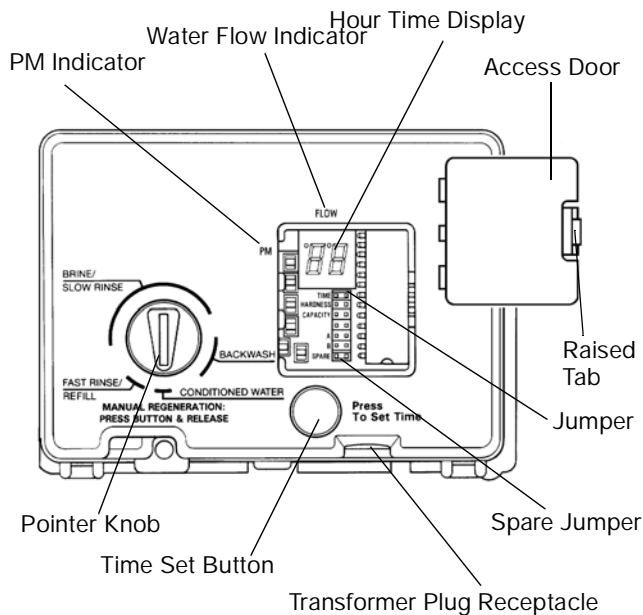


Figure 1

### Time of Day Setting

With the jumper on the set of pins next to the word **TIME** (Figure 2), 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 or tweezers 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. To have the unit regenerate at 4:00 a.m., two hours later, set the clock two hours earlier than the actual current time.

### Hardness Setting

Move the upper jumper to the set of pins next to the word **HARDNESS** (Figure 3). Press the black **TIME SET** BUTTON until the correct hardness 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.

$$\frac{\text{Parts per million}}{17.1} = \text{grains per gallon}$$

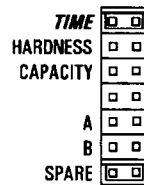


Figure 2

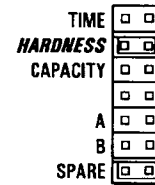


Figure 3

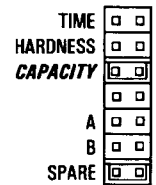


Figure 4

### Capacity Setting

Move the upper jumper to the set of pins next to the word **CAPACITY** (Figure 4). Press the black **TIME SET** BUTTON until the correct capacity value is displayed. The capacity range is 1 to 99 kilograins. Refer to the salt setting chart (Figure 6).

Return the jumper to the top set of pins next to the word **TIME** and replace the access door. The next three sets of pins are used for factory testing and are not used in normal operation. The jumper must **NOT** be left on any pins other than the top pair next to the word **TIME**. Otherwise, the unit may not function.

**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.

## Control Features

### Time Display

The time of day to the nearest hour will continually appear in the time display during normal conditioning operation. To change the hour display, press the **TIME SET** BUTTON until the present hour appears. The PM light will be on when the time is between 12:00 noon and midnight. The light is off during the AM hours.

### Flow Indicator

The water flow indicator on the time display flashes whenever service water is flowing through the valve. This allows an easy determination of proper meter operation.

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## Hardness and Capacity Settings

Once the hardness and capacity settings have been set, the information cannot be lost due to a power outage; reprogramming is not necessary.

### Guest Cycle

An extra regeneration can be achieved at any time by pressing the pointer knob. It will take a few minutes for the regeneration to start and the unit will return to conditioned water in two hours. This feature is beneficial when you expect to use more than the normal amount of water, for example: guest visits, extra heavy laundry days, etc.

### 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 the regeneration positions may be dialed manually by pressing the pointer knob with a straight-blade screwdriver and turning COUNTERCLOCKWISE.

- Backwash...14 minutes
- Brine and slow rinse...52 minutes
- Brine refill...10 minutes
- Fast rinse/refill...6 minutes

Do not exceed 10 minutes for the refill cycle as this will cause excessive salt usage during the next regeneration and possibly a salt residue in the conditioned water.

DO NOT advance the pointer knob directly to the conditioned water position (6 o'clock) when manually advancing the camshaft after a manual regeneration or when servicing the conditioner. Advance it to just past the fast rinse position, approximately 7 o'clock. The timer will then advance itself to the conditioned water position where the internal switch will turn the motor off. The internal switch will not be operated and the motor will continue to run if advanced directly to the conditioned water position.

If power fails during a conditioner regeneration, the cycle will be completed normally when the power is restored.

### Adjustment of Brine Control

The amount of salt placed into the regenerant storage 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 lbs. (6.8 Kg), the amount of brine the conditioner will use for each cycle will contain 15 lbs. (6.8 kg) of salt. Never let the amount of salt in the brine tank be less than the amount required for the next regeneration.

Refer to the salt setting table, Table 1, for proper salt settings. To set the salt dial, insert a screwdriver into the pointer knob (Figure 5) and move the pointer to the proper setting.

Note: To convert the salt settings from English to Metric, divide by 2.2.

Example: 12 pound  $\div$  2.2 = 5.5 kg of salt.

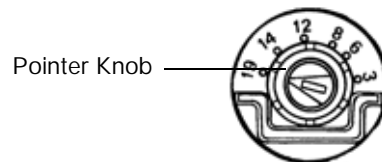


Figure 5

**Table 1 - Suggested Salt Dial Settings (Pounds of Salt)  
for Various Size Softeners**

Capacity Setting Kilograins	Resin Bed Volume							
	.5 ft <sup>3</sup>	.75 ft <sup>3</sup>	1.0 ft <sup>3</sup>	1.25 ft <sup>3</sup>	1.5 ft <sup>3</sup>	1.75 ft <sup>3</sup>	2.0 ft <sup>3</sup>	2.5 ft <sup>3</sup>
12	4.5	-	-	-	-	-	-	-
16	9.	5	-	-	-	-	-	-
20	-	8.5	6	-	-	-	-	-
24	-	14	8.5	7	-	-	-	-
30	-	-	15	11	9	-	-	-
32	-	-	18.5	12.5	10	9	-	-
35	-	-	-	16	12	10	9	-
40	-	-	-	11.5*	17	14	12	-
48	-	-	-	-	14*	10.5*	17	13
60	-	-	-	-	-	-	15*	10.5*

\*This setting requires use of "XS" (Extra Salt) cam and doubles the amount of the setting.

## Splicing the Low Voltage Transformer Cord

If it is necessary to extend the length of the transformer cord, an optional 15-foot (4.6-m) extension is available, or the cord may be spliced as follows:

1. Strip insulation from wire 5/16 inch from wire end.
2. Insert stripped wire into barrel of connector and crimp. For best results, crimp twice per wire as shown in Figure 6.

Splice connectors or extension wire are not supplied. They are available at hardware or electrical stores.

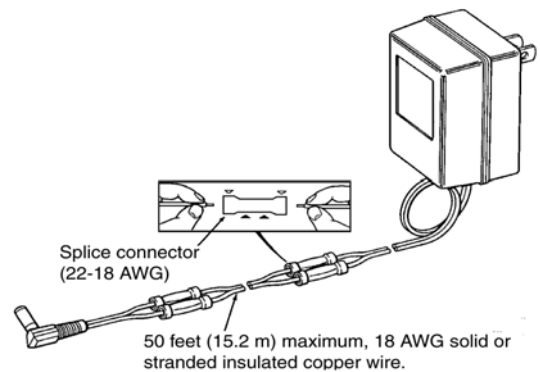


Figure 6

## Troubleshooting

Your water conditioning system is designed and manufactured for efficient, low maintenance service. However, if problems do occur, this section provides a list of possible causes and solutions. You can solve some problems yourself, such as low salt in the salt storage tank or a blown household fuse. However, some problems require installer or dealer assistance.

**IMPORTANT:** Service procedures that require the water pressure to be removed from the system are marked with a !. 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 sixth valve back from the control) with a screwdriver. Restore system water pressure when the service work is completed.

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

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

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

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## 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 exchange, 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, greens and bentonites.

#### 5.25% Sodium Hypochlorite

These solutions are available under trade names such as Clorox, Linco, Bo Peep, White Sail and Eagle Brand 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 ounce per cubic foot.
  - b. Non-resinous exchanger; 0.8 fluid ounce per cubic foot.
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. 2 grams (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.