

460 NOV RAM MP

**The COMMANDER
Electronic Control System
Operation and Maintenance Manual**

460 NOVRAM MP Electronic Demand System

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

The two key components of the Commander 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 causes electrical impulses to be generated, which in turn, are sent to the computer. The computer takes this information and determines the amount of conditioned water being used.

Every night, at 2 AM, the past 7 days' water usage is statistically averaged to anticipate the amount of water that will 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.

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.

Self-adjusting Reserve

The Commander 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 Commander performs its regeneration computation.

Low or No Water Usage

The Commander 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 Commander 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...the rotating turbine that measures water usage and creates magnetic pulses that are continually counted by the microprocessor to determine the need to regeneration.

Programming the Commander

1. Plug the Commander into a functioning, grounded electrical outlet that is not controlled by a switch.

Caution: Be sure the electric outlet for the softener is properly grounded to protect the user from injury or possibly fatal shock. Do not remove the ground pin from the plug.

2. Open the access door by inserting a small screwdriver into the small opening at the bottom of the door and gently pry up (Figure 1).

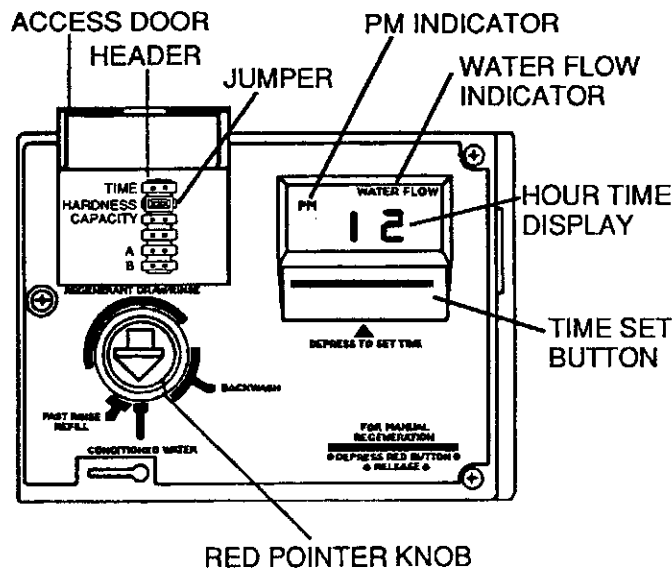


Figure 1

3. 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 depressing the black TIME SET BUTTON. PM hours are indicated by a light next to the letters PM on the display window.

NOTE: The unit is factory set to regenerate at 2 AM. 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 AM, 2 hours later, set the clock 2 hours earlier than the actual current time.

4. Pull the jumper off the top set of pins and place it on the set of pins next to the word "HARDNESS" (Figure 3). Depress 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,

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

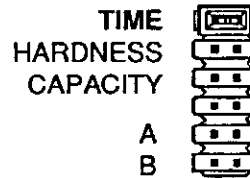


Figure 2

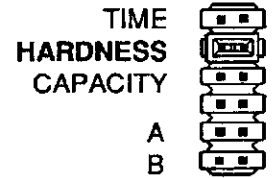


Figure 3

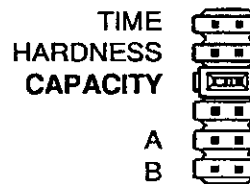


Figure 4

PPM, to grains per gallon, GPG, use this formula.

5. Place the jumper on the set of pins next to the word "CAPACITY" (Figure 4). Depress 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).

NOTE: The use of a small needle nose pliers or tweezers will aid in moving the jumper.

6. Return the Jumper to the top set of pins next to the word "Time" and close the access door. The bottom 3 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." Failure to do this will cause the unit not to operate.

In the event that the hardness or capacity setting must be changed, simply follow Steps 1 through 6.

Control Features

Time Display

The correct time will continually appear in the time display during normal conditioning operation. To change the hour display, depress the TIME SET BUTTON until the present hour appears. The PM light will be on when the time is between 12 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.

Hardness and Capacity Settings

Once the hardness and capacity settings have been set, the information cannot be lost due to a power outage and no reprogramming is necessary.

Guest Cycle

An extra regeneration can be achieved at any time by depressing the red pointer knob. It will take a few minutes for the regeneration to start and the unit will return to service 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 various regeneration positions may be dialed manually by depressing the red pointer knob with a wide bladed screwdriver and turning COUNTER-CLOCKWISE.

Manual time cycles:

- Backwash...14 minutes
- Brine and rinse...52 minutes
- Brine refill...10 minutes
- Purge...6 minutes

Do not exceed 10 minutes for the brine 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 red pointer knob directly to the service position, 6 o'clock, when manually advancing the camshaft to place the conditioner in service after a manual regeneration or when servicing the conditioner. Advance it short of the service position to just past the purge position, approximately 7 o'clock. The timer will then advance itself to the service 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 service 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 on the control, 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. Do not overload the brine tank with salt.

Refer to the salt setting chart (Figure 6) for proper salt settings. To set the salt dial, insert a small screwdriver into the white 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 ÷ 2.2 = 5.5 kg of salt.

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

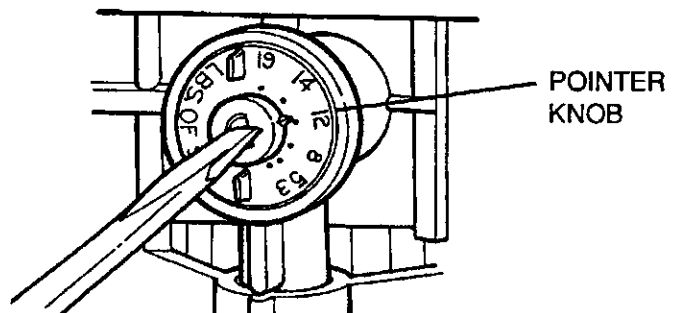


Figure 5

**Suggested Salt Dial Settings (Pounds of Salt)
For Various Size Softeners**

| Capacity Setting (Kilograms) | .5 Ft. ³ | .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 | — | — | — | — | — | — | — |
| 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.

Figure 6

Troubleshooting

| Problem | Possible Cause | Solution |
|--|---|--|
| 1. Clock does not display time of day | <ul style="list-style-type: none"> a. Electric 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 display. 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 material in meter d. Defective meter probe. e. Defective circuit board. | <ul style="list-style-type: none"> 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. 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 backwards. c. No electric power at outlet. c. Incorrect voltage or frequency (Hz). e. Broken gear. f. Defective switch. g. Air leak in brine connections. h. Binding of camshaft. i. Water pressure greater than 125 psi during regeneration. j. Defective circuit board. | <ul style="list-style-type: none"> a. Replace motor. b. Replace motor. c. Repair outlet or use working outlet. d. Replace timer with one of correct voltage and frequency (Hz). e. Replace timer. f. Replace timer. g. Check all junction points and make appropriate corrections. h. Remove foreign object obstruction from valve discs or camshaft. i. Install pressure regulator. j. Replace timer. |
| 8. Continuous regeneration. Camshaft does not stop at the end of regenera- | <ul style="list-style-type: none"> a. Broken projection on red gear. b. Defective switch. | <ul style="list-style-type: none"> a. Replace timer. b. Replace timer. |

| Problem | Possible Cause | Solution |
|---|--|---|
| 9. Control will not regenerate automatically or when red button is depressed. | <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 motor. d. Replace timer. e. Replace timer. f. Replace timer. |
| 10. Control will not regenerate automatically but will regenerate when red button is depressed. | <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 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. | <ul style="list-style-type: none"> a. Repeat regeneration making certain that correct salt dosage is used. b. Use resin cleaner. 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 up 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. |

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