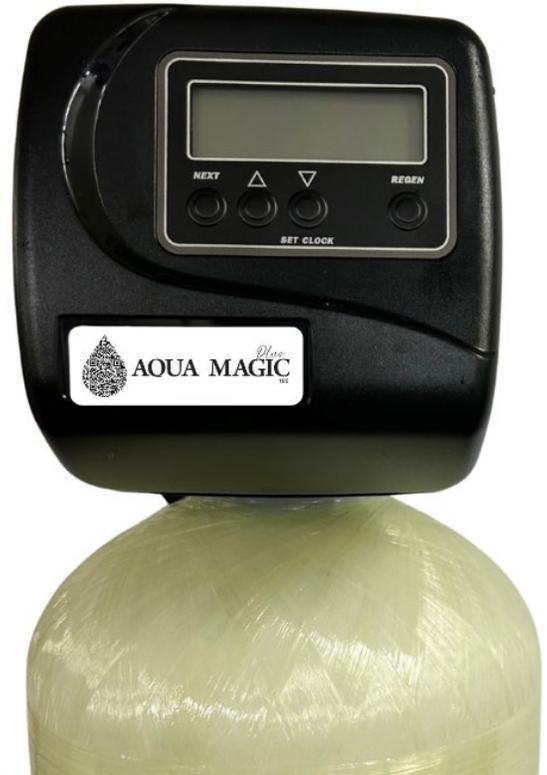




# AQUA MAGIC <sup>Plus</sup> 1EE

## Owner and Operational Manual



Model: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Install Date: \_\_\_\_\_

Installed By: \_\_\_\_\_

Service Phone: \_\_\_\_\_

Sold By: \_\_\_\_\_

**Please read this manual carefully before proceeding with installation. Your failure to follow any of these instructions or operating parameters may lead to personal injury or damage to the equipment and/or personal property. Do not use this water treatment system with water that is microbiologically unsafe or of unknown quality, without adequate disinfection before or after the system. This water treatment system contains replaceable treatment components critical for effective performance. It is the user's responsibility to periodically test the product water to verify the system is performing satisfactorily. Failure to properly maintain this water treatment system may cause a health risk.**

**Save this manual for future reference.**

# Contents

|   |    |
|---|----|
| AMIEE Control Specifications.....   | 3  |
| Control Valve Function and Cycles of Operation .....  | 5  |
| Service Instructions .....  | 6  |
| Drive Assembly .....  | 6  |
| Drive Cap Assembly, Main Piston, and Regenerant Piston .....  | 7  |
| Spacer Stack Assembly .....   | 8  |
| Injector Cap, Screen, Injector Plug, and Injector .....   | 8  |
| Refill Flow Control Assembly of Refill Port Plug.....   | 9  |
| Water Meter or Meter Plug .....   | 9  |
| Bypass Valve.....   | 10 |
| EE Front Cover and Drive Assembly .....   | 11 |
| AM1 Drive Cap Assembly, Downflow Piston, Upflow Piston, Regenerant Piston and Spacer Stack Assembly ..... | 12 |
| Injector Cap, Injector Screen, Injector, Plug and O-Ring.....   | 13 |
| Refill Flow Control Assembly and Refill Port Plug .....   | 14 |
| Drain Line – 3/4” .....   | 15 |
| Water Meter, Meter Plug and Mixing Valve .....  | 16 |
| Bypass Valve.....   | 17 |
| Bypass Valve Operation .....  | 18 |
| Regeneration and Error Screens .....  | 19 |
| Button Operation and Function.....  | 19 |
| Regeneration Cycles and Times.....  | 19 |
| User Displays .....   | 20 |
| Configuration Settings .....  | 21 |
| Configuring the Control Valve for No Hard Water Bypass Operation .....                                    | 22 |
| Configuring the Control Valve for Separate Source Operation.....  | 22 |
| Configuring the Control Valve for System Controller Operation.....  | 24 |
| OEM Softener System Setup .....   | 25 |
| Setting Options Table .....   | 28 |
| OEM Filter System Setup .....   | 29 |
| Installer Display Settings - Regeneration Type Auto.....  | 31 |
| Installer Display Settings - 28 Day Regeneration .....  | 32 |
| Installer Display Settings - 7 Day Regeneration .....   | 33 |
| Diagnostics .....   | 34 |
| Water Treatment System Warranty.....  | 36 |

# AM1EE Control Specifications

|  |                            |
|--|----------------------------|
| Inlet/Outlet.....  | 1"                         |
| Cycles .....   | 3 - 6                      |
| Valve Material.....  | Noryl (1)                  |
| <b>FLOW RATES</b>  |                            |
| Service @ 15 psi drop (includes bypass and meter).....     | 27 gpm                     |
| Backwash @ 25 psi drop (includes bypass and meter) .....   | 27 gpm                     |
| Cv Service. ....   | 7.0                        |
| Cv Backwash.....   | 5.4                        |
| <b>OPERATING PRESSURES</b>                                 |                            |
| Minimum/Maximum.....                                       | 20 psi - 125 psi           |
| <b>OPERATING TEMPERATURES</b>                              |                            |
| Minimum/Maximum.....                                       | 40° - 110° F               |
| Regeneration .....   | downflow                   |
| <b>METER</b>   |                            |
| Accuracy.....  | ± 5%                       |
| Flow Rate Range. ....                                      | 0.25 - 27 GPM              |
| Gallon Range.....  | 20 - 50,000                |
| <b>DIMENSIONS</b>  |                            |
| Distributor Pilot.....                                     | 1" (1.050) OD Pipe         |
| Drain Line.....  | 3/4" or 1" NPT             |
| Brine Line.....  | 3/8" or 1/2" OD Poly tube  |
| Mounting Base. ....  | 2 1/2" - 8 NPSM            |
| Height From Top of Tank .....                              | 7 3/8"                     |
| Weight .....   | 4.5 lbs.                   |
| Current Draw and Voltage.....                              | A 110v                     |
| <b>TANK APPLICATIONS</b>                                   |                            |
| Water Softener .....                                       | 8" - 13" diameter          |
| Water Filter (2). ....                                     | 8" - 13" diameter          |
| <b>CYCLES OF OPERATION (Softener Downflow)</b>             |                            |
| <b>Cycle</b>   | <b>Range of times min.</b> |
| 1. Backwash 1 <sup>st</sup> (upflow). 6.....               | 12                         |
| 2. Regenerate Draw (downflow). 45.....                     | 75                         |
| 3. Backwash 2 <sup>nd</sup> (upflow). 3.....               | 12                         |
| 4. Rinse (downflow). 3 .....                               | 8                          |
| 5. Regenerant Refill (in service with treated water) ..... | As Programmed              |
| 6. Service   |                            |

Options: Backwash Filter, 3/4" & 1" inlet/outlet, Bypass, Weather Cover

Compatible with the following regenerants or chemicals: Sodium Chloride, potassium chloride, potassium permanganate, sodium bisulfite, sodium hydroxide, hydrochloric acid, chlorine and chloramines

1. Noryl is a trademark of General Electric

|   |  |
|---|--|
| Minimum/Maximum Operating Pressures   | 20 psi (138kPa or 1.4 bar) -125 psi (862 kPa or 8.6 bar) |
| Minimum/Maximum Operating Temperatures  | Minimum/Maximum Operating Temperatures                   |
| Power Adapter:<br>Supply Voltage<br>Supply Frequency<br>Output Voltage<br>Output Current  | See Drawings and Part Numbers page 1 for data            |
| No user serviceable parts are on the PC board, the motor, or the power adapter. The means of disconnection from the main power supply is by unplugging the power adapter from the wall. |  |

The control valve, fittings and/or bypass are designed to accommodate minor plumbing misalignments but are not designed to support the weight of a system or the plumbing.

**Do not use vaseline, oils, other hydrocarbon lubricants, or spray silicone anywhere. A silicone lubricant may be used on black O-rings but is not necessary. Avoid any type of lubricant, including silicone, on red or clear lip seals.**

The nuts and caps are designed to be unscrewed or tightened by hand or with a special plastic wrench. If necessary, pliers can be used to unscrew the nut or cap. Do not use a pipe wrench to tighten or loosen nuts or caps. Do not place screwdriver in slots on caps and/or tap with a hammer.

**Do not use pipe dope or other sealants on threads. Teflon tape must be used on the threads of the 1" NPT elbow or the 1/4" NPT connection and on the threads of the drain line connection. Teflon tape is not necessary on the nut connection or caps because of O-ring seals.**

After completing any valve maintenance involving the drive assembly or the drive cap assembly and pistons, press and hold NEXT and REGEN buttons for 3 seconds or unplug the power source jack from the printed circuit board (black wire) and plug it back in. This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version (e.g. 154), and then reset the valve to the service position.

All plumbing should be done in accordance with local plumbing codes. The pipe size for the drain line should be a minimum of 1/2". Backwash flow rates over 7 gpm or length over 20' require 3/4" drain line.

Solder joints near the drain must be done prior to connecting the drain line flow control fitting. Leave at least 6" between the drain line control fitting and solder joints when soldering pipes that are connected to the drain line control fitting. Failure to do this could cause interior damage to the drain line flow control fitting.

When assembling the installation fitting package (inlet and outlet), connect the fitting to the plumbing system first and then attach the nut, split ring, and O-ring. The heat from soldering or solvent cements may damage the nut, split ring, or O-ring. Solder joints should be cool and solvent cements should be set before installing the nut, split ring, and O-ring. Avoid getting primer and solvent cement on any part of the O-rings, split rings, bypass valve, or control valve.

Plug into an electrical outlet. Note: All electrical connections must be connected according to local codes. (Be certain the outlet is uninterrupted.)

Install grounding strap on metal pipes.

## Control Valve Function and Cycles of Operation

This glass filled Noryl<sup>1</sup> fully automatic control valve is designed as the primary control center to direct and regulate all cycles of a water softener or filter. When the control valve is set up as a filter, the control valve can be set to perform downflow regeneration or simply backwash. The control valve can be set to regenerate on demand (consumption of a predetermined amount of water) and/or as a time clock (passage of a particular number of days). The control valve can be set so that a softener can meet the Water Quality Association (WQA) or NSF International efficiency rating.

The control valve is compatible with a variety of regenerates and resin cleaners. The control valve is capable of routing the flow of water in the necessary paths to regenerate or backwash water treatment systems. The injector regulates the flow of brine or other regenerates. The control valve regulates the flow rates for backwashing, rinsing, and replenishing treated water into a regenerate tank, when applicable.

The control valve is designed to deliver high service (27 gpm @ 15 psi) and backwash (27 gpm @ 25 psi) flow rates when the bypass has straight fittings. The control valve uses no traditional fasteners (e.g. screws), instead clips, threaded caps, nuts, and snap-type latches are used. Caps and nuts only need to be firmly hand-tightened because radial seals are used. Tools required to service the valve include one small blade screwdriver, one large blade screwdriver, pliers, and a pair of hands. A plastic wrench is available which eliminates the need for screwdrivers and pliers. Disassembly for servicing takes much less time than comparable products currently on the market. Control valve installation is made easy because the distributor tube can be cut ½” above to ½” below the top of the tank thread. The distributor tube is held in place by an O-ring seal and the control valve also has a bayonet lock feature for upper distributor baskets.

The transformer power pack comes with a 15-foot power cord and is designed for use with the control valve. The transformer power pack is for dry location use only. The control valve remembers all settings for eight hours if the power goes out. After eight hours, the only item that needs to be reset is the time of day, all other values are permanently stored in the nonvolatile memory. If a power loss lasts less than eight hours and the time flashes on and off, the time of day should be reset and the non-rechargeable battery should be replaced.

For DIR Softeners, there are two options for setting the gallons capacity. The gallons capacity is automatically calculated if set to AUTO. Reserve Capacity is automatically estimated based on water usage if AUTO is used. The other option is to set the Gallons Capacity to a specific number. If a specific number is set, reserve capacity is zero, unless the value is manually set (i.e. the manufacturer intentionally sets the gallon capacity number below the calculated capacity of the system).

The control valve can also be set to regenerate immediately or at the next regeneration time by changing the Regeneration Time Option. There are three choices for settings:

1. “NORMAL” means regeneration will occur at the preset regeneration time.
2. “On 0” means regeneration will occur when the gallons capacity reaches zero.
3. “NORMAL” and “on 0” means the regeneration will occur at the preset regeneration time unless the gallons capacity reaches zero. If the gallons capacity reaches zero the regeneration will begin 10 minutes after no water usage.

The user can initiate manual regeneration. The user has the option to request the manual regeneration at the delayed regeneration time or to have the regeneration occur immediately:

1. Pressing and releasing the REGEN button. “Regen Today” will flash on the display and the regeneration will occur at the delayed regeneration time. The user can cancel the request by pressing and releasing the REGEN button. This method of manually initiating regeneration is not allowed when the system is set to immediately regenerate when the gallon capacity reaches zero.
2. Pressing and holding the REGEN button for approximately 3 seconds will immediately start the regeneration. The user cannot cancel this request, except by resetting the control by pressing NEXT and REGEN buttons simultaneously for 3 seconds.

# Service Instructions

## Drive Assembly

Remove the valve cover to access the drive assembly.

Disconnect the power source plug (black wire) from the PC board prior to disconnecting the motor or water meter plugs from the PC board. The motor plug connects to the two-pin jack on the left-hand side of the PC board. The power source plug connects to the four-pin jack. The four-pin jack is between the two-pin and three-pin jacks. The water meter plug (gray wire) connects to the three-pin jack on the far right-hand side of the PC board.

The PC board can be removed separately from the drive bracket but it is not recommended. Do not attempt to remove the display panel from the PC board. Handle the board by the edges. To remove the PC board from the drive bracket, unplug the power, water meter, and motor plugs from the PC board. Lift the middle latch along the top of the drive bracket while pulling outward on the top of the PC board. The drive bracket has two plastic pins that fit into the holes on the lower edge of the PC board. Once the PC board is tilted about 45° from the drive bracket it can be lifted off of these pins. To reinstall the PC board, position the lower edge of the PC board so that the holes in the PC board line up with the plastic pins. Push the top of the PC board towards the valve until it snaps under the middle latch, weave the power and water meter wires into the holders, and reconnect the motor, water meter, and power plugs.

The drive bracket must be removed to access the drive cap assembly and pistons or the drive gear cover. It is not necessary to remove the PC board from the drive bracket to remove the drive bracket. To remove the drive bracket, start by removing the plugs for the power source and the water meter. Unweave the wires from the side holders. Two tabs on the top of the drive back plate hold the drive bracket in place. Simultaneously lift the two tabs and gently ease the top of the drive bracket towards your body. The lower edge of the drive bracket has two notches that rest on the drive back plate. Lift up and outward on the drive bracket to disengage the notches.

To reassemble, seat the bottom of the drive bracket so the notches are engaged at the bottom of the drive back plate. Push the top of the drive bracket towards the two latches. The drive bracket may have to be lifted slightly to let the threaded piston rod pass through the hole in the drive bracket. Maintain a slight engaging force on top of the drive bracket while deflecting the bracket slightly to the left by pressing on the side of the upper right corner. This helps the drive gears mesh with the drive cap assembly. The drive bracket is properly seated when it snaps under the latches on the drive back plate. If resistance is felt before latching, then notches are not fully engaged, the piston rod is not in the hole, and the wires are jammed between the drive bracket and drive back plate, or the gear is not engaging the drive cap assembly.

To inspect drive gears, the drive gear cover needs to be removed. The drive gear cover is held in place on the drive bracket by three clips. The largest of the three clips is always oriented to the bottom of the drive bracket. Before trying to remove the drive gear cover, the drive bracket must be removed from the drive back plate. The drive gear cover can be removed from the drive bracket without removing the motor or the PC board. Simultaneously, push in and down on the large clip at the bottom and the clip on the left-hand side of the drive bracket behind the PC board. Keep your fingers behind the drive gear cover so the drive gears do not drop on the ground.

Replace broken or damaged drive gears. Do not lubricate any of the gears. Avoid getting any foreign matter on the reflective coating because dirt or oils may interfere with pulse counting.

The drive gear cover only fits one way, with the large clip orientated towards the bottom. If all three clips are outside of the gear shroud on the drive bracket the drive cover slips easily into place.

The drive bracket does not need to be removed from the drive plate if the motor needs to be removed. To remove the motor, disconnect the power and motor plugs from the jacks on the PC board. Move the spring clip loop to the right and hold. Rotate the motor at least a ¼ turn in either direction before gently pulling on the wire connectors to remove the motor. Pulling directly on the wires without rotating the motor may break the wires off the motor.

Replace the motor if necessary. Do not lubricate the motor or the gears. When reinstalling the motor gently turn the motor while inserting so that the gear on the motor meshes with the gears under the drive gear cove and the small plastic bulge engages one of the slots on the motor housing. Reconnect the motor plug to the two-pronged jack on the lower left-hand side of the PC board. If the motor will not easily engage with the drive gear when reinstalling lift and slightly rotate the motor before reinserting.

Replace the valve cover. After completing any valve maintenance, press and hold NEXT and REGEN buttons for 3 seconds or unplug the power source jack (black wire) and plug it back in. This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version (e.g. 154), and then reset the valve to the service position.

## Drive Cap Assembly, Main Piston, and Regenerant Piston

The drive must be removed to access the drive cap assembly. The drive cap assembly must be removed to access the piston(s). The drive cap assembly is threaded into the control valve body and seals with an O-ring. To remove the drive cap assembly, use the special plastic wrench or insert a ¼" to ½" flat-bladed screwdriver into one of the slots around the top 2" of the drive cap assembly so it engages the notches molded into the drive back plate around the top 2" of the piston cavity. See Figure 5. The notches are visible through the holes. Lever the screwdriver so the drive cap assembly turns counterclockwise. Once loosened unscrew the drive cap assembly by hand and pull straight out.

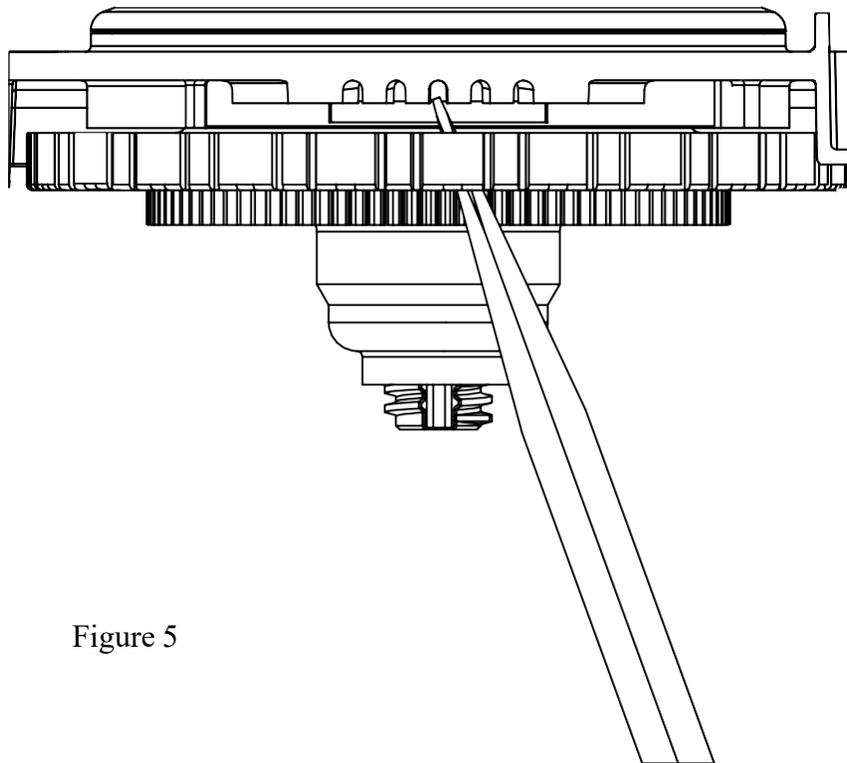


Figure 5

The drive cap assembly contains the drive cap, main drive gear, drive cap spline, piston rod, and various other parts that should not be disassembled in the field. The only replaceable part on the drive cap assembly is the O-ring. Attached to the drive cap assembly is the main piston (down flow or up flow) and if a regenerant is used, a regenerant piston.

The regenerant piston (the small diameter one behind the main piston) is removed from the main piston by unsnapping it from its latch. Chemically clean in dilute sodium bisulfite or vinegar or replace the regenerant piston if needed. To remove the main down flow or up flow piston fully extend the piston rod and then unsnap the main piston from its latch by pressing on the side with the number. Chemically clean in dilute sodium bisulfite or vinegar or replace the main piston.

Reattach the main piston to the drive cap assembly. Reattach the regenerant piston (if needed) to the main piston. Do not lubricate the piston rod, main piston, or regenerant piston. Lubricant will adversely affect the red or clear lip seals. Reinsert the drive cap assembly and piston into the spacer sack assembly and hand tighten the drive cap assembly. Continue to tighten the drive cap assembly using a screwdriver as a ratchet until the black O-ring on the spacer stack assembly is no longer visible through the drain port. Excessive force can break the notches molded into the drive back plate. Make certain that the main drive gear still turns freely. The exact position of the piston is not important as long as the main drive gear turns freely.

Reattach the drive assembly to the control valve and connect all plugs. After completing any valve maintenance, press and hold NEXT and REGEN buttons for 3 seconds or unplug the power source jack (black wire) and plug it back in. This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version (e.g. 154), and then reset the valve to the service position.

## **Spacer Stack Assembly**

To access the spacer stack assembly, remove the drive assembly, drive cap assembly, and piston. The spacer stack assembly can be removed easily without tools by using a thumb and forefinger. Inspect the black O-rings and red or clear lip seals for wear or damage. Replace the entire stack if necessary. The spacer stack assembly has been 100% tested at the factory to ensure the proper orientation of one-way seals. Do not disassemble the stack.

The spacer stack assembly may be chemically cleaned (dilute sodium bisulfite or vinegar) or wiped with a soft cloth.

The spacer stack assembly can be pushed into the control valve body bore by hand. Since the spacer stack assembly can be compressed it is easier to use a blunt object (5/8" to 1-1/8" in diameter) to push the center of the assembly into the control valve body. The assembly is properly seated when at least four threads are exposed (approximately 5/8"). Do not force the spacer stack assembly in. The control valve body bore interior can be lubricated with silicone to allow for easy insertion of the entire stack.

Reattach the drive cap assembly and piston(s) and the drive assembly.

After completing any valve maintenance, press and hold NEXT and REGEN buttons for 3 seconds or unplug the power source jack (black wire) and plug it back in. This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version (e.g. 154), and then reset the valve to the service position.

## **Injector Cap, Screen, Injector Plug, and Injector**

Unscrew the injector cap and lift off. Loosen the cap with a special plastic wrench or pliers if necessary. Attached to the injector cap is a screen. Remove the screen and clean it if fouled.

The plug and/or injector can be pried out with a small screwdriver. The plug can be wiped clean. If the plug leaks replace the entire plug. The injector consists of a throat and a nozzle. Chemically clean the injector with vinegar or sodium bisulfite. The holes can be blown out with air. Both pieces have a small diameter hole that controls the flow rates of water to ensure that the proper concentration of regenerant is used. Sharp objects, that can score the plastic, should not be used to clean the injector. Scoring the injector or increasing the diameter of the hole could change the operating parameters of the injector.

Two holes are labeled DN and UP. Check for compliance with one of the following:

- a. For down flow systems, the appropriate size injector is located in the “DN” hole, a plug is in the “UP” hole, and the piston is a combination of the down flow main piston and the regenerate piston;
- b. For up-flow systems, the appropriate size injector is located in the “UP” hole, a plug is in the “DN” hole, and the piston is a combination of the up-flow main piston and the regenerant piston;
- c. For backwash only systems, a plug is in the “DN” hole and the “UP” hole, and the piston only has a downflow main piston (the regenerant piston must be removed) and a plug is in the refill flow control position.

Push the plug(s) and/or injectors firmly in place, replace the screen, and hand-tighten the injector cap.

## **Refill Flow Control Assembly of Refill Port Plug**

To clean or replace the refill flow control, pull out the elbow-locking clip and then pull straight up on the elbow. Replace the elbow locking clip in the slot so that it is not misplaced. Twist to remove the white flow control retainer. The flow control can be removed by prying upward through the side slots of the retainer with a small blade flat screwdriver.

Chemically clean the flow control or the white flow control retainer using dilute sodium bisulfate or vinegar. Do not use a wire brush. If necessary, replace the flow control, the O-ring on the flow control retainer, or the O-ring on the elbow.

Reseat the flow control so the rounded end is visible in the flow control. Reseat the white flow control retainer by pushing the retainer into the elbow until the O-ring seats. Remove the locking clip, push down on the elbow to reseat, and insert the locking clip.

Do not use Vaseline, oils, or other unacceptable lubricants on O-rings. A silicone lubricant may be used on the O-ring on the elbow or the white retainer.

## **Water Meter or Meter Plug**

The water meter assembly is connected to the PC board by a wire. If the entire water meter assembly is to be replaced, remove the control valve cover and remove the power source and water meter plugs from the PC board. Unlatch the drive assembly and lean it forward. Unthread the water meter wire from the side of the drive assembly and through the drive back plate. To reinstall, rethread the water meter wire through the drive back plate and the side of the drive assembly. Reattach the drive assembly, the water meter, and power plugs.

If no water meter wire is visible, then a plug is installed not a water meter.

The water meter wire does not need to be removed from the PC board if the water meter is only being inspected and cleaned. To remove the water meter assembly, unscrew the meter cap on the left side of the control valve. Pliers may be used to unscrew the nut if necessary.

With the nut removed, a slot at the top of the water meter is visible. Twist a flat-blade screwdriver in the slot between the control valve body and the meter. When the meter is part way out it is easy to remove the water meter from the housing. Once the water meter is removed from the control valve body, use your fingers to gently pull forward on the turbine to remove it from the shaft.

Do not use a wire brush to clean. Wipe with a clean cloth or chemically clean in dilute sodium bisulfite or vinegar. The turbine can be immersed in the chemical. Do not immerse electronics in chemicals. If the turbine is scored or damaged or the bearings on the turbine are worn replace the turbine.

Do not lubricate the turbine shaft. The turbine shaft bearings are pre-lubricated. Do not use Vaseline, oils, or other unacceptable lubricants on the O-ring. A silicone lubricant may be used on the black O-ring.

Snap the turbine on the shaft and reinsert the water meter into the side slot. Hand-tighten the nut, do not use a pipe wrench to tighten the nut.

## Bypass Valve

The working parts of the bypass valve are the rotor assemblies that are contained under the bypass valve caps. Before working on the rotors, make sure the system is depressurized. Turn the red arrow-shaped handles towards the center of the bypass valve and back to the arrow direction several times to ensure the rotor is turning freely.

The nuts and caps are designed to be unscrewed or tightened by hand. If necessary, pliers can be used to unscrew the nut or cap. Do not use a pipe wrench to tighten or loosen nuts or caps. Do not place screwdriver in slots on caps and/or tap with a hammer. To access the rotor, unscrew the cap and lift the cap, rotor, and handle out as one unit. Twisting the unit as you pull it out will help to remove it more easily. There are three O-rings: one under the rotor cap, one on the rotor stem, and the rotor seal. Replace worn O-rings. Clean rotor. Reinstall rotor.

When reinstalling the red arrow handles be sure that:

1. O-rings on both rotors face to the right when being viewed from the front of the control valve when the handle pointers are lined up with the control valve body arrows; or
2. Arrows point toward each other in the bypass position.

Since the handles can be pulled off, they could be accidentally reinstalled 180° from their orientation. To install the red arrow handles correctly, keep the handles pointed in the same direction as the arrows engraved on the control valve body while tightening the bypass valve caps.

After completing any valve maintenance, press and hold NEXT and REGEN buttons for 3 seconds or unplug the power source jack (black wire) and plug it back in. This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version (e.g. 154), and then reset the valve to the service position.

## EE Front Cover and Drive Assembly

| Drawing No. | Order No.       | Description                     | Quantity |
|-------------|-----------------|---------------------------------|----------|
| 1           | V3175EE-01      | AM1EE FRONT COVER ASSEMBLY      | 1        |
| 2           | V3107-01        | AM1 MOTOR                       | 1        |
| 3           | V3106-01        | AM1 DRIVE BRACKET & SPRING CLIP | 1        |
| 4           | V3408EE-04BOARD | AM1THRU/2 EE PCB 5 DIGIT REPL   | 1        |
| 5           | V3110           | AM1 DRIVE GEAR 12X36            | 3        |
| 6           | V3109           | AM1 DRIVE GEAR COVER            | 1        |
| Not Shown   | V3186           | AM1 AC ADAPTER 120V-12V         | 1        |
|             | V3186-01        | AM1 AC ADAPTER CORD ONLY        |          |
| Not Shown   | V3178           | AM1 Drive Back Plate            | 1        |

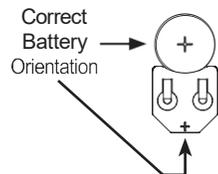
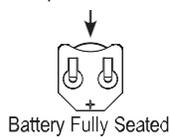
Refer to Control Valve Service Manual for other drawings and part numbers.

| AC Adapter       | U.S.     | International |
|------------------|----------|---------------|
| Supply Voltage   | 120 V AC | 230V AC       |
| Supply Frequency | 60 Hz    | 50 Hz         |
| Output Voltage   | 12 V DC  | 12 V AC       |
| Output Current   | 500 mA   | 500 mA        |

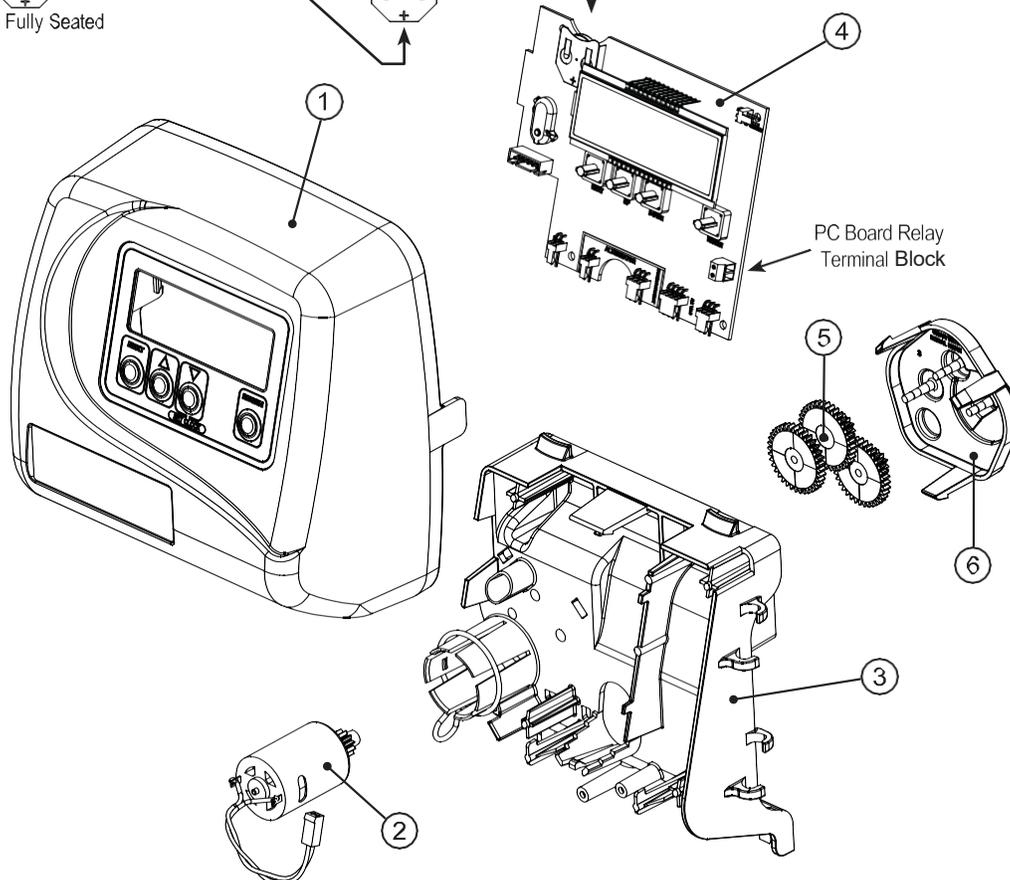
Relay Specifications: 12V DC Relay with a coil resistance not less than 80 ohms. If mounting relay under the cover check for proper mounting dimensions on the backplate.

| Wiring for Correct On/Off Operation |        |
|-------------------------------------|--------|
| PC Board Relay Terminal Block       | Relay  |
| RLY 1                               | Coil - |
| + COM                               | Coil + |

When replacing the battery, align positives and push down to fully seat.



Battery replacement is 3-volt lithium coin cell type 2032.

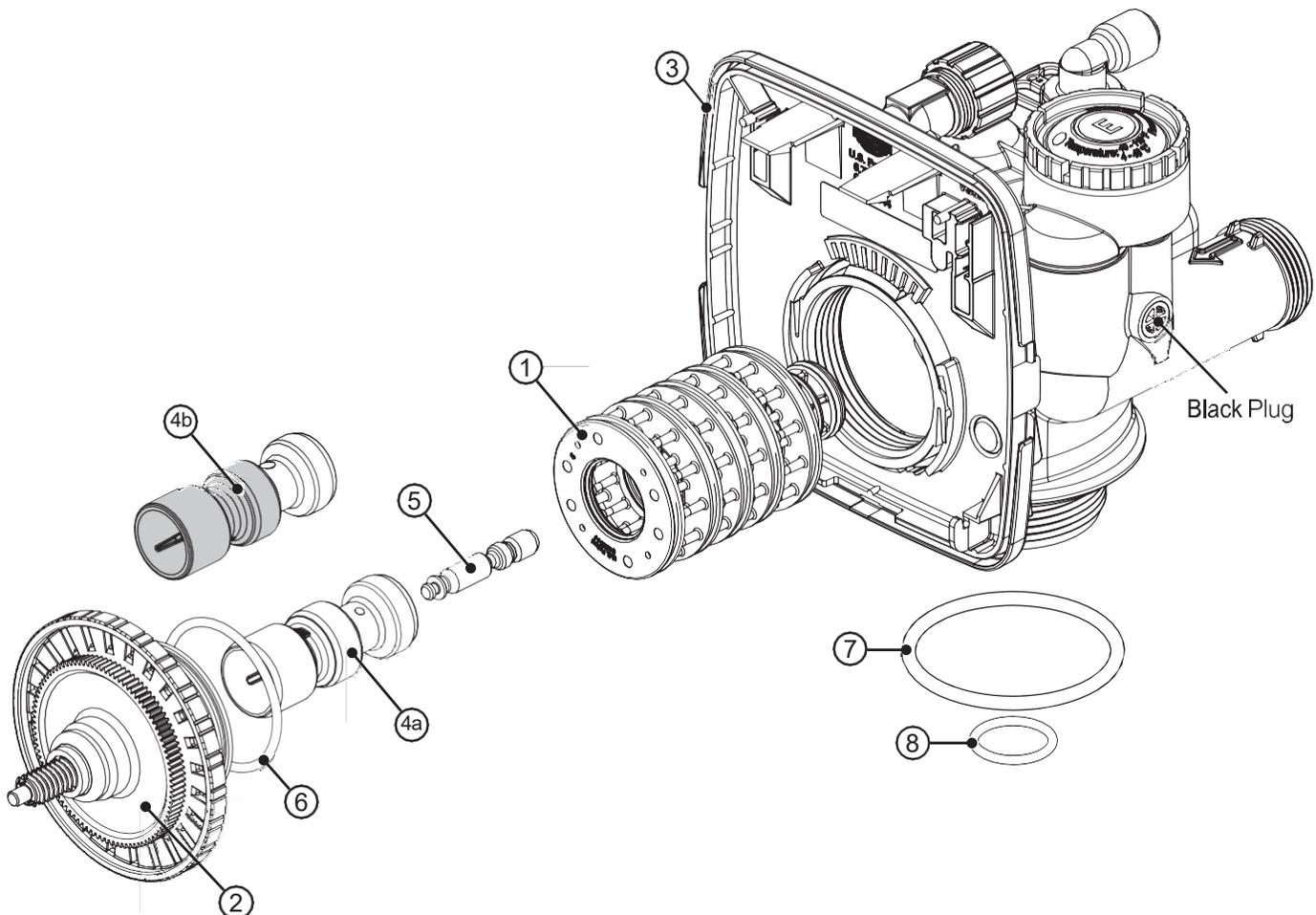


# AM1 Drive Cap Assembly, Downflow Piston, Upflow Piston, Regenerant Piston and Spacer Stack Assembly

| Drawing No. | Order No.  | Description                                   | Quantity |
|-------------|------------|---|----------|
| 1           | V3005-02   | AM1 Spacer Stack Assembly                     | 1        |
| 2           | V3004      | Drive Cap ASY                                 | 1        |
| 3           | V3178      | Refer to Programming and Cover Drawing Manual | 1        |
| 4a          | V3011*     | AM1 Piston Downflow ASY                       | 1        |
| 4b          | V3011-01*  | AM1 Piston Upflow ASY                         |          |
| 5           | V3174      | AM1 Regenerant Piston                         | 1        |
| 6           | V3135      | O-ring 228                                    | 1        |
| 7           | V3180      | O-ring 337                                    | 1        |
| 8           | V3105      | O-ring 215 (Distributor Tube)                 | 1        |
| Not Shown   | V3001      | AM1 Body ASY Downflow                         | 1        |
|             | V3001-02   | AM1 Mixing Valve Body ASY                     |          |
|             | V3001UP    | AM1 Body ASY Upflow                           |          |
|             | V3001-02UP | AM1 Mixing Valve Body Upflow ASY              |          |
| Not Shown   | V3193-02   | AM1 Service Spanner Wrench                    |          |

\*V3011 is labeled with DN and V3011-01 is labeled with UP. Upflow option is not applicable to TC control valves.

Note: The regenerant piston is not used in backwash only applications.

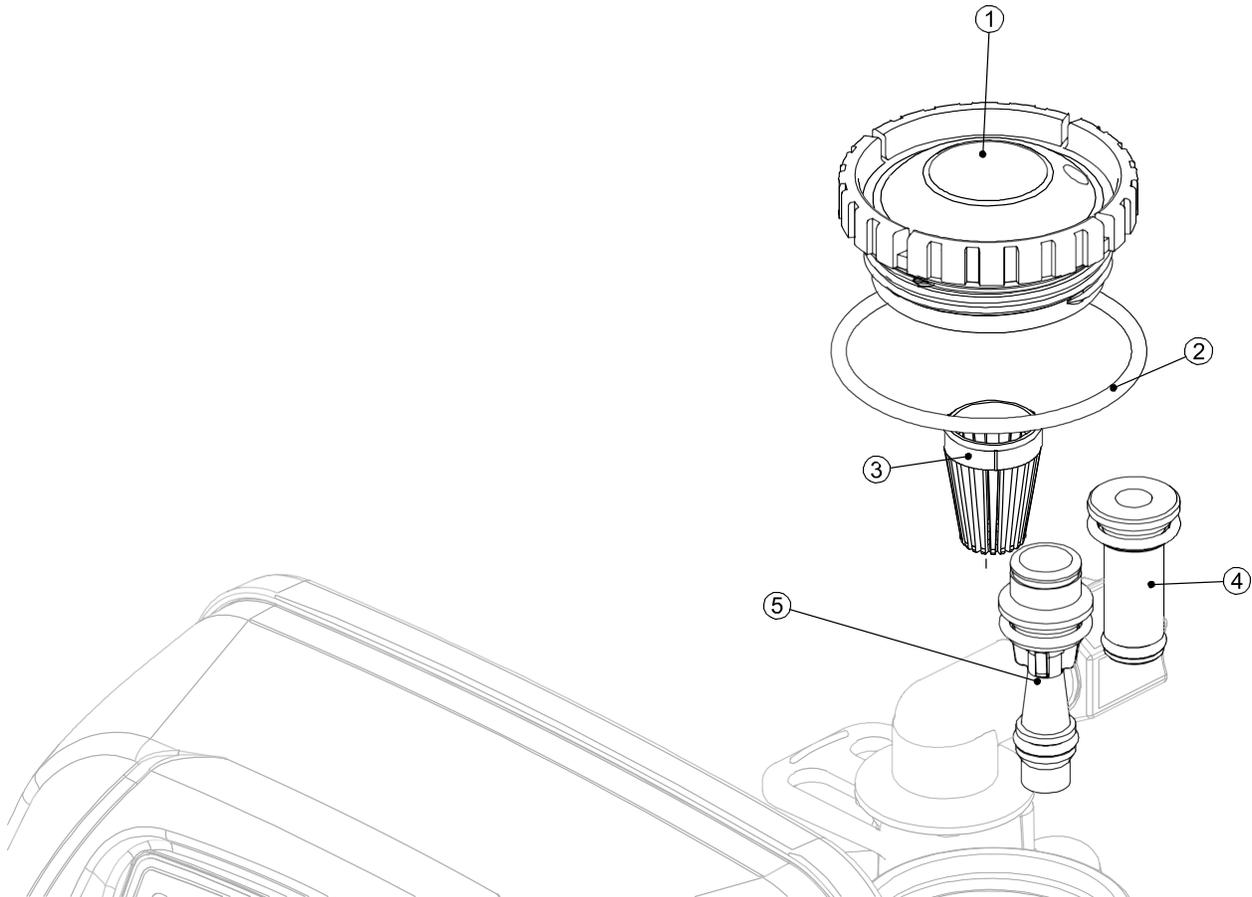


# Injector Cap, Injector Screen, Injector, Plug and O-Ring

| Drawing No. | Order No. | Description               | Tank Size | Quantity |
|-------------|-----------|---------------------------|-----------|----------|
| 1           | V3176     | Injector Cap              |           | 1        |
| 2           | V3152     | O-Ring 135                |           | 1        |
| 3           | V3177-01  | Injector Screen Cage      |           | 1        |
| 4           | V3010-1Z  | AM1 Injector Asy Z Plug   |           | 1        |
| 5           | V3010-1C  | AM1 Injector Asy C Violet | 8         | 1        |
|             | V3010-1D  | AM1 Injector Asy D Red    | 9         |          |
|             | V3010-1E  | AM1 Injector Asy E White  | 10        |          |
|             | V3010-1F  | AM1 Injector Asy F Blue   | 12        |          |
|             | V3010-1G  | AM1 Injector Asy G Yellow | 13        |          |
| Not Shown   | V3170     | O-Ring 011                |           | *        |
| Not Shown   | V3171     | O-Ring 013                |           | *        |

\* The injector plug and the injector each contain one 011 (lower) and 013 (upper) O-ring.

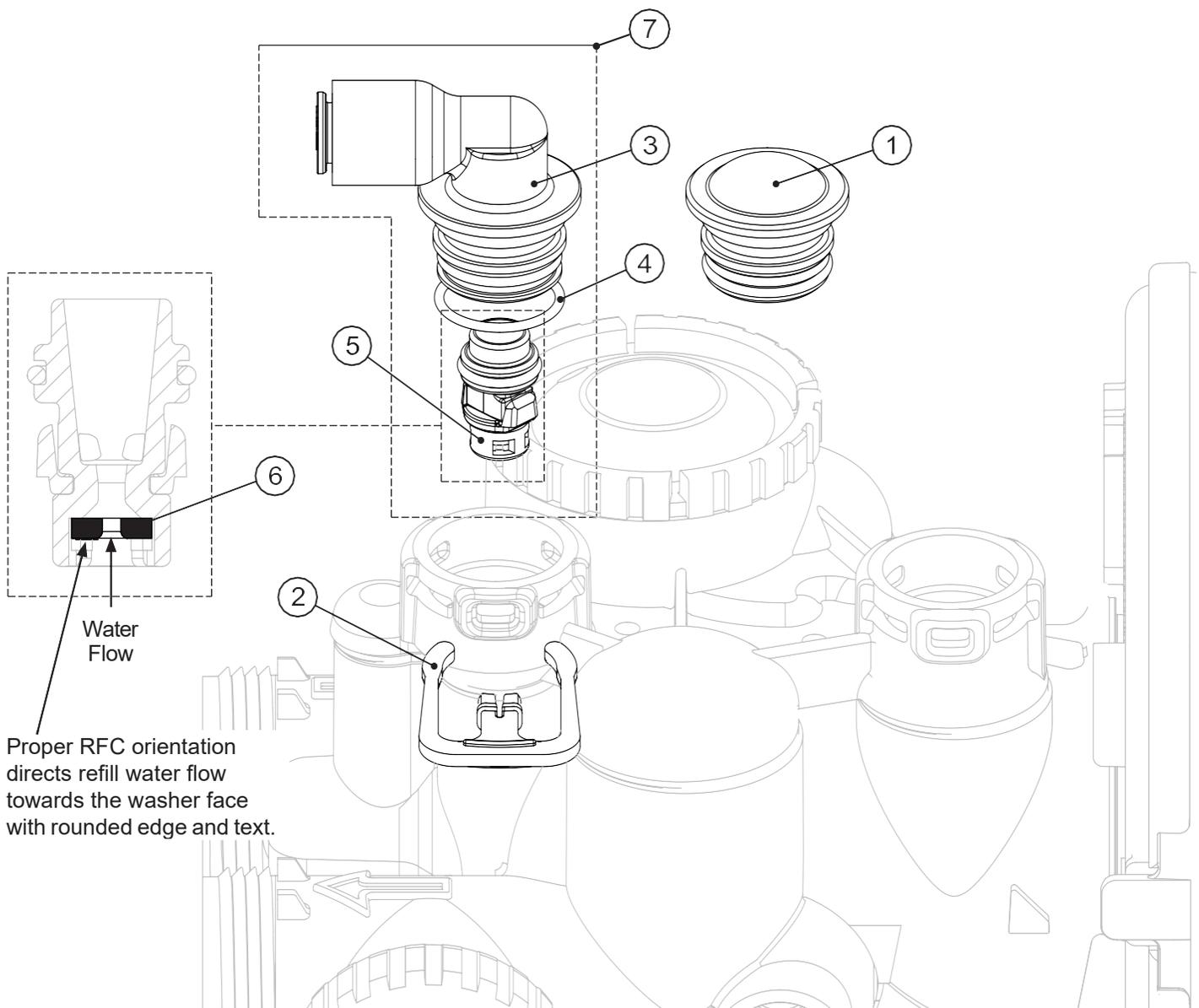
Note: For upflow position, injector is located in the up hole and injector plug is in the other hole.



## Refill Flow Control Assembly and Refill Port Plug

| Drawing No. | Order No. | Description                    | Quantity  |
|-------------|-----------|--------------------------------|---|
| 1           | V3195-01  | AM1 Refill Port Plug Asy       | This part is required for backwash only systems |
| 2           | H4615     | Elbow Locking Clip             | 1   |
| 3           | H4628     | Elbow 3/8" Liquifit            | 1   |
| 4           | V3163     | O-ring 019                     | 1   |
| 5           | V3165-01* | AM1 RFC Retainer Asy (0.5 gpm) | 1   |
| 6           | V3182     | AM1 RFC                        | 1   |
| 7           | V4144-01  | Elbow 3/8 Liquifit Asy w/RFC   | 1   |
| Not Shown   | V3552     | AM1 Brine Elbow Asy w/RFC      | Option  |
| Not Shown   | H4650     | Elbow 1/2" with nut and insert | Option  |

\*Assembly includes V3182 AM1 (0.5 gpm) RFC.

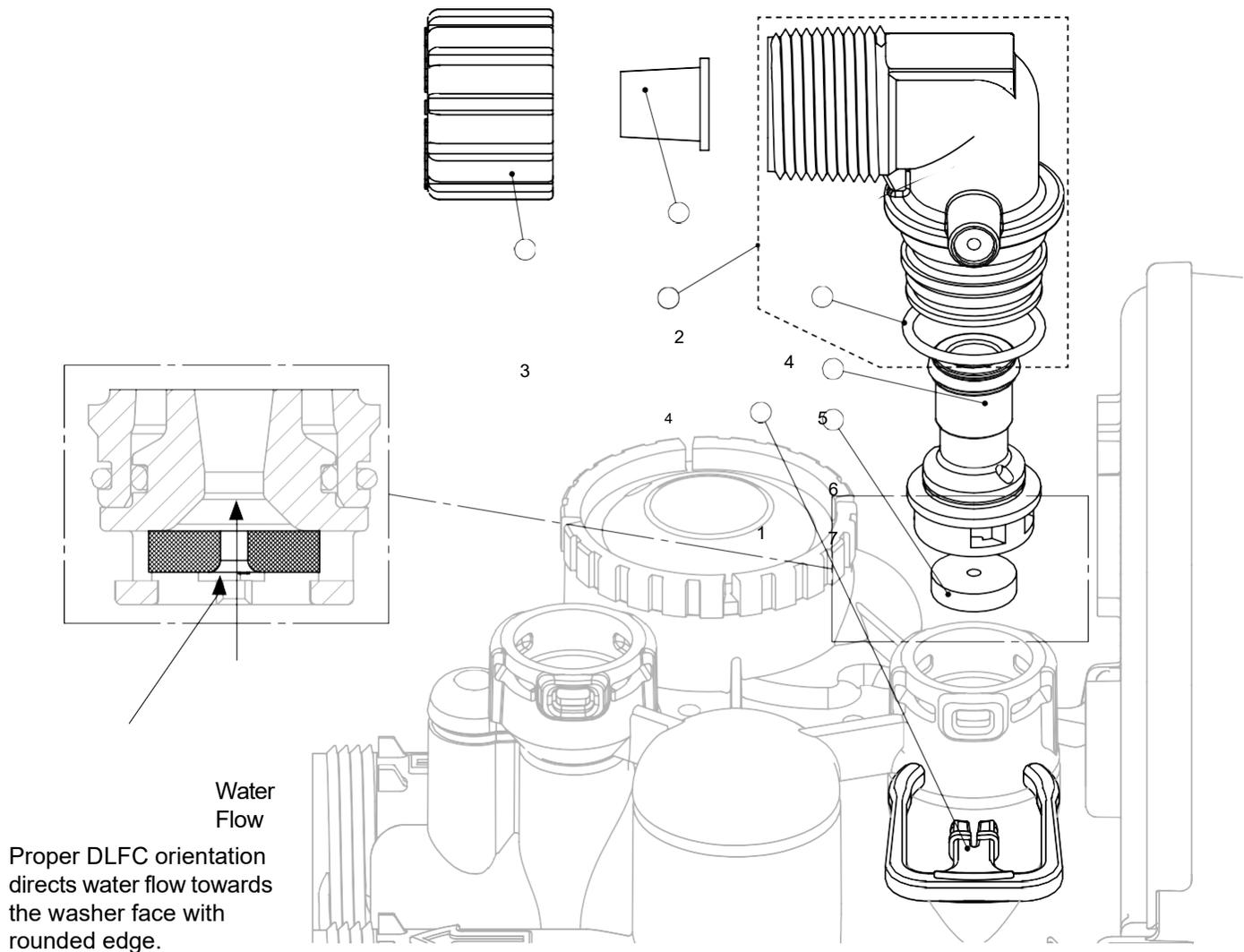


## Drain Line – 3/4"

| Drawing No. | Order No.     | Description               | Tank Size | Quantity |
|-------------|---------------|---------------------------|-----------|----------|
| 1           | H4615         | Elbow Locking Clip        |           | 1        |
| 2           | PKP10TS8-BULK | Polytube insert 5/8"      |           | Option   |
| 3           | V3192         | AM1 Nut 3/4 Drain Elbow   |           | Option   |
| 4*          | V3158-01      | AM1 Drain Elbow 3/4 Male  |           | 1        |
| 5           | V3163         | O-ring 019                |           | 1        |
| 6*          | V3159-01      | AM1 DLFC Retainer ASY     |           | 1        |
| 7           | V3162-017     | AM1 DLFC 1.7 gpm for 3/4" | 8         | 1        |
|             | V3162-022     | AM1 DLFC 2.2 gpm for 3/4" | 9         |          |
|             | V3162-027     | AM1 DLFC 2.7 gpm for 3/4" | 10        |          |
|             | V3162-032     | AM1 DLFC 3.2 gpm for 3/4" | 12        |          |
|             | V3162-042     | AM1 DLFC 4.2 gpm for 3/4" | 13        |          |

\*4 and 6 can be ordered as a complete assembly - V3331 AM1 Drain Elbow and Retainer Asy

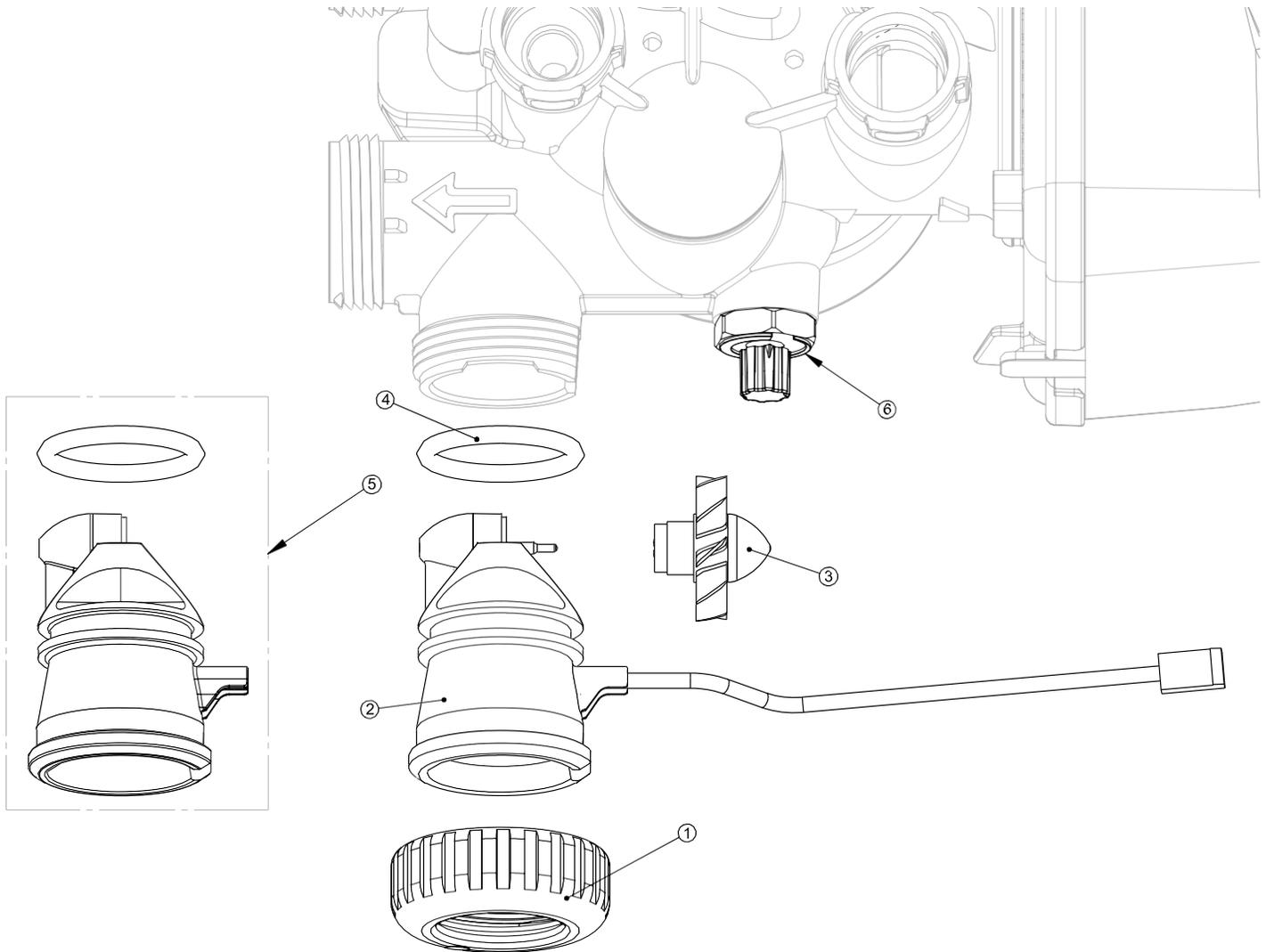
Valves are shipped without drain line flow control (DLFC) - install DLFC before using. Valves are shipped without 3/4" nut for drain elbow (polytube installation only) and 5/8" polytube insert (polytube installation only).



## Water Meter, Meter Plug and Mixing Valve

| Drawing No. | Order No. | Description        | Quantity |
|-------------|-----------|--------------------|----------|
| 1           | V3151     | AM1 Nut 1" QC      | 1        |
| 2           | V3003*    | AM1 Meter ASY      | 1        |
| 3           | V3118-01  | AM1 Turbine ASY    | 1        |
| 4           | V3105     | O-ring 215         | 1        |
| 5           | V3003-01  | AM1 Meter Plug ASY | 1        |
| 6           | V3013     | Mixing Valve       | Optional |

\*Order number V3003 includes V3118-01 AM1 Turbine ASY and V3105 O-ring



**THIS WATER METER SHOULD NOT BE USED AS THE PRIMARY MONITORING DEVICE FOR CRITICAL OR HEALTH EFFECT APPLICATIONS.**

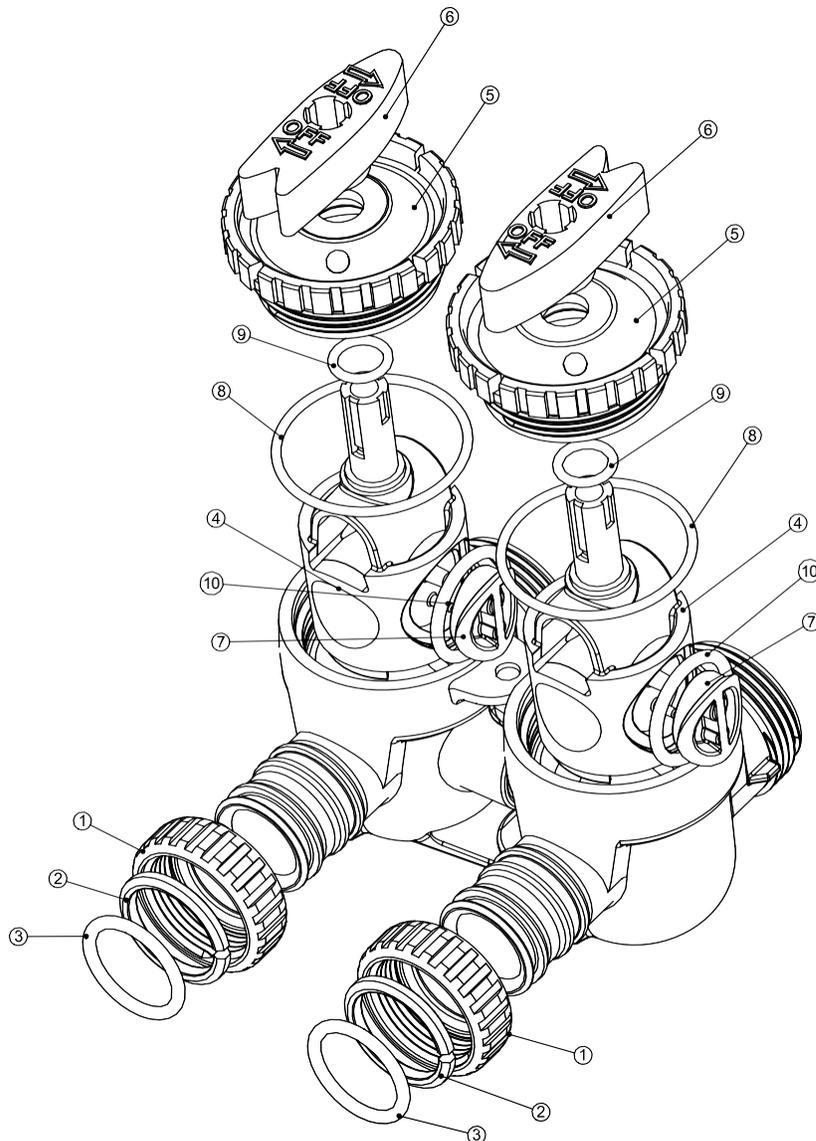
NOTE: A water meter is not applicable for a TC control valve.

## Bypass Valve

| Drawing No. | Order No. | Description                    | Quantity |
|-------------|-----------|--------------------------------|----------|
| 1           | V3151     | AM1 Nut 1" Quick Connect       | 2        |
| 2           | V3150     | AM1 Split Ring                 | 2        |
| 3           | V3105     | O-Ring 215                     | 2        |
| 4           | V3145     | AM1 Bypass 1" Rotor            | 2        |
| 5           | V3146     | AM1 Bypass Cap                 | 2        |
| 6           | V3147     | AM1 Bypass Handle              | 2        |
| 7           | V3148     | AM1 Bypass Rotor Seal Retainer | 2        |
| 8           | V3152     | O-ring 135                     | 2        |
| 9           | V3155     | O-ring 112                     | 2        |
| 10          | V3156     | O-ring 214                     | 2        |

(Not Shown) Order No. V3191-01, Description: AM1 Bypass Vertical Adapter Assembly

| Order No. | Description                 | Quantity |
|-----------|-----------------------------|----------|
| V3151     | AM1 Nut 1" Quick Connect    | 2        |
| V3150     | AM1 Split Ring              | 2        |
| V3105     | O-Ring 215                  | 2        |
| V3191     | AM1 Bypass Vertical Adapter | 2        |



# Bypass Valve Operation

Figure 1

## NORMAL OPERATION

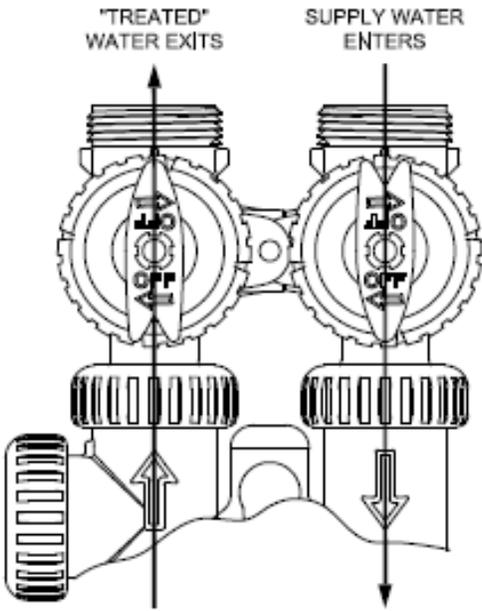


Figure 2

## BYPASS OPERATION

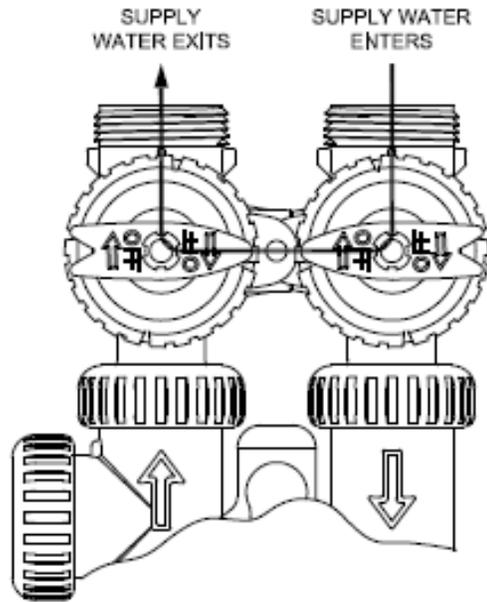


Figure 3

## DIAGNOSTIC MODE

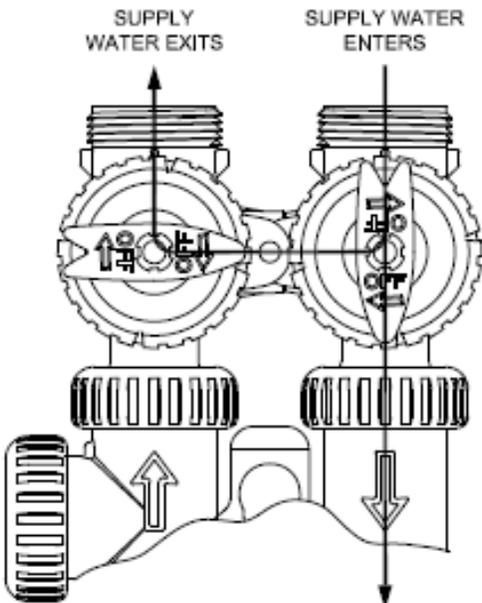
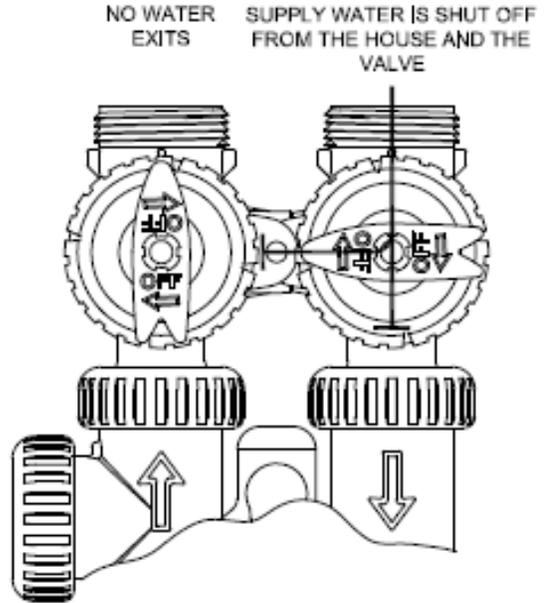


Figure 4

## SHUT OFF MODE

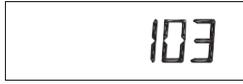


# Regeneration and Error Screens



## Regen Screen

Displays the time remaining in the current cycle. Pressing REGEN advances to the next cycle.



## Error Screen

Alternated flashing Err and error code every 3 seconds. Clear by disconnecting the power supply at the PC board and reconnecting, or press NEXT and REGEN simultaneously for 3 seconds.



In Alternator Systems when a unit is waiting to initiate the first cycle step of regeneration, “REGEN Pndg” is displayed.



“STbY” is displayed in Alternator Systems when a valve is in Standby state.



“REGEN Pndg RINSE FILL” is displayed whenever a zero-capacity tank has transferred to an off-line state and is currently waiting to initiate the second portion of a regeneration cycle. Viewed only when Delayed Rinse and Fill is set to ON.

## Button Operation and Function



Scrolls to the next display.

Pressing once and releasing will schedule a regeneration at the preset delayed regeneration time.



Pressing again and releasing will cancel the regeneration.

Pressing and holding for 3 seconds will initiate an immediate regeneration

Pressing while in regeneration will advance to the next cycle.

Pressing in the program levels will go backward to the previous screen



Changes variable being displayed.



Key sequence to lock and unlock program settings.



Holding for 3 seconds initiates a control reset. The software version is displayed and the piston returns to the home/service position, resynchronizing the valve.



Used with valve type 1.0”, holding for at least 3 seconds causes a switch in the tank in Service without cycling the regeneration valve. After tank switch, days remaining and capacity remaining status is retained for each tank until the next regeneration.

## Regeneration Cycles and Times

| Cycle  | Range            |                  |                    |
|--|------------------|------------------|--------------------|
|  | Softening        | Filtering Regen  | Filtering Backwash |
| Backwash   | 1-120 minutes    | 1-120 minutes    | 1-120 min.         |
| Regenerant Draw/Slow Rinse (UP or DN)                    | 1-180 minutes    | 1-180 minutes    | NA                 |
| Fast Rinse   | 1-120 minutes    | 1-120 minutes    | 1-120 min.         |
| Regenerant Refill  | 0.1-200.0 lbs.   | 1-99.0 GAL       | NA                 |
| Regenerant Refill 2.0 or 1.5 set to MIN (softening only) | 0.1-99.0 minutes | 0.1-99.0 minutes | NA                 |
| Service  | 1-480 minutes    | NA               | NA                 |

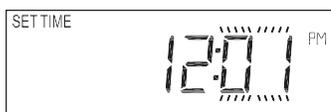
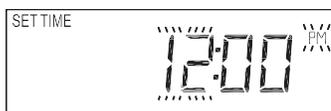
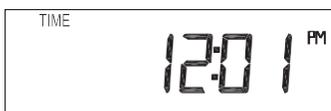
If 1.5 or 2.0 is selected in Step 2CS, cycles can be set to “OFF”.

The user can initiate manual regeneration. The user has the option to request the manual regeneration at the delayed regeneration time or to have the regeneration occur immediately:

1. Pressing and releasing the REGEN button. “REGEN TODAY” will flash on the display and the regeneration will occur at the delayed regeneration time. The user can cancel the request by pressing and releasing the REGEN button.
2. Pressing and holding the REGEN button for approximately 3 seconds will immediately start the regeneration. The user cannot cancel this request, except by resetting the control by pressing NEXT and REGEN simultaneously for 3 seconds.

# User Displays

## General Operation



When the system is operating, one of five displays may be shown. Pressing NEXT will alternate between the displays shown below.

### User 1

Typical user display. Shows volume remaining to regeneration. This screen will not be viewed if the control is set for time-clock operation.

### User 2

Displays the number of days until next regeneration.

### User 3

Flow Rate.

Displays present flow rate.

Not viewed (along with SOFTENING or FILTERING icon) if ALT A or ALT B is set in CONFIGURATION 4 and the valve is currently in Standby. When 1.0Γ is set in CONFIGURATION 1, the display will indicate the tank currently in Service (“A” or “b”) in the leftmost digit.

### User 4

Displays total volume in gallons since last reset. If a meter is not used this display will be shown but 0 will be displayed.

PRESS ▼ FOR 3 SECONDS TO RESET TO 0.

### User 5

Shows current time.

### Setting Time of Day

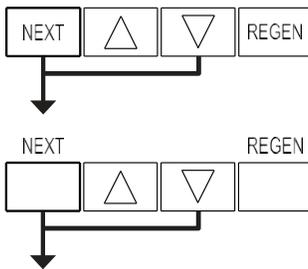
Push NEXT until the “time of day” screen is displayed. Press and hold ▼ until SET TIME is displayed and the hour flashes once. Press ▲ or ▼ until the correct hour is displayed.

Then press NEXT. The minutes will flash. Press ▲ or ▼ until the correct minute is displayed.

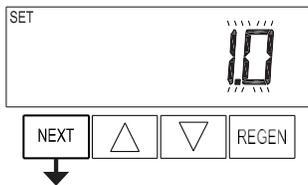
Press NEXT to return to the User Displays. Time of day should only need to be set after power outages lasting more than 8 hours if the battery has been depleted and a power outage occurs, or when daylight saving time begins or ends. If a power outage lasting more than 8 hours occurs, the time of day will flash on and off which indicates the time of day should be reset. If a power outage lasts less than 8 hours and the time of day flashes on and off, the time of day should be reset and the battery replaced.

## Configuration Settings

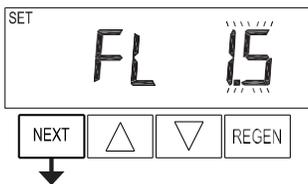
### Step 1CS



### Step 2CS



### Step 3CS



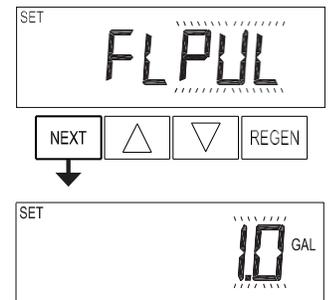
### Step 4CS



**Step 1CS** – Press NEXT and ▼ simultaneously for 5 seconds and release. Press NEXT and ▼ simultaneously for 5 seconds and release. If the screen in Step 2CS does not appear, the lock on the valve is activated. To unlock, press ▼, NEXT, ▲ and REGEN in sequence, then press NEXT and ▼ simultaneously for 5 seconds and release. Press NEXT and ▼ simultaneously for 5 seconds and release.

**Step 2CS** – Use ▲ or ▼ to select 1.0 for 1” valve, 1.25 for 1.25” valve, 1.5 for 1.5” valve, 2.0 for 2” valve or 1.0T for twin valve. Press NEXT to go to Step 3CS. Press REGEN to exit Configuration Settings.

**Step 3CS** – If 1.5 or 2.0 is selected in Step 2CS, an additional screen will appear. It is used to select which size flow meter is to be used with the valve, 1.0r, 1.5, 2.0 or 3.0. Variable meter pulses of 0.1-150.0 PPG can also be selected. Press NEXT to go to Step 4CS. Press REGEN to return to the previous step.



**Step 4CS** – Selecting the use of an outside signal to initiate a regeneration: Selection only matters if a connection is made to the two pin connector labeled DP SWITCH located on the printed circuit board.

Following is an explanation of the options:

OFF - feature not used

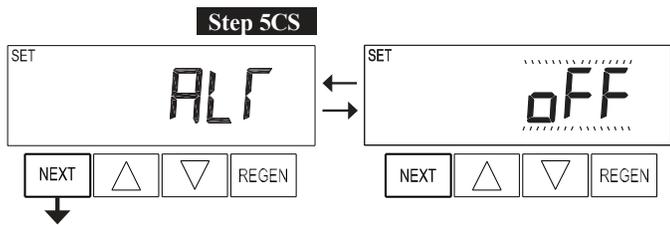
NOTE: In a twin alternating system each control must have a separate dP signal or dP switch. One dP signal or one dP switch cannot be used for both controls.

on0 – If the dP switch is closed for an accumulative time of 2 minutes a regeneration will be signaled to the unit. In a twin alternating system the MAV will transition first to switch units so that the signaled unit can start regeneration. After the MAV has fully transitioned, the regeneration begins immediately. Note: For AM1 – AM1.5 control valves programmed for twin alternating: if the dP function “on0” is set, the Delayed Rinse and Fill feature is not available.

dEL – If the dP switch is closed for an accumulative time of 2 minutes a regeneration will occur at the scheduled delayed regeneration time. In a twin alternating system once the dP switch is triggered the PC Board will display “REGEN TODAY” and when the delayed regen time comes the control will switch tanks and the triggered unit will then go into regeneration. Note: For AM1 – AM1.5 control valves programmed for twin alternating: if the dP function “dEL” is set, the Delayed Rinse and Fill feature is not available.

HoLd – If the dP switch is closed a regeneration will be prevented from occurring while there is switch closure. In a twin alternating system the regeneration of a unit can be prevented upon switch closure. If the unit depletes the capacity down to zero, it will not be allowed to switch tanks to regenerate until the switch is open. Note: For AM1 – AM1.5 control valves programmed for twin alternating the Delayed Rinse and Fill feature can be set.

Press NEXT to go to Step 5CS. Press REGEN to return to previous step.



**Step 5CS** – This display will not appear if 1.0T was selected in Step 2CS. Allows selection of one of the following using ▲ or ▼:

- the Control Valve to have no hard water bypass;
- the Control Valve to act as an alternator;
- the Control Valve to have a separate source during the regeneration cycle; or
- the Control Valve to operate with the System Controller.

Select OFF when none of these features are used.

Only use Clack No Hard Water Bypass Valves or Clack Motorized Alternating Valves (MAV) with these selections. Clack No Hard Water Bypass Valves (1” or 1.25” V3070FF or V3070FM) are not designed to be used with the alternator or separate source functions.

### Configuring the Control Valve for No Hard Water Bypass Operation:

Select nHbP for control operation. For no hard water bypass operation, the three-wire communication cable is not used.



Selection requires that a connection to MAV or a Clack No Hard Water Bypass Valve is made to the two pin connector labeled MAV located on the printed circuit board. If using a MAV, the A port of the MAV must be plugged and the valve outlet connected to the B port. When set to nHbP the MAV will be driven closed before the first regeneration cycle that is not FILL or SOFTENING or FILTERING, and be driven open after the last regeneration cycle that is not FILL.

NOTE: If the control valve enters into an error state during regeneration mode, the no hard water bypass valve will return to the open position, if not already there.

### Configuring the Control Valve for Separate Source Operation:

Select SEPS for control operation. For separate source operations, the three wire communication cable is not used.



Selection requires that a connection to a Clack Motorized Alternator Valve (MAV) is made to the two pin connector labeled MAV located on the printed circuit board. The C port of the MAV must be connected to the valve inlet and the A port connected to the separate source used during regeneration. The B port must be connected to the feed water supply.

When set to SEPS the MAV will be driven closed before the first regeneration cycle, and be driven open after the last regeneration cycle.

NOTE: If the control valve enters into an error state during regeneration mode, the MAV will return to the open position, if not already there.

#### Selecting the Control Valve to act as an alternator:

519.0 and higher = Use 3-wire Interconnect Cables for all communication between units.

518.3 and lower = Use 2-wire Interconnect Cables for twin alternators with independent flow meters.

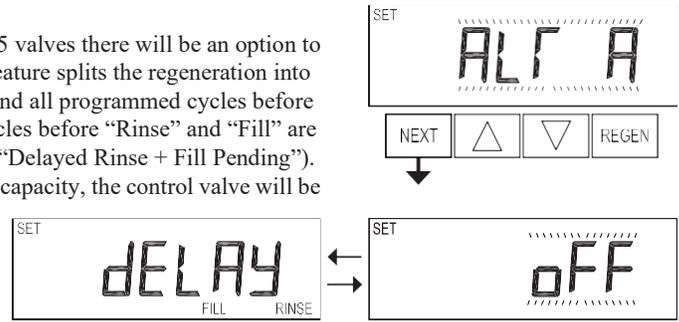
|  |          |   |   |
|--|----------|---|---|
| Prior to starting the programming steps, connect the communication cable to each control valve board’s three pin connector labeled ‘COMM CABLE’. Also connect the meter cord to either control valve to the three pin connector labeled ‘METER’. |          |   |   |
|  |          | Softener Valve Programming Steps  |   |
| Configuration Settings   | Step 5CS | Set to ALT A<br>Connect the outlet plumbing of ALT A valve to the MAV’s A port and connect the MAV’s two pin wire connector to the two pin connector labeled “DRIVE” on the ALT A valve | Set to ALT b<br>Connect the outlet plumbing of ALT b valve to the MAV’s B port. No electrical connections are required between the ALT b valve and the MAV. |
| Softener System Setup  | Step 10S | Set System Capacity   | Set System Capacity   |
| Softener System Setup  | Step 11S | Set to ‘AUTO’   | Set to ‘AUTO’   |
| Softener System Setup  | Step 12S | Set regeneration time option to ‘on 0’.   | Set regeneration time option to ‘on 0’.   |
| Installer Display Settings   | Step 3I  | Set Day Override to “oFF”   | Set Day Override to “oFF”   |

If set up for a filter, in Step 5F set Volume Capacity in Gallons; in Step 6F select Regeneration Time Option “on 0”; and in Step 3I select Day Override “oFF”.

NOTE: If the control valve is in an error state during regeneration mode the MAV will close the B port and keep open the A port until the error is corrected and reset.

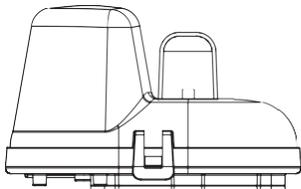
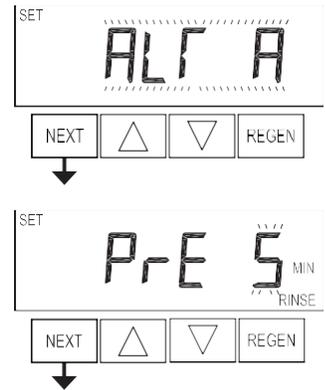
**AM1, AM1.25 and AM1.5 Valves**

For Clack Corporation alternator systems using AM1, AM1.25 and AM1.5 valves there will be an option to delay the last two cycles of regeneration (only “Rinse” and “Fill”). This feature splits the regeneration into two portions. The first portion of the regeneration will start immediately and all programmed cycles before the “Rinse” and “Fill” cycles will be performed. After all programmed cycles before “Rinse” and “Fill” are completed the control valve will drive to the service position (displaying “Delayed Rinse + Fill Pending”). When the volume of the on-line unit is depleted to 10% of its programmed capacity, the control valve will be triggered to finish the second portion of the regeneration and complete the “Rinse” and “Fill” cycles and return to Service and be placed into Standby mode, and wait to come on-line for service. Set to oFF to deactivate this feature.



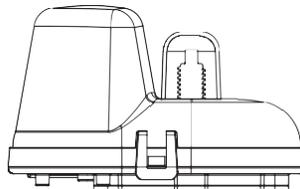
**AM2 Valve**

For Clack Corporation alternator systems using the AM2 valve, when NEXT is pressed after selecting ALT A or ALT B, a display will allow the user to set the amount of pre-service rinse time for the stand by tank just prior to returning to service. Set to oFF to deactivate this feature. With 1.0Tset, the same display appears and is set in a similar manner.



**Retracted**

Valve “A” in Service Position =  
MAV piston rod Retracted



**Extended**

Valve “B” in Service Position =  
MAV piston rod Extended

**Note: Clack Twin Alternator Operations**

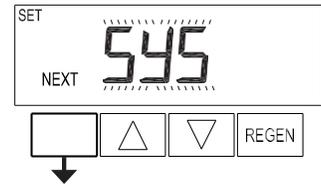
- Twin alternating systems can be programmed with a day override setting combined with the normal volume-based regeneration programming. A twin alternating system in this configuration will then regenerate based on the volume used or the day override if there is a period of low water usage.
- Twin alternating systems can be programmed as a time clock only based regenerating system. In this configuration, the days remaining are counted only on the unit that is in service. The unit in Stand-by Mode only notes days in diagnostics, which results in time clock only twin regeneration initiation.
- Twin alternating systems can be programmed for a delayed regeneration time. The system will allow an immediate transfer of the MAV to switch tanks and place a fully regenerated unit in service once a unit becomes exhausted. The exhausted unit will then be placed into Stand-by Mode and allowed to have a delayed regeneration at the pre-set time.

## Configuring the Control Valve for System Controller Operation:

Select "SYS" to link the control valve to the System Controller. For communication between the control valve and the System Controller, a three-wire communication cable is required.

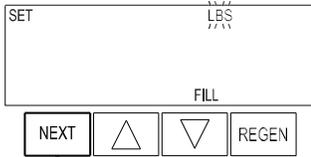
Selection requires that a connection to a Clack No Hard Water Bypass (V3070FF or V3070FM) be made to the two-pin connector labeled MAV located on the printed circuit board for AM1 and AM1.25 control valves. For valve types AM1.5 and AM2, a connection from a Clack No Hard Water Bypass (V3097/BSPT or V3098/BSPT) to the two pin connector labeled MAV located on the printed circuit board is required.

Press NEXT to go to Step 6CS. Press REGEN to return to the previous step.



### Step 6CS

**Step 6CS – Fill Units:** If set as a softener, if Step 2CS is set to 1.5, and FILL is part of the Regeneration Cycle Sequence, FILL UNITS of MIN or LBS can be selected. Press NEXT to exit OEM Configuration Setup. Press REGEN to return to the previous step.

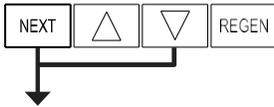


**EXIT TO DISPLAY SCREENS**



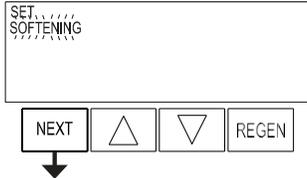
# OEM Softener System Setup

## Step 1S



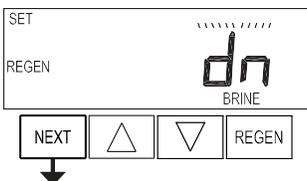
**Step 1S** - Press NEXT and ▼ simultaneously for 5 seconds and release. If the screen in Step 2S does not appear, the lock on the valve programming has been activated. To unlock press ▼, NEXT, ▲, REGEN in sequence, then press NEXT and ▼ simultaneously for 5 seconds and release.

## Step 2S



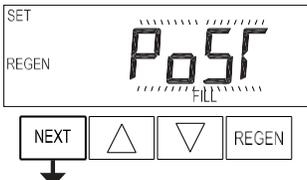
**Step 2S** – Choose SOFTENING using ▲ or ▼. Press NEXT to go to Step 3S. Press REGEN to exit OEM Softener System Setup.

## Step 3S



**Step 3S** – Choose Brining Direction using ▲ or ▼. This screen is not viewed when Step 2S is set to Filtering. Press NEXT to go to Step 4S. Press REGEN to return to the previous step.

## Step 4S

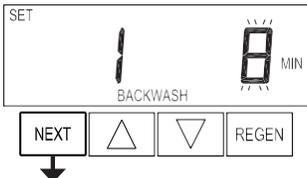


**Step 4S** – Set Refill location using ▲ or ▼:

- “PoST” to refill the brine tank after the final rinse; or
- “PrE” to refill the brine tank four hours before the regeneration time set.

This screen is not viewed when Step 2S is set to Filtering.  
Press NEXT to go to Step 5S. Press REGEN to return to the previous step.

## Step 5S



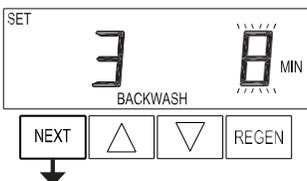
**Step 5S** – Select the time for the first cycle using ▲ or ▼. For valve types 1.5 and 2.0, “oFF” is also available.  
Press NEXT to go to Step 6S. Press REGEN to return to the previous step.

## Step 6S



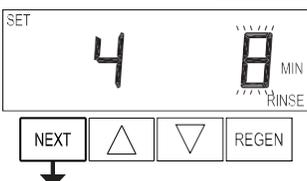
**Step 6S** – Select the time for the second cycle using ▲ or ▼. For valve types 1.5 and 2.0, “oFF” is also available.  
NOTE: The display will flash between cycle number and time, and brine direction (UP or dn).  
Press NEXT to go to Step 7S. Press REGEN to return to the previous step.

## Step 7S



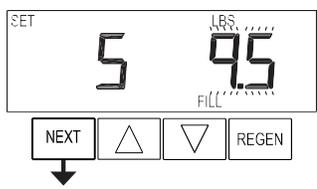
**Step 7S** – Select the time for the third cycle using ▲ or ▼. For valve types 1.5 and 2.0, “oFF” is also available.  
Press NEXT to go to Step 8S. Press REGEN to return to previous step.

## Step 8S



**Step 8S** – Select the time for the fourth cycle using ▲ or ▼. For valve types 1.5 and 2.0, “oFF” is also available.  
Press NEXT to go to Step 9S. Press REGEN to return to previous step.

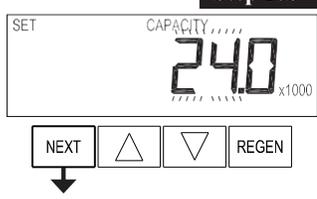
**Step 9S**



**Step 9S** – Select the pounds for the fifth cycle using ▲ or ▼. For valve types 1.5 and 2.0, “oFF” is also available.

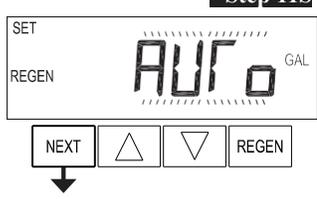
NOTE: if Step 2CS is set to 2.0 or Step 7CS is set to MIN, Fill will be in minutes. Press NEXT to go to Step 10S. Press REGEN to return to previous step.

**Step 10S**



**Step 10S** – Set System Capacity using ▲ or ▼. The System Capacity setting should be based on the volume of resin and LBS of salt fill set in Step 9S. Press NEXT to go to Step 11S. Press REGEN to return to previous step.

**Step 11S**

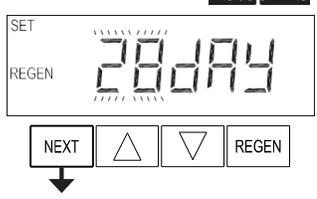


**Step 11S** – Set Volume Capacity using ▲ or ▼. If value is set to:

- “AUTO” capacity will be automatically calculated and reserve capacity will be automatically estimated;
- “oFF” regeneration will be triggered by the day override setting, or can be set to regenerate on specific days of the week.
- a number, regeneration will be triggered by the value specified (in Gallons).

If “oFF” or a volume is used, the hardness display will not be allowed to be set in Installer Display Settings Step 2I. See Setting Options Table for more detail. Press NEXT to go to Step 12S. Press REGEN to return to previous step.

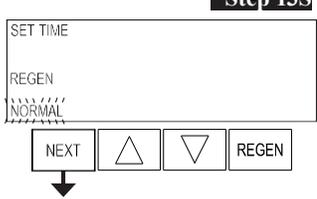
**Step 12S**



**Step 12S** – Set Regeneration Trigger using ▲ or ▼. If Step 11S is set to OFF, Regeneration Trigger can be set to 28 day or 7 day. Press NEXT to go to Step 13S. Press REGEN to return to previous step.



**Step 13S**



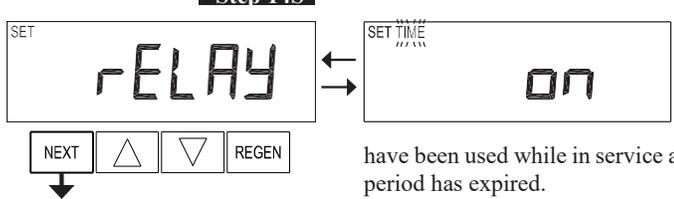
**Step 13S** – Set Regeneration Time Options using ▲ or ▼. NOTE: This step will not appear if Step 11S is set to oFF or Step 5CS is set to “SYS”.

If value is set to:

- “NORMAL” means regeneration will occur at the pre set time;
- “On 0” means regeneration will occur immediately when the volume capacity reaches 0 (zero); or
- “NORMAL + on 0” means regeneration will occur at one of the following:
  - the preset time when the volume capacity falls below the reserve or the specified number of days between regenerations is reached whichever comes first; or
  - immediately after 10 minutes of no water usage when the volume capacity reaches 0 (zero).

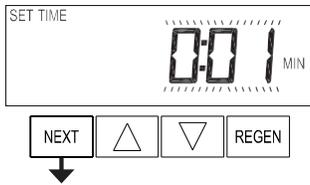
“NORMAL” is the default if Step 5CS is set to ALT A or ALT B, and “NORMAL + on 0” is not available. “on 0” is the default if Step 2CS is set to 1.0T , and “NORMAL + on 0” is not available. See Setting Options Table for more details. Press NEXT to go to Step 14S. Press REGEN to return to the previous step.

**Step 14S**



**Step 14S** – Set Relay Operation using ▲ or ▼. The choices are:

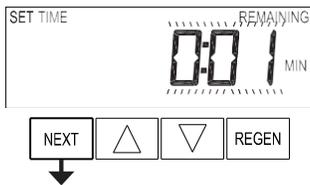
- Time on: Relay activates after a set time at the beginning of a regeneration and then deactivates after a set time. The start of regeneration is defined as the first backwash cycle or Dn brine cycle, whichever comes first.
  - Gallons Softening on: Relay activates after a set number of gallons have been used while in service and then deactivates after the meter stops registering flow and the set time period has expired.
  - Gallons Softening Regen on: Relay activates after a set number of gallons have been used while in service, or during regeneration, and then deactivates after the meter stops registering flow and the set time period has expired.
  - ERROR: Relay closes whenever the valve enters error mode, and immediately deactivates when error mode is exited. If set to ERROR, Steps 15S and 16S will not be shown.
  - Off: If set to Off, Steps 15S and 16S will not be shown.
- Press NEXT to go to Step 15S. Press REGEN to return to the previous step.

**Step 15S**

**Step 15S** – Set Relay Actuation Time or Gallons using ▲ or ▼. The choices are:

- Relay Actuation Time: After the start of a regeneration the amount of time that should pass prior to activating the relay. The start of regeneration is defined as the first backwash cycle, Dn brine cycle or UP brine cycle whichever comes first. Ranges from 1 second to 200 minutes.
- Relay Actuation Gallons: Relay activates after a set number of gallons has passed through the meter. Ranges from 1 to 200 gallons.

Press NEXT to go to Step 16S. Press REGEN to return to the previous step.

**Step 16S**

**Step 16S** – Set Relay Deactivate Time using ▲ or ▼.

- If Set Time on is selected in Step 14S the relay will deactivate after the time set has expired. Ranges from 1 second to 200 minutes.
- If Set Gallons Softening on or Set Gallons Softening Regen on is selected in Step 14S the relay will deactivate after the time set has expired or after the meter stops registering flow, whichever comes first. Ranges from 1 second to 20 minutes.

Press NEXT to exit OEM Softener System Setup. Press REGEN to return to the previous step.

**EXIT OEM SOFTENER SYSTEM SETUP**

# Setting Options Table

Filters should only use shaded options

| Volume Capacity | Regeneration Time Option   | Day Override | Result <sup>1</sup>   |
|-----------------|----------------------------|--------------|---|
| AUTO            | NORMAL                     | oFF          | Reserve capacity automatically estimated.<br>Regeneration occurs when volume capacity falls below the reserve capacity at the next Regen Set Time.  |
| AUTO            | NORMAL                     | Any number   | Reserve capacity automatically estimated.<br>Regeneration occurs at the next Regen Set Time when volume capacity falls below the reserve capacity or the specified number of days between regenerations is reached.   |
| Any number      | NORMAL                     | oFF          | Reserve capacity <u>not</u> automatically estimated.<br>Regeneration occurs at the next Regen Set Time when volume capacity reaches 0.  |
| oFF             | NORMAL<br>(not adjustable) | Any number   | Reserve capacity not automatically estimated.<br>28 day - Regeneration occurs at the next Regen Set Time when the specified number of days between regenerations is reached.<br>7 day – Regeneration will occur on the day(s) of the week set in Installer Settings.  |
| Any number      | NORMAL                     | Any number   | Reserve capacity <u>not</u> automatically estimated.<br>Regeneration occurs at the next Regen Set Time when volume capacity reaches 0 or the specified number of days between regenerations is reached.   |
| AUTO            | On 0                       | oFF          | Reserve capacity is <u>NOT</u> automatically estimated.<br>Regeneration occurs immediately when volume capacity reaches 0. The time of regeneration will not be allowed to be set because regeneration will always occur when volume capacity reaches 0.  |
| Any number      | On 0                       | oFF          | Reserve capacity is <u>NOT</u> automatically estimated.<br>Regeneration occurs immediately when volume capacity reaches 0. The time of regeneration will not be allowed to be set because regeneration will always occur when volume capacity reaches 0.  |
| AUTO            | NORMAL on 0                | oFF          | Reserve capacity is automatically estimated.<br>Regeneration occurs when volume capacity falls below the reserve capacity at the next Regen Set Time or regeneration occurs after 10 minutes of no water usage when volume capacity reaches 0.  |
| AUTO            | NORMAL on 0                | Any number   | Reserve capacity is automatically estimated.<br>Regeneration occurs at the next Regen Set Time when volume capacity falls below the reserve capacity or the specified number of days between regenerations is reached or regeneration occurs after 10 minutes of no water usage when volume capacity reaches 0. |
| Any number      | NORMAL on 0                | Any number   | Reserve capacity <u>not</u> automatically estimated.<br>Regeneration occurs at the next Regen Set Time when the specified number of days between regenerations is reached or regeneration occurs after 10 minutes of no water usage when volume capacity reaches 0.   |

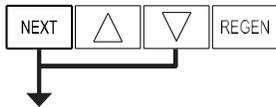
<sup>1</sup> Reserve Capacity estimate is based on history of water usage. Reserve Capacity estimate is not available with alternator systems or Twin Tank Valve.

# OEM Filter System Setup

| Cycle Sequence, Adjustable Default Times (minutes) |          |      |          |       |           |         |
|--|----------|------|----------|-------|-----------|---------|
| Type   | Backwash | Draw | Backwash | Rinse | Backwash* | Fill    |
| Filtering Backwash                                 | 8        |      |          | 4     |           |         |
| Filtering Regen                                    | 8        | 60   | 8        | 8     | 0:30      | .95 GAL |
| Filtering Regen (2.0")                             | 8        | 60   | 8        | 8     | 0:30      | 6       |

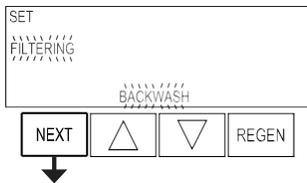
\*Cycle is non-adjustable, not shown in cycle sequence programming.

**Step 1F**



**Step 1F** - Press NEXT and ▼ simultaneously for 5 seconds and release. If the screen in Step 2CS does not appear, the lock on the valve is activated. To unlock press ▼, NEXT, ▲, REGEN in sequence, then press NEXT and ▼ simultaneously for 5 seconds and release.

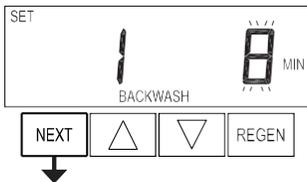
**Step 2F**



**Step 2F** - Choose FILTERING BACKWASH or FILTERING REGEN (see table) using ▲ or ▼. Press NEXT to go to Step 3F. Press REGEN to exit OEM Filter System Setup.

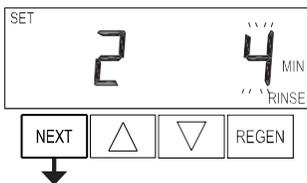


**Step 3F**



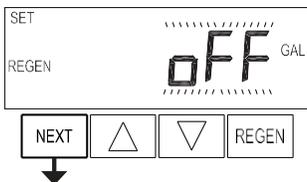
**Step 3F** - Select the time for the first cycle using ▲ or ▼. Press NEXT to go to Step 4F. Press REGEN to return to the previous step.

**Step 4F**



**Step 4F** - Select the time for the second cycle using ▲ or ▼. If Step 2F is set to FILTERING REGEN, press NEXT to program the rest of the cycle times. If Step 2F is set to FILTERING BACKWASH, press NEXT to go to Step 5F. Press REGEN to return to the previous step.

**Step 5F**

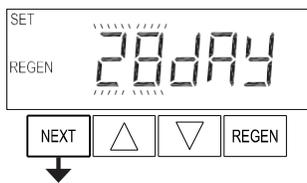


**Step 5F** - Set Regeneration trigger using ▲ or ▼. If value is set to:

- “oFF” regeneration will be triggered by the day override setting or can be set to regenerate on specific days of the week.
- a number, regeneration will be triggered by the value specified (in gallons). See Setting Options Table for more detail.

Press NEXT to go to Step 6F. Press REGEN to return to previous step.

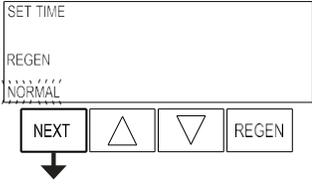
**Step 6F**



**Step 6F** - Set Regeneration Trigger using ▲ or ▼. If Step 5F is set to OFF, Regeneration Trigger can be set to 28 day or 7 day. Press NEXT to go to Step 7F. Press REGEN to return to previous step.



**Step 7F**



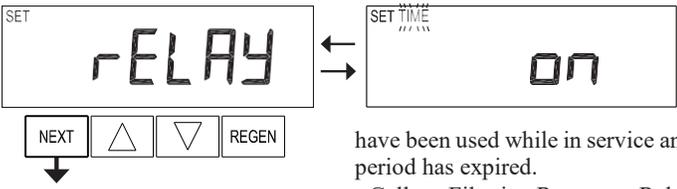
**Step 7F** – Set Regeneration Time Options using ▲ or ▼. NOTE: This step will not appear if Step 5F is set to oFF or Step 5CS is set to “SYS”.

If value is set to:

- “NORMAL” means regeneration will occur at the preset time;
- “on 0” means regeneration will occur immediately when the volume capacity reaches 0 (zero); or
- “NORMAL + on 0” means regeneration will occur at one of the following:
  - the preset time when the volume capacity falls below the reserve or the specified number of days between regenerations is reached whichever comes first;
  - immediately after 10 minutes of no water usage when the volume capacity reaches 0 (zero).

“NORMAL” is the default if Step 5CS is set to ALT A or ALT B, and “NORMAL + on 0” is not available. “on 0” is the default if Step 2CS is set to 1.0T , and “NORMAL + on 0” is not available. See Setting Options Table for more detail. Press NEXT to go to Step 8F. Press REGEN to return to previous step.

**Step 8F**

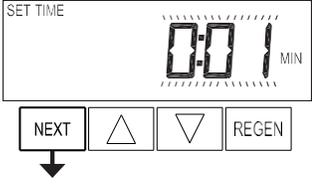


**Step 8F** – Set Relay Operation using ▲ or ▼. The choices are:

- Time on: Relay activates after a set time at the beginning of a regeneration and then deactivates after a set period of time. The start of regeneration is defined as the first backwash cycle or Dn brine cycle, whichever comes first.
- Gallons Filtering on: Relay activates after a set number of gallons have been used while in service and then deactivates after the meter stops registering flow and the set time period has expired.
- Gallons Filtering Regen on: Relay activates after a set number of gallons have been used while in service, or during regeneration, and then deactivates after the meter stops registering flow and the set time period has expired.
- ERROR: Relay closes whenever the valve enters error mode, and immediately deactivates when error mode is exited. If set to ERROR, Steps 9F and 10F will not be shown.
- Off: If set to Off, Steps 9F and 10F will not be shown.

Press NEXT to go to Step 9F. Press REGEN to return to previous step.

**Step 9F**

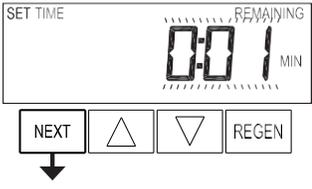


**Step 9F** – Set Relay Actuation Time or Gallons using ▲ or ▼. The choices are:

- Relay Actuation Time: After the start of a regeneration the amount of time that should pass prior to activating the relay. The start of regeneration is defined as the first backwash cycle or brine cycle, whichever comes first. Ranges from 1 second to 200 minutes.
- Relay Actuation Gallons: Relay activates after a set number of gallons has passed through the meter. Ranges from 1 to 200 gallons.

Press NEXT to go to Step 10F. Press REGEN to return to the previous step.

**Step 10F**



**Step 10F** – Set Relay Deactivate Time using ▲ or ▼.

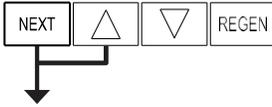
- If Set Time on is selected in Step 8F the relay will deactivate after the time set has expired. Ranges from 1 second to 200 minutes.
- If Set Gallons Filtering on or Set Gallons Filtering Regen on is selected in Step 8F the relay will deactivate after the time set has expired or after the meter stops registering flow, whichever comes first. Ranges from 1 second to 20 minutes.

Press NEXT to exit OEM Filter System Setup. Press REGEN to return to the previous step.

**EXIT OEM FILTER SYSTEM SETUP**

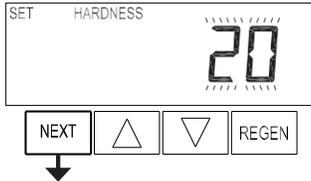
# Installer Display Settings - Regeneration Type Auto

## Step 1I



**Step 1 |** - To enter Installer Display press NEXT and ▲ simultaneously for about 5 seconds and release.

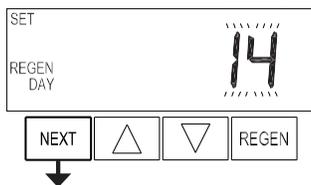
## Step 2I



**Step 2 |** – Hardness: Set the amount of influent hardness using ▲ or ▼. This display will not be viewed if FILTERING BACKWASH or FILTERING REGEN is selected in Step 2F or if “oFF” or a number was selected in Step 1IS.

Press NEXT to go to step 3I. Press REGEN to exit Installer Display Settings.

## Step 3I



**Step 3 |** – Day Override: When volume capacity is set to “oFF”, sets the number of days between regenerations. When volume capacity is set to AUTO or to a volume, sets the maximum number of days between regenerations. If value set to “oFF”, regeneration initiation is triggered solely by volume used. If value is set in days (allowable range from 1 to 28) regeneration initiation will be called for on that day regardless of actual water usage. Set Day Override using ▲ or ▼:

- number of days between regeneration (1 to 28); or
- “oFF”.

See Setting Options Table for more details on setup.

Press NEXT to go to step 4I. Press REGEN to return to the previous step.

## Step 4I



**Step 4 |** – Next Regeneration Time (hour): Set the hour of day for regeneration using ▲ or ▼. The default time is 2:00. This display will show “REGEN on 0 GAL” if “on 0” is selected in Set Regeneration Time Option in OEM Softener System Setup or OEM Filter System Setup.

Press NEXT to go to step 5I. Press REGEN to return to the previous step.

## Step 5I



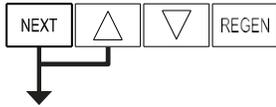
**Step 5 |** – Next Regeneration Time (minutes): Set the minutes of day for regeneration using ▲ or ▼. This display will not be shown if “on 0” is selected in Set Regeneration Time Option in OEM Softener System Setup or OEM Filter System Setup.

Press NEXT to exit Installer Display Settings. Press REGEN to return to the previous step.

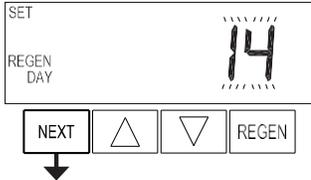
**EXIT INSTALLER DISPLAY SETTINGS**

## Installer Display Settings - 28 Day Regeneration

### Step 1I



### Step 2I



### Step 3I



### Step 4I



**Step 1 |** - To enter Installer Display press NEXT and ▲ simultaneously for about 5 seconds and release.

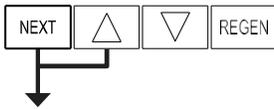
**Step 2 |** – Day Override: When volume capacity is set to “oFF”, sets the number of days between regenerations. Set Day Override using ▲ or ▼ number of days between regeneration (1 to 28). See Setting Options Table for more detail on setup. Press NEXT to go to step 3I. Press REGEN to return to previous step.

**Step 3 |** – Next Regeneration Time (hour): Set the hour of day for regeneration using ▲ or ▼. The default time is 2:00. Press NEXT to go to step 4I. Press REGEN to return to previous step.

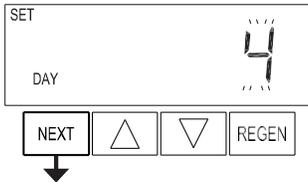
**Step 4 |** – Next Regeneration Time (minutes): Set the minutes of day for regeneration using ▲ or ▼. Press NEXT to exit Installer Display Settings. Press REGEN to return to previous step.

## Installer Display Settings - 7 Day Regeneration

### Step 1I



### Step 2I



**Step 1** | – To enter Installer Display press NEXT and ▲ simultaneously for about 5 seconds and release.

**Step 2** | – Use ▲ or ▼ to set the current day of the week.

Default = 4 (Wednesday)

1 = SUNDAY

2 = MONDAY

3 = TUESDAY

4 = WEDNESDAY

5 = THURSDAY

6 = FRIDAY

7 = SATURDAY

Press NEXT to go to Step 3I. Press REGEN to exit Installer Display.

### Step 3I



**Step 3** | – Scroll through days 1 to 7 using NEXT. Use ▲ or ▼ to turn regen ON or OFF for each individual day. After completing the 7th day, press NEXT to go to Step 4I. Press REGEN to go to previous display.

### Step 4I



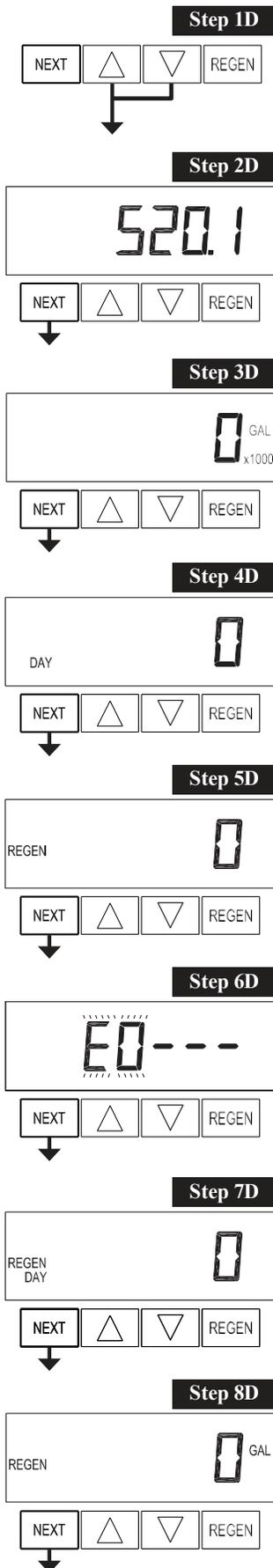
**Step 4** | – Next Regeneration Time (hour): Set the hour of day for regeneration using ▲ or ▼. The default time is 2:00. Press NEXT to go to step 5I. Press REGEN to return to previous step.

### Step 5I



**Step 5** | – Next Regeneration Time (minutes): Set the minutes of day for regeneration using ▲ or ▼. Press NEXT to exit Installer Display Settings. Press REGEN to return to previous step.

# Diagnostics



**Step 1D** - Press ▲ and ▼ simultaneously for 5 seconds and release. If screen in Step 2D does not appear the lock on the valve is activated. To unlock press ▼, NEXT, ▲, REGEN in sequence, then press ▲ and ▼ simultaneously for 5 seconds and release.

**Step 2D** – Software Version. Press NEXT to go to Step 3D. Press REGEN to exit Diagnostics.

**Step 3D** – Volume, total used since start-up: This display shows the total gallons treated since startup. This display will equal zero if a water meter is not installed. Press the NEXT button to go to Step 4D. Press REGEN to return to previous step.

**Step 4D** – Days, total since start-up: This display shows the total days since startup. Press the NEXT button to go to Step 5D. Press REGEN to return to previous step.

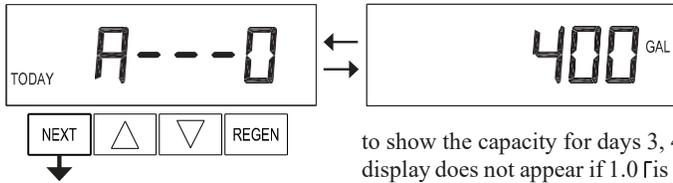
**Step 5D** – Regenerations, total number since start-up: This display shows the total number of regenerations that have occurred since startup. Press the NEXT button to go to Step 6D. Press REGEN to return to previous step.

**Step 6D** – Error Log: This display shows a history of the last 10 errors generated by the control during operation. Press ▲ or ▼ to view each recorded error. Press NEXT to go to Step 7D. Press REGEN to return to previous step.

**Step 7D** – Days, since last regeneration: This display shows the days since the last regeneration occurred. Press NEXT to go to Step 8D. Press REGEN to return to previous step.

**Step 8D** – Volume, since last regeneration: This display shows the volume of water that has been treated since the last regeneration. This display will equal zero when a water meter is not installed. Press NEXT to go to Step 9D. Press REGEN to return to previous step.

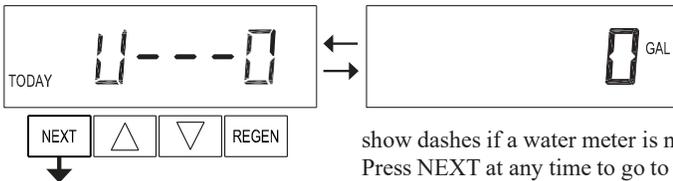
**Step 9D**



**Step 9D** – Volume, reserve capacity used for last 7 days: If the valve is set up as a softener, a meter is installed, and Set Volume Capacity is set to “Auto,” this display shows day 0 (for today) and flashes the reserve capacity. Pressing ▲ will show day 1 (which would be yesterday) and flashes the reserve capacity used. Pressing ▲ again will show day 2 (the day before yesterday) and the reserve capacity. Keep pressing ▲ to show the capacity for days 3, 4, 5 and 6. ▼ can be pressed to move backwards in the day series. This display does not appear if 1.0Γ is set in Step 2CS, if ALT A or ALT B are selected in Step 5CS, or anytime the reserve capacity is not determined by the control.

Press NEXT at any time to go to Step 10D. Press REGEN to return to previous step.

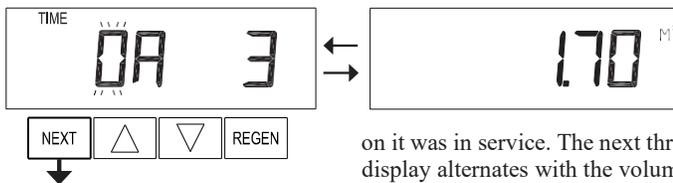
**Step 10D**



show dashes if a water meter is not installed.

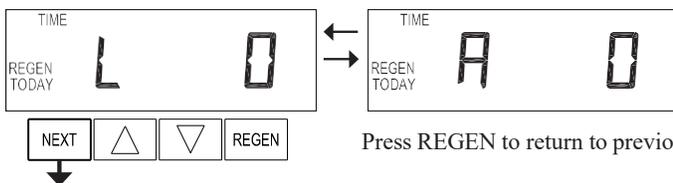
Press NEXT at any time to go to Step 11D. Press REGEN to return to previous step.

**Step 11D**



**Step 11D** – Twin Tank Valve transfer history: only displays when 1.0Γ was selected in Step 2CS. Use ▲ or ▼ to scroll through the last 10 tank transfers. The first position in the display ranges from 0 to 9 with the lowest number being the most recent transfer. The second position in the display will be either “A” or “b”. If “A” then the tank with the valve on it was in service, if “b” the tank with the in/out head on it was in service. The next three digits represent the number of hours ago that the transfer occurred. The display alternates with the volume that was treated before the tank transferred. Press NEXT at any time to go to Step 12D. Press REGEN to return to previous step.

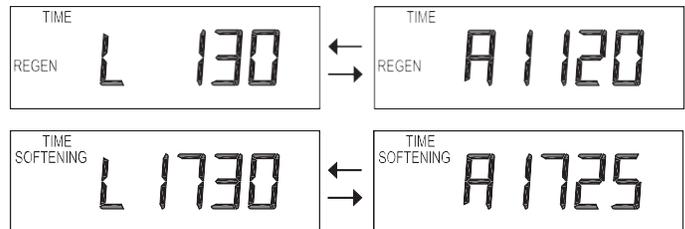
**Step 12D**



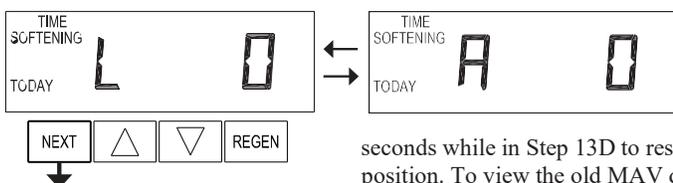
Press REGEN to return to previous step.

Press and hold ▲ and ▼ buttons for 3 seconds while in Step 12D to reset the MAV drive history in both the retracted and extended piston rod position. To view the old MAV drive history data for retracted and extended rod position press and hold REGEN and ▲ while in Step 12D. Press NEXT to advance display to the old MAV drive history.

**Step 12D** – MAV Drive History in the direction of retracted piston rod position. Display will only be shown if 1.0Γ is selected in Step 2CS, or OFF is not selected in Step 5CS. Up to a four digit number will appear after the “L” which stands for latest and “A” which stands for average. Drive time is measured in 1/100 of a second; i.e., a 17.10 second move is displayed as “1710”. Press NEXT at any time to go to Step 13D.



**Step 13D**



**Step 13D** – MAV Drive History in the direction of extended piston rod position. Display will only be shown if 1.0Γ is selected in Step 2CS, or OFF is not selected in Step 4CS. Up to a four digit number will appear after the “L” which stands for latest and “A” which stands for average. Drive time is measured in 1/100 of a second; i.e., a 17.15 second move is displayed as “1715”. Press and hold ▲ and ▼ for 3 seconds while in Step 13D to reset the MAV drive history in both the extended and retracted piston rod position. To view the old MAV drive history data see Step 12D. Press NEXT at any time exit Diagnostics. Press REGEN to return to previous step.

**EXIT DIAGNOSTICS**

# Water Treatment System Warranty

This quality FRAKCO water softener is designed and built to provide many years of satisfactory performance under normal use. FRAKCO, INC. pledges to the original owner that for sixty months, all non-wearable items of the above-described water treatment system proven to be defective due to workmanship and/or materials will be replaced or repaired. Our pledge does not apply if the damage is caused by defective installation; water pressure in excess of eighty pounds per square inch; water temperature in excess of 110° F.; misuse; unauthorized alterations; freezing; accident; fire; neglect; or damage caused by shipping.

To obtain service under this warranty, notify FRAKCO, INC in writing of any defects in workmanship within thirty days of the appearance of such defects. Such written notice must include the date of purchase, the part number, and a description of the defect. Upon receiving such notice and determining that the defect is covered by this warranty, FRAKCO, INC. will replace or repair the defective item.

Replacement of a defective item will be at FRAKCO’S factory in Luverne, MN, and the purchaser must ship the defective item at its own expense to FRAKCO’S factory. Replacement items will be shipped by FRAKCO F.O.B. Luverne, Minnesota, with a shipping carton furnished. In the event certain models or colors of the replacement item are out of stock, FRAKCO, INC. may, after notifying the purchaser, furnish another model or color of the replacement item. The factory will not pay for service charges and will not perform any repair or service functions other than at its home office.

Please follow the enclosed instructions and local codes in installing your water treatment system. Failure to do so will void this warranty. Nothing in the warranty may be construed as involving the factory in the relationship between Dealer and Owner.

This warranty gives the purchaser specific legal rights. The purchase may also have implied warranty rights. In the event of a problem with warranty service or performance, the purchaser may be able to go to a Small Claims Court, a State Court, or a Federal District Court. This warranty complies with the 1975 Federal Warranty Law.

Model No. \_\_\_\_\_ Serial No. \_\_\_\_\_

Date Installed \_\_\_\_\_ Dealer \_\_\_\_\_

Address \_\_\_\_\_

*MANUFACTURED BY: FRAKCO, INC.  
500 N BLUE MOUND AVE  
LIVERNE, MINNESOTA 56156  
WWW.FRAKCO.COM*