



**AQUA MAGIC** *Plus*  
1.5EE

# 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**

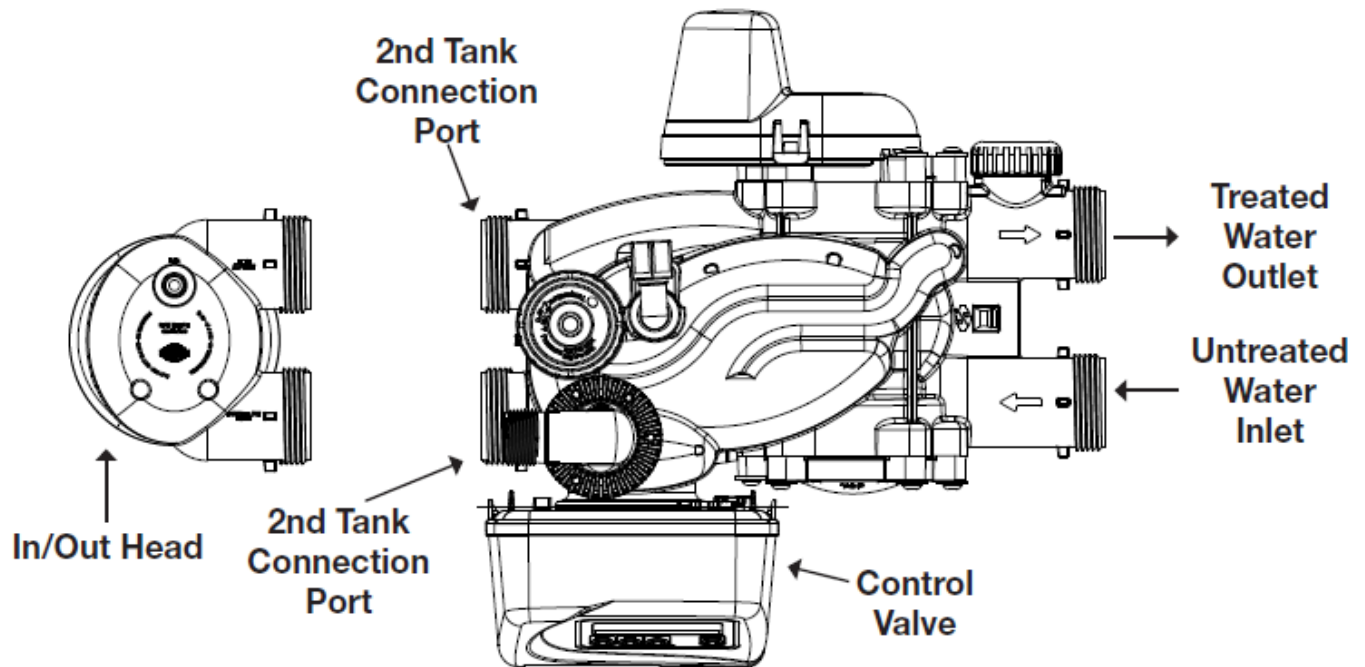


## Twin Valve Installation Tips:

We have had a number of instances where customers have incorrectly installed the in/out head to the untreated water inlet/treated water outlet of the control valve, rather than to the 2nd tank connection ports.

Below are a number of situations that will occur when the in/out head is incorrectly installed to the untreated water inlet/treated water outlet of the control valve.

- 1) When tank A is in the draw cycle, it will not draw brine and will put water into the salt tank. Tank B will draw properly.
- 2) When tank B is in the backwash cycle, tank A will have no flow to service.
- 3) The transfer disc seals may be forced out of their cavities on the back/motor side of the transfer discs, and it is possible that one of the seals could get pushed up into the valve and get stuck in the top of tank port of the spacer stack assembly.



Proper installation shown above.

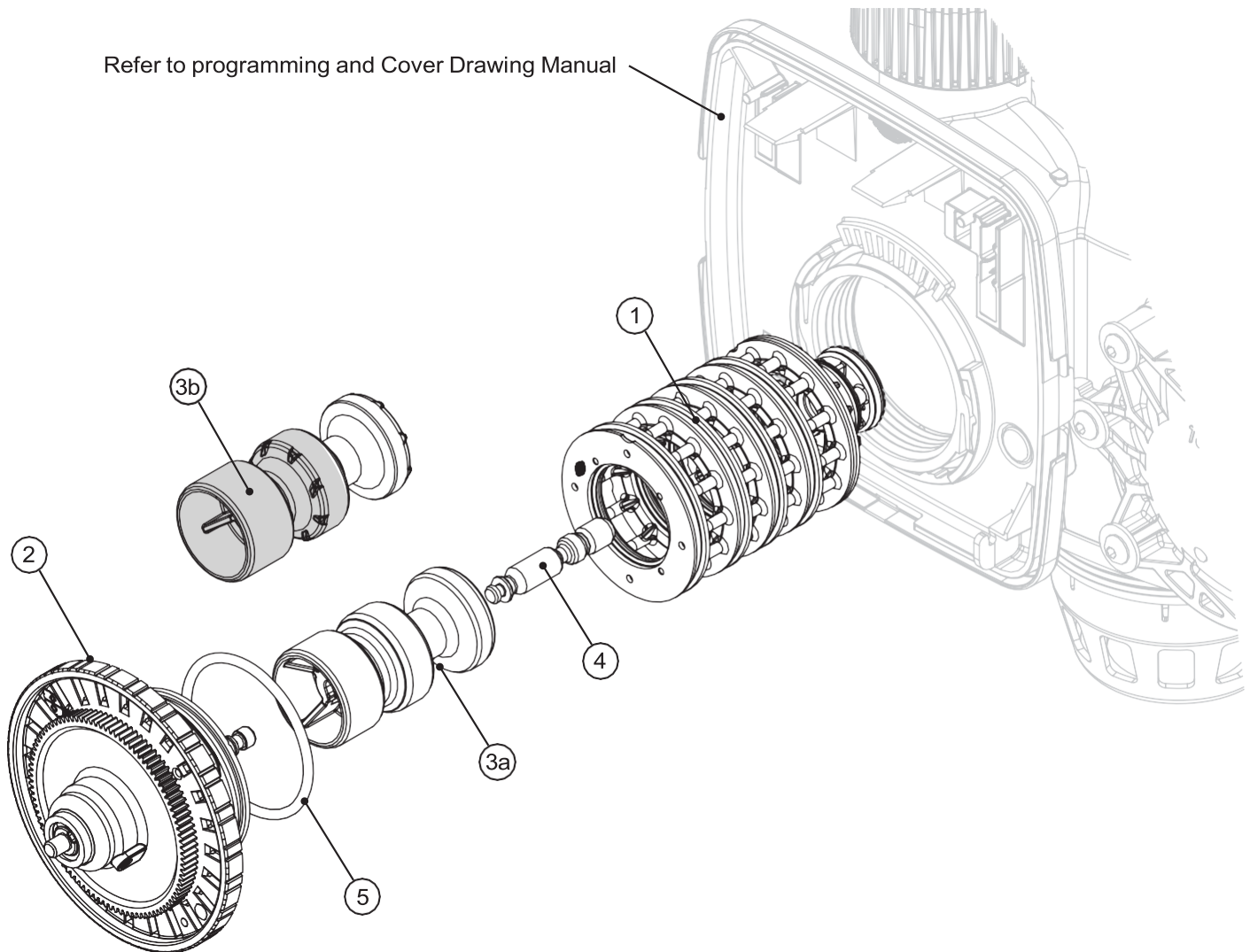
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## Drive Cap Assembly, Downflow Piston, Upflow Piston, Regenerant Piston, and Spacer Stack Assembly

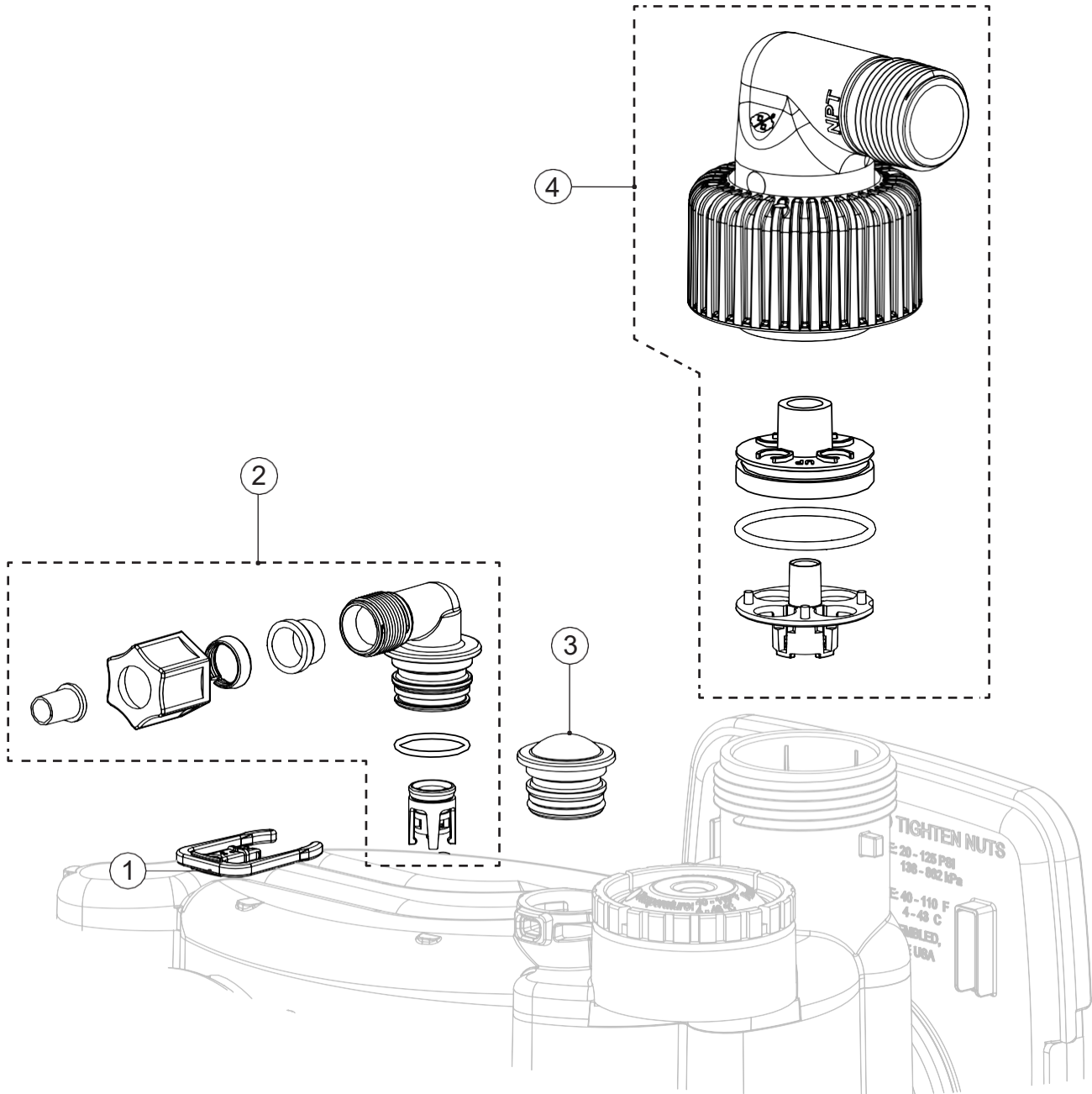
Drawing No.	Order No.	Description	Quantity
1	V3430-01	WS125/15 EDPM SPACER STACK ASY	1
2	V3004	DRIVE CAP ASY	1
3a	V3407	WS125/15 PISTON DOWNFLOW ASY (AMBER)	1
3b	V4042	WS125/15 PISTON UPFLOW ASY (BLACK)	
4	V3174	WS1 REGENERANT PISTON	1
5	V3135	O-RING 228	1

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

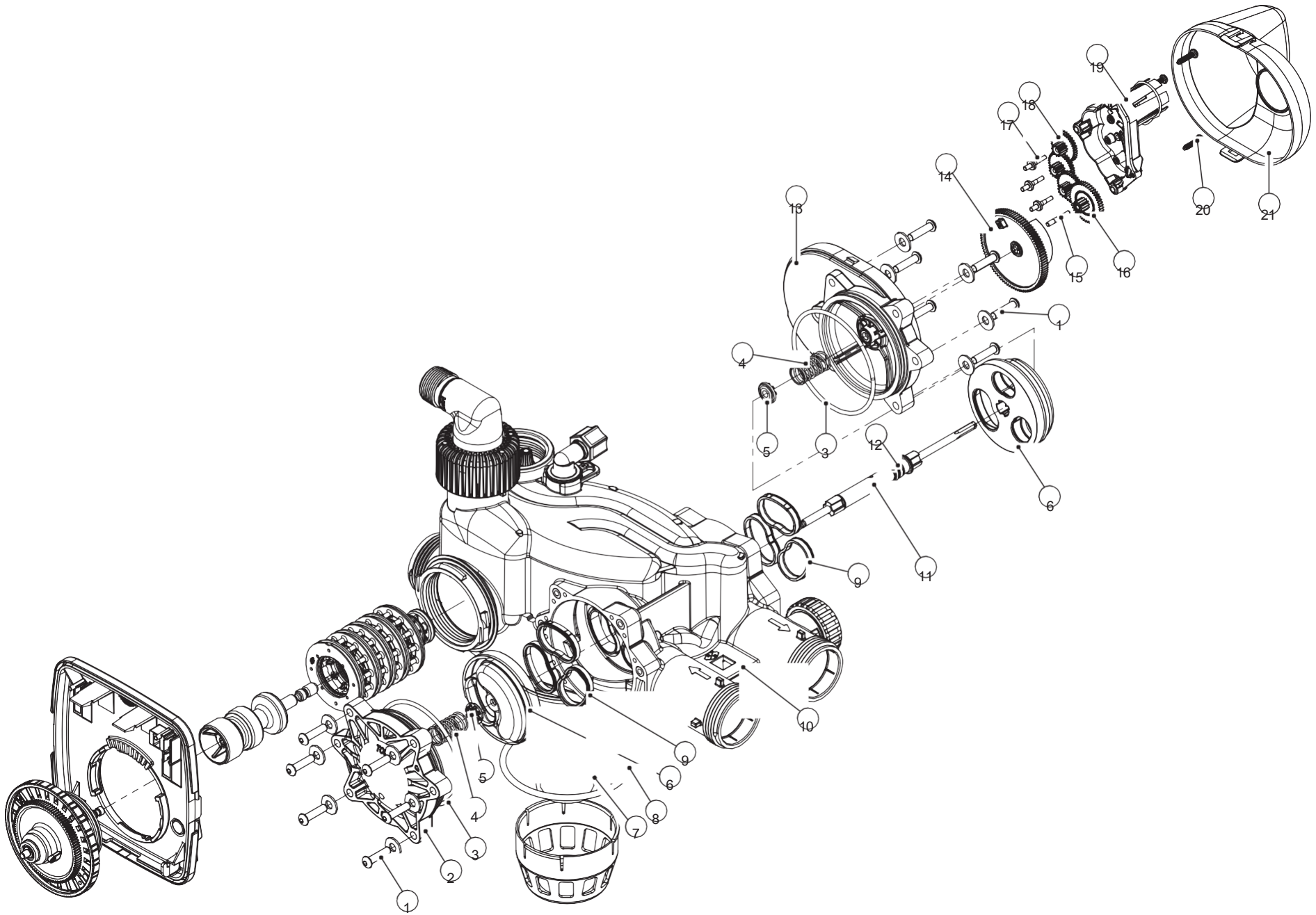


## Regenerant Components

Drawing No.	Order No.	Description	Quantity
1	H4615	RETAINING CLIP	1
2	V3498	WS15 BRINE ELBOW ASY W/RFC ½	1
3	V3195-01	REFILL PORT PLUG ASY	1
4	V4430-04NPT	WS15P NPT DRAIN KIT	1
	V4430-04BSPT	WS15P BSPT DRAIN KIT	



# Twin Transfer



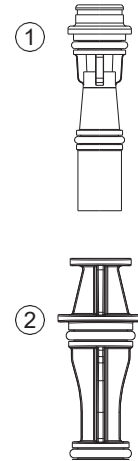
### Twin Transfer

Drawing No.	Order No.	Description	Quantity
1	V3470	SCREW BHC 1/4-20 X 1 SS	12
	V3724	SS 1/4 WASHER	12
2	V4547	T15 TRANSFER CAP	1
3	V4536	O-RING 240	2
4	V4552	T15 TRANSFER SPRING	2
5	V4014	T1 TRANSFER SPRING SUPPORT	2
6	V4551	T15 ROTOR DISC ASY	2
7	V3641	O-RING 225 (NPT only)	1
	V3441	O-RING 226 (BSPT only)	
8	V3419	O-RING 347	1
9	V4543	T15 TRANSFER SEAL	6
10	V4700-NPT	T15 BODY NPT ASY	1
	V4700-BSPT	T15 BODY BSPT ASY	
11	V4545	T15 TRANSFER DRIVE SHAFT	1
12	D1245	O-RING 111	2
13	V4548-01	T15 TRANSFER DRIVE CAP ASY	1
14	V4011-01	T1 TRANSFER DRIVE GEAR ASY	1
15	V4012	T1 TRANSFER DRIVE GEAR AXLE	1
16	V4013	T1 TRANSFER REDUCTION GEAR	1
17	V3264	WS2H BYPASS REDUCTION GEAR AXLE	3
18	V3110-01	WS1 DRIVE REDUCING GEAR PLAIN	3
19	V3262-01	WS1.5&2ALT/2BY REDUC GEAR CVR ASY	1
20	V3592	SCREW #8-1 PHPN T-25 SS	3
21	V4049	T1 COVER ASSEMBLY	1
NOT SHOWN	V4043	T1 TRANSFER MOTOR ASY	1
NOT SHOWN	V3151	WS1 NUT 1 QC	1
NOT SHOWN	V4055*	TWIN TANK METER ASY	1
NOT SHOWN	D1403	1192 1.5 IN/OUT HEAD	1
	D1403-01	1192 50MM IN/OUT HEAD	1

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

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

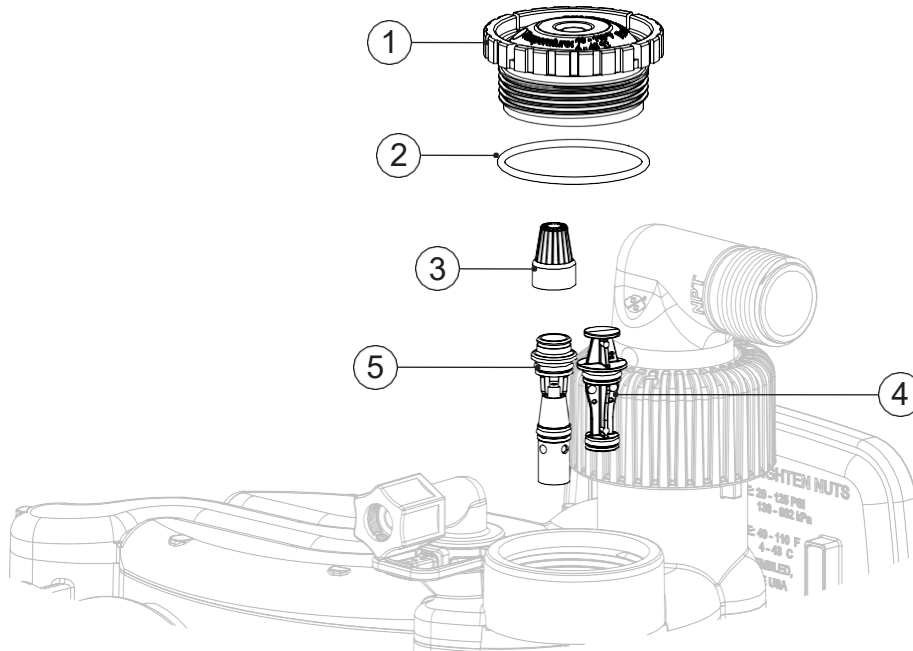
Drawing No.	Order No.	Description	Nozzle Color	Downflow Typical Tank Diameter	Quantity
1	V3010-15B	WS1.5 INJECTOR ASY B	Violet	12"	1
	V3010-15C	WS1.5 INJECTOR ASY C	Red	13"	
	V3010-15D	WS1.5 INJECTOR ASY D	White	14"	
	V3010-15E	WS1.5 INJECTOR ASY E	Blue	16"	
	V3010-15F	WS1.5 INJECTOR ASY F	Yellow	18"	
	V3010-15G	WS1.5 INJECTOR ASY G	Green	21"	
	V3010-15H	WS1.5 INJECTOR ASY H	Orange	24"	
2	V3010-15Z	WS1.5 INJECTOR PLUG		N/A	



V3010-15B – V3010-15H injectors include one V3416 O-ring 012 (lower) and one V3171 O-ring 013 (upper).

For upflow brine applications, it is recommended that the injector be downsized 2 tank sizes minimum. Refer to the injector graphs for verifying proper selection.

Drawing No.	Order No.	Description	Quantity
1	V4349	WS15P INJECTOR CAP	1
2	V3152	O-RING 135	1
3	V4120	INJECTOR SCREEN	1
4	V3010-15Z	WS15 INJECTOR PLUG ASY	1 or 2
5	V3010-15X	WS15 INJECTOR ASY	1 or 0



## Fitting Kits

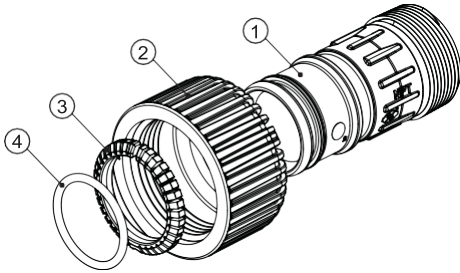
USE ONLY SILICONE BASED LUBRICANTS ON ALL CLACK COMPONENTS. HYDROCARBONS WILL DAMAGE COMPONENTS THAT CONTAIN O-RINGS AND/OR PLASTIC. THIS CAN CAUSE LEAKS OR BREAKAGE. DO NOT USE LUBRICANTS THAT CONTAIN HYDROCARBONS SUCH AS VASELINE®/PETROLEUM JELLY, WD-40®, ETC. DO NOT USE CLACK CONTROL VALVE PRODUCTS ON WATER SUPPLIES THAT CONTAIN HYDROCARBONS SUCH AS BENZENE, GASOLINE, KEROSENE, ETC.

### Fitting Installation Instructions:

- Installation fittings are designed to accommodate minor plumbing misalignments, but are not designed to support the weight of a system or the plumbing.
- Teflon tape must be used on the fitting threads.
- Slide nut on first, then the split ring and O-ring.
- Hand-tighten the nut only.

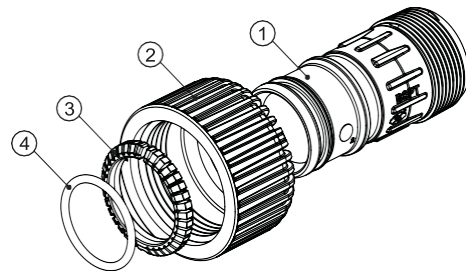
**Clack Order No. V4430-01**  
Description: WS15P QC to NPT Fitting Kit

Drawing No.	Order No.	Description	Quantity
1	V4353	WS15P QC TO NPT FITTING	2
2	V4344	WS15P QC NUT	2
3	V4345	WS15P SPLIT RING	2
4	V4367	O-RING 222	2



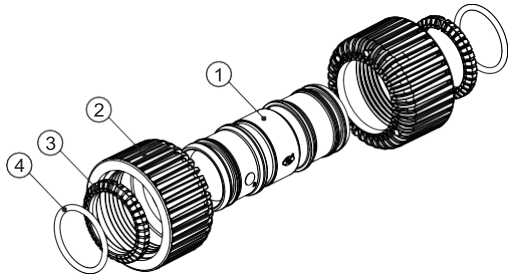
**Clack Order No. V4430-02**  
Description: WS15P QC to BSPT Fitting Kit

Drawing No.	Order No.	Description	Quantity
1	V4355	WS15P QC TO BSPT FITTING	2
2	V4344	WS15P QC NUT	2
3	V4345	WS15P SPLIT RING	2
4	V4367	O-RING 222	2



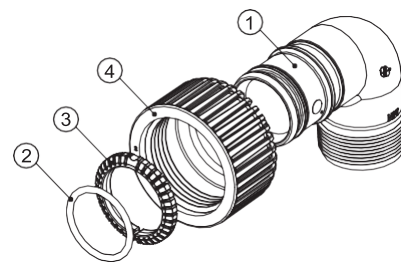
**Clack Order No. V4430-03**  
Description: WS15P QC to QC Fitting Kit

Drawing No.	Order No.	Description	Quantity
1	V4354	WS15P QC TO QC FITTING	1
2	V4344	WS15P QC NUT	2
3	V4345	WS15P SPLIT RING	2
4	V4367	O-RING 222	2



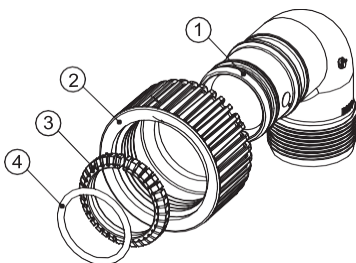
**Clack Order No. V4430-07**  
Description: WS1.5 PLASTIC ELBOW QC TO NPT

Drawing No.	Order No.	Description	Quantity
1	V4432NPT	1.5 PLASTIC QC TO NPT ELBOW	2
2	V4367	O-RING -222	2
3	V4345	1.5 SPLIT RING	2
4	V4344	QC NUT 1.5 PLASTIC	2



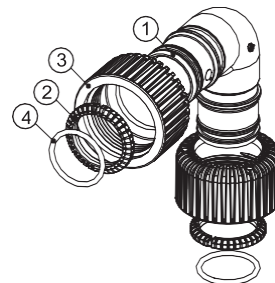
**Clack Order No. V4430-08**  
Description: WS1.5 PLASTIC ELBOW QC TO BSPT

Drawing No.	Order No.	Description	Quantity
1	V4432BSPT	1.5 PLASTIC QC TO BSPT ELBOW	2
2	V4344	QC NUT 1.5 PLASTIC	2
3	V4345	1.5 SPLIT RING	2
4	V4367	O-RING 222	2



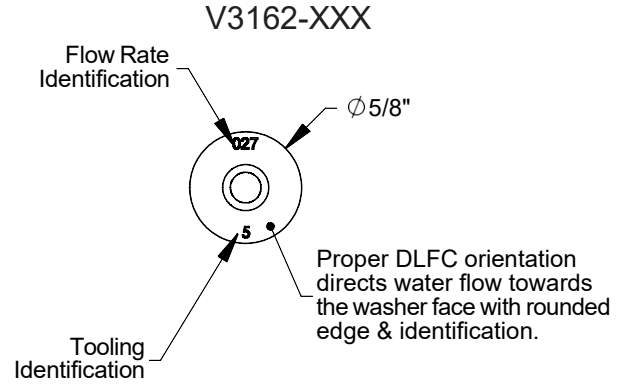
**Clack Order No. V4430-09**  
Description: WS1.5 PLASTIC ELBOW QC TO QC

Drawing No.	Order No.	Description	Quantity
1	V4432QC	1.5 PLASTIC QC TO QC ELBOW	1
2	V4345	1.5 SPLIT RING	2
3	V4344	QC NUT 1.5 PLASTIC	2
4	V4367	O-RING 222	2



### Drain Line Flow Control Washers

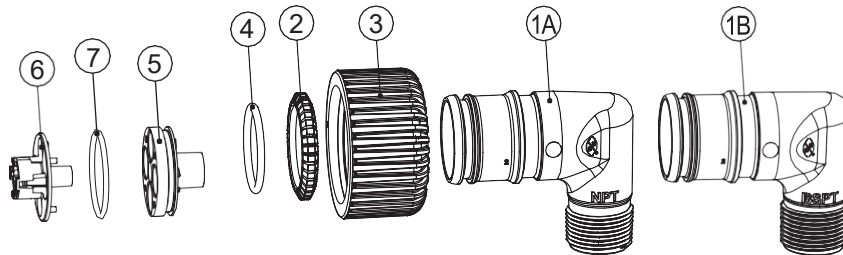
Order No.	Description
V3162-007	0.7 GPM DRAIN LINE FLOW CONTROL
V3162-010	1.0 GPM DRAIN LINE FLOW CONTROL
V3162-013	1.3 GPM DRAIN LINE FLOW CONTROL
V3162-017	1.7 GPM DRAIN LINE FLOW CONTROL
V3162-022	2.2 GPM DRAIN LINE FLOW CONTROL
V3162-027	2.7 GPM DRAIN LINE FLOW CONTROL
V3162-032	3.2 GPM DRAIN LINE FLOW CONTROL
V3162-042	4.2 GPM DRAIN LINE FLOW CONTROL
V3162-053	5.3 GPM DRAIN LINE FLOW CONTROL
V3162-065	6.5 GPM DRAIN LINE FLOW CONTROL
V3162-075	7.5 GPM DRAIN LINE FLOW CONTROL
V3162-090	9.0 GPM DRAIN LINE FLOW CONTROL
V3162-100	10.0 GPM DRAIN LINE FLOW CONTROL



All DLFC housings ship without DLFC installed.  
 Up to 5 x V3162-XXX DLFC may be installed in V4430.  
 Select 1 – 5 flow controls from table for proper backwash flow,  
 based on media manufacturer's recommendations.

**Clack Order No. V4430-04NPT OR V4430-04BSPT**  
**Description: WS15P 1.5 Drain Elbow**

Drawing No.	Order No.	Description	Quantity
1A	V4358	WS15P DRAIN ELBOW 1" NPT	1
1B	V4359	WS15P DRAIN ELBOW 1" BSPT	1
2	V4345	WS15P SPLIT RING	1
3	V4344	QC NUT 1.5 PLASTIC	1
4	V4367	O-RING 222	1
5	V4351	FLOW CONTROL HOUSING	1
6	V4352	FLOW CONTROL RETAINER	1
7	V4364	O-RING 129	1



## Introduction

This manual is for control valve to be used on water softeners or water filters. The manual is designed to aid water treatment equipment manufacturers in the selection of the various control valve options. Information in this manual is different than what is needed for installation and service of a particular water treatment system. This manual is not intended to be used as a manual for a complete water softener or filter.

## General Warnings

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

**USE ONLY SILICONE BASED LUBRICANTS ON ALL CLACK COMPONENTS. HYDROCARBONS WILL DAMAGE COMPONENTS THAT CONTAIN O-RINGS AND/OR PLASTIC. THIS CAN CAUSE LEAKS OR BREAKAGE. DO NOT USE LUBRICANTS THAT CONTAIN HYDROCARBONS SUCH AS VASELINE®/PETROLEUM JELLY, WD-40®, ETC. DO NOT USE CLACK CONTROL VALVE PRODUCTS ON WATER SUPPLIES THAT CONTAIN HYDROCARBONS SUCH AS BENZENE, GASOLINE, KEROSENE, ETC.**

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

The nuts and caps are designed to be unscrewed or tightened by hand or with the special plastic wrench. If necessary, a 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 a screwdriver in the slots on caps and/or tap with a hammer.

Do not use pipe dope or other sealants on threads. Use Teflon tape on the threaded inlet, outlet, and drain fittings. 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, reset the PC board. This can be done by unplugging the power source from the printed circuit board (black wire) and plugging it back in or by pressing and holding NEXT and REGEN buttons for 3 seconds. The display should flash all wording, then flash the software version, 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". Backwash flow rates in excess of 25 GPM (94.6 Lpm) or length in excess of 20' (6.1 m) with no air-gap or vacuum breaker to protect the system will require 1½" 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 on 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. 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.

This glass-filled Noryl<sup>1</sup> (or equivalent) fully automatic control valve is designed as the primary control center to direct and regulate all cycles of a water softener or filter.

The control valve is compatible with a variety of regenerants 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 regenerants. The control valve regulates the flow rates for backwashing, rinsing, and replenishing of treated water into a regenerant tank, when applicable.

Control valve installation is made easy because the distributor tube can be cut ½" above to ½" below the top of 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 power adapter comes with a 15-foot power cord and is designed for use with the control valve. The power adapter is for dry location use only. The control valve remembers all settings until the battery power is depleted if the power goes out. After the battery power is depleted, the only item that needs to be reset is the time of day; other values are permanently stored in the nonvolatile memory. The control valve battery is not rechargeable but is replaceable.

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.

<sup>1</sup>Noryl is a trademark of Sabic.

Minimum/Maximum Operating Pressures	20 – 125 psi (138 kPa – 862 kPa)	
Minimum/Maximum Operating Temperatures	40° – 110°F (4° – 43°C)	
Power Adapter:	U.S.	International
Supply Voltage	100 VAC – 240 VAC	200 VAC – 240 VAC
Supply Frequency	50/60 Hz	50/60 Hz
Output Voltage	15 VDC	15 VDC
Output Current	500 mA	500 mA
Service Flow Rate	54 GPM @ 15 psi drop (204 Lpm, 12.3 m <sup>3</sup> /h)	
Backwash Flow Rate	22 GPM @ 25 psi drop (83 Lpm, 4.9 m <sup>3</sup> /h)	
Meter:		
Accuracy	±5%	
Flow Range	0.75 – 75 gpm (2.8 – 284 Lpm)	
Inlet/Outlet	1.5" Male NPT or BSPT	
Drain Line	1" Male Elbow NPT or 1" BSPT	
Brine Line	½" OD polytube compression	
Tank Connection	4"-8 UN	
Height from Top of Tank	11"	
PC Board Memory	Nonvolatile EEPROM	
Valve material	Glass-filled composite	
Regenerant/Chemical Compatibility	Sodium chloride, potassium chloride, potassium permanganate, sodium bisulfite, chlorine, and chloramines	
Regeneration	Downflow or upflow	
Tank Applications	12" – 24" diameter	

## Component Information

The WS1.5T control valves consist of the following components:

- |                                                           |                                                 |
|-----------------------------------------------------------|-------------------------------------------------|
| 1. Drive Assembly                                         | 6. Drain Line Flow Control and Fitting Assembly |
| 2. Drive Cap Assembly, Main Piston, and Regenerant Piston | 7. Water Meter                                  |
| 3. Spacer Stack Assembly                                  | 8. Twin Transfer Valve                          |
| 4. Injector Cap, Screen, Injector Plug, and Injector      |                                                 |
| 5. Refill Flow Control Assembly or Refill Port Plug       |                                                 |

### **Drive Assembly:**

The drive assembly consists of the following parts:

- Drive Bracket
- Printed Circuit (PC) Board
- Motor
- Drive Gears
- Drive Gear Cover

The drive bracket holds the PC board, the motor, the drive gears and the drive gear cover in place.

The PC board receives and retains information, displays the information, determines when to regenerate and initiates regeneration. The display shows different types of information in the initial system set up (for softeners or filters), installer display settings, diagnostics, valve history or user display settings.

The PC board powers the direct current (DC) motor via the 2-pin connector. The motor is held in place on the drive bracket by a spring-loaded clip and a small bulge in the plastic, which fits in one of the slots on the motor housing. The motor turns drive gears that drive the piston to cycle positions for backwash, regeneration, rinse, refill, or service. The motor is fully reversible (turns both ways) and changes the direction of rotation to change the direction of piston motion. The motor is easily replaced if necessary.

There are 3 drive gears held in place by the drive gear cover. All 3 drive gears are the same size. A reflective coating is applied to the gears. As the center drive gear turns, a light shines on the coating and a light sensing diode determines if a light pulse was returned. The PC board counts the pulses and determines when to stop driving the motor.

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

The drive gears turn the main gear of the drive cap assembly, which moves the piston. The screw-driven, horizontally-moving piston stops at specific positions to direct the flow of water to backwash, regenerate, rinse, or refill. The PC board determines the position of the piston by counting pulses produced when the piston is moved. An optical sensor looking at one of the reduction drive gears generates these pulses. Each cycle position is defined by a number of pulses. The counter is zeroed each time the valve goes to the service position. The PC board finds the service position by noting the increase in current delivered to the motor when the mechanical stop at the service position is reached. This method of controlling piston position allows for greater flexibility and requires no switches or cams (U.S. Patent 6444127).

One of 2 main pistons is always used:

1. A 1.5" diameter downflow piston is used when the WS1.5T control valve is used as a downflow softener, regenerating filter, or non-regenerating filter.
2. A 1.5" diameter upflow piston is used when the WS1.5T control valve is used as an upflow softener.

If the control valve is used as a softener or a regenerating filter, a regenerant piston must be attached to the main piston. If the control valve is to be used on a system that does not require a regenerant to be added, the regenerant piston must be removed.

### **Spacer Stack Assembly:**

The spacer stack assembly provides the necessary flow passage for water during the different cycles. The all-plastic spacer stack assembly (U.S. Patent 6402944) is a one-piece design which allows the stack to be removed using your fingers.

The exterior of the stack is sealed against the body bore with self-lubricating EPDM O-rings, while the interior surface is sealed against the piston using slippery self-cleaning directional (one-way) silicone lip seals. The lip seals are clear in color and have a special slippery coating so that the piston does not need to be lubricated.

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

The screen, injector, and/or injector plug(s) are installed under the injector cap in an easy-to-access location on top of the valve. The injector cap contains 4 slots so no water accumulates in the cap. The injector cap is designed to be hand-tightened.

Under the injector cap, there is an easy-to-clean removable screen to prevent fouling of the injector. There are 2 holes under the injector cap labeled *DN* and *UP*. The holes will be filled with a plug or an injector.

The plug (Order # V3010-15Z) prevents water from traveling a certain pathway. The injector lets water pass through the pathway. The self-priming injector increases the velocity of the water, creating a zone of negative pressure that draws in the concentrated liquid regenerant, such as sodium chloride (brine), potassium permanganate, etc. The regenerant blends with the stream of water, which passes through the media to regenerate the bed.

The injector provides a consistent regenerant/water mixture ratio over the entire operating pressure range of the control valve. The injector provides good performance in a variety of applications, which may involve elevated drain lines and long regenerant draw lengths. Injectors are chosen by knowing the type, amount, and regenerant flow rate for a particular type of media. Guidelines can be found in the media manufacturer's literature. The color coded injectors give different regenerant draw, slow rinse, and total flow rates over the pressure range. See injector graphs (pages 10 – 13) for total, slow rinse, and draw flow rates.

The control valve has been manufactured to be one of the following:

- Regeneration downflow WS1.5T (for softeners or regenerating filters install injector in *DN* location, plug in *UP* location).
- Regeneration upflow WS1.5T (Upflow option is for softeners only. Install injector in *UP* location, plug in other hole location).
- No regenerant WS1.5T (both the *DN* and *UP* holes have injector plugs installed and plug installed for the refill elbow).

*Note:* It is okay to field convert valves from upflow to downflow and vice versa with the WS1.5T valve as long as software supports upflow brine.

### **Refill Flow Control Assembly or Refill Port Plug:**

The refill flow control assembly consists of an elbow, flow control retainer, and flow control washer. The flow control retainer fits in the elbow. The flow control retainer houses the flow control washer which controls the flow rate when the regenerant tank is being refilled. The flow control is a flexible washer-like part with a small orifice and a precision molded contour that delivers a steady 0.5 GPM regenerant tank refill rate at varying inlet pressures.

Refill is accomplished with filtered water on filters and soft water on water softeners.

The refill flow control elbow assembly is attached to the control valve with a locking clip. The locking clip allows the elbow to rotate 270° so the outlet can be oriented towards the regenerant tank.

If the control valve is to be used as a non-regenerant filter control valve, the refill elbow is removed and replaced with a refill port plug (Order # V3195-01).

## Service Instructions



When servicing the valve, water may leak from the valve. Water from the valve may create a slip hazard. Clean up water spills.



Disconnect from electrical power prior to servicing the valve.

### Drive Assembly:

Remove the valve cover to access the drive assembly.

Disconnect the power source (black wire) from the PC board prior to disconnecting the motor or water meter. The power source connects to the 4-pin connector. The motor connects to the 2-pin connector on the left side of the PC board. The water meter (gray wire) connects to the 3-pin connector on the far right 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 and 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 2 plastic pins that fit into the holes on the lower edge of the PC board. Once the PC board is tilted about 45° away 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 and push the top of the PC board towards the valve until it snaps under the middle latch. Then, weave the power and 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, unplug the power source and meter and unweave the wires from the side holders. There are 2 tabs on the top of the drive backplate that hold the drive bracket in place. Simultaneously lift the 2 tabs and gently ease the top of the drive bracket forward. The lower edge of the drive bracket has 2 notches that rest on the drive backplate. 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 backplate. Push the top of the drive bracket toward the 2 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 backplate. If resistance is felt before latching, then notches are not fully engaged, the piston rod is not in hole, the wires are jammed between the drive bracket and drive backplate, or the gear is not engaging the drive cap assembly.

To inspect the drive gears, the drive gear cover needs to be removed. Before trying to remove the gear cover, the drive bracket must be removed from the drive backplate. (Refer to the instructions above regarding removing the drive bracket from the drive backplate.) The drive gear cover can be removed from the drive bracket without removing the motor or the PC board. The drive gear cover is held in place on the drive bracket by 3 clips. The largest of the 3 clips is always oriented to the bottom of the drive bracket. With the PC board facing up, push in and down on the large clip on the drive gear cover. Handle the cover and the gears carefully so that the gears do not fall off the pegs in the cover.

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 oriented towards the bottom. If all 3 clips are outside the gear shroud on the drive bracket, the drive gear cover slips easily into place.

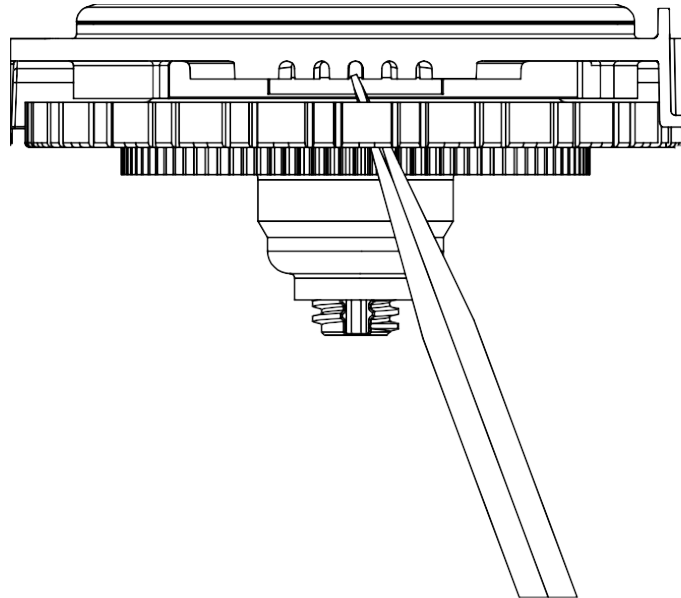
The drive bracket does not need to be removed from the drive backplate if the motor needs to be removed. To remove the motor, disconnect the power and motor plugs from the PC board. Move the spring clip loop to the right and hold. Rotate the motor at least a quarter turn in either direction so the wires are vertical (up & down) 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. To reinstall the motor, move the spring clip loop to the right and hold. Gently turn the motor while inserting so that the gear on the motor meshes with the gears under the drive gear cover. Release the spring clip loop and continue to rotate the motor until the wires are horizontal and the motor housing engages the small plastic bulge inside the drive bracket motor retainer. Reconnect the motor plug to the 2-pin connector on the lower left side of the PC board. If the motor will not easily engage with the drive gears when reinstalling, lift and slightly rotate the motor before reinserting. Reconnect the power source.

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

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

The drive assembly 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" – ½" flat blade screwdriver into one of the slots around the top 2" of the drive cap assembly so it engages the notches molded into the drive backplate around the top 2" of the piston cavity. 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.



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 (downflow or upflow) 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 pressing sideways and unsnapping it from its latch. Chemically clean in dilute sodium bisulfite or vinegar, or replace the regenerant piston if needed. To remove the main 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. Reinsert the drive cap assembly and piston into the spacer stack 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 backplate. 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 involving the drive assembly or the drive cap assembly and pistons, unplug power source from the PC board (black wire) and plug back in or press and hold NEXT and REGEN for 3 seconds. This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version and 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 thumb and forefinger. Inspect the black O-rings and clear lip seals for wear or damage. Replace the entire stack if necessary. 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 ( $\frac{5}{8}$ " –  $1\frac{1}{8}$ " in diameter) to push the center of the assembly into the control valve body. The assembly is properly seated when at least 4 threads are exposed (approximately  $\frac{5}{8}$ "). Do not force the spacer stack assembly into the body bore. The 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 involving the drive assembly or the drive cap assembly and pistons, unplug the power source from the PC board (black wire) and plug back in or press and hold NEXT and REGEN for 3 seconds. This resets the electronics and establishes the service piston position. The display should flash all wording, then flash the software version and reset the valve to the service position.

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

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

The plug and/or injector can be extracted 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 small diameter holes that control the flow rates of water to ensure the proper concentration of regenerant is used. Sharp objects, which 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*. Refer to Valve Body Compliance Table for more information.**

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

### **Refill Flow Control Assembly or 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 flat blade screwdriver.

Chemically clean the flow control or the white flow control retainer using dilute sodium bisulfite or vinegar. Do not use a wire brush. If necessary, replace the flow control, 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 locking clip, push down on elbow to reseat, and insert 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:**

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 disconnect 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 backplate. To reinstall, rethread the water meter wire through the drive backplate and the side of the drive assembly. Reattach the drive assembly and connect water meter and power source.

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

**OPERATING PRESSURES: 20 PSI MINIMUM / 125 PSI MAXIMUM • OPERATING TEMPERATURES: 40°F MINIMUM / 110°F MAXIMUM**

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.

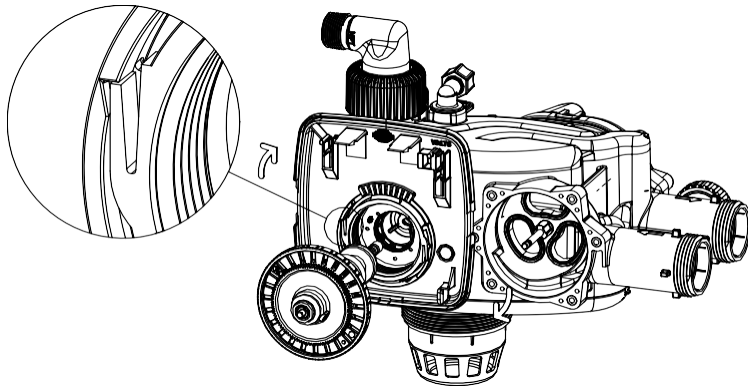
With the nut removed, a slot at the top of the water meter is visible. Twist a flat blade screwdriver in the slot between the control valve body and the meter. When the meter is part way out, it is easy to remove the water meter from the housing. Once the water meter is removed from the control valve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

Do not use a wire brush to clean the turbine. 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. 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.

Reinsert the water meter into the side slot. Hand-tighten the nut. Do not use a pipe wrench to tighten nut.

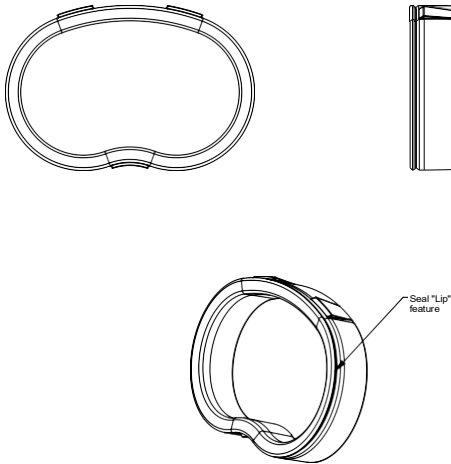
## Servicing Transfer Cap Assemblies



The control valve's backplate must be removed first to allow access to removing the transfer cap assembly. *Note:* Hold slight downward pressure on the top left corner of the backplate while using a thin flat screwdriver or knife blade to push in on the locking tabs, this will release the backplate and it will twist to the left off of the valve body. For removal of the drive motor side, you will need to remove the drive cover assembly to access the motorized drive. The drive motor can be removed by pressing the spring clip loop to the right, rotating the motor a quarter turn, and pulling outward to remove the motor from the reducing gear cover assembly. Remove the 3 Phillips head stainless steel screws that retain the reducing gear cover to the drive cap. Once the cover is

removed, you have access to the reducing drive gears. Simply slide them off of the gear axles with your fingers to inspect them. There are 3 small, black gears with foil decals and 1 larger black reducing gear. Remove the large white drive gear from the stainless steel drive shaft. To remove the large white transfer drive gear, firmly grab the outside edge of the gear with your fingers and pull it outward away from the control valve assembly. Now you can use a 5/32" or 4 mm Allen wrench to remove the 1/4-20 screws that retain the transfer drive cap assemblies on both sides of the valve.

*Note:* Once the screws are removed from retaining the inlet side transfer valve cap and the outlet drive motor transfer cap from the control valve, the cap will spring out away from the valve body. At this point, the transfer discs may be removed by pulling the discs outward off of the shaft away from the valve body with your hand. With the disc out, you can inspect the flat surface area to be sure it's clean and smooth free of any debris or scratches. Note that the disc is keyed to the drive shaft so that it will only assemble in one orientation. The transfer discs may be chemically cleaned with a dilute sodium bisulfate solution or vinegar, or wiped with a soft clean cloth.



To remove seals, gently pull on the outer lip of the seal to lift the seal out from its cavity, being careful not to damage the face surface of the seal. To reassemble, reseal seals into the seal cavity of the control valve body, being sure that the lip of the seal is facing outward. With seals in place, put a thin film of Dow #7 lubricant on the tops of the seals and the flat surface of the discs. Prior to reinstalling the discs, the drive shaft should be removed and the O-rings cleaned, inspected, and lubricated with Dow #7. The shaft can then be installed into the disc prior to installation. With the outlet disc assembled to the shaft, the orientation of the shaft to inlet disc can be assured by installing the set with the through hole on the outlet disc at the 6 o'clock position.

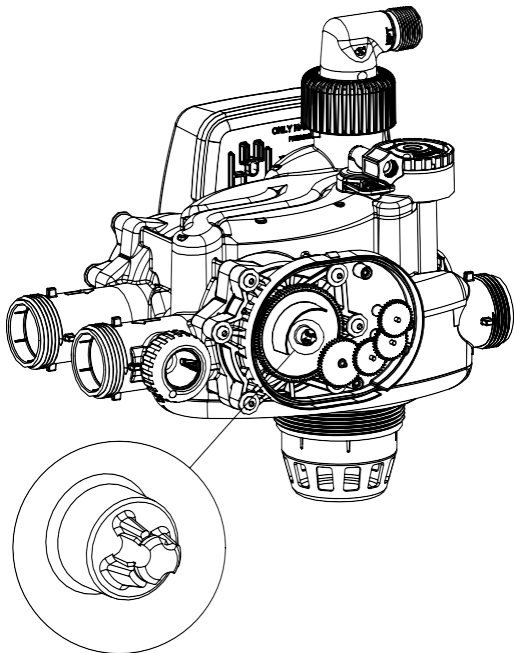
The easiest thing would be to remove both disc drives and assemble the outlet side first. Then each disc could be fitted on the shaft individually. At this point, the transfer valve cap assemblies can be reinstalled.

*Note:* Both transfer caps only mount in one orientation. Prior to installation of cap assembly, be sure to check that the stainless steel spring and the plastic spring support is in place attached to the inside of the assembly. Next, you can wipe the outside edge of the O-ring on the cap and the inside mating area of the valve with a clean cloth & re-apply a thin layer of silicone lubricant like Dow #7.

**USE ONLY SILICONE BASED LUBRICANTS ON ALL CLACK COMPONENTS. HYDROCARBONS WILL DAMAGE COMPONENTS THAT CONTAIN O-RINGS AND/OR PLASTIC. THIS CAN CAUSE LEAKS OR BREAKAGE. DO NOT USE LUBRICANTS THAT CONTAIN HYDROCARBONS SUCH AS VASELINE®/PETROLEUM JELLY, WD-40®, ETC. DO NOT USE CLACK CONTROL VALVE PRODUCTS ON WATER SUPPLIES THAT CONTAIN HYDROCARBONS SUCH AS BENZENE, GASOLINE, KEROSENE, ETC.**

Noting the one possible orientation of the transfer drive cap, use one hand to press in and support the transfer drive cap while using the other hand to start two screws in, one on the top and one opposing it on the bottom. Tighten the screws in evenly so the cap seats the O-ring without getting pinched or damaged. Screws should only be hand tightened with a 5/32" or 4 mm Allen wrench. **DO NOT OVER-TIGHTEN SCREWS.**

*Note:* Be careful to make sure the meter cable doesn't get under the drive cap while tightening as it will result in damaging the cable.



Position the large white drive gear with the A pointing toward the 1 o'clock position and then press it onto the stainless-steel drive shaft, make sure it snaps & locks into position.

*Note:* The white drive gear is splined to the drive shaft and will only assemble in one orientation. Because of this, it is not necessary that the discs and gear be exactly positioned, the positioning needs to be approximate but they have to fit on the shaft.

Next, install the larger black reducing gear onto the stainless-steel shaft, then install the remaining smaller reducing gears from left to right. Reinstall the reducing gear cover over the gears and affix with the 3 stainless-steel screws. Now you can reinstall the drive motor by pressing the spring clip loop to the right and rotating the motor as you are inserting it so the gear of the motor meshes properly with the reducing gears. Release the spring clip loop and rotate the motor until the motor housing engages with the plastic nub inside the housing that holds the motor in place. Make sure that the top of the motor is flush with the top of the gear housing. Press the drive motor wires down into the strain relief of the drive cap. Then, reinstall the cover assembly.

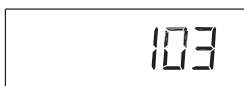
**After completing any valve maintenance involving the valve drive assembly or the transfer drive assembly, press and hold NEXT and REGEN simultaneously for 3 – 5 seconds to perform a soft reset which will synchronize the control valve's positions.**

## Regeneration and Error Screens



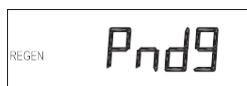
### Regen Screen

Displays the time remaining in the current cycle. Press REGEN to advance to the next cycle.

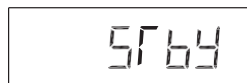


### Error Screen

Alternated flashing Err and error code every 3 seconds. To clear, disconnect the power supply at the PC board and reconnect, or press NEXT and REGEN simultaneously for 3 seconds.



*REGEN Pndg* is displayed in alternator systems when a unit is waiting to initiate the first cycle step of regeneration.



*Stby* is displayed in alternator systems when a valve is in standby mode.



*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.

Press and release once to schedule a regeneration at the preset delayed regeneration time.



Press and release again to cancel the regeneration.

Press and hold for at least 3 seconds to initiate an immediate regeneration.

Press while in regeneration to advance to the next cycle.

Press while in the program levels to go back to the previous display.



Changes variable being displayed.



Key sequence to lock and unlock program settings.



Hold for 3 seconds to initiate 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 T and 1.5T. Hold for at least 3 seconds to cause 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.

**Table 1**  
**Regeneration Cycles and Times**

Cycle	Range		
	Softening	Filtering Regen	Filtering Backwash
Backwash	1 – 120 min or OFF	1 – 120 min or OFF	1 – 120 min or OFF
Regenerant Draw/Slow Rinse (UP or DN)	1 – 180 min or OFF	1 – 180 min or OFF	N/A
Fast Rinse	1 – 120 min or OFF	1 – 120 min or OFF	1 – 120 min or OFF
Regenerant Refill	0.1 – 200 lb or OFF	0.05 – 20 gal or OFF	N/A
Regenerant Refill for 2.0" or 1.5" set to MIN (softening only)	0.1 – 99 min or OFF	0.1 – 99 min or OFF	N/A
Service	1 – 480 min or OFF	N/A	N/A

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

1. Press and release REGEN. *REGEN TODAY* will flash on the display and regeneration will occur at the delayed regeneration time. Press and release REGEN to cancel the request.
2. Press and hold REGEN for approximately 3 seconds to immediately start the regeneration. The user cannot cancel this request except by resetting the control by pressing NEXT and REGEN simultaneously for approximately 3 seconds.

## User Displays

### General Operation:



When the system is operating, one of 5 displays may be shown. Press NEXT to 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 number of days to next regeneration.



#### User 3

Flow Rate.

Displays present flow rate.

This display will not appear if Step 5CS is set to *ALT A* or *ALT b* and the valve is currently in standby. If Step 2CS is set to *1.0T* or *1.5T*, the display will indicate the tank currently in Service (*A* or *b*) in the left-most digit.



#### User 4

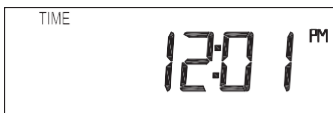
Displays total volume in gallons since last reset. If a meter is not used, this display will show zero.

Press ▼ for 3 seconds to reset to 0.



#### User 5

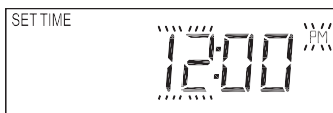
Shows current time.



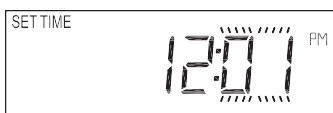
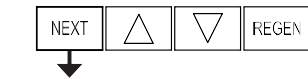
### Setting Time of Day

Press NEXT until time of day is displayed. Then, 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.

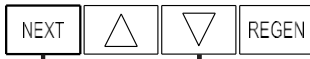


Press NEXT to return to User displays. Time of day should only need to be set after power outages lasting more than 8 hours, if the battery has been depleted and a power outage occurs, or when daylight saving time begins or ends. If a power outage lasting more than 8 hours occurs, the time of day will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



## Configuration Settings

### STEP 1CS



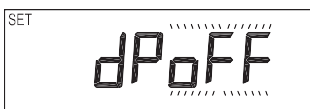
### STEP 2CS



### STEP 3CS



### STEP 4CS



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

**Step 2CS** – Valve Type: 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, *1.0T* for 1.0" twin valve, or *1.5T* for 1.5" twin valve. Press NEXT to go to Step 3CS. Press REGEN to exit Configuration Settings.

**Step 3CS** – Meter Size: Use ▼ or ▲ 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 PPG can also be selected. This display will only appear if Step 2CS is set to *1.5* or *2.0*. Press NEXT to go to Step 4CS. Press REGEN to return to the previous step.

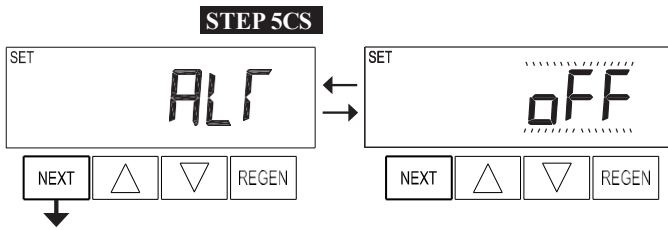


**Step 4CS** – Auxiliary Input: Allows for the use of an outside signal to control the initiation of a regeneration. Selection only needed if a connection is made to the 2-pin connector labeled *DP SWITCH* located on the printed circuit board. Use ▼ or ▲ to select one of the following options:

- *oFF*: Feature not used.
- *on0*: Regeneration will occur immediately if the dP switch is closed for 2 uninterrupted minutes. 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. The Delayed Rinse and Fill feature will not be available for WS1 – WS1.5 control valves programmed for twin alternating if this option is selected.
- *dEL*: Regeneration will occur at the scheduled delayed regeneration time if the dP switch is closed for 2 uninterrupted minutes. In a twin alternating system, once the dP switch is triggered, the PC Board will display *REGEN TODAY*. At the delayed regeneration time, the control will switch tanks and the triggered unit will regenerate. The Delayed Rinse and Fill feature will not be available for WS1 – WS1.5 control valves programmed for twin alternating if this option is selected.
- *HoLd*: Regeneration will be prevented from occurring while the dP switch is closed. 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. The Delayed Rinse and Fill feature can be set in conjunction with this option if desired.

*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.

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



**Step 5CS – ALT MAV Output:** Use ▼ or ▲ to select one of the following options:

- *nHbP*: The control valve operates with a no hard water bypass.
- *SEPS*: The control valve has a separate source during the regeneration cycle.
- *SYS*: The control valve operates with a Clack system controller.
- *ALT A* or *ALT b*: The control valve acts as an alternator.
- *OFF*: None of these features are used.

This display will not appear if Step 2CS is set to *1.0T* or *1.5T*.

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 3-wire communication cable is not used.

Selection requires that a connection to a MAV or a Clack no hard water bypass valve is made to the 2-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 B port connected to the valve outlet. When set to *nHbP*, the MAV will be driven closed before the first regeneration cycle that is not Fill, 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, 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 operation, the 3-wire communication cable is not used.

Selection requires that a connection to a Clack motorized alternating valve (MAV) is made to the 2-pin connector labeled *MAV* located on the printed circuit board. The C port of the MAV must be connected to the valve inlet, the A port connected to the separate source used during regeneration, and the B port 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.



#### **Configuring the Control Valve to Operate with Clack System Controller:**

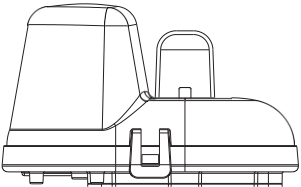
Select *SYS* to link control valve to the Clack system controller. For communication between the control valve and the system controller, a 3-wire communication cable is required.

Selection requires that a connection to a Clack no hard water bypass (V3070FF or V3070FM) be made to the 2-pin connector labeled *MAV* located on the printed circuit board for WS1 and WS1.25 control valves. For valve types WS1.5 and WS2, a connection from a Clack no hard water bypass (V3097-BSPT or V3098-BSPT) to the 2-pin connector labeled *MAV* located on the printed circuit board is required.



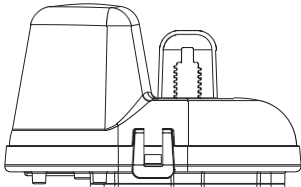
**Configuring the Control Valve to Act as an Alternator:**

Prior to starting the programming steps, connect the communication cable to each control valve board's 3-pin connector labeled <i>COMM CABLE</i> . Also connect the meter cord to either control valve to the 3-pin connector labeled <i>METER</i> .			
		Softener Valve Programming Steps	
Configuration Settings	Step 5CS	Set to <i>ALT A</i> Connect the outlet plumbing of ALT A valve to the MAV's A port and connect the MAV's 2-pin wire connector to the 2-pin connector labeled <i>DRIVE</i> on the ALT A valve.	Set to <i>ALT b</i> 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 6S	Set Ionic Capacity.	Set Ionic Capacity.
Softener System Setup	Step 7S	Set to <i>AUTO</i> .	Set to <i>AUTO</i> .
Softener System Setup	Step 8S	Set Regeneration Time Option to <i>on 0</i> .	Set Regeneration Time Option to <i>on 0</i> .
Installer Display Settings	Step 3I	Set Day Override to <i>oFF</i> .	Set Day Override to <i>oFF</i> .
If set up for a filter, set Volume Capacity in Step 4F; set Regeneration Time Option in Step 5F to <i>on 0</i> ; and set Day Override in Step 3I to <i>oFF</i> .			



**Retracted**

Valve A in Service Position = MAV piston rod retracted



**Extended**

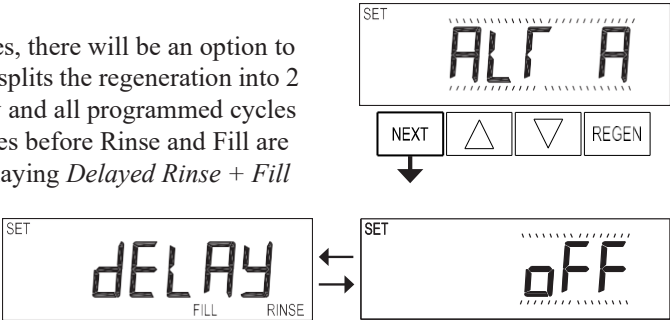
Valve B in Service Position = MAV piston rod extended

**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 standby 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 standby mode and allowed to have a delayed regeneration at the pre-set time.

**WS1, WS1.25, and WS1.5 Valves**

For Clack alternator systems using WS1, WS1.25, and WS1.5 valves, there will be an option to delay the last 2 cycles of regeneration (Rinse and Fill). This feature splits the regeneration into 2 portions. The first portion of the regeneration will start immediately and all programmed cycles before Rinse and Fill 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 online unit is depleted to 10% of its programmed capacity, the control valve will be triggered to finish the second portion of the regeneration. Once Rinse and Fill cycles are complete, the valve will re-enter standby mode until requested to come online for service. Set to *oFF* to deactivate this feature.

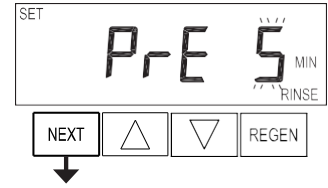
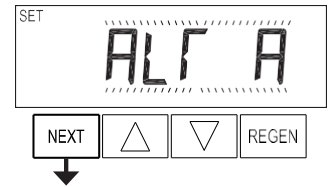


**WS2 Valve**

For Clack alternator systems using the WS2 valve, when NEXT is pressed after selecting *ALTA* or *ALT B*, a display will allow the user to set the length of pre-service rinse time for the standby tank just prior to returning to service. Set to *oFF* to deactivate this feature. With *1.0T* or *1.5T* set, the same display appears and is set in a similar manner.

*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.

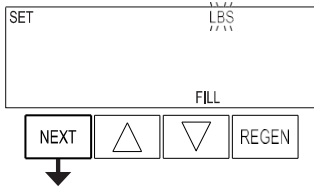
Press NEXT to go to Step 6CS. Press REGEN to return to previous step.



**STEP 6CS**

**Step 6CS – Fill Units:** If set as a softener, Step 2CS is set to *1.5* or *1.5T*, and Fill is part of the Regeneration Cycle Sequence, fill units of *MIN* or *LBS* can be selected.

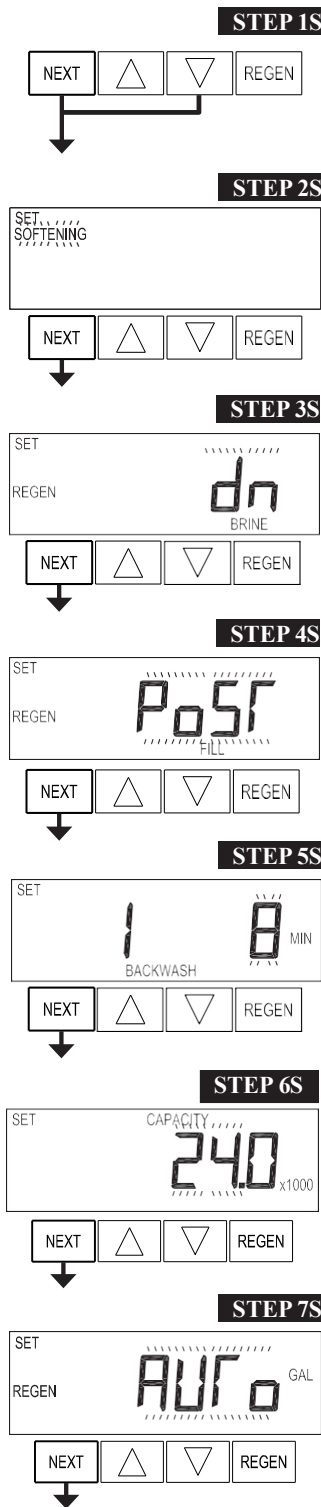
Press NEXT to exit OEM Configuration Setup. Press REGEN to return to previous step.



**EXIT TO DISPLAY SCREENS**



## OEM Softener System Setup



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

**Step 2S** – Treatment Type: Use ▼ or ▲ to select *SOFTENING*. Press NEXT to go to Step 3S. Press REGEN to exit OEM Softener System Setup.

**Step 3S** – Brining Direction: Use ▼ or ▲ to select *UP* or *dn*. Prior to selecting the upflow regeneration cycle, verify that the correct body, main piston, regenerant piston, and stack are being used and that the injector plug(s) are in the correct location. Refer to the Service Manual for drawings and part numbers. Press NEXT to go to Step 4S. Press REGEN to return to previous step.

**Step 4S** – Refill Option: Use ▼ or ▲ to select one of the following options:

- *PoST*: The brine tank refills after the final rinse.
- *PrE*: The brine tank refills 4 hours before the regeneration time set.

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

**Step 5S** – Cycle Durations: Use ▼ or ▲ to set the value for the first cycle. Value ranges and units will vary depending on the cycle, see Table 1 for more detail. Press NEXT to set the value for the next cycle. Repeat for all cycles. Once a value is set for all cycles, press NEXT to go to Step 6S. Press REGEN to return to previous step.

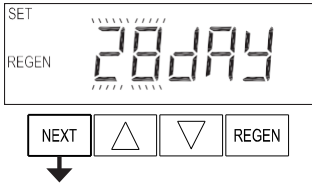
**Step 6S** – Ionic Capacity: Use ▼ or ▲ to set the ionic capacity. The ionic capacity is based on the volume of resin and LBS of salt fill previously selected. Press NEXT to go to Step 7S. Press REGEN to return to previous step.

**Step 7S** – Volume Capacity: Use ▼ or ▲ to select one of the following options:

- *AUTO*: Capacity will be automatically calculated and reserve capacity will be automatically estimated.
- *oFF*: If this option is selected, regeneration trigger must be set in Step 7S(A).
- A number: Regeneration initiation will be based on the value specified (in gallons).

See Setting Options Table for more detail. Press NEXT to go to Step 8S. Press REGEN to return to previous step.

**STEP 7S(A)**



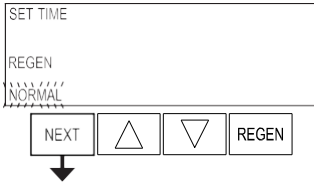
**Step 7S(A) – Regeneration Trigger:** Use ▼ or ▲ to select one of the following options:

- *28 day:* Regeneration will be triggered by Day Override set in Installer Settings.
- *7 day:* Regeneration will be triggered on specific days of the week.



This display will only appear if Step 7S is set to *oFF*. Press NEXT to go to Step 8S. Press REGEN to return to previous step.

**STEP 8S**



**Step 8S – Regeneration Time Option:** Use ▼ or ▲ to select one of the following options:

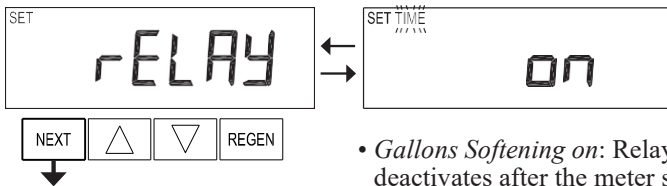
- *NORMAL:* Regeneration will occur at the preset time.
- *on 0:* Regeneration will occur immediately when the volume capacity reaches 0 (zero).
- *NORMAL + on 0:* Regeneration will occur at one of the following:
  - the preset time when the volume capacity falls below the reserve or the specified number 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).

This option will not be available if Step 5CS is set to *ALTA* or *ALT b* or if Step 2CS is set to *1.0T* or *1.5T*.

This display will not appear if Step 7S is set to *oFF* or if Step 5CS is set to *SYS*. See Setting Options Table for more detail.

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

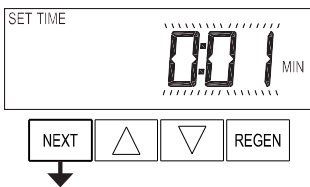
**STEP 9S**



**Step 9S – Relay Output:** Use ▼ or ▲ to select one of the following options:

- *Time on:* Relay activates a set time after the start of a regeneration and deactivates after a set period of time. The start of regeneration is defined as the first Backwash cycle, Dn Brine cycle, or UP Brine cycle whichever comes first.
  - *Gallons Softening on:* Relay activates after a set volume has been used while in service and deactivates after the meter stops registering flow and the set time period has expired.
  - *Gallons Softening Regen on:* Relay activates after a set volume has been used while in service or during regeneration and deactivates after the meter stops registering flow and the set time period has expired.
  - *ERROR:* Relay closes whenever the valve enters an error state and immediately deactivates when the control exits the error state. Step 9S(A) and Step 9S(B) will not appear if this option is selected.
  - *Off:* Feature not used. Step 9S(A) and Step 9S(B) will not appear if this option is selected.
- Press NEXT to go to Step 9S(A). Press REGEN to return to previous step.

**STEP 9S(A)**

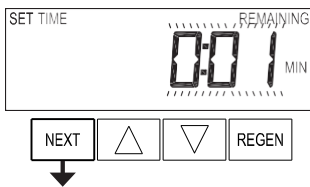


**Step 9S(A) – Relay Setpoint Actuation:** Use ▼ or ▲ to select one of the following options:

- *Relay Actuation Time:* Set the length of time after the start of regeneration prior to relay activation (Range: 1 second – 200 minutes). The start of regeneration is defined as the first Backwash cycle, Dn Brine cycle, or UP Brine cycle, whichever comes first.
- *Relay Actuation Gallons:* Set the number of gallons that will be treated prior to relay activation (Range: 1 – 200).

Press NEXT to go to Step 9S(B). Press REGEN to return to previous step.

**STEP 9S(B)**



**Step 9S(B) – Relay Duration:** Use ▼ or ▲ to set the length of time the relay will stay active prior to deactivation. If Step 9S is set to *Time on*, value range is 1 second – 200 minutes. If Step 9S is set to *Gallons Softening on* or *Gallons Softening Regen on*, value range is 1 second – 20 minutes.

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

**EXIT OEM SOFTENER SYSTEM SETUP**

## Setting Options Table

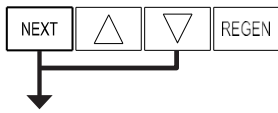
Filters should only use shaded options

Volume Capacity	Regeneration Time Option	Day Override	Result <sup>1</sup>
AUTO	NORMAL	oFF	Reserve capacity automatically estimated. Regeneration occurs at the next regeneration time when volume capacity falls below the reserve capacity.
AUTO	NORMAL	Any number	Reserve capacity automatically estimated. Regeneration occurs at the next regeneration time when volume capacity falls below the reserve capacity or the specified number of days between regenerations is reached, whichever comes first.
Any number	NORMAL	oFF	Reserve capacity <u>not</u> automatically estimated. Regeneration occurs at the next regeneration time when volume capacity reaches 0.
oFF	NORMAL (not adjustable)	Any number	Reserve capacity <u>not</u> automatically estimated. 28 day: Regeneration occurs at the next regeneration time when the specified number of days between regenerations is reached. 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. Regeneration occurs at the next regeneration time when volume capacity reaches 0 or the specified number of days between regenerations is reached, whichever comes first.
AUTO	On 0	oFF	Reserve capacity automatically estimated. Regeneration occurs immediately when volume capacity reaches 0. 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 <u>not</u> automatically estimated. Regeneration occurs immediately when volume capacity reaches 0.
AUTO	NORMAL + on 0	oFF	Reserve capacity automatically estimated. Regeneration occurs at the next regeneration time when volume capacity falls below the reserve capacity, or regeneration occurs after 10 minutes of no water usage when volume capacity reaches 0.
AUTO	NORMAL + on 0	Any number	Reserve capacity automatically estimated. Regeneration occurs at the next regeneration 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. Regeneration occurs at the next regeneration 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 valves.

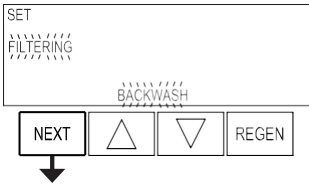
## OEM Filter System Setup

### STEP 1F



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

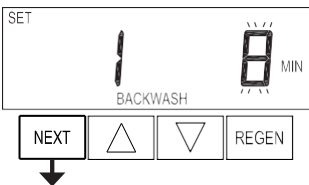
### STEP 2F



**Step 2F** – Treatment Type: Use ▼ or ▲ to select *FILTERING BACKWASH* or *FILTERING REGEN* (see table). Press NEXT to go to Step 3F. Press REGEN to exit OEM Filter System Setup.



### STEP 3F



**Step 3F** – Cycle Durations: Use ▼ or ▲ to set the value for the first cycle. Value ranges and units will vary depending on the cycle, see Table 1 for more detail. Press NEXT to set the value for the next cycle. Repeat for all cycles.

Once a value is set for all cycles, press NEXT to go to Step 4F. Press REGEN to return to previous step.

### STEP 4F



**Step 4F** – Volume Capacity: Use ▼ or ▲ to select one of the following options:

- *oFF*: If this option is selected, regeneration trigger must be set in Step 4F(A).
- A number: Regeneration initiation will be based on the value specified (in gallons). See Setting Options Table for more detail.

Press NEXT to go to Step 4F(A). Press REGEN to return to previous step.

### STEP 4F(A)



**Step 4F(A)** – Regeneration Trigger: Use ▼ or ▲ to select one of the following options:

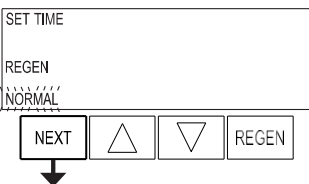
- *28 day*: Regeneration will be triggered by Day Override set in Installer Settings.
- *7 day*: Regeneration will be triggered on specific days of the week.

This display will only appear if Step 4F is set to *oFF*

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



### STEP 5F



**Step 5F** – Regeneration Time Option: Use ▼ or ▲ to select one of the following options:

- *NORMAL*: Regeneration will occur at the preset time.
- *on 0*: Regeneration will occur immediately when the volume capacity reaches 0 (zero).
- *NORMAL + on 0*: 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).

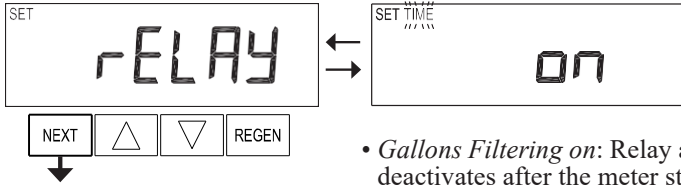
This option will not be available if Step 5CS is set to *ALT A* or *ALT b* or if Step 2CS is set to *1.0T* or *1.5T*.

This display will not appear if Step 4F is set to *oFF* or if Step 5CS is set to *SYS*.

See Setting Options Table for more detail.

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

**STEP 6F**

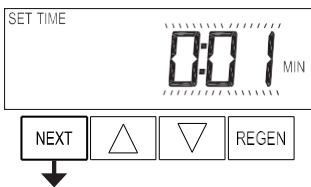


**Step 6F – Relay Output:** Use ▼ or ▲ to select one of the following options:

- *Time on:* Relay activates a set time after the start of a regeneration and 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 volume has been used while in service and deactivates after the meter stops registering flow and the set time period has expired.
- *Gallons Filtering Regen on:* Relay activates after a set volume has been used while in service or during regeneration and deactivates after the meter stops registering flow and the set time period has expired.
- *ERROR:* Relay closes whenever the valve enters an error state and immediately deactivates when the control exits the error state. Step 6F(A) and Step 6F(B) will not appear if this option is selected.
- *Off:* Feature not used. Step 6F(A) and Step 6F(B) will not appear if this option is selected. Press NEXT to go to Step 6F(A). Press REGEN to return to previous step.

**STEP 6F(A)**

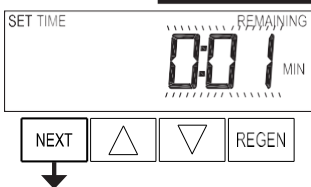


**Step 6F(A) – Relay Setpoint Actuation:** Use ▼ or ▲ to select one of the following options:

- *Relay Actuation Time:* Set the length of time after the start of regeneration prior to relay activation (Range: 1 second – 200 minutes). The start of regeneration is defined as the first Backwash cycle or Dn Brine cycle, whichever comes first.
- *Relay Actuation Gallons:* Set the number of gallons that will be treated prior to relay activation (Range: 1 – 200).

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

**STEP 6F(B)**



**Step 6F(B) – Relay Duration:** Use ▼ or ▲ to set the length of time the relay will stay active prior to deactivation. If Step 6F is set to *Time on*, value range is 1 second – 200 minutes. If Step 6F is set to *Gallons Filtering on* or *Gallons Filtering Regen on*, value range is 1 second – 20 minutes.

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

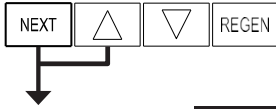
**EXIT OEM FILTER SYSTEM SETUP**

## Installer Display Settings: 7 Day Regeneration

Note: These displays will only appear if Volume Capacity is set to *oFF* and Regeneration Trigger is set to *7 day*.

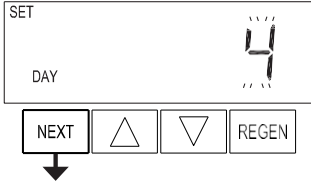
**STEP 1I**

**Step 1I** – Press NEXT and ▲ simultaneously for about 5 seconds and release.



**STEP 2I**

**Step 2I** – Current Day: Use ▼ or ▲ to set the current day of the week:



- 1: Sunday
- 2: Monday
- 3: Tuesday
- 4: Wednesday
- 5: Thursday
- 6: Friday
- 7: Saturday

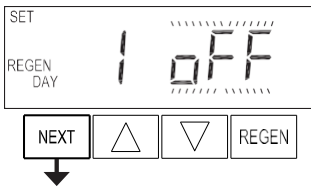
Press NEXT to go to Step 3I. Press REGEN to exit Installer Display.

**STEP 3I**

**Step 3I** – Regeneration Days: Use ▼ or ▲ to turn regeneration *on* or *oFF* for day 1 (Sunday).

Press NEXT to advance to day 2. Repeat for each day of the week.

After completing day 7, press NEXT to go to Step 4I. Press REGEN to go to previous display.



**STEP 4I**

**Step 4I** – Next Regeneration Time: Use ▼ or ▲ to set the hour of day for regeneration. The default time is 2:00. Press NEXT to set the minutes.

Once the minutes are set, press NEXT to go to exit Installer Display Settings. Press REGEN to return to previous step.



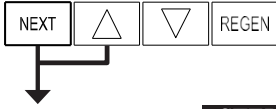
**EXIT INSTALLER DISPLAY SETTINGS**

## Installer Display Settings: 28 Day Regeneration / Auto

*Note:* These displays will only appear if Volume Capacity is set to anything other than *oFF* or if Regeneration Trigger is set to 28 day.

**STEP 1I**

**Step 1I** – Press NEXT and ▲ simultaneously for about 5 seconds and release.



**STEP 2I**

**Step 2I** – Hardness: Use ▼ or ▲ to set the amount of influent hardness.

This display will only appear if Step 7S is set to *Auto*.

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



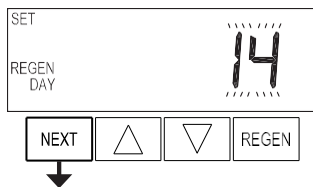
**STEP 3I**

**Step 3I** – Day Override: When Regeneration Trigger is set to 28 day, sets the number of days between regenerations. When Volume Capacity is set to *Auto* or a number, sets the maximum number of days between regenerations. Use ▼ or ▲ to select one of the following options:

- A number (1 – 28): Regeneration will be called for every set number of days even if sufficient volume of water was not used to call for a regeneration.
- *oFF*: Regeneration initiation is based solely on volume used.

See Setting Options Table for more detail on setup.

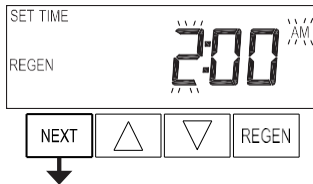
Press NEXT to go to Step 4I. Press REGEN to return to previous step.



**STEP 4I**

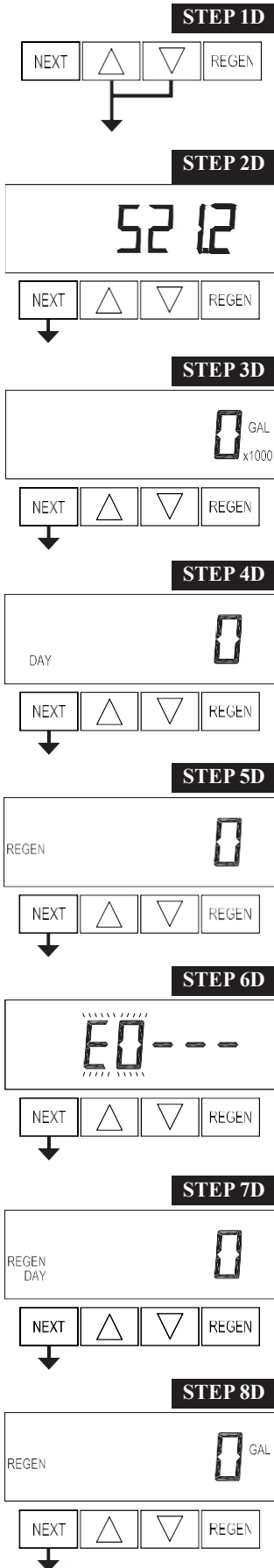
**Step 4I** – Next Regeneration Time: Use ▼ or ▲ to set the hour of day for regeneration. The default time is 2:00. This display will show *REGEN on 0 GAL* if Regeneration Time Option is set to *on 0*. Press NEXT to set the minutes.

Once the minutes are set, press NEXT to exit Installer Display Settings. Press REGEN to return to previous step.



**EXIT INSTALLER DISPLAY SETTINGS**

## 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, ▲, and REGEN in sequence, and try again.

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

**Step 3D** – Total Volume Used Since Startup: This display will show zero if a water meter is not installed.  
Press NEXT to go to Step 4D. Press REGEN to return to previous step.

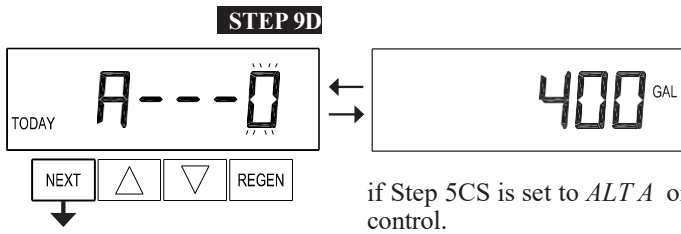
**Step 4D** – Total Days Since Startup.  
Press NEXT to go to Step 5D. Press REGEN to return to previous step.

**Step 5D** – Total Regenerations Since Startup.  
Press NEXT to go to Step 6D. Press REGEN to return to previous step.

**Step 6D** – Error Log: Use ▼ or ▲ to scroll through the last 10 errors generated by the control during operation.  
Press NEXT to go to Step 7D. Press REGEN to return to previous step.

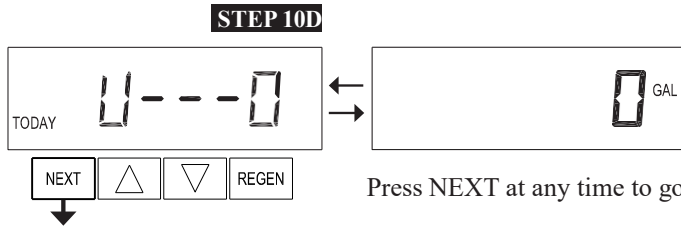
**Step 7D** – Days Since Last Regeneration.  
Press NEXT to go to Step 8D. Press REGEN to return to previous step.

**Step 8D** – Volume Since Last Regeneration: This display will show zero when a water meter is not installed.  
Press NEXT to go to Step 9D. Press REGEN to return to previous step.



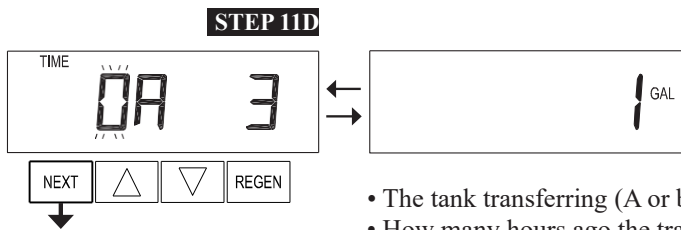
**Step 9D – Reserve History, Last 7 Days:** If the valve is set up as a softener, a meter is installed, and Volume Capacity is set to *AUTO*, this display shows the reserve capacity for each of the last 7 days. Use ▼ or ▲ to scroll. Day 0 is today, day 1 is yesterday, etc.

This display will not appear if Step 2CS is set to *1.0T* or *1.5T*, if Step 5CS is set to *ALTA* or *ALT b*, 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.



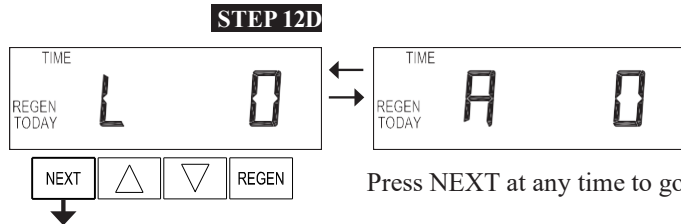
**Step 10D – Usage History, Last 63 Days:** This display shows the volume of water treated on each of the last 63 days. Use ▼ or ▲ to scroll. Day 0 is today, day 1 is yesterday, etc. If a regeneration occurred on the day, the word *REGEN* will also be displayed. This display will show dashes if a water meter is not installed.

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



**Step 11D – Twin Tank Transfer History:** This display will only appear if Step 2CS is set to *1.0T* or *1.5T*. Use ▼ or ▲ to scroll through the last 10 tank transfers. This display shows, from left to right:

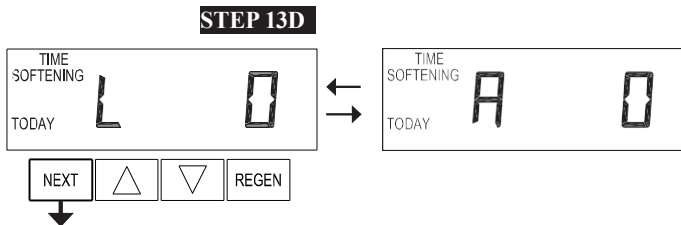
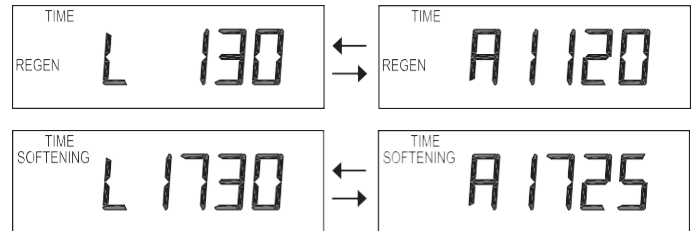
- The transfer number (0 – 9) with 0 being the most recent transfer.
  - The tank transferring (A or b).
  - How many hours ago the transfer occurred (999 hour maximum).
- The display alternates with the volume that was treated before the tank transferred.  
Press NEXT at any time to go to Step 12D. Press REGEN to return to previous step.



**Step 12D – MAV Drive History (Retracted):** This display shows the history of MAV output to drive the piston rod into the valve. This display will only appear if the MAV Output is active. *L* is the latest drive time and *A* is the average drive time. Drive time is measured in 1/100 of a second, meaning a 17.10 second move is displayed as *1710*.

Press NEXT at any time to go to Step 13D. Press REGEN to return to previous step.

Press and hold ▼ and ▲ 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.



**EXIT DIAGNOSTICS**

**Step 13D – MAV Drive History (Extended):** This display shows the history of MAV output to drive the piston rod out of the valve. This display will only appear if the MAV Output is active. *L* is the latest drive time and *A* is the average drive time.

Drive time is measured in 1/100 of a second, meaning a 17.10 second move is displayed as *1710*.  
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.

## Troubleshooting

Problem	Possible Cause	Solution
1. No Display on PC Board	a. No power at electric outlet	a. Repair outlet or use working outlet
	b. Control valve power adapter not plugged into outlet or power cord end not connected to PC board connection	b. Plug power adapter into outlet or connect power cord end to PC board connection
	c. Improper power supply	c. Verify proper voltage is being delivered to PC Board
	d. Defective power adapter	d. Replace power adapter
	e. Defective PC board	e. Replace PC board
2. PC Board does not display correct time of day	a. Power adapter plugged into electric outlet controlled by light switch	a. Use uninterrupted outlet
	b. Tripped breaker switch and/or tripped GFI	b. Reset breaker switch and/or GFI switch
	c. Power outage	c. Reset time of day. If PC board has battery back up present the battery may be depleted—see Front Cover and Drive Assembly drawing for instructions
	d. Defective PC board	d. Replace PC board
3. Display does not indicate that water is flowing. Refer to user instructions for how the display indicates water is flowing	a. Meter is not connected to meter connection on PC board	a. Connect meter to 3-pin connection labeled <i>METER</i> on PC board
	b. Restricted/stalled meter turbine	c. Remove meter and check for rotation or foreign material
	c. Meter wire not installed securely into 3-pin connector	c. Verify meter cable wires are installed securely into 3-pin connector labeled <i>METER</i>
	d. Defective meter	d. Replace meter
	e. Defective PC board	e. Replace PC board
4. Control valve regenerates at wrong time of day	a. Power outage	a. Reset time of day. If PC board has battery back up present, the battery may be depleted—see Front Cover and Drive Assembly drawing for instructions
	b. Time of day not set correctly	b. Reset to correct time of day
	c. Time of regeneration set incorrectly	c. Reset regeneration time
	d. Control valve set to <i>on 0</i> (immediate regeneration)	d. Check programming setting and reset to <i>NORMAL</i> (for a delayed regen time)
	e. Control valve set to <i>NORMAL + on 0</i> (delayed and/or immediate)	e. Check programming setting and reset to <i>NORMAL</i> (for a delayed regen time)
5. Time of day flashes on and off	a. Power outage	a. Reset time of day. If PC board has battery back up present, the battery may be depleted—see Front Cover and Drive Assembly drawing for instructions
6. Control valve does not regenerate automatically when the REGEN button is depressed and held.	a. Broken drive gear or drive cap assembly	a. Replace drive gear or drive cap assembly
	b. Broken piston rod	b. Replace piston rod
	c. Defective PC board	c. Defective PC board
7. Control valve does not regenerate automatically but <b>does</b> when the REGEN button is depressed and held.	a. Meter is not connected to meter connection on PC board	a. Connect meter to 3-pin connection labeled <i>METER</i> on PC board
	b. Restricted/stalled meter turbine	b. Remove meter and check for rotation or foreign material
	c. Incorrect programming	c. Check for programming error
	d. Meter wire not installed securely into 3-pin connector	d. Verify meter cable wires are installed securely into 3-pin connector labeled <i>METER</i>
	e. Defective meter	e. Replace meter
	f. Defective PC board	f. Replace PC board

Problem	Possible Cause	Solution
8. Hard or untreated water is being delivered	a. Media is exhausted due to high water usage	a. Check program settings or diagnostics for abnormal water usage
	b. Meter not registering	b. Remove meter and check for rotation or foreign material
	c. Water quality fluctuation	c. Test water and adjust program values accordingly
	d. No regenerant or low level of regenerant in regenerant tank	d. Add proper regenerant to tank
	e. Control fails to draw in regenerant	e. Refer to Troubleshooting Guide number 12
	f. Insufficient regenerant level in regenerant tank	f. Check refill setting in programming. Check refill flow control for restrictions or debris and clean or replace
	g. Damaged seal/stack assembly	g. Replace seal/stack assembly
	h. Control valve body type and piston type mismatched	h. Verify proper control valve body type and piston type match
	i. Fouled media bed	i. Replace media bed
9. Control valve uses too much regenerant	a. Improper refill setting	a. Check refill setting
	b. Improper program settings	b. Check program setting to make sure they are specific to the water quality and application needs
	c. Control valve regenerates frequently	c. Check for leaking fixtures that may be exhausting capacity, or system is undersized
10. Residual regenerant being delivered to service	a. Low water pressure	a. Check incoming water pressure—water pressure must remain at minimum of 25 psi
	b. Incorrect injector size	b. Replace injector with correct size for the application
	c. Restricted drain line	c. Check drain line for restrictions or debris and clean
11. Excess water in regenerant tank	a. Improper program settings	a. Check refill setting
	b. Plugged injector	b. Remove injector and clean or replace
	c. Drive cap assembly not tightened in properly	c. Re-tighten the drive cap assembly
	d. Damaged seal/stack assembly	d. Replace seal/stack
	e. Restricted or kinked drain line	e. Check drain line for restrictions or debris and/or straighten drain line
	f. Plugged backwash flow controller	f. Remove backwash flow controller and clean or replace
	g. Missing refill flow controller	g. Replace refill flow controller
12. Control valve fails to draw in regenerant	a. Injector is plugged	a. Remove injector and clean or replace
	b. Faulty regenerant piston	b. Replace regenerant piston
	c. Regenerant line connection leak	c. Inspect regenerant line for air leak
	d. Drain line restriction or debris cause excess back pressure	d. Inspect drain line and clean to correct restriction
	e. Drain line too long or too high	e. Shorten length and or height
	f. Low water pressure	f. Check incoming water pressure—water pressure must remain at minimum of 25 psi
13. Water running to drain	a. Power outage during regeneration	a. Upon power being restored, control will finish the remaining regeneration time. Reset time of day
	b. Damaged seal/stack assembly	b. Replace seal/stack assembly
	c. Piston assembly failure	c. Replace piston assembly
	d. Drive cap assembly not tightened in properly	d. Re-tighten the drive cap assembly

Problem	Possible Cause	Solution
14. E1, Err – 1001, Err – 101 = Control unable to sense motor movement	a. Motor not inserted full to engage pinion, motor wires broken or disconnected	a. Disconnect power, make sure motor is fully engaged, check for broken wires, make sure 2-pin connector on motor is connected to the 2-pin connection on the PC Board labeled <i>MOTOR</i> . Then, press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect
	b. PC board not properly snapped into drive bracket	b. Properly snap PC board into drive bracket. Then, press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds then reconnect.
	c. Missing reduction gears	c. Replace missing gears
15. E2, Err – 1002, Err – 102 = Control valve motor ran too short and was unable to find the next cycle position and stalled	a. Foreign material is lodged in control valve	a. Open up control valve and pull out piston assembly and seal/stack assembly for inspection. Then, press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect.
	b. Mechanical binding	b. Check piston and seal/stack assembly, check reduction gears, check drive bracket and main drive gear interface. Then, press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect.
	c. Main drive gear too tight	c. Loosen main drive gear. Then, press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect.
	d. Improper voltage being delivered to PC Board	d. Verify that proper voltage is being supplied. Then, press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect.
16. E3, Err – 1003, Err – 103 = Control valve motor ran too long and was unable to find the next cycle position	a. Motor failure during a regeneration	a. Check motor connections. Then, press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds and then reconnect.
	b. Foreign matter built up on piston and stack assemblies creating friction and drag enough to time out motor	b. Replace piston and stack assemblies. Then, press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds then reconnect.
	c. Drive bracket not snapped in properly and out enough that reduction gears and drive gear do not interface	c. Snap drive bracket in properly. Then, press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds then reconnect.
17. Err – 1004, Err – 104 = Control valve motor ran too long and timed out trying to reach home position	a. Drive bracket not snapped in properly and out enough that reduction gears and drive gear do not interface	a. Snap drive bracket in properly. Then, press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect.

Problem	Possible Cause	Solution
<p>18. Err -1006, Err – 106, Err - 116 = MAV/ SEPS/ NHBP/ AUX MAV valve motor ran too long and unable to find the proper park position</p> <p>Motorized Alternating Valve = MAV</p> <p>Separate Source = SEPS</p> <p>No Hard Water Bypass = NHBP</p> <p>Auxiliary MAV = AUX MAV</p>	<p>a. Control valve programmed for ALT A or b, nHbP, SEPS, or AUX MAV without having a MAV or NHBP valve attached to operate that function</p>	<p>a. Press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect. Then, re-program valve to proper setting</p>
	<p>b. MAV/NHBP motor wire not connected to PC board</p>	<p>b. Connect MAV/NHBP motor to PC board 2-pin connector labeled <i>DRIVE</i>. Press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect</p>
	<p>c. MAV/NHBP motor not fully engaged with reduction gears</p>	<p>c. Properly insert motor into casing, do not force into casing. Press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect</p>
	<p>d. Foreign matter built up on piston and stack assemblies creating enough friction and drag to time out motor</p>	<p>d. Replace piston and stack assemblies. Press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect</p>
<p>19. Err – 1007, Err – 107, Err - 117 = MAV/ SEPS/ NHBP/ AUX MAV valve motor ran too short (stalled) while looking for proper park position</p> <p>Motorized Alternating Valve = MAV</p> <p>Separate Source = SEPS</p> <p>No Hard Water Bypass = NHBP</p> <p>Auxiliary MAV = AUX MAV</p>	<p>a. Foreign material is lodged in MAV/NHBP valve</p>	<p>a. Open MAV/NHBP valve and check piston and seal/stack assembly for foreign material. Press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC board for 5 seconds then reconnect</p>
	<p>b. Mechanical binding</p>	<p>b. Check piston and seal/stack assembly, check reduction gears, drive gear interface, and MAV/NHBP black drive pinion on motor for being jammed into motor body. Press NEXT and REGEN for 3 seconds to resynchronize software with piston position or disconnect power supply from PC Board for 5 seconds then reconnect</p>

## 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. FRAKCO also pledges that the fiberglass media tank is covered under this warranty for ten years if owned by the original purchaser. 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