Operation & Maintenance Manual

WS2H/WS3 Single & Multi-Tank Systems

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Foreword

The operating instructions contained herein are intended to serve as a guide for the operation of the water softener equipment.

Since it is impossible to cover all operating contingencies and emergencies in a normal operating manual, the operator should read the manual and become familiar with its contents. They should also review the flow diagrams and vendor literature. This also should include all physical details, and full knowledge of the location and function of the equipment.

The use of an operating logbook is recommended in order to provide a proper record of performance. In the event of operational problems, such a record will prove invaluable when "trouble shooting" the system. This log should include all pertinent flow rates, temperatures and water characteristics. Equipment requiring maintenance or repair should be noted so that it can be scheduled for service or repair.

Frequently, water softener equipment like other processes, develop their own distinct characteristics. Design criteria outlined in this manual is based on many years of experience. However, they do not preclude modifications due to "personality" of the system. Operators should guide themselves accordingly and make any minor adjustments necessary for proper operation of the system.

Section 1: Introduction

Long term, successful operation of any softening system depends upon the care and attention it receives. Ordinarily, water treatment systems will provide uniform performance after the initial start-up period. Total gallons between regenerations and treated water purity usually do not vary appreciably over the life of the resin as long as the incoming water does not change.

This manual in intended to be a practical reference guide for operators. In view of the fact that system performance can change very dramatically throughout the year, a discussion of "ion exchange" theory is included in addition to basic information relative to equipment operation and regeneration procedures. Thorough understanding of the simple chemical reactions will help to determine if some equipment malfunction has occurred, or if the system is simply responding to changing water conditions. For this reason, the operator and supervising personnel should review Section 2, which defines terminology and simple chemistry associated with this system.

Ion exchange (softening process) is a reversible reaction. Ion exchange softening resins have only a limited capacity for removing hardness (calcium & magnesium). If the volume of water through the resin bed exceeds its capacity, hardness leakage will be detected in the effluent water. Therefore, service runs must be terminated before hardness leakage occurs. When the service run is completed, the resin is treated with sodium chloride (NaCl) to displace the hardness and restore its capacity. This process is termed "regeneration".

How completely softening can be accomplished depends upon several factors. The primary influences are the incoming water, type of resin, and amount of salt. Equally important, secondary influences are the concentrations and flow rates at which NaCl is introduced.

Section 2: Principles Of Ion Exchange

2.1 Ion Exchange Softening Process

In order to understand the softening process of ion exchange, it is first necessary to understand the meaning of the terms which are used in the explanation. Hard Water, Cation Exchanger, and Brine are defined below and used to show how the ion exchange process works.

Hard Water – All natural water contains dissolved impurities, but in widely varying amounts. There is always a balance of cations (+) and anions(-), but in the softening process anions have no effect. Water will be hard if it contains large amounts of calcium (Ca++) and/or magnesium (Mg++) ions.

Brine – Salt which has dissolved in water. Completed brine (100%) saturation contains as much salt as possible in water solution (26% to 27%). Salt – Sodium chloride (NaCl), when dissolved in water splits up (ionizes) into sodium (Na+) ions and chloride (Cl-) ions.

Saturated Brine – Contains a large amount of Na+ and Cl- ions (concentration is over 200,000 ppm). When used to regenerate a cation exchanger, only the sodium (Na+) ions are used. The chloride (Cl-) ions are washed to drain.

Cation Exchanger – A high-capacity bead form polystyrene sulfonate cation resin. These beads have negative (-) electric charge, which attracts and holds the cations, which are positively (+) charged (works like a magnet).

Softening Process – When the bead reaches the exchange capacity of Ca++ or Mg++ hardness break through the resin bed will increase. The increase in effluent hardness will indicate that the effective capacity of the cation resin has been reached. The cation exchanger must be regenerated to restore it to its original capacity.

Regeneration – Brine is used to regenerate the cation exchanger to its original capacity. Sodium (Na) ions attach to the resin beads forcing the calcium and magnesium ions to release from the resin beads. Once the exchange has taken place the sodium ions are rinsed to drain. The softener in now ready to remove hardness from the water.

Soft Water – The most common definition of soft water is water with <1 grain of hardness as calcium carbonate equivalent. Some critical applications may specify a maximum tolerable hardness.

2.2 Quality Of Effluent

If the hard water contains less than 500 ppm (about 30 grains) of calcium, magnesium and sodium salts, all expressed as CaCO3, it will be found that the effluent from a softener will contain an average of not more that 2 ppm actual total hardness (zero hardness by the soap test). However, as the total cation concentration in the hard water increases above 500 ppm, the average hardness in the effluent will also increase proportionately

The reason for this is that when the sodium salt - those present in the raw water plus those formed by the exchange reactions - are present in high enough concentrations, they cause a "back-regeneration" effect at the same time as the softening process is taking place. This effect prevents as complete a removal of calcium and magnesium as would otherwise be possible.

It is often possible to reduce the average hardness in the effluent below normally expected concentrations, by using a greater amount of salt than usual for regeneration. Normal Softening Cycle - At the start of a normal softening cycle, the hardness in the effluent drops rapidly as the residue of hardness ions left in the bed at the end of the rinse are forced out. The effluent hardness reaches a certain minimum value and remains at approximately this concentration for the major part of the softening run.

2.3 Capacity Of Ion Exchanger

The capacity for the removal of calcium and magnesium depends mainly upon the type of ion exchanger which is used. It is further influenced by the amounts of hardness and sodium ions in the raw water, and by the amount of salt used for regeneration.

Raw Water - The effect of the amounts of hardness and sodium ions in the raw water, is expressed in terms of compensated hardness. The hardness of the raw water is considered to be greater than it actually is for capacity determinations, whenever: (a) the total hardness is greater than 400 ppm (as CaCO3), or (b) the sodium salts are over 100 ppm as (CaCO3). This "greater-than-actual" hardness is referred to as compensated hardness.

Salt Dosage - The capacity, which will be obtained from a cation exchanger, is also determined by the amount of salt used during regeneration. The grains of hardness, which can be removed by each cubic foot of ion exchange, resin increases as more salt is used for regeneration.

At the same time, the efficiency of salt usage decreases with the higher regenerant dosages. That is, a greater number of grains of hardness are removed for each pound of salt used at the lower salt dosages, (and consequently, at the lower capacities). Thus, greater economy may be obtained at the expense of the number of gallons of water softened between regenerations.

Calculation Of Capacity - To determine the capacity of any cation exchanger, follow the procedure outlined below:

From the analysis of the raw water, determine the actual total hardness as the sum of the calcium and magnesium concentrations expressed as $CaCO_3$. If necessary, calculate the compensated hardness in accordance with the formula given above.

Express parts per million (ppm) of total hardness as grains per gallon by means of the following conversion formula: PPM / 17.1= grains per gallon (gpg)

2.4 Regeneration Steps

Regeneration is a process by which ions are stripped from the exhausted resin bed and its ion removal ability is restored. All exchangers, ranging from a simple water softener to a complex mixed bed deionizer go through four basic regeneration steps. There may be variations in flow rates; types of regenerating chemicals and regenerant concentrations but these general steps are as follows:

Backwash - Water flow is reversed so that it passes upward through the resin bed. Flow rates are sufficiently high to expand (fluidize) and to agitate the bed without washing large resin particles out of the tank. This action relieves any compaction that may have occurred during the service run. In addition, very fine resin fragments that can form during normal service are washed to drain. Proper backwash is essential to good exchanger performance. A compacted bed can develop high-pressure losses during service, which, in turn, can lead to flow channeling problems.

Brine In - A brine solution is passed slowly through the resin, displacing the exchanged ions and discharging them to drain. Proper control of flow rate and brine concentration is important to insure high regeneration efficiency. The amount of salt that is used depends upon the allowable hardness leakage for any given water supply and the desired resin operating capacity.

Displacement Rinse (Slow Rinse) - After all of the brine has been introduced into the resin bed, water continues to flow at approximately the same low flow rate. This slowly displaces the salt from the free space above the bed and from the void volume between resin particles, insuring that it is utilized to maximum efficiency.

Final Rinse - The final step in regenerating is important in that it will displace any salt left in the exchanger vessel prior to returning to service.

Section 3: Installation, Loading & Start Up Procedures

3.1 Installation of Equipment

1. Before beginning installation, review the following instructions to familiarize yourself with the general placement of the equipment.
2. The operating pressure is between 30 to 100 psi. If pressure is higher than 100 psi, then a pressure regulator must be installed.
3. The operating temperature is between 35° to 100° F.
4. Locate the equipment in the specified location. When setting the equipment, install on level concrete pad if possible. Level equipment as required.
5. Equipment should be located near a floor drain. The floor drain should be adequate in size to handle the softener backwash flow rate.

NOTE: The fiberglass pressure vessel is treated for an internal negative pressure of 5y HG (17 Pa) vacuum below atmospheric. If negative pressure should ever exceed 5y HG (17 Pa), an adequate vacuum breaker must be properly installed.

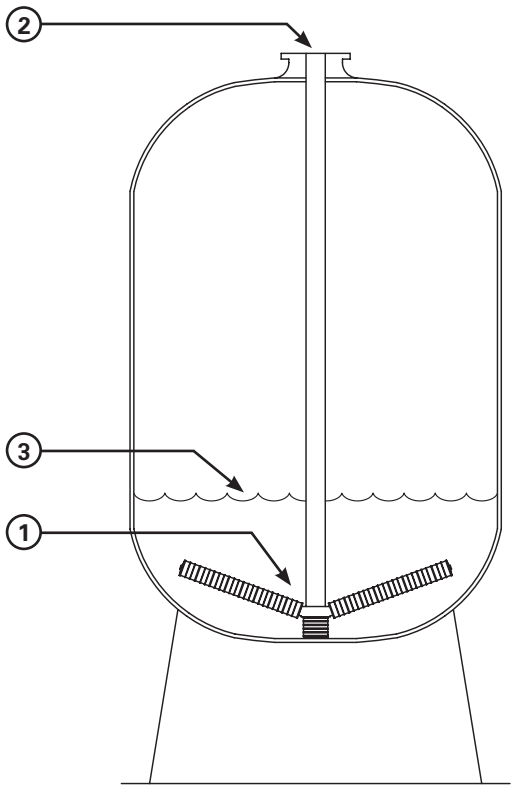
6. Interconnecting piping and shut off valves of equipment should be installed per local plumbing codes by a certified plumber.
7. Unions to be installed in the drain line for cleaning of the backwash flow control. **Do NOT** reduce the drain line pipe size, or install a manual shut off valve. Provide an air gap in the drain line in accordance with local plumbing codes.
8. Before installing any flow meters, read the instruction manual on proper installation of the sensor. Many flow meters must be installed in a certain way to operate properly.
9. Once installed close all manual shut off valves.
10. Brine tank should be located near the softeners, installed on a smooth flat surface. If not the brine tank should be placed on a smooth piece of exterior plywood and leveled.
11. Once the brine tank has been set in place, remove the lid and check that the brine well is in a vertical position. If the brine tank is equipped with a brine valve/float assembly, remove and check to make sure the brine float setting is correct (See Section 7 – Brine Float Setting). The float will have a certain setting depending on the amount of salt used per regeneration. If incorrect adjust float to proper setting.
12. Place brine valve into brine well and set all the way to the bottom of the brine tank.
13. Fill brine tank with approximately 13-19 inches of water. The water level should be approximately half to the height of float setting.

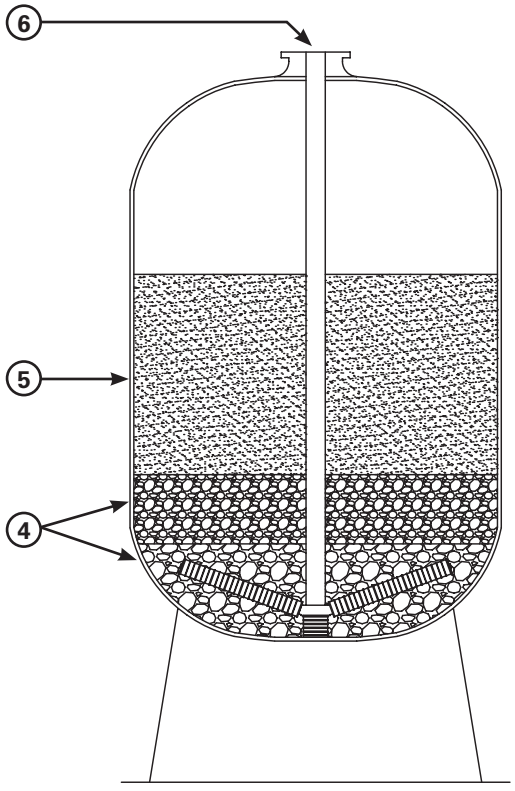
3.2 Loading Gravel & Resin

1. Before loading the gravel, check the lower distributor for possible damage from shipping. Making sure all laterals are in proper location. Do **NOT** proceed with loading if any damage is evident.
2. Once the distributor is checked out ok, plug the end of the distributor tube with a PVC cap/plug, clean rag or tape to keep the gravel and resin out of the center of the riser.
3. Fill the tank approximately 1/4 -1/3 full of water. The water will act as a buffer when loading the gravel and prevent any damage to the lower distributor.
4. Determine the amount of gravel and resin required for each tank. **When coarse, medium and fine gravels are specified, add in that order.** Slowly pour the gravel into the tank. Try to keep it as level as possible. **(Not all systems have multiple sizes of gravel)**
5. Once the gravel has been loaded. Slowly pour the determined amount of resin into the tank. Try to keep it as level as possible.
6. Flush the tank opening with water to clean resin beads from the top of the tank. Then, remove the cap, plug, rag or tape from the distributor pipe. Apply a light coat of approved lubricating silicone to the top edge of the pipe.

(DO NOT USE PETROLIUM LUBRICANTS, ie. Vaseline)

7. Finish filling the tank with water, up to the top. This will eliminate air space and prevent excessive air – head pressure when the water conditioner is pressurized.
8. Once completed, lubricate the o-ring and carefully install control valve, then secure the top flange.
9. Keep power off until final checkout procedure is completed.





3.3 Start-Up Procedures

1. Once the piping and installation completed, and with the mineral in the tank, proceed with the following.
2. Open the manual by-pass valve. The manual inlet and outlet valves are to remain closed.
3. Plug electrical power of the main controller to a wall outlet (120v)
4. The main controller is ready to be programmed. See Section VIII – Clack WS2H and WS3 control valve & programming guide. Familiarize yourself with this manual, on proper wiring and programming procedure of the controller.
5. Once the programming of the valve is completed, manually set the unit into backwash. Slowly open the manual inlet valve. DO NOT OPEN INLET VALVE COMPLETELY. (Full flow of water could cause loss of resin) Water will enter in the bottom of the mineral tank, causing any air to expel from top to the drain. Continue to slowly fill until all the air has expelled from the tank and only water flows to drain.
6. When only water flows to drain, open manual inlet valve completely and continue backwashing until water is clear from any color.
7. Manually set the unit through regeneration one step at a time. When doing this make sure the piston completely comes to a stop before proceeding to the next step.
8. One completed set the other unit into backwash and repeat steps 5, 6, & 7.
9. Fill brine tank with proper amount and type of salt recommended.
10. Close the manual by-pass valve and open manual outlet valves. The system is ready for service.

Section 4: Operating & Regeneration Procedures

4.1 Normal System Operation

The system is designed for fully automatic operation. Service runs will automatically terminate when an exhaustion end-point is reached.

Although it should not be absolutely necessary to observe every regeneration, Operators should periodically witness a complete cycle to make sure that critical flow rates and steps have not gotten out of adjustment.

Daily

Date and Time
Meter Reading
Outlet Hardness
Inlet Hardness
Inlet and outlet pressure gauge readings; calculated pressure drop
Record Salt Usage

Miscellaneous

All of this information can be invaluable in detecting if something is going wrong, or when trouble shooting. High-pressure drop during the run can be symptomatic of buildup of suspended solids on the bed or excess breakage of resin beads. Short runs or higher than normal effluent hardness could be caused by resin fouling. This could be caused by malfunction during regeneration or even a contaminated batch of salt.

4.2 Multi-Port Valve Operation (See Section 8 – Clack Control Manual)

Multi-port valve consist of Clack multi-port double piston operated valve. The valve operates with upper and lower piston that moves on a seals and spacer assembly. The upper piston is for regeneration and the lower piston is for service. The piston moves to a certain location, which determines the operation position of the unit.

SERVICE

During service flow, raw water passes through the valve and downflow through the softener up through the distributor tube to service. Service flow continues until the water meter/ counter has signaled an end of run and will automatically switch service flow to the other unit and go into regeneration.

REGENERATION

Based on 10 grains/gallon of hardness as $CaCO_3$, approximately 3000 gallons of water per cubic foot of resin in the softener can flow before exhaustion of resin.

BACKWASH

Raw water flow is diverted to pass down through the distributor tube and up-flow through the softener. The water expands the bed scrubbing the resin beads and washing any entrapped dirt out to drain. Backwash sequence lasts approximately 15 minutes.

BRINE AND SLOW RINSE

Raw water is directed through the ejector located at the multi-port valve creating a venturi action in the ejector to draw the required amount of brine into the softener. The brine float air check valve shuts off the brine flow when the preset draw down is reached. Raw water continues to the drain slow rinsing the resin for the remainder of the cycle. Brine and slow rinse sequence generally lasts 60 minutes.

FAST RINSE

Raw water passes through the multi-port valve down flow through the softener and out to drain. This sequence removes all remaining brine from the resin and lasts 10 minutes. When the regeneration cycle is completed and the softener goes back into service, raw water will backflow through the ejector refilling the brine tank to its normal level. The brine valve float will control water makeup level.

Section 5: Operator Responsibilities

5.1 Operator Maintenance

Long term, reliable system performance depends upon how conscientiously the equipment is operated and maintained. Operator responsibilities should include the following recommended practices:

1 Maintain Operating Logs - Operators should maintain close control of the process by monitoring system performance daily. Effluent hardness, service run lengths and pressure drop should be recorded. Since resins are subject to fouling, decrease in product quality or run length could be the result of fouling. In addition to operating data, log notations should include equipment design changes, or modifications in programmed times. This information can be invaluable if trouble shooting is ever required.

2 Check Regeneration Flow rates - Check and adjust flows during regeneration on a regular basis.

3 Institute, a Program of Preventative Maintenance - Setup a definite schedule for routine maintenance. Typical recommended practices are: annual resin sampling and analysis; and annual inspection, lubrication and/or replacement of diaphragms on all diaphragm valves.

5.2 Salt Specification - Use Salt As Specified.

a. ***Type*** - Rock salt or evaporated salt

b. ***Color*** - White to grayish white

c. ***Composition*** - Not less than 98% sodium chloride, with a minimum of calcium and magnesium salts; zero phenolphthalein alkalinity (Alkalinity P); no grease, fat, or oil content

d. ***Fineness*** - Softeners using polyethylene brine tanks, with no gravel in the bottom, must use an extra coarse grade of rock salt.

e. ***Solubility*** - The salt should dissolve rapidly without packing, to form a clear solution.

Section 6: Trouble Shooting

6.1 General

The most common system failures are either “poor water quality’ or “short service run. lf the change in performance occurs suddenly – i.e., within a couple of operating cycles, 9 times out of 10 these problems result from:

a Insufficient regenerating chemical quantity,

b Poor control of chemical concentrations and/or flow rates,

c Over-running (over exhausted) resin beds during a service run

d Flow channeling because of a plugged or failed internal flow distributor.

If however, the change occurs gradually over a period of weeks or months, the problem is more likely due either to a change in feed water mineral content or from fouling of the resins. Under any circumstance, the importance of maintaining Operating Logs cannot be stressed too strongly. Study of the Log will often reveal any trend that might be developing. In the case of fouling, periodic resin analyses are the only way to identify such problems.

General guidelines that wilt assist in determining common operating difficulties are given below. Often poor performance results because of one or more contributing factors. The recommended approach is to go systematically through the list to see what symptoms apply and then to take corrective action.

6.2 Reduced Capacity Or Poor Effluent Quality

SOURCE OF TROUBLE	POSSIBLE CAUSE	CORRECTIVE ACTION
Change In Chemical Composition Of Raw Water	Higher hardness in raw water	Check hardness by chemical test. If it has changed, compute new capacity and use new meter setting
Softener Being Overrun Consistently	Raw water has more hardness	Check raw water hardness and meter setting. Give unit a “double regeneration
	Meter setting is incorrect	Reset meter per manual
Incorrect Chemical Test Results	Test procedure in error	Follow instructions carefully
	Chemicals for test causing error	Replace weak or contaminated test solutions
Meter Slippage	Worn or damaged meter	Replace or repair as necessary

Inadequate Regeneration	Using a weak (less than 22 Be) brine solution	Recharge at required times Use salt which meets specification
		Use correct amount of dilution water
	Not using enough salt	Check text for specified amount. Use correct saturated brine draw (or pumpage)
Loss Of Ion Resin	Surges during backwash	Install pressure regulator
		Replace lost ion exchanger resin
***Fouling Of Ion Resin**	Oxidized iron (Fe) or manganese (Mn) coating resin	If iron & manganese are in oxidized form at source, provide filter to remove. If water supply is clear when first drawn (Fe & Mn are in soluble form) eliminate any air leaks from suction piping. Do NOT feed chlorine or other oxidizing chemicals before softening the water
	Organic matter (slime) coating resin	Provide treatment to destroy organic matter
Damage To Ion Resin	High concentrations of chlorine (or other oxidizing agents) in water.	Add reducing agent (such as Sodium Sulfite) or otherwise remove
Channeling - caused by:		
1. Dirty or packed bed	Backwash rate too low	Adjust controller to correct rate
	Dirty inlet water or backwash water	May require pretreatment
2. Gravel hills, tipped bed or potholes	Careless placement of supporting bed	Inspect and probe bed
	Surges during backwash	Install pressure regulator
	Air in backwash water.	Eliminate air leaks and cause of surges

*NOTE: It is sometimes possible to restore a fouled bed to its original condition, or very nearly so.

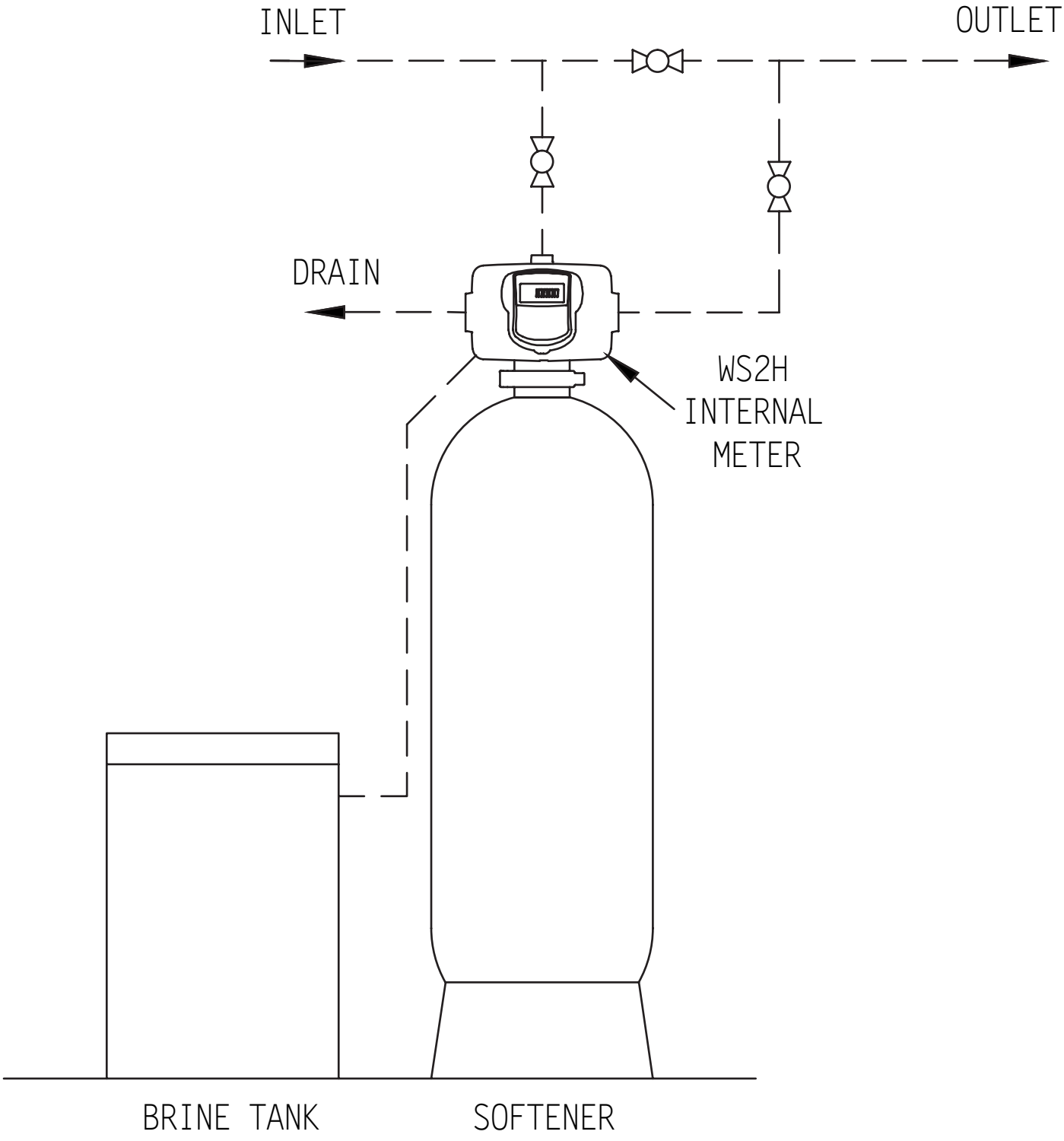
6.3 Increase Pressure Lose Or Decrease In Flow Rate

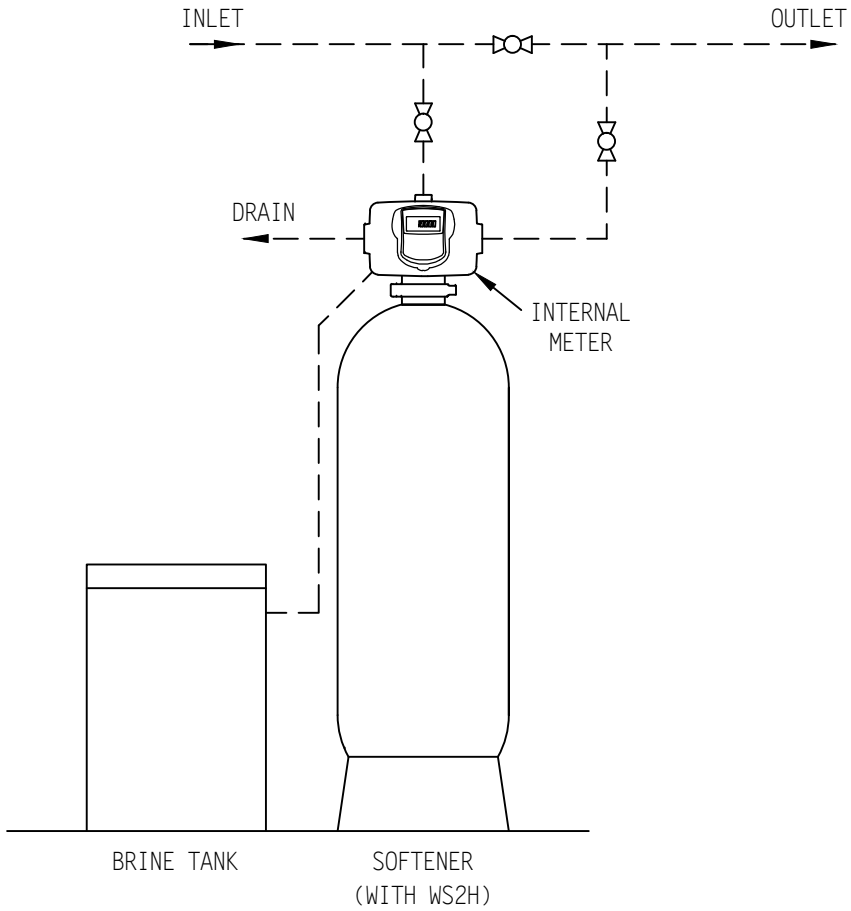
Dirty Or Packed Bed - See above for possible causes and corrective actions.

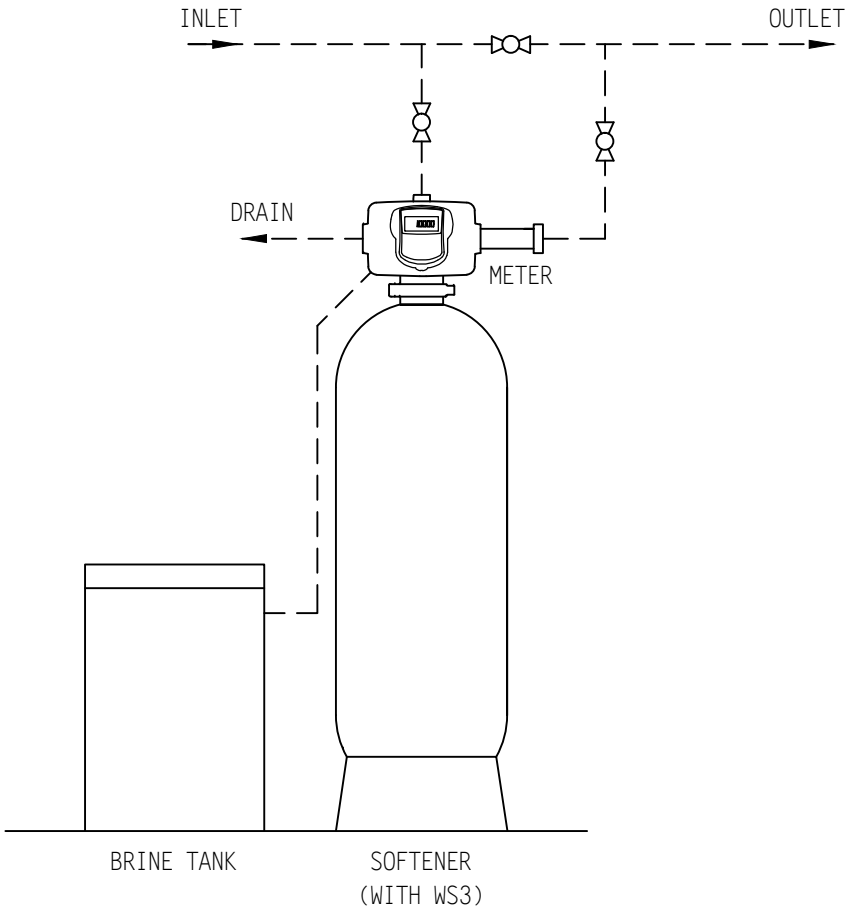
Restricted Flow – Obstruction in meter, piping or valves. Inspect and clean as required.

Section 7: Softener System Drawings & Specifications

7.1 Typical Single Unit Installation







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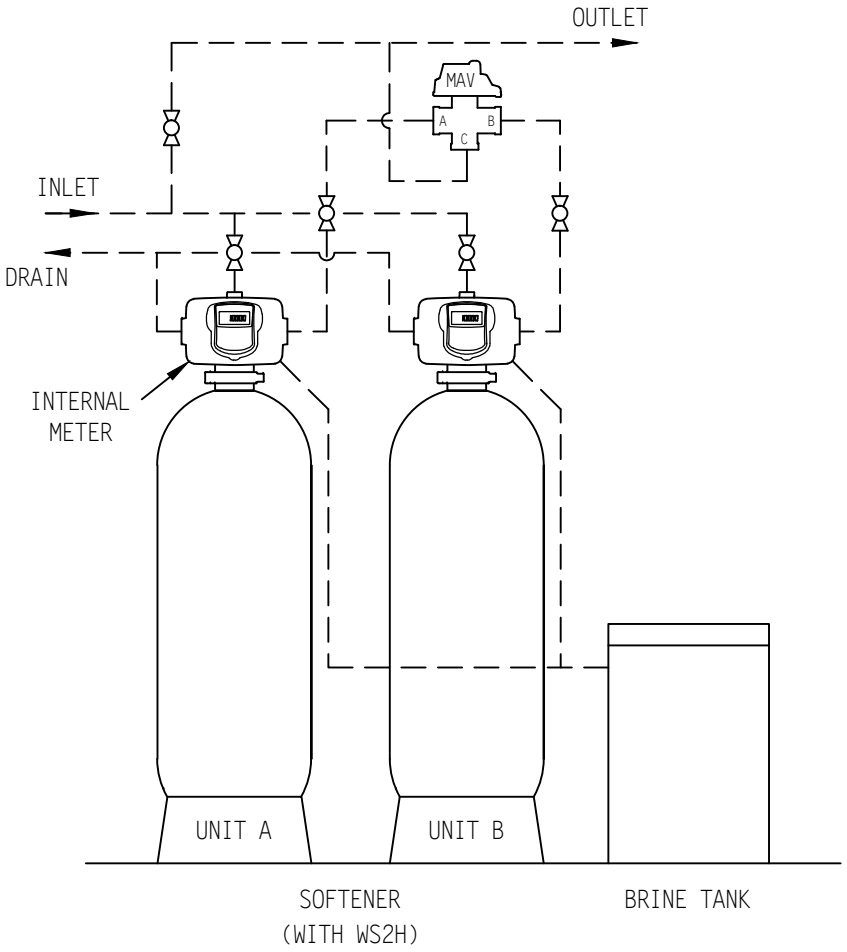
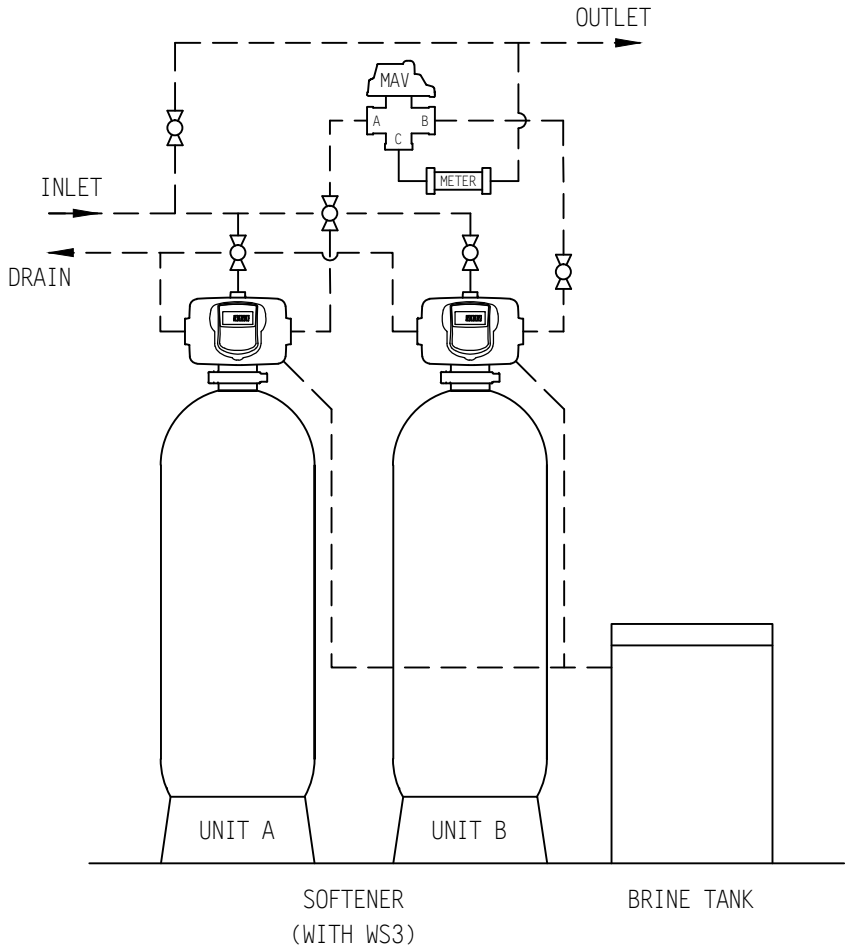
7.1 TYPICAL SINGLE TANK SYSTEM





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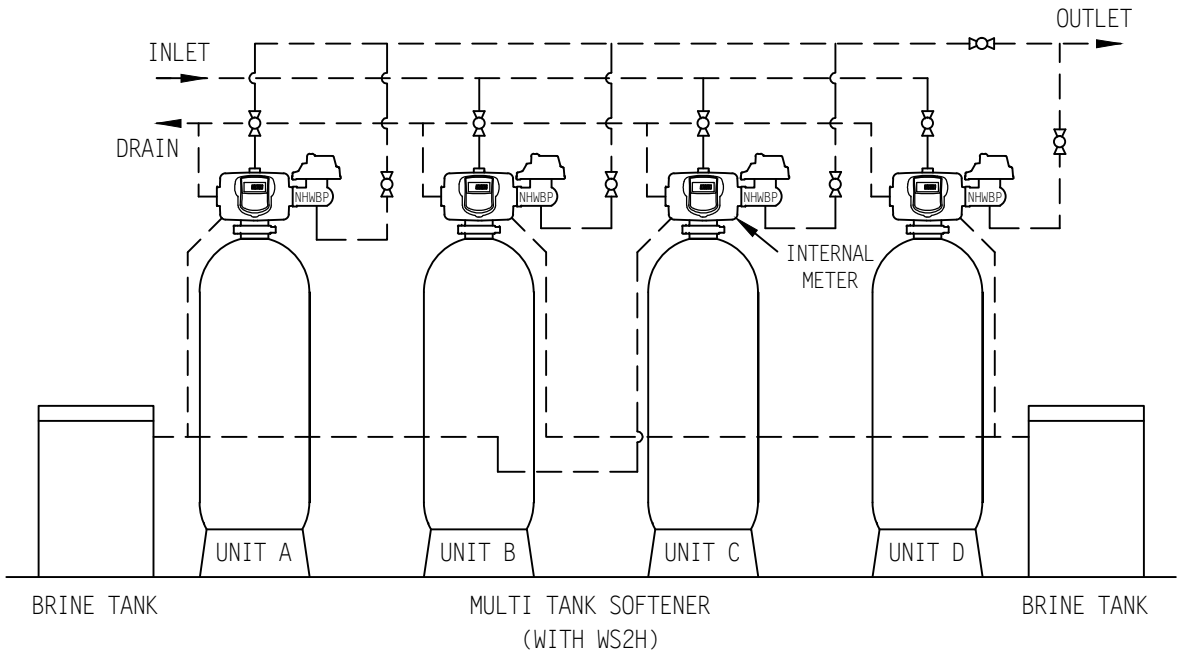
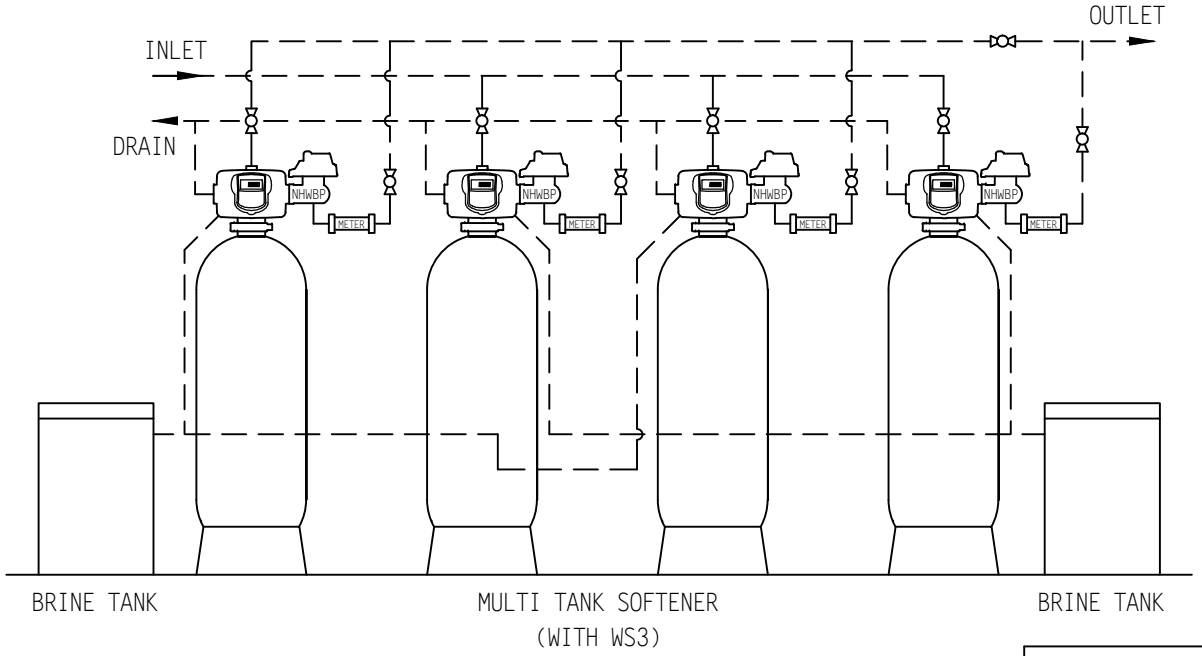
7.2 TYPICAL TWIN ALTERNATING SYSTEM





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7.3 TYPICAL MULTI TANK SYSTEM

7.2 Specifications

WS2H & WS3 Specifications

Model	Tank Size		Capacity		Resin	Support Bed		Flow Rates*		BKW	Salt Req'd	
Number	Resin	Brine	Min[1]	Max[2]	Cu Ft	½ x	¼ x	Min	Max		9#	15#
WS2-210	21 x 62	24 x 50	168k	210k	7	50	100	66	85	12	70	105
WS2-300	24 x 72	30 x 48	240k	300k	10	100	150	73	94	15	100	150
WS2-450	30 x 72	39 x 48	360k	450k	15	100	250	88	113	25	150	225
WS2-600	36 x 72	50 x 60	480k	600k	20	150	350	97	126	35	200	300

Model	Tank Size		Capacity		Resin	Support Bed		Flow Rates*		BKW	Salt Req'd	
Number	Resin	Brine	Min[1]	Max[2]	Cu Ft	½ x	¼ x	Min	Max		9#	15#
WS3-300	24 x 72	39 x 48	240k	300k	10	150	100	120	170	15	90	150
WS3-450	30 x 72	39 x 48	360k	450k	15	250	100	155	210	25	135	225
WS3-600	36 x 72	42 x 60	480k	600k	20	350	150	185	250	35	180	300
WS3-900	42 x 72	50 x 60	720k	900k	30	450	250	200	270	50	270	450
WS3-1200	48 x 72	50 x 60	960k	1200k	40	600	300	205	280	60	360	600
WS3-1950	60 x 72	60 x 66	1560k	1950k	65	1000	400	213	275	100	585	975

7.3 Brine Float Settings

Tank Size	Cu. Ft.	Brine Tank	Brine Valve[1]	Salt Deck[2]		Brine valve set at[3]	
				Yes	NO	9lb/cf.	15lb/cf.
30 x 72	15	30 x 48	494	9"		26"	44"
					X	38"	—
		39 x 48	494	9"		14"	25"
					X	23"	34"
36 x 72	20	39 x 48	494	12"		18"	39"
					X	30"	—
		42 x 60	494	9"		17"	30"
					X	26"	39"
42 x 72	30	42 x 60	494	12"		27"	—
					X	39"	—
		50 x 60	494	12"		16"	29"
					X	28"	41"
48 x 72	40	50 x 60	494	12"		29"	—
					X	37"	—
		60 x 60	494	12"		—	26"
					X	26"	38"

Notes:
1 - Brine Valve Clack 494 – 1" connection
2 - Salt deck height as noted.
3 - Float setting from bottom of brine tank.

494 1" Commercial Brine Valve

U.S. and Foreign Patents Pending

Built from a revolutionary new design the 494 1" commercial brine valve delivers on today's demand for simplicity and higher brine draw and refill rates. The 494's "top of brine tank" design allows for easy access and serviceability as well as brine draw rates up to 20 gpm and refill rates up to 10 gpm.

The patent pending design features an "over-center" check disc to prevent prechecking during brine refill, when air in the brine line could cause excessive flow rates.

The 494 brine valve also features a new adjustable float design, which allows the float to be adjusted with a simple twist of the locking nut.

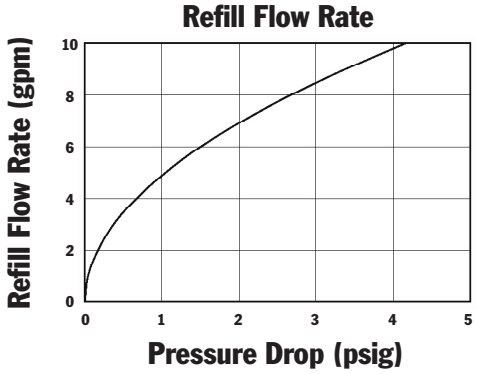
The 494 assembly (H4900) includes the brine valve, two brine connection elbows, adjustable float, air check assembly with 60" riser, 1" riser adapter and float rod guide.

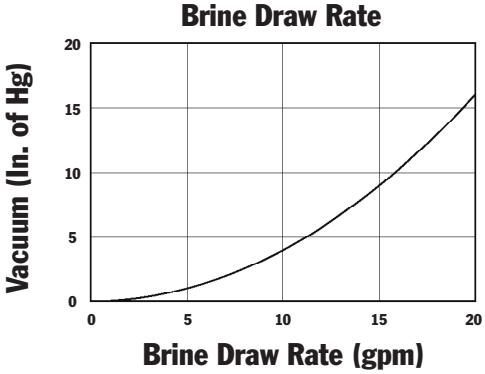
PRODUCT FEATURES

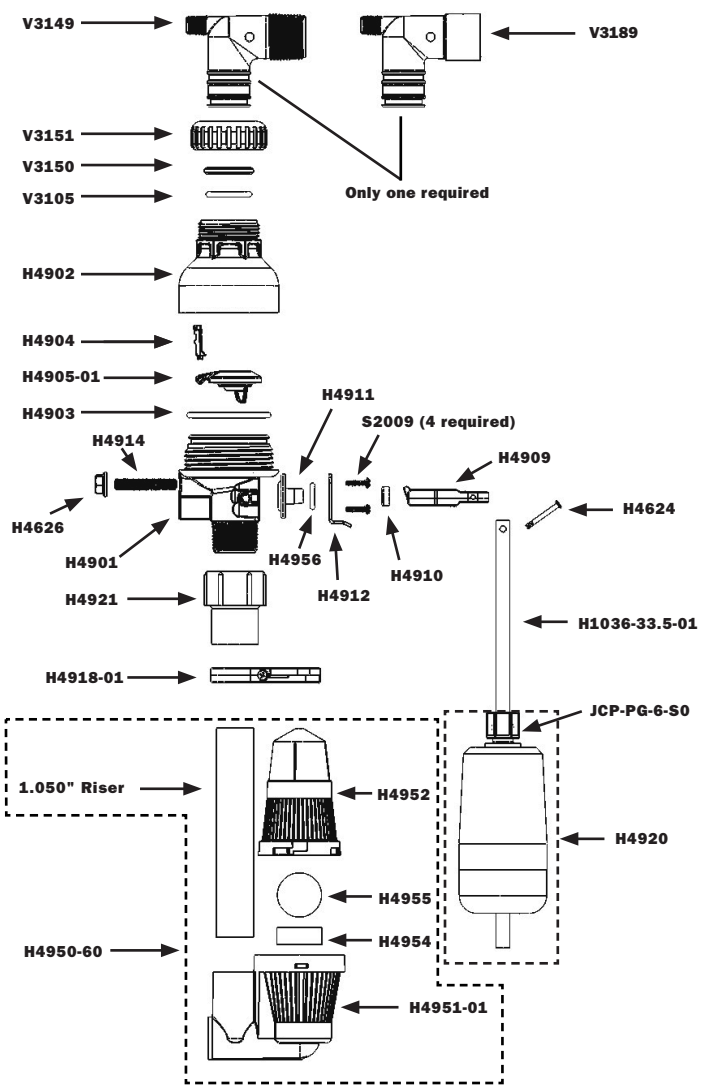
- High flow rates in both refill and draw position
- Plastic valve and air check
- Brine Valve molded from composite plastics to ensure strength and durability
- Easily adjustable float design with locking nut
- Easy access to check disk for serviceability
- Two Brine elbows included (1" PVC male and ¾" x 1" PVC solvent)

ORDER INFORMATION

Order No.	Description	Qty/Ctn
H4900	494 1" BRINE VALVE, FLOAT ASSEMBLY, AIR CHECK AND 60" RISER (AS SHOWN IN PICTURE)	1
H4940	494 1" BRINE VALVE AND FLOAT ASSEMBLY ONLY (LESS RISER AND AIR CHECK)	1
H4950	494 1" AIR CHECK (LESS RISER)	1
H4950-48	494 1" AIR CHECK WITH RISER (48" LENGTH)	6
H4950-60	494 1" AIR CHECK WITH RISER (60" LENGTH)	6







ORDER NUMBERS:

JCP-PG-6-S0	Nut 3/8	H4921	1” Socket Adapter
H1036-33.5-01	Float Rod	H4950-60	Air Check with Riser 60" length
H4624	Float Rod Pin		
H4626	Mounting Stud Nut	H4951-01	Air Check Body
H4901	Body	H4952	Air Check Basket
H4902	Cap	H4954	Air Check Seat
H4903	O-Ring 226	H4955	Air Check Ball
H4904	Disk Retaining Block	H4956	Diaphragm Backup Ring
H4905-01	Check Disk Asy	S2009	Screw #6 X 5/8 SS
H4909	Cam Lever Arm	V3105	O-Ring 215
H4910	Diaphragm Retaining Band	V3149	FTG 1 PVC Male NPT Elbow
H4911	Diaphragm Seal	V3150	Fitting Split Ring
H4912	Diaphragm Retainer	V3151	Fitting Nut
H4914	Mounting Stud	V3189	FTG 3/4&1 PVC Solvent Elbow
H4918-01	Float Rod Guide Asy		
H4920	Float w/Lock 160 grams		

494 1" Commercial Brine Valve Installation Guide

1. If an external flow control is used, install on the inlet side of the brine valve.
2. Use Teflon tape only on threaded plastic connections. Many liquid or paste pipe sealing products contain compounds that may cause plastics to crack with time.
3. Position float. Hand tighten the nut.
4. Place the float rod guide close to the float (but not as to hinder float operation), adjust the guide to position the float so float rod pin operates freely and tighten securely.
5. Position the assembly securely in the brine well and check to see that there is no interference with the float operation.

NOTE: When brine valve is used as a safety float for timed brine systems use refill rates up to 10 gpm. If used as a primary shut off, use refill rates up to 5 gpm. Repeated float closures at high refill rates can cause “water hammer,” which may damage the plumbing. This brine valve is designed for salt brine only and will fit inside a brine well that is 5" diameter or larger.

7.3 Commercial/Industrial Rotationally Molded Brine Tanks

Commercial and industrial water softeners require a large volume of brine during each regeneration. From a capacity of 95 gallons to 500 gallons, our Rotationally Molded Brine Tanks are built to last. Molded out of durable, chemically resistant high density polyethylene, their 1/4" seamless walls won't bulge. All tanks and covers are black. Rotationally Molded Brine Tanks are strong enough to handle your toughest brine requirements.

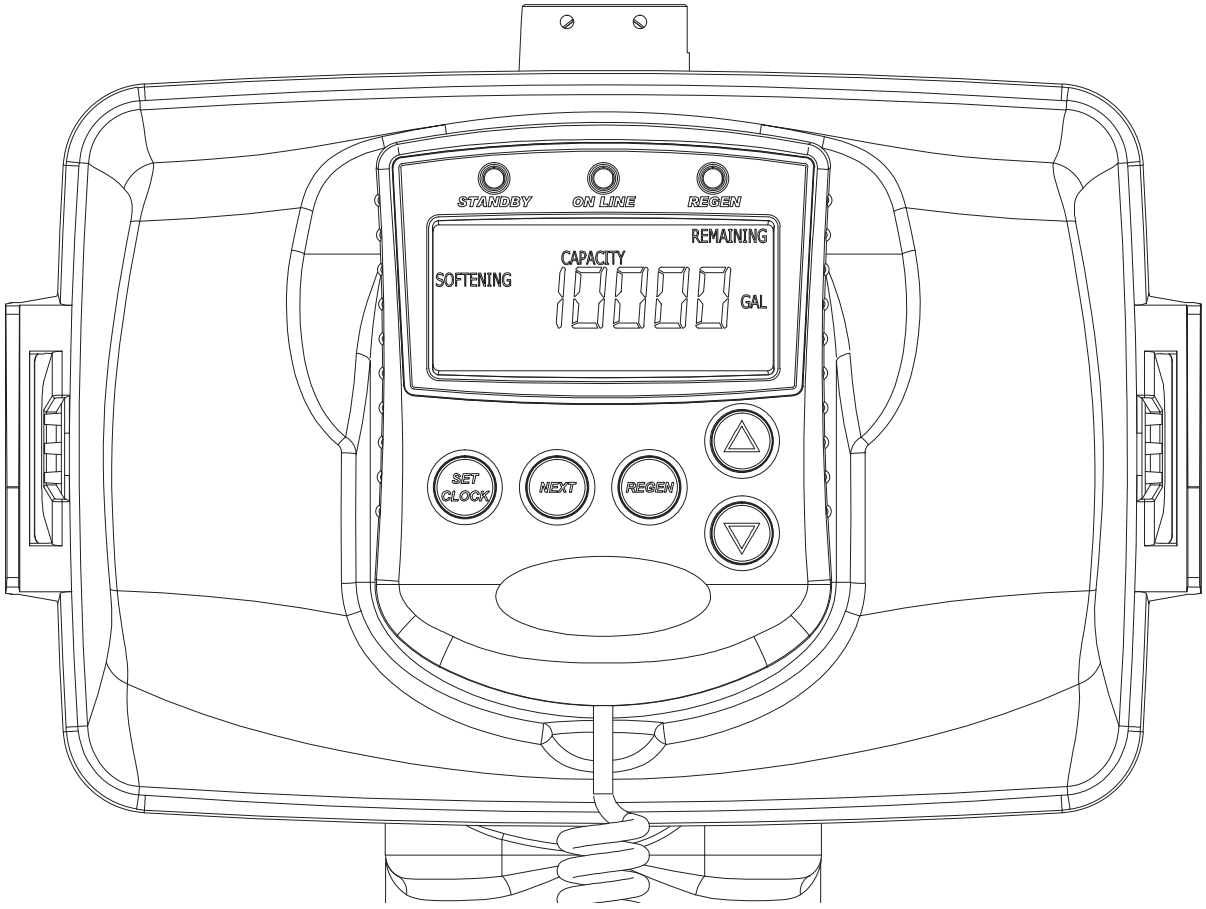
Also available:

24" Plastic Grids
30" Plastic Grids

TANK SIZE	ORDER NUMBER	DIAMETER	HEIGHT	SALT CAPACITY	VOLUME	WEIGHT
24 x 48	G22448CB1P00	24"	48"	800 lbs.	95 gal.	30 lbs.
24 x 60	G22460CB1P00	24"	60"	1000 lbs.	115 gal.	32 lbs.
30 x 48	G23048CB1P00	30"	48"	1200 lbs.	145 gal.	48 lbs.
30 x 60	G23060CB1P00	30"	60"	1600 lbs.	180 gal.	56 lbs.
39 x 48	G23948CB1P00	39"	48"	2200 lbs.	250 gal.	67 lbs.
39 x 60	G23960CB1P00	39"	60"	2700 lbs.	300 gal.	80 lbs.
42 x 60	G24260CB1P00	42"	60"	3100 lbs.	350 gal.	84 lbs.
50 x 60	G25060CB1P00	50"	60"	4500 lbs.	500 gal.	107 lbs.

Section 8: Service Manuals

Water Specialist
WS2H and WS3 Control Valve
Manual



HYDROCARBONS SUCH AS KEROSENE, BENZENE, GASOLINE, ETC., MAY DAMAGE PRODUCTS THAT CONTAIN O-RINGS OR PLASTIC COMPONENTS. EXPOSURE TO SUCH HYDROCARBONS MAY CAUSE THE PRODUCTS TO LEAK. DO NOT USE THE PRODUCT(S) CONTAINED IN THIS DOCUMENT ON WATER SUPPLIES THAT CONTAIN HYDROCARBONS SUCH AS KEROSENE, BENZENE, GASOLINE, ETC.

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GENERAL SPECIFICATIONS AND PRE-INSTALLATION CHECKLIST
TABLE 1

Minimum/Maximum Operating Pressures	20 psi (138 kPa) -125 psi (862 kPa)			
Minimum/Maximum Operating Temperatures	40°F (4°C) – 110°F (43°C)			
Power Adapter: Supply Voltage Supply Frequency Output Voltage Output Current	U.S. 120V AC 60 Hz 20V or 24V AC (see Table 2) 800 mA		International 230V AC 50 Hz 20V or 24V AC 800 mA	
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.				
Service flow rate	WS2H Valve: 125 gpm (473 lpm, 28.4 m_3/h) @ 15 psig (103 kPa) drop WS3 Valve: 250 gpm (946 lpm, 56.8 m_3/h) @ 15 psig (103 kPa) drop			
Backwash flow rate	WS2H Valve: 125 gpm (473 lpm, 28.4 m_3/h) @ 25 psig (172 kPa) drop WS3 Valve: 220 gpm (833 lpm, 50.0 m_3/h) @ 25 psig (172 kPa) drop			
CV Service	WS2H Valve: 32.3 WS3 Valve: 64.6			
CV Backwash	WS2H Valve: 25.0 WS3 Valve: 44.0			
Meter: Accuracy Flow Range	WS2H Valve: Internal Meter + 5 % 1.5 – 125 gpm (5.7 – 473 lpm)	WS3 Valve: Optional External Meter + 5 % 3.5 – 350 gpm (13.3 – 1325 lpm)		
Regenerant Refill Rate	WS2H and WS3 Valves: Variable - Shipped from Factory with 2.2 gpm (8.33 lpm)			
Injectors	WS2H & WS3 Valves: See Injector Graphs V3010-2A through 2H			
Brine Line Adapters Included	1” Male NPT Elbow & ¾” x 1” Solvent Weld Elbow			
Inlet, Outlet and Drain Line Openings	WS2H Valve: 2” Female NPT or BSPT or 2.5” Groove Lock WS3 Valve: 3” Female NPT or BSPT, No Groove Lock			
*Distributor Tube Sizing: WS2H Valve WS3 Valve	Female NPT Inlet & Outlet		Female BSPT Inlet & Outlet	
	2.375” OD (2.0” NPS) 3.5” OD (3” NPS)	+2.25” - +2.5” +2.5” – 2.75”	63 mm OD 90 mm OD	+57 mm - +64 mm +64 mm - + 70 mm
Tank Connection: WS2H Valve WS3 Valve	4”-8UN, 6” Flange, Side Mount (2” Female NPT or BSPT or 2.5” Groove Lock) 6” Flange or Side Mount (3” Female NPT or BSPT)			
Shipping Weight	WS2H Valve with Meter: 50 lbs. (22.7 kg) WS3 Valve: 57 lbs. (25.9 kg) Meter Sold Separately			
PC Board Memory	Nonvolatile EEPROM (electrically erasable programmable read only memory)			
Compatible with the following typical concentrations of regenerants/chemicals	Sodium chloride, potassium chloride, potassium permanganate, sodium bisulfite, chlorine and chloramines			

*Height is based off the top of tank. Installer to verify proper engagement and allowance for tank expansion

SOFTWARE AND POWER SUPPLY COMPATIBILITY
TABLE 2

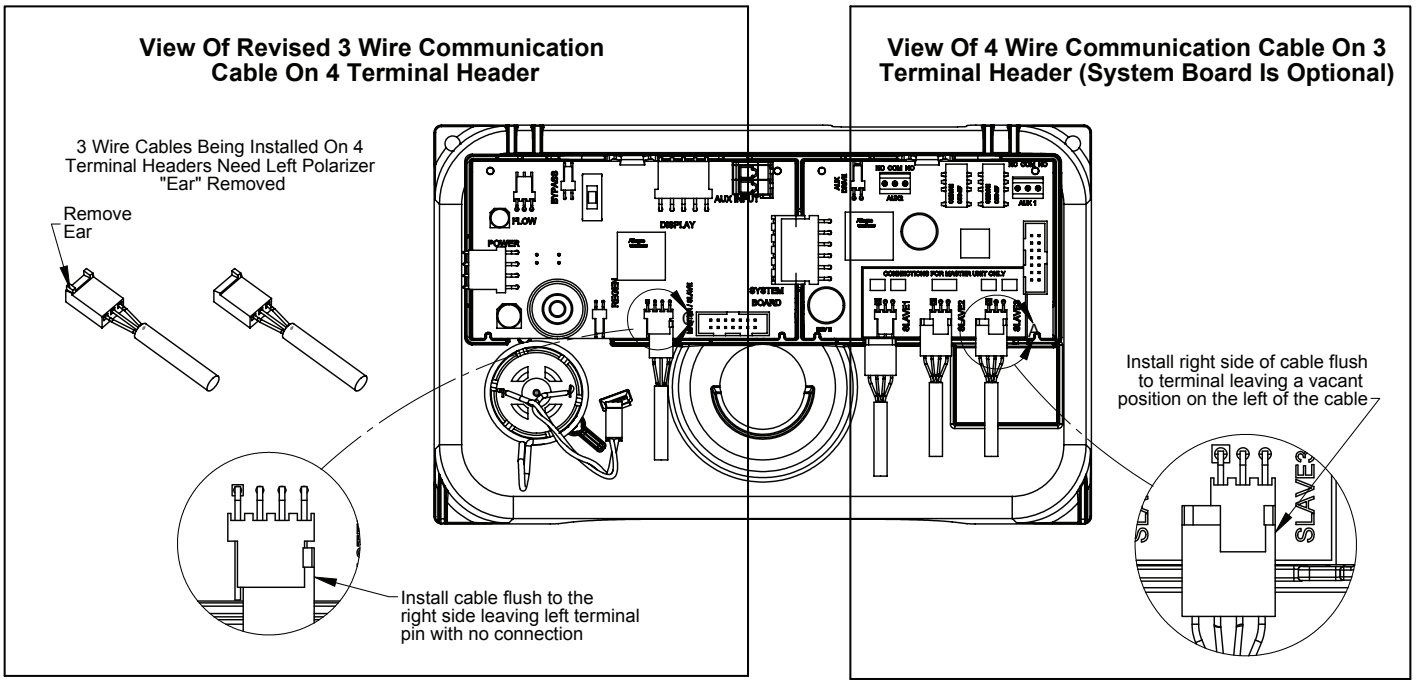
Software Version		Power Supply	
V3242-01BOARD Main Board[1]	V3243-01BOARD System Board	Output Voltage	Part # and Description
114.10	1.03	24 VAC	V3461[2] WS2H/3 AC ADAPTER V3461EU WS2H/3 AC ADAPTER EU V3461UK WS2H/3 AC ADAPTER UK
114.11			
115.17	1.07 or 1.08		
115.25			
200.01			
215.02	1.11 or 1.13		
215.03			
215.04			
215.10	1.11 or 1.13	20 VAC[3]	V3461-01 WS2H/3 AC ADAPTER 20V V3461EU-01 WS2H/3 AC ADAPTER EU 20V V3461UK-01 WS2H/3 AC ADAPTER UK 20V
216.04 or greater	1.13 or greater	20 VAC	V3461-01 WS2H/3 AC ADAPTER 20V V3461EU-01 WS2H/3 AC ADAPTER EU 20V V3461UK-01 WS2H/3 AC ADAPTER UK 20V

[1]It is recommended to maintain one version throughout a system.
[2]Replacement V3461 power supplies have screw terminals and are shipped less a cord. Use cord from existing power supply to connect to the screw terminals.
[3]V3461EU-01 and V3461UK-01 will not be available for sale until August 2010.

COMMUNICATION CABLE CONNECTION TO PC BOARD LAYOUT

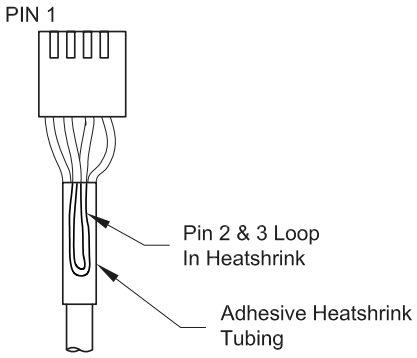
Revised communication cable connectivity.

Refer to diagram (below) when combining 3- and 4-wire communication hardware.



WIRING FOR CUSTOM AC ADAPTER

1. See Table 2 Software and Power Supply Compatibility.
2. Cable should be one unshielded pair of 22AWG, UV resistant UL2464 compliant wire.
3. Connector details:
   a. Terminate end with one Molex white housing, P/N 09-50-8043 and four Molex pins, P/N 08-50-0108.
   b. Pin 1 = AC from power supply (White)
      Pin 2 = Jumper to Pin 3
      Pin 3 = Jumper to Pin 2
      Pin 4 = AV from power supply (Black)

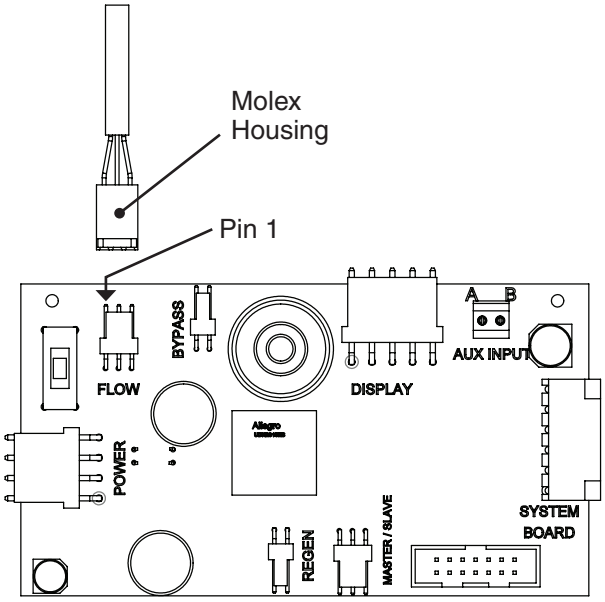


CUSTOM METER WIRING

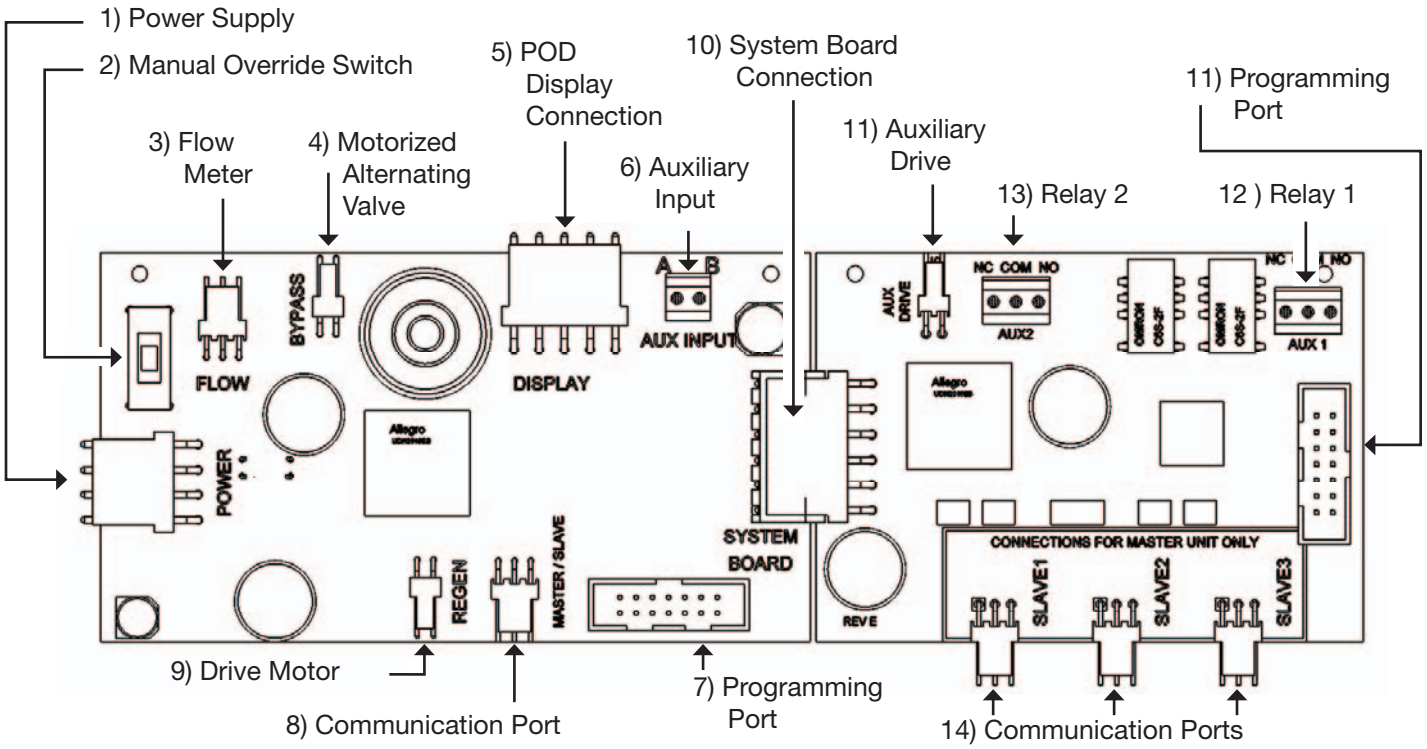
1) Terminate end with a Molex series 2695 housing, part number 22-01-3037 and (3) Molex series 41572 (or 40445) pins, part number 08-65-0805 (or 97-00-44).

2) Auxilliary meter must be able to operate on 5VDC
   Pin 1 = +5VDC,
   Pin 2 (Center) = Signal
   Pin 3 = Ground

3) Acceptable pulse input is .1 – 999 pulses/gallon, or .4 –519 pulses / liter.



MAIN PC BOARD WITH SYSTEM BOARD



Item	Board label	Description
1	POWER	Connect to proper power supply
2	SW1	Manual override switch used to force isolation (On Line or Standby status) The units corresponding LED will flash twice / second to alert its override condition
3	FLOW	Input for the units flow meter
4	BYPASS	Drive circuit for factory motorized isolating valve (MAV or NoHBP)
5	DISPLAY	Connection for POD display or data extraction with the proper software and cabling
6	AUX INPUT	Connect to external dry contacts to control functionality based on the unit's settings **Wiring units inputs in parallel requires matching each units polarity**
7	PROGRAM	Factory use only
8	MASTER/SLAVE	Communication port on the main board can be used on the master of a 2 unit system & is the communication port for any slave unit **Greater than 2 unit systems require the optional system board on the master for additional ports**
9	REGENERATION	Motor circuit used to power the main drive of the unit during regeneration
The following connections are for an optional expansion board		
10	SYSTEM BOARD	Connection for the optional V3243 system board to expand communication ports, add a second motor circuit or relay output functionality
11	AUX DRIVE	2nd Drive circuit for factory motorized isolating valve (MAV or NoHBP)
12	AUX 1	Dry contact outputs to operate external devices based on the program settings of Relay 1
13	AUX 2	Dry contact outputs to operate external devices based on the program settings of Relay 2
		Maximum power through either relay to be: A) 1A, 30 VDC B) 1A, 30 VAC
14	SLAVE 1, 2 or 3	Expanded communication ports for connecting up to 3 additional units to the master unit in a system

TYPICAL SYSTEM EXAMPLES

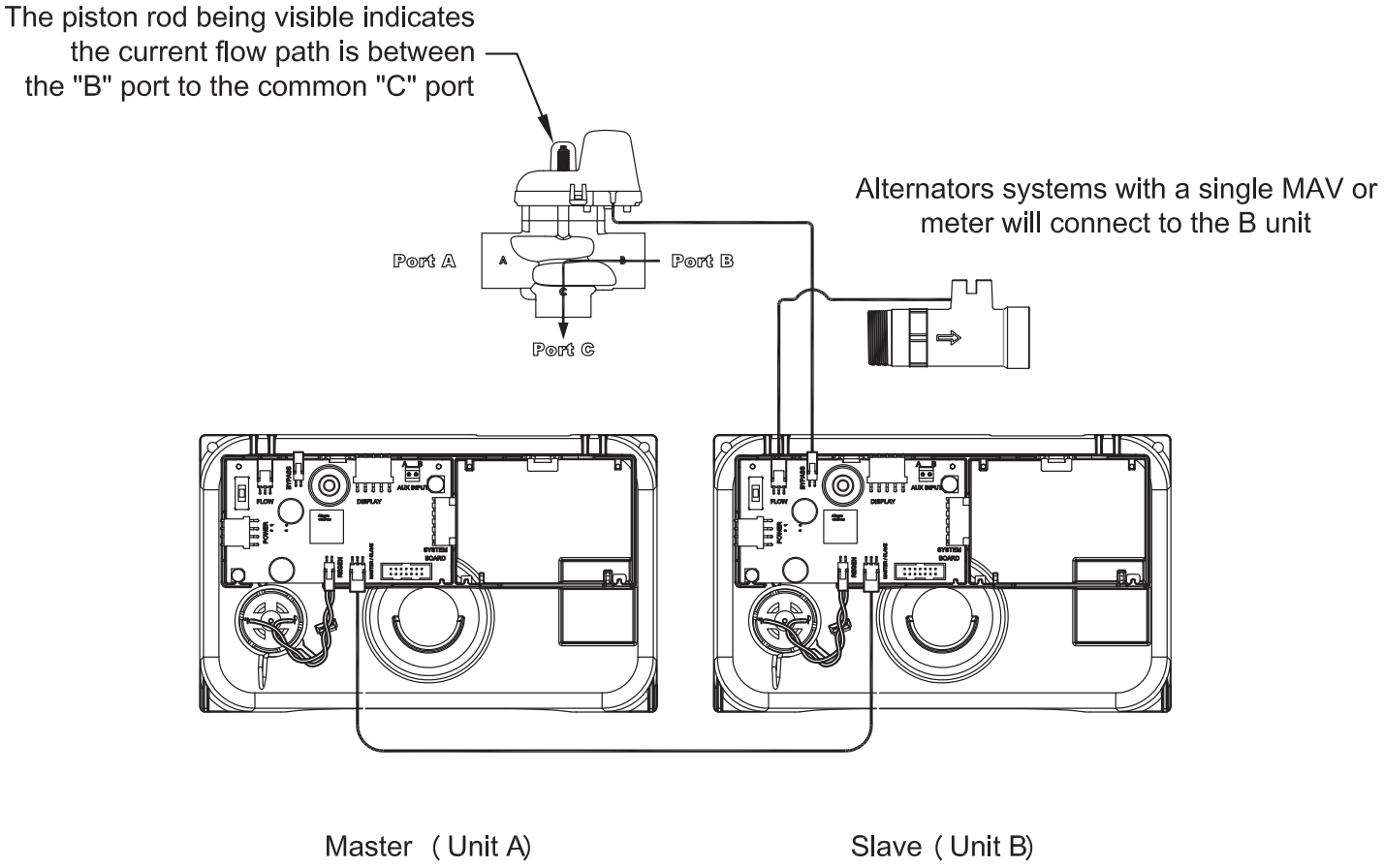
Twin Tank System, Simple Alternator (Sharing a MAV)
System consists of 2 power heads, 1 communication cable and 1 MAV

Electrical Connections:

- The MAV's motor wire is connected to the 2-pin connector labeled BYPASS on Unit 2 (Unit B) PC board
- The communication cable is connected to each unit's 3-pin connector labeled MASTER/SLAVE
- If a single external meter is used, it should be connected to the 3-pin connector on Unit 2 (Unit B) labeled FLOW. NOTE: When using a single external meter, "SYSTEM PULSES" and the proper pulse rate must be selected in the programming section.

Plumbing Connections:

- To regenerate with raw/untreated water, the outlet of each unit is piped to the MAV. Port A will be piped to the Master (Unit A) , Port B to the slave (Unit B), and Port C to the common supply outlet.
- To regenerate with soft/treated water, the inlet of each unit is piped to the MAV. Port A will be piped to the Master (Unit A), Port B to the slave (Unit B) and Port C to the common supply outlet.



TYPICAL SYSTEM EXAMPLES (CONTINUED)

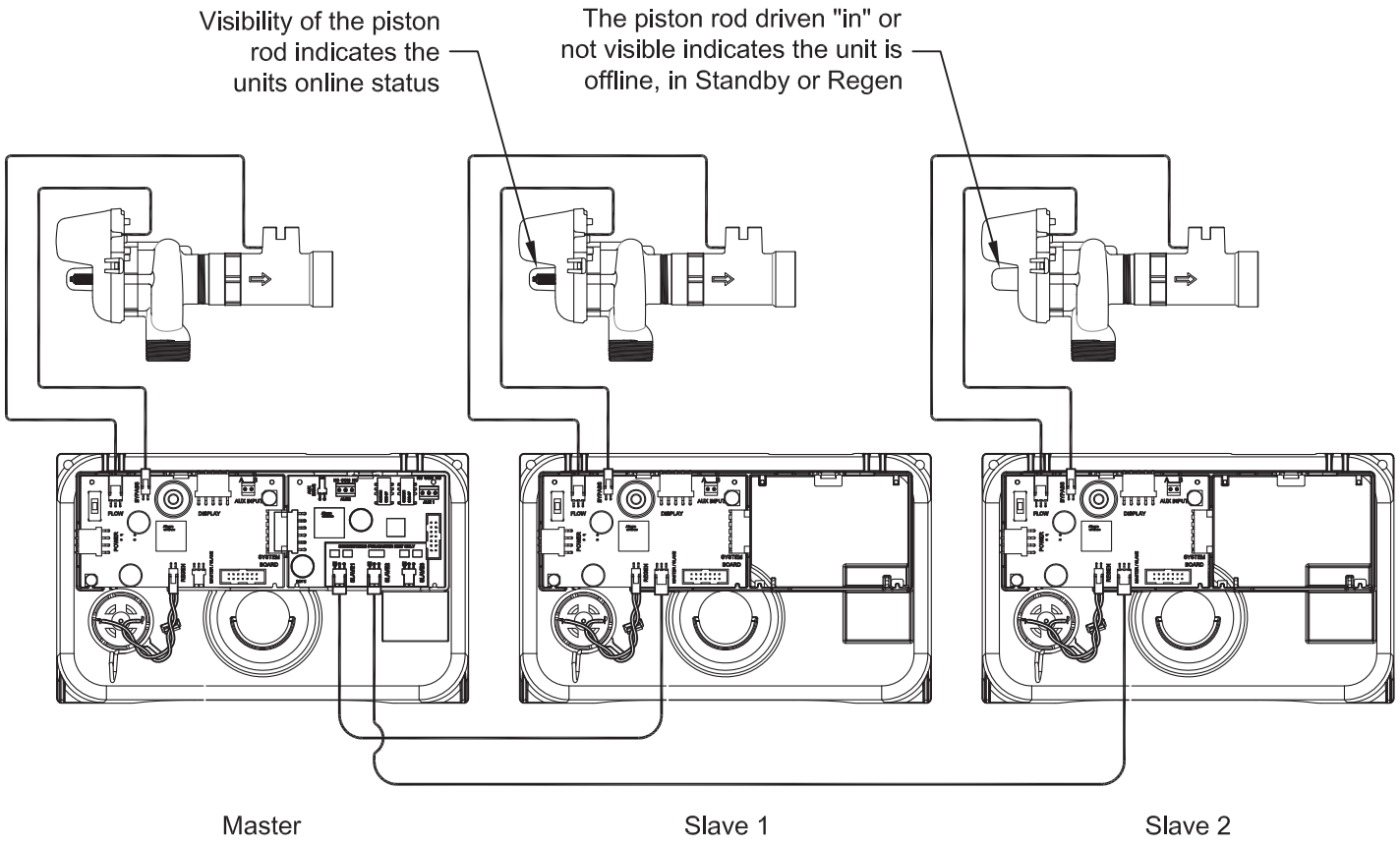
Multi-tank System, 3 Unit shown
System consists of 3 power heads, 2 communication cables and 3 No Hard Water Bypass (Isolation) valves

Electrical Connections:

- Each unit's isolation valve motor wire is connected to the 2-pin connector labeled BYPASS on each unit's PC board.
- The communication cable is connected to each unit's 3-pin connector labeled MASTER/SLAVE
- Communication cables are connected to each unit's 3-pin connector labeled MASTER/SLAVE. NOTE: Systems with more than 2 units require the Master Unit to have the optional System Board for communication port expansion, routing communications from the expansion ports (Slave 1, 2 or 3) to each unit's MASTER/SLAVE connector.

Plumbing Connections:

- To regenerate with raw/treated water, the isolation valve is piped into the outlet of each unit.
- To regenerate with soft/treated water, the isolation valve is piped into the inlet of each unit.



BUTTON FUNCTION AND PROGRAMING KEY SEQUENCE

STANDBY *ON LINE* *REGEN*

Standby LED

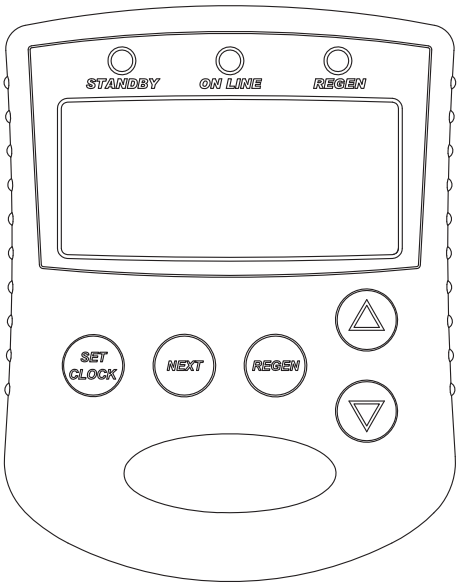
- Signals that a unit is not in service, or regen
- Flashes to alert status conditions
  - 1 per second indicates flow had been detected while the unit was offline
  - 2 per second indicates the bypass override switch is being used to force the unit offline.

Online LED

- Signals that a unit is currently in service
- Flashes to alert status conditions
  - 2 per second indicates the bypass override switch is being used to force the unit online.

Regen LED

- Signals that a unit is currently in regen



Set Clock — Set clock from Usert Screens
Exit & save from setup or program screens.

Next — Move to the next display

Up / Dn — Change variable being displayed

Regen — Toggles scheduled regen time on/off.
Holdlng for >3 sec. starts Immedlate regen
(immediate regen is the only option if set to immediately regenerate upon 0 gallons).
Moves back one display while in program mode.

Next + Regen — Reset
Holdlng for >3 seconds Initiates a reset. The software version Is shown and the piston returns to the "home" position, re-synchronizing the valve.

Set Clock + Regen — History Reset
Holding the Set Clock & Regen buttons for >3 seconds initiates a totallzer or hlstory reset.

Dn + Next + Up + Set Clock — Key sequence to lock and unlock programming screens

Programming Key Sequence	
Programming Level	Buttons
Installer	Next, Up
System Setup	Next, Dn
Timers	Next, Dn
Cycle Setup	Next, Dn
Diagnostic History	Up, Dn

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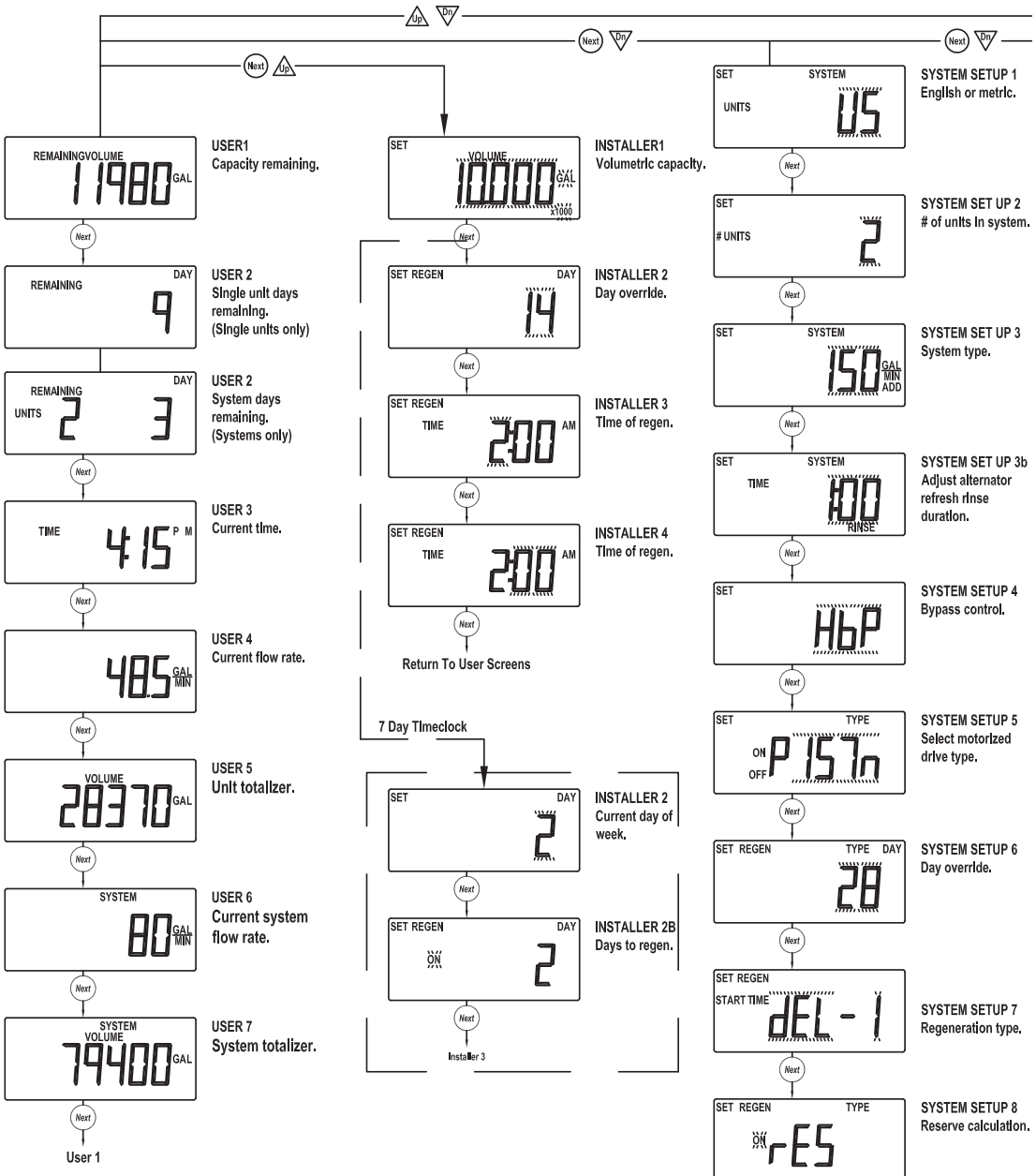
PROGRAMING QUICK REFERENCE



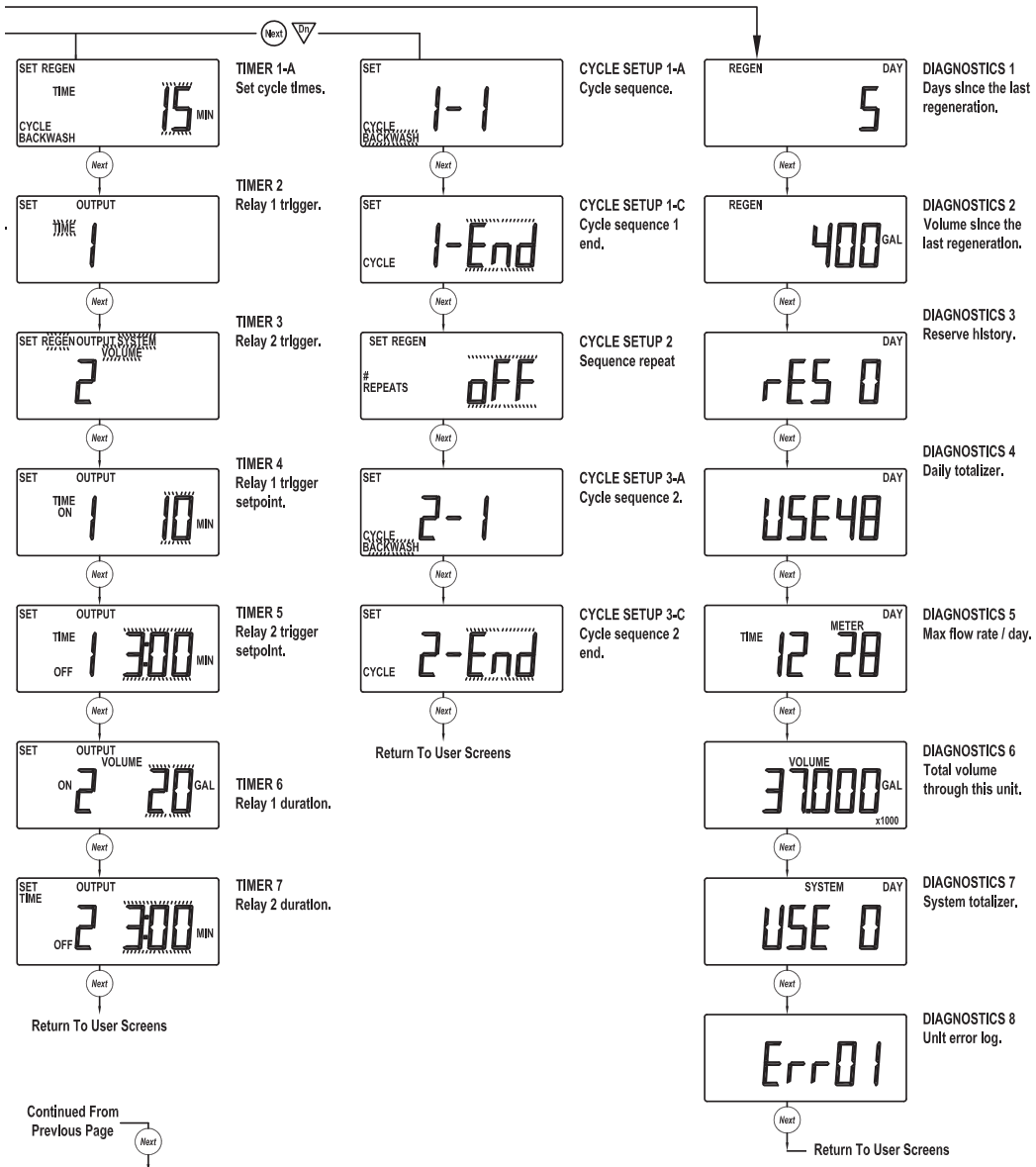
Recommended System Setup Sequence

1. Connect all wiring and communication cables
2. Apply power.
3. Enter system setup screens and set screen 2 to number of units in the particular system.
   a. Setting this value assigns master status to that unit
   b. The master unit will establish communication with the remaining units and transfer the remaining settings to them.
4. Set cycle sequence
5. Set cycle times
6. Set installer data

WS2 Programming Screen Quick Reference

1. Individual screen descriptions and settings are detailed on the following pages.
2. Some screens have been omitted for clarity.

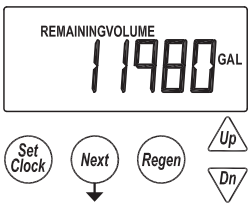
PROGRAMING QUICK REFERENCE



List Of Error Codes	
Code	Description
1001	No Encoder Pulses
1002	Unexpected Stall, Main Drive
1003	Run Time Too Long, Main Drive
14001	Message Queue Full
15003	Run Time Too Long, Bypass Drive
15010	Run Time Too Short, Bypass Drive Could Not Drive Offline
15011	Run Time Too Short, Bypass Drive Could Not Drive Online
16001	Communication Lost With Unit 2
16002	Communication Lost With Unit 3
16003	Communication Lost With Unit 4
17000	Run Time Too Long, Auxiliary Drive Of Option Board
17002	Run Time Too Short, Auxiliary Drive Of Option Board
18000	Reset Performed
18001	Power Loss
18002	Power Restored

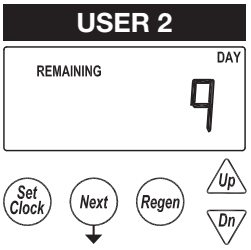
TYPICAL USER SCREENS

USER 1



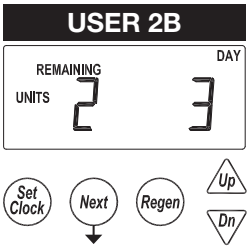
USER 1 - Capacity Remaining
- Displays the units current capacity remaining
- This screen does not display on units with volumetric capacity turned off
- Can be manually decremented by holding the down arrow

USER 2



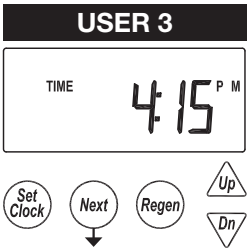
USER 2 - Days Remaining, Single Unit
- Displays a single units days until a regeneration, based on the day override setting
- This screen does not display on units with day override turned off
- On systems the master unit displays the days remaining on the lead unit
- Days can be manually reduced by holding the down arrow

USER 2B



USER 2B - Days Remaining, System
- The master in a system displays the days until a regeneration, based on the day override settings.
- The displays also indicates which unit the day over ride is currently pertaining to
  - Series regen systems do not display a unit as they will regenerate all units sequentially

USER 3

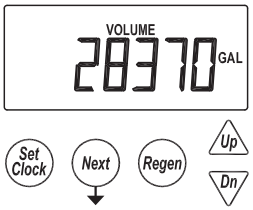


USER 3 - Time
- Displays the current time of day

USER 4

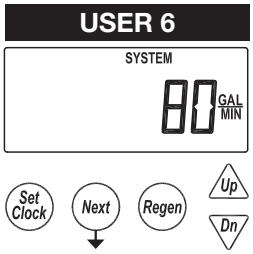
USER 4 - Flow Rate, Unit
- Displays that units current flow rate

USER 5



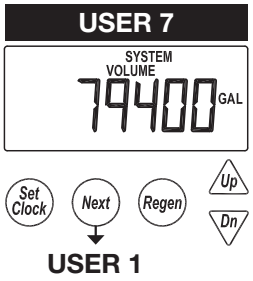
USER 5 - Volume Totalizer, Unit
- Displays the total volume since install / reset
- Re-settable to zero, while in this screen, by holding the “Set Clock” & “Regen” buttons

TYPICAL USER SCREENS (CONTINUED)



USER 6 – Flow Rate, System

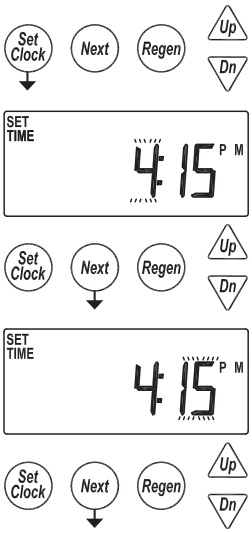
- Displays the current combined flow rate of all the units in the system
- This screen does not display on single tank units, or systems with volumetric capacity turned off



USER 7 – Volume Totalizer, System

- Displays the total volume of the system since install / reset
- Re-settable to zero, while in this screen, by holding the “Set Clock” & “Regen” buttons
- This screen does not display on single tank units

SETTING TIME OF DAY

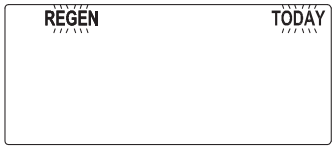


RETURN TO NORMAL OPERATION

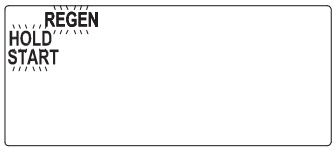
SET TIME

Accessed by pressing Set Clock while in the User Screens. Use UP and DOWN arrows to scroll hours. AM/PM alternates at midnight.

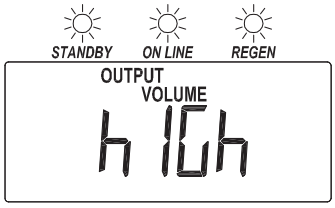
NOTIFICATIONS



- **REGEN TODAY**
  - Flashing indicates a regeneration has been manually set and can be turned off by pressing and releasing the REGEN button
  - A solid display indicates the regeneration has been scheduled by input requirements and can't be manually turned off

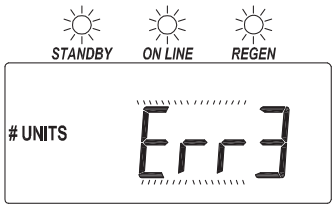


- **REGEN START / REGEN HOLD**
  - The display will flash "REGEN" or "REGEN HOLD", depending on settings, to indicate an external switch closure to the Aux. Input

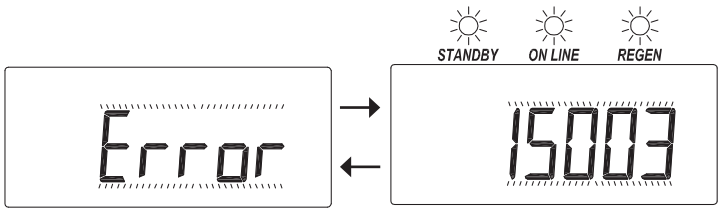


- **HIGH USAGE**
  - Screen flashes indicating setpoint was reached when using relay outputs to signal high water usage. All LED lights flash and the relay with that setpoint closes.
    - Screen and the relay are re-set by pressing any button
    - System operates as normal behind the indicator screen.
  - Only active if Timer 2 or Timer 3 is set to "Day & Gal" or "Day & Gal & System"

ERRORS

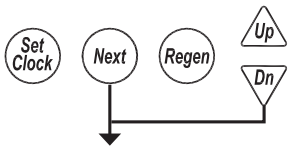


- **NUMBER OF UNITS ERROR**
  - The master unit of a system would flash an error screen alerting of a loss of communication with a unit
  - Check for proper operation and connectivity of the unit specified as lost communications
  - Pressing any button will return the user to the # units set up screen to correct / verify the value of units in the system. Exiting will re-establish communications
  - Each unit of the system will regenerate, based on its settings, with hard water bypass



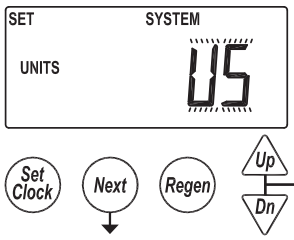
- **FUNCTIONAL ERROR**
  - "Error" and its code alternate on the display
  - The unit attempts to return to service but will not regenerate until the error is cleared
  - See troubleshooting section for a description of possible error codes.

SYSTEM SETUP SCREENS



Accessed by pressing NEXT and DOWN simultaneously for >3 seconds.
- System setup screens will be hidden on units determined to be a slaves of a system
  - Slave units need to be reset, “Next” & “Regen”, from the Timer 1 screen to have their slave status tuned off.

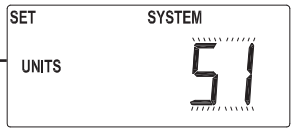
SYSTEM SETUP 1



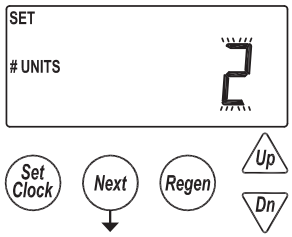
SYSTEM SETUP 1 – Select units of operation

US: Volume measurements are in gallons, time is displayed in 12 hour format, meter selections are in inches.

SI: Volume measurements are in liters or cubic meters, time is displayed in 24 hour format, meter selections are in mm.



SYSTEM SETUP 2A

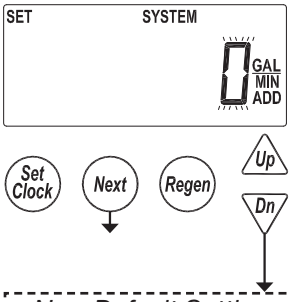


SYSTEM SETUP 2A - Set number of units

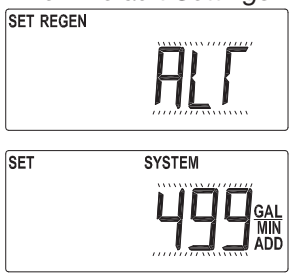
1 – 2 Up to 2 units can be connected off the communicate port of the main board

3 – 4 Requires an optional system board to expand communication ports

SYSTEM SETUP 2B



Non-Default Settings



SYSTEM SETUP 2B – Select System Type / Operation
- Setting a flow rate adder point determines the system operation

0: Parallel Flow; All units are always online unless they are regenerating.
- Units in a parallel flow system will determine the need to regenerate based on:
  - Any one unit reaching 0 capacity
  - Day over ride
- Any one units need to regenerate will initiate sequential regenerations of all units (series regeneration)
- On0 systems will regenerate all units in series at the first available time slot
- Delayed units will regenerate at each available time slot, one unit per time slot

ALT: Operates the system as an alternator, having one unit off line at all times either regenerating or fully regenerated.
- A unit in an alternator system will determine the need to regenerate based on:
  - The current “lead” unit reaching 0 capacity
    - On0 systems immediately regenerate and alternate the exhausted unit with a fully regenerated standby unit.
    - Delayed systems will immediately alternate the exhausted unit with a fully regenerated standby unit, and regenerate at the next available time slot.
  - “Lead” unit regenerates based on “Lag” units
    - The first “lag” unit depleting down to 15% less than its ratio of system capacity
      - 1/3 for a 4 unit; ½ for a 3 unit
  - The second “lag” unit depleting down to 15% less than its ratio of system capacity
    - 2/3 for a 4 unit
    - Delayed systems will flag “lead” units based on “lag” capacity, but will not alternate with remaining capacity until the next available delayed time.
  - Day over ride
    - 1 day; 1 unit will regen
    - Day triggered regens will run at the time set in DEL-1

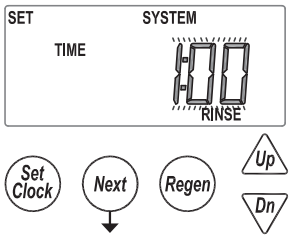
CONTINUED...

SYSTEM SETUP SCREENS (CONTINUED)

1 – 499: Demand Recall; one unit is always online & additional units are added as the online units exceed this flow rate / unit set point.

- Additional units are brought online when:
  - The adder point is exceeded for 30 seconds
  - All required units required to cover the flow conditions will be brought into service immediately if the flow exceeds 120% of the adder point.
- Units will go offline when
  - System flow reduces to 95% of the set adder point / unit for 1 minute.
- Any unit in a demand recall system will determine the need to regenerate based on:
  - Each unit individually reaching 0 capacity
    - On 0 systems will regenerate depleted units immediately after current flow conditions allow depleted units offline.
    - Delayed units will alternate lead units immediately upon exhaustion & regenerate them at the next available time slot.
- Day Override
  - One unit will be regenerated per delayed time slot (i.e. a 4 unit system will need 4 delayed times to regenerate all units / set number of days).
  - Day triggered regens will run at the time set in DEL-1
- Units cannot regenerate if flow demands them to remain online
  - On 0 units regen immediately after flow allows them offline
  - Del units regen at the next available time slot
  - Day units regen at the next time slot

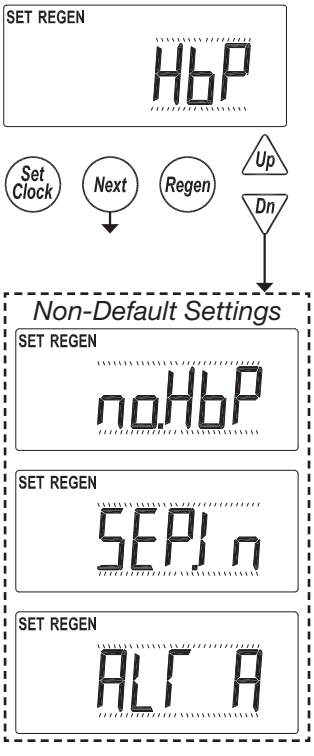
SYSTEM SETUP 2C



SYSTEM SETUP 2C – Set Pre-Service Rinse

- Only available on Alternator systems
- Standby units will run through a rinse cycle before coming into service

SYSTEM SETUP 3A



SYSTEM SETUP 3A - Select isolation timing

- Selections allow enabling and timing control of motorized drive
- Selection availability can vary by the type of system
- Custom timing sequences can be configured under “Custom Motorized Drive Timing” at the end of the programming section

HbP: Hardwater Bypass

- Only available on single units
- Unit will internally bypass hard water to the service lines while in regeneration

no.HbP: No Hardwater Bypass

- Each unit has isolation to control system operation and will not supply service water during regeneration
- Drive timing will bring the unit into service during fill

SEP.In: Separate Source

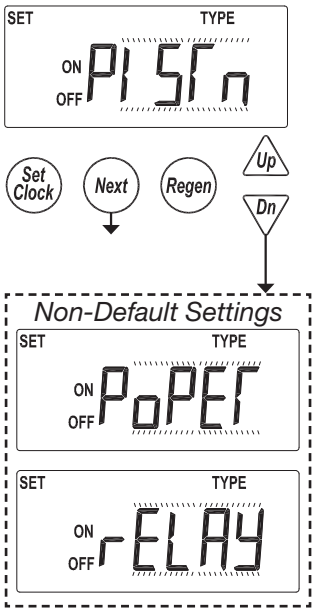
- Each unit has isolation to control system operation and will not supply service water during regeneration
- Drive timing will keep units isolated through the entire regeneration sequence

ALT-A: Simple Alternator Sharing 1 MAV

- Only available when set to a 2 unit alternator
- A “Simple 2 Unit” shares one MAV to be electrically connected to the bypass connection of the “B” (slave) unit

SYSTEM SETUP SCREENS (CONTINUED)

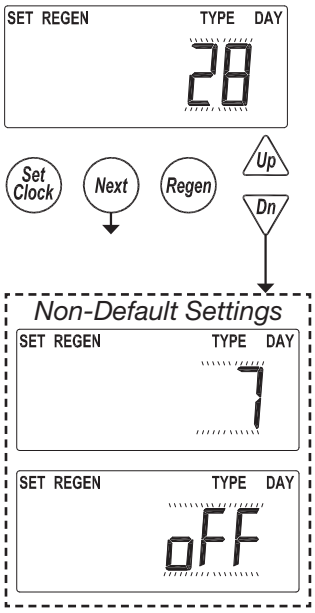
SYSTEM SETUP 3B



SYSTEM SETUP 3B - Select isolation type

- Piston: Factory motorized isolation drive has an internal piston & seals similar to the main piston
- Poppet: Factory motorized isolation drive uses a flat disc “face” seal
- Relay: Isolation will be done through the optional board relays & does not initialize the BYPASS motorized drive circuit

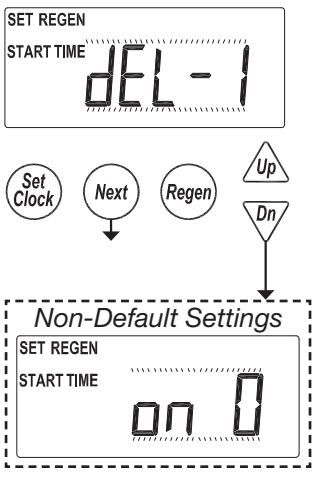
SYSTEM SETUP 4



SYSTEM SETUP 4 - Day override control

- 28 day time clock: Used to regenerate units based on a set number of days between regenerations
- 7 Day Time Clock: Used to control regeneration based on specific days
- OFF: Days have no control on regenerations, and will not be a selection if volumetric capacity is set to OFF

SYSTEM SETUP 5



SYSTEM SETUP 5 - Regeneration control

Delayed 1 – 4

- Delays regeneration of units upon reaching 0 gallons capacity
- Allows setting of up to 4 regeneration times per day
- Systems with delayed regen will remove a unit from service based upon 0 capacity and regenerate at the scheduled regen time.
  - Only one unit will regen / scheduled time
    - Day driven regens will regen at the DEL-1 time slot
    - Depleted units will regen at the next available delayed time slot

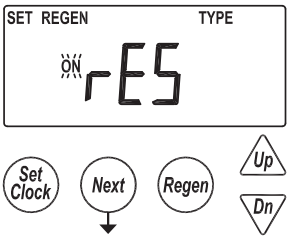
On 0

-Immediate regeneration of units upon reaching 0 capacity

-Series regeneration systems set to On0 will sequentially regenerate all units at the delayed time based on day override

SYSTEM SETUP SCREENS (CONTINUED)

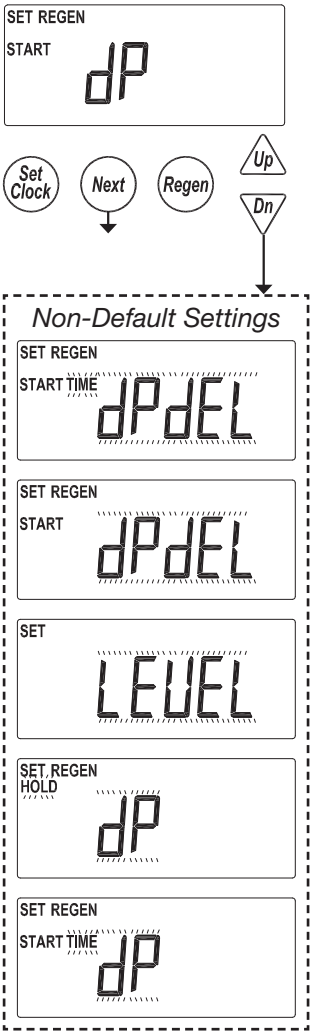
SYSTEM SETUP 6



SYSTEM SETUP 6 – Automatic reserve calculation

This screen will not display on units set to On 0, capacity set to Off, or any systems
On: Unit will regenerate before reaching 0 capacity, based on previous usage trends
Requires delayed regeneration
OFF: Regeneration is scheduled after reaching 0 capacity

SYSTEM SETUP 7A



SYSTEM SETUP 7A - Auxiliary Input

START REGEN

- Control will start an immediate regeneration upon switch closure
- Systems follow “on0 logic” regenerating all flagged units sequentially

START TIME REGEN dEL

- Control will immediately schedule a regeneration upon accumulating 2 minutes of intermittent switch closures
- Systems follow “Delayed Logic” regenerating flagged units in available time slots

START REGEN dEL

- Control will immediately schedule a regen upon switch closure
- Systems follow “Delayed Logic” regenerating flagged units in available time slots

LEVEL

- Only available on single units
- External switching can be used to control the On Line / Standby status
  - Switch closure will trigger the unit to go to a standby condition

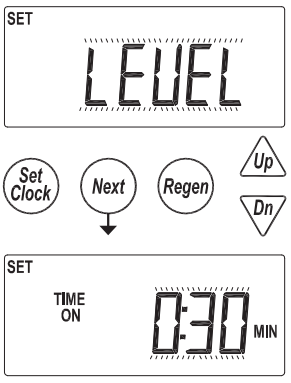
HOLD

- Regeneration will not be allowed as long as there is switch closure
  - On0 units will regenerate immediately after the hold switch opens
  - Delayed regenerations will be delayed until the next scheduled time if the hold is active when the scheduled time passes

START TIME REGEN

- Control will immediately regenerate upon accumulating 2 minutes of intermittent switch closures
- Systems follow “on0 logic” regenerating all flagged units sequentially

SYSTEM SETUP 7B

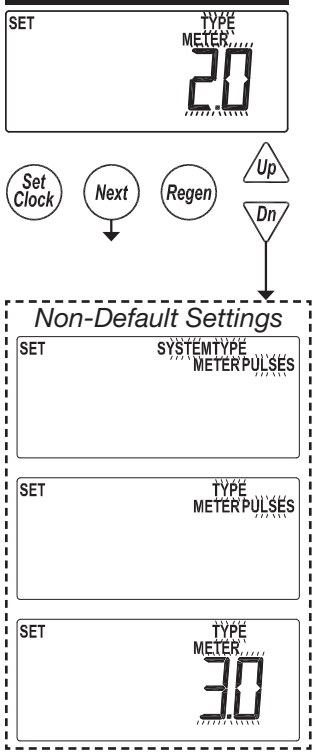


SYSTEM SETUP 7B - Level option selected

Set a time duration of switch closure when Level option is selected

SYSTEM SETUP SCREENS (CONTINUED)

SYSTEM SETUP 8A



SYSTEM SETUP 8A - Meter Calibration

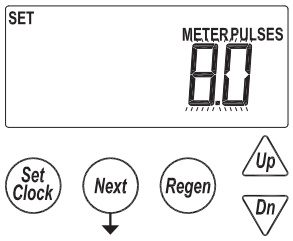
2.0: Setting for using a factory 2" meter

3.0: Setting for using a factory 3" meter

Pulses: Used to set meter input off custom pulse rate, typically for non-factory meters

System Pulses: Only available on 2 unit alternators. The system shares 1 external meter which is connected to the slave unit's meter connection.

SYSTEM SETUP 8B

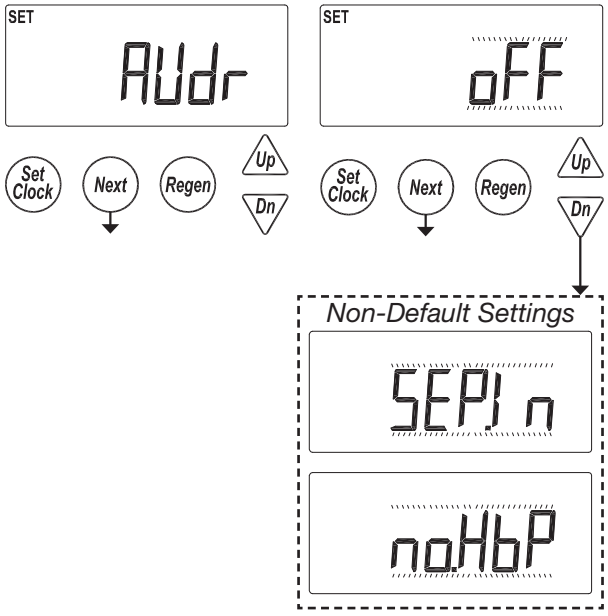


SYSTEM SETUP 8B - Set Meter Pulses / Gallon

-Only displays if "Pulses" or "System Pulses" is selected in the previous screen

-Set to the desired pulse rate of the installed metering device

SYSTEM SETUP 9



SYSTEM SETUP 9 – Auxiliary Drive

- Selections allow enabling and timing control of the Auxilliary motorized drive circuit
  - This screen does not display if the unit does not have a system board
- Requires a factory motorized drive to be connected to the drive circuit of the system board
- Custom timing sequences can be configured under "Custom Motorized Drive Timing" at the end of the programming section

no.HbP: No Hard Water Bypass

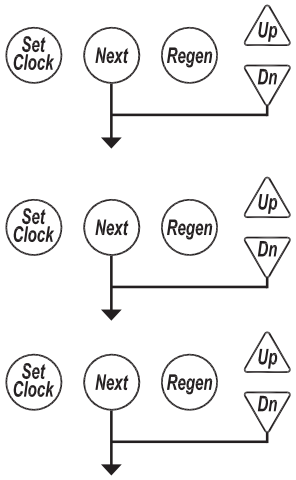
- Each unit has isolation to control system operation and will not supply service water during regeneration
- Drive timing will bring the unit into service during fill

SEP.In: Separate Source

-Each unit has isolation to control system operation and will not supply service water during regeneration

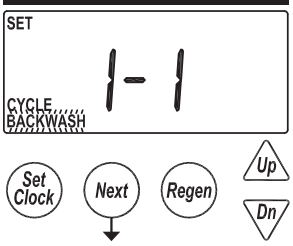
-Drive timing will keep units isolated through the entire regeneration sequence

CYCLE SETUP SCREENS



Accessed by pressing NEXT and DOWN simultaneously for >3 seconds, then by pressing NEXT and DOWN simultaneously again for >3 seconds, then by pressing NEXT and DOWN simultaneously again for >3 seconds

CYCLE SETUP 1A

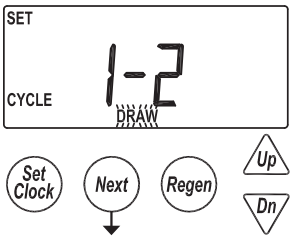


CYCLE SETUP 1A

Select first regeneration cycle.

Available Cycles	
Backwash	
Draw	
Slow Rinse	Separate cycle from Draw
2nd Backwash	
Rinse (fast)	
Fill	
End	
Hold	Piston in Service position

CYCLE SETUP 1B

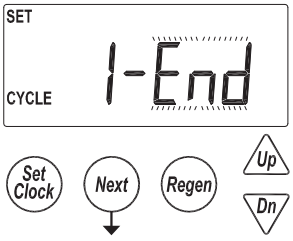


CYCLE SETUP 1B

Select second cycle.

Cycle Number	Cycle Default
1	Backwash
2	Draw
3	2nd Backwash
4	Rinse
5	Fill
6	End

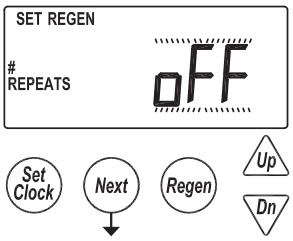
CYCLE SETUP 1C



CYCLE SETUP 1C

After cycles are configured, an END is added. (9 cycles maximum.)

CYCLE SETUP 2



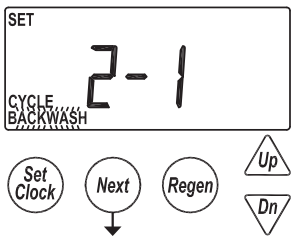
CYCLE SETUP 2

Select regeneration repeats, 1-9 or OFF.
Repeats regeneration cycle Sequence 1 a selected number of times before regenerating a single time with Sequence 2.

The following screens will not appear if Cycle Setup 2 is set to OFF.

CYCLE SETUP SCREENS (CONTINUED)

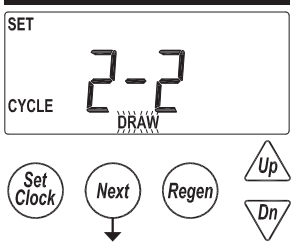
CYCLE SETUP 3A



CYCLE SETUP 3A

Select first cycle of “alternate” regeneration sequence (Sequence 2).

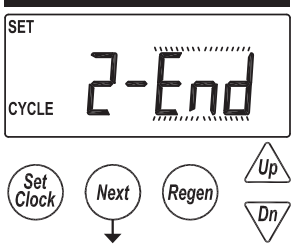
CYCLE SETUP 3B



CYCLE SETUP 3B

Select second cycle of ‘alternate’ regeneration sequence.

CYCLE SETUP 3C

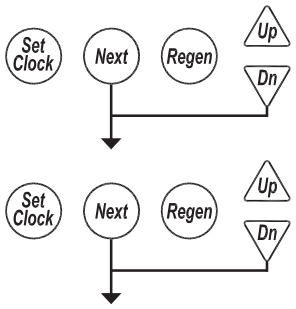


CYCLE SETUP 3C

After cycles are configured, an END is added. (9 cycles maximum.)

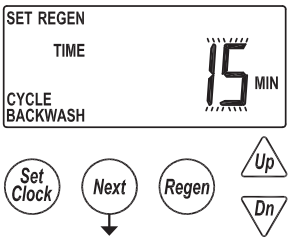
RETURN TO NORMAL OPERATION

TIMER SCREENS



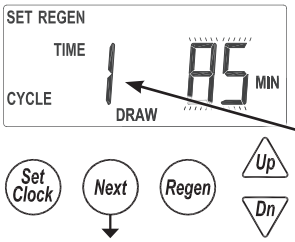
Accessed by pressing NEXT and DOWN simultaneously for >3 seconds, then by pressing NEXT and DOWN simultaneously again for >3 seconds.

TIMER 1A



TIMER 1A
Select runtime of cycle 1.

TIMER 1B

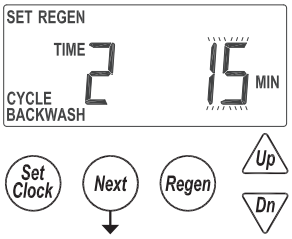


TIMER 1B
Select runtime of cycle 2.

1 or 2 will be displayed if set for Alternate Regenerations in Cycle Setup 2.

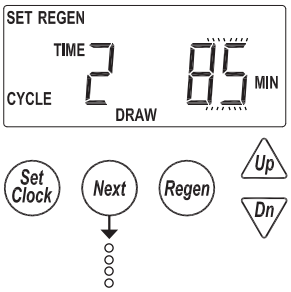
Cycle	Units	Range	Increments
Backwash	Minutes	1-30 30-95	1 5
Draw	Minutes	1-30 30-100 100-180	1 5 10
Slow Rinse	Minutes	1-30 30-95	1 5
Rinse	Minutes	1-30 30-95	1 5
Fill	Minutes	0.1-10.0 10.0-30.0 30.0-99.0	0.1 0.2 1.0
Hold	Minutes	1-30 30-100 100-480	0.1 2.0 10.0

TIMER 1A2



TIMER 1A2
If Alternate Regenerations has been selected in Cycle Setup 2, select runtime of Alternate Regeneration Cycle 1.

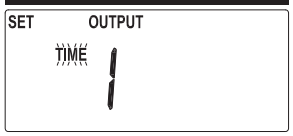
TIMER 1B2

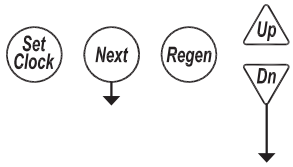


TIMER 1B2
Select runtime of Alternate Regeneration, cycle 2.

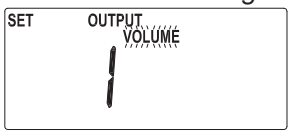
TIMER SCREENS (CONTINUED)

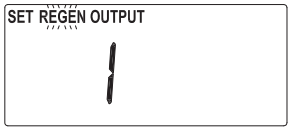
TIMER 2

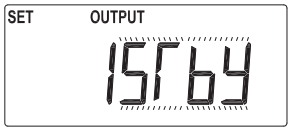


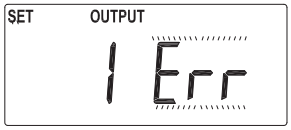


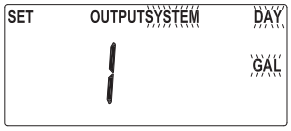
Non-Default Settings

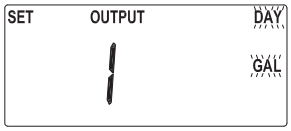


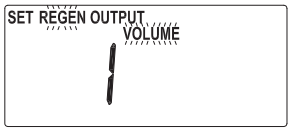


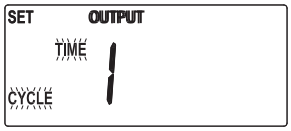












TIMER 2 – Set Trigger for Output 1

•Timer screens are only available with a system board installed

Time

•The relay is actuated based on a set amount of time after the start of regeneration

Volume

• The relay is actuated, during service only, every specified amount of volume usage

Regen

• Relay actuation is based on regen status

Standby

• Relay actuation is based on the units Standby status
• Relays would be used to control external valving or signaling a units Online status.

Error

• Relay actuates to signal an error condition

Day & Gal & System

• Relay actuates, based on system usage, at a specified daily volume to signal a usage alarm.
• “Usage High” flashes on the screen with unit continues to operate as normal. Pressing any button resets the relay and returns the unit to the user screens.
• Only available on the master unit of a system

Day & Gal

• Relay actuates, based on a units usage, at a specified daily volume to signal a usage alarm
• “Usage High” flashes on the screen with unit continues to operate as normal. Pressing any button resets the relay and returns the unit to the user screens.

Volume & Regen

• Relay is actuates, during service & while in regen, every specified amount of service flow

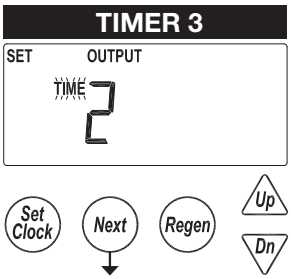
Volume & System

• Relay actuates, at a specified amount, based on combined volume usage of all units in the system
• Only available on the master unit of a system

Cycle

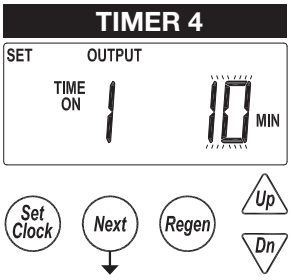
• Relay actuation is based on the start of a specified cycle

TIMER SCREENS (CONTINUED)



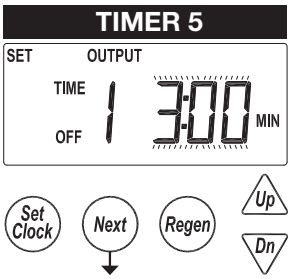
TIMER 3 – Set Trigger for Output 2

- Trigger options are the same as for output 1



TIMER 4 – Set Output 1 Trigger

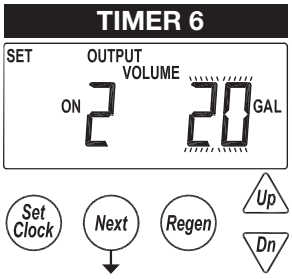
- Set the trigger point in these screens are based on the selection in the previous screens



TIMER 5 – Set the relays ON time duration

- A unit's ON time does not accumulate; ie a unit set to trigger the relay every 10 gallons and stay on for 5 minutes is flowing 10 gpm. The unit would not add 5 minutes every 10 gallons, it would reset the 5 minute countdown every 10 gallons
- A unit which is manually stepped through regeneration will reset the relay.

Relay Trigger Settings				
Trigger	Units	Range	Increment	Default
Time	Min-utes	0-240	1	10
Cycle				Slow Rinse
Volume	Gal-lons	1-200 200-1000 1000-10000	1 5 10	20
Volume	Liters	5-750 750-4000 4000-38000	5 20 40	75
Relay Duration Settings				
Trigger	Units	Range	Increment	Default
Time	Min-utes	:01-2:00 2:00-20:00 20-240	:01 :05 1	3:00



TIMER 6

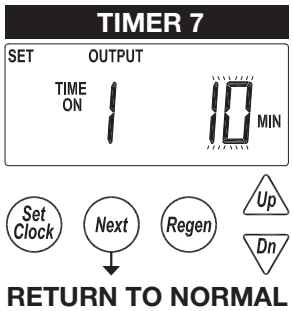
Select Relay 2 output "ON", per units previously selected.

Time
Time after the start of a regen before relay is actuated.

Cycle
Select a cycle which will actuate output 1.

Volume
Volume of water interval during service between relay actuations.

TIMER SCREENS (CONTINUED)

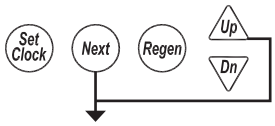


RETURN TO NORMAL OPERATION

TIMER 7 – Set the relays ON time duration

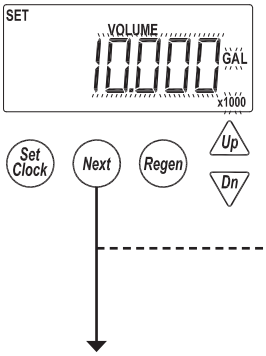
- A unit's ON time does not accumulate; ie a unit set to trigger the relay every 10 gallons and stay on for 5 minutes is flowing 10 gpm. The unit would not add 5 minutes every 10 gallons, it would reset the 5 minute countdown every 10 gallons
- A unit which is manually stepped through regeneration will reset the relay.

INSTALLER SETUP SCREENS



Accessed by pressing NEXT and UP simultaneously for >3 seconds.

INSTALLER 1



INSTALLER 1 – Set Volumetric Capacity

Capacity: Set the units Volumetric Capacity in gallons or cubic meters

OFF

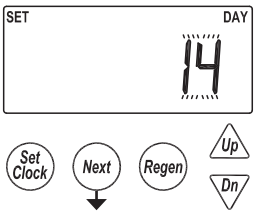
- Units will not regenerate based on volume but will track usage history
- Will not be an option on units with no day override set

Set current day and regen days when set as a 7 day time clock in System Setup 1. See next page.

X1000 Indicator Illuminates At 10,000 Gallons

Units	Range	Increments
US (GAL)	10-10,000	10
	10,000-100.00 x 1000	100
	100.00-999.00 x 1000	1000
SI (L)	50-50,000	50
	50,000-50.00 x 1000	50
	500.00-5000.0 x 1000	5000

INSTALLER 2



INSTALLER 2 – Set Days Between Regenerations (Day override)

Set day override. 1-28 days between regenerations, or if set to 7 day time clock, see 7 day setup on next page. OFF will only be displayed if "OFF" is selected in System Setup 4.

- Settings will be based on the type of day override control set in system setup.
- Off will be displayed for units with day override turned off

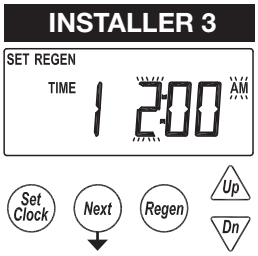
1 – 28: When set as a 28 day override

- Set the days between regens

1 – 7: When set as a 7 day timeclock

- First, set 1 – 7 to signify the current day (1 = Sunday – 7 = Saturday)
- Next turn regen on or off for each specific day of the week, 1 - 7

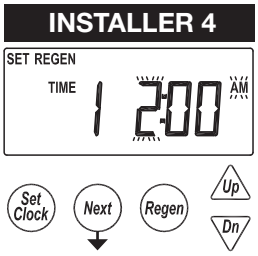
INSTALLER 3



INSTALLER 3 – Set Delayed Regeneration Time

- Set the delayed time of regeneration, hour (AM / PM toggles at midnight)
- Units with no time dependent control (Aux Input settings or Day Override) will display on0

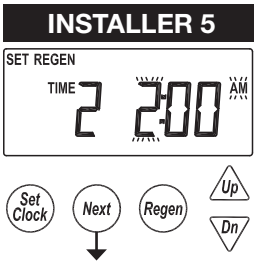
INSTALLER 4



INSTALLER 4 – Set Delayed Regeneration Time

- Set delayed time of regeneration, minutes

INSTALLER 5



INSTALLER 5 – Set Multiple Delayed Regeneration Times

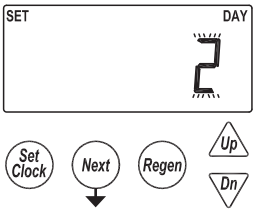
- When configured for multiple delayed regeneration times, repeat steps 3 & 4 for each additional time slot

RETURN TO NORMAL OPERATION

INSTALLER SETUP SCREENS (CONTINUED)

7 DAY OPTION

INSTALLER 2A

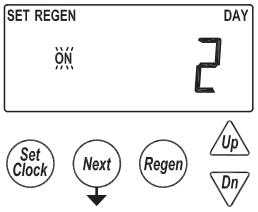


INSTALLER 2A

7 day time clock option. Set current day of the week:

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

INSTALLER 2B

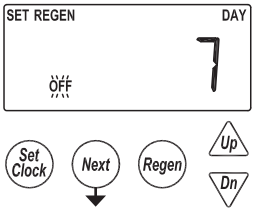


INSTALLER 2B

1 – 7: Signifies each day of the week, Sunday thru Saturday

- Scroll through each day using the up & down arrow
- Use Set Clock to toggle between ON or OFF to control regeneration for each day - i.e., regen on Monday, no regen on Sunday

INSTALLER 2C



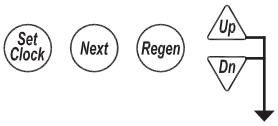
INSTALLER 2C

(i.e., no regeneration on Saturday.)

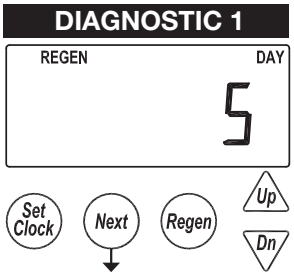
INSTALLER 3

(see previous page)

DIAGNOSTIC SCREENS

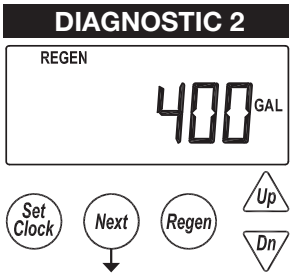


Accessed by pressing UP and DOWN simultaneously for >3 seconds.

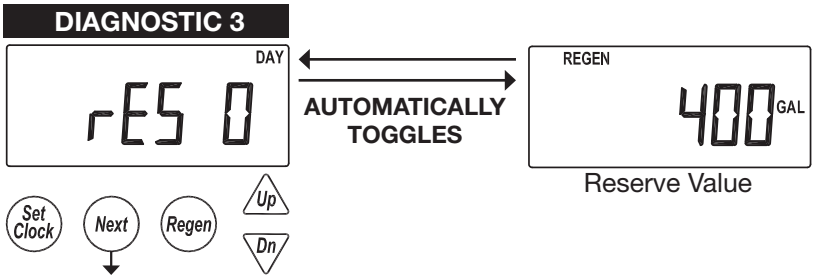


DIAGNOSTIC 1
Days since the last regeneration.

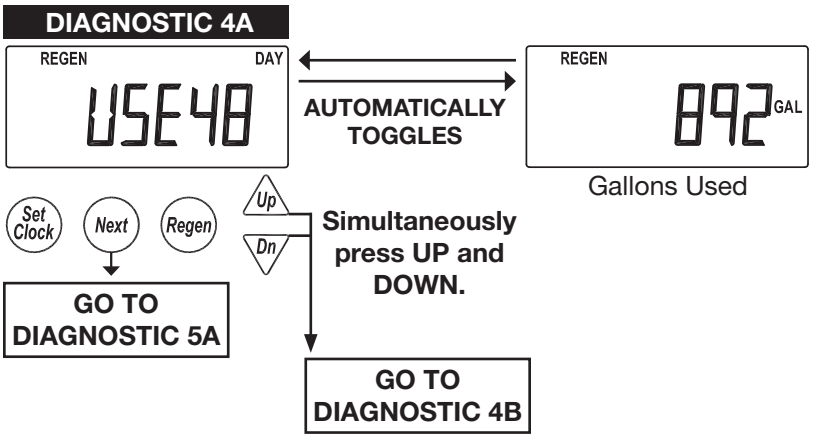
All Diagnostic History screens are resettable with the History Reset sequence while in the Diagnostics 1 screen. Holding the Set Clock and Regen buttons for > 3 seconds initiates a totalizer or history reset.



DIAGNOSTIC 2
Volume since the last regeneration.



DIAGNOSTIC 3
- Displays the reserve history
- Does not display on systems, or units with reserve set to OFF
- Use the UP & DN arrows to scroll through each days history
  - Day 0 is today's reserve (tomorrows anticipated usage)
  - 1 was yesterday's reserve (today's anticipated usage)

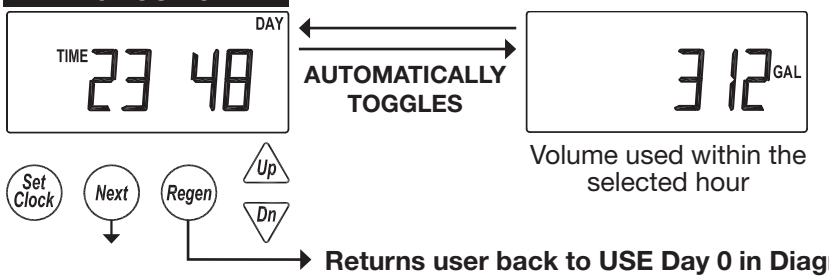


DIAGNOSTIC 4A
History of volume used.
Use UP and DOWN arrows to select a day.
0 = Today
1 = Yesterday
63 = 63 days ago (max.)

REGEN will display if a regeneration occurred that day.

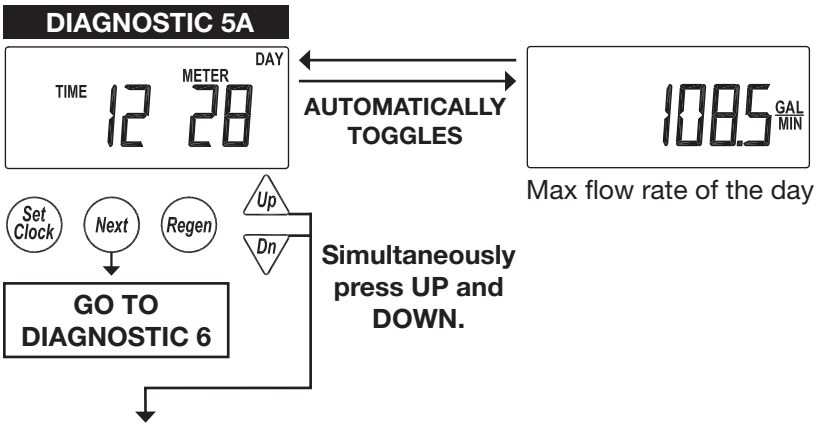
DIAGNOSTIC SCREENS (CONTINUED)

DIAGNOSTIC 4A



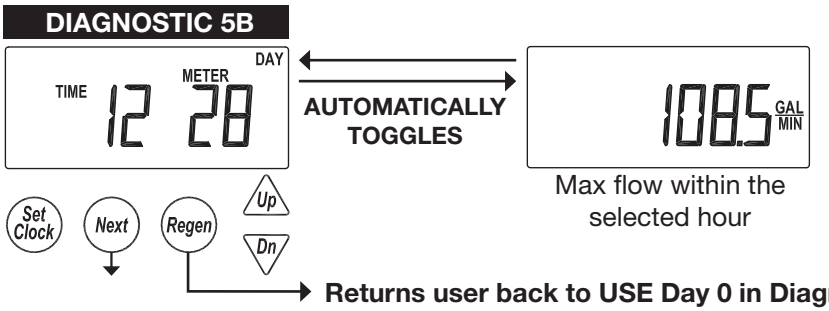
DIAGNOSTIC 4B
Hourly history of volume use. Use the UP and DOWN arrow to select the hours of the day.

DIAGNOSTIC 5A



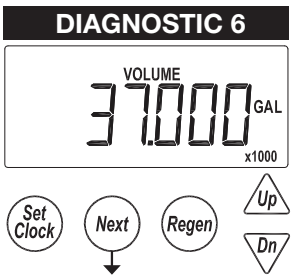
DIAGNOSTICS 5A
- Displays the max flow rate and the hour it occurred
- Use the UP & DN arrows to scroll through 28 days history
  - Day 0 is today
  - Day 1 was yesterday

DIAGNOSTIC 5B



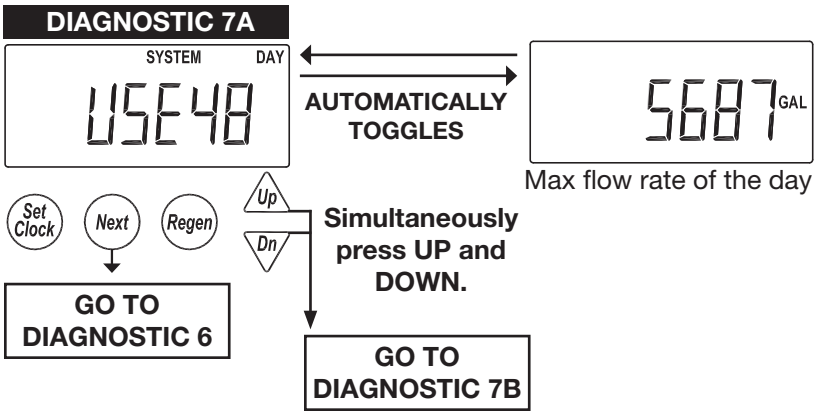
DIAGNOSTICS 5B
Hourly history of maximum flow rate. Use the UP and DOWN arrow to select the hours of the day from screen 5.

DIAGNOSTIC 6



DIAGNOSTIC 6
Total volume through the unit.

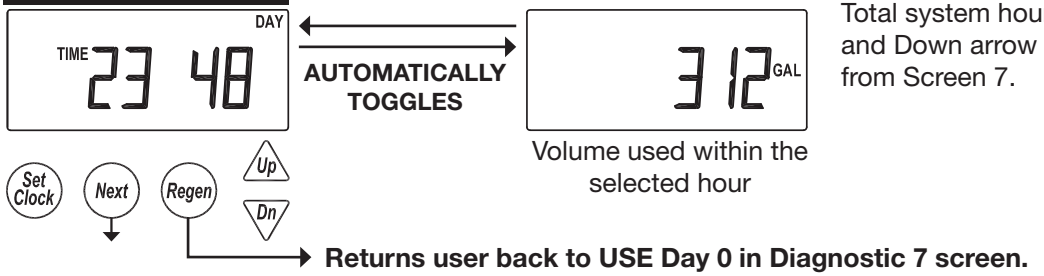
DIAGNOSTIC 7A



DIAGNOSTICS 7A
Total system history of volume used use UP and DOWN arrows to select a day.
0 = Today
1 = Yesterday
63 = 63 days ago (max.)

DIAGNOSTIC SCREENS (CONTINUED)

DIAGNOSTIC 7B

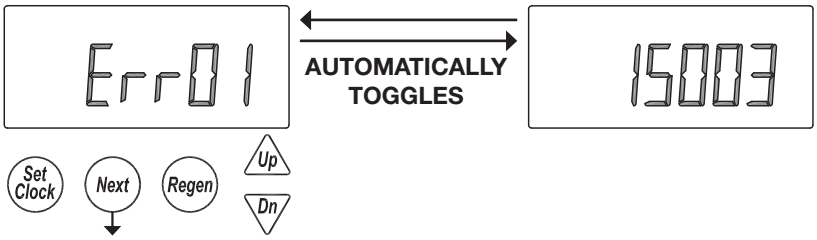


Returns user back to USE Day 0 in Diagnostic 7 screen.

DIAGNOSTICS 7B

Total system hourly history of volume use Up and Down arrow to select the hours of the day from Screen 7.

DIAGNOSTIC 8



RETURN TO USER SCREEN

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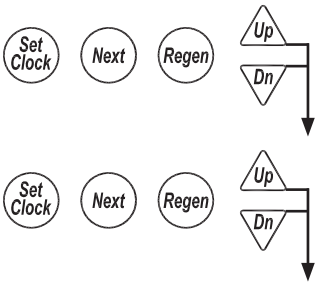
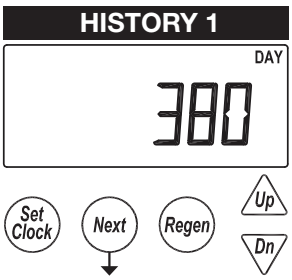
VALVE HISTORY

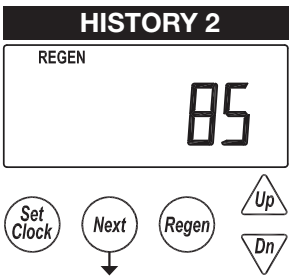


Accessed by pressing UP and DOWN simultaneously for >3 seconds, then by pressing UP and DOWN simultaneously again for >3 seconds.
Non-Resettable



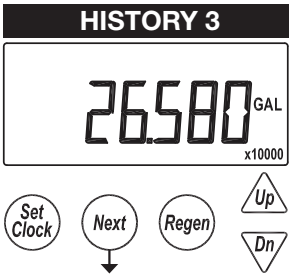
HISTORY 1

Total days since startup.
Time only accumulates while the unit is plugged in.



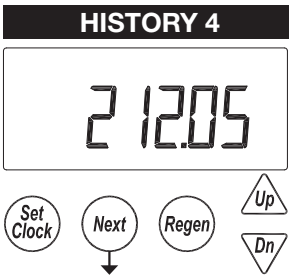
HISTORY 2

Total regenerations since startup.



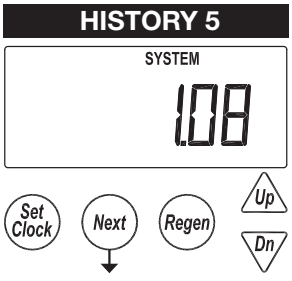
HISTORY 3

Total volume treated since startup.



HISTORY 4

Main board software

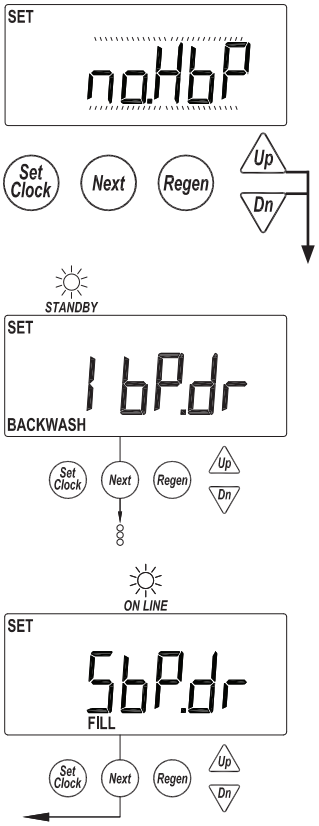


HISTORY 5

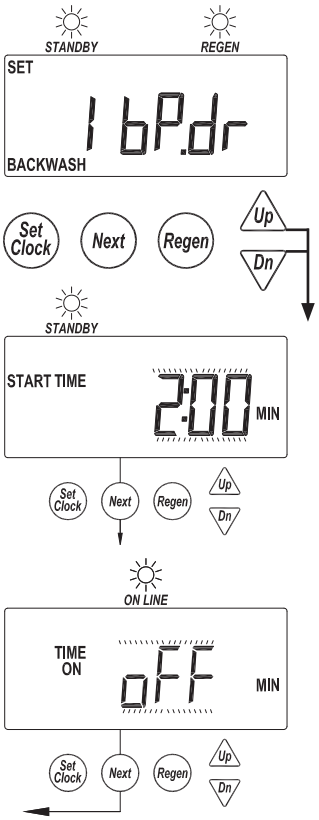
System board software revision. Will display -nA- if no system board is detected.

RETURN TO NORMAL OPERATION

CUSTOM MOTORIZED DRIVE TIMING



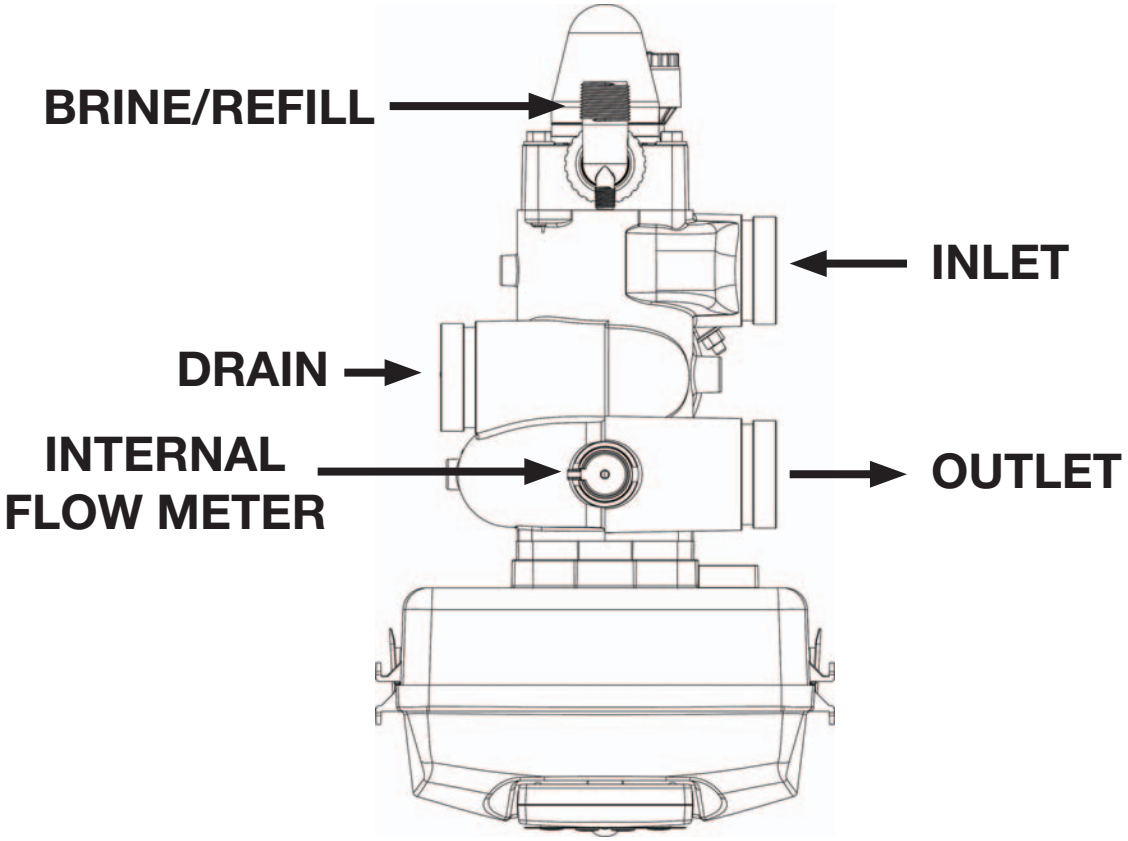
- Used to alter the standard timing sequence of the motorized isolation valve for complete custom timing of the drive circuits
  - Setup procedure applies to both the “Bypass” drive of the main board and “Aux Drive” of the optional expansion board
- Customization needs to be done after defining the regeneration cycle sequence
- Accessed by pressing the Up & Dn arrows simultaneously while in the No Hard Water Bypass selection
  - Next will scroll through each cycle of the regeneration program
  - Arrow buttons toggle Standby and Online indicating the desired position the drive during that cycle of the regeneration.
  - In the example screens the “Bypass” drive will be transitioning offline for Backwash (Cycle 1) and coming online for Fill (Cycle 5).



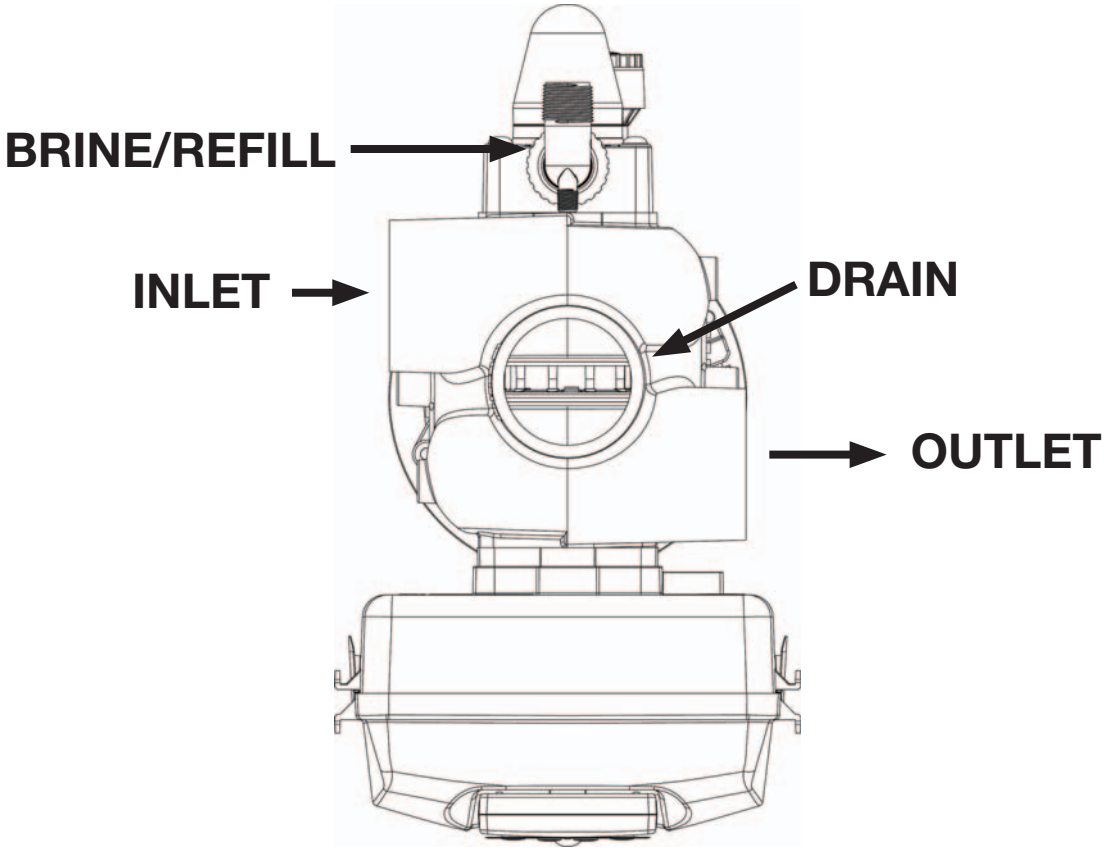
- Timing can be further customized per cycle by adding a time delay to the sequence
  - Accessed by pressing the Up & Dn arrows simultaneously while in the drive sequence screens
  - Setting a “Start Time” delays the start of that transition after reaching set cycle
  - A second time screen then sets the time the drive maintains that set position before transition back to its previous position.
  - “Regen” will be illuminated to identify that a sequence has a time modifier associated with it
  - In the example screens the “Bypass” drive will delay its transition to offline until 2 minutes into Backwash (Cycle 1) and coming online for Fill (Cycle 5).

INSTALLATION

WS2H CONTROL VALVE TOP VIEW



WS3 CONTROL VALVE TOP VIEW



INSTALLATION (CONTINUED)

GENERAL INSTALLATION & SERVICE WARNINGS
The control valve and fittings are not designed to support the weight of the system or the plumbing.

Do not use Vaseline, oils, other hydrocarbon lubricants or spray silicone anywhere. A silicone lubricant may be used on black o-rings but is not necessary.

HYDROCARBONS SUCH AS KEROSENE, BENZENE, GASOLINE, ETC., MAY DAMAGE PRODUCTS THAT CONTAIN O-RINGS OR PLASTIC COMPONENTS. EXPOSURE TO SUCH HYDROCARBONS MAY CAUSE THE PRODUCTS TO LEAK. DO NOT USE THE PRODUCT(S) CONTAINED IN THIS DOCUMENT ON WATER SUPPLIES THAT CONTAIN HYDROCARBONS SUCH AS KEROSENE, BENZENE, GASOLINE, ETC.

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

Do not use pipe dope or other sealants on threads. Teflon tape is recommended to be used on all threads.

Use of pipe dope may break down the plastics in the control valve.

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.

Allow two feet of clearance to service WS2H and WS3 valves.

The valve will withstand transportation and storage temperatures of -13 ˚F (-25 ˚C) to 131 ˚F (55 ˚C) and for short periods up to 158 ˚F (70 ˚C). If valve has been exposed to freezing conditions let valve warm up to room temperature before running water through it. The valve has been packaged to prevent damage from the effects of normal humidity, vibration and shock.

SITE REQUIREMENTS:
- The plug-in Power adapter is for dry locations only
- The tanks should be on a firm, level surface
- Electrical: Use an uninterrupted outlet installed within 15 feet (4.57 meters) of the water conditioner.

All plumbing should be done in accordance with local codes.

1. Locate the water conditioner so the distance between the drain and the water conditioner is as short as possible.

2. Regenerant tanks that must be refilled should be located where they are easily accessible. It is recommended a safety brine valve be used.

3. Do not install any water conditioner with less than 10 feet of piping between its outlet and the inlet of a water heater.

4. Do not locate unit where it or its connections (including the drain and overflow lines) will ever be subjected to room temperatures under 40° F (4° C).

5. The use of resin cleaners in a non-vented enclosure is not recommended.

INSTALLATION (CONTINUED)

6. INLET/OUTLET PLUMBING: Connect to a supply line downstream of outdoor spigots. Install inlet and outlet shutoff valves for the control valve; see top view drawings for control valve inlet and outlet locations. Installation of a three valve bypass is recommended. If using plastic fittings ground the water conditioner per local electric codes. If an external water meter is used, install the water meter on the outlet side of the control valve. It is recommended that the meter assembly be installed horizontally or in a downflow vertical position to reduce turbine bearing wear. The turbine assembly may be orientated in any direction. Remove the cover and drive bracket and thread the water meter cord through the hole in the back plate. Reinstall the drive bracket. Weave the cord through the strain relief on the backplate and connect the end to the three prong connector labeled FLOW on the printed circuit board. Re-install the cover.

7. Drain: Verify that the drain can handle the backwash rate of the water conditioner. Correctly size the drain line and install an appropriately sized drain line flow control. For WS2H and WS3 valves a drain line flow control are NOT supplied with a valve. For WS2H valves the drain outlet is 2” Female NPT or BSPT threads or 2.5” groove lock connection. For WS3 valves the drain port is 3” Female NPT or BSPT, no groove lock connection. If using copper, solder joints near the drain must be done prior to connecting the drain line flow control fitting. Leave at least 6” (152.4 mm) between the drain line flow control fitting and solder joints to prevent heat from damaging the flow control. Avoid elevating the drain line above the control valve where possible. Discharge the drain line through an air gap to a receptacle in accordance with local plumbing codes.

IMPORTANT: Never insert a drain line directly into a drain, sewer line, or trap. Always allow an air gap between the drain line and the receptacle to prevent back siphonage.

8. Regeneration: If the control valve is to be used to regenerate the water conditioner with brine (saturated salt solution) or other regenerants. The WS2H and WS3 control valves regenerant port has a 1” 90° Male NPT threaded outlet connection that swivels 360°. To ensure acceptable operation of the injectors use 1” pipe to connect to the brine tank. Smaller drain line flow controls may result in the injector performance not matching the injector graphs. Use an adequately size drain line flow control to ensure proper brine draw.
See Table 3 for injector order number and size for tank diameter. An overflow drain line from the regenerant tank that discharges into an acceptable drain is recommended, as a regenerant overflow could damage furnishings or the building structure. Connect a line to the overflow fitting on the regenerant tank. If an overflow fitting is not already installed on the regenerant tank, install one. Do not elevate the overflow drain line. Discharge the overflow drain line through an air gap to a receptacle in accordance with local plumbing codes.

9. Power Adapter: If a Power Adapter is already connected to the control valve, plug the Power Adapter into an uninterrupted outlet. If the Power Adapter cord has not yet been connected to the control valve, remove the control valve cover and the drive bracket and thread Power Adapter cord through the hole in the back plate. Reinstall the drive bracket. Weave the cord through the strain relief on the backplate and connect the end to the four pin connector on the printed circuit board labeled POWER. Reinstall the cover. Plug the Power Adapter into an uninterrupted outlet.

10. Program the control valve: It is very important to program the control valve for the type of system (e.g. water softener of filter) and the end use application. Check the program used prior to testing the system.

INSTALLATION SUMMARY

Installation Date:_____
Installation Location: _____
Installer(s): _____
Phone Number:
Application Type: (Softener) _____Other: _____

Water Source: _____

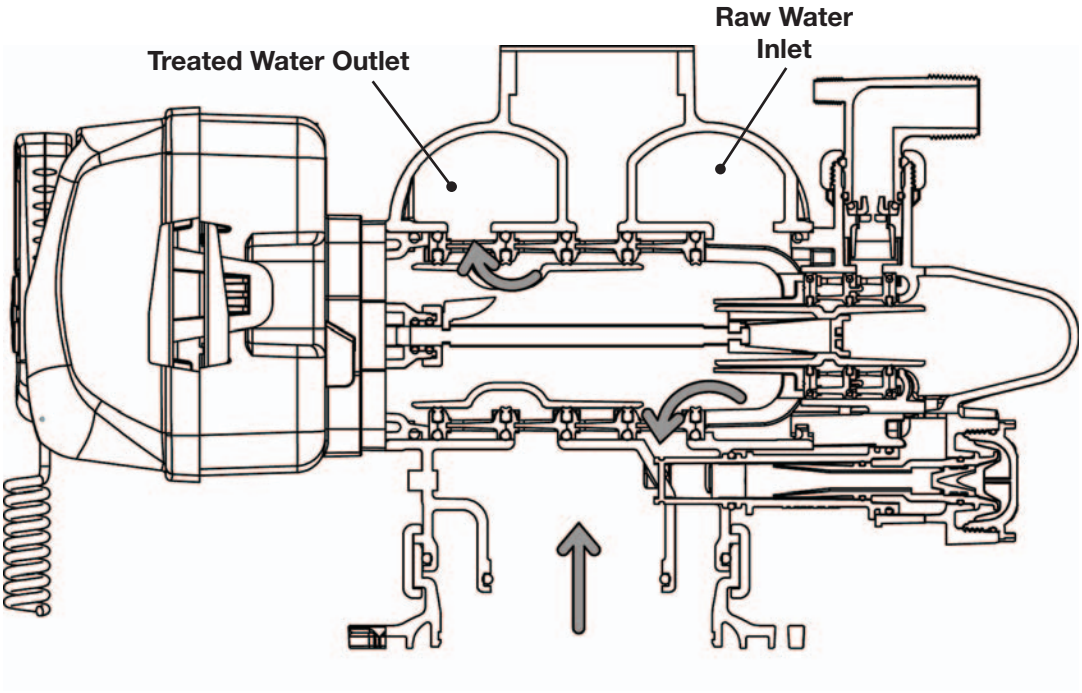
Water Test Results:
Hardness: _____Iron:_____pH: _____
Other: _____
_____

Misc:
Service Flow Rates: min. _____ max._____
Tank Size: Diameter_____ Height: _____
Resin or Media Volume: _____
Resin or Media Type:_____
Capacity: _____
Salt or Fill Setting per Regeneration: _____
Brine Tank Size: _____

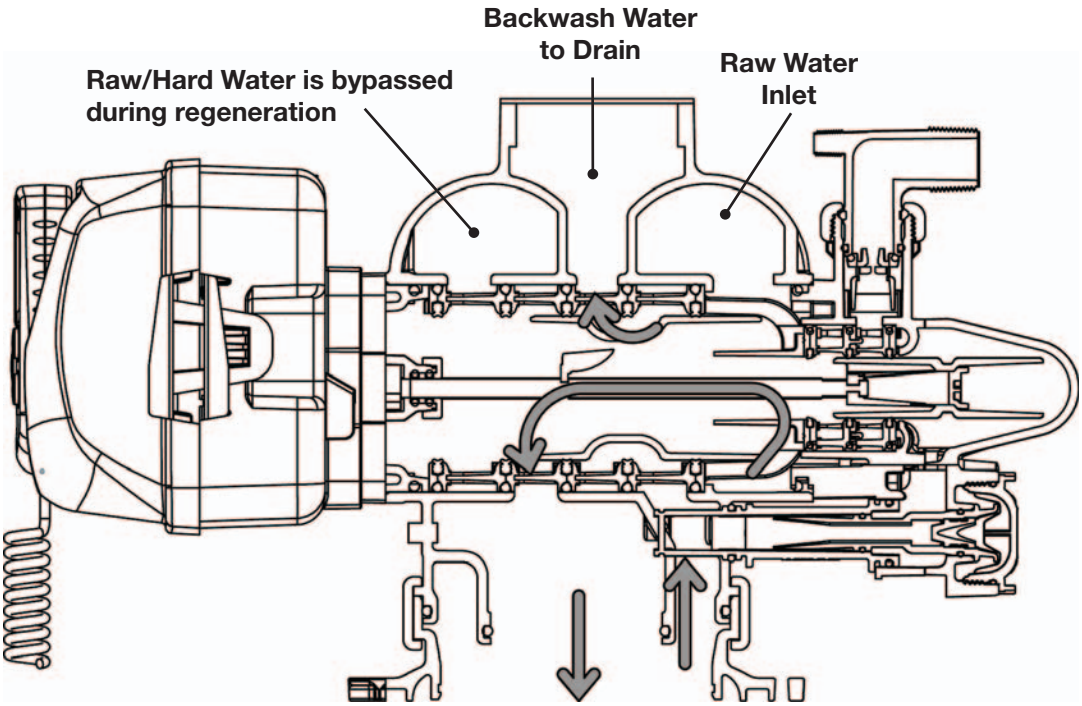
Control Valve Configuration:
Valve Type:_____
Valve Part Number: _____
Valve Serial Number: _____
Regenerant Refill Control: _____ gpm/lpm
Injector Size: _____
Drain Line Flow Control: _____ gpm/lpm

CYCLE POSITIONS / FLOW DIAGRAMS

SERVICE

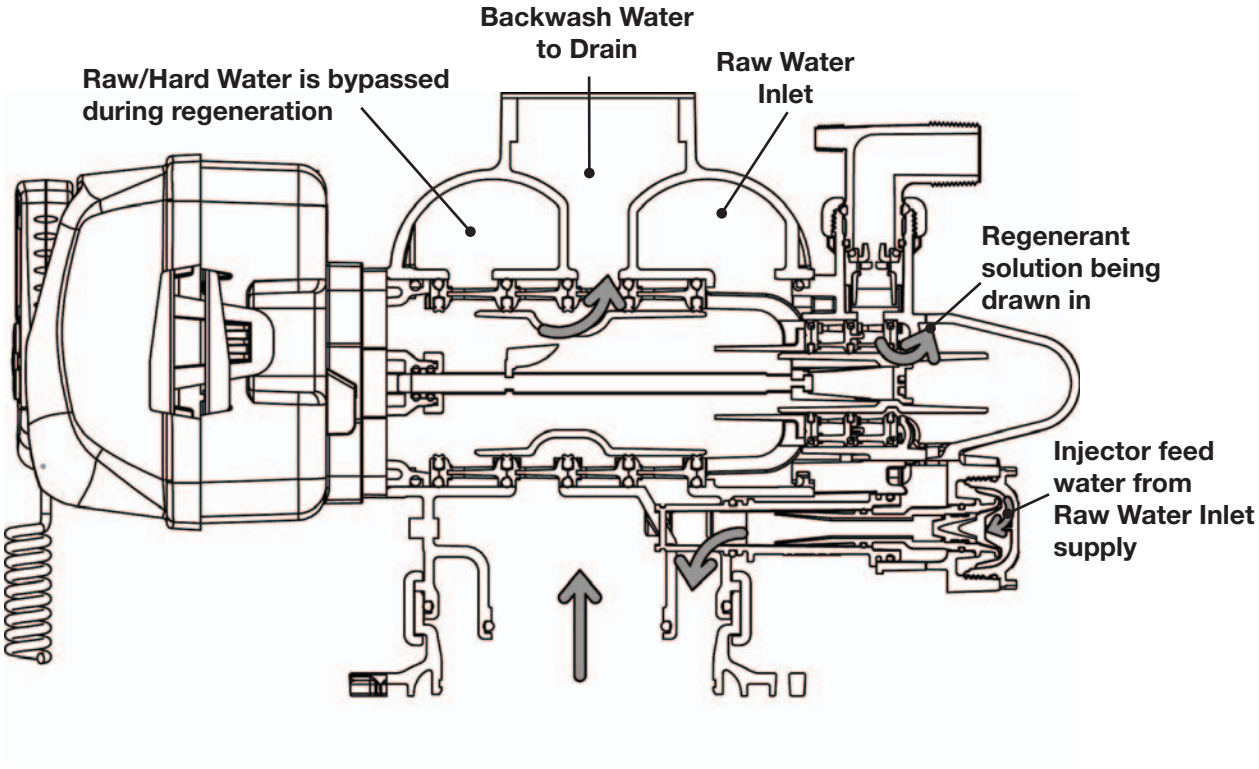


BACKWASH

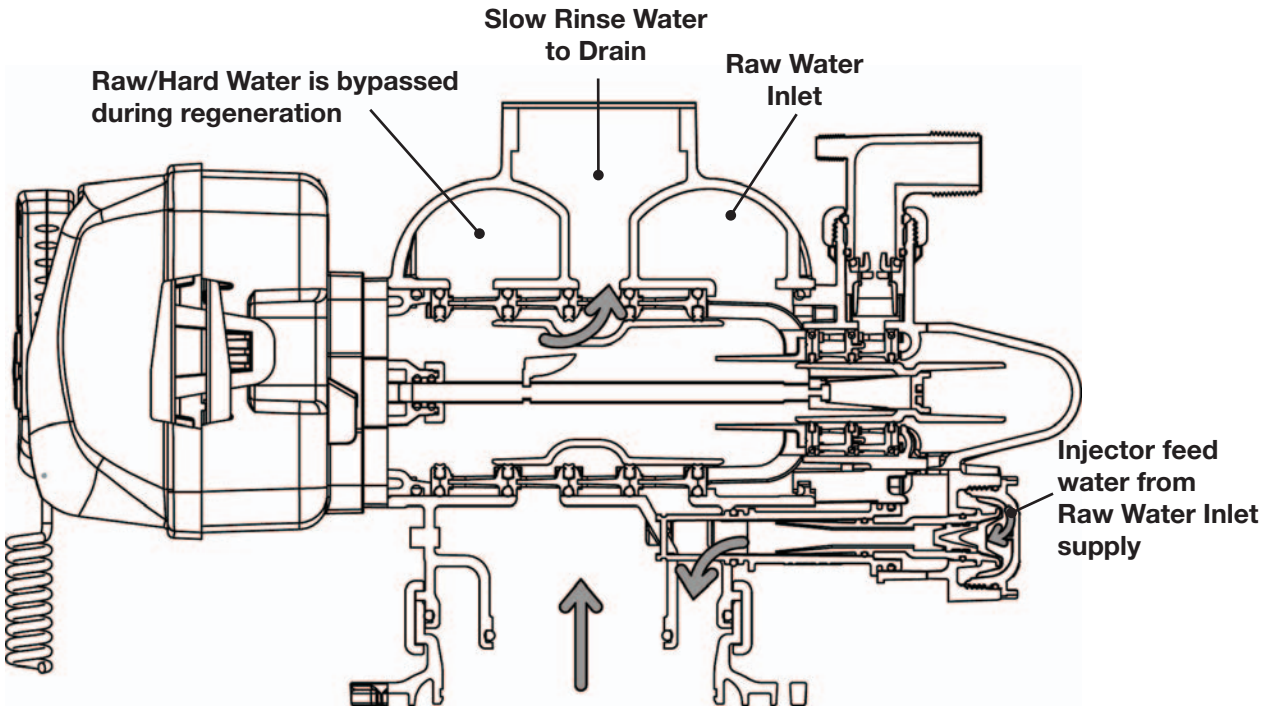


CYCLE POSITIONS / FLOW DIAGRAMS (CONTINUED)

DRAW

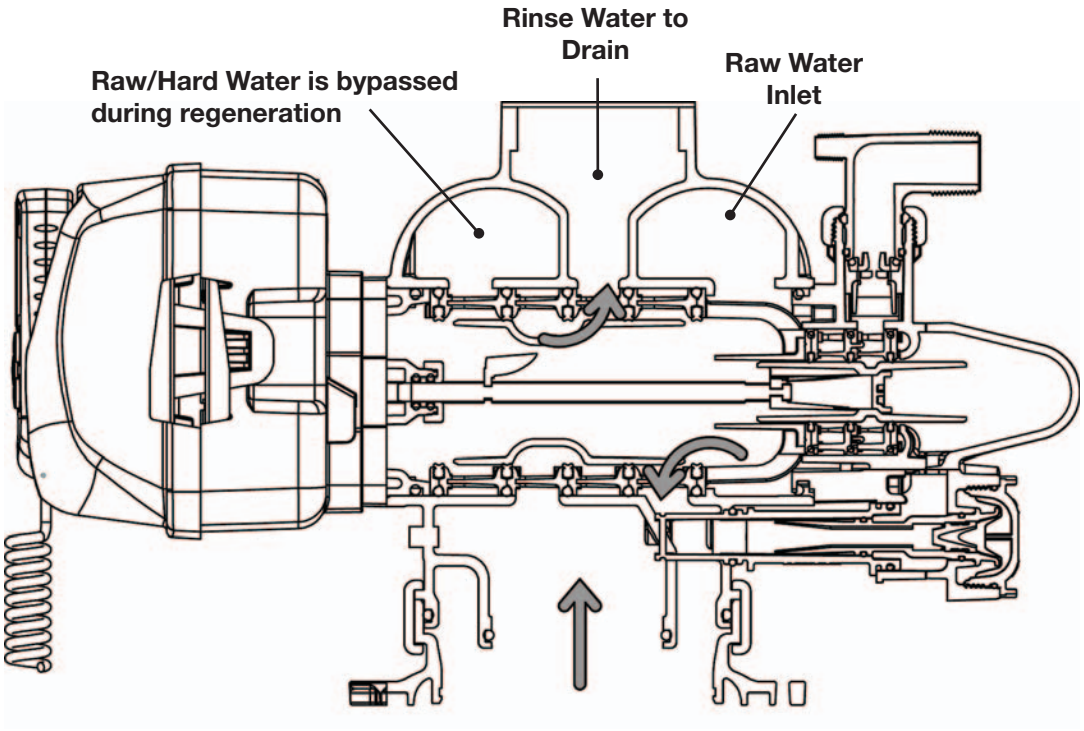


SLOW RINSE

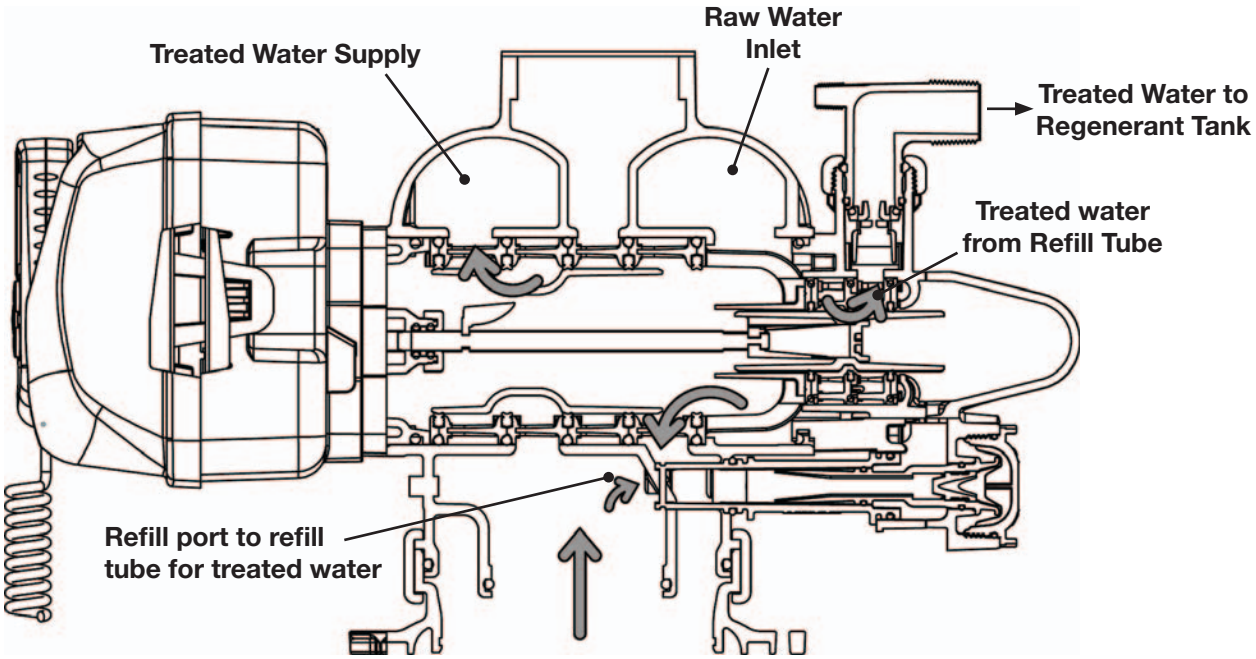


CYCLE POSITIONS / FLOW DIAGRAMS (CONTINUED)

RINSE



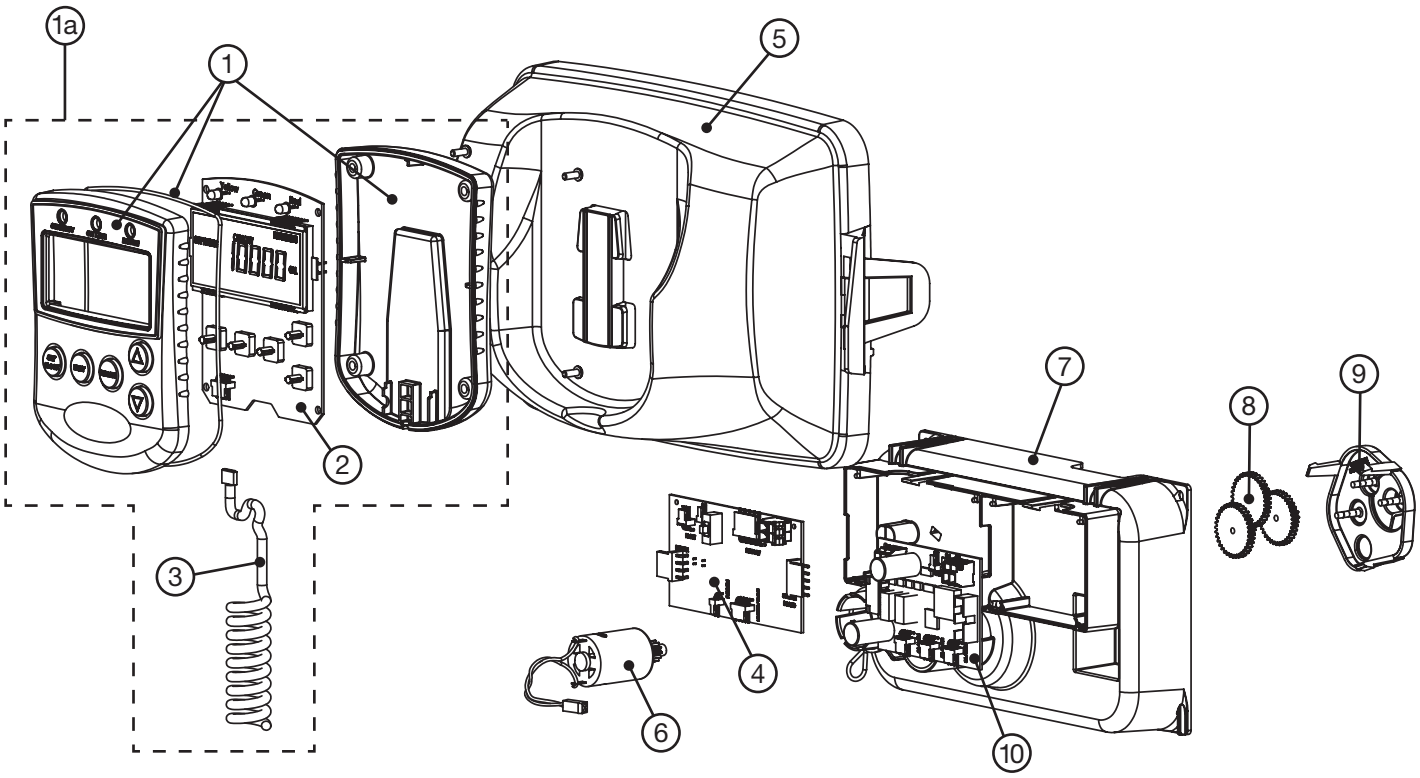
SOFT WATER REFILL



FRONT COVER AND DRIVE ASSEMBLY

Drawing No.	Order No.	Description	Quantity
1	V3068	WS2H/3 POD FRNT-BK COVERS	1
1a	V3082	WS2H/3 POD ASY COMPLETE W/BOARD*	Optional
2	V3241-01 BOARD	WS2H/3 PC BOARD DISPLAY	1
3	V3248	WS2H/3 CABLE DISPLAY POD	1
4	V3242-01BOARD	WS2H/3 PC BOARD VALVE	1 See Table 2 Software and Power Supply Compatibility for option Selection
5	V3224-01R	WS2H/3 COVER ASY PLATINUM	1
6	V3107-01	WS1 MOTOR ASY	1
7	V3226-01	WS2H/3 DRIVE BRACKET ASY	1
8	V3110	WS1 DRIVE GEAR 12X36	3
9	V3109	WS1 DRIVE GEAR COVER	1
Not Shown	V3461-01	WS2H/3 AC ADAPTER 20VAC	1 See Table 2 Software and Power Supply Compatibility for option selection
	V3461EU-01	WS2H/3 AC ADAPTER EU 20VAC	
	V3461UK-01	WS2H/3 AC ADAPTER UK 20VAC	
10	V3243-01BOARD	WS2H/3 PC BOARD SYSTEM	1 See Table 2 Software and Power Supply Compatibility for option Selection
Not Shown	V3475-12	WS2H/3 SYS CONNECT CORD 12 FT RED	Optional
Not Shown	V3475-24	WS2H/3 SYS CONNECT CORD 24 FT BL	Optional
Not Shown	V3475-36	WS2H/3 SYS CONNECT CORD 36 FT YEL	Optional

*Contains items 1,2 & 3 Pod Assembly, PC Board and Cable



WS2H DRIVE CAP ASSEMBLY, DOWNFLOW PISTON, REGENERANT PISTON, SPACER STACK ASSEMBLY, DRIVE BACK PLATE, MAIN BODY AND METER

Drawing No.	Order No.	Description	Quantity
1	V3275	WS2H/3 SCREW BTNSKT HD SS3/8-16X2-1/4 (7/32" hex allen wrench required)	4
2	V3291	WS2H/3 WASHER SS 3/8	4
3	V3225	WS2H/3 BACK PLATE	1
4	V3066	WS2H DRIVE ASY	1
5	V3289	O-RING 344	1
6	V3204-01	WS2H PISTON	1
7	V3238-01***	WS2H/3 BRINE PISTON	1
8	V3065	WS2H STACK ASY	1
Not Shown	V3468-04	WS15/2/3 PLUG 1/4NPT PLST TAPE	2
	V3465-04	WS15/2/3 PLG 1/4BSPT PLST TAPE	
9	V3201-03	WS15/2/3 PLG 1/4BSPT PLST TAPE	1
	V3201BSPT-03	WS2H BSPT BODY W/V3465 PLUG	
10	V3632*	WS1.5/2/3 METER RETAINING CLIP	1
11	V3003-02	WS1.5/2H METER COMMERCIAL ASY	1
12	V3118-03	WS1.5/2 TURBINE ASY	1
13	V3105	O-RING 215	1
14	V3501	WS1.5/2 TURBINE CLIP	1
15	V3279	O-RING 346	1
16	V3280	O-RING 332 FOR VALVE BODIES WITH NPT THREADS	1
	V3452	O-RING 230 FOR VALVE BODIES WITH BSPT THREADS	
17	V3054**	WS2H 4 IN BASE CLAMP ASY	1
18	V3276	WS2H/3 BOLT HEX SS 5/16-18X1-3/4	1
19	V3269	WS2H/3 NUT 5/16-18 SS HEX	1
Not Shown	D1300-01	TOP BAFFLE DFSR CLACK 2/63MM	1

* In 2008 a modification was made to Meter Housings to use V3632 WS1.5/2/3 Meter Retaining Clip. Do not use V3632 on old style housings which have holes through the castings to accept the U-shaped V3223 WS2 Meter Clip.
**V3054 WS2 4 IN BASE CLAMP ASY includes a V3276 WS2 BOLT HEX SS 5/16-18X1-3/4 and V3269 WS2 NUT 5/16-18 SS HEX.
***V3238-01 Brine Piston is used for Backwash Only valves.

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

Service or replace the turbine by:
1. Turn the bypass for the system off and relieve the pressure on the system.
2. Press downward on the remote meter assembly to relieve tension on the retaining clip V3632 (or the U-shaped V3223 WS2 Meter Clip). Remove the clip and take the meter assembly out of the housing.
3. Remove the bend from the two exposed tips of the retaining clip V3501 and remove clip.
4. Service or replace the V3118-03 WS15/2 Turbine Assembly and place it back in the turbine shaft.
5. Insert the V3501 WS15/2 Turbine Clip and re-bend the exposed ends of the clip. The V3118-03 turbine has a groove to line up with the V3501 WS15/2 Turbine Clip.
6. Insert meter assembly back into the meter housing.
7. Re-install the meter retaining clip V3632 as shown below (or the U-shaped V3223 WS2 Meter Clip).
8. Open the bypass for the system slowly to bring back into service and check to be sure you have no water leaks.

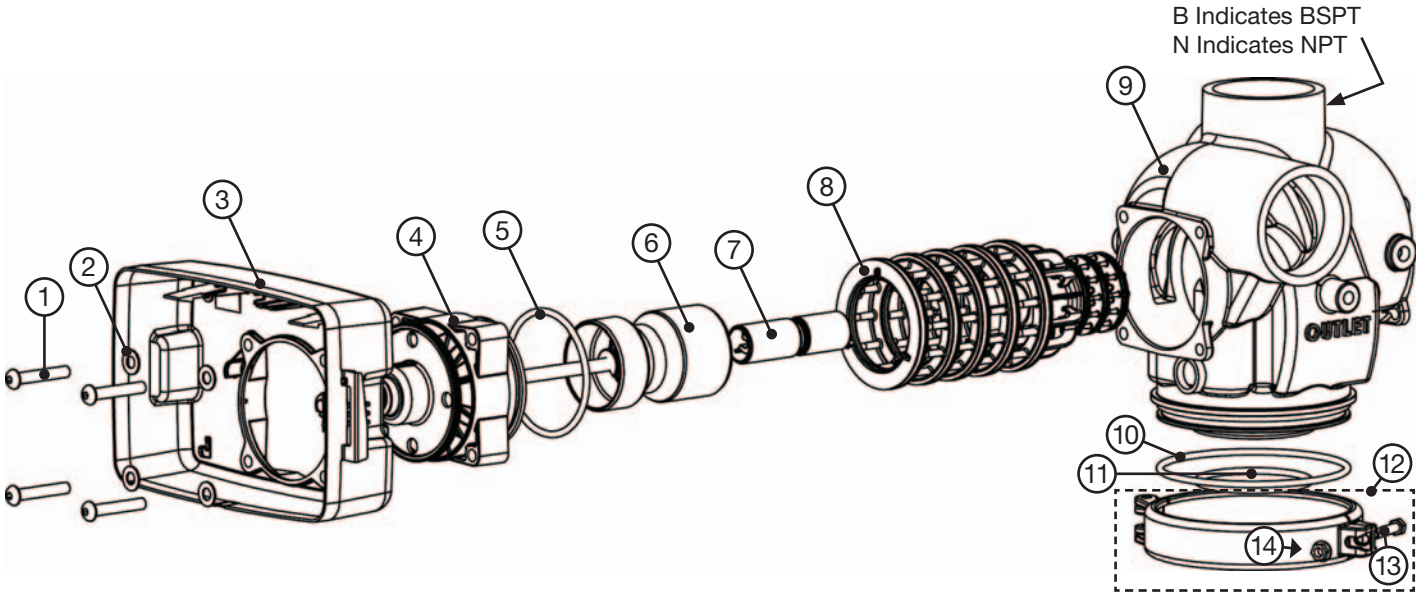
Typical meter retaining clip installation. Ensure clip is fully engaged in groove and tabs positioned in slot as shown.

Install D1300-01 upper diffuser (not shown) when using the 4" Quick Disconnect (V3064)

WS3 DRIVE CAP ASSEMBLY, DOWNFLOW PISTON, REGENERANT PISTON, SPACER STACK ASSEMBLY, DRIVE BACK PLATE AND MAIN BODY

Drawing No.	Order No.	Description	Quantity
1	V3274	WS2H/3 SCREW BTNSKT HD SS3/8-16X2 (7/32" hex allen wrench required)	4
2	V3291	WS2H/3 WASHER SS 3/8	4
3	V3225	WS2H/3 BACK PLATE	1
4	V3093	WS3 DRIVE ASY	1
5	V3289	O-RING 344	1
6	V3666-01	WS3 PISTON	1
7	V3238-01**	WS2H/3 BRINE PISTON	1
8	V3092	WS3 STACK ASY	1
Not Shown	V3468-04	WS15/2/3 PLUG 1/4NPT PLST TAPE	2
	V3465-04	WS15/2/3 PLG 1/4BSPT PLST TAPE	
9	V3667-03	WS3 BODY W/V3468 PLUG	1
	V3667BSPT-03	WS3 BSPT BODY W/V3465 PLUG	
10	V3763	O-RING 361	1
11	V3762	O-RING 341 FOR VALVE BODIES WITH NPT OR BSPT THREADS	1
12	V3091*	WS3 BASE CLAMP ASY	1
13	V3276	WS2H/3 BOLT HEX SS 5/16-18X1-3/4	1
14	V3269	WS2H/3 NUT 5/16-18 SS HEX	1
Not Shown	V3672	TOP BAFFLE DFSR CLACK 3/90MM	1

*V3091 WS3 BASE CLAMP ASY includes a V3276 WS2H/3 BOLT HEX SS 5/16-18X1-3/4 and V3269 WS2H/3 NUT 5/16-18 SS HEX.
**V3238-01 Brine Piston is used for Backwash Only valves.



Install V3672 upper diffuser (not shown) when using the 6" Flange Base (V3090) ⟶

WS2H AND WS3 BRINE VALVE BODY AND INJECTOR COMPONENTS

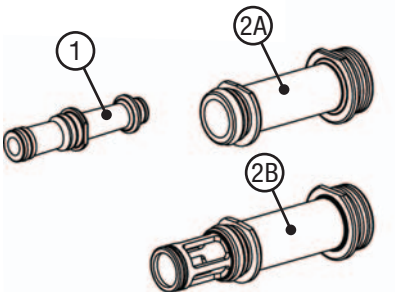
Drawing No.	Order No.	Description	Quantity	
			WS2H	WS3
1	V3237-01	WS2H/3 SOFTFILL TUBE ASY	1	1
2a	V3236-04*	WS2H INJECTOR TUBE ASY FOR A THRU H	1	
2b	V3670-01**	WS3 INJECTOR TUBE DOWNFLOW ASY		1
3	V3289	O-RING 344	1	1
4	V3067	WS2H/3 BRINE BODY ASY	1	1
5	V3477	WS2H/3 INJECTOR CAP	1	1
6	V3152	O-RING 135	1	1
7	V3275	WS2H/3 SCREW BSHD SS 3/8-16X2-1/4 (7/32” hex allen wrench required)	4	4
8	V3291	WS2H/3 WASHER SS 3/8	4	4
9	V3162-022***	WS1 DLFC 022 FOR 3/4	1	1
10	V3231	WS2H/3 REFILL FLOW CNTRL RETAINER	1	1
11	V3277	O-RING 211	1	1
12	V3105	O-RING 215	1	1
13	V3150	WS1 SPLIT RING	1	1
14	V3151	WS1 NUT 1 QC	1	1
15	V3149	WS1 FTG 1 PVC MALE NPT ELBOW	1	1
Not Shown	V3189	WS1 FTG 3/4&1 PVC SLVNT 90	Optional	Optional
Not Shown	V3499*****	WS2H/3 FITTING CAP 1 IN THREADED	1	1
Not Shown	V3797******	WS1 FTG 1 PVC MALE BSPT ELBOW	BSPT Only	BSPT Only

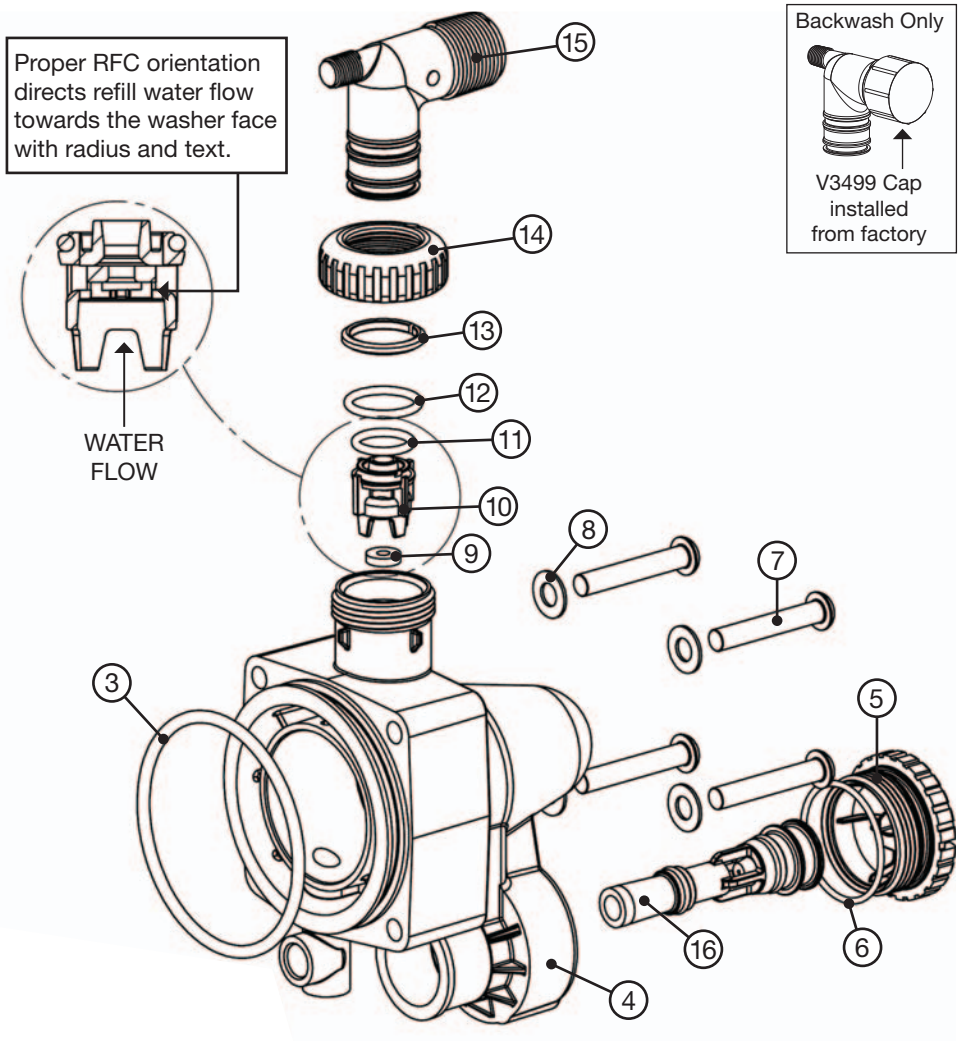
*V3236-04 WS2H INJECTOR TUBE ASY A thru H contains a V3285 O-RING 213 and a V3286 O-RING 216.
**V3670-01 WS3 INJECTOR TUBE DOWNFLOW ASY contains a V3285 O-RING 213, V3286 O-RING 216 and a V3163 O-RING 019.
***Any V3162-XXX flow control may be used. V3237-01 WS2H SOFTFILL TUBE ASY contains a V3155 O-RING 112, V3287 O-RING 110 and a V3288 O-RING 206.
****V3010-2A through V3010-2G injectors contain a V3283 O-RING 117 and a V3284 O-RING 114. V3010-2H injectors use a V3283 O-RING 117 and D1263 O-RING 116. Backwash Only Valves include a V3499 but do not include the following parts: V3189, V3162-022, V3231 and V3277.
***** Install V3499 on V3149 if valve is to be set up as a backwash only valve.
****** BSPT valves also include a V3797 WS1 FTG 1 PVC MALE BSPT ELBOW

WS2H AND WS3 VALVE INJECTOR ORDER INFORMATION

Injector Order Number	Typical Tank Diameter [1]
V3010-2A	18”
V3010-2B	21”
V3010-2C	24”
V3010-2D	30”
V3010-2E	36”
V3010-2F	42”
V3010-2G	48”
V3010-2H	63”

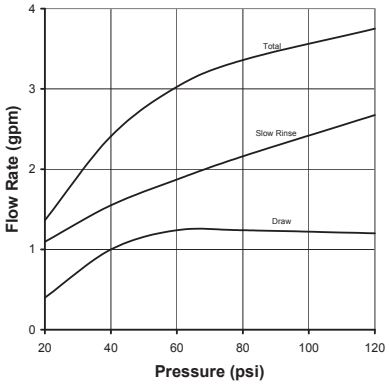
[1]Actual injector size used may vary depending on the design and application of the system. Injectors in table are sized for a typical downflow softener using standard mesh synthetic cation exchange media regenerating with sodium chloride.



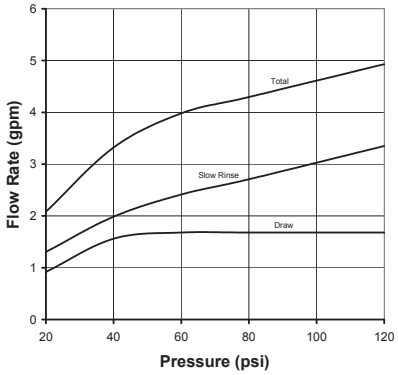


STANDARD INJECTOR GRAPHS

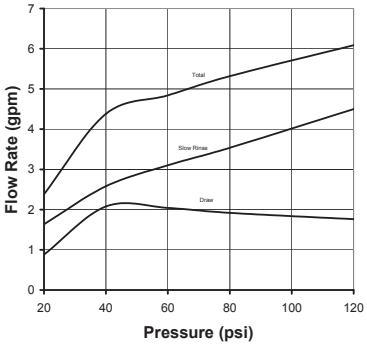
Order No. V3010-2A
US Units



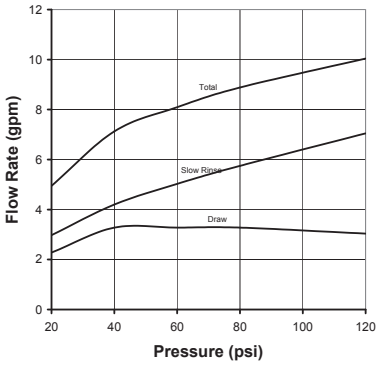
Order No. V3010-2B
US Units



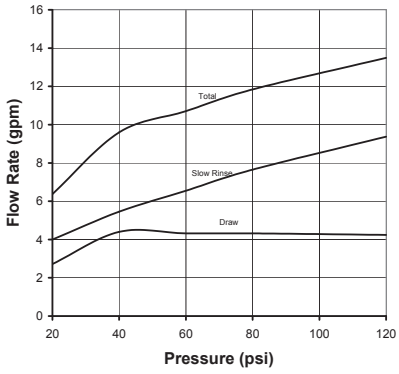
Order No. V3010-2C
US Units



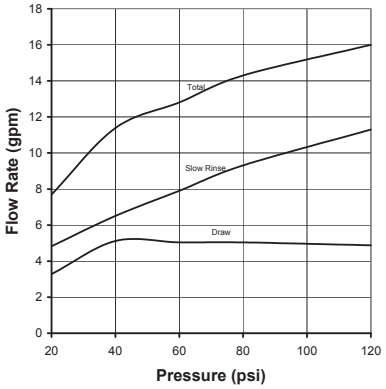
Order No. V3010-2D
US Units



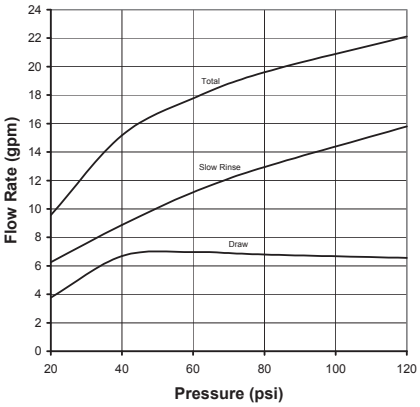
Order No. V3010-2E
US Units



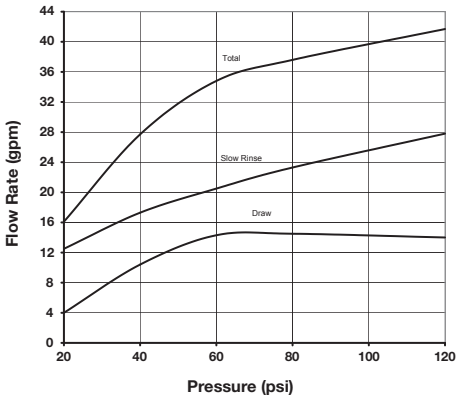
Order No. V3010-2F
US Units



Order No. V3010-2G
US Units

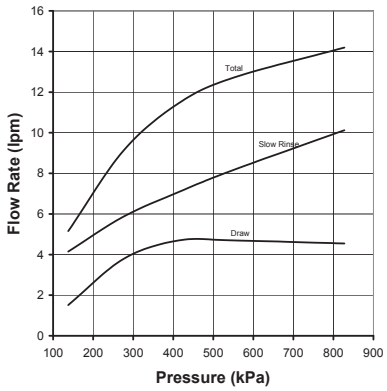


Order No. V3010-2H
US Units

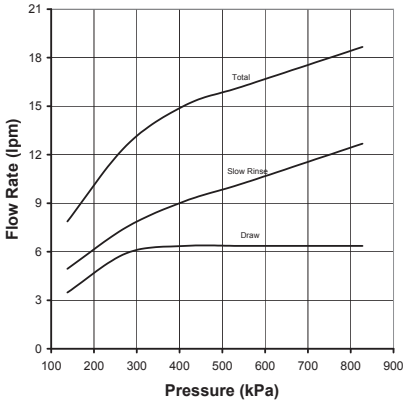


STANDARD INJECTOR GRAPHS (CONTINUED)

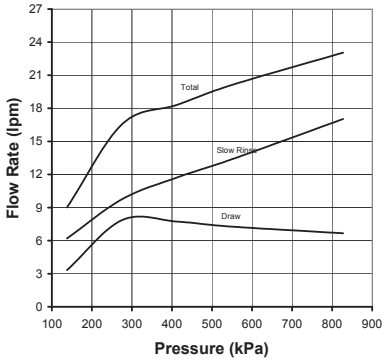
Order No. V3010-2A
Metric Units



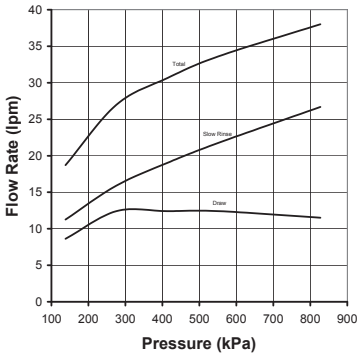
Order No. V3010-2B
Metric Units



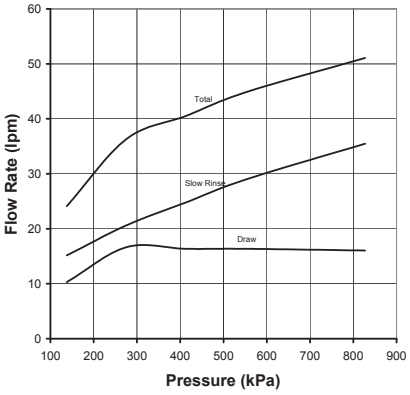
Order No. V3010-2C
Metric Units



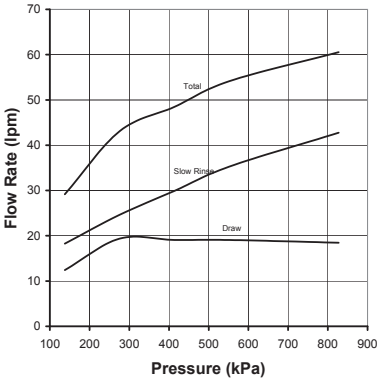
Order No. V3010-2D
Metric Units



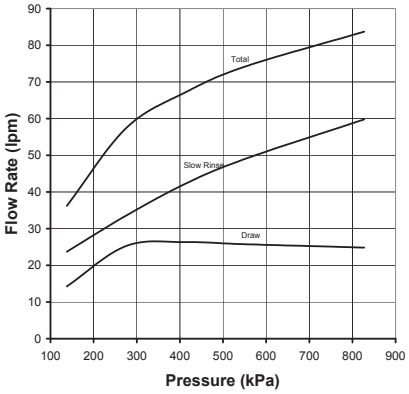
Order No. V3010-2E
Metric Units



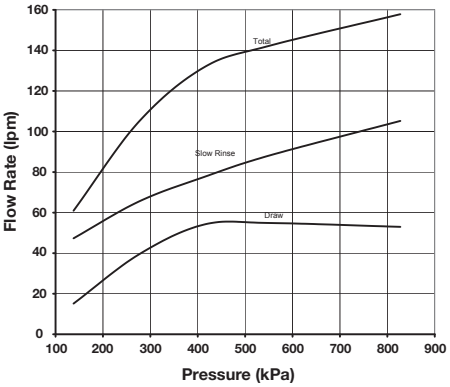
Order No. V3010-2F
Metric Units



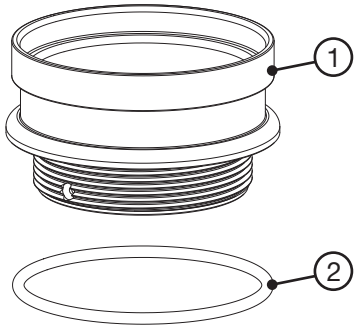
Order No. V3010-2G
Metric Units



Order No. V3010-2H
Metric Units

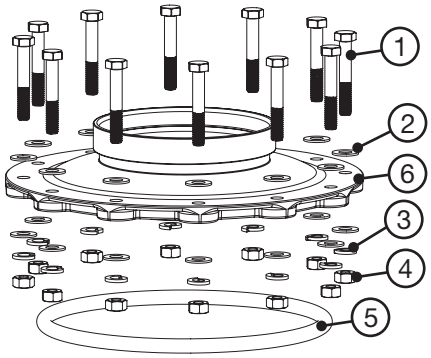


V3064 WS2H/2QC 4 INCH BASE ASY (FOR USE ON WS2H OR WS2QC ONLY)



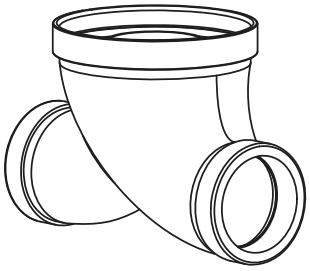
Drawing No.	Order No.	Description	Quantity
1	V3202-01	WS2H BASE	1
2	V3419	O-RING 347	1

V3055 WS2H/2QC 6 INCH FLANGE BASE ASY or V3090 WS3 6 INCH FLANGE BASE ASY



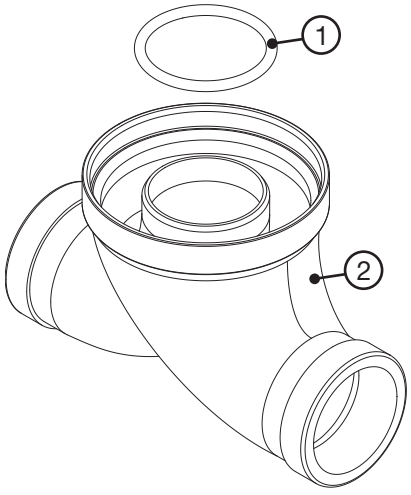
Drawing No.	Order No.	Description	Quantity	
			V3055	V3090
1	V3444	WS2H SCREW HEXCAP 5/16-18X2 SS	12	12
2	V3293	WS2H WASHER SS 5/16 FLAT	24	24
3	V3445	WS2H WASHER SPLIT LOCK 5/16 SS	12	12
4	V3447	NUT HEX 5/16-18 SILICON BRASS	12	12
5	COR60FL	O RING 6 FLANGE ADAPTER	1	1
6	V3261-01	WS2H FLANGE BASE	1	
	V3671-01	WS3 FLANGE BASE		1

WS2H/2QC SIDE MOUNT BASE ASSEMBLY



Order No.	Description	Inlet/Outlet	For Valve
V3260-02	WS2H/2QC SIDE MOUNT NPT ASY	2” Female NPT or 2.5” Groove Lock	WS2H NPT
V3674-02	WS3 SIDE MOUNT NPT ASY	3” Female NPT	WS3 NPT
V3674BSPT-02	WS3 SIDE MOUNT BSPT ASY	3” Female BSPT	WS3 BSPT

V3260BSPT-02 WS2H/2QC SIDE MOUNT BASE BSPT ASSEMBLY



Drawing No.	Order No.	Description	Quantity
1	V3280	O-RING 332	1
2	V3260BSPT-01	WS2H SIDE MOUNT BASE BSPT	1

When using a side mount base with 2H or 2QC BSPT valves replace distributor pilot o-ring V3452 O-RING 230 with V3280 O-RING 332. See exploded view of 2H or 2QC valve for specific location of distributor pilot o-ring.

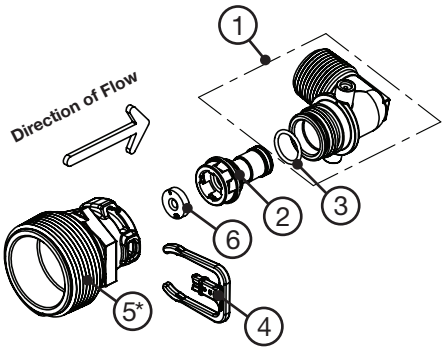
DRAIN LINE FLOW CONTROLS

All drain line flow control housings are shipped without flow control washers.
See drain line flow control washer section for available flow selections.

PVC Elbow, 0.7 - 10 GPM

Item	Part#	Description	Qty.
	V3158-04	WS Drain Fitting, 3/4" Elbow	
1	V3158-03	Drain Elbow, 3/4 NPT	1
2	V3159-01	DLFC Retainer Assembly	1
3	V3163	O-ring, -019	1
4	H4615	Locking Clip	1
5*	V3983	WS2 DLFC Adapter	1
6	V3162-xx	See DLFC Section	1

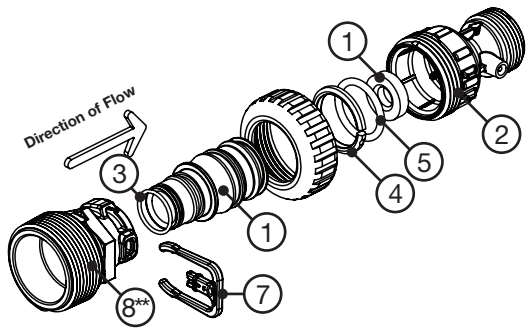
*Also available: V3414 WS1.5 DLFC Adapter



Inline Plastic, 9 - 25 GPM

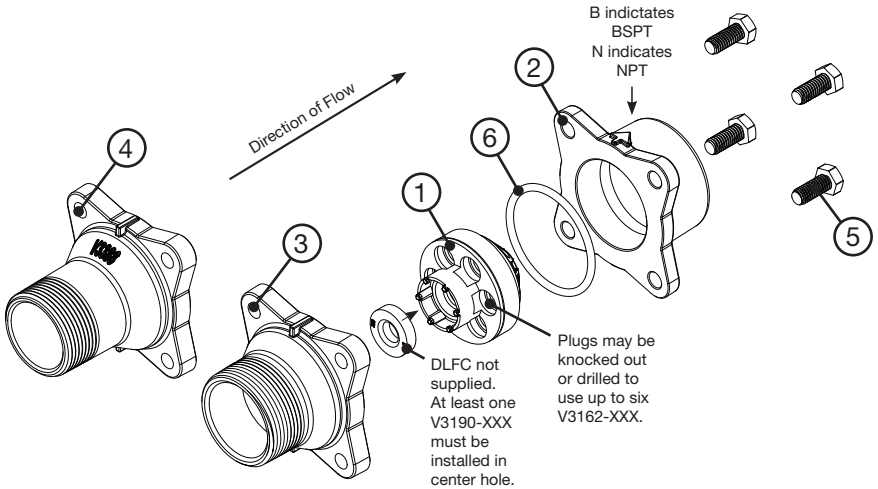
Item	Part#	Description	Qty.
	V3008-05	WS Drain Fitting, 1" Straight	
1	V3167	WS Drain Fitting Adapter, 1" NPT	1
2	V3166-01	Drain Fitting Body	1
3	V3151	WS1 Nut, QC	1
4	V3150	WS1 Split Ring	1
5	V3105	O-ring -215	1
6	V3163	O-ring -019	1
7	H4615	Locking Clip	1
8**	V3983	WS2 DLFC Adapter	1
9	V3190-xx	See DLFC Section	1

**Also available: V3414 WS1.5 DLFC Adapter



Stainless Steel, 9 - 85 GPM

Drawing No.	Order No.	Description	Quantity			
			V3079	V3079BSPT	V3080	V3080BSPT
1	V3081	WS15 RETAINER DLFC ASY	1	1	1	1
2	V3645	WS15 DLFC FLANGE OUTLET FNPT	1		1	
	V3645BSPT	WS15 DLFC FLANGE OUTLET FBSPT		1		1
3	V3646	WS15 DLFC FLANGE INLET MNPT			1	1
4	V3388	WS125 DLFC FLANGE INLET MNPT	1	1		
5	V3652	B S 5/16-18x3/4	4	4	4	4
6	V3441	O-RING 226	1	1	1	1
7	V3162-xx	See DLFC Table	0-6	0-6	0-6	0-6
8	V3190-xx	See DLFC Table	1	1	1	1

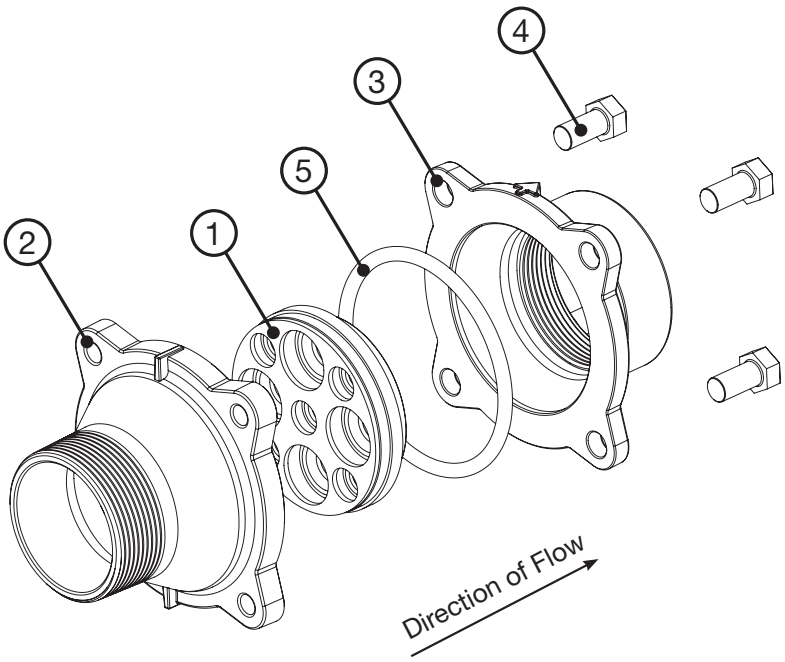


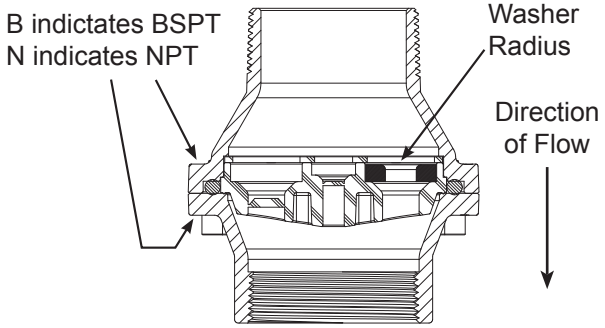
M X F STAINLESS STEEL, 0.7 – 150 GPM

Drawing No.	Order No.	Description	Quantity	
			V3051	V3051BSPT
1	V3052	WS2 DLFC Retainer Asy	1	1
2	V3245	WS2 DLFC Flange Inlet NPT	1	
	V3245BSPT	WS2 DLFC Flange Inlet BSPT		1
3	V3246	WS2 DLFC Flange Outlet NPT	1	
	V3246BSPT	WS2 DLFC Flange Outlet BSPT		1
4	V3273	Bolt Hex Hd S/S HCS 3/8-16x3/4	4	4
5	V3278	O-ring 338	1	1
6	V3162-XX	See DLFC table	0-5	0-5
7	V3190-XX	See DLFC table	0-4	0-4

Assemblies are shipped without drain line flow control (DLFC). Assembly instructions:

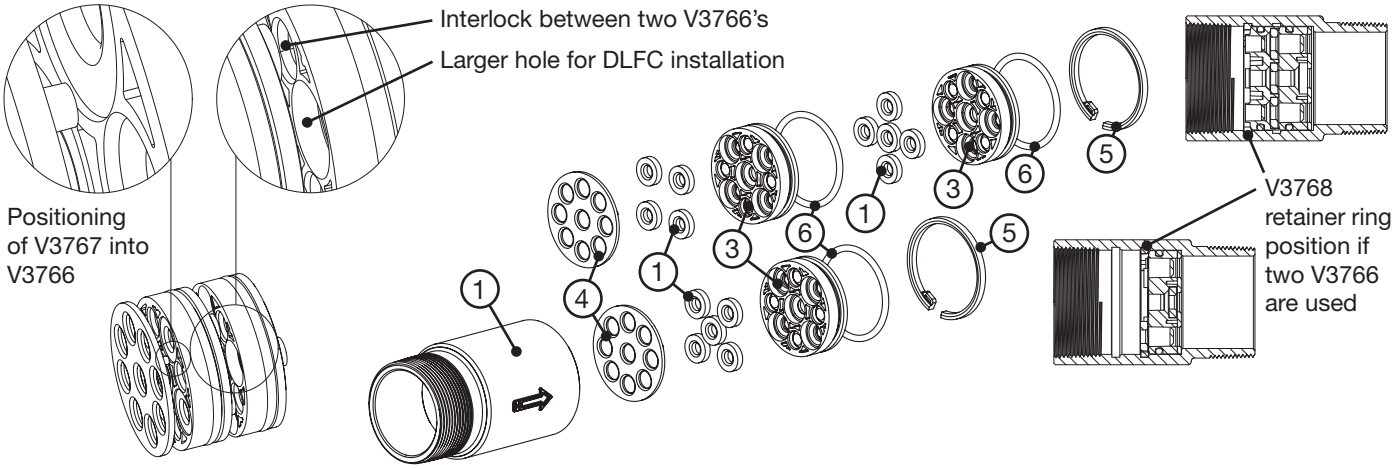
1. Determine the desired flowrate. Select a combination of V3162-XXX's and V3190-XXX's to arrive at the desired flow rate. Up to five of the smaller V3162-XXX's may be used. Up to four of the larger V3190-XXX's may be used.
2. Using a drill or punch remove the desired knockout(s) in V3052.
3. Smooth hole(s).
4. Install appropriate size(s) of drain line flow control washers. Pay close attention to proper DLFC orientation.
5. Assemble. Properly orientate the V3052 in the direction of flow.
6. Inlet and outlet threads are 2". Couplings for iron pipe may also be used.





MXF STAINLESS STEEL, 9-225 GPM

Drawing No.	Order No.	Description	Quantity	
			V3764	V3764BSPT
1	V3765-01	WS3 DLFC HOUSING NPT	1	
	V3765BSPT-01	WS3 DLFC HOUSING BSPT		1
2	V3766	WS3 DLFC RETAINER	1	1
3	V3767	WS3 DLFC RETAINER COVER	1	1
4	V3768	WS3 DLFC RETAINER RING	1	1
5	V3769	O-RING 336	1-2	1-2
6	V3190-XX	See DLFC table	1-9	1-9



Assemblies are shipped without drain line flow control (DLFC) washers.

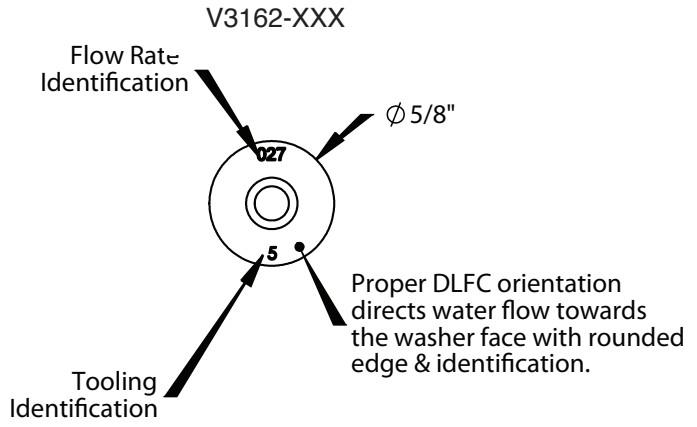
Assembly instructions:

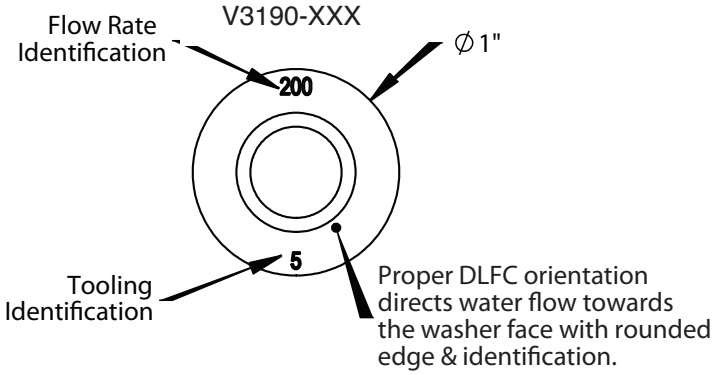
1. Determine the desired flow rate. Select a combination of V3190-XXX's to arrive at the desired flow rate.
2. Using a drill or punch remove the desired knockout(s) in V3766. Each V3766 retainer contains two types of knock outs. The larger knockouts are removed to install a DLFC. If two V3766 retainers are needed remove the smaller diameter knockout that lines up with the DLFC installed in the other retainer. One or two V3766 retainers may be used. When using one V3766 retainer V3190-XXX must be installed in the center hole. When using two V3766 retainers a V3190-XXX must be installed in the center hole of one of the retainers and the center hole on the other retainer must remain open.
3. Smooth hole(s).
4. Install appropriate size(s) of drain line flow control washers. Pay close attention to proper DLFC orientation.
5. Assemble. Each V3766 retainer must have a V3769 o-ring installed. One each of the V3767 retainer cover and V3768 retainer ring must be used whether one or two V3766 retainers are used. The positioning of the V3768 retainer ring varies depending on the number of V3766 retainer(s) used. Properly orientate the V3766(s) in the direction of flow.
6. Properly orientate the complete assembly in the direction of flow. Inlet and outlet threads are 3".

DRAIN LINE FLOW CONTROL WASHERS

Order No.	Description
V3162-007	.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
V3190-090	9.0 GPM Drain line flow control
V3190-100	10.0 GPM Drain line flow control
V3190-110	11.0 GPM Drain line flow control
V3190-130	13.0 GPM Drain line flow control
V3190-150	15.0 GPM Drain line flow control
V3190-170	17.0 GPM Drain line flow control
V3190-200	20.0 GPM Drain line flow control
V3190-250	25.0 GPM Drain line flow control

All DLFC housings ship without DLFC installed. Select control from table for proper backwash, based on media manufacturer's recommendations.





WS2H/ WS3 TROUBLE SHOOTING GUIDE

Problem	Possible Cause	Solution
1. No Display on POD	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. Poor connection between POD connector and PC Board.	d. Check connector on POD, possible broken wire or terminal pin not inserted properly in connector. Clean pins on PC Board by plugging & unplugging the POD connector a few times to remove excess protective coating.
	e. Defective Power Adapter	e. Replace Power Adapter
	f. Defective PC Board	f. Replace PC Board
2. POD 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
	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. Bypass/ isolation valve in bypass position	a. Turn bypass/ isolation handles to place in service position
	b. Meter is not connected to meter connection on PC Board	b. Connect meter to three pin connection labeled FLOW on PC Board
	c. Restricted/ stalled meter turbine	c. Remove meter and check for rotation or foreign material
	d. Meter wire not installed securely into three pin connector	d. Verify meter cable wires are installed securely into three pin connector labeled FLOW
	e. Defective meter	e. Replace meter
	f. Defective PC Board	f. Replace PC Board
4. Control valve regenerates at wrong time of day	a. Power outage	a. Reset time of day.
	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 at “on 0” (immediate regeneration)	d. Check programming setting and reset to dEL (for a delayed regen time)
5. Time of day flashes on and off	a. Power outage	a. Reset time of day.
6. Control valve does not regenerate automatically when the REGEN button is depressed and held.	a. Defective PC Board	a. Replace PC Board
	b. For the case of systems, another unit in regen would not allow another unit to go into regeneration.	b. Wait for unit in regeneration to finish

WS2H/ WS3 TROUBLE SHOOTING GUIDE (CONTINUED)

Problem	Possible Cause	Solution
7. Control valve does not regenerate automatically but **does** when the REGEN button is depressed and held.	a. Bypass/ isolation valves in bypass position b. Meter is not connected to meter connection on PC Board c. Restricted/ stalled meter turbine d. Incorrect programming e. Meter wire not installed securely into three pin connector f. Defective meter g. Defective PC Board	a. Turn bypass/ isolation valves handles to place in service position b. Connect meter to three pin connection labeled FLOW on PC Board c. Remove meter and check for rotation or foreign material d. Check for programming error e. Verify meter cable wires are installed securely into three pin connector labeled FLOW f. Replace meter g. Replace PC Board
8. Hard or untreated water is being delivered	Check water quality directly at unit outlet 1. Water quality is good a) Bypass/ isolation valves are open or faulty 2. Water quality is poor a) Damaged seal/stack assembly b) Faulty riser tube or seal c) Control valve body type and piston type mix matched 3. Media is exhausted, water quality is poor a) Higher than anticipated water usage b) Meter not registering c) No regenerant or low level of regenerant in regenerant tank d) Control fails to draw in regenerant e) Water quality fluctuation f) Fouled media bed	1. External Bypass Leak a) Fully close bypass/ isolation valves or replace 2. Internal Bypass Leak a) Replace seal/stack assembly b) Verify seal placement & engagement with riser c) Verify proper control valve body type and piston type match 3. No internal leaks a) Check program settings or diagnostics for abnormal water usage b) See Troubleshooting Guide #3 c) Check refill setting in programming. Check refill flow control for restrictions or debris and clean or replace, check refill flow control rate for proper fill time. d) Refer to Troubleshooting Guide # 12 e) Test water and adjust program values accordingly f) Replace media bed
9. Control valve uses too much regenerant	a. Improper refill setting or refill fill flow control is not sized properly b. Improper program settings c. Control valve regenerates frequently	a. Check refill setting and check refill flow control for proper refill rate. b. Check program setting to make sure they are specific to the water quality and application needs c. Check for leaking fixtures that may be exhausting capacity or system is undersized

WS2H/ WS3 TROUBLE SHOOTING GUIDE (CONTINUED)

Problem	Possible Cause	Solution
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. Plugged, fouled, or incorrect injector size	b. Inspect and clean or replace injector, or replace injector with correct size for the application
	c. Restricted drain line	c. Check drain line for restrictions or debris and clean
	d. Damaged seal/ stack assembly or piston allowing leakage during draw	d. Check seal/ stack assembly and piston for damage and replace
	e. Draw time too short	e. Program proper draw time needed
	f. Excessive refill	f. Program proper refill time needed
	g. Vacuum leak in draw line / elbow	g. Locate vacuum leak and fix
11. Excessive water in regenerant tank	1. Tank is being overfilled a) Improper program settings b) Missing refill flow controller	1. Excess from fill cycle a) Verify program settings b) Visual inspection / measure volume output into container
	2. Previous regenerant is not being drawn out	2. See Troubleshooting Guide #12
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
	g. Damaged seal/ stack assembly	g. Inspect seal stack assembly for damage and replace
13. Water running to drain	a. Power outage during regeneration or unit is currently in 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 properly	d. Re-tighten the drive cap assembly
14. Motor drives intermittently during regeneration.	a. Low power	a. See Table 2 Software and Power Supply Compatibility

WS2H/ WS3 TROUBLE SHOOTING GUIDE (CONTINUED)

Problem	Possible Cause	Solution
15. Err – 1001 = Control unable to sense motor movement	a. Motor not inserted fully to engage pinion, motor wires broken or disconnected	a. Disconnect power, make sure motor is fully engaged, check for broken wires, make sure two pin connector on motor is connected to the two pin connection on the PC Board labeled REGEN. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
	b. PC Board not properly snapped into drive bracket	b. Properly snap PC Board into drive bracket and then Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
	c. Missing reduction gears	c. Replace missing gears
	d. Damaged or dirty reduction gear reflectors	d. Clean or replace reduction gear
	e. Faulty or dirty optics on back of PC board	e. Clean or replace PC Board
16. Err – 1002 = 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. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
	b. Mechanical binding	b. Check piston and seal/ stack assembly, check reduction gears, check drive bracket and main drive gear interface. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position. Check that pinion is not pressed up tight against motor
	c. Main drive gear too tight	c. Loosen main drive gear. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position. Verify free motion by rotating main drive gear by hand, driving piston in and out
	d. Improper voltage being delivered to PC Board	d. Verify that proper voltage is being supplied. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.

WS2H/ WS3 TROUBLE SHOOTING GUIDE (CONTINUED)

Problem	Possible Cause	Solution
17. Err – 1003 = 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 buttons for about 3 seconds to resynchronize software with piston position.
	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. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
	c. Drive bracket not snapped in properly and out of position enough that reduction gears and drive gear do not interface	c. Snap drive bracket in properly then press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
	d. Low voltage slowing drive	d. See Table 2 Software and Power Supply Compatibility
18. Err - 14001 = Message queue full	a. Master PC Board did not receive a response from slave units.	a. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
19. Err -15003 = Motorized Bypass or MAV for NHBP valve motor ran too long and unable to find the proper park position Motorized Alternating Valve = MAV No Hard Water Bypass = NHBP	a. Control valve programmed for ALT A or noHbP without having a motorized drive securely connected to the 2 pin terminal labeled “BYPASS” on the main PC Board	a. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position. Then re-program valve to proper setting
	b. Poor wire connection	b. Remove power and check connection for Motorized Bypass or MAV for NHBP motor to PC Board two pin connection labeled BYPASS. Make sure wires in connector are inserted securely and no wires are broken. Clean pins on PC Board by plugging and unplugging the connector a few times to remove excess protective coating. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
	c. Excess drag causing timeout before stall	c. Open up Motorized Bypass or MAV for NHBP to check for obstructions
	d. Motorized Bypass or MAV for NHBP motor not fully engaged with reduction gears	d. Properly insert motor into casing, do not force into casing. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.

WS2H/ WS3 TROUBLE SHOOTING GUIDE (CONTINUED)

Problem	Possible Cause	Solution
20. Err – 15010 = Motorized Bypass or MAV for NHBP valve motor ran too short (stalled) while trying to drive **off-line** Motorized Alternating Valve = MAV No Hard Water Bypass = NHBP	a. Foreign material is lodged in Motorized Bypass or MAV for NHBP valve b. Mechanical binding	a. Open up Motorized Bypass or MAV for NHBP and check for foreign material. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position. b. Check poppet drive assembly or piston and seal/ stack assembly, check reduction gears, drive gear interface, and check Motorized Bypass or MAV for NHBP black drive pinion on motor. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
21. Err – 15011 = Motorized Bypass or MAV for NHBP valve motor ran too short (stalled) while trying to drive **on-line** Motorized Alternating Valve = MAV No Hard Water Bypass = NHBP	a. Foreign material is lodged in Motorized Bypass or MAV for NHBP valve b. Mechanical binding	a. Open up Motorized Bypass or MAV for NHBP and check for foreign material. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position. b. Check poppet drive assembly or piston and seal/ stack assembly, check reduction gears, drive gear interface, and check Motorized Bypass or MAV for NHBP black drive pinion on motor. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.

WS2H/ WS3 TROUBLE SHOOTING GUIDE (CONTINUED)

Problem	Possible Cause	Solution
22. # of units error: Communications has been broken with the unit specified in the error message. These errors are logged as 16K series errors as follows: 16001: error with unit 2 16002: error with unit 3 16003: error with unit 4		Correct all errors on satellite units before attempting to reset error on master
	a. System is programmed for the wrong number of units or a Slave unit is in “error # of units” mode due to loss of power.	a. Pressing any button while in the # of units error will enter the user into the setting screen. Adjust to the correct units for the system and press NEXT to exit the set up screen. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position. Re-program valve to proper setting.
	b. Poor connection on PC Boards	b. Make sure wires in connector are inserted securely and no wires are broken. Clean pins on PC Board by plugging and unplugging the connector a few times to remove excess protective coating. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
	c. More than one unit has determined that it is the master control	c. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position. Then re-program each valve to operate as single individual unit. Re-program the control that is to be the master control and it will filter down the programming to the slave controls automatically.
23. Err – 17000 = MAV for Separate Source valve motor ran too long while trying to find proper park position	a. Control valve programmed for “ON SEP In” with out having a MAV for separate source attached	a. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position. Re-program valve to proper setting
	b. MAV for separate source motor wire not connected to System Board or poor connection	b. Remove power and check connection on MAV for separate source motor wire to System Board two pin connection labeled AUX DRIVE. Make sure wires in connector are inserted securely and no wires are broken. Clean pins on System Board by plugging and unplugging the connector a few times to remove excess protective coating. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
	c. MAV for separate source motor not fully engaged with reduction gears	c. Properly insert motor into casing, do not force into casing. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.

WS2H/ WS3 TROUBLE SHOOTING GUIDE (CONTINUED)

Problem	Possible Cause	Solution
24. Err – 17002 = MAV for Separate Source valve motor ran too short while trying to find proper park position	a. Foreign material is lodged in MAV for separate source valve b. Mechanical binding	a. Open up MAV for separate source and check for foreign material. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position. b. Check poppet drive assembly or piston and seal/ stack assembly, check reduction gears, drive gear interface, and check MAV for separate source black drive pinion on motor. Press NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.
25. Err – 18000 = Reset was performed, this error code will display in the diagnostics under the error log	a. Press the NEXT and REGEN buttons for about 3 seconds to resynchronize software with piston position.	
26. Err – 18001 = Power loss, this error code will display in the diagnostics under error log	a. When power is lost a signal is sent to log the power loss	
27. Err – 18002 = Power restored, this error code will display in the diagnostics under error log	a. When power is restored a signal is sent to log the power being restored	

Revision History:

6/27/2016

Updated manual – combined parts manual and programming manuals; refined and revised many sections.

1/6/2017

PAGE 5:

216.04[4]	1.13 or greater	20 VAC	V3461-01 WS2H/3 AC ADAPTER 20V V3461EU-01 WS2H/3 AC ADAPTER EU 20V V3461UK-01 WS2H/3 AC ADAPTER UK 20V

[4]If using old and new version in a system, the master must be an older version.

PAGE 7:
Description in table -
Maximum power through either relay to be:
A) 1A, 30 VDC
B) 1A, 30 VAC

2/3/2017

PAGE 4:
New table

PAGE 8:
New drawing

PAGE 9:
New drawing

PAGE 37:
Removed Distributer Pipe Height

3/10/2017

PAGE 5:

216.04 or greater	1.13 or greater	20 VAC	V3461-01 WS2H/3 AC ADAPTER 20V V3461EU-01 WS2H/3 AC ADAPTER EU 20V V3461UK-01 WS2H/3 AC ADAPTER UK 20V

Section 9: Softener Addendum
Softener Log Sheet

SOFTENER LOG					SOFTENER LOG SHEET NO.	
Date	Time	Meter Reading	Gallons Delivered	Inlet Pressure	Outlet Pressure	Salt Used