



Water Softener

SSE & FSE
Multiport Valve

Installation and Operation Manual



750-261
02/08

SAFETY PRECAUTIONS AND ABBREVIATIONS

Safety Precautions

It is essential to read and understand the following safety precautions before attempting to operate the equipment. Failure to follow these precautions may result in damage to equipment, serious personal injury, or death. A complete understanding of this manual is required before attempting to start-up, operate or maintain the equipment. The equipment should be operated only by personnel who have a working knowledge and understanding of the equipment.

The following symbols are used throughout this manual:



WARNING
This symbol indicates a potentially hazardous situation which, if not avoided, could result in serious personal injury or death.



CAUTION
This symbol indicates a potentially hazardous situation which, if not avoided, could result in damage to the equipment.

Notice

Notice
This symbol indicates information that is vital to the operation of this equipment.

Abbreviations

Following is an explanation of the abbreviations, acronyms, and symbols used in this manual.

AC	Alternating Current
AR	Automatic Reset
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
BHP	Boiler Horsepower
BTU	British Thermal Unit
°C	Degrees Celsius
CFH	Cubic Feet per Hour
Cu Ft	Cubic Feet
DC	Direct Current
°F	Degrees Fahrenheit
FM	Factory Mutual
FS	Flame Safeguard
ft	Feet
GPM	Gallons per Minute
Hd	Head
HT	Height
HTB	High Turndown Burner
HZ	Hertz
In H ₂ O	Inches of Water
IRI	Industrial Risk Insurance
Lb	Pound
LWCO	Low-Water Cut-Off
M	Million
MFD	Micro-Farad
MR	Manual Reset
NEC	National Electric Code
No.	Number
pH	Measure of the degree of acidity or alkalinity of a solution
P/N	Part Number
PPM	Parts Per Million
PR	Program Relay
psi	Pounds Per Square Inch
SAE	Society of Automotive Engineers
scfh	Standard Cubic Feet per Hour
T	Temperature
TC	Temperature Control
TI	Temperature Gauge
UL	Underwriter's Laboratories
V	Volt
WC	Water Column
WSI	Watts Per Square Inch

CLEAVER-BROOKS

Water Softener

SSE & FSE Multiport Valve

Installation and Operation Manual



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DO NOT OPERATE, SERVICE, OR REPAIR THIS EQUIPMENT UNLESS YOU FULLY UNDERSTAND ALL APPLICABLE SECTIONS OF THIS MANUAL.

DO NOT ALLOW OTHERS TO OPERATE, SERVICE, OR REPAIR THIS EQUIPMENT UNLESS THEY FULLY UNDERSTAND ALL APPLICABLE SECTIONS OF THIS MANUAL.

FAILURE TO FOLLOW ALL APPLICABLE WARNINGS AND INSTRUCTIONS MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH.

TO: Owners, Operators and/or Maintenance Personnel

This operating manual presents information that will help to properly operate and care for the equipment. Study its contents carefully. The unit will provide good service and continued operation if proper operating and maintenance instructions are followed. No attempt should be made to operate the unit until the principles of operation and all of the components are thoroughly understood. Failure to follow all applicable instructions and warnings may result in severe personal injury or death.

It is the responsibility of the owner to train and advise not only his or her personnel, but the contractors' personnel who are servicing, repairing or operating the equipment, in all safety aspects.

Cleaver-Brooks equipment is designed and engineered to give long life and excellent service on the job. The electrical and mechanical devices supplied as part of the unit were chosen because of their known ability to perform; however, proper operating techniques and maintenance procedures must be followed at all times. Although these components afford a high degree of protection and safety, operation of equipment is not to be considered free from all dangers and hazards inherent in handling and firing of fuel.

Any "automatic" features included in the design do not relieve the attendant of any responsibility. Such features merely free him of certain repetitive chores and give him more time to devote to the proper upkeep of equipment.

It is solely the operator's responsibility to properly operate and maintain the equipment. No amount of written instructions can replace intelligent thinking and reasoning and this manual is not intended to relieve the operating personnel of the responsibility for proper operation. On the other hand, a thorough understanding of this manual is required before attempting to operate, maintain, service, or repair this equipment.

Because of state, local, or other applicable codes, there are a variety of electric controls and safety devices which vary considerably from one boiler to another. This manual contains information designed to show how a basic burner operates.

Operating controls will normally function for long periods of time and we have found that some operators become lax in their daily or monthly testing, assuming that normal operation will continue indefinitely. Malfunctions of controls lead to uneconomical operation and damage and, in most cases, these conditions can be traced directly to carelessness and deficiencies in testing and maintenance.

It is recommended that a boiler room log or record be maintained. Recording of daily, weekly, monthly and yearly maintenance activities and recording of any unusual operation will serve as a valuable guide to any necessary investigation. Most instances of major boiler damage are the result of operation with low water. We cannot emphasize too strongly the need for the operator to periodically check his low water controls and to follow good maintenance and testing practices. Cross-connecting piping to low water devices must be internally inspected periodically to guard against any stoppages which could obstruct the free flow of water to the low water devices. Float bowls of these controls must be inspected frequently to check for the presence of foreign substances that would impede float ball movement.

The waterside condition of the pressure vessel is of extreme importance. Waterside surfaces should be inspected frequently to check for the presence of any mud, sludge, scale or corrosion.

It is essential to obtain the services of a qualified water treating company or a water consultant to recommend the proper boiler water treating practices.

The operation of this equipment by the owner and his or her operating personnel must comply with all requirements or regulations of his insurance company and/or other authority having jurisdiction. In the event of any conflict or inconsistency between such requirements and the warnings or instructions contained herein, please contact Cleaver-Brooks before proceeding.

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Fill in the following data for future reference:

Model: _____

Type of Controls: _____

Regeneration time settings:

Backwash _____

Brine & Slow Rinse _____

Fast Rinse _____

Refill _____

Salt dosage (lbs per regeneration) _____



Section 1 Installation

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1.1-PRE-INSTALLATION DATA

Read the entire instruction manual before you begin installation. Failure to install and operate the system as required will void the warranty. The system will perform at maximum efficiency, when installed and operated as designed.

Obtain all the materials and tools needed for the installation before beginning. Always use the correct tools to install and maintain the system. The installation must conform to local plumbing and electrical codes. Code compliance is the responsibility of the installer or contractor.

Operating Parameters - Softeners

Parameter	Minimum	Maximum
Hardness	-	100 Grains per gallon
Iron (Ferrous)	-	10 ppm
Iron (Ferric)	-	5 ppm
Flow Rate	0.5 gpm / ft ³	10 gpm / ft ³
Chlorine	-	0.1 ppm
Turbidity	-	5 NTU
Water Pressure	25 psi	100 psi *
Water Temperature	35° F	100° F ***
pH	6.8	-

* Maximum pressure dependent on components. High pressure designs are available.

*** High Temperature systems available on special order – consult factory.

Protect the system from pressure extremes. Do not expose the system to surging pressures or water hammer. Water hammer will cause damage to the control valves, mineral tanks, and plumbing. If a condition of this type exists, a “Water Hammer Arrestor” must be installed to prevent damage.

Protect the system against back-pressure caused by a pump or any type of water storage system. If pressure on outlet exceeds inlet pressure, resin can be flushed into the inlet water supply during the service cycle.

When routing the outlet piping to an atmospheric storage tank, a valve or flow control must be installed in the outlet piping to prevent over running of the system. A back-pressure of 15 to 20 psi should be maintained on the system at all times.

Protect the system from freezing weather conditions. Temperatures at and below freezing will cause damage to tanks, valving and plumbing. Water expands when it freezes and can cause the tanks and plumbing to burst.

Protect the system from high temperatures in excess of 100° F. Some of the components used in the manufacture of the system will not withstand high temperatures. Do not connect the system downstream of a hot water system. Also protect the outlet of the system from backup of hot water from a water heater or boiler.

The system operates on 24 Volts AC supplied from a step down transformer using 120 Volts on the primary side. The 120 volts operates from a normal 15 amp wall outlet receptacle which is properly grounded. The power reduction transformer supplied with the equipment is UL listed. Conformance to local and National Electrical Codes must be observed and are the responsibility of the installer.

The system must be located within 10 feet of an open floor drain or sump. The drain from the system must contain a vent, in accordance with the local plumbing codes. The flow of drain water should be observable. Water softeners use an eduction system to draw the brine into the mineral tank. Back-pressure from overhead drain systems can affect the draw rate of the softener, therefore; it is not recommended to run the drains any higher than 8 feet above the control valve assembly. On overhead drains, an air gap must be installed in the highest point of the drain line, and local plumbing codes and regulations should be followed.

It is recommended that inlet, outlet and by-pass valves be installed on the unit for future service ability. The inlet and outlet valves are utilized to turn off the water to the unit so that the valve and other components can be serviced. The by-pass valve allows water downstream to the process (by-passing the unit) so that water can still be supplied, even though it is raw water, should it be needed.

Metal shavings, solder flux, threading compounds and other contaminating materials from the installation of the piping; must be flushed from the piping prior to allowing water to enter the system. These foreign materials can cause damage to the control valve.

Components Of A Water Softener

The system normally is not assembled at the factory. **Table 1.1** should be used as a reference for the correct parts against what was received. Different size units have different quantities of the media and style of internal distributors. All systems up to and including 30" diameter have a single-point lower distributor. Systems 36" and larger have hub radial lower distributor systems.

Table 1.1 - WATER SOFTENER COMPONENTS
Mineral Tank
Control Valve & Controller*
Controller*
Flow Meter*
Resin
Gravel Underbedding
Backwash Flow Control
Standpipe & Distributor
Brine Tank
Brine Well & Air-check
Brine Tubing Kit
Transformer

* Systems with Standard Time Clock Fleck Controls come with the controls as part of the Control Valve Assembly. Systems using an Electronic Demand Controller have the Flow Meters and Controller shipped as separate items.

Water Softening Process

A water softener removes the hardness from the water by a process known as ion exchange. Hardness in the water causes scale to form inside pipes, water heaters or boilers. This scale shortens the life of these products. The most common hardness ions in the water are calcium, magnesium and iron. The media, called resin, in the softener is charged with sodium ions from the brine (sodium chloride) contained in the brine tank, during the regeneration process. The calcium, magnesium and iron which come in contact with the resin beads, are exchanged for sodium on the resin.

The amount of hardness removed by a softener is determined by the level of salt (salt dosage) and amount of resin available. The amount of removal capability is referred to as the capacity of the resin. The volume of resin is measured in cubic feet. The salt dosage is normally 5, 10, or 15 pounds per cubic foot. The corresponding capacities are as follows:

5 lbs / cubic foot = 20,000 grains
 10 lbs / cubic foot = 25,000 grains
 15 lbs / cubic foot = 30,000 grains

A water softener with 2 cubic feet of resin and regenerated with 5 lbs / ft³ of salt will be capable of removing up to 40,000 grains of hardness. Each grain of hardness is equal to 17.1 parts per million (ppm). If the hardness of the influent water is tested to be 20 grains (342 ppm), then the 2 cubic foot water softener with 40,000 grains removal capability can soften 2,000 gallons of water between regenerations.

Hardness leakage from a water softener is directly proportional the amount of TDS in the inlet supply and the salt dosage provided during regeneration. Example: If 500 ppm TDS as CaCO₃ is in the influent and a salt dosage of 10 lbs per cubic foot is being used – hardness leakage will be at least 1.5 ppm during the normal service run. The Water Quality Association (WQA) defines the degree of hard water as follows:

Term	Grains/Gallon	PPM
Soft	less than 1.0	less than 17.1
Slightly Hard	1.0 to 3.5	17.1 to 60
Moderately Hard	3.5 to 7.0	60 to 120
Hard	7.0 to 10.5	120 to 180
Very Hard	10.5 and above	180 and above

Note: If water hardness leakage is critical for a particular application, then a custom system may need to be designed for that application.

1.2-INSTALLATION

Locating The Equipment

Locate the mineral tank on a firm, level foundation, preferably concrete (plastic shims are available from CB). The system should be within 10 feet of an electrical outlet. A floor drain capable of handling the maximum backwash flow rate must be located near the system (refer to drain line flow control chart below). Trial fit the control valve to the tank, in order to properly align the control valve and mineral tank to the plumbing. Once loaded, the tank is not easily moved.

Locate and connect the brine tank as shown in the installation drawings. Brine hose and adapter fittings are shipped inside the brine tank. The brine draw hose supplied is 10 feet long. The brine tank must be located on a smooth, clean surface. Do not set on bricks or wooden blocks. The bottom of the brine tank can distort, if placed on an irregular surface, when filled with salt, which could cause damage to the brine tank.

Assembly Of Equipment

The system is not assembled prior to shipment. The components for the water softener system are in a list on page 5.

The standpipe and distributor are shipped installed in the mineral tank. Be sure the distributor and standpipe assembly is centered in the tank and is resting on the bottom of the tank. Verify that the length of the standpipe is correct (flush to 1/8" above top of tank). If needed, cut to proper length.

Once the mineral tank is in the proper location, fill the mineral tank with approximately 12" of water. The water will help absorb the shock when the gravel is loaded into the tank. Plug the end of the standpipe to prevent resin or gravel from entering it during the filling process.

A funnel is recommended for loading the resin and gravel into the mineral tank. A funnel kit is available from CB.

Loading gravel and resin:

Load the gravel into the mineral tank.

Level the gravel. A 1/2" piece of copper pipe can be used for this purpose.

Load the resin into the mineral tank.

Fill the void in the top of the tank with water.

Wash all resin from the threads in the top of the tank.

Caution: Resin left in threads on top of the tank can cause the valve to cross thread damaging the sealing area and causing leaks.

See "Resin Loading Chart" for quantities of gravel and resin required.

Thread the control valve onto the top of the mineral tank, being careful not to cross thread. Assemble the drain line flow control (DLFC) to the drain line connection on the control valve assembly. A missing flow control can result in resin being washed out of the mineral tank and down the drain. Shims are provided for use with the steel Polybond® mineral tanks so that the fill port can be located in the proper position. Each 1/16" shim will change the position of the valve by 1/4 to 1/2 turn. The o-ring should be removed from the valve base. The 3" control valves are flange mounted to the tank. Connect the drain line from the control valve to the nearest floor drain. If the drain line must be installed overhead, do not exceed 8 feet above the control valve, and provide a vacuum break, before returning to the floor drain. See the "Softener Drain Line Flow Rate Chart".

Piping can now be connected to the inlet and outlet of the control valve. It is recommended that inlet, outlet and by-pass valves be installed on each system. Note the location of the flow meter in the attached drawing. The flow meter should be 10 pipe diameters

down stream from the last fitting and there should be 5 pipe diameters after the flow meter. See the typical installation drawing.

Connect hose provided from the brine tank to the brine valve located on the side of the control valve assembly. An air check assembly is provided inside the brine tank, which prevents air from being drawn into the softener during the slow rinse cycle of regeneration. It acts as a check valve when all the brine has been drawn out of the brine tank.

 Caution

To insure against damage, connect overflow drain from brine tank to an open floor drain. Do not connect to the multiport valve drain.

Install the control in the position shown on the drawing. Connect transformer and Flow Meter to the control if required. **Note: *Time clock units do not have a transformer or flow meter.*** Plug into 120 volt receptacle and cycle system through a regeneration cycle without water. Make sure everything is functioning properly.

Turn on water and check for leaks. Installation is complete. Program the control as required. See appropriate control section in this manual.

RESIN LOADING CHART

MODEL	GRAVEL QTY - LBS	RESIN QTY. – FT ³
S-30	12	1
S-60	25	2
S-90	50	3
S-120	100	4
S-150	100	5
S-180	100	6
S-210	150	7
S-240	150	8
S-270	150	9
S-300	150	10
S-450	250	15
S-600	300	20
S-900	400	30
S-1200	500	40

DRAIN LINE FLOW RATE and INJECTOR SIZE CHART

Valve Type	Softener Tank Diameter	Valve Size	Injector size	Injector Color	Drain Line Flow Rate
Multiport	9 or 10	1"	#1	White	2 gpm
	12	1"	#2	Blue	3 gpm
	14	1"	#2	Blue	5 gpm
	16	1-1/2" or 2"	#3	Yellow	7 gpm
	17	1-1/2" or 2"	#3	Yellow	7 gpm
Multiport	18	1-1/2" or 2"	#3	Yellow	7 gpm
	20	1-1/2" or 2"	#3	Yellow	12 gpm
	24	1-1/2" or 2"	#4C	Green	15 gpm
	30	1-1/2" or 2"	#5C	White	20 gpm
	36	1-1/2" or 2"	#5C	White	30 gpm
Multiport	30	3"	#5	Red	20 gpm
	36	3"	#5	Red	30 gpm
	42	3"	#6	White	40 gpm
	48	3"	#7	Blue	50 gpm
Side Mount Multiport	54	2" or 3"	#8	Yellow	70 gpm
	60	2" or 3"	#9	Violet	90 gpm
	72	2" or 3"	#10	Black	130 gpm

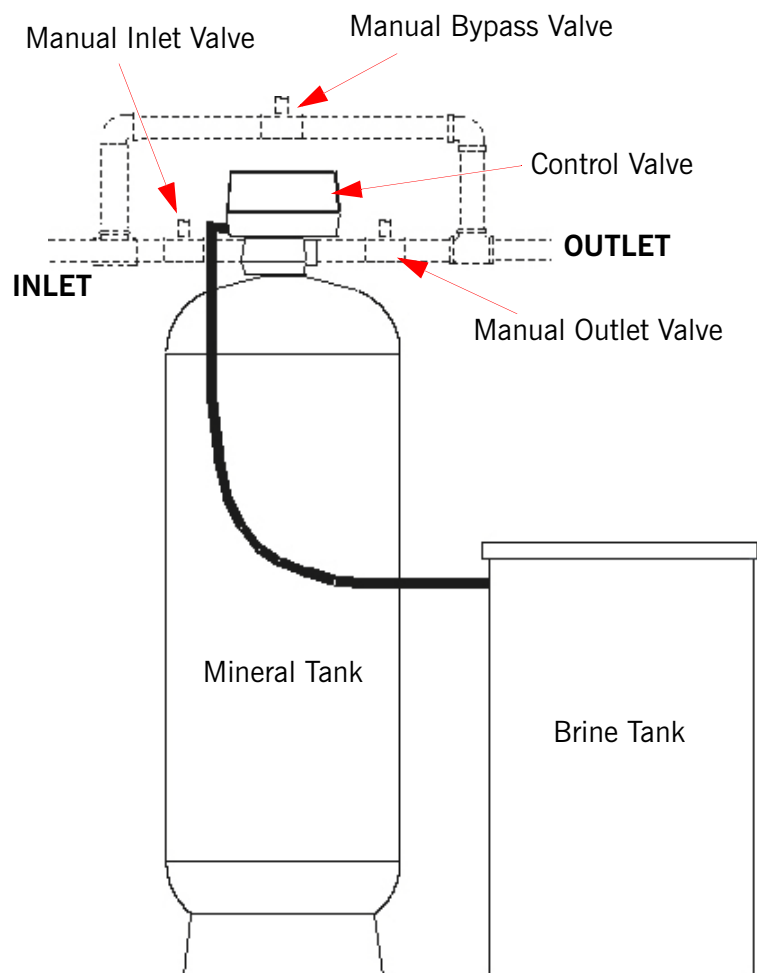
SINGLE SOFTENER INSTALLATION – TIME CLOCK MODELS

Figure 1-1 24" Time Clock Softener

Installation Instructions:

- Install manual inlet, manual outlet and manual by-pass valves for each system to allow for servicing.
- See control section of the manual to obtain instructions for setting up and programming the timer control.
- Once installation is complete, turn on the water and check for leaks.

Important: Install the drain line flow control. The flow rate is determined by the size of the mineral tank. Refer to the flow control chart on the page 9.

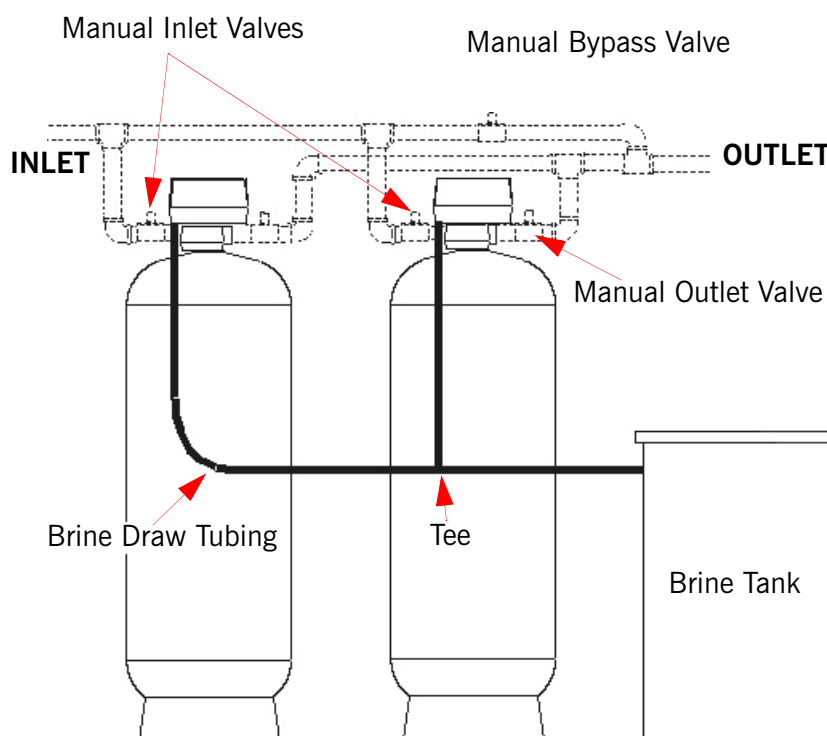
- Instructions for locating and assembling the softener are detailed on pages 7 and 8.
- Turn off water and index control to backwash position (see control section). Slowly turn on water, to insure that the mineral tank is full of water and all air has been evacuated.
- Continue advancing the control valve through the regeneration cycles and back into service. See "Brine Tank Installation Instructions" for details on the brine tank.



Figure 1-2 24" Time Clock Duplex

DUPLEX SOFTENER INSTALLATION - TIME CLOCK MODELS

The diagram below shows two softeners, each with its own top mount valve. Each tank should be installed with inlet and outlet isolation valves, which can be closed when service is required on the system. Each tank can be taken off line, repaired and brought back on line, while the other tank remains on line providing soft water.



The system should also be installed with a by-pass valve for use in the event of an emergency. The plumbing header shown is called a **Reverse Return Header System**. This header system is also known as a balanced header system. Water enters from the left and exits to the right. This type of plumbing system insures that the flow of water through the first unit is equal to the flow of water from the second unit. Simply close the inlet valves and open the by-pass, depressurize the system and repairs can be made. See "Brine Tank Installation Instructions" for details on the brine tank.

SINGLE SOFTENER INSTALLATION – DEMAND MODELS

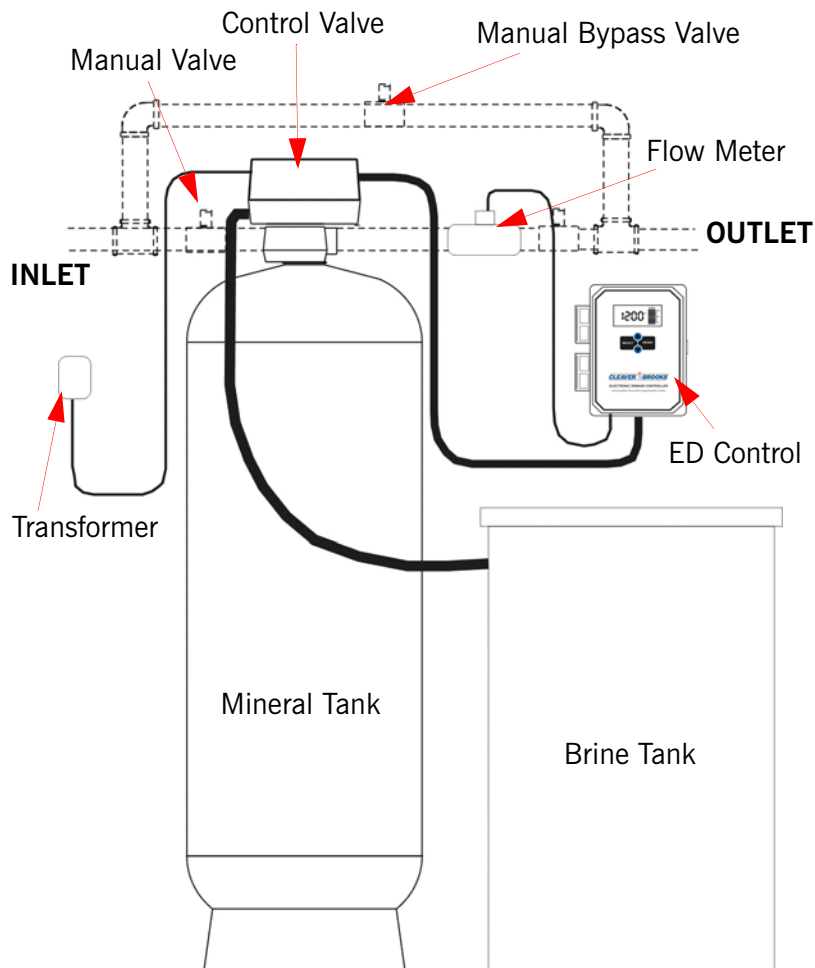


Figure 1-3 24" Demand Softener

Installation Instructions:

- Install manual inlet, manual outlet and manual by-pass valves for each system to allow for servicing.
- When installing the flow meter leave 10 pipe diameters up stream and 5 pipe diameters down stream to insure accuracy of the flow meter.
- Connect all wiring to the control before plugging in the transformer.
- See control section of the manual to obtain instructions for setting up and programming the control.

Important: Install the drain line flow control. The flow rate is determined by the size of the mineral tank. Refer to the flow control chart on the page 9.

- Instructions for locating the filter and assembly of the filter are detailed on pages 7 and 8.
- Once installation is complete, turn on the water and check for leaks.
- Turn off water and index control to backwash position (see control section). Slowly turn on water to fill the mineral tank with water. Continue advancing control valve to the service position. See "Brine Tank Installation Instructions" for details of the brine tank.

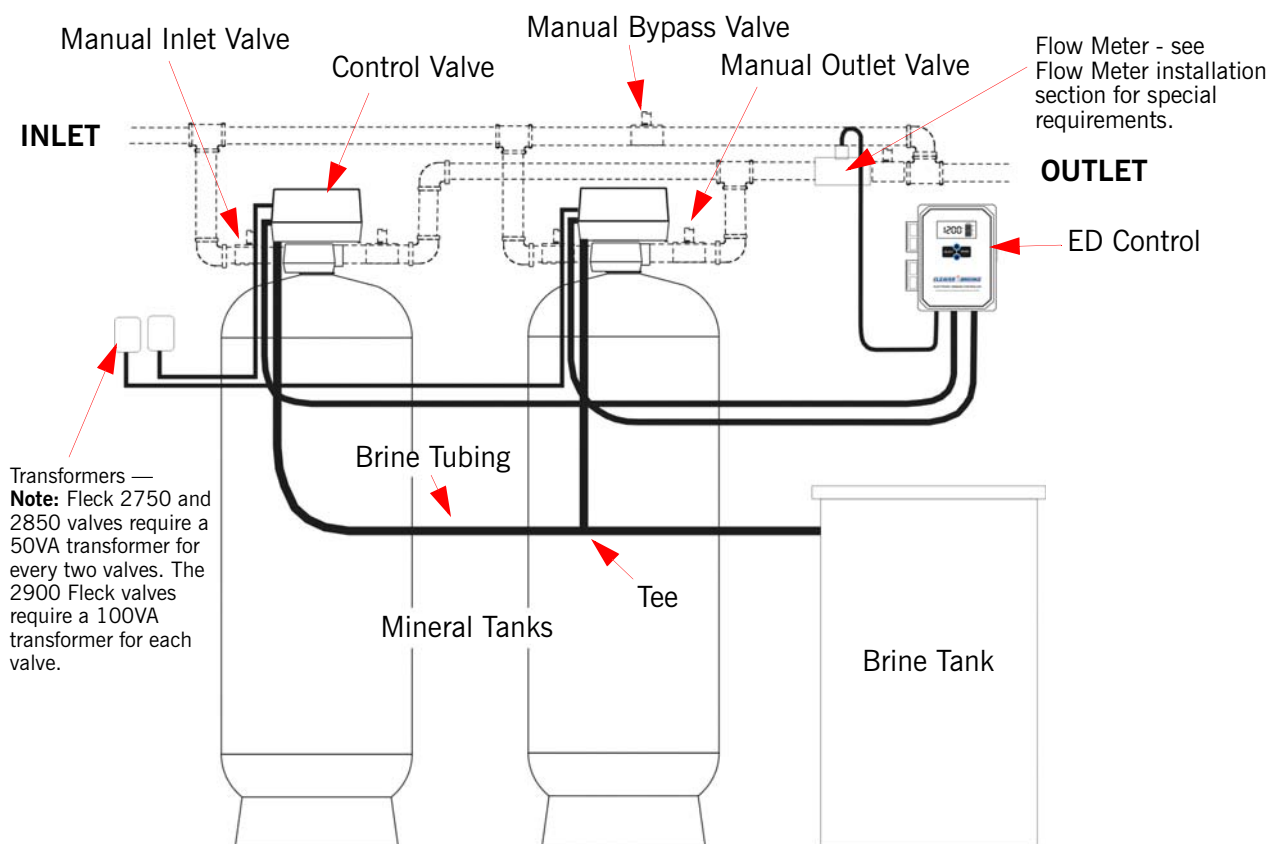


Figure 1-4 24" Duplex Demand Softener

DUPLEX SOFTENER INSTALLATION – DEMAND MODELS

The diagram below shows two tanks, each with its own top mount valve. The installation of a flow meter for a demand system is also shown. Each tank should be installed with inlet and outlet isolation valves, which can be closed when service is required on the system. Each tank can be taken off line, repaired and brought back on line, while the other tank remains on line providing filtered water.

The system should also be installed with a by-pass valve for use in the event of an emergency. The plumbing header shown is called a **Reverse Return Header System**. This header system is also known as a balanced header system. Water enters from the left and exits to the right. This type of plumbing system insures that the flow of water through the first unit is equal to the flow of water from the second unit. Note that there is an additional valve after the flow meter, which will allow it to be serviced when required. Simply close the inlet valves, close the one after the flow meter and open the by-pass, depressurize the system and repairs can be made on the flow meter. See "Brine Tank Installation Instructions" for details on the brine tank.



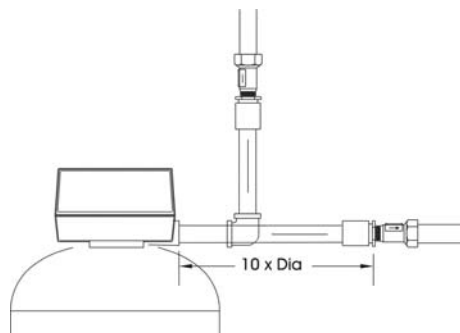
FLOW METER INSTALLATION

Flow meters must be installed in a horizontal or upward flow position only. Allow an appropriate straight length of pipe before and after the meter. These installations and appropriate straight lengths (specified in pipe diameters) are shown below.

Two types of flow sensors are commonly provided:

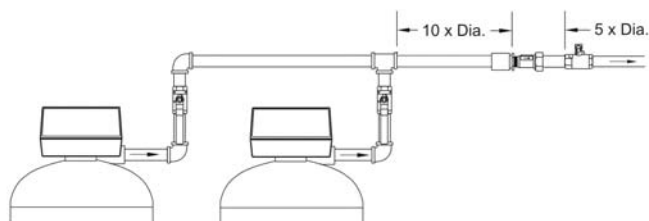
- A turbine type in a 1", 1-1/2" & 2" plastic, PVC, or brass housing
- An insertion type with a tee or saddle fitting is standard on 3" and larger plumbing

Typical Single Installation



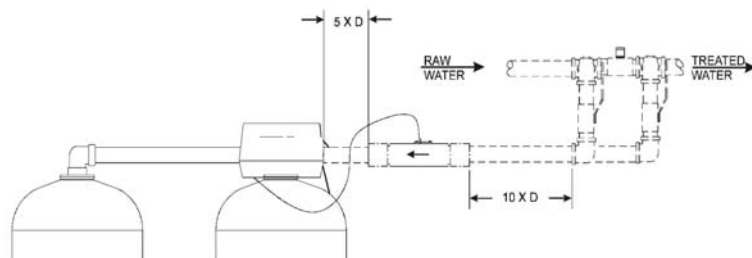
Note: Extension cables in 5', 10', and 15' lengths are available for both the control and flow meter cables.

Typical Duplex Installation



Note: On Duplex Systems the meter is installed on the common **OUTLET** header.

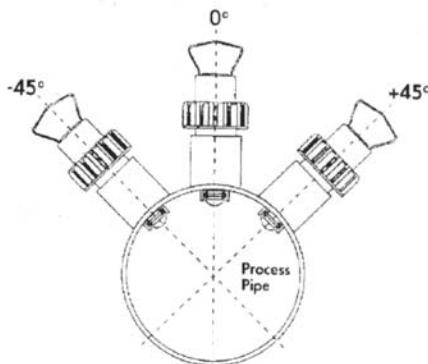
Typical Twin Installation



Note: On Twin Systems the meter is installed on the common **INLET** header.

3" and 4" FLOW SENSORS

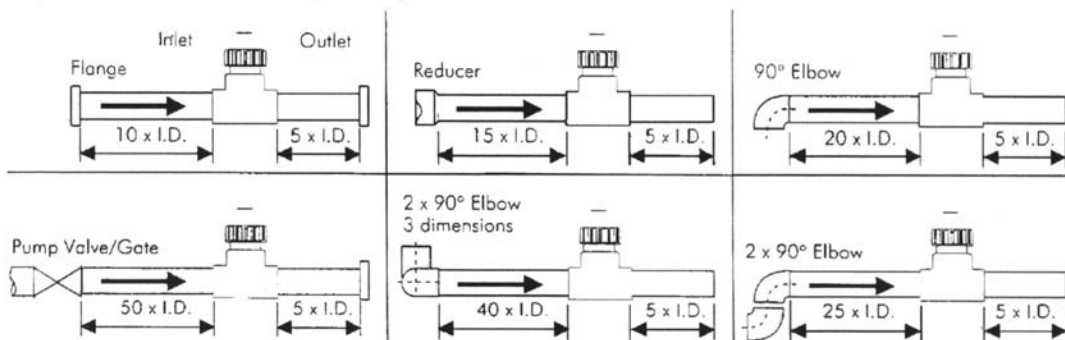
In horizontal pipe runs with no air pockets or sediment present, mount the sensor/fitting in the 12 o'clock position or 6 o'clock position. If sediment or air pockets are present tilt the sensor/fitting at a maximum angle of 45° to overcome these obstacles. In vertical runs, upward flow is required. Full



Warning: Saddle clamps used with insertion type flow

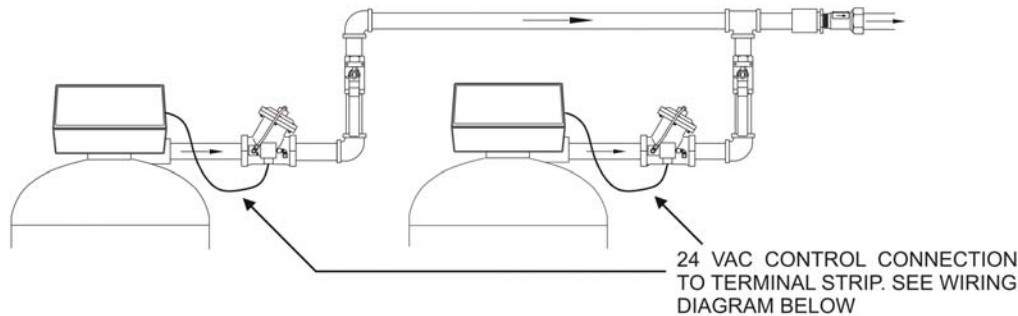
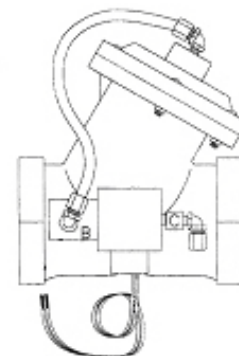
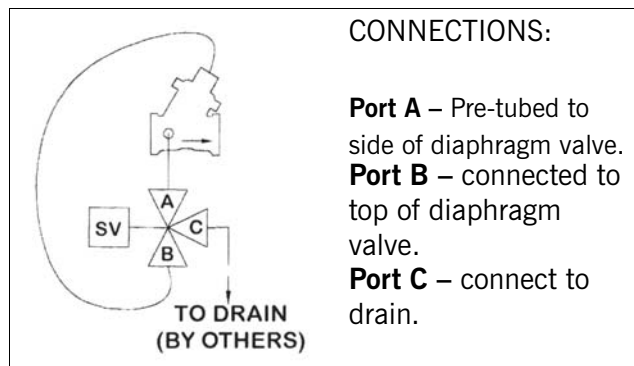
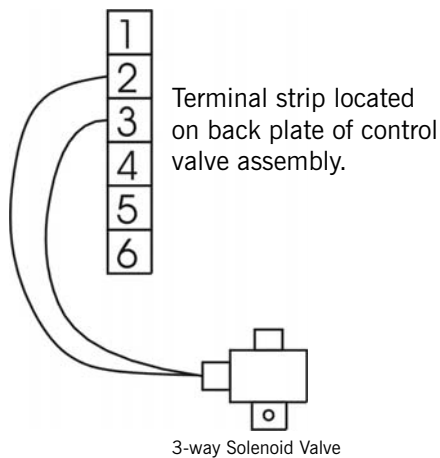
Installation / Dimensions

For maximum linearity and accuracy, the sensor must be located in a straight run of pipe upstream and downstream of the sensor. Major obstructions such as pumps or throttled valves will require longer straight runs.



NO-HARD-WATER BY-PASS

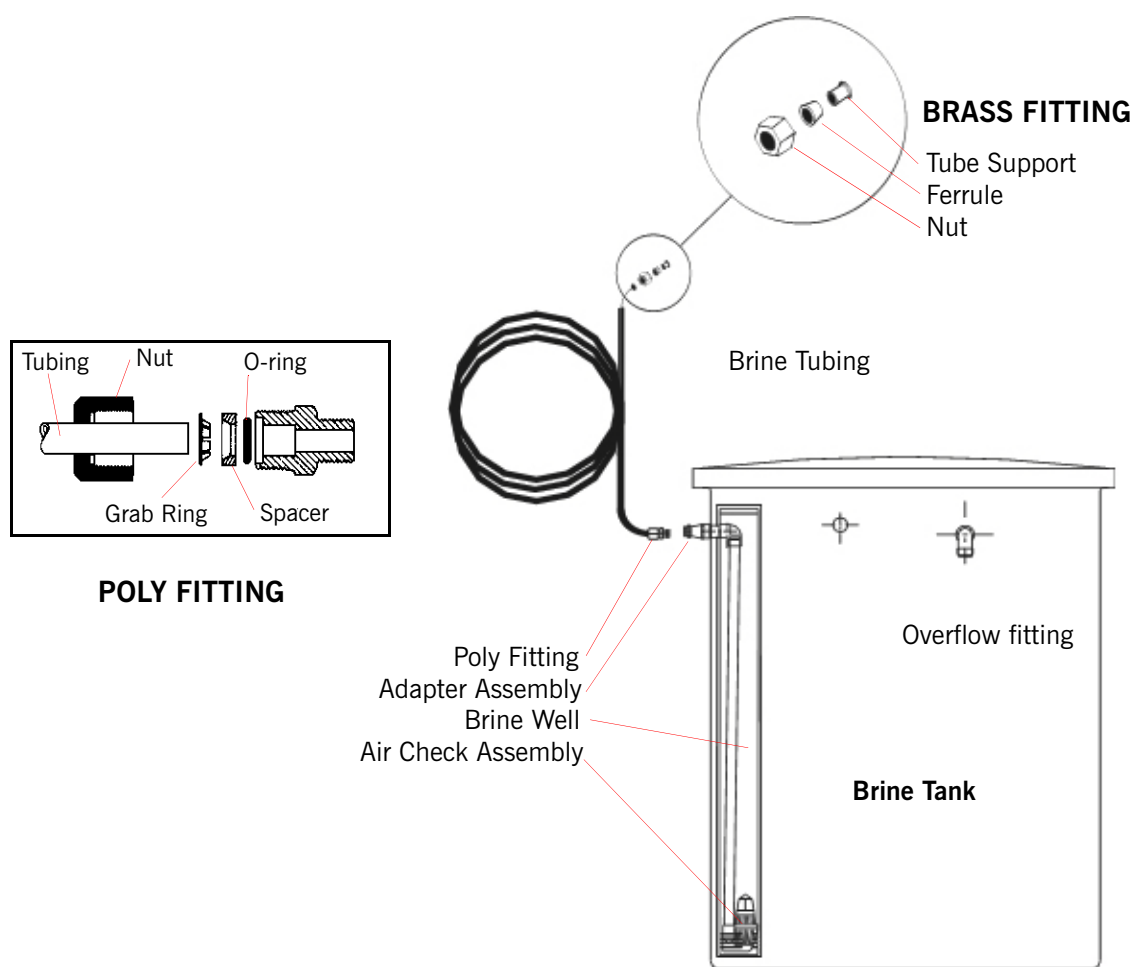
To eliminate hard water bypass on systems with 1", 1½", and 2" control valves, a solenoid-operated outlet diaphragm valve is provided. Install the valve on the outlet line of the control valve, maintain appropriate straight lengths for turbines and wire as shown below.

**3-way Solenoid Installation – No Bypass****Valve Assembly No Bypass**

Fleck 2750, 2850 and 3150 valve assemblies are shipped with diaphragm valves for multiple unit installation. The diaphragm valves serve 2 functions; first, to prevent raw water from entering the service line and second, to hold units off line when operated in the duplex alternating mode. Fleck 2900 and 3900 valves have double pistons and the lower piston serves the same purpose as the diaphragm valve.

BRINE TANK ASSEMBLY

The brine tank assembly consists of a plastic storage tank for salt and an air-check assembly. Some systems are installed with more than one brine tank and / or multiple air-check assemblies. Locate the brine tank on a firm foundation. Install the air-check by putting the top elbow through the side wall of the brine tank into one of the holes provided, and screw on the adapter supplied. A black poly fitting is supplied with the black poly tubing which is used for the brine hose. Install the poly fitting into the adapter, loosen the nut and push the poly tubing into the fitting as far as it will go. Disassemble fitting to make sure that the metal grab ring is at least $\frac{1}{4}$ " past the end of the tubing and that the o-ring and plastic spacer are in place. Put the fitting back together and tighten the plastic nut.



The other end of the tubing connects to the control valve. A brass nut, ferrule and tube support are provided with the control valve assembly. Slide the nut over the end of the tubing. Then slide on the ferrule over the tubing. The tube support is inserted into the tubing. Push the assembly onto the fitting and tighten the nut.

Caution: the tube support must be in place to prevent the hose from blowing off the brine valve.

On duplex systems, a poly tee is provided and the two brine lines are simply connected together. On a triplex and quad systems, all can be connected together. It should be noted, that some quadraplex systems come with two brine tanks.

Load salt into the brine tank (at least half full). Fill the brine tank the rest of the way with water. Warm water will produce the required brine concentration much faster than cold water. The resin in the softener comes in regenerated form and does not require an initial regeneration, however; a manual regeneration should be initiated and the softener allowed to cycle through the various regeneration cycles to insure proper operation. The overflow drain fitting on the brine tank should be connected to the nearest floor drain. This drain is not under pressure, so pressure piping need not be utilized.

Optional Safety Float

Safety overflow floats may be installed to prevent accidental overflow of the brine tank. The float should be adjusted up to the point that the safety valve is activated just before the water reaches the overflow drain connection. The safety float valve will shut off the brine line to prevent water from entering the brine tank through the brine line, should a malfunction occur in the control valve assembly. To adjust the float, simply slide the grommets and float up to the desired position. There are grommets above and below the float, adjust both.

CALIBRATION DATA for ED SENSORS

Pipe Size	Pulses Per Gallon
3/4"	200
1"	100
1 1/2"	46
2"	46

Specifying the exact ED meter on the “turbine select” screen will enable low flow correction routines which improve the accuracy at lower flow rates. Alternatively, selecting the “ADJ” selection allows the pulses per gallon to be calibrated exactly; however, low flow correction is no longer available.

CALIBRATION DATA for Model 2536 SENSORS**Iron Tees and Saddles**

Pipe Size	Pulses Per Gallon Sch 40 Pipe	Pulses Per Gallon Sch 80 Pipe
1" Tee	287	---
1 1/2" Tee	91	---
2" Tee	54	---
2" Saddle	54	65
3" Saddle	23.2	26
4" Saddle	13.3	14.7

PVC Tees and Saddles

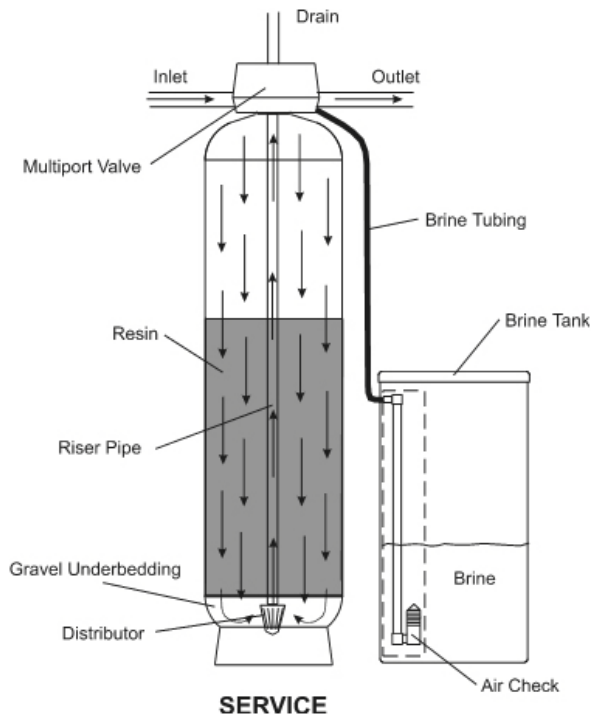
Pipe Size	Pulses Per Gallon Sch 40 Pipe	Pulses Per Gallon Sch 80 Pipe
1" Tee	---	352
1 1/2" Tee	---	117
2" Tee	---	67
2" Saddle	55	67
3" Saddle	23.7	27
4" Saddle	13.5	15.0

Copper Tube

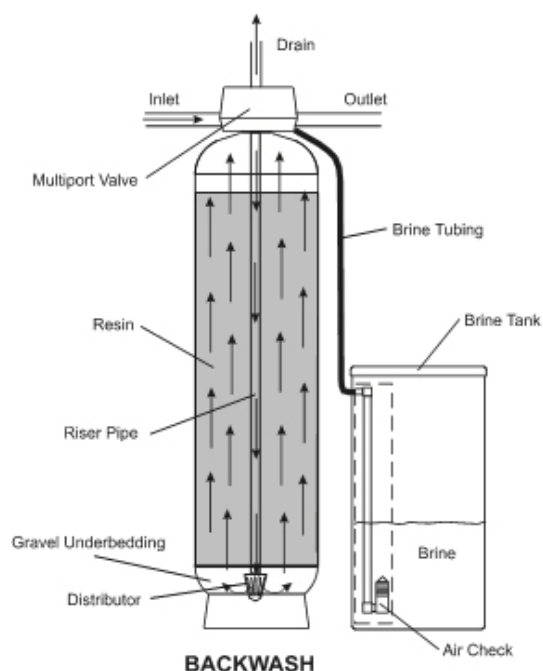
Pipe Size Copper Tube	Pulses Per Gallon		
	K	L	M
3"	28	27	26
4"	15.8	15.2	14.9

1.3-SOFTENER REGENERATION

Softening is an ion exchange process. The hardness ions (calcium and magnesium) are exchanged for sodium ions on the resin. When the hardness starts to leak through the softener, the resin is considered exhausted, and must be regenerated. There are five regeneration cycles: Backwash, Brine Draw, Slow Rinse, Fast Rinse and Refill. When the softener is providing soft water it is in the Service cycle. See page 2 for the required parameters of a water softener. Pages 4-5 contains a detailed explanation of the water softening process, or Service cycle. An explanation of each regeneration cycle, including the Service cycle, follows.

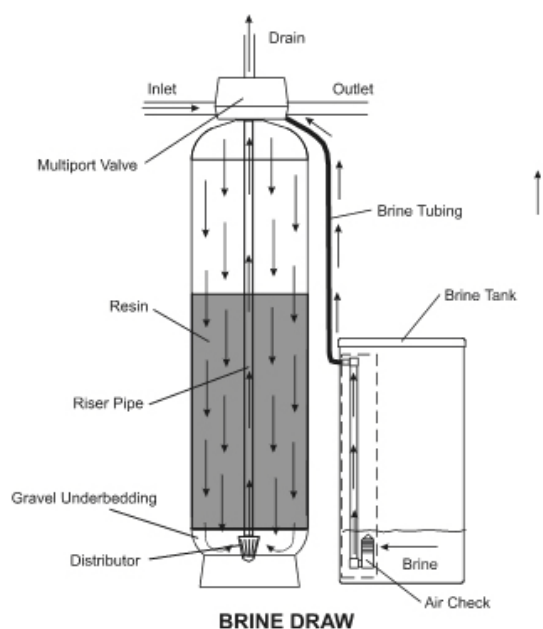
**SERVICE CYCLE:**

The Service Cycle is the normal softening cycle. The raw water flows into the control valve and is directed into the top of the tank. The water then flows down through the resin, into the gravel underbed and into the lower distributor system. As the raw water passes through the resin, the hardness is removed. The soft water flows into the distributor and up the standpipe or riser into the control valve. The control valve directs the soft water to the outlet and on to point of use.

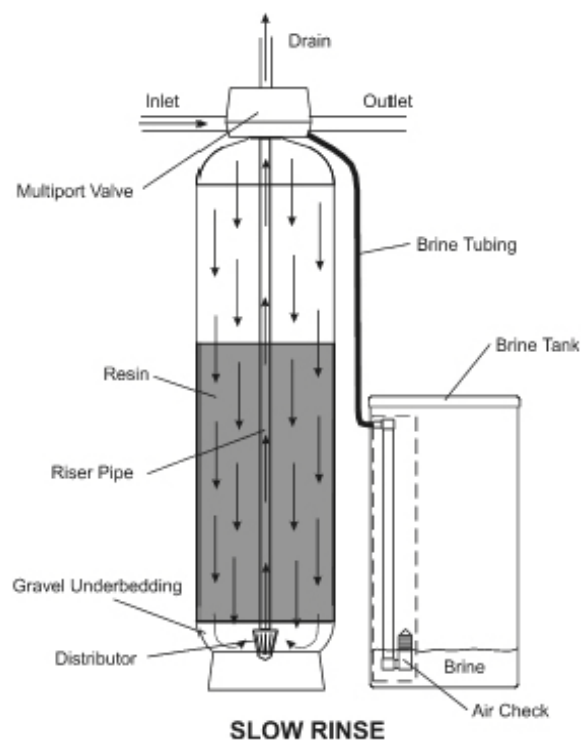
**BACKWASH CYCLE:**

The Backwash Cycle is the first cycle of regeneration. Raw water enters the control valve and is directed down the riser pipe and out the distributor at the bottom of the mineral tank. The water flows evenly up through the resin, expanding it and washing the turbidity collected during the service cycle down the drain through the drain line flow control (DLFC).

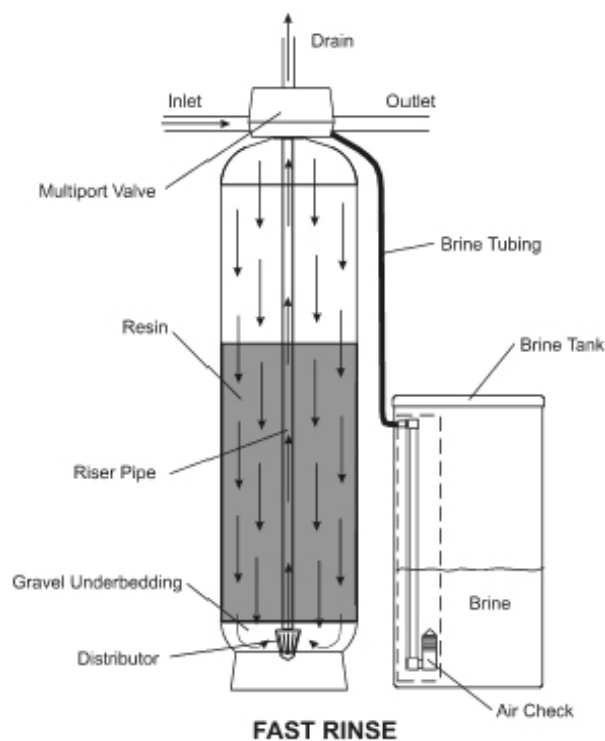
The expansion of the resin is normally 50% per the resin manufacturer's specifications. The backwash flow rate is restricted by a self-adjusting flow control assembled on the drain connection of the control valve assembly. The backwash flow rate is between 4.0 to 4.5 gpm per square foot of bed area. The normal time setting is 10 minutes.

**BRINE DRAW CYCLE:**

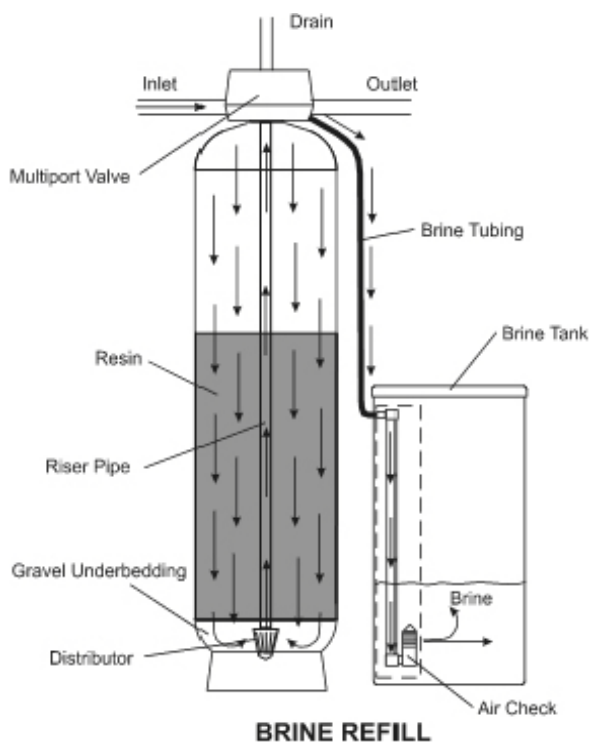
The control valve indexes into the Brine Draw Cycle after backwash is complete. The raw water is directed into the top of the tank through an eductor. A vacuum, determined by the rate of water flow, is generated as the water passes through the eductor. This vacuum draws a concentrated sodium solution out of the brine tank and up into the top of the mineral tank. The sodium rich brine flows down through the resin exchanging its sodium for the calcium and magnesium on the resin. The water flows down into the distributor, up the riser tube, and out the drain.

**SLOW RINSE CYCLE:**

Brine draw continues until all the liquid brine has been drawn out of the brine tank. The ball in the aircheck seats, stopping the draw cycle and starting the Slow Rinse Cycle. Raw water flows down through the resin at the same rate as during the draw cycle. Excess brine and the remainder of the hardness is washed out to the drain. Another term for slow rinse is displacement. The flow rate is proportional to the amount of resin being regenerated.

**FAST RINSE CYCLE:**

Raw water enters the top of the mineral tank the same as during the service cycle. The water flows down through the resin and gravel, and is collected in the distributor and directed up the riser pipe. The water flows through the control valve to drain through the drain line flow control. The fast rinse flow rate is the same as the backwash flow rate. The fast rinse compacts the resin bed preparing it for the removal of hardness during the service cycle.

**REFILL CYCLE:**

The refill cycle is a timed cycle. A brine line flow control is utilized along with a time setting to return the water to the brine tank. The amount of water placed back in the brine tank is determined by the salt dosage of the resin and the amount of resin contained in the mineral tank. See page 6. An example of this: a 5 lb per cubic foot salt setting is used and each mineral tank has 5 cubic feet of resin, then 25 lbs of salt is required for regeneration. Since 3 lbs of salt can be dissolved by a gallon of water, a minimum of 8.33 gallons of water is required. If the refill rate is 2.0 gpm then, the refill time required is 5 minutes. When refill is complete, the system advances to stand-by or service.



Section 2

Electronic Demand Controller

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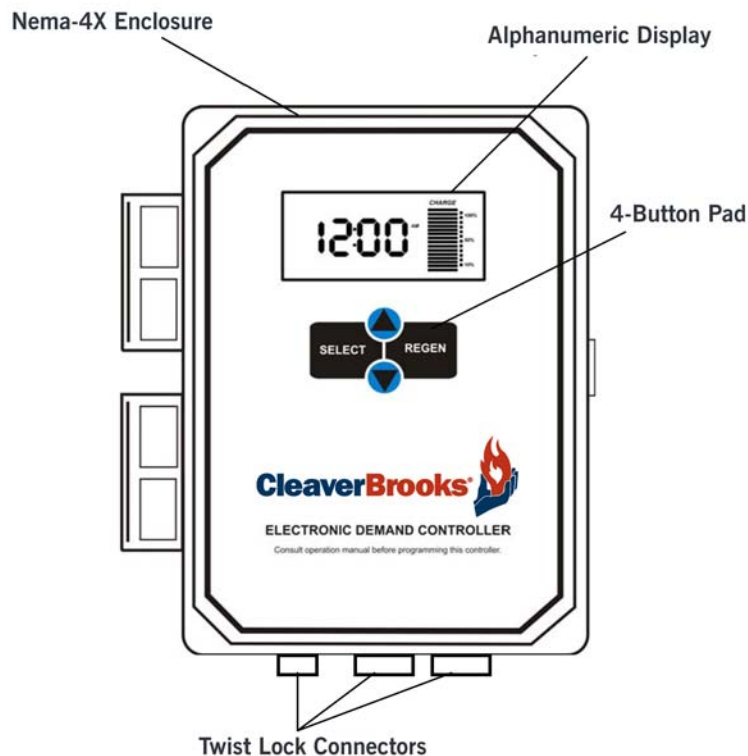
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2.1-INTRODUCTION

The Electronic Demand (ED) control is a computer based, demand initiated controller for commercial and industrial filter, softener, and dealkalizer systems. The controller operates by sensing water flow and remembering water usage history to anticipate future water requirements and to optimally control system operation. Softeners, Dealkalizers or Filters can be operated as single tank systems, alternating two tank systems, or parallel two tank systems. Additionally, the controller provides powerful features, which allow precise monitoring of system performance and detailed assistance in diagnosing problems.

The ED control works with a full line of 1", 1.5", 2" and 3" commercial and industrial softener, dealkalizer and filter multi-port valves. The ED control also works in conjunction with stagers for operation of a complete line of valve nest systems. The control accepts flow signals from a number of Hall effect type flow sensors. When operated in conjunction with 1", 1.5", or 2" ED flow sensors, the control will automatically make low flow rate corrections to improve accuracy. For larger system requirements, the controller operates with 3", 4" and larger insertion type paddlewheel flow meters.

2.2-ED FEATURES





Four Button Pad

The Button Pad is used for both operating and programming the system.

<SELECT> is the navigation button and is used to advance display screens and to access higher level programming and diagnostics screens.

The ▲ (up) and ▼ (down) buttons are used to change user-configurable values. Whenever a display value is flashing, the ▲ (up) and ▼ (down) buttons can be used to change that value.

<REGEN> is used for manual control. The <REGEN> button can be used to schedule regeneration tonight by pushing the button once. Pushing and holding the <REGEN> button for 4 seconds will initiate an immediate regeneration. The <REGEN> button can also be used to manually index systems through the steps of regeneration after initiation.

Alphanumeric Display

The display is an illuminated, alphanumeric, liquid crystal display (LCD) which presents the information used to program, operate, and diagnose the systems and performance. The normal time of day is displayed along with the percent capacity remaining for the system. When programming for Softeners, Filters or Dealkalizers the critical parameters can be set and are displayed.

Twist Lock Connectors

All interconnections to the ED I Controllers are plastic, water resistant, indexed, turn-to-lock, quick connectors. The control interconnecting cables are pre-installed on valves and turbines. No wiring is required.

- **Flow Meter Connector** - one flow meter is used in conjunction with single or duplex systems.
- **Unit 1 Control Connector** - contains all the wiring required to power and control a first unit.
- **Unit 2 Control Connector** - on single valve systems, its connections allow remote initiation and provide a 24 VAC alarm signal. On two valve systems, it is the second unit's power and control connection.

Nema-4X Enclosure

The enclosure is constructed of corrosion resistant plastic. It is a watertight enclosure measuring 6-1/2" wide x 8-1/2" high x 5" deep. The controller may be wall mounted or bracket mounted to a nearby pipe.

Optional Control Features

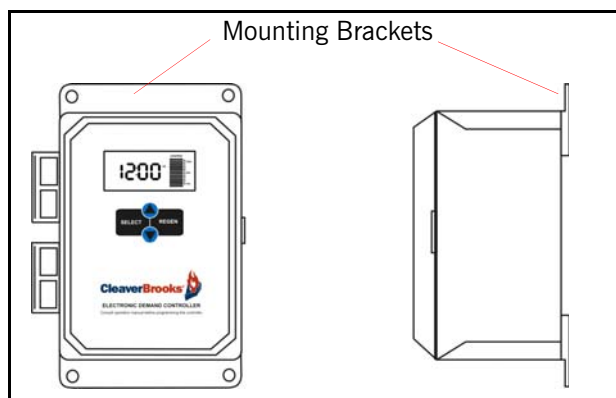
- **Service and Regeneration Outputs** - The ED control has two relay outputs available for adding Service and Regeneration indicator lights. Each relay is off when its respective unit is in the service position and activated when in the regeneration mode. The relays are Single Pole Double Throw relays with 10 amp contacts. A terminal strip is provided inside the control for connection to the indicator lights. The terminal strip has the common, normally open and the normally closed connections to the relays. Wiring diagrams are included at the end of this programming manual.
- **Remote Alarm Output** - The ED is equipped with an alarm relay output. When an Error has occurred the control will flash Error on the screen and both of the relays for the service and regeneration indicators are activated. A wiring diagram is included at the end of this programming manual.
- **Brine / Caustic Pump Output** - The control has a relay built in that can operate a pump for brine or a chemical pump for caustic feed. The length of time it is activated during the brine draw cycle is controlled independently of the regeneration time. TDRA can be turned **off** or set for a specific time from 1 minute up to 120 minutes. The default time is 50 minutes.
- **Salt Monitor** - The Salt Monitor feature indicates the amount of salt that is in the brine tank and will alert the user when the level is low. This option is only available on the ED single and duplex systems. The brine tank is equipped with a black and yellow label, which shows the level of dry salt it contains. The level can be adjusted between 1 and 10. Bars shown on the display of the control relate to the levels indicated on the label in the brine tank. An alarm sounds when the level drops to a programmed level in the brine tank.

The current salt level is displayed on the control when the Salt Monitor is enabled and the type of unit selected is a softener. Start with the current time of day on the display. The Level of Salt can be displayed by pressing the Select button twice. There are 10 bars on the display of the control, corresponding to the 10 levels of salt in the brine tank. The current salt level can be adjusted by pressing the Up or Down arrows until the level of salt in the brine tank is matched. The level on the control is then automatically reduced based on the amount of salt dissolved by the water put into the brine tank during the refill cycle at the end of each regeneration.

2.3-CONTROL INSTALLATION

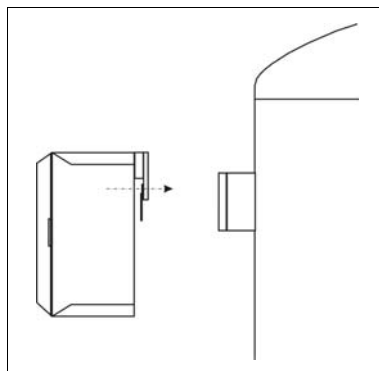
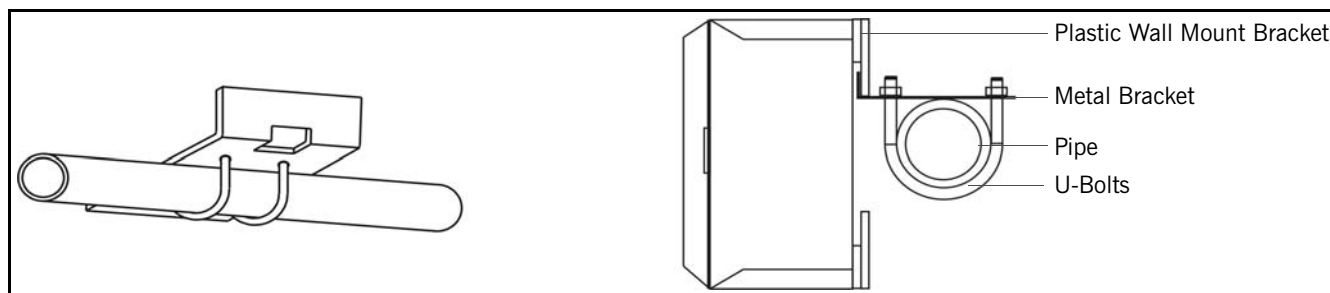
Wall Mounting

Plastic Wall Mounting brackets are supplied with the ED Control. The brackets should be bolted onto the back of the control with the screws provided. The mounting tabs are shown at the top and bottom of the control at the right.



Pipe Mounting

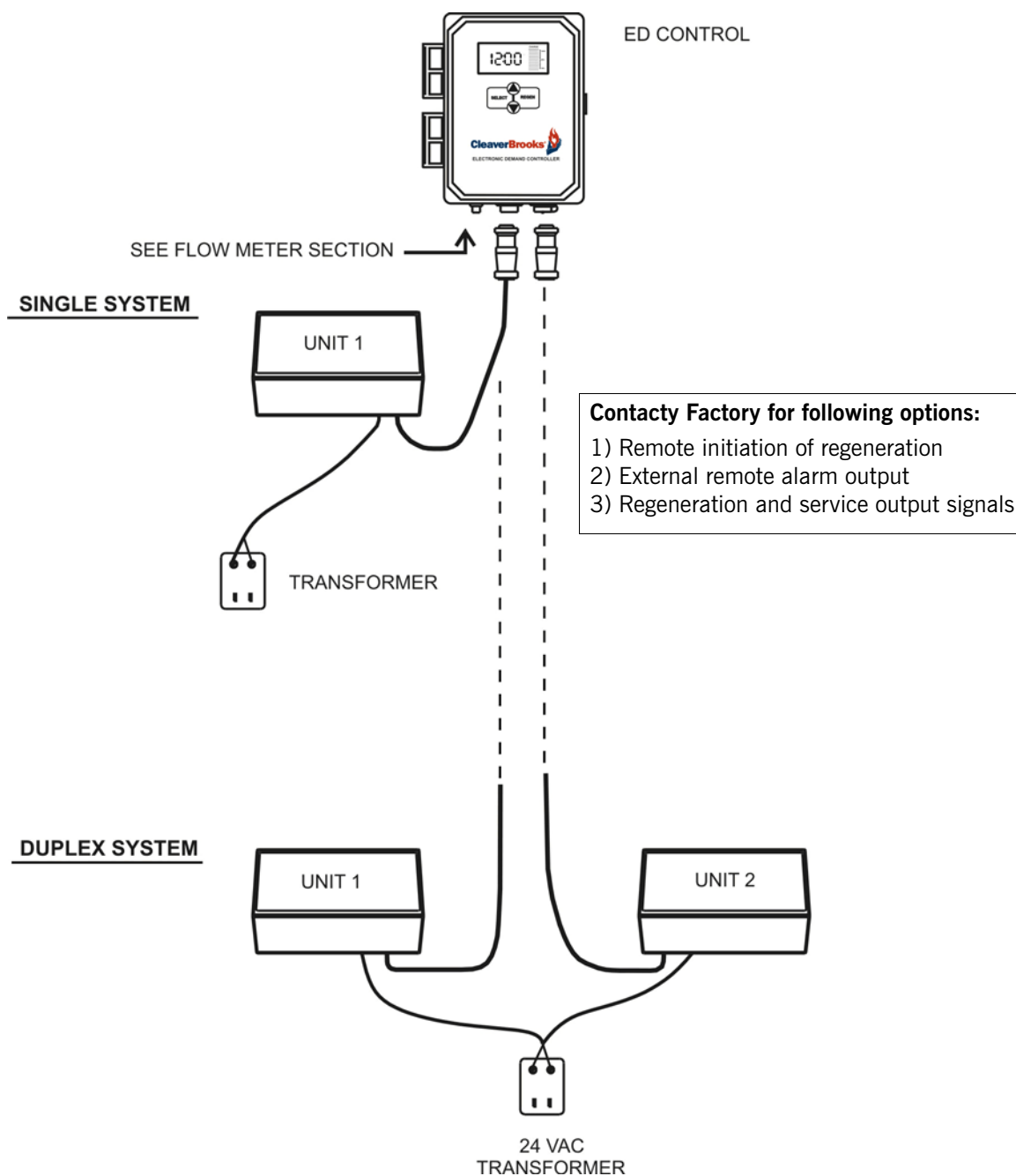
Attach the Wall Mount brackets (rotated 180°) on the back of the control. Mount the large 'L' bracket to a nearby pipe as shown. U-bolts are provided. Hang the control from this bracket. If a more rigid installation is desired bolt the plastic wall mount bracket to the metal bracket before attaching to the control.



Polybond Tank Bracket Mounting

The aluminum 'Z' bracket can be utilized to mount the control on the front of a Polybond Tank Assy. Drill holes in the 'Z' bracket and the plastic wall mount brackets, bolt them together and hang on the bracket that is welded on the tank.

Wiring Connections

**NOTE:**

All 2750 and 2850 valves use 1 – 50va transformer per system

All 2900 valves use 1 – 50va transformer per valve.

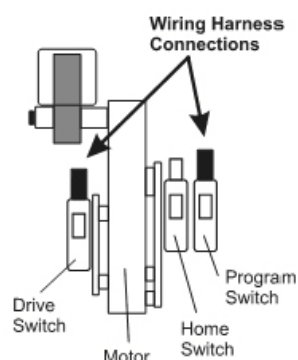
All 3150 and 3900 valves use 1 – 100va transformer per valve.

ED Valve Wiring Harness Connections

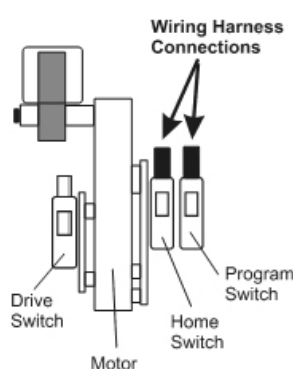
The small red and black wiring harness is connected to the **Program Switch**. This switch tells the ED Control the position of the valve. The other wiring harness is connected to either the *Home Switch* or the *Drive Switch* depending on the function of the valve. *Single and Parallel* operation requires the wiring harness to be on the **Drive Switch**. *Alternating and Variable Flow* systems require the harness to be on the **Home Switch**.

2750 – 2850 and 2900 Upper Drive Motor Assembly

SINGLE AND PARALLEL OPERATION

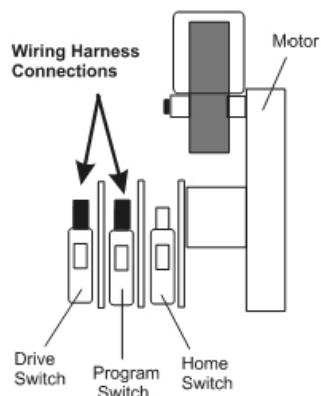


ALTERNATING AND VARIABLE OPERATION

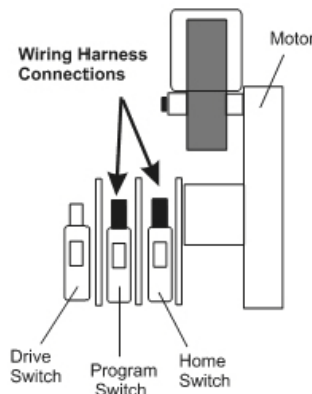


3150 and 3900 Upper Drive Motor Assembly

SINGLE AND PARALLEL OPERATION



ALTERNATING AND VARIABLE OPERATION



2.4-MAIN SCREEN

The Main Screen, showing the Time and Charge Bar displays, is the default display screen for the controller. The Main Screen is the starting point from which system, status, settings, configuration, and diagnostics can be reached. Once the control has been initially programmed or after being left idle for four (4) minutes, the display will always revert back to the Main Screen from any other screen.

Basic operating information is supplied by the Main Screen such as Time of Day, Charge Bar, and Recharge Tonight segments as explained in detail below.

Time of Day

The Time of Day appears (non-flashing) in a four-character display. The display format can be 12 hour (with AM or PM) or 24 hour as designated during programming.



Charge Bar

The Charge Bar indicates the percentage of unused operating capacity remaining. The figure above indicates that 50% of the operating capacity remains. As capacity is depleted, the charge bar segments are reduced. During reconditioning, the charge bar segments are added as the regeneration cycle takes place.

On Alternating Systems, the charge bar indicates the capacity remaining in the service tank. On Parallel Systems, the charge bar shows the capacity of unit 1 for six (6) seconds, blanks for one (1) second, and then shows the capacity of unit 2 for two (2) seconds.

Recharge Tonight – (Single Systems Only)

The words **Recharge Tonight** flash in the display when the controller has determined that a regeneration is needed. At the next programmed recharge time, regeneration will occur.

When the word **Recharge** flashes in the display, regeneration is currently underway. The Recharge segment will continue to flash until the regeneration is complete.

2.5-SYSTEM STATUS – FIRST LEVEL PROGRAMMING

The <SELECT> button is the navigational button. By pressing and releasing this button repeatedly, operation and status information screens can be accessed.

Note: A beeper sounds while pressing buttons for setup. One beep signals a change in the display. Several repeat beeps indicates the button pressed is invalid, telling you to try another button.



Change Time of Day

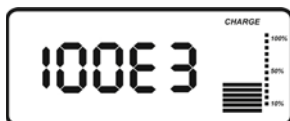
The Time of Day screen is entered by a press and release of the <SELECT> button. Should a power outage occur, the **Time of Day** is maintained for a minimum of 96 hours. The **Time of Day** is changed using the ▲ up and ▼ down buttons. Each push changes the display by one (1) minute. If the buttons are held, the time display changes at a faster rate.

The ▲ up and ▼ down buttons are used to change the selection. Press the <SELECT> button to advance the control to the next screen.



Brine Tank Salt Level

The brine tank salt level is indicated on the display using the bars on the right. **Only if the salt monitor is activated in “Level Three Programming” of the control.** When filling the brine tank, use the ▲ up button to increase the number of bars displayed. This will correspond to the number on the sticker in the brine tank. The bars will be depleted as the unit regenerates. “Load” “Salt” will alternate on the main screen when the level drops below the predetermined alarm level. If the salt monitor is turned off, this display will not show. This screen is not available on filters. See “**Third Level Programming**” for more information.



Average Daily Gallons

The Average Daily Gallons screen displays the average daily gallons (liters) based upon the past 7 days of water usage. The figure adjusts daily at midnight. The display uses all 5 digits to show values from 0 to 1,040,000 gallons.

Note: For usage greater than 99,999, the display uses exponential notation. For example to display 100,000 the display would read “100E3” (100E3 = 100 x 10³ = 100,000 just like many calculators show).

This is a display only screen and can not be changed. Press and release the <SELECT> button to advance to the next screen.



Flow Rate

The Flow Rate screen indicates the current flow rate in gallons (or liters) passing by the flow sensor. Flow rates can be displayed from 0 to 999 GPM (LPM) using up to three LCD digits. When the flow rate is under 100, the tenths indicator is used.

This is a display only screen and can not be changed. Press and release the <SELECT> button to advance to the next screen.

Gallons

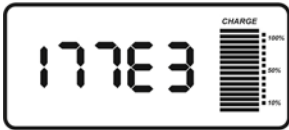
The Gallons screen indicates the amount of treated water that has passed by the turbine. Bypass water is not included. Accumulated flow is shown in gallons (liters) up to 1,040,000 gallons. For display values greater than five (5) digits, scientific notation is used. When **999E4** (9,990,000) is reached the counter will roll over back to 0 and resume counting.

Press and release the ▼ down button to manually reset this value to zero. Press and release <SELECT> button to advance to the next screen.



Capacity (grains)

The Capacity screen indicates the total *grains capacity* of each unit. It is based on the cubic feet of resin, the hardness of the water, and the salt setting. Display values greater than five (5) digits are shown in scientific notation. 177E3 indicates that each unit has 177,000 grains capacity. The display will alternate between **CAP** and **177E3**.



Total Capacity (gallons)

Buttons located on front of the ED controlThe Total Capacity screen indicates the total *gallons capacity* of treated water for each unit, which can be obtained between the regeneration cycles. This capacity is based on the input hardness, amount of resin in the vessel and the salt dosage in pounds per cubic foot. Display values greater than five (5) digits will use scientific notation. The 11,800 in the display at the right, indicates that each unit will provide 11,800 gallons of treated water between regenerations. The display will alternate between **tCAP** and **11800**.



Initiating Extra Regenerations

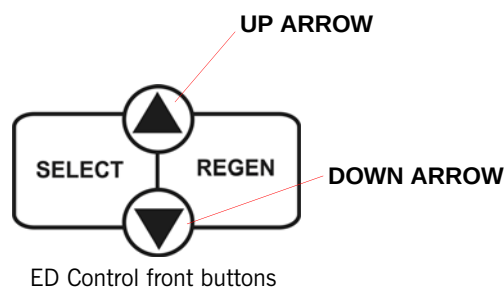
Single Tank Systems

Press and release <REGEN> to schedule a regeneration. **Recharge Tonight** will flash in the display. Press and release <REGEN> a second time to deselect a scheduled regeneration.

Press and hold <REGEN> for three (3) seconds to initiate an immediate regeneration.

Duplex Systems

Press and release <REGEN> to initiate an immediate regeneration of the service or primary tank.



2.6-START-UP

When the control is powered up, the programmed model designation is displayed for 4 seconds. Next, the software release version is displayed for 4 seconds. Finally, the time of day is displayed. Programming is started at **Level 3**.

Push and hold the select button for 3 *seconds* and the control will advance from *Level 1* to *Level 2*. Push and hold for an additional 3 seconds and the control will advance from *Level 2* to *Level 3*. *Level 3* is where programming is started. Push and hold for 3 seconds again and the control will advance from *Level 3* to the diagnostics mode, *Level 4*.

2.7-THIRD LEVEL PROGRAMMING

Model or Type Selection

The Model or Type Selection screen is used to designate the type of system the control will operate. Go to Level 3 to change the type of equipment or to program the other parameters.

The three types of equipment are:

SOFTENER

FILTER

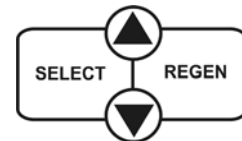
DEALKALIZER

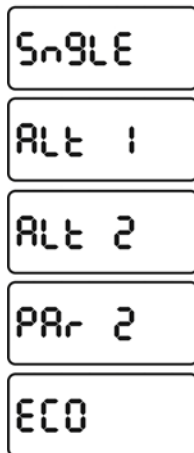
If *SOFTENER* is selected, then the model of the softener may be entered. The model designations are S-30 through S-1200. Fourteen (14) predefined models can be chosen. Selecting a predefined model option loads default values for most programming choices, simplifying start-up of the system.

Screen Navigation

The ▲ up and ▼ down buttons are used to change the selection. Pressing the <SELECT> button confirms the choice and advances the control to the next screen. The <REGEN> button initiates regeneration and advances the control through a regeneration cycle.

NOTE: A beeper sounds while pressing buttons for setup. One beep signals a change in the display. Repeat beeps indicate the button pressed is invalid, telling you to try another button.





Mode Selection

Different Softener valves can be operated in a variety of different modes. Five (5) choices are possible with the ED Control:

SNGL — A single tank, single control valve system. (Motor driven)

ALT1 — A two tank, single valve twin system. (Motor driven)

ALT2 — A two tank, two control valve system that operates in a duplex alternating mode. (Motor driven)

PAR2 — A two tank, two control valve system that operates in a duplex parallel mode. (Both tanks on line – motor driven)

ECO — A Single tank, 5-cycle control valve system. (Solenoid operated; not used by Cleaver-Brooks)

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.

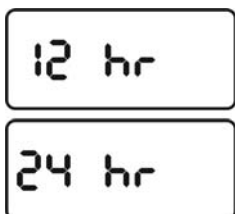
Note: When an operating mode is first selected or whenever the mode is changed, the control will execute a routine designed to verify the presence and position of the control valve. The control will drive the valve motor(s) through approximately two revolutions and stop in the service or standby position as is appropriate for mode chosen.



Gallons / Liters Selection

All water flow or usage displays can be shown in gallons (gallons per minute) or liters (liters per minute).

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.



12 / 24 Hour Selection

Indications of time can be in either 12 or 24-hour format. When **12-hour** is selected, the time displays are shown in standard clock time (1am to 12pm, 1pm to 12am). When the **24-hour** clock is selected, the time displays are shown in military time (1:00 to 24:00).

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.



Error Beep Off / On Selection

If the controller should encounter an error condition and the beeper is **ON**, the speaker will beep 5 times every second and the error code will be displayed. If this feature is turned **OFF**, the error code will be displayed, but no beeping will occur.

Use the ▲ up or ▼ down buttons to identify the correct choice and then press <SELECT>.

Resin Quantity Selection

The Resin Quantity select or display is used to let the controller know how much resin (per tank) is being used in a softener or dealkalizer. The controller allows a range of .5 - 150 ft³ per tank. The display at the right shows 10.0 ft³. This screen is not available when **FILTER** is selected.

Use the ▲ up or ▼ down buttons to identify the correct choice and then press <SELECT>.



Refill Rate Selection

VALVE SIZE – RESIN QUANTITY – REFILL RATES																	
Valve Size	1		1 & 1.5		1.5" and 2"				2"		3"				3" and 4"		
Resin (Ft³)	1	2	3		4	5	7	10	15	20	15	20	30	40	50	60	85
Refill (GPM)	0.5						2				4				10		

The Refill Rate selection screen identifies the brine tank refill rate to the controller. This value is used to calculate the correct refill time for a given salt setting. The control valve brine system is stamped or labeled with this rate. Alternatively, look at the standard rates in the table above. This screen is not available when **FILTER** has been selected.

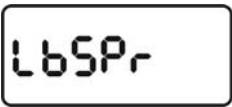
Note: Always check the refill rate setting versus the actual refill rate as measured. An accurate setting is essential for correct operation of your system.

Use the ▲ up or ▼ down buttons to identify the correct choice and then press <SELECT>.

The brine refill step can be eliminated by selecting **OFF**. The refill step can be turned off when pumped brine or an external brine maker is used.



LBS per Selection



The optional salt level monitor is turned *on* or *off* with this selection. The default value is OFF. The amount of salt per level is shown in the chart below. The brine tank is split into 10 levels by a optional black and yellow sticker for the brine tank, which is placed on the brine well.

Brine Tank Size	Length of Brine Label	Inches per Level	Lbs of SALT* per Level
400 lb. – 18" x 39"	30"	3"	32
700 lb. – 24" x 41"	30"	3"	58
1000 lb. – 24" x 50"	40"	4"	78
1500 lb. – 30" x 50"	40"	4"	122
2500 lb. – 39" x 48"	40"	4"	208
4500 lb. – 52" x 60"	50"	5"	375

* The weight of the salt is based on White Crystal Rock Salt from Morton Salt Company.

The lbs per level can be programmed from OFF up to 510, in two lb increments. The control calculates the lbs of salt used per regeneration and sends an alarm signal when it has determined that the salt level is below the preset value. The amount of salt in the brine tank is programmed on the main menu, by activating the number of bars on the right of the screen equivalent to the level of salt in the brine tank. A prompt will appear in the Level 1 programming asking for the level of salt in the brine tank. Increase or decrease the number of bars showing on the right side of the screen by pushing the ▲ up or ▼ down buttons.

Brine / Caustic Pump Selection



The control has a relay built in which can operate a pump during the brine draw cycle of regeneration. This relay can also be used to operate a chemical feed pump for the caustic feed of a dealkalizer, 10 amps maximum. The timing starts when brine draw starts and ends as programmed. This timing is independent of the brine draw cycle. The time the relay is activated can be programmed from OFF up to 120 minutes in 1-minute increments. Default is 50 minutes.

Caustic Feed Pump Activation – (Dealkalizer only)



A caustic feed pump may be activated during brine draw, only if Dealkalizer is chosen under type of equipment. The caustic pump default is “no”, but can be turned on any time. The length of time that the pump is activated is equal to the time set in the *tdrA* screen. Answering “YES” to caustic also allows the control to calculate the capacity of the dealkalizer based on caustic addition. If the pump is off, the capacity calculated is based on sodium chloride only regenerations, which is approximately 30% less capacity than using salt and caustic. This screen will not appear if *Filter* or *Softener* is selected.

Salt Alarm Level Selection

The level at which the alarm to Load Salt activates is programmable. Select the number of bars at which the alarm will activate. When the salt level drops below the chosen number of bars, the alarm will sound, and “Load” “Salt” will alternate being displayed on the main screen. The alarm beeper will sound until salt is added to the brine tank and the level on the main screen is increased above the alarm level setting. This display will only appear if a value is programmed in the *LBS per* screen. The display at the right shows 3 bars lit, which is approximately 1/3 of the brine tank.

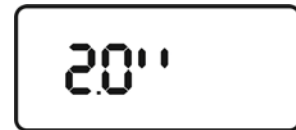
Use the ▲ up or ▼ down buttons to increase or decrease the number of bars, and then press <SELECT>.



Turbine Selection

The Turbine selection screen displays the nominal size of the turbine being used by the unit. Five turbine size selections are available - .75", 1.0", 1.5", 2.0", and "ADJ." "ADJ" allows the programming of the "K" factor for the flow meter being used.

Use the ▲ up or ▼ down buttons to identify the correct choice and then press <SELECT>.



Turbine Adjustable Selection

If the "ADJ" setting was selected on the previous screen, the turbine pulses per gallon value must be programmed into the control. The tables on page 24 will be helpful in making the correct choice. Consult your supplier if you have any questions.



Note: If this is an initial programming sequence or if the model or system has been changed, programming will continue with the operating settings (second level select). If only configuration items (other than the model and system) have been changed; or, after a 4-minute idle period, the control will revert back to the Main Screen.

2.8-SECOND LEVEL PROGRAMMING

The Second Level select screens are accessed in two ways:

By continuation – After completing the third level programming screens on an initial start-up, the control continues with second level select screens.

Manual entry – Press and hold the <SELECT> button for 3 seconds to access the second level screens.



Hardness Selection – (Softener only)

Hardness is required when setting up a softener. Set the grains per gallon hardness of the water supply (determined by the water analysis or contact the local water department).

Use the ▲ up button to increase the number and the ▼ down button to reduce the number. Each press of a button changes the display by 1, between 1 and 25. Between 25 and 125, the display changes by 5. Press and hold the buttons for fast advance. This screen is not available when **Filter** or **Dealkalizer** is selected.

Note: To compensate for iron in the water supply, add 4 to the hardness number for each 1-ppm of iron.

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.



Total Exchangeable Anions – (Dealkalizer only)

Total Exchangeable Anions (TEA) is required when setting up a dealkalizer. Set the grains per gallon of the total exchangeable anions of the water supply (determined by the water analysis). Default is 20 grains.

Use the ▲ up button to increase the number and the ▼ down button to reduce the number. Each press of a button changes the display by 1, between 1 and 25. Between 25 and 125, the display changes by 5. Press and hold the buttons for fast advance. This screen is not available when **Filter** or **Softener** is selected.



Chlorides Selection – (Dealkalizer only)

The chloride content of the water being treated in conjunction with the total exchangeable anions is used to calculate the capacity of the dealkalizer. Chlorides are settable in increments of 1 from 0 to 25 grains and in increments of 5, between 25 and 100 grains. Default is 5 grains. This screen is not available when **Filter** or **Softener** is selected.

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.

Backwash Time Setting

The Backwash Time screen is used to tell the controller how long to backwash a softener or filter during the first step of a reconditioning cycle. The recommended setting is 10 minutes for a clean, clear raw water supply. If the water condition is too poor, recommended pretreatment equipment should be installed. The backwash time is adjustable from 1-30 minutes.

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.



Brine Draw Time Setting

The Brine Time screen is used to tell the controller how long to allow for brine eduction and slow rinse. As the programmed salt dose increases, the amount of time required by a softener to draw brine and slow rinse increases.

As a rule of thumb, the following settings are suggested, yet should be adjusted as experience and observation with a particular installation dictate. The first regeneration cycle should be observed and timed to verify this setting.

- 5 lb./ Ft³60 minutes
- 10 lb./ Ft³80 minutes
- 15 lb./ Ft³100 minutes

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>. This screen is not available when **FILTER** is selected. Set the salt dosage for Dealkalizers at minimum setting.

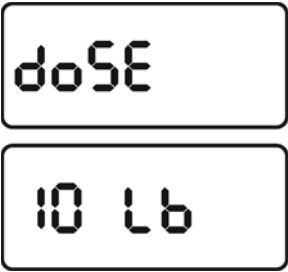


Fast Rinse Time Setting

The Fast Rinse Time screen is used to tell the controller how long to fast rinse a filter, softener or dealkalizer.

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.





Salt Dosage Setting – (Softener only)

The salt dose screen is used to tell how much salt per ft³ of resin should be used when regenerating the softener. The nominal capacity of a softener is achieved when 15 lbs./ ft³ is used for regeneration. More efficient operation can be achieved with lower salt settings such as 10 lbs./ ft³ or 5 lbs./ ft³; however, the capacity of the system will be lower. The following table will be useful in selecting the appropriate settings. (Salt dose settings can be set in the range of 4 - 20 lbs./ ft³.)

Dose (lbs./ Ft ³)	Capacity (grains/ Ft ³)
5	17,700
10	24,900
15	29,400
20	32,400

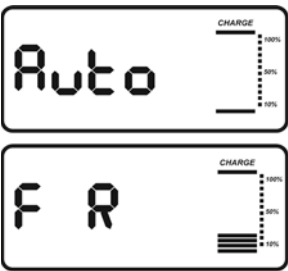
Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.



Recharge Time – (Single Systems only)

The Recharge Time screen is used on Single (ED) softener or filter systems to specify the time at which regeneration will begin. The recharge time can only be set to a whole hour increment in the 24-hour mode. The default time for Softeners and Dealkalizers is 2:00 am. The default for filters is 12:00 midnight.

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.



Fixed Reserve – (Single Systems only)

The Fixed Reserve screen is used to choose whether or not the control will be allowed to determine the best choices of when to regenerate a single softener, dealkalizer or filter. In **AUTO** mode, the control uses sophisticated rules to examine water usage and history to make decisions about scheduling regenerations in anticipation of demand.

There are certain situations where the control’s decision may not provide the best choice of when to regenerate. In these situations, the controller can be set to regenerate based upon a preset trip point rather than a variable. This trip point is adjustable from 0% (all capacity depleted) to 100% (schedule the next available regeneration).

The fixed reserve is indicated by the number of charge bar segments showing (each segment equals 10%). Press <SELECT> to advance to the next screen.

Maximum Days Between Regenerations

The Maximum Days Screen is used to force a regeneration if one has not occurred within a given number of days. The control default is **AUTO**. This means that regeneration occurs only as called for by the control.

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.



97% Capacity Setting – (Single Systems only)

When the 97% screen is selected **ON**, a single softener, filter and dealkalizer will regenerate **immediately** when 97% of the capacity is depleted. The default for this setting is **OFF**.

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.



Filter Gallons

The Filter Gallons screen is used to set how many gallons (liters) is allowed to pass through a filter before backwashing is required. The filter gallons (liters) value has a range off 1000 to 999,000 gallons (378E4 liters) and is adjustable in 1000-gallon increments. If the value is adjusted to below 1000 gallons the display will read **OFF** indicating the gallons (liters) function is **OFF** and the unit will only regenerate manually or by an external signal. This screen is not available when *Softener* or *Dealkalizer* is selected. The display to the right shows 7000 gallons.

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.



2.9-INITIAL CHECKOUT

The ED I Electronic Control offers an unprecedented amount of information and assistance for monitoring system performance and diagnosing system problems. The tools for accessing this information are reviewed in detail in the following sections - Automatic Diagnostics and Manual Diagnostics.

Before moving to the more advanced tools, always perform the following initial checkout.



1. Is the display time correct?
 - If the display is blank, check power.
 - If the display time is flashing, there was a power failure for more than 4 days. The system will continue to operate correctly; however, reconditioning will occur at incorrect times. Reset the time of day to correct the problem.
 - If the **Error** code is showing, go to the **Automatic Diagnostics** section.
2. Are plumbing isolation valves fully open? Is the manual bypass valve fully closed?
3. Are power, control, and turbine cables installed correctly and securely?
4. Are inlet, outlet, and drain lines installed correctly (including brine well flow controls)?
5. Is there salt in the brine system? Is the brine tubing installed correctly? Has bridging occurred in the brine system? Does the valve draw and refill properly?
6. Is the hardness setting correct for your water supply? Has the hardness level changed since it was tested?

If you do not find the problem after making the initial check, go to the **Manual Diagnostics** section of this manual.

Automatic Diagnostics

The computer automatically performs a number of diagnostics checks during the normal operation of the system. If a condition is detected that would prevent the system from functioning properly, an error code is displayed and if the alarm feature is **ON**, the speaker will begin beeping.

When an error code is being displayed and the <SELECT> button is held, the controller will enter the manual diagnostics display screen to aid in trouble shooting.

Error Code

Error — Indicates one of the following is occurring:

- The motor is not running and/or the position switch is bad.
- A timing or valve position error has occurred during regeneration.
- The valve is unable to find the home position.
- The valve is cycling continuously.



Problem	Solution
Faulty Motor.	Replace Motor
Faulty Position Switch	Replace Position Switch
Faulty Cable to Position Switches	Replace Cable to Position Switch
Bad Output Drive Circuit to Motor	Replace Electronics
Improperly Placed Position Switch	Reposition Switch
Bad Wiring or Connector to Motor	Replace Motor
Bad Position Input Circuits	Replace Face Plate

Clearing the Error Code

The Error Code can be cleared in two ways:

- **Turn off and then restore power.** This will reset the error code and the system will return to normal operation. If the error code still exists, the controller will redisplay the error code the next time it checks for that condition.
- Pressing the <REGEN> button will direct the control to attempt to clear the error. If successful, normal operation will resume. If unsuccessful, the error code will reappear and operation will again be halted.

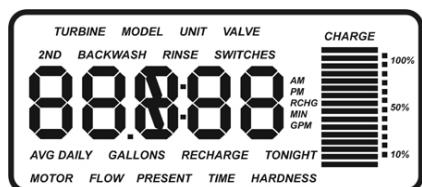
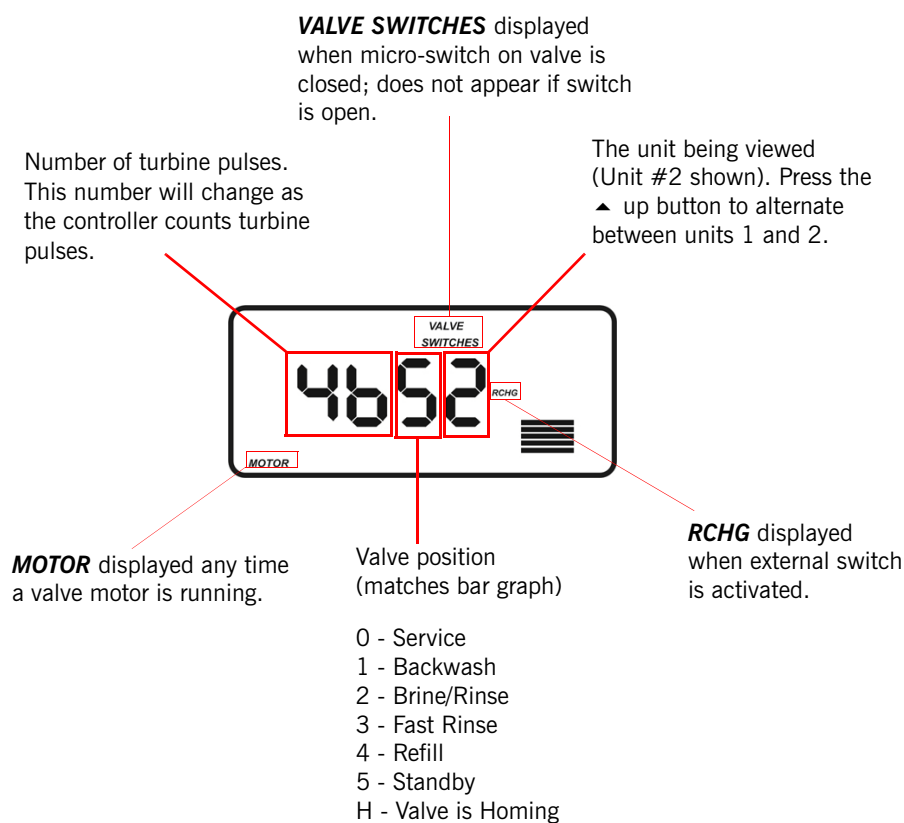
Fourth Level Manual Diagnostics

These functions are accessed through the Manual Diagnostics (fourth level select) screen. This screen is used to diagnose problems with the turbine, valve position, outputs, and inputs. The manual diagnostics screen can be accessed in two ways.

Pressing the <SELECT> button when an error code is showing.

Fourth Level Select Screens — Press and hold <SELECT> button for 3 seconds one time, repeat a second time, and then a third time.

Manual Diagnostics Display



Display All Digits

If both of the ▲ up and ▼ down buttons are depressed while in the Manual Diagnostics display, the controller turns on all display segments. This verifies that all display segments and the up and down buttons are working.

Number of Regenerations

Pressing and holding the ▼ down button will temporarily display the **UNIT** and **RECHARGE** segments and the number of regenerations. Pressing and holding again will show the **UNIT** and **TIME** segments and the number of days in operation.

Manually Advancing through the Regeneration Cycles

The units can be manually advanced through the regeneration cycles utilizing the <REGEN> button. Place the control in the Fourth Level Diagnostics screen and depress the <REGEN> button. The unit will advance into the backwash cycle of regeneration.

Note: *If system is an ALT2 system, then both units will advance into the service position. There will be a 20 second delay and then one unit will advance into backwash cycle.*

When the motor stops, depress the <REGEN> button again and the unit in regeneration will advance one step. This function can be used to manually advance a valve through the regeneration cycle to check valve operation.

The system can be manually advanced through a regeneration cycle without going to the Diagnostics level, but there is nothing to indicate the cycle the unit is in.

2.10-FIFTH LEVEL ADVANCED DIAGNOSTICS

The Fifth Level Diagnostics will display the history of the control and should only be accessed by a qualified Technical Service Representative. The display will provide the following information:

- | | |
|------------------------------------|--------------------------------|
| • Status of Tank #1 | • Control state |
| • Status of Tank #2 | • Error Code |
| • Tank #1 Days since last regen | • Digital input state |
| • Tank #2 Days since last regen | • Digital output state |
| • Tank #1 capacity left in gallons | • Regen Flags |
| • Tank #2 capacity left in gallons | • Regen phase timer |
| • Tank #1 filter gallons used | • Reason for last regeneration |
| • Tank #2 filter gallons used | • Current regen step |
| • Total gallons through system | • Regen tank (1 or 2) |
| • Today's water usage | • Pounds of salt in brine tank |
| • Average daily gallons | • Brine draw output time |
| • Day counter | • Daily gallons difference |
| • Previous average daily gallons | • History of gallons |
| • Number of regenerations | • Day counter |
| • Days in service | • Gallons capacity |

2.11-CALIBRATION DATA FOR FLOW SENSORS

The proper size Flow Sensor must be specified in the Turbine Select screen of the ED Control. The ED Control has the “K” factors for the .75”, 1”, 1.5” and 2” built in to its algorithm. The “K” factor is the number of pulses per gallon. If ADJ is selected then the ED has the capability to accept the “K” factor from any Flow Meter with a square wave output. Signet model 2536 is one such meter. The tables below provide the “K” factor associated with the type of pipe for standard meters offered.

Type of Sensor	Pipe Size	Pulses per Gallon		
ED PVC & Brass	.75”	200		
	1.0”	100		
	1.5”	46		
	2.0”	46		
Signet 2536 for Iron Pipe		Sch 40 Pipe	Sch 80 Pipe	
	1” Tee	287	-	
	1.5” Tee	91	-	
	2” Tee	54	-	
	2” Saddle	54	65	
	3” Saddle	23.2	26	
	4” Saddle	13.3	14.7	
Signet 2536 for PVC Pipe		Sch 40 Pipe	Sch 80 Pipe	
	1” Tee	-	352	
	1.5” Tee	-	117	
	2” Tee	-	67	
	2” Saddle	55	67	
	3” Saddle	23.7	27	
	4” Saddle	13.5	15.0	
Signet 2536 for Copper Pipe		Type K	Type L	Type M
	3”	28	27	26
	4”	15.8	15.2	14.9

2.12-OPTIONAL RELAY OUTPUTS

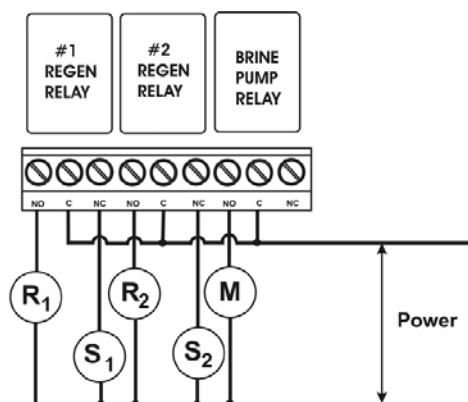
The control is equipped with three - single pole double throw relays. Relay #1 corresponds to Unit #1 and is "Off" during the Service cycle and "On" during the regeneration. Relay #2 is "Off" during the Service cycle and "On" during the regeneration. Relay #3 is only "On" during the brine draw cycle of Unit #1 or Unit #2 when the TDRA time in the control is programmed. See TDRA programming information.

Cycle	Relay #1	Relay #2	Relay #3
Unit #1 Service	Off	Off	Off
Unit #1 Regeneration	On	Off	*
Unit #2 Service	Off	Off	Off
Unit #2 Regeneration	Off	On	*
Error - Alarm	On	On	NA
* Unit #1 or #2 Brine Draw	NA	NA	On

Regeneration and Service Signals

The wiring diagram shows how to connect the regeneration indicators for systems #1 and #2. The terminal strip shown in the diagram is located on the back of the PC board. The contacts on the relays are isolated contacts. The relays must have an external power source connected. The relay contacts are rated for 10 amps. The regeneration signal outputs are labeled "R₁" and "R₂" in the diagram below, while the service signal outputs are labeled "S₁" and "S₂". The "M" indicates the Brine or Caustic Pump Motor connection.

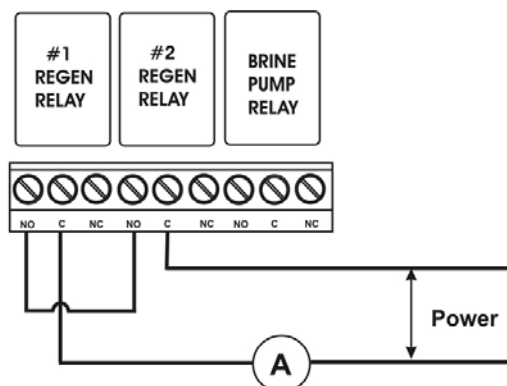
S1 = System #1 Service Indicator
 R1 = System #1 Regeneration Indicator
 S2 = System #2 Service Indicator
 R2 = System #2 Regeneration Indicator
 M = Brine Pump or Caustic Pump Motor - Maximum 10 Amp



Alarm Connection

Should an alarm output be desired, wire the terminal block as shown. In an alarm or error condition both Relay #1 and Relay #2 are activated. An external power source may be used for the alarm. The relay contacts are rated for 10 amps. The alarm will activate when an **Error** code is encountered.

A = Alarm Output - Audible Alarm or indicator light.





Section 3

Time Clock Programming Guide

REGENERATION CYCLE TIMER SETUP	3-2
How to Change the Backwash Time	3-3
How to Change the Brine Draw and Slow Rinse Time	3-3
How to Change the Fast Rinse Time	3-3
How to Change the Refill Time	3-3
SETTING TIME OF DAY	3-5
MANUAL REGENERATION	3-5
SETTING REGENERATION DAYS	3-5

3.1-REGENERATION CYCLE TIMER SETUP

All control valves come from the factory configured with the default regeneration cycle program settings. Even if you do not intend to change the factory settings, they should be checked. Refer to the valve's separate instruction manual for these settings:

- Backwash 10 minutes
- Brine and Slow Rinse . . 60 minutes
- Rapid Rinse 10 minutes
- Brine Refill 10 minutes

Backwash: time is based upon the clarity of the raw water. The minimum recommended time setting for softeners is 5 minutes for a clean, clear raw water supply. If the raw water contains small amounts of turbidity, backwashing longer and more frequently is recommended. If the raw water condition is too poor, pre-treatment equipment must be installed. Filters should be set to match the application; 20 minutes is normal.

Brine and Slow Rinse: time must be adjusted according to the salt dosage selected for the softener. As Brine Refill settings rise, the amount of time required by a softener to draw brine and slow rinse increases. As a rule of thumb, use the following:

- 5 lb/ft³. Use the default setting, 60 minutes.
- 10 lb/ft³. Increase Brine and Slow Rinse to 80 minutes.
- 15 lb/ft³. Increase Brine and Slow Rinse to 100 minutes.

Rapid Rinse: time is recommended at 10 minutes **minimum**. Experience with the equipment may indicate that longer rapid rinse period is required.

Brine Refill determines the capacity of the softener. Consult Capacity Chart (page 3-4) for the relationship between refill times and the capacity that will result. Filters should be set to the minimum setting, 4 minutes (2 pins).

HOW TO CHANGE THE BACKWASH TIME

The program wheel as shown in the drawing is in the service position. As you look at the numbered side of the program wheel, the group of pins starting at zero determines the length of the time your unit will backwash.

For example: If there are six pins in this section, the time of backwash will be 12 min. (2 min. per pin). To change the length of backwash time, add or remove pins as required. The number of pins times two equals the backwash time in minutes.

HOW TO CHANGE THE BRINE DRAW AND SLOW RINSE TIME

The group of holes between the last pin in the backwash section and the second group of pins determine the length of time that your unit will brine and rinse (2 min. per hole).

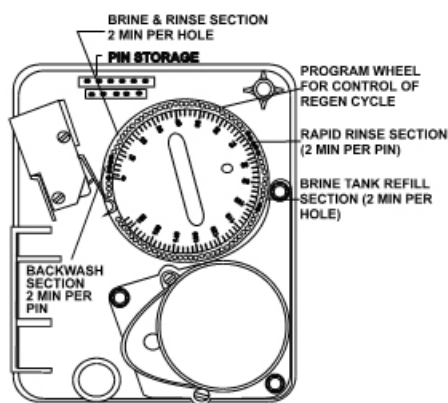
To change the length of brine and rinse time, move the rapid rinse group of pins to give more or fewer holes in the brine and rinse section. Number of holes times two equals brine and rinse time in minutes.

HOW TO CHANGE THE FAST RINSE TIME

The second group of pins on the program wheel determines the length of time that your water conditioner will rapid rinse (2 min. per pin).

To change the length of rapid rinse time, add or remove pins at the higher numbered end of this section as required. The number of pins times two equals the rapid rinse time in minutes.

HOW TO CHANGE THE REFILL TIME



The second group of holes on the program wheel determines the length of time that your water conditioner will refill the brine tank (2 min. per hole).

To change the length of refill time, move the two pins at the end of the second group of holes as required.

The regeneration cycle is complete when the outer

micro-switch is tripped by the two-pin set at end of the brine tank refill section. The program wheel, however, will continue to rotate until the inner micro-switch drops into the notch on the program wheel.

Note: Program wheels have 0 to 165 min. cycle times; use “2” min. per pin or hole to set regeneration times. The layout of pins and holes on the program wheel follow the same procedures as on this page.

Capacity Chart

Capacity	30K A (1")	60K A (1")	90K B (1 ½")	120K B (1 ½") C (2")	150K B (1 ½") C (2")	210K B (1 ½") C (2")	300K B (1 ½") C (2")	450K C (2")	450K E (3")	600K C (2")	600K E (3")	900K E (3")	1200K E (3")	1500K E (3") F (4")	900K E (3") F (4")	1200K E (3") F (4")
Resin (Ft³):	1	2	3	4	5	7	10	15	15	20	20	30	40	50	60	85
Refill (GPM):	0.5	0.5	0.5	0.5	0.5	2	2	2	4	2	4	4	4	10	10	10
Refill Time:																
4 min.	19,600															
6	24,100	33,400				123,900			265,500							
8	26,900	39,200				149,800	177,000		307,500		354,000			885,000		
10	30,000	44,200	53,100			164,500	196,000		342,000		392,000			980,000	1,062,000	
12		48,200	58,800	66,800		177,800	214,000	265,500	367,500		428,000	531,000		1,070,000	1,176,000	
16		53,800	68,400	78,400	88,500	197,400	245,000	307,500	415,500	354,000	490,000	615,000	708,000	1,225,000	1,284,000	1,620,000
20		58,800	74,700	88,400	98,000	210,000	269,000	342,000	450,000	392,000	538,000	684,000	784,000	1,345,000	1,470,000	1,818,000
24		60,000	80,700	96,400	107,000		291,000	367,500		434,000	582,000	735,000	856,000	1,455,000	1,614,000	1,980,000
28			86,100	101,600	117,500		300,000	388,500		470,000	600,000	792,000	940,000	1,500,000	1,746,000	2,082,500
32			90,000	107,600	122,500			415,500		490,000		831,000	980,000		1,800,000	2,250,000
36				112,800	129,500			436,500		518,000		873,000	1,036,000			2,286,000
40				117,600	134,500			450,000		538,000		900,000	1,076,000			2,473,000
44				120,000	138,500					554,000			1,128,000			2,550,000
48					145,500					582,000			1,164,000			
52					148,500					600,000			1,200,000			
56					150,000											
60																

Capacities Shown Are Based Upon :

Influent Hardness..... 500 PPM as CaCO₃

Minimum Salt Dosage 5 lb./ft³

Maximum Salt Dosage 15 lb./ft³

Refill Formula: Refill Time (Minutes) = $\frac{\text{Dose (\#/ft}^3\text{)} \times \text{Resin (Ft}^3\text{)}}{3 \times \text{Refill Rate (gpm)}}$

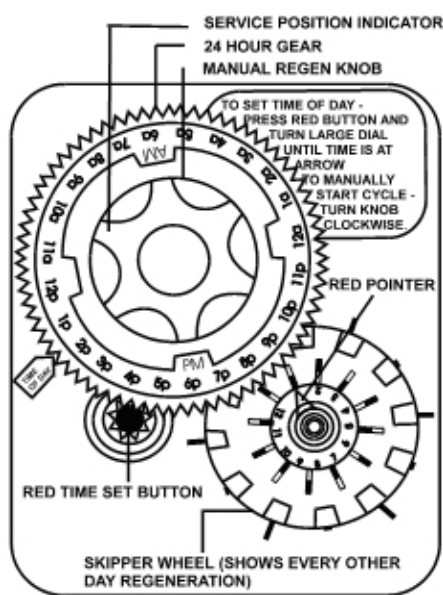
3.2-SETTING TIME OF DAY

1. Press and hold the red button in to disengage the drive gear.
2. Turn the large gear until the actual time of day is opposite the time of day pointer.
3. Release the red button to again engage the drive gear.

* Immediate regeneration timers do not have 24-hour gear. No time of day can be set.

3.3-MANUAL REGENERATION

1. Turn the manual regeneration knob clockwise.
2. This slight movement of the manual regeneration knob engages the program wheel and starts the regeneration program.
3. The black center knob will make one revolution in the following approximately three hours and stop in the position shown in the drawing.
4. Even though it takes three hours for this center knob to complete one revolution, the regeneration cycle of your unit might be set for only one half of this time.
5. In any event, conditioned water may be drawn after rinse water stops flowing from the water conditioner drain line.



3.4-SETTING REGENERATION DAYS

Rotate the skipper wheel until the number "1" is at the red pointer. Set the days that regeneration is to occur by sliding tabs on the skipper wheel outward to expose trip fingers. Each tab is one day (Finger at red pointer is tonight). Moving clockwise from the red pointer, extend or retract fingers to obtain the desired regeneration schedule.

A 7-day wheel is standard. The 12-day wheel is optional.

Regeneration occurs at approximately 2 a.m.



Appendix: Variable Flow Controller Programming Guide

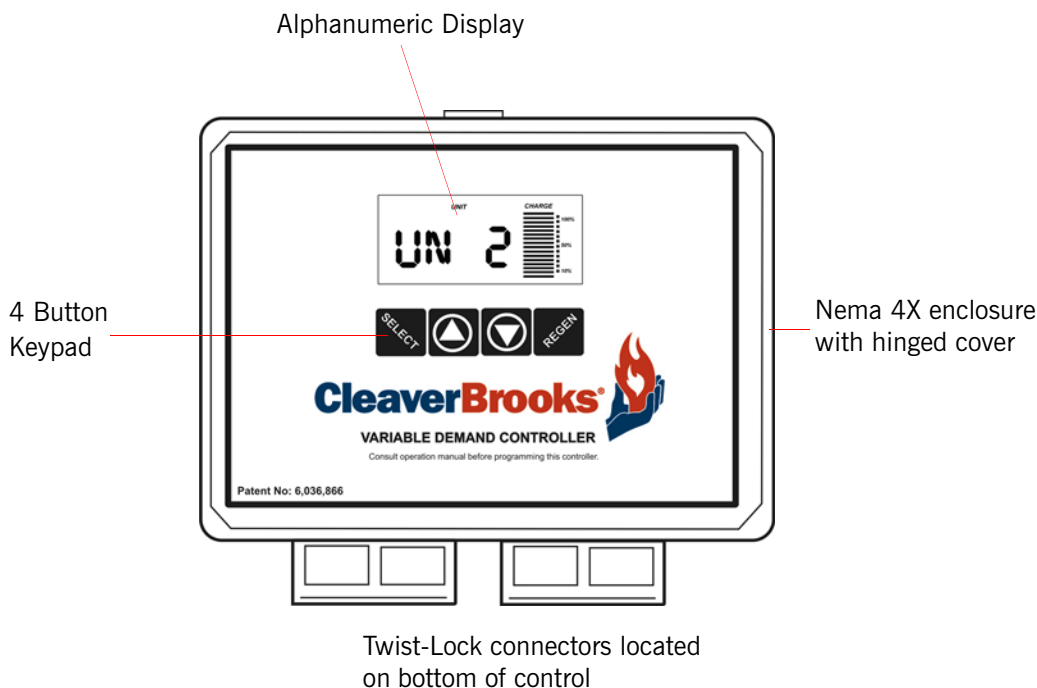
INTRODUCTION	A-2
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1 - INTRODUCTION

The VF Control is a computer based, demand initiated controller for commercial and industrial Water Softener, Dealkalizer, and Filter systems. The controller operates by sensing water flow to optimally control system operation. Softeners, Dealkalizers, and Filters can be operated as two, three, or four tank alternating, parallel, or variable flow softener systems. Additionally, the computer provides powerful features, which allow precise monitoring of system performance and detailed assistance in diagnosing problems.

The VF works with a full line of 1" (A), 1½" (B), 2" (C), and 3" (E) commercial and industrial softener, dealkalizer, and filter valves. The control accepts flow signals from a number of Hall effect type flow sensors. When operated in conjunction with ¾" (Z), 1" (A), 1½" (B), or 2" (C) VIP flow sensors, the computer will automatically make low flow rate corrections to improve accuracy. For larger system requirements, the controller operates with 3", 4" or larger insertion type paddlewheel flow meters.

Features



Four Button Keypad - The Keypad is used for both operating and programming the system.

<SELECT> is the navigation key. <SELECT> is used to advance display screens and to access higher level programming and diagnostic screens.

The UP ▲ and DOWN ▼ keys are used to change values. Whenever a display value is flashing, the ▲ and ▼ keys can be used to change that value.

<REGEN> is used for manual control. The <REGEN> key can be used to schedule regeneration, initiate an immediate regeneration, or to manually index through the steps of regeneration.

Alphanumeric Display - The display is an illuminated, alphanumeric, liquid crystal display (LCD) which presents the information used to program, operate, and diagnose systems and performance.

Safety Fuse - The control is equipped with a safety fuse. Should a short circuit occur, the fuse will blow preventing damage to the PC Board. The fuse is a Buss (5x20mm) fuse type GMA-5 amp and is available at a local electrical supply or from the factory.

Beeper - The Beeper provides audible feedback for the buttons and signals alarm conditions.

Connectors - All interconnections to the VF Controller are plastic, water resistant, indexed, turn-to-lock, quick connectors. The control interconnecting cables are pre-installed on valves and turbines. No wiring is required.

Flow Meter Connector – One VIP flow meter is used in conjunction with each tank in the system. There are connectors for 2, 3, or 4 units.

Control Connector – Contains all the wiring required to control a unit. There are connectors for 2, 3, or 4 units.

Remote Regeneration - A connection is provided for remote initiation of regeneration. There are two terminals provided, simply make contact between the two and regeneration will be initiated.

Enclosure - The enclosure is a watertight enclosure (8.5" wide x 6.5" height x 5.5" deep) with a removable neoprene gasket and hinged cover. The controller may be wall mounted or bracket mounted to a nearby pipe.

Alarm Relay Output - The control is equipped with an Alarm Relay Output. The terminal strip has connections that will provide 24 Volts output when an error occurs. See Terminal Block Connections at the end of this manual.

Service and Regeneration Signals - The control is equipped with single pole double through relays that provide 24 volts output during Service Cycle and during Regeneration. Maximum current draw is 10 amps. See Terminal Block Connections at the end of this manual.

Pump Relay - During the Brine Draw Cycle of regeneration, a relay can be activated to operate a brine pump or a caustic pump. The tdrA option on the control must be set.. The Relay will close at the beginning of the Brine Draw Cycle and remain closed for the set time in tdrA. If the time on the tdrA is set longer than the total brine draw / slow rinse time, the relay will turn off at the end of slow rinse. This option is not available for Filters. See Terminal Block Connections at the end of this manual.

2 - OPERATION

Note: If this is a first time start-up, refer to and complete the programming steps in **Section 3 — Programming the VF Control**.

The Main Screens

The unit/charge bar screen and the flow rate screen are the default display screens for the controller. The Main Screens are the starting points from which system, status, settings, configuration, and diagnostics can be reached. Once the control has been initially programmed or after being left idle for four (4) minutes, the display will always revert back to the Main Screen from any other screen.



Unit / Charge Bar Screen

In normal operation, the system will continuously step through the units in a system and display Unit/Charge Bar Screen and then the Flow Rate Screen.

The Unit Number identifies an individual unit in the system and its corresponding Charge Bars. It also indicates to which unit the next Flow Rate screen is referring.

The **Flow Rate Screen** indicates the amount of flow passing through the system for a particular tank.

The Charge Bar indicates the percentage of unused operating capacity remaining. The figure indicates that 100% of the operating capacity remains. As capacity is depleted, the charge bar segments

are reduced. During reconditioning, the charge bar segments are added as the regeneration cycle takes place.

Recharge

When the small **RCHG** segment is visible in the display, a regeneration has been scheduled for that unit. The regeneration will occur in a sequence determined by the computer. When the word **Recharge** flashes in the display, regeneration is currently underway for that unit. The **Recharge** segment will continue to flash until the regeneration is complete.

2.1 - Checking System Status (First Level Select)

The <SELECT> key is the navigational key. Pressing and releasing this key repeatedly can access operation and status information screens,

Note: A beeper sounds while pressing buttons for setup. One beep signals a change in the display. Three repeated beeps indicates the button pressed is invalid, telling you to try another button.

Average Daily Gallons (Liters)

The **Average Daily Gallons** screen displays the average daily gallons (liters) based upon the past 7 days of water usage. The figure adjusts daily at midnight. The display uses all 5 digits to show values from 0 to 9,990,000 gallons.

Note: For usage greater than 99,999, the display uses exponential notation. For example to display 100,000 the display would read "100E3" ($100E3 = 100 \times 10^3 = 100,000$ as on many calculators).

This is a display only screen and cannot be changed. Press and release the <SELECT> key to advance to the next screen.



Days in Service

While in the **Average Daily Gallons** screen, if the up ▲ arrow is depressed, the display indicates the number of days the controller has been in operation as well as the Unit and Time segments.



Number of Regenerations

While in the **Average Daily Gallons** screen if the down ▼ arrow is depressed, the display indicates the number of regenerations that the unit has undergone since it has been in operation, and the Unit and Recharge indicators will be lit





Totalizer

The **Totalizer** screen indicates the total amount of treated water that has passed by the turbines. Accumulated flow is shown in gallons (liters) up to 9,990,000 gallons. For display values greater than five (5) digits, a scientific notation is used. When 999E4 (9,990,000) is reached the counter will roll over back to 0 and resume counting.

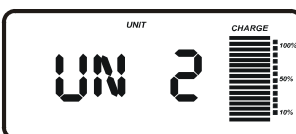
Press and release the down ▼ arrow key to manually reset this value to zero. Press and release the <SELECT> key to advance to the next screen.



Operating Capacity

The **Operating Capacity** screen displays the “per tank” operating capacity (in grains) of the system. Capacity is a function of the resin (ft³) and the salt dosage (lbs./ft³) used to regenerate. If the capacity is over 99,999 grains, exponential notation is used.

This is a display-only screen and cannot be changed. Press and release to advance back to the **Main** screen.



2.2 - Manually Initiating a Regeneration

Press and hold <REGEN> button for 3 seconds to start a regeneration. **RECHARGE** will flash in the display for the unit currently regenerating. If the control is programmed for Softeners or Dealkalizers, only one unit will regenerate and return to stand-by or service as programmed. If the control is programmed for Filters, all the filters will regenerate in sequence. **RECHARGE** will flash on the filter regenerating and **RCHG** will be lit on the other units indicating regeneration is scheduled for those units. To remove the additional scheduled regenerations simply push and hold the <REGEN> button for 3 seconds a second time.

3 - PROGRAMMING THE VF CONTROL

Initial Startup



When the control is powered up; the control model designation (VIP-2 or VF) is displayed for 4 seconds. Next, the last programmed type of unit is displayed. Softener, Filter or Dealkalizer is displayed for 4 seconds. Finally, the software version is displayed, and then the unit enters the configuration (third level select) screens.

On initial startup, or any time the model or mode is changed, the control requires a full setup sequence in order: configuration (third level select) screens, settings (second level select) screens, and normal operating screens.

Go to section titled **Changing the System Configuration (third level setup)** and continue.

Selecting or Changing the Program

Programmed values can be changed at any time. Not all selection screens are available for all models. Appropriate screens will appear for your configuration. The computer will guide you.

The normal operating and status screens are viewed using the **First Level** screens.

The operating settings display screens allow the operating parameters of a system to be changed. Press and hold <SELECT> for three (3) seconds to access these screens.

The system configuration displays allow the physical system details to be changed.

Press and hold <SELECT> for three (3) seconds one time open the **Second Level** screens.

Press and hold <SELECT> for three (3) seconds twice to access the **Third Level** screens.

Press and hold <SELECT> for three (3) seconds three times to access the **Diagnostics Level**. (See Manual Diagnostics)

Screen Level Quick Reference

The guide that follows can be used as a quick reference for the different levels of programming.

FIRST LEVEL DATA

Average Daily Gallons

Days in Service

Number of Regenerations Completed

Total Gallons

Operating Capacity

SECOND LEVEL DATA

Hardness for Softener or TEA for Dealkalizer

Chloride content – Dealkalizer only

Backwash Time

Brine Draw / Slow Rinse Time

Rinse Time

Salt Dosage

Minimum Days between Regenerations

THIRD LEVEL DATA

System Type Select (Softener, Filter or Dealkalizer)

Number of Units

Mode Select - Alternating or Parallel (or Variable – VF)

Minimum Number of Units in Service

Gallons or Liters Select

Beep (on / off)

Resin Quantity

Refill Rate

Time Delay Relay Output (tdrA)

Caustic Feed – Dealkalizer only (yes – no)

Trip Point Set (Variable Flow)

Turbine Size or Adj.

Note: Pushing and holding the select button for 3 seconds – twice in a row will open the Third Level Data. When programming from this point – the control will automatically go through the Second Level Data also.

3.1 - Changing The System Configuration (Third Level Select)

The third level select screens are accessed in two ways:

Initial Startup — The first time the control is powered up, the system enters Third Level Select screens.

Manual Entry — Press and hold the <SELECT> button for 3 seconds then release. Press and hold <SELECT> for 3 seconds a second time; the control will enter the third level setup screens.

System Type Select

The **System Type** selection screen is used to designate what type of system the control will operate. The three options are *Softener*, *Filter*, or *Dealkalizer*. When *Softener* or *Dealkalizer* is selected, the control will operate a variety of valves or valve nest stagers with 5-cycle reconditioning steps – service, backwash, brine rinse, fast rinse, and separate time fill. When *Filter* is selected, the control will operate a variety of valves or valves nest stagers with 3-cycle reconditioning steps – service, backwash, and fast rinse.

The up ▲ and down ▼ arrow keys are used to change the selection. Pressing the <SELECT> key confirms the choice and advances the control to the next screen.

Note: A beeper sounds while pressing buttons for setup. One beep signals a change in the display. Repeat beeps indicate the button pressed is invalid, telling you to try another button.

Number of Units Select

The **number of units selection** screen is used to tell the system how many units will be used in the system. The minimum is 2 units and the maximum is 4 units.

Mode Select

Different softener and filter valves can be operated in a variety of different modes. Three (3) choices are possible with the VF Control.

ALT — A system that operates in an alternating mode.

PAR — A system that operates in a parallel mode.

VAR — A system that moves units into and out of service as conditions require.

Use the up ▲ and down ▼ keys to identify the correct choice and press <SELECT>.

SOFnr

FILtEr

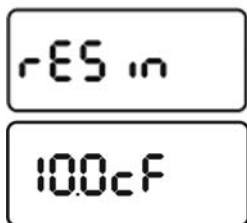
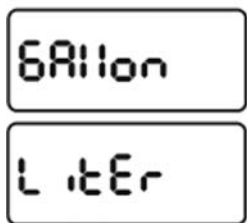
dEALc

UNIT
4

MODE
ALt

MODE
PAR

MODE
VAR



Minimum Service Tanks

In order to assure a minimum system flow, the control is programmed with a minimum number of tanks that should be in service under normal working conditions. For most applications set this value to 1. For some applications, you may wish to ensure a higher minimum available flow capacity. For those applications set the value higher. Consult the factory if you need application assistance.

Gallons (Liters) Selection

All water flow or usage displays can be shown in gallons (gallons per minute) or liters (liters per minute).

Use the up ▲ and down ▼ keys to identify the correct choice and press <SELECT>.

Error Alarm

If the controller should encounter an error condition and the beeper is **ON**, the speaker will beep 5 times every second and the error code will be displayed. If this feature is turned **OFF**, the error code will be displayed, but no beeping will occur.

Use the up ▲ and down ▼ keys to identify the correct choice and press <SELECT>.

Resin Quantity

The **Resin Quantity** select or display is used to let the controller know how much resin (per tank) is being used in a softener. The controller allows a range of .5 – 150 Ft³ per tank. This screen is not available when **FILTER** is selected.

Use the up ▲ and down ▼ keys to identify the correct choice and press <SELECT>.

**Nominal capacities and per tank resin volumes for softeners
are as follows:**

CAPACITY AND REFILL RATES						
Capacity	Resin Qty.	Refill Rate		Capacity	Resin Qty.	Refill Rate
30K – 1" (A)	1	0.5		450K – 3" (E)	15	4.0
60K – 1" (A)	2	0.5		600K – 2" ©	20	2.0
90K – 1/1.5" (A/B)	3	0.5		600K – 3" (E)	20	4.0
120K – 1.5/2" (B/C)	4	0.5		900K – 3" (E)	30	4.0
150K – 1.5/2" (B/C)	5	0.5		1200K – 3" (E)	40	4.0
210K – 1.5/2" (B/C)	7	2.0		1500K – 3" (E) / 4" (F)	50	10.0
300K – 1.5/2" (B/C)	10	2.0		1800K – 3" (E) / 4" (F)	60	10.0
450K – 2" ©	15	2.0		2550K – 3" (E) / 4" (F)	85	10.0

Refill Rate Select

The **Refill Rate Selection** screen identifies the brine tank refill rate to the controller. This value is used to calculate the correct refill time for a given salt setting. The control valve brine system is stamped or labeled with this rate. Alternatively, look at the standard rates in the previous table. This screen is not available when **FILTER** has been selected.

Note: Always check the programmed refill rate versus the actual refill rate as measured. An accurate setting is essential for correct operation of your system.

Use the up ▲ and down ▼ keys to identify the correct choice and press <SELECT>.



Brine / Caustic Pump Selection

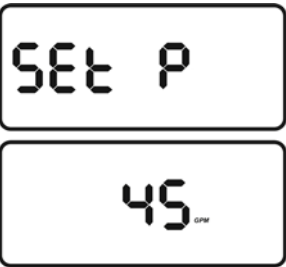
The control has a relay built in which can operate a pump during the brine draw cycle of regeneration. This relay can also be used to operate a chemical feed pump for the caustic feed of a dealkalizer, 10 amps maximum. The timing starts when brine draw starts and ends as programmed or when slow rinse is complete, which ever is shorter. This timing is independent of the brine draw cycle. The time the relay is activated can be programmed from OFF up to 120 minutes in 1-minute increments. Default is 50 minutes.





Caustic Feed Pump Activation (Dealkalizer only)

A caustic feed pump may be activated during brine draw, only if *Dealkalizer* is chosen under type of equipment. The caustic pump default is “no”, but can be turned on any time. The length of time that the pump is activated is equal to the time set in the *tdrA* screen. Answering “YES” to caustic also allows the control to calculate the capacity of the dealkalizer based on caustic addition. If the pump is off, the capacity calculated is based on sodium chloride only regenerations, which is approximately 30% less capacity than using salt and caustic. This screen will not appear if *Filter* or *Softener* is selected.



Demand Trip Point Variable Flow System Configuration

The **Variable Demand Trip Point** screen displays the trip point setting for VF Systems. When the average flow per tank exceeds this trip point, additional units will be brought into service. Provided the units have been in service for at least 30 minutes, when the average flow per tank drops below a computer defined percentage of this value, units will be taken out of service.

The trip point may be adjusted to meet each application’s specific need. The table below suggests trip point settings for various softener systems.

Suggested Demand Trip Point for VF Units (GPM/Tank)	
Softener	
Capacity	GPM
30,000	6
60,000	12
90,000	18
120,000	24
210,000	27
300,000	45
450,000	59
600,000	94
900,000	120
1,200,000	145
1,500,000	165
1,800,000	190
2,550,000	200

Note: Values should be adjusted as required to meet the needs of each specific application. The table values are a suggestion only.

Turbine Select

The **turbine selection** screen displays the nominal size of the turbine being used by the unit. Five turbine size selections are available – $\frac{3}{4}$ ", 1", 1½", 2", and ADJ

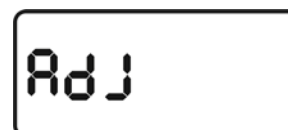
During periods of low flow, the computer will correct the flow meter readings to improve accuracy when a $\frac{3}{4}$ ", 1", 1½", or 2" flow meter is used. If a different sensor is used, the setting ADJ must be selected. The control will prompt you to input the correct pulses per gallon value at the next screen.

Use the up ▲ and down ▼ keys to identify the correct choice and press <SELECT>.



Turbine Adjustable Selection

If the "ADJ" setting was selected on the previous screen, the turbine pulses per gallon value must be programmed into the control. The tables in the appendix will be helpful in making the correct choice. Consult the factory if you have any questions. See Flow Sensor "K" Factors on page 21.



Note: If this is an initial programming sequence or if the model or system has been changed, programming will continue with the operating settings (second level select). If only configuration items (other than the model and system) have been changed; or, after a 4-minute idle period, the control will revert back to the Main Screen.

3.2 - Changing The Operating Settings (Second Level Select)

The Second Level select screens are accessed in two ways:

By continuation — After completing the third level select screens on an initial start-up, the control continues with second level select screens.

Manual entry — Press and hold the <SELECT> button for 3 seconds to access the second level screens.

Hardness Selection (softeners only)

Set the grains per gallon hardness of your water supply (determined by the water analysis or call your local water department).

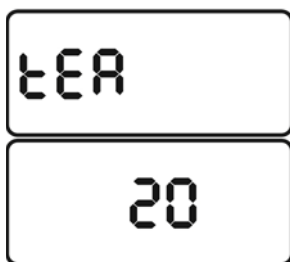
Use the up ▲ arrow to increase the number and the down ▼ arrow to reduce the number. Each press of a button changes the display by 1, between 1 and 25. Between 25 and 125, the display changes by 5. Press and hold the buttons for fast advance. This screen is not available when **FILTER** is selected.



Note: To compensate for iron in the water supply, add 5 to the hardness number for each 1ppm of iron.

Total Exchangeable Anions (dealkalizer only)

Total Exchangeable Anions (TEA) is required when setting up a dealkalizer. Set the grains per gallon of the total exchangeable anions of the water supply (determined by the water analysis). Default is 20 grains.



Use the up ▲ arrow to increase the number and the down ▼ arrow to reduce the number. Each press of a button changes the display by 1, between 1 and 25. Between 25 and 125, the display changes by 5. Press and hold the buttons for fast advance. This screen is not available when **Filter** or **Softener** is selected.

Chlorides Selection (dealkalizer only)

The chloride content of the water being treated in conjunction with the total exchangeable anions is used to calculate the capacity of the dealkalizer. Chlorides are settable in increments of 1 from 0 to 25 grains and in increments of 5, between 25 and 100 grains. Default is 5 grains. This screen is not available when **Filter** or **Softener** is selected.

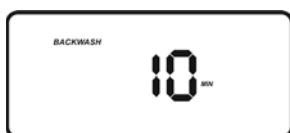


Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.

Backwash Time

The **Backwash Time** screen is used to tell the controller how long to backwash a softener or filter during the first step of a reconditioning cycle. The minimum recommended setting is 5 minutes for a clean, clear raw water supply. If the water condition is too poor, recommended pretreatment equipment should be installed. The backwash time is adjustable from 1 – 30 minutes.

Use the up ▲ and down ▼ arrow keys to identify the correct choice and press <SELECT>.

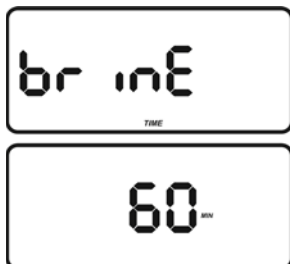


Brine Draw Time Setting

The **brine time** screen is used to tell the controller how long to allow for brine eduction and slow rinse. As the programmed salt dose increases, the amount of time required by a softener to draw brine and slow rinse needs to be increased.

As a rule of thumb, the following settings are suggested, yet should be adjusted as experience and observation with a particular installation dictate. The first regeneration cycle should be observed and timed to verify this setting.

5 lb./ Ft³ 60 minutes



10 lb./ Ft³ 80 minutes

15 lb./ Ft³ 100 minutes

Use the ▲ up or ▼ down arrow keys to identify the correct choice and press <SELECT>. This screen is not available when **FILTER** is selected.

Fast Rinse Time Setting

The **Fast Rinse Time** screen is used to tell the controller how long to fast rinse a filter or softener.

Use the ▲ up or ▼ down buttons to identify the correct choice and press <SELECT>.



Salt Dose

The **Salt Dose** screen is used to tell how much salt per Ft³ of resin should be used when regenerating the softener. The nominal capacity of a softener is achieved when 15 lbs./ Ft³ is used for regeneration. Operation that is more efficient can be achieved with lower salt settings such as 10 lbs./ Ft³ or 5 lbs./ Ft³; however, the capacity of the system will be lower. The following table will be useful in selecting the appropriate settings. (Salt dose settings can be set in the range of 4 – 20 lbs./ Ft³.)

Dose (lbs/ft ³)	Capacity (grains/ft ³)
5	17,700
10	24,900
15	29,400
20	32,400

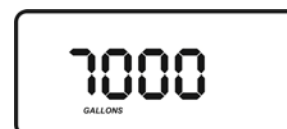


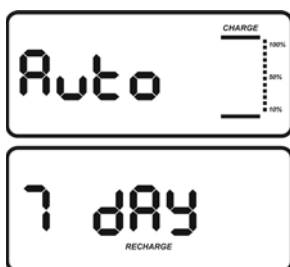
Use the up ▲ and down ▼ arrow keys to identify the correct choice and press <SELECT>.

Filter Gallons (Liters)

The **Filter Gallons** screen is used to set how many gallons (liters) are allowed to pass through a filter before it regenerates. The filter gallons (liters) value has a range off 1000 to 999,000 gallons (378E4 liters) and is adjustable in 1000-gallon increments. If the value is adjusted to below 1000 gallons the display will read **OFF** indicating the gallons (liters) function is off and the unit will only regenerate manually or by an external signal. This screen is not available when **SOFTENER** is selected.

Use the up ▲ and down ▼ arrow keys to identify the correct choice and press <SELECT>.





Maximum Days

The **Maximum Days** screen is used to force regeneration if one has not occurred within a given number of days. The controller default is **AUTO**. This means that regeneration occurs only as called for by the computer.

Use the up ▲ and down ▼ arrow keys to identify the correct choice and press <SELECT>.

4 - SYSTEM DIAGNOSTICS

The VF Electronic Control offers an unprecedented amount of information and assistance for monitoring system performance and diagnosing system problems. The tools for accessing this information are reviewed in detail in the following sections – Automatic Diagnostics, Manual Diagnostics, and Service Center Diagnostics.

Initial Checkout

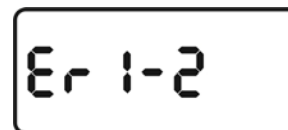
Before moving to the more advanced tools, always perform the following initial checkout.

- Is the display correct?
If the display is blank, check power.
If an error code is showing (Example: Er1-3), go to the **Automatic Diagnostics** section.
- Are plumbing isolation valves fully open? Is the manual bypass valve fully closed?
- Are power, control, and turbine cables installed correctly and securely?
- Are inlet, outlet, and drain lines installed correctly?
- Is there salt in the brine system? Is the brine tubing installed correctly? Has bridging occurred in the brine system? Does the valve draw and refill properly?
- Is the hardness setting correct for your water supply? Has the hardness level changed since it was tested?
- Is the control programmed correctly? Review and understand each of the programmed settings.

If you do not find the problem after making the initial check, go to the **Manual Diagnostics** section of this manual.

4.1 - Automatic Diagnostics

The computer automatically performs a number of diagnostics checks during the normal operation of the system. If a condition is detected that would prevent the system from functioning properly, an error code is displayed and the alarm relay is activated. The control will cease normal operation, the motors will be turned OFF, and the error number will be displayed along with the number of the tank associated with the error code. The display shown indicates that an Error Code #1 occurred on tank #2.



The Error Display will remain until it is acknowledged by pressing the <SELECT> button.

ERROR NO.	ERROR CONDITION
1	No signal from the cam switch.
2	The cam lobe timing was not correct, during the homing operation of the system.
3	The depletion count has reached the maximum allowed.

Description of ERROR CODES:

ERROR #1 : Error #1 will occur any time a signal from the cam switch is not received during positioning of the valve. The error will be detected either during homing of the valve or when positioning the valve during a regeneration. The controller will allow a grace period up to 150 seconds for a cam switch position change to be detected. If this error occurs, there is a problem with a broken or shorted wire, a motor is no longer operational, or the switch is broken. The control will stay in the Fourth Level Diagnostics until the problem is corrected and manually stepped out. The valves will then rotate to home position either stand-by or service.

ERROR #2 : Error #2 can occur only during homing of the valves. This error indicates a problem in the timing of the switch closures as the cam rotates. There is a specific relationship between the shortest distance a detent is detected and the longest distance a detent is detected. If this relationship is not detected, Error #2 is reported. There is a problem with the motor not running, a broken switch or a broken or shorted wire. The problem should be corrected and the control stepped out of the Fourth Level Diagnostics to restart the homing sequence.

ERROR #3 : Error #3 is the depletion error. The control tracks the number of times a unit's capacity is depleted. Error #3 is displayed when the number of depletions reaches 8 in total. Each time a

depletion occurs, the control adds 1 to the total. Each time a unit is regenerated before it is depleted, the control subtracts 1 from the total. In normal operation, a unit will not be completely exhausted when it is triggered to regenerate. If the system is undersized, the units can not be regenerated fast enough, therefore depletions will occur. If the programming is not correct for a unit, this error could occur (check hardness, salt dosage, refill rate and resin quantity). Pressing **[SELECT]** will clear the error, transfer the control to the Fourth Level Diagnostics, and reset the depletion level on the unit to "0". Only one tank is reported for each Error #3 message. If multiple tanks have a depletion count equal to 8, each will have a separate Error #3 message that must be cleared.

Suppressing an Alarm Condition

The ALARM OUTPUT is activated when an ERROR occurs. An activated alarm can be temporarily suppressed by pressing the <REGEN> button while the error is displayed. The alarm will be deactivated for 60 seconds.

Acknowledging an Error

Pressing the <SELECT> button when an Error is displayed will acknowledge the error and temporarily deactivate the alarm and advance the control to Level 4 Diagnostics. The condition of each tank can be viewed. If the Error Code #3 was displayed, acknowledging the error will clear the error and reset the depletion code for that tank to "zero". If Error Code #1 or #2 was displayed, the unit is taken "offline" and the control will advance to the Level 4 Diagnostics. The "offline" unit can be manually advanced for troubleshooting and correcting the cause for the ERROR. Leaving the Fourth Level Diagnostics screen will trigger the control to re-home all the valves in sequence.

4.2 - Manual Diagnostics

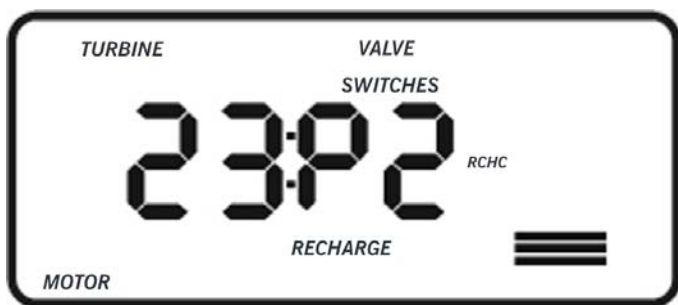
The control functions are accessed through the Fourth Level Diagnostics screen. This screen is used to Manually Index Regeneration Cycles, diagnose problems with the turbine, valve position, outputs, and inputs. The Manual Diagnostics Screen can be accessed in two ways:

- 1) Pressing the <SELECT> key when an error code is showing
- 2) Press and hold <SELECT> key for 3 seconds one time, repeat a second time, and then repeat a third time will open the Manual Diagnostics Screen.

Turbine Counts

A two or three-digit number on the left side of the display is the turbine count. This number will increment with each revolution of the turbine water meter. When a full gallon has counted, the digits will

reset to zero and the beeper will sound. This verifies that the flow meter is functioning correctly.



Motor

The Motor segment will be displayed any time a valve motor is operating.

Switch Position

A “P” under the Valve Switches segments indicates that the position switch is closed. A “-” indicates that the switch is open.

Unit Number

A “1”, “2”, “3”, or “4” in the second position under the Valve Switches segments indicates the unit number to which the switch information applies.

Charge Bars

Indicates the position of the valve.

Service – 0 bars

Backwash – 1 bar

Brine Draw / Rinse – 2 bars

Fast Rinse – 3 bars

Refill – 4 bars

Stand-by – 5 bars

If the valve is in transition from one cycle to another the bar will flash. The charge bars do not show during initial homing of the system.

RCHG – Indicates the unit is scheduled for regeneration.

RECHARGE – Indicates the unit is in regeneration. (blinking).

Colon – If this icon is “on”, the external regen input is activated.



Display All Segments

If the ▼ down arrow is depressed while in the manual diagnostics display, the controller turns on all display segments. This verifies that all segments are working.

Online / Offline

If the ▲ up arrow is held while in Fourth Level Diagnostics, the Online/Offline status of a unit is displayed. Releasing the button advances the display to show the status of the next unit. Each press and release scrolls through the unit numbers.

If the ▲ up arrow is held and the ▼ down arrow is depressed, the unit is taken Offline. An Offline unit is ignored by the system and can be manually indexed through its regeneration steps individually by depressing the <RECHARGE> button. Only one unit can be manually designated as Offline at a time.

Press and hold the ▲ up arrow and then the ▼ down arrow a second time to bring the unit back Online. If the unit is in regeneration, the regeneration will continue and the unit will return to normal operation.

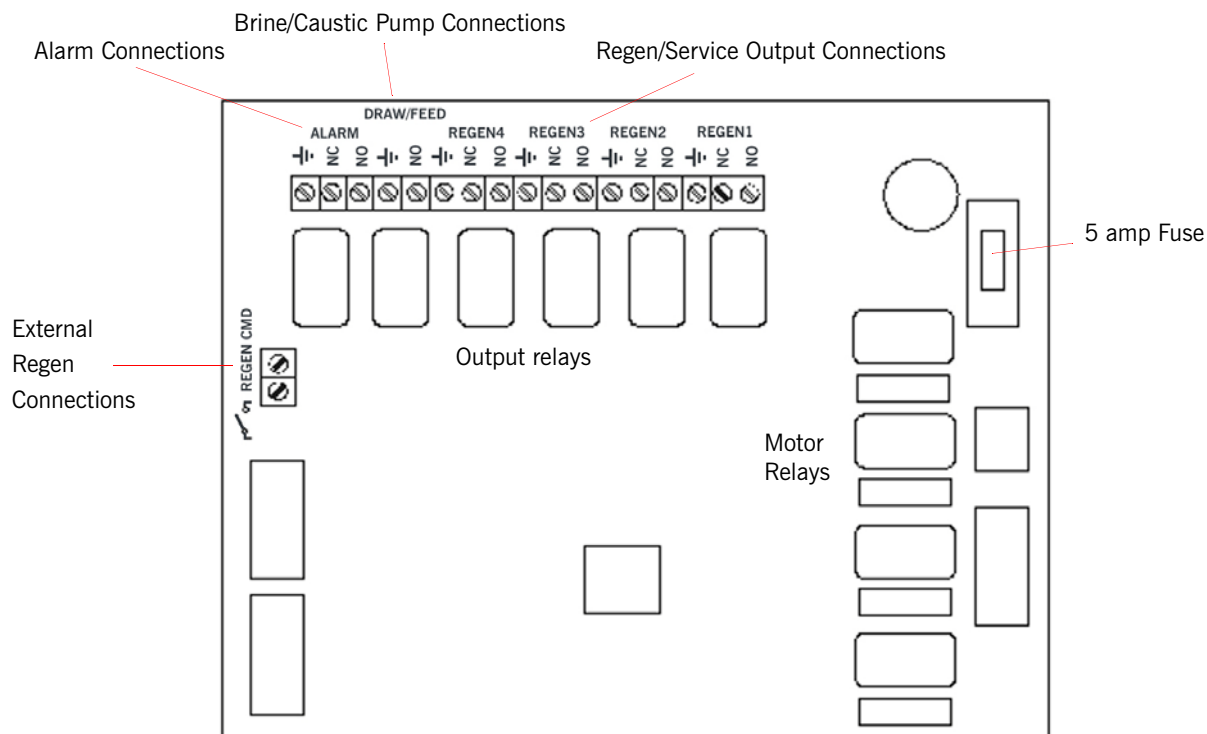
Manually Cycle a Unit through Regeneration

Advance the control to Fourth Level Diagnostics. Take the unit to be manually advanced “Offline”. Press and hold the <REGEN> button for 3 seconds. The unit will advance to the backwash cycle. After the unit is in backwash, press the <REGEN> button again and the unit will advance to the next cycle. This can be continued until the unit has returned to service. Once in service, the unit can be put back Online. This function can be used to manually advance a valve through the reconditioning cycle to check valve operation in each step.

5 - CONTROL OUTPUTS

Terminal Connections

The picture below indicates the location of the 5 amp fuse, the motor relays, the manual regeneration terminal block, and the main terminal block. A regeneration can be started from a remote signal by completing the circuit between the two terminals labeled **REGEN CMD**.



The main terminal block provides **24 volt powered** outputs for the following:

Output Signal	Connections
Unit #1 in SERVICE	REGEN1 – GND and NC
Unit #2 in SERVICE	REGEN2 – GND and NC
Unit #3 in SERVICE	REGEN3 – GND and NC
Unit #4 in SERVICE	REGEN4 – GND and NC
Unit #1 in REGEN	REGEN1 – GND and NO
Unit #2 in REGEN	REGEN2 – GND and NO
Unit #3 in REGEN	REGEN3 – GND and NO
Unit #4 in REGEN	REGEN4 – GND and NO
Brine or Chemical Pump	DRAW/FEED – GND and NO
Alarm Deactivated	ALARM – GND and NC
Alarm Activated	ALARM – GND and NO

6 - FLOW METER CALIBRATION

Flow Sensor “K” Factors

The “K” Factor for the different size Flow Sensors is listed in the table below. The “K” Factors used in the VIP Control are built into it’s algorithm for the .75”, 1”, 1.5” and 2” Flow Meters. The “K” Factor for a flow meter is the number of pulses per gallon of water. If ADJ is selected, then the VIP has the capability to accept the “K” Factor from any Flow Meter with a square wave signal output. Signet Paddle Wheel Model 2536 is one such meter. The Tables below provide the “K” Factor associated with the various sizes and types of pipe available.

Type of Sensor	Pipe Size	Pulses Per Gallon (“K” Factor)		
VIP PVC & Brass	.75”	200		
	1”	100		
	1.5”	46		
	2”	46		
Signet 2536 and Iron Pipe		<i>Sch 40 Pipe</i>	<i>Sch 80 Pipe</i>	
	1” Tee	287	-	
	1.5” Tee	91	-	
	2” Tee	54	-	
	2” Saddle	54	65	
	3” Saddle	23.2	26	
	4” Saddle	13.3	14.7	
Signet 2536 and PVC Pipe		<i>Sch 40 Pipe</i>	<i>Sch 80 Pipe</i>	
	1” Tee	-	352	
	1.5” Tee	-	117	
	2” Tee	-	67	
	2” Saddle	55	67	
	3” Saddle	23.7	27	
	4” Saddle	13.5	15	
Signet 2536 and Copper Pipe		<i>Type K</i>	<i>Type L</i>	<i>Type M</i>
	3” Tee	28	27	26
	4” Tee	15.8	15.2	14.9



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