

Cat. No. 01020767

Rev. G 10/05/23
DCO # 230220

Installation,
Operation, and
Service Instructions
with Parts List

CULLIGAN®
Hi-Flo® 3e
Water Softener, 3" Piping

Featuring the Culligan® Smart Controller™

Models from 2011

Culligan®

Attention Culligan Customer:

Your local independently operated Culligan dealer employs trained service and maintenance personnel who are experienced in the installation, function and repair of Culligan equipment. This publication is written specifically for these individuals and is intended for their use.

We encourage Culligan users to learn about Culligan products, but we believe that product knowledge is best obtained by consulting with your Culligan dealer. Untrained individuals who use this manual assume the risk of any resulting property damage or personal injury.

NOTICE Please send any suggestions for improving this manual to productmanuals@culligan.com.



WARNING! Electrical shock hazard! Prior to servicing equipment, disconnect power supply to prevent electrical shock.



WARNING! If incorrectly installed, operated, or maintained, this product can cause severe injury. Those who install, operate, or maintain this product should be trained in its proper use, warned of its dangers, and should read the entire manual before attempting to install, operate, or maintain this product. Failure to comply with any warning or caution that results in any damage will void the warranty.



CAUTION! This product is not to be used by children or persons with reduced physical, sensory or mental capabilities, or lack of experience or knowledge, unless they have been given supervision or instruction.



CAUTION! Children should be instructed not to play with this appliance.



CAUTION! If the power cord from the transformer to the unit looks or becomes damaged, the cord and transformer should be replaced by a Culligan Service Agent or similarly qualified person in order to avoid a hazard.



WARNING! This device complies with Part 15 of the FCC rules subject to the two following conditions: 1) This device may not cause harmful interference, and 2) This device must accept all interference received, including interference that may cause undesired operation.

This equipment complies with Part 15 of the FCC rules. Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



CAUTION! To reduce the risk of fire, use only No. 26 AWG or larger telecommunications line cord.

NOTE This system is not intended for use with water that is microbiologically unsafe or of unknown quality without adequate disinfection either before or after the system.

NOTE Check with your public works department for applicable local plumbing and sanitation codes. Follow local codes if they differ from the standards used in this manual. To ensure proper and efficient operation of the Culligan equipment to your full satisfaction, carefully follow the instructions in this manual.

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Culligan® Hi-Flo 3e Water Softener, 3" Piping

Featuring the Culligan® Smart Controller™

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Read this Manual First

Before you operate the Culligan Hi-Flo® 3e, read this manual to become familiar with the device and its capabilities.

The Culligan Hi-Flo 3e 3" 450, 600, 900, 1200 HWB and NHWB Softeners have been certified by IAPMO R&T against NSF/ANSI/CAN Standard 372, CSA B483.1 and NSF/ANSI/CAN Standard 61 for Material Safety and Structural Integrity Requirements. Not certified for Contaminant Reductions by IAPMO R&T. The skid mounted systems have not been tested or certified by IAPMO R&T.

The Culligan Hi-Flo 3e 3" 300 HWB and NHWB Softeners have been certified by IAPMO R&T against NSF/ANSI/CAN Standard 372 for low lead compliance. Not certified for Contaminant Reductions by IAPMO R&T. The skid mounted systems have not been tested and certified by IAPMO R&T.



NOTE Refer to GBE Programming for Commercial Softeners and Filters (except for HFXN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the [Technical Service Tab](#) or on the iPad Service Tech App.

About this Manual

This manual:

- familiarizes the operator with the equipment
- explains installation and setup procedures
- explains the various modes of operation
- gives specifications and troubleshooting information

Safe Practices

Throughout this manual there are paragraphs set off by special headings.

Notice

Notice is used to emphasize installation, operation or maintenance information which is important, but does not present any hazard. For example,

NOTICE The nipple must extend no more than 1 inch above the cover plate.

Caution

Caution is used when failure to follow directions could result in damage to equipment or property. For example,



CAUTION! Disassembly while under water pressure can result in flooding.

Warning

Warning is used to indicate a hazard which could cause injury or death if ignored. For example,



WARNING! Electrical shock hazard!
Unplug the unit before removing the timer mechanism or cover plates!

The CAUTION and WARNING paragraphs are not meant to cover all possible conditions and situations that may occur. It must be understood that common sense, caution, and careful attention are conditions which cannot be built into the equipment. These MUST be supplied by the personnel installing, operating, or maintaining the system.

Be sure to check and follow the applicable plumbing codes and ordinances when installing this equipment. Local codes may prohibit the discharge of sanitizing or descaling solutions to drain.

Use protective clothing and proper face or eye protection equipment when handling chemicals or power tools.

NOTE The Culligan Hi-Flo® 3e is not intended for use with water that is microbiologically unsafe or of unknown quality without adequate disinfection either before or after the system.

NOTE Check with your public works department for applicable local plumbing and sanitation codes. Follow local codes if they differ from the standards used in this manual. To ensure proper and efficient operation of the Culligan Hi-Flo® 3e to your full satisfaction, carefully follow the instructions in this manual.

Basic Principles

What Is Hard Water?

Water is said to be hard when it contains more than one grain per gallon of dissolved calcium and magnesium.

Why Should Hardness Be Removed?

Hard water causes scaling and etching which greatly impairs the life and efficiency of boilers, air-conditioning systems, cooling towers, water heaters, refrigeration plants and other equipment using water.

How Does It Work?

The components of dissolved minerals are called ions. They carry either a positive or negative charge. Hardness ions of minerals dissolved in water carry a positive charge. These positively charged ions (cations) are attracted to a synthetic softening material called ion exchange resin.

The heart of the softening system, therefore, is a deep bed of resin which draws calcium and magnesium ions, as well as ferrous iron, from the water as it passes through the resin bed.

Can The Resin Draw Out Hardness Ions Indefinitely?

No. During normal operation, the resin becomes saturated with positive ions and functions less efficiently. When hardness leakage occurs, the resin should be regenerated to restore its efficiency.

How Do You Regenerate Resin?

You regenerate a resin bed by removing the mineral ions through a process called ion exchange. This regeneration process occurs in four steps and takes approximately 80 to 90 minutes.

Backwash

During the backwash step, raw water flows rapidly upward (in reverse direction to the service flow) through the resin bed to expand the bed and flush out accumulated dirt, sediment and other sources of turbidity.

Brine Draw

The brine solution consisting of water and salt is drawn from a brine storage tank and allowed to flow slowly down through the resin bed. The brine solution removes the calcium and magnesium ions from the resin.

Slow Rinse

Brine draw is then followed by a raw water slow rinse. This rinse step will slowly remove most of the remaining brine, exchanged calcium and magnesium ions from the resin.

Fast Rinse

Slow rinse is followed by a raw water flush, a very rapid down flow of raw water which removes the last traces of brine, and settles the resin bed.

How Often Must You Regenerate?

Frequency must be determined for each installation based on the amount of water usage, its amount of hardness and the amount of resin through which it flows. In some cases it is necessary to utilize a resin cleaner when the raw water contains iron. Contact your local Culligan dealer for more information.

How Do You Control The Regeneration Process?

The regeneration process for your commercial water softener is controlled automatically either on a predetermined time, volume, or external signal basis through the use of the Culligan GBE controller with optional flow sensor. See the Installation chapter for further information. The regeneration process can also be initiated manually by the operator as required.

Performance Specifications

Specifications for Hi-Flo® 3e Water Softeners

Culligan commercial water softeners are designed to remove hardness minerals from water. In order to function properly, some operational parameters must be followed. They include:

1. An operating water pressure between 25 and 120 psi. If water pressure is greater, a pressure regulating valve should be installed ahead of the system. If water pressure is lower, additional equipment will be required to maintain a 25 psi minimum operating pressure.
2. Operating temperature between 40° and 100°F or 4.4° to 38°C.
3. Clear (non-turbid) water supplies (Less than 5 NTU).

Table 1. Hi-Flo® 3e Specifications.

Model No.	Exchange Capacity (kgr) Per Tank		Service Flow Rate (gpm) Per Tank		Backwash Flow Rate (gpm) Per Tank	*Minimum System WxHxD Dimensions (in.)		Valve Size (in.)
	Maximum (grains)	Minimum (grains)	Continuous @ 15 psi max. pressure loss	Peak @ 25 psi. max. pressure loss		Single	Duplex	
HCE-450-3	450	300	160	210	20	69x104x32	111x104x32	3"
HCE-600-3	600	400	185	250	30	83x106x39	131x106x39	
HCE-900-3	900	600	200	270	35	94x105x45	148x105x45	
HCE-1200-3	1200	800	215	280	45	106x108x51	166x108x51	
HCE-300-3	300	200	114	150	15	56x103x24	92x103x24	

Table 2. Hi-Flo® 3e Specifications (metric).

Model No.	Exchange Capacity (kgr) Per Tank		Service Flow Rate (m³/h) Per Tank		Backwash Flow Rate (m³/h) Per Tank	*Minimum System WxHxD Dimensions (cm)		Valve Size (in.)
	Maximum (grains)	Minimum (grains)	Continuous @ 1 bar drop	Peak @ 1.7 bar drop		Single	Duplex	
HCE-450-3	450	300	36.3	47.7	4.5	175x264x81	282x264x81	3"
HCE-600-3	600	400	42.0	56.8	6.8	211x269x99	333x269x99	
HCE-900-3	900	600	45.4	61.3	7.9	239x267x114	376x267x114	
HCE-1200-3	1200	800	48.8	63.6	10.2	269x274x130	422x274x130	
HCE-300-3	300	200	25.9	34.1	3.4	142x262x61	234x262x61	

NOTE Dimensions assume systems includes an optional, standard size brine tank.

NOTE Allow a minimum of 24" above the overall system height for access into the top of tank(s).

Installation

NOTE Read this section carefully. Follow all local plumbing and electrical codes.



CAUTION! The media tank must never be subjected to an internal vacuum or it may be damaged. Drain line suction can be prevented by piping the system in similar fashion to that shown in Figure 1. If the service line may be subjected to a vacuum (for example, due to a pump downstream), a vacuum breaker such as Culligan Part Number 00401584 or Part Number 01003701 should be installed immediately before the control valve inlet. Duplex units require two vacuum breakers, one at each control valve inlet. See Figure 2.

Each Hi-Flo 3e water softener contains the following item(s):

- FRP water softening media tank(s).
- Optional Brine tank
- Control valve(s)

NOTE Single systems include valve P/N 01021765, which has a hard water bypass piston (white). Multi-tank systems should have valve P/N 01021764, which has a no hard water bypass piston (black).

- Small parts package
- Media—refer to the table below for quantities of: Culllex Resin and Cullsane underbedding
- Manifold kit
- Tank closure kit

Table 3. Loading quantities.

Model Series	Qty Culllex (Ft ³)	Qty Cullsane (lbs)	Freeboard (inches)
HCE-450-3	15	300	27.6
HCE-600-3	20	400	30.8
HCE-900-3	30	450	30.0
HCE-1200-3	40	500	30.5
HCE-300-3	10	130	22.9

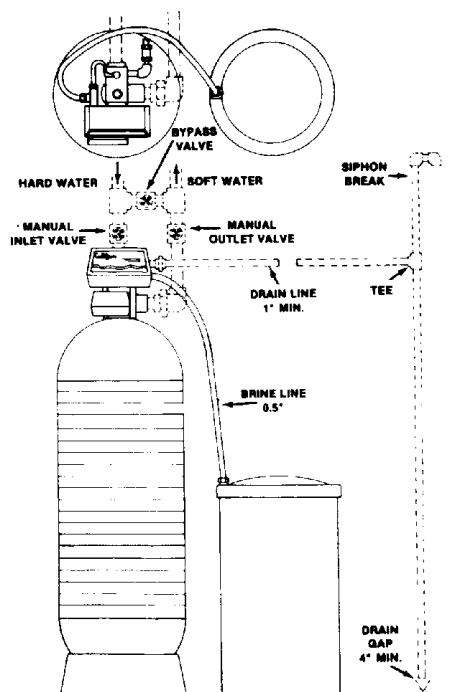


Figure 1. Recommended Hi-Flo 3e system piping



Figure 2. Suggested vacuum breaker location

Locate Softener

1. Select a space that is level and allows a sufficient amount of room above and behind the softener tank(s) for service access and plumbing supply and drain lines. Allow a minimum of 24 inches (61 cm) above the top of the system. Note that upon initial installation or in the event the distribution pipe ever needs to be replaced, as much as 75 inches (191 cm) of clearance may be required above the tank if it is not possible to SAFELY lie the tank on its side for installation/replacement of this distributor.
2. Floor surface—Choose an area with a smooth, solid and level floor capable of supporting the operating weight of the softening system
3. Drain facilities—A nearby drain must be capable of handling the water softener discharge flow rates during the backwash cycle of the regeneration process. Refer to the Specifications Table on [page 3](#) for information concerning the backwash flow rate.



CAUTION! Do not attempt to use any distribution part that is damaged. Doing so may create operational problems and/or create a substantial risk of consequential damage not covered by the product warranty.

Distribution System Installation

1. Locate the distributor components and carefully inspect them to be sure they have not been damaged from handling during transit. See Table 4 to confirm correct manifold.

Table 4. Distribution System Components.

Model/Tank Size	Upper Lateral Qty/Type	Lower Lateral Qty/Type I	Dimension "X"
HCE-450-3 / 30"	(4) 53 Slot	(4) 65 Slot	1.0"
HCE-600-3 / 36"	(8) 15"	(8) 12"	1.7"
HCE-900-3 / 42"	(8) 15"	(8) 13"	0"
HCE-1200-3 / 48"	(8) 17"	(8) 15"	0"
HCE-300-3 / 24"300	(8) 9"	N/A	1.0"

2. Screw the lateral hub to the riser pipe's threaded end. See Figure 3.
3. Lay the tank on its side and insert the hub and riser through the top opening.
4. Locate the laterals and wrap each of them with two (2) wraps of thread sealing Teflon tape. The HCE-450-3 uses eight laterals in a single row. All other systems use 16 laterals in two rows. The HCE-450 has four (4) laterals with 53 slots and (4) with 65 slots. Alternate the laterals when assembling. All other units have eight (8) short laterals and (8) long laterals. The short laterals go along the bottom row of the hub and the long laterals along the top row.
5. Install two laterals 180° apart. Do not tighten because you will need to remove them. See Figure 4.

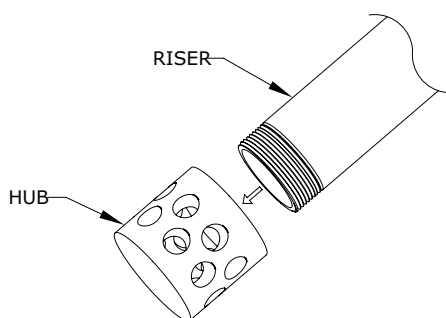


Figure 3. Lateral hub and riser pipe.

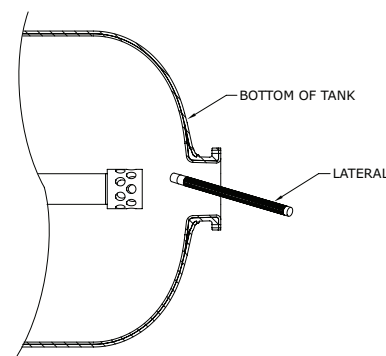


Figure 4. Installing laterals.

6. For the larger tanks, install two of the longer laterals. After installing the two laterals, position the manifold from the top of the tank with the laterals just touching the bottom of the tank. Mark the riser pipe flush with the top of the tank flange. Remove the laterals and remove the riser pipe from the tank. Measure about 1" down the riser pipe (towards the hub) and make another mark. Squarely cut off the riser pipe at this mark. De-burr the cut. When installed, the hub and laterals should sit on the underbedding and not rest on the inside of tank. See Figure 5.

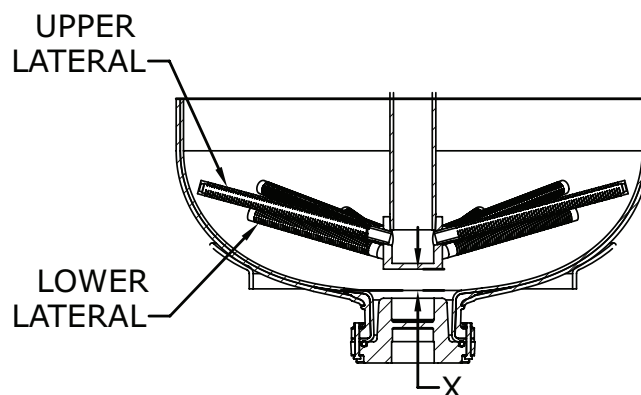


Figure 5. Dimension X between hub and bottom of tank.

7. Insert the hub back in the tank and install all of the laterals hand tight.
8. Close off the bottom of the tank with the closure kit. See Figure 6.
9. Stand the tank upright.

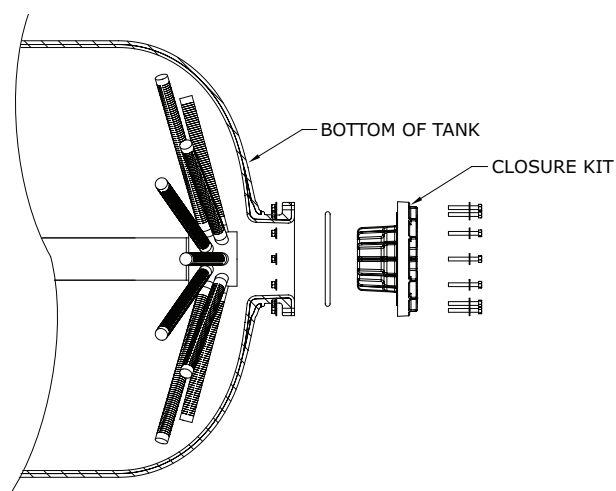


Figure 6. Bottom of tank with closure kit.



CAUTION! Do not leave any laterals touching the side of the tank or the curvature of the head. Damage may occur to laterals during operation.

Load the Media and Install the Hi-Flo® 3e Valve

Before the valve can be finally attached to the tank, the media (gravel and resin) must be loaded. Do not attempt to load the media without having the tank in its final position. Moving the tank once the media has been loaded will be difficult at best.

1. Do not proceed unless the distribution assembly has been installed as previously outlined.
2. The media will be loaded through the opening in the top of the tank. DO NOT allow media to fall into the distributor tube.
3. Prior to loading the media tank, cover the tube with a clean rag or bag being sure to secure the cover in place. Do not allow the item covering the tube or any thing other than the media to fall in to the tank.
4. Keep the distributor tube as close to the center of the tank as possible while filling.
5. Fill the tank with enough water to cover the tips of the radials 1-2". The water will cushion the gravel underbedding as it is loaded
6. Insert a large mouth funnel and begin pouring the Cullsan underbedding into the tank. Level the first bag and adjust the lower manifold so the lateral tips are not touching the tank. Add more underbedding if necessary. The top of the manifold should end up flush with the top of the tank flange (see step 6 on [page 6](#)).
7. Add the remaining underbedding. Distribute the underbedding (Cullsan) as evenly as possible around the bottom of the tank. (Additional water or a length of pipe/broom handle or board might be helpful with accomplishing this).
8. Add the Cullex resin to the tank. Slowly fill the tank with water.
9. Remove the item previously installed to cover the distributor tube during the media loading process. Be sure there are no foreign objects in the tank.
10. Locate the manifold O-ring and install into the bottom of the valve, in the O-ring groove. Lubricate with a silicone-based lubricant.
11. Place the tank O-ring on the tank flange, then place the flange ring on the tank flange, lined up with the bolt holes.
12. Install the inlet disperser into the flange ring.
13. Place the valve O-ring on the top of the flange ring.
14. Lower the control valve slowly onto the tank so that the distributor tube fits into the center of the control valve and then align the valve with the front of the tank and the tank flange bolt holes.
15. Place the flange segments over the lip of the valve and line up with tank flange holes. See Figure 7.
16. Inserts bolts, nuts and washers and tighten.

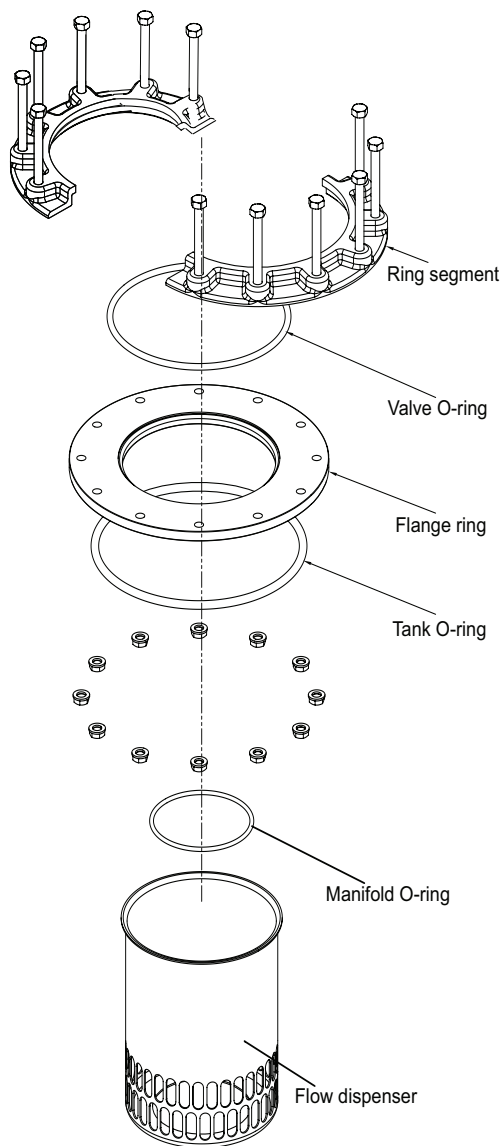


Figure 7. Hi-Flo 3e valve.

Install Piping

- Depending on the type of softener system (such as single, twin, etc.) and the installation parameters, required pipe lengths and piping accessories will vary. See [Figure 9](#), [Figure 10](#), and [Figure 11 on page 10](#) to aid the installation. If the layout drawings are not sufficient for your application, consult a Culligan dealer for specific installation guidelines.

NOTE The use of unions and inlet and outlet isolation valves is recommended to facilitate the servicing of the system. It is also recommended a full flow by-pass line be provided.

- Follow good plumbing practices for installation. These include:
 - Check threads and make certain that they are clean and free of foreign matter.
 - Fittings must be free of cracks or chips.
 - Prepare threads with either a pipe dope sealant or Teflon tape.
 - Make certain that the fittings are not cross threaded during the assembly process.
 - Do not over-tighten fitting or threaded pipe being inserted into a cast or forged part.



CAUTION! Never connect two dissimilar metals (such as copper and steel) together. The use of dielectric unions or schedule 80 PVC or PVC plastic to break the connection is highly recommended in order to reduce the risk of galvanic reaction and subsequent corrosion.

- Drain Piping—Connect the proper 2" flow control (see Table 5) with the flow control arrow pointing in the direction of the drain flow. Use 2" minimum piping to complete the drain line plumbing. Remember to provide a vacuum breaker or standpipe to prevent drain line suction (see [page 10](#)). Maximum drain line length is 300 feet with a maximum discharge height of 10 feet. The standpipe height should be at least 25% of the discharge height.



CAUTION! DO NOT make a direct connection to the drain. Provide an air gap of at least four times the diameter of the drain pipe or conform to local sanitation codes and to permit the observation of drain flow.

- To provide adequate regeneration, units larger than the HCE-450-3 must have the eductor nozzle and throat replaced per Table 5. Refer to [Figure 8](#).
- There are two brine line flow controls included with the valve. One has the 5 GPM flow control washer; the other has the 12 GPM flow control washer. If the washer needs to be changed (see Table 5), the 6 GPM washer should replace the 5 GPM washer, and the 8 GPM washer should replace the 12 GPM washer. A pair of snap ring pliers are required to change the washer. Use the piers to remove the snap ring, and the washer will come out. Reassemble in reverse order. The brine line flow control is then corrected to the brine valve (see [Figure 8](#)).

Table 5. Injector table.

Model	Tank Diameter (in.)	Injector	Brine Line Flow Control	Drain Line Flow Control
HCE-450-3	30	#5 Red	5 gpm	2" - 20 gpm
HCE-600-3	36	#6 White	6 gpm	2" - 30 gpm
HCE-900-3	42	#7 Blue	8 gpm	2" - 35 gpm
HCE-1200-3	48	#8 Yellow	12 gpm	2" - 45 gpm

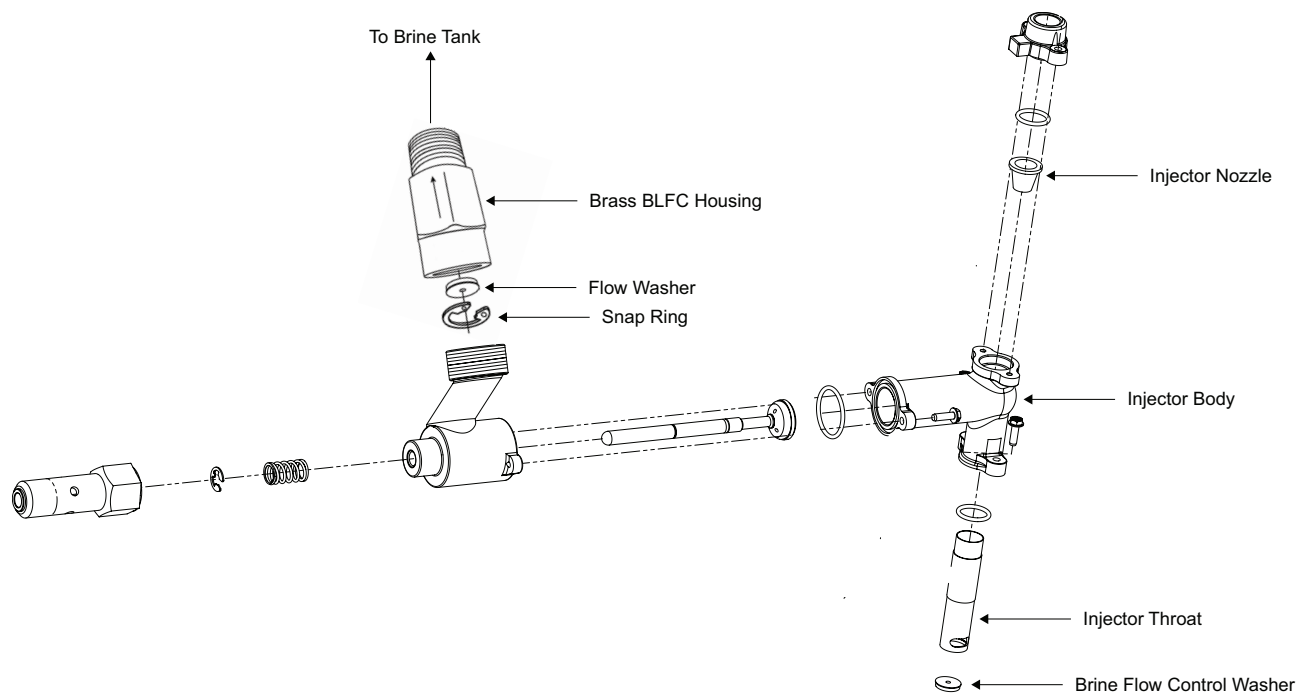


Figure 8.Brine valve.

Suggested Piping Installations

NOTE Drawings not to scale.

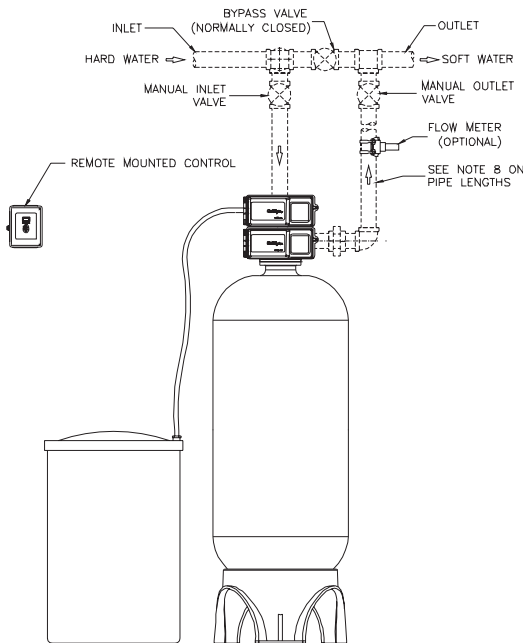


Figure 9. Single Tank

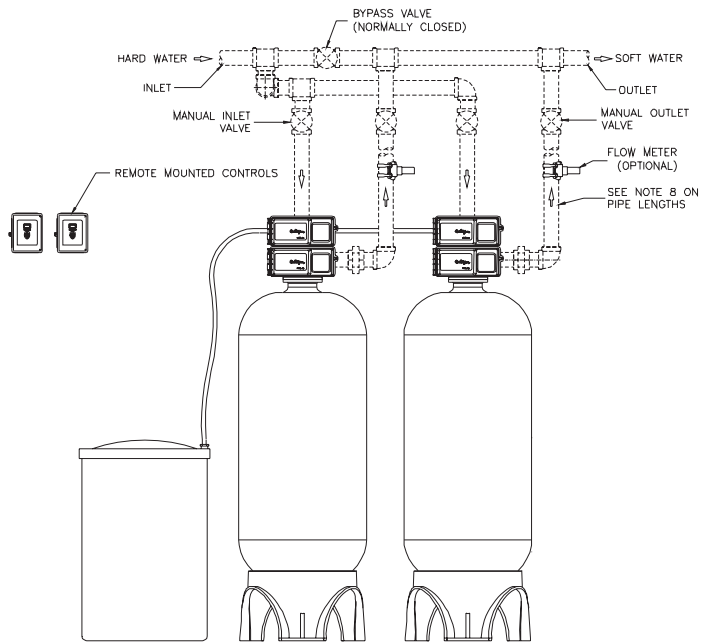


Figure 10. Duplex Alternating Tanks

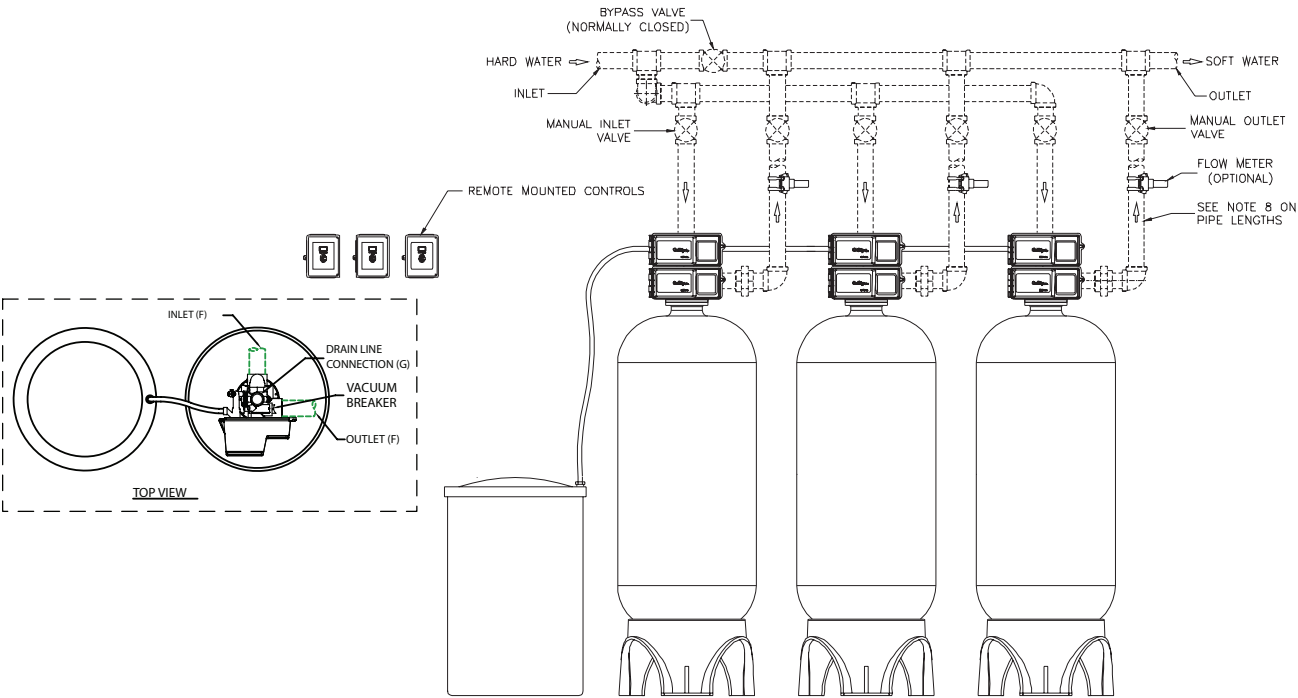


Figure 11. Progressive Flow/Triplex Parallel Tanks

Brine System Installation

NOTE The brine system is purchased as an optional item to allow the use of various brine tank sizes to better suit the needs of the user.

The Hi-Flo® 3e system is normally regenerated using a timed brine refill, dry or wet salt storage brine system. To properly install the brine system, locate the brine tank assembly in a convenient location for ease of service and refill of salt into the brine tank.

The piping from the brine valve within the brine tank and the brine valve on control should be done using 3/4" pipe and fittings (not included). Plastic pipe is recommended because of its corrosion resistance and ease of installation. See Figure 12.

Brine Piping

Position the salt storage tank in a convenient location on a smooth surface. The brine valve should be at the rear to simplify removal of the tank cover.

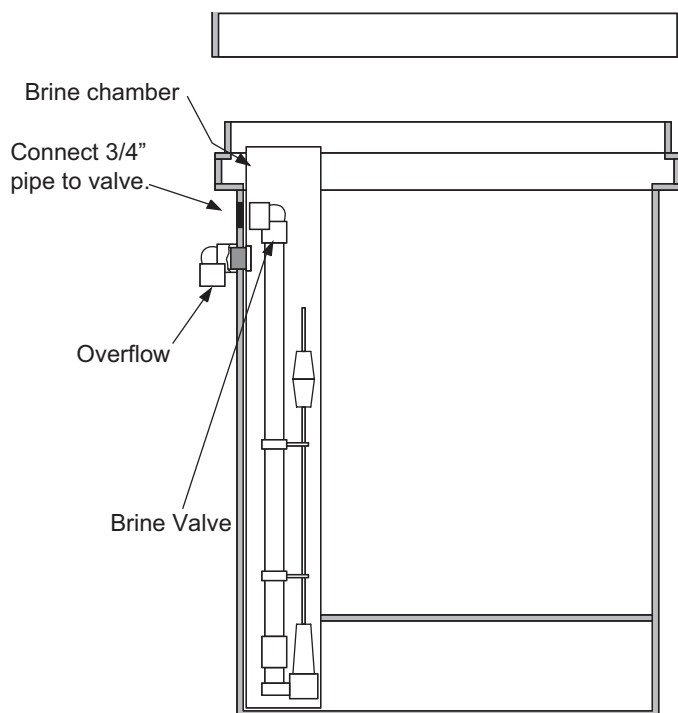


Figure 12. Brine piping position.

Electrical Installation



CAUTION! Observe the precautions listed below before electrical installation of your controllers. Failure to do so may cause permanent damage to the controllers.

- Do not plug in the transformer to a 120 V source until all electrical connections have been made or damage to the controller could occur!!!
- Follow the local electrical code requirements.
- Be sure electrical power is off and disconnected at the source before completing any wiring/cabling connections.
- Provide a dedicated 120 Volt circuit for the GBE system to ensure maximum electrical protection.
- DO NOT include the GBE wiring cables in any conduit or raceway containing other 120 Volt or higher circuits.
- Maintain a distance of at least 10 feet between the GBE controller and any electrical distribution panels, raceways carrying 300 Volts or more, and electrical motors of 1 horsepower or more.
- Use the cabling provided. Failure to do so may effect performance of the GBE controller adversely.

One transformer is required for each controller in the system. Do not attempt to operate multiple controllers without a dedicated transformer for each or your system will experience operational difficulties. Failure to provide each controller in the system with one transformer will also void the warranty. Refer to [“Connecting Multiple Circuit Boards to 24VAC Power Supplies” on page 20.](#)

Smart Controller Circuit Board Outputs

The circuit board supports four outputs:

- Upper Motor Power (Use Aux Out 1)
- Lower Motor Power (Use Aux Out 4)
- Two programmable auxiliary outputs (Aux Out 2 and 3)
- Controller interface (communication between multiple controllers) (RS485).



CAUTION! Connecting 24V to the 2.5 VAC connection on the circuit board will damage the circuit board.



Figure 13. Hi-Flo 3e 3" Smart Controller.

Wiring Procedures and Diagrams

Preparation

1. Loosen the screws or latches securing the controller access cover on each controller provided.
2. Run the 8-conductor cable over to the 3" valve. Connect the wires to the terminal strip, as shown in the wiring diagram in Figure 14 and [Figure 15](#).

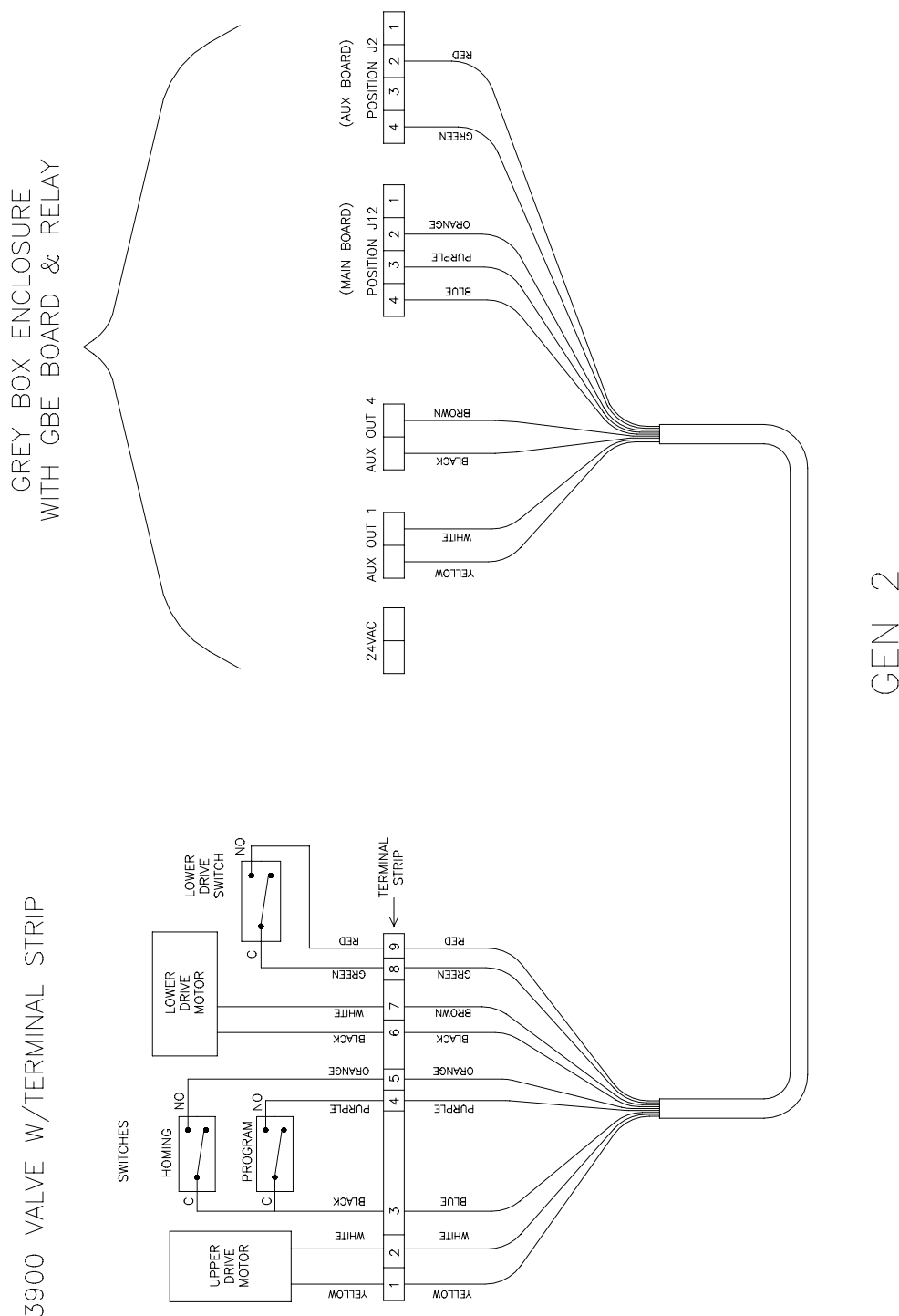
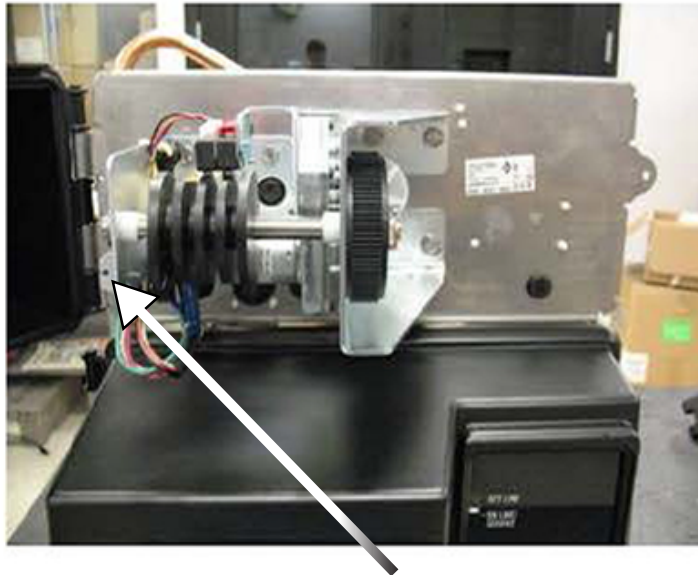


Figure 14. 3900 to GBE board wiring.



TERMINAL STRIP

Figure 15. Left side of valve.

3. Mount the Smart Controller to a nearby wall or piping.

Cable Routing

All input and output connections to the circuit board are 24V or less.

Although the cables do not have to be run in conduit, it is necessary that long runs of cable be supported or protected by strapping them to the equipment piping. If conduit will be used to route the shielded cables, three factors must be considered:

1. DO NOT share the same conduit or raceway with 120 Volt or higher circuits.
2. Keep cables at least six (6) inches away from 120 Volt or higher electrical circuits.
3. GROUND the conduit (if metallic) to a known "earth ground" location.

A series of holes are located on the sides of the controller. Strain relief fittings are provided with the controller enclosure for interconnecting wiring. Install the plastic fittings as needed. Remove the compression nut and rubber sleeve from each fitting. Prior to connection of the cable wires to the circuit board, slide the compression nut and sleeve over the cable for the wiring connections. When wiring is completed, apply a small amount of silicone to the rubber sleeve and reassemble. This will assure all wiring is secure and assist in making the tightening of the fitting easier. Insert the plugs provided to block any holes not used for wiring or other accessories.

24 V Transformer

The Smart Controller is powered by a 24V/60 Hz/2.1 Amp (24V/50VA) transformer. If there are multiple controllers in the system being installed, each controller will require its own transformer. It is recommended that the transformer be plugged into a dedicated 120V circuit.



CAUTION! Connecting 24V to the 2.5 VAC connection on the circuit board will damage the circuit board.

1. Connect one wire from the 24V cable to the outermost 24V transformer screw terminal (see Figure 16). The other end of the wire should be connected to one of the 24V terminals on the GBE control circuit board (Figure 17) by way of the white connector.
2. Repeat the process for the other 24V power supply wire attaching the second wire to the opposite terminal on the transformer and next to the other wire connected to the 24V pins on the GBE board.

POWER SUPPLY

ONE transformer is required for each Controller

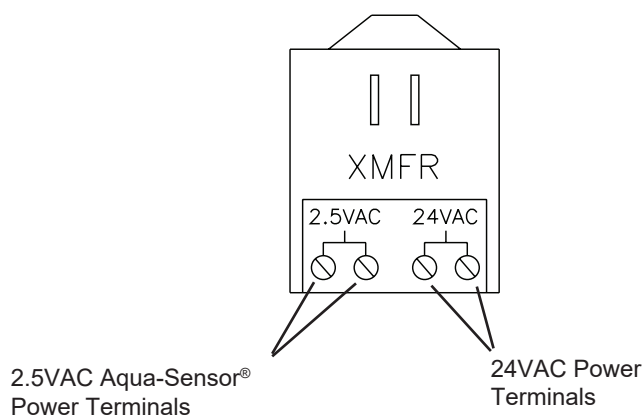


Figure 16. Transformer

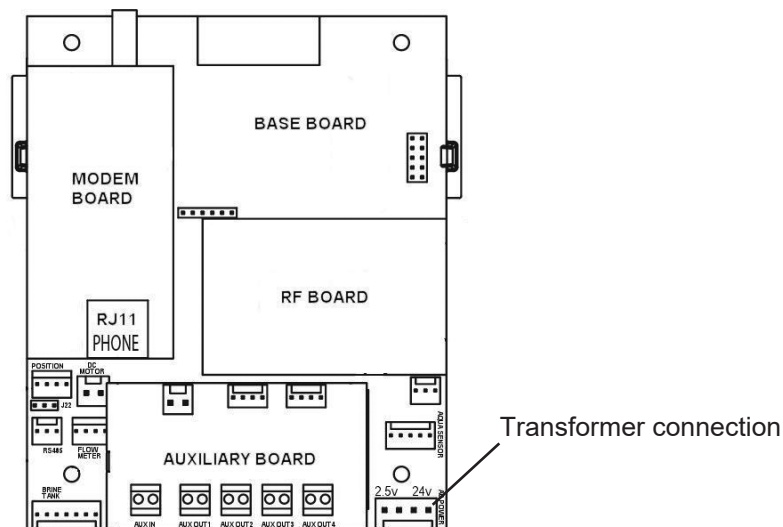


Figure 17. GBE circuit board.

NOTE Refer to GBE Programming for Commercial Softeners and Filters (except for HFXN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the [Technical Service Tab](#) or on the iPad Service Tech App.

Multi-Tank Systems

NOTE Refer to GBE Programming for Commercial Softeners and Filters (except for HFXN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the [Technical Service Tab](#) or on the iPad Service Tech App.

Multi-Tank System Installation

Controls used on multi-tank systems should have a no hard water bypass system. To verify which piston is installed in the valve, remove the lower control cover. Look at where the piston rod comes through the backplate. See Figure 18.

If you have a no hard water piston, the piston end plug will be black. If it is white, you have a hard water bypass piston. If you need to change the piston, refer to the parts list for the correct part number.

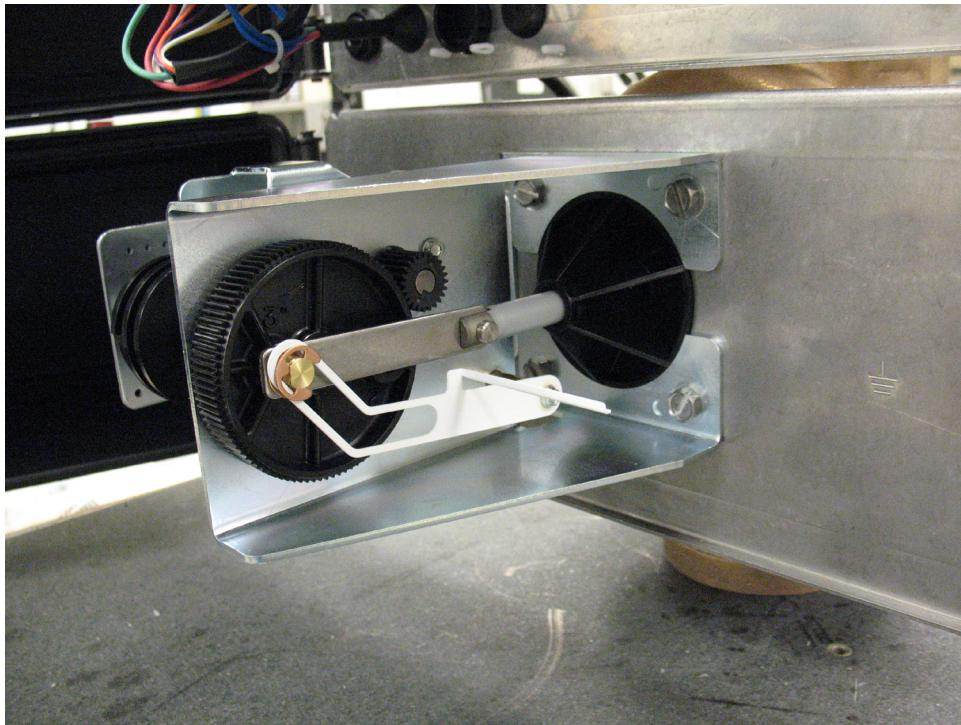


Figure 18. Hi-Flo 3e backplate and piston rod (black, therefore no hard water).

Communication Cable—Multiple Units

Multiple units require a communication cable between each unit. Refer to the table below for the cable type, part number and quantity required. Cables are attached to the RS485 terminal of the circuit board.

Table 6. Communication cable requirements

System Configuration	Cable Part Number	Qty of Cables Required
Duplex Alternating	01016342	1
Duplex Parallel	01016327	1
Triplex Parallel	01016327	2
Duplex Progressive	01016327	1
Triplex Progressive	01016327	2

Multiple units can be set up as progressive flow, alternating or parallel operation. Refer to the instructions and schematics on the following pages for connection to the circuit board.

Progressive Flow or Parallel Flow

Flow meters are required for progressive flow—one for each unit. See the GBE Programming for Commercial Softeners and Filters (except HFxN) Manual (P/N 01027295) to set up the meters.

IMPORTANT—Setting the Jumpers for Progressive Flow

For progressive flow to operate properly, the first and last units must have the jumpers set to pins 1 and 2 on terminal J22 (see Figure 19 at right). All middle units should have the jumpers on pins 2 and 3 (see Figure 19). The diagram below (Figure 20) shows duplex connections. Repeat the connections on any additional systems.

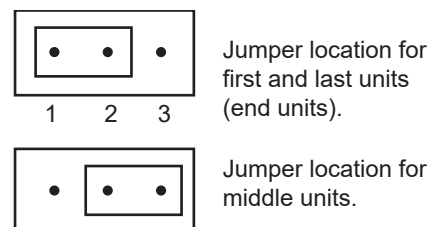


Figure 19.

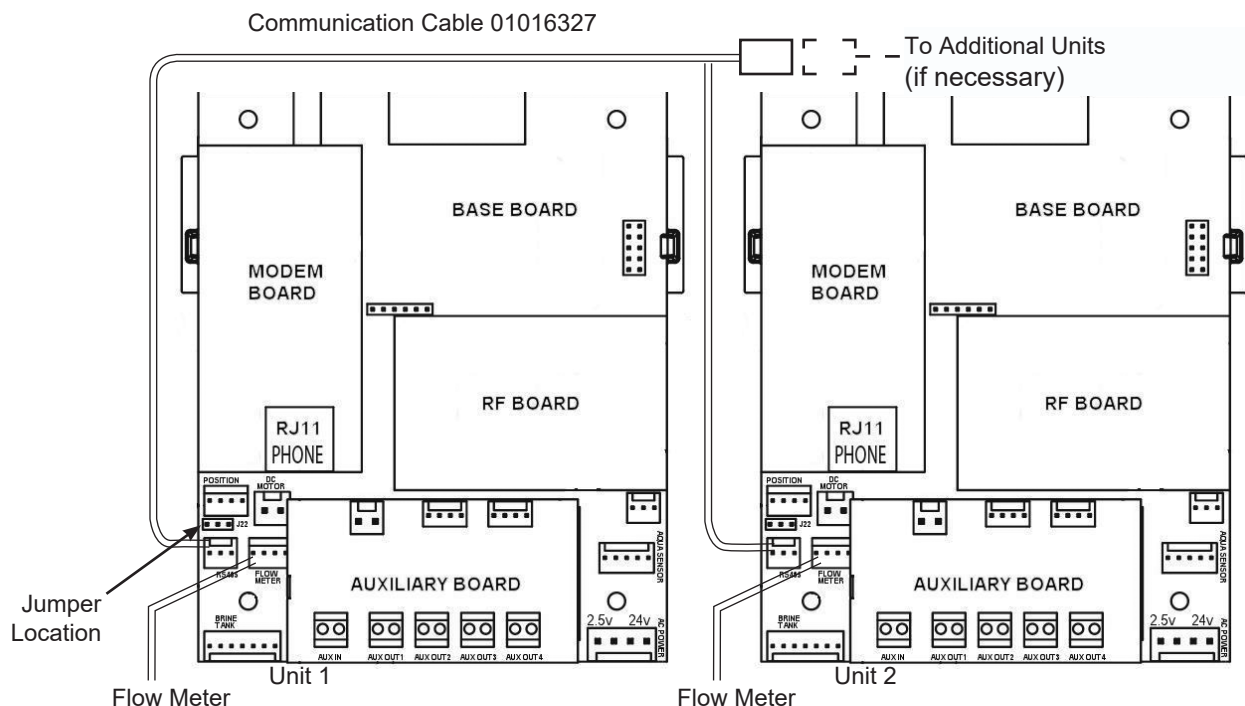


Figure 20. Duplex connections.

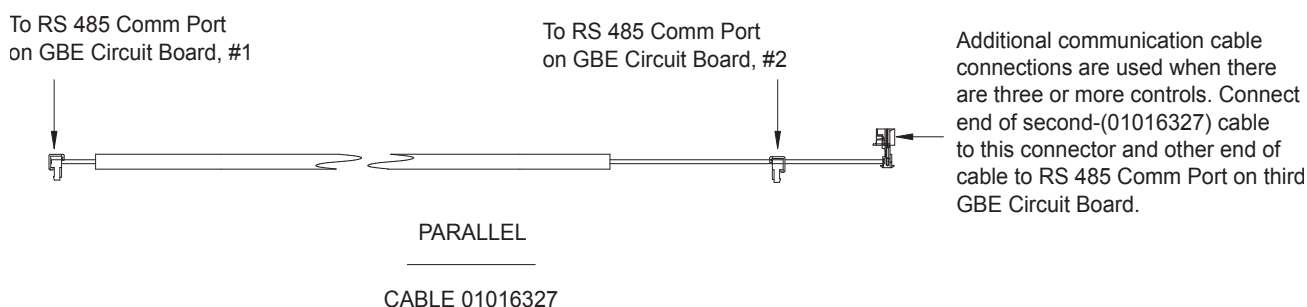


Figure 21. Parallel cable for Smart Controller.

Alternating with Meter (Optional)

For duplex, triplex, quad, and other alternating connections, you must use a meter on each unit and connect the same way as progressive flow. See Figure 22.

Communication Cable 01016342

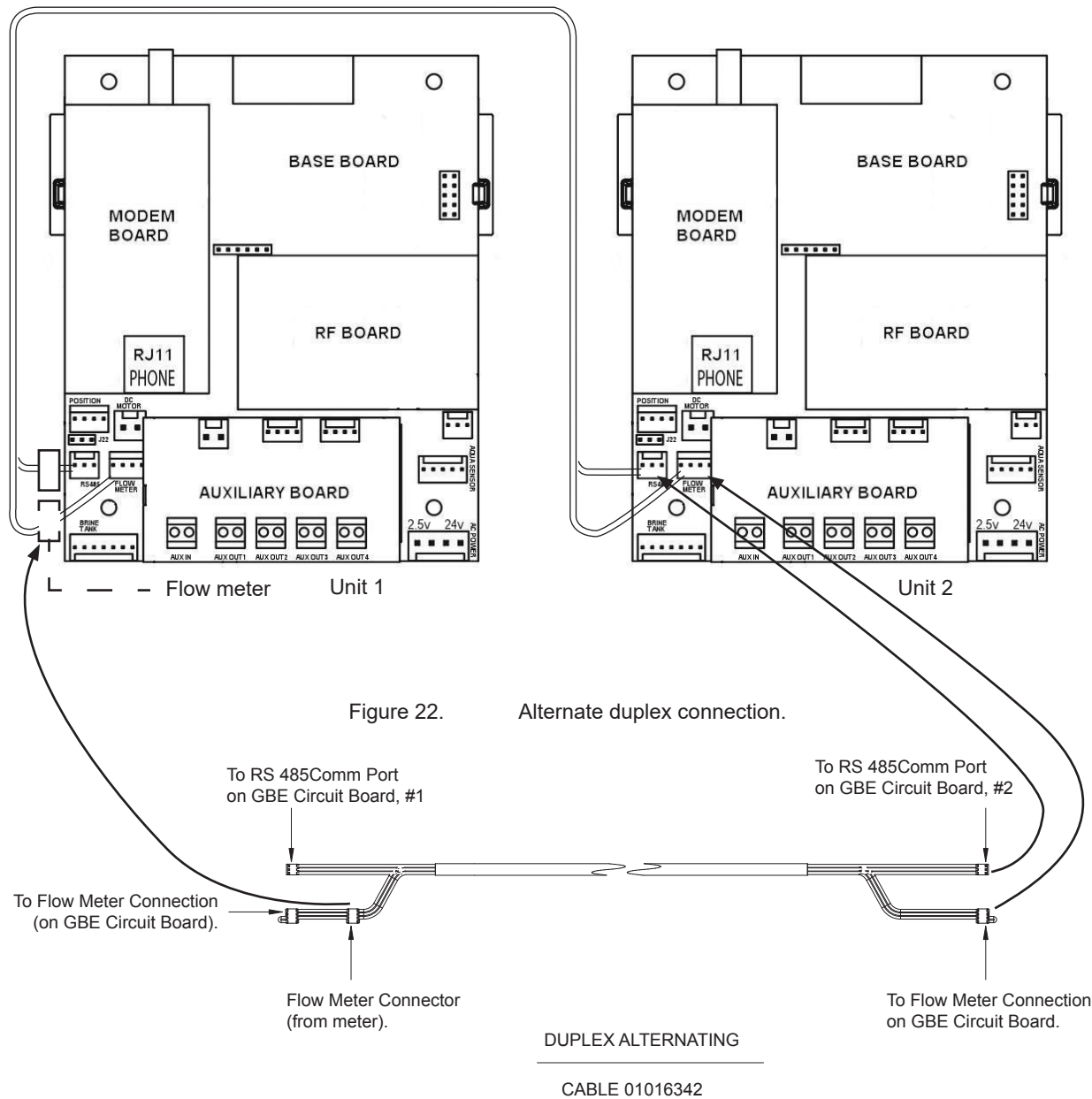


Figure 22. Alternate duplex connection.

Figure 23. Duplex alternating cable.

Connecting Multiple Circuit Boards to 24VAC Power Supplies

In progressive flow systems, each GBE circuit board requires electrical power. Because the GBE circuit boards are electrically connected to each other via the communication cable, it is very important to use care in properly wiring these systems to electrical power. Failure to do so can result in, at a minimum, damaging the GBE circuit boards. Culligan **STRONGLY RECOMMENDS** that every GBE circuit board be provided with its own individual power transformer as shown in Figure 24.

When using individual power supplies, the GBE boards can be connected to each other using communication cables without paying attention to the polarity of the wiring used on the power supplies. **DO NOT** connect the Aux-Outputs of multiple GBE boards to the same electrical load (for example, a “load” can be the coils of a relay or a solenoid valve). If you need the Aux Outputs of multiple GBE boards to run the same load; it is required that you use isolation relays as shown in [Figure 25](#).

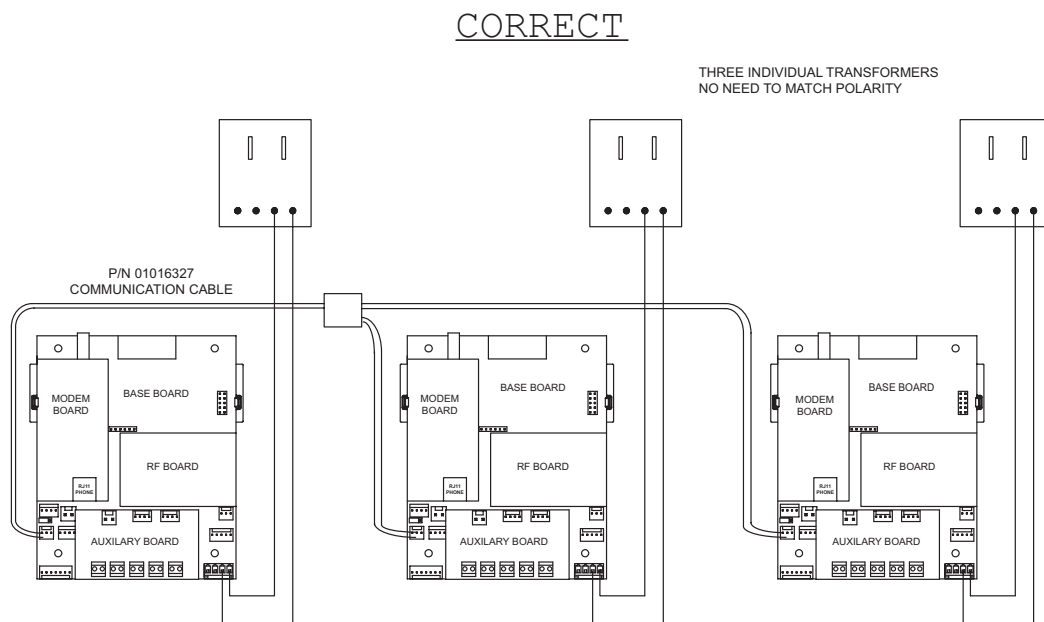


Figure 24. Correct connections for multiple GBE boards to individual 24VAC power supplies.

CORRECT

FOUR INDIVIDUAL TRANSFORMERS
NO NEED TO MATCH POLARITY

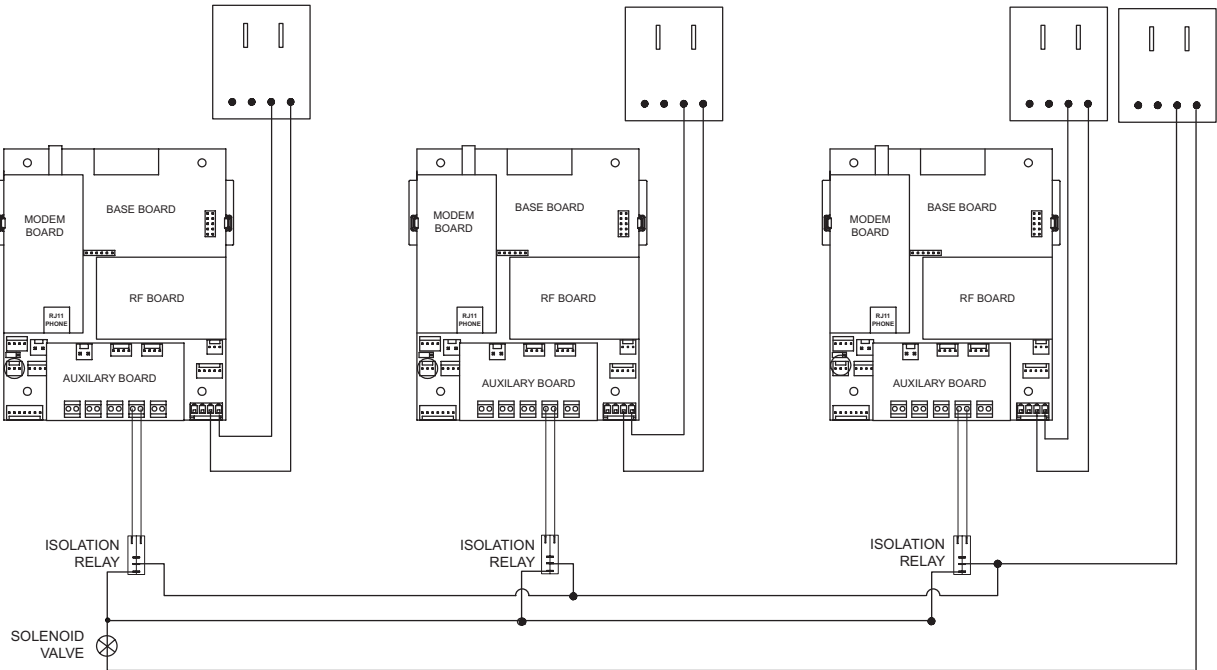


Figure 25. Use of isolation relays to allow multiple GBE boards to control a shared solenoid valve.

NOT RECOMMENDED

POLARITY IS THE SAME
ON ALL UNITS

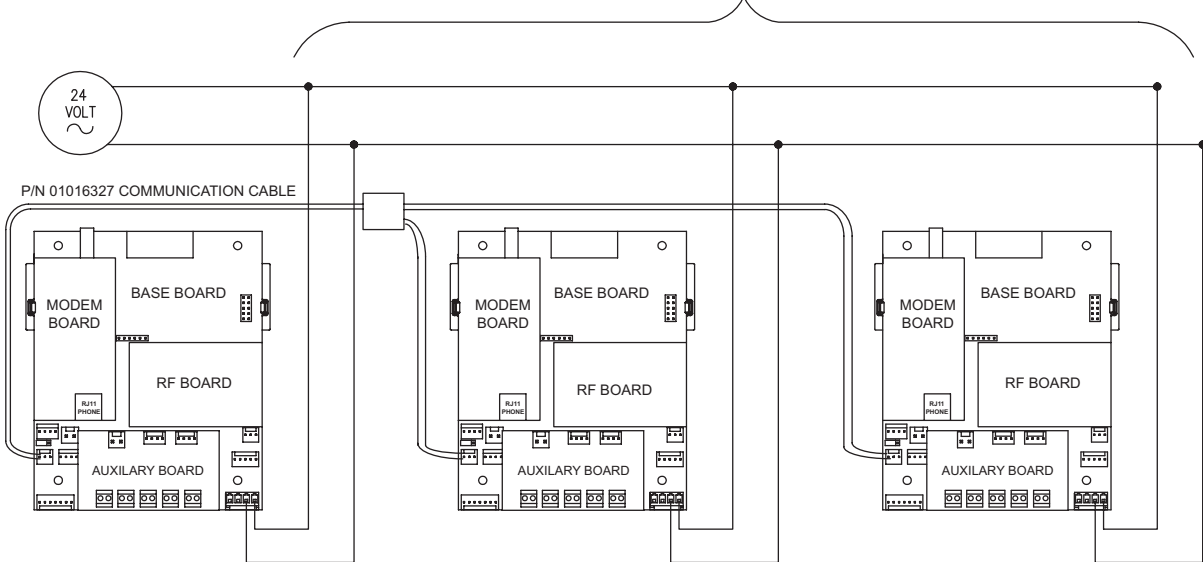


Figure 26. Not recommended connections for multiple GBE boards to shared 24VAC.

NOTE This configuration, while correct, should be avoided, since any single polarity change will cause immediate failure of GBE boards and/or transformers.

Auxiliary Input (Optional)

One auxiliary input is provided for optional signal devices such as remote push buttons, differential pressure switches, hardness monitors, turbid meters, etc. for the purpose of receiving a regeneration signal. The Aux Input can also be configured as an external alarm trigger.

To provide a regeneration signal, select an UNPOWERED contact within the remote device that will close when regeneration is desired. The duration of the switch closure can be as low as 0 seconds; 6 seconds is the recommended minimum and default but can be as long as 999 seconds. The contact must automatically open following the start of a regeneration sequence. To use as external alarm trigger, select an UNPOWERED contact within the remote device that will close when the alarm condition exists. The duration of the switch closure can be as low as 0 seconds; 6 seconds is the recommended minimum and default but can be as long as 999 seconds.

Refer to GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the [Technical Service Tab](#) or on the iPad Service Tech App.

Auxiliary Outputs

The auxiliary board (Figure 27) comes installed in all Hi-Flo 3e softeners. It has four 24 VAC outputs for driving 24VAC control valve motors, energizing 24VAC relay coils, or 24VAC solenoids directly. Each solid state triac output is capable of handling up to 4 Amps maximum; HOWEVER, the 24VAC transformer determines how much total current is available. Max supply current of the 01014897 transformer is only 2.1 Amps, so the sum of all loads on the triac outputs should never exceed the maximum that the transformer can supply. The Auxiliary Outputs (see Figure 28) can be programmed to be “normally off” (output stays OFF until the designated time, it is needed to be ON) or “normally on” (output stays ON until the designated time, it is needed to be turned OFF).

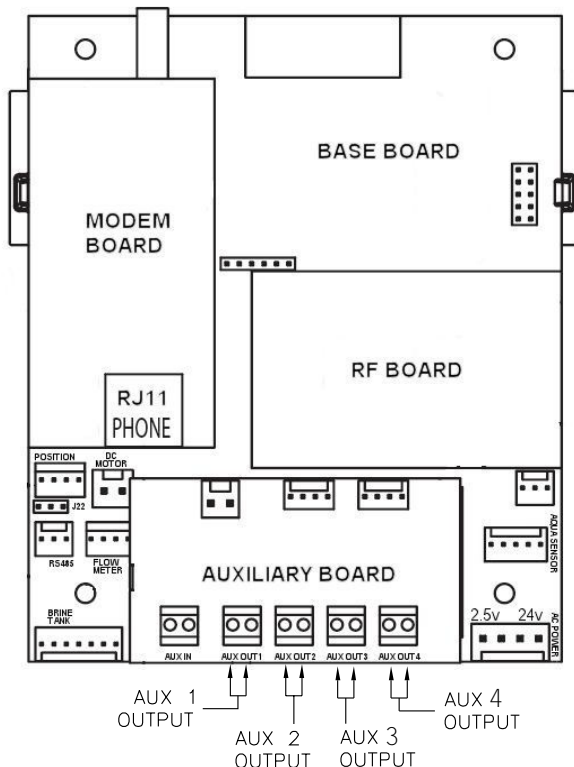


Figure 27. Auxiliary outputs.

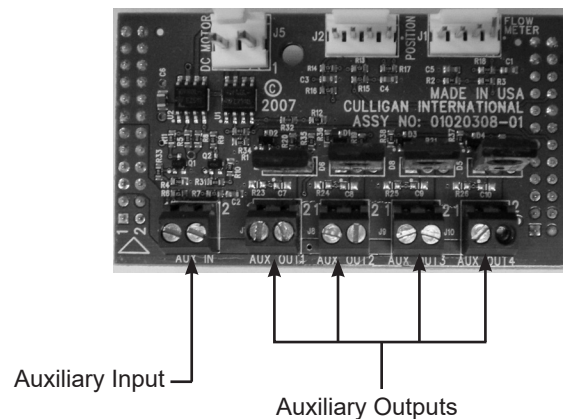


Figure 28. Auxiliary board input and outputs.

Aux Output 1 is used to power the 24V drive motor found on all valves. When Aux Output 1 is used for this, then Aux Output 4 is automatically configured to operate a solenoid which can be used for a standby or blocking. Aux Output 4 is powered during all cycles except service, and unpowered during service.

For example, [Figure 29](#) shows how the timing would work if the CYCLE TYPE was set to NORMALLY OFF, the CYCLE POSITION was set to BACKWASH, the DELAY minutes greater than zero, and ON minutes greater than zero.

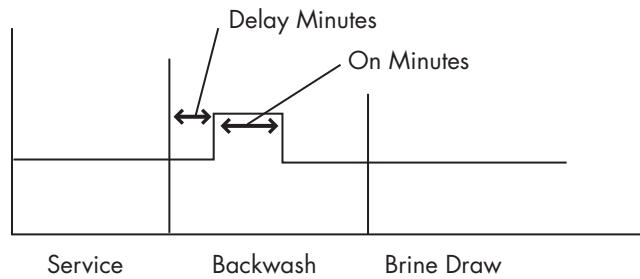


Figure 29. Auxiliary board activation timing.

An additional Aux Output 5 is available by using the optional Alarm Relay board. See [page 26](#).

Refer to GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the [Technical Service Tab](#) or on the iPad Service Tech App.

Installing the Smart Brine Tank (SBT) Probe in to the Brine Tank



CAUTION! Do not use the SBT probe if you are using Brine Reclaim.

NOTE For a multi-tank system using one brine tank, connect the probe to the Master controller.

NOTE IMPORTANT! In order for proper probe functioning, you must physically install the probe into the brine tank and fill the brine tank with a minimum of 16" depth of salt prior to selecting INSTALLED on the SBT Sensor settings. Failure to take these steps will result in an error message. If these steps were not followed, go to the SBT settings, select NOT INSTALLED, then press the CHECK button to accept the change, and then press the X/CANCEL button. When the probe is installed correctly and salt is added to the brine tank, change the SBT setting to INSTALLED.

1. Place the smart brine probe on top of the brine plate as shown in Figure 30.
2. Loop the two zip ties thru the holes in the probe housing and loop the zip ties around the outside of the brine well as shown in Figure 31.

NOTE IMPORTANT! Tighten zip ties securely to prevent movement.

3. Use zip tie to snug the top of the brine tank probe against the top of the brine well.
4. Route the smart brine tank probe cable to an appropriate opening in the valve control housing. Use the strain-relief plug provided with the SBT probe for installation.
5. Plug the SBT probe connector into the circuit board at the position labeled Brine Tank. See Figure 32.



Figure 30.



Figure 31.

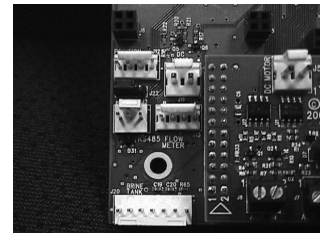


Figure 32.

Refer to GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the [Technical Service Tab](#) or on the iPad Service Tech App.

Installing the Wireless Remote

1. Select a location for the wireless remote monitor (Figure 33). The location must be near an electrical outlet. If a modem is used in the remote, then the location should also be near a standard RJ-11 type telephone wall jack.



Figure 33. Wireless remote monitor.

	CAUTION! Do not touch any surfaces of the circuit board. Electrical static discharges may cause damage to the board. Handle the circuit board by holding only the edges of the circuit board. Keep replacement boards in their special anti-static bags until ready for use. Mishandling of the circuit board will void the warranty.
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2. (Optional) If a modem is to be installed into the remote monitor, refer to ["Installing the Landline Modem In the Remote" on page 26](#) for installation and setup.
3. Connect the power cord to the bottom of the remote monitor. If a modem is to be used in the remote, plug a standard telephone extension cord into the bottom of the remote monitor. Plug into 120V outlet.
4. Disconnect power to the softener. Open the control.

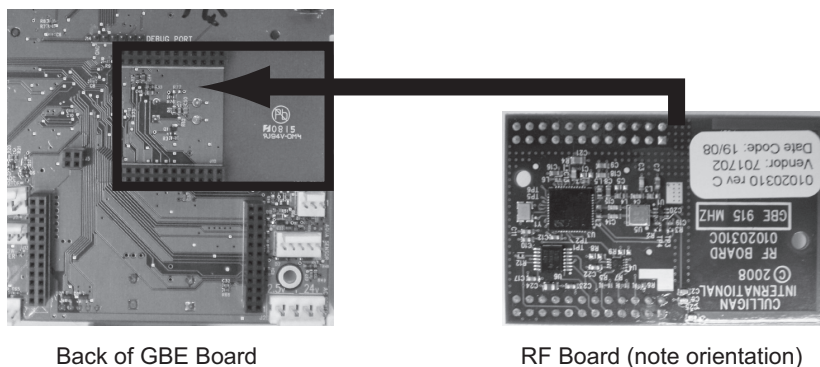


Figure 34. RF board location on Smart Controller board.

5. Install RF board into unit controller. Line up pins in RF board and press firmly into black connectors. Note orientation of RF board (see Figure 34). Make sure the RF board is fully seated into all of the sockets. Reconnect power.
6. Program the remote and main monitor units using the instructions found in the GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295). This manual can be obtained from your local dealer, Cport (www.cport.culligan.com) under the [Technical Service Tab](#) or the iPad Service Tech App.
7. Place the remote monitor against the wall in the selected location, then check the signal strength. Refer to the GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for instructions.
8. Use the Hole Drilling Template (Figure 33) as a guide to drilling two holes to mount the remote monitor. If drilling into wall board, drill two 5/16" diameter holes and insert the plastic drywall anchors into the holes securing them with the two #10 screws provided. If drilling into a solid surface, drill two 7/32" holes into the surface and screw the two #10 screws into the holes. In either case, leave a gap of approximately 3/32" between the head of the screw and the wall. Hang the remote monitor on the two screws.

Installing the Landline Modem (Optional)

NOTE Refer to GBE Programming for Commercial Softeners and Filters (except for HfXN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, Cport (www.cport.culligan.com) under the [Technical Service Tab](#) or the iPad Service Tech App.

NOTE The modem can be installed into either the back of the main controller or the back of the remote control board. The functionality of the modem is the same in either installation.

NOTE Use of the modem kit requires a one-year subscription to either a Level 1 or Level 2 Telecom package. Self-service registration is available at www.cport.culligan.com under the Technical Service tab on the Telemetry page's subpage called [Setup Self-Service](#).

1. Before installing the modem into the back of the Smart Controller board or the back of the remote, the Smart Controller circuit board or the remote must first be powered off.
2. When handling all circuit boards, take care to only touch the edges of the circuit boards—not the metal pins. The electronics on all circuit boards can be damaged by static electricity.
3. Make sure all of the pins at all four connectors are aligned between the modem board and the main controller board. Make sure that the modem board is fully seated into all four sockets.
4. When all connections have been made restore power.
5. Connect the modem to the telephone line by plugging a standard RJ-11 phone extension cord into the modem board.

NOTE The Smart Controller is designed to plug into an analog telephone line (standard residential phone line). This includes phone lines connected to most residential VoIP (voice over Internet) phone systems and to residential DSL phone systems. If you are connecting the softener to a DSL phone system, follow the DSL provider recommended method to connect standard phones to the DSL service. Many systems recommend or require the use of DSL line filters between the phone jack and the device.

NOTE Try to place the Smart Controller or Remote Display near a telephone jack. A splitter might be needed if the jack is already in use.

Installing the Landline Modem on the Smart Controller Board

Open the controller cover and locate the modem connection on the back of the board (see Figure 35). Insert line modem board (part number 01020747) into the socket on the back of the board. Make sure that all of the pins in all four connectors are aligned and make sure the modem is fully seated into all of the sockets.

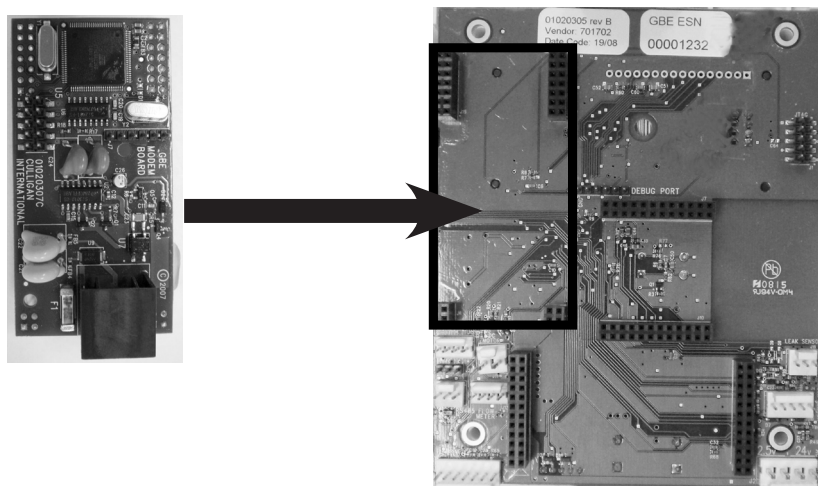


Figure 35. Back of GBE board.

Installing the Landline Modem In the Remote

Open the remote monitor housing by removing the two screws and squeezing the sides of the monitor housing slightly. Insert the modem board (P/N 01020747) into the socket on the back of the remote board (see Figure 36). Make sure that all of the pins in all four connectors are aligned and make sure the modem is fully seated into all of the sockets. Snap the two halves of the remote housing back together using light finger pressure and insert the two screws.

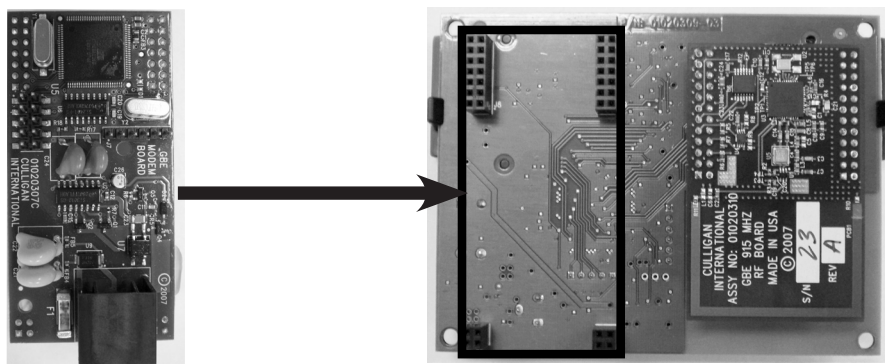


Figure 36. Back of remote board.

Auxiliary Output 5

The GBE board offers support for the Culligan Chlorinator/Relay board (P/N 01022238). See Figure 37.

To use the chlorinator/relay board, install it onto the back of the GBE board. See Figure 38.

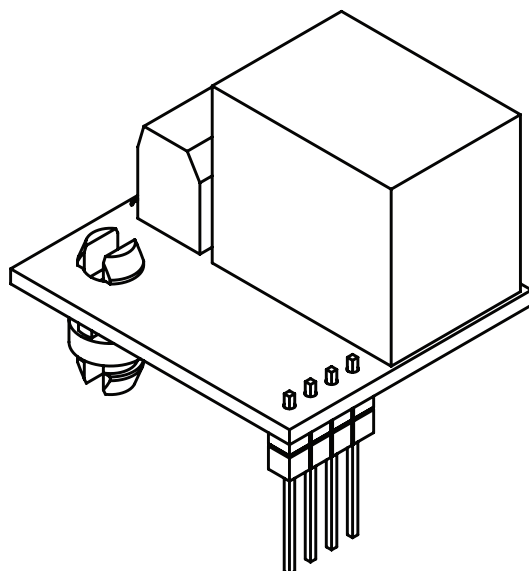


Figure 37. Alarm Relay board.

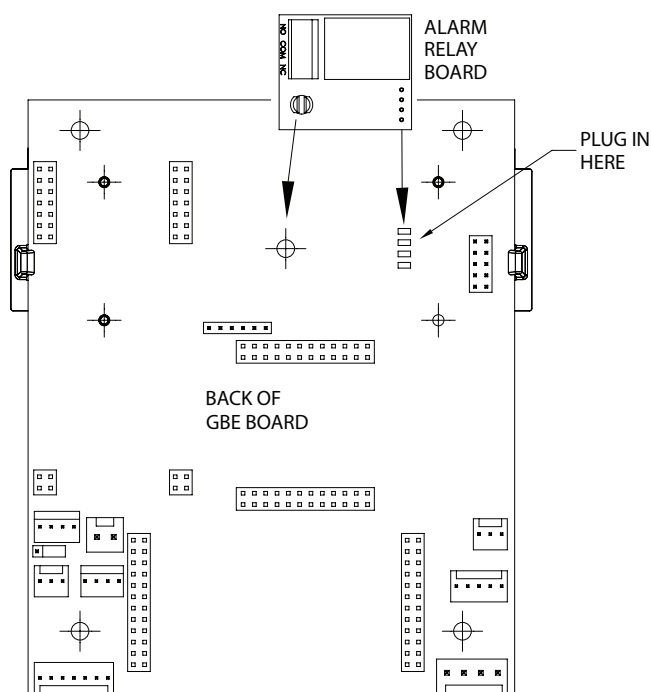


Figure 38. Alarm Relay Board—>Smart Controller.

You must configure the Auxiliary Output 5 settings, if you use the chlorinator/relay board. Refer to GBE Programming for Commercial Softeners and Filters (except for HFxN) Manual (P/N 01027295) for programming information. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the [Technical Service Tab](#) or on the iPad Service Tech App.

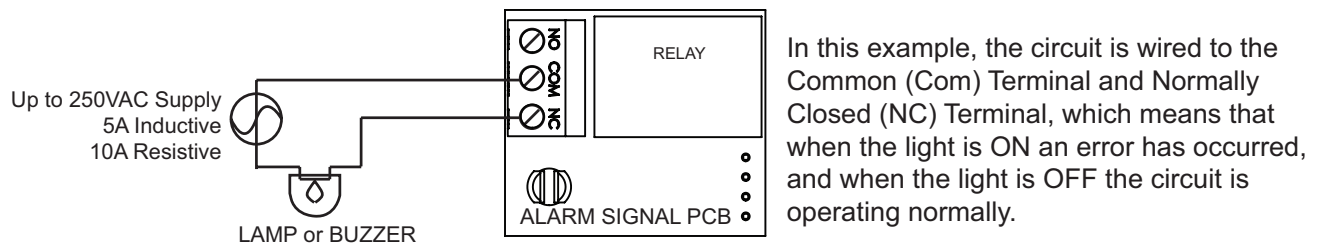


Figure 39. Example of customer wiring to the GBE Alarm Signal Output

Smart Controller Alarm Signal Output

The Smart Controller Alarm Signal Output is provided thru three screw terminals located on the Plug-in Circuit board. These terminals provide a pair of dry contacts rated at 10 A at 240 VAC. One dry contact is open and one is closed at all times as defined in the table below.

When Smart Controller is...	Contact A (screw terminals COM & NC)	Contact B (screw terminals COM & NO)
Operating Normally	Continuity	Open circuit
In "Error Condition", or when the Smart Controller is not powered on	Open circuit	Continuity

A simple error alarm can be constructed by routing a customer supplied power source thru the Alarm Signal Output contact terminals COM & NC as shown in Figure 39. The indicating light will be ON any time that the Smart Controller is either not powered on, or if it is in an "error condition." Alternatively, the Alarm Signal Output contact terminals can be wired to a customer supplied PLC or SCADA system to provide an indication to the customer of the status of the Smart Controller equipment.

On a multiple-tank softener system, such as a twin-alternating, or progressive flow network, the Alarm Signal Output Relay board must be installed on each Smart Controller that the user wants monitored for errors.

Flow Sensor/Meter

Flow Measuring Devices

Two popular types of flow measuring devices can be used with the controller; paddlewheel flow sensors or in-line turbine meters. Please refer to the table below for the number of meters required for your system configuration.

To properly measure flow accurately, the paddlewheel flow sensor(s) must be installed with a certain amount of straight pipe both before and after the paddlewheel flow sensor—see Figure 40 - Figure 42. Turbine meters do not have the same installation requirements and therefore may be positioned immediately following the Hi-Flo® 3e valve if the system is a single or parallel configuration or at any point in the common outlet header for alternating configurations.

NOTE Time clock initiated regenerated systems do not necessarily require using a flow measuring device.

System Configuration	Paddlewheel Flow Sensor	Turbine Meter
Single	(1)	(1)
Duplex Parallel (includes progressive flow)	(2)	(2)
Duplex Alternating	(1)	(1)
Triplex Parallel (includes progressive flow)	(3)	(3)

Flow Sensor Installation

1. Location of the Paddlewheel Flow Sensor

Package—The flow sensor is to be mounted on the outlet piping of each softener for single and duplex and triplex parallel systems and in the common outlet piping of duplex alternating systems.

- The piping that the flow sensor is being connected to should be the same diameter as the mounting fitting. The flow sensor must also be located in a free-flowing straight run of pipe. This straight run includes the upstream piping and downstream piping of the flow sensor (Figure 40).

- The proper length of upstream and downstream straight piping is a minimum of 10 pipe diameters of free-flowing straight pipe upstream of the flow sensor and 5 pipe diameters of free-flowing straight pipe downstream.

Example: A flow sensor that is installed on a length of 2" diameter straight pipe (see Figure 41).

Example: D=2"

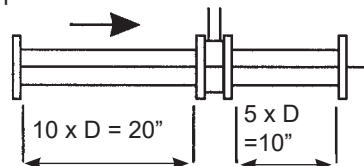


Figure 41.

Example: D=2"

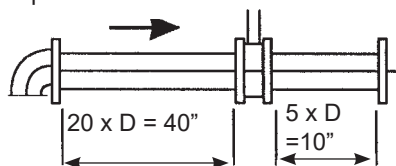


Figure 42.

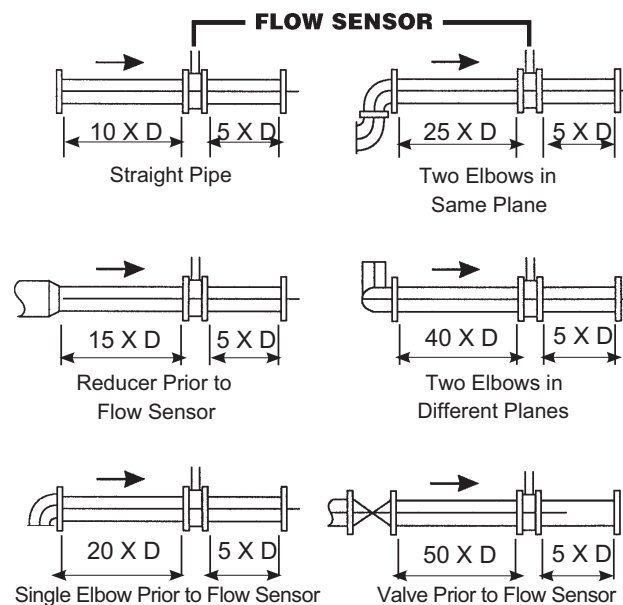


Figure 40.

The examples in Figure 40 – Figure 42 are intended as guidelines for the proper length of straight pipe required both upstream and downstream of the flow sensor installation point. These recommendations are minimum requirements.

2. **Position of the Flow Sensor Fitting**—The flow sensor position is also important to the accuracy of the output signal. When installing the flow sensor in a horizontal pipe, the optimum position of the flow sensor in the pipe is at 0 or 180 degrees, assuming the pipe is always full of liquid and contains no suspended solids. Air pockets or sediment in the pipe will disturb the rotation of the flow sensor, causing inaccuracy in the output signal.

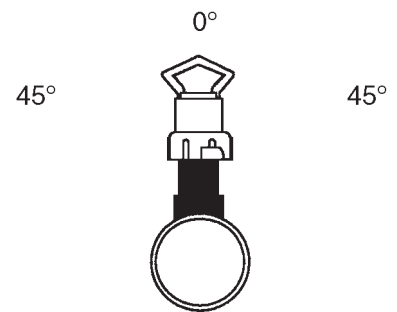


Figure 43.

- a. Because of certain installation requirements due to space restrictions, it may be necessary to tilt the flow sensor slightly, (max. 45° angle). Excessive angles will cause bearing drag on the flow sensor rotor at lower flow rates (see Figure 43).
- b. On a vertical pipe run, it is preferable to locate the flow sensor where the flow is upward. But, if downward flow is necessary, the system must be designed to prevent air/water vapor pockets from developing in the pipe which will affect the performance of the flow sensor.
- c. The maximum distance that the flow sensor can be located from the controller is 500'. Paddlewheel type flow sensors should be supported in the piping as required by local plumbing codes; typically 18" before and after each joint (in a horizontal run of pipe).

NOTE Signet flow sensors must be installed as indicated. Failure to follow these instructions may result in improper operation. Please refer to any supplemental instructions accompanying the flow sensor for additional information.

3. For each of the different types of installations, certain requirements must be followed to assure a proper installation.

- a. **Turbine Meter Installation**—Turbine meters (Figure 44) are less sensitive to position. They can be mounted horizontally or vertically but straight runs before and after the meter are best for accuracy. If mounted vertically, the water flow must be upward. Turbine meters however must be supported as required by local plumbing codes; typically 18" before and after each joint (in a horizontal run of pipe).
- b. **Copper sweat tee**—for use on copper tubing sizes. 1", 1-1/4", 1-1/2", and 2". With the exception of the 1" copper sweat tee, all of the copper tees include a plastic insert which the flow sensor will attach to. This insert should be removed in order to properly solder the tee into the correct position. A tag is attached to the fitting to indicate the proper "H" dimension of the plastic insert when reassembling. This dimension is critical to the proper calibration of the flow sensor. Note the location of the notch to the pipe (see Figure 45).
- c. **Threaded galvanized tee**—for use on galvanized/iron pipe sizes 1", 1-1/4", 1-1/2", and 2". All tees are threaded with NPT threads and have a plastic insert to attach flow sensor. This insert is factory installed and should not be removed. It is necessary for determining the proper location for the flow sensor wheel when inserted into the fitting. Again this insert should not be removed from the tee assembly (see Figure 46).



Figure 44.

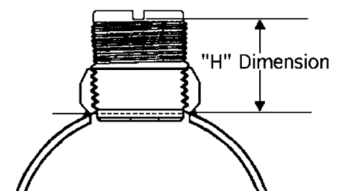


Figure 45.

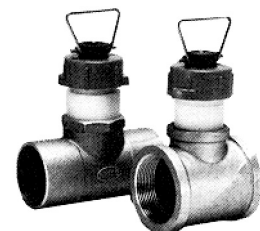


Figure 46.

- d. **Copper brazolet**—for use on copper pipe sizes 2-1/2" and 3". The copper brazolet should be installed by a certified welder. A hole will need to be drilled in the pipe at the desired location as described in this section. The hole size should be 1-7/16" and must be completely deburred and free of any projections. Prior to welding the brazolet, the plastic insert must be removed. A special tool is provided with each brazolet assembly for the removal and the replacement of the plastic insert. When the plastic insert is replaced (after the welding is complete), Teflon tape should be used on the threads. There is a special card that is attached to the insert, this card indicates the proper "H" dimension for the insert depth when you reassemble the insert back into the brazolet. This dimension is critical to the proper calibration of the flow sensor. Note the location of the notch to the pipe (see Figure 47).
- e. **Iron saddle**—for use on steel pipe 2", 2-1/2" and 3". A 1-7/16" hole will need to be drilled in the pipe at the desired location as described in this section. The assembly comes complete with a plastic insert which is factory installed and should not be removed. The assembly also comes with a rubber washer that must be installed between the clamp and pipe. Coat the rubber washer with a silicon lubricant and place it on the inside of the saddle and form it around the raised groove. With the flat side of the rubber washer facing the pipe surface, insert the plastic insert and saddle to the drilled hole. Using the saddle clamps, tighten the saddle into place (Figure 48).
- f. **PVC socket weld tee**—for use on sizes 1", 1-1/4", 1-1/2", 2", 2-1/2", 3" and 4" schedule 80 PVC pipe. All tees are socket welded with a NPT threaded port containing a plastic insert to attach the flow sensor. This insert is factory installed and should not be removed. It is necessary in determining the proper location for the flow sensor wheel when inserted into the fitting. Again, this insert should not be removed from the tee assembly. Once the flow sensor installation is completed, locate the warning decal attached to the flow sensor. Apply the decal to a visible location near the flow sensor in the event service is required.



Figure 47.



Figure 48.



CAUTION! Be certain there is no pressure in the pipe **BEFORE** removing or installing the flow sensor.

Flow Sensor Meter Connections (Optional)

The Smart Controller is capable of detecting the signal from a Hall effect sensor device to provide flow rate information, totalization and volume based regeneration initiation.

There are several different types of flow measuring devices and differences in the wiring of the devices to the Smart Controller circuit board do exist. See Figure 49 below.

For all but duplex alternating, a meter needs to be connected to each circuit board at the location shown below in the drawing. For duplex alternating meter connection, please refer to [“Alternating with Meter \(Optional\)” on page 19](#).

See the GBE Programming for Commercial Softeners and Filters (except HFxN) Manual (P/N 01027295) for programming information and [“Flow Device K-Factor Data” on page 65](#) for K factors. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the [Technical Service Tab](#) or on the iPad Service Tech App.

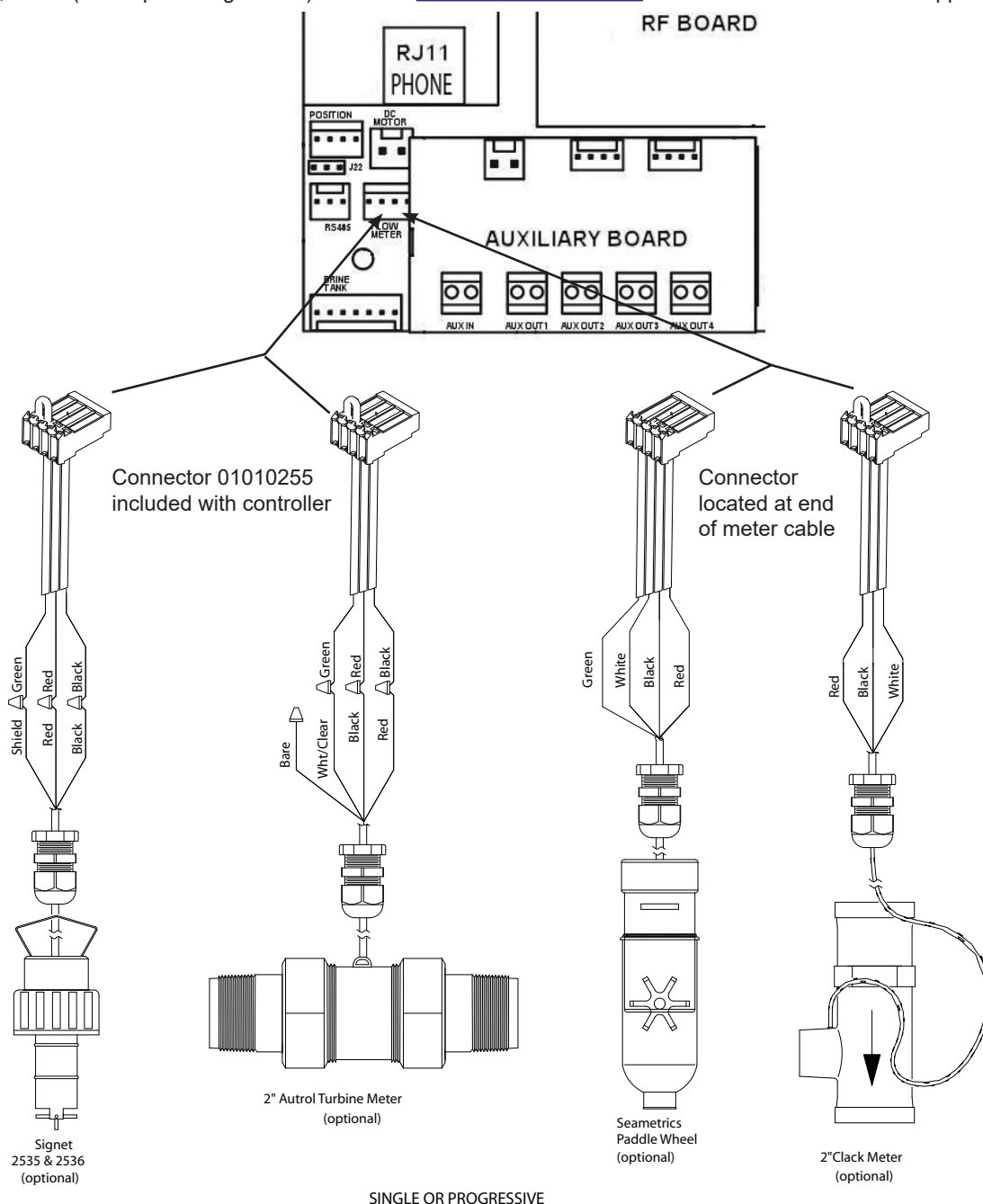


Figure 49. Flow measuring devices.

Final Startup

Initial Backwash of the System

1. Referencing the instructions in the GBE Programming for Commercial Softeners and Filters (except HF xN) Manual (P/N 01027295) regarding manual cycling, cycle the control to the backwash position.
2. Cycle the control through the remaining steps and back to the home (service) position.

Installation Wrap Up

Table 7 in [Appendix A, "Hi-Flo® 3e Water Softeners—Flow Rate Data \(gpm\)" on page 59](#), provides the expected flow rates to the drain during the various steps of the regeneration process.

Fill the Salt Storage Container

Before filling the brine tank with salt, refer to [Appendix A, "Hi-Flo 3e Refill Minutes/Salt Dosage/Capacity" on page 60](#) to find the salt dosage and capacity rating per regeneration.

Dry Storage

If the salt dosage/capacity rating falls within the non-shaded area, fill the storage container to within a few inches of the top. This is called dry salt storage; see Figure 50. When the proper amount of water is returned to the salt storage tank during brine refill, the salt level is higher than the water level.

Wet Storage

If the salt dosage/capacity rating falls within the shaded area, the amount of salt that can be put in the salt container is limited. Since the salt level will be below the water level, this is called wet salt storage; see Figure 51. When the correct amount of water has been returned to the salt storage tank, all the salt is under water. Refer to [Appendix A, Table 8 on page 60](#) to determine how much salt can be added.

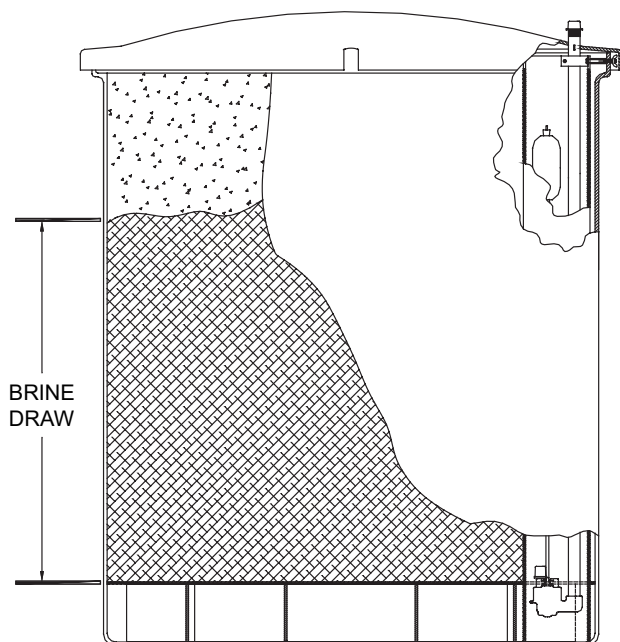


Figure 50. Dry storage.

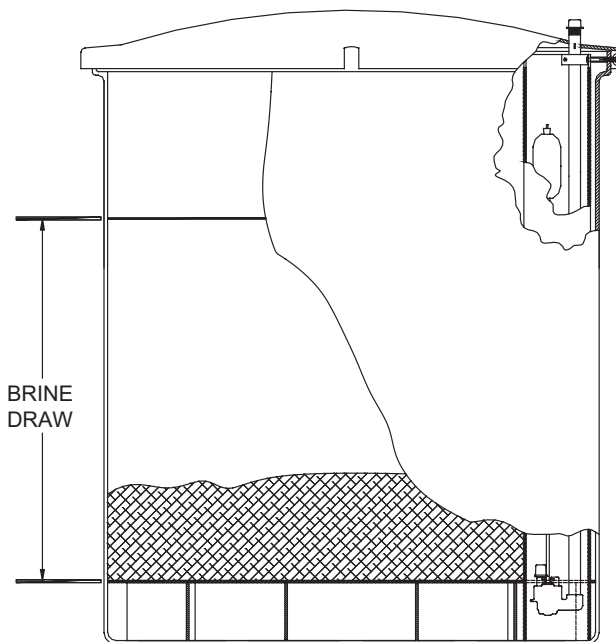


Figure 51. Wet storage.

Creating Brine

Once salt has been added to the brine tank the control valve must be manually cycled to the brine refill cycle to create the required amount of brine for the unit's first regeneration. Allow the valve to refill for the cycle #4 programmed time.

NOTE If the control valve is not cycled to the brine refill cycle there will be no brine for regeneration.

NOTE The salt level must be checked frequently; in some cases, after each regeneration. After the brine refill step is finished, add salt. To ensure complete brine saturation in wet storage, maintain a salt depth of at least 18 inches.
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Before Leaving the Installation Site

1. Clean up the unit and the installation site, removing any soldering or pipe threading residues from the equipment with a damp towel.
2. Explain the operation of the softener and bypass valves to the customer.
3. Advise the customer to check and replenish the salt supply regularly.

Wrap Up Checklist

Once you have completed the installation the system is ready to be placed in service. Prior to placing the system in service review the following checklist to be sure the system is properly installed.

Check List

- ✓ The media tank(s) has been properly loaded with gravel and media.
- ✓ The drain line has been properly installed.
- ✓ All option kits have been properly installed.
- ✓ The system has been properly piped and tubed.
- ✓ Each media tank has been backwashed manually.
- ✓ The GBE controller(s) have been correctly and completely wired, including differential pressure switches if equipped.
- ✓ All GBE controllers have been properly programmed and are active (power on).
- ✓ All manual isolation valves are open and system by-pass valves are closed.
- ✓ Clean up the unit and the installation site, removing any soldering or pipe threading residues from the equipment with a damp towel.
- ✓ Explain the operation of the system and the [“Suggested Preventive Maintenance Inspection Schedule” on page 35](#) to the customer.

Use of Bypass Valve

Depending on where the particular installation was made, the outside sill cocks may or may not be served by conditioned water. Ideally, all lines not requiring soft water should be taken off upstream of the softener. This is not always possible, however, due to the difficulty or expense of rearranging the piping.

Bypass the softener if:

1. The outside lines do not bypass the water softener and the water is to be used for lawn sprinkling or other outside uses.
2. Water is not used for several days.
3. You wish to inspect or work on the valve or brine system.
4. A water leak from the valve is evident.

Three-Valve Bypass

To bypass, close the inlet and outlet valves, and open the bypass valve. Reverse the process to get soft water once again. Be sure to close the bypass valve completely to avoid mixing hard water with soft water.



CAUTION! If the media tank is to remain attached to the control valve, close only the inlet valve, then open the bypass valve. This will prevent pressure from increasing in the media tank due to warming.

Care and Cleaning

Protect the operation and appearance of the water conditioner by following these precautions:

1. Do not place heavy objects on top of the conditioner cover.
2. Use only mild soap and warm water to clean the exterior of the unit. Never use harsh abrasive cleaners or compounds which contain acid or bleach.
3. Protect the conditioner and drain line from freezing temperatures.
4. Reset the time, if required, after any interruption of electrical power to keep the unit on its normal schedule.

Service and Maintenance

Suggested Preventive Maintenance Inspection Schedule

The Culligan commercial water softener has been designed to provide a good, consistent service life. Routinely inspecting the system may help avoid potentially costly breakdowns related to circumstances outside of the control of the dealer and/or user.

Component	Suggested Inspection Frequency	Reason for Maintenance
Entire System	At Startup, after infrequent use (idle for one week or more) or every 3–6 months if on a private water supply.	On private supplies, the appearance of off-tastes and odors, particularly if musty or “rotten egg” (caused by harmless sulfate-reducing bacteria) may indicate a need for the system to be sanitized.
Backwash Flow Controller	Every 12 months or every time service is performed on the system.	Build up of sediment, iron and/or other foreign materials (found in some water supplies but not necessarily all) could negatively affect system performance. Monitor item for normal (or unexpected) wear.
Valve	Every 6–12 months or every time service is performed on the system.	Build up of sediment, iron and/or other foreign materials (found in some water supplies but not necessarily all) could negatively affect system performance. Monitor item for normal (or unexpected) wear.
Softening Media	Every 2–3 years	Chlorinated water supplies can break-down/destroy resin material. Resin material may also perform poorly if subjected to other materials (sediment, iron, alum, etc) found in some water supplies (but not necessarily all).

Sanitize the System

A water softener in daily use on a potable water supply generally requires no special attention other than keeping the salt tank filled. Occasionally, however, a unit may require sanitization under one of the following conditions:

- At start-up time.
- After standing idle for a week or more.
- On private supplies, the appearance of off-tastes and odors, particularly if musty or “rotten egg” (caused by harmless sulfate-reducing bacteria).

NOTE If the water supply contains iron, regenerate the softener before sanitizing to remove iron from the resin.



CAUTION! Hazard from toxic fumes! Chlorine bleach and common iron control chemicals may generate toxic fumes when mixed.

If the unit uses Culligan® Sofner-gard® or other compounds containing sodium hydrosulfate, sodium bisulfate, or any other reducing agent, disconnect the device feeding the chemical(s) and manually regenerate the unit before sanitizing.

Do not use this procedure if the softener salt contains iron control additives.

1. Remove the brine tank cover.
2. Pour directly into the brine chamber one-cup of common household bleach (5.25% sodium hypochlorite) for each cubic foot of resin in the tank.
3. Manually start recharge. Allow the unit to complete the recharge cycle automatically.

NOTE If tastes and odors return frequently, even after sanitization, a continuous chlorination system may be needed. Send a water sample to a qualified laboratory, such as the [Culligan Analytical Lab](#), for bacterial analysis.

Analyze the System

Analyzing the problem involves three basic steps:

1. Check the system in all cycle positions.
2. Compare the data to normal operating data.
3. Determine which component may cause the problem (troubleshooting).
4. If steps 1-3 did not reveal the problem, initiate a regeneration cycle and manually cycle the valve to brine draw (#2 position). Allow the unit to complete the brine draw cycle and observe how the system reacts.

Although it may be possible to solve a specific problem simply by changing a component, analyzing the entire system can reveal additional problems which would otherwise require extra service calls. Changing parts is not the same as service.

Check the System

The following tools are needed to collect data:

1. Hardness, iron and chlorine test kits
2. Thermometer
3. Pressure gauge, 0-120 psi
4. 5-gallon bucket and watch
5. Calculator

The customer can provide most data. By collecting data prior to a service call, a first guess about the cause of the problem can be made and the need for any special parts can be determined. If the problem is as simple as lack of salt in the brine tank, a service call may not be needed at all. A recommended system data report described in the GBE Programming for Commercial Softeners and Filters (except for HF xN) Manual (P/N 01027295) can assist the troubleshooting process.

NOTE	Refer to GBE Programming for Commercial Softeners and Filters (except for HF xN) Manual (P/N 01027295) for information regarding error codes and diagnostics. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the Technical Service Tab or on the iPad Service Tech App.
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Three-Inch Valve Water Flow

Service Position Flow

1. Hard water enters unit at valve inlet and flows down through the mineral in the mineral tank.
2. Conditioned water enters the center tube through the bottom distributor.
3. Conditioned water flows up through the center tube, around the piston and out the side outlet of the valve. See Figure 52.

Backwash Position Flow

1. Hard water enters unit at valve inlet.
2. Water flows through service adapter for by pass, and up through coupling to regenerating valve inlet.
3. Water then flows through the regenerating valve piston—down the center tube—through the bottom distributor, and up through the mineral, around the piston and out the drain line.
4. If optional no hard water bypass piston is used, water flow to outlet is prevented by an extended section of the service piston that closes the outlet port from bypass water until the end of rapid rinse. See Figure 53.

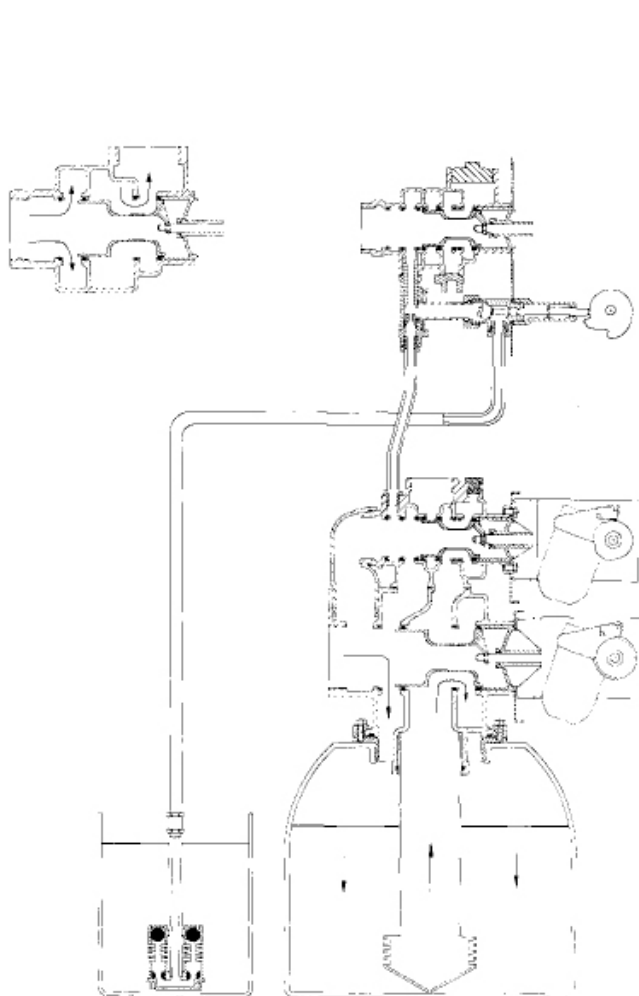


Figure 52. Service position.

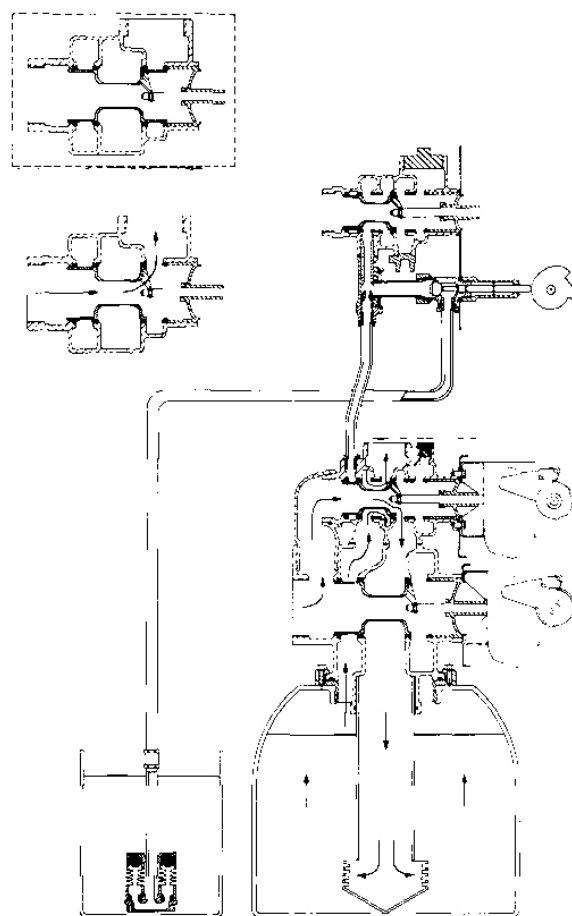


Figure 53. Backwash position.

Brine Position Flow

1. Hard water enters unit at valve inlet.
2. Flows up into injector housing and down through nozzle and orifice to draw brine from the brine tank
3. Brine flows down through mineral and enters the center tube through bottom distributor
4. Brine flows up through center tube, around the piston, and out through the drain line. See Figure 54.

Slow Rinse Position

1. Hard water enters unit at valve inlet.
2. Water flows up into injector housing and down through nozzle and orifice, around the piston, and down through mineral.
3. Water enters center tube through bottom distributor, flows up through center tube, around the piston, and out through the drain line. See Figure 55.

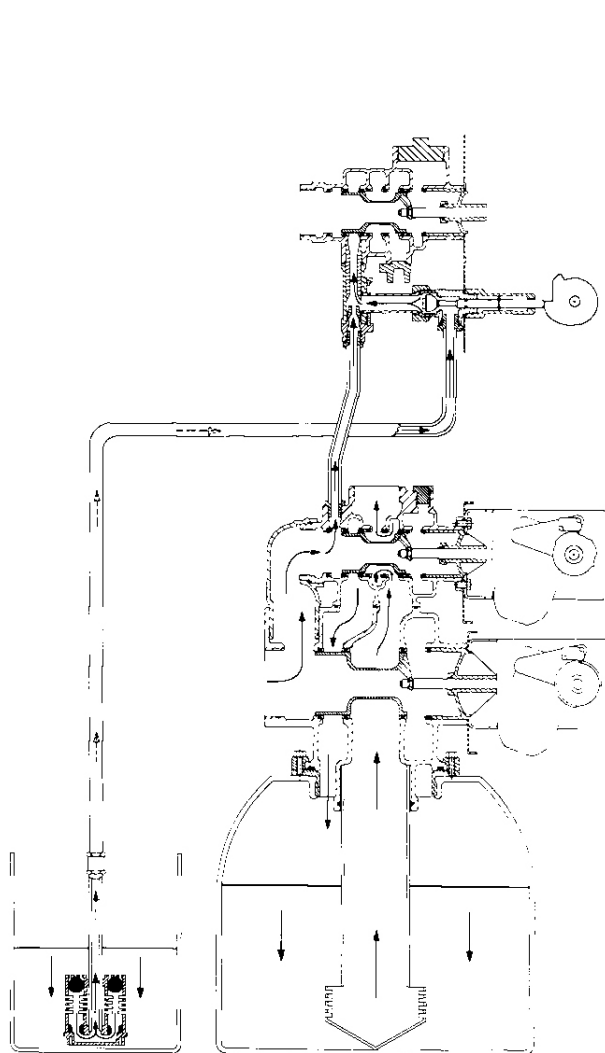


Figure 54. Brine position flow.

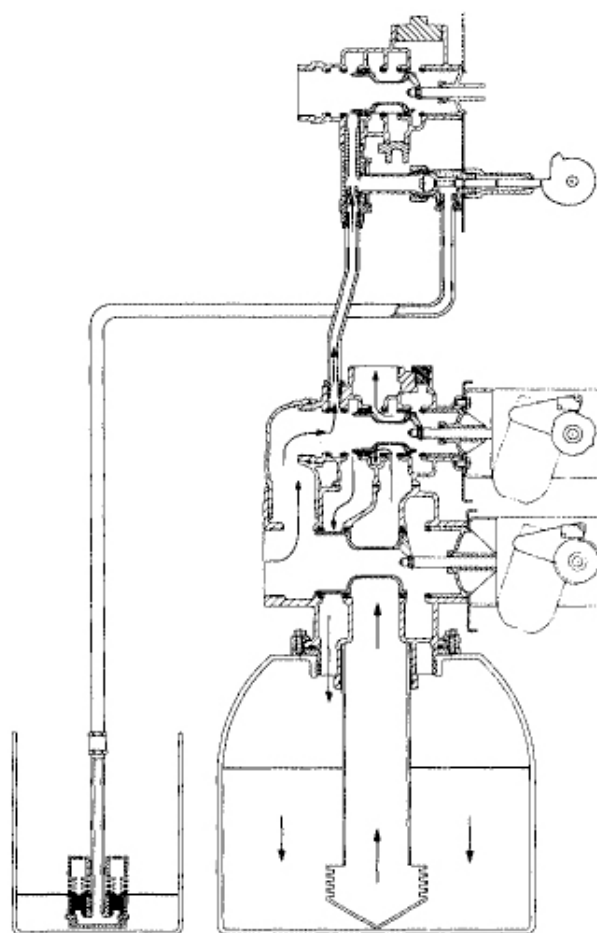


Figure 55.

Slow Rinse position water flow.

Rapid Rinse

1. Hard water flows through the regenerating valve directly down through the mineral into the bottom distributor.
2. Water flows up through the center tube, around the piston, and out the drain line. See Figure 56.

Brine Tank Fill

1. Hard water flows through the service valve and down through the mineral.
2. Conditioned water enters the bottom distributor, then flows up the center tube around the piston to the outlet.
3. Hard water flows to the regenerating valve thru the injector housing and brine valve to fill the brine tank. See Figure 57.

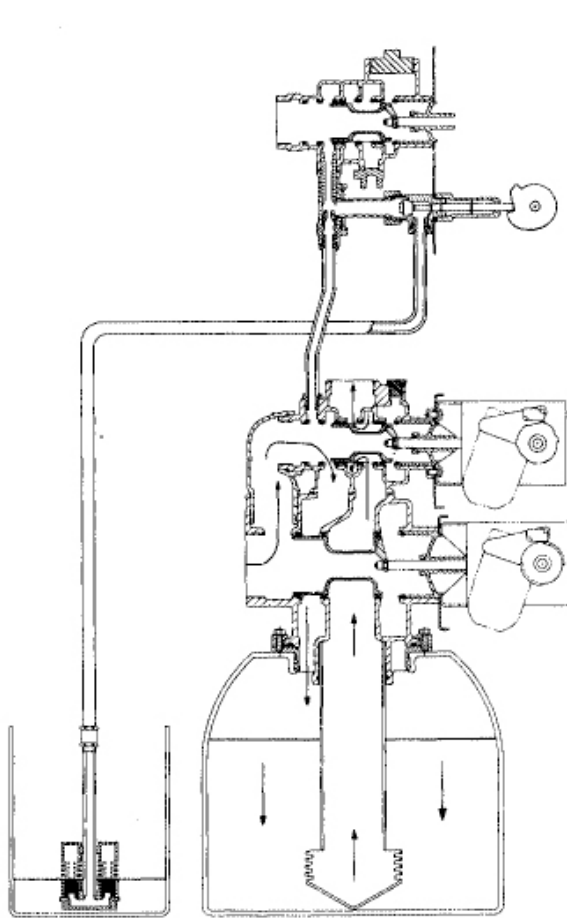


Figure 56. Rapid rinse fill flow.

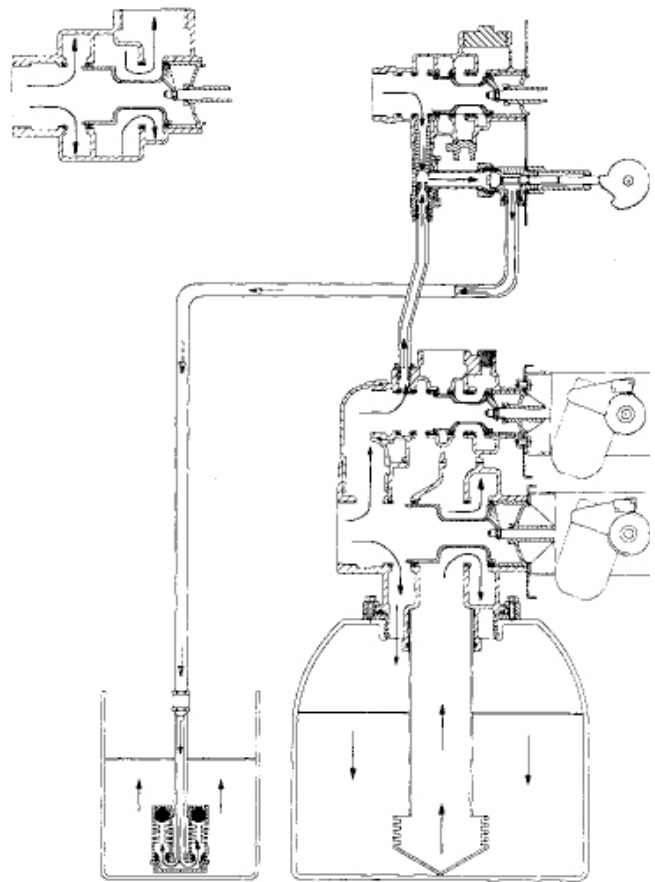


Figure 57. Brine Tank fill.

Wiring Diagram

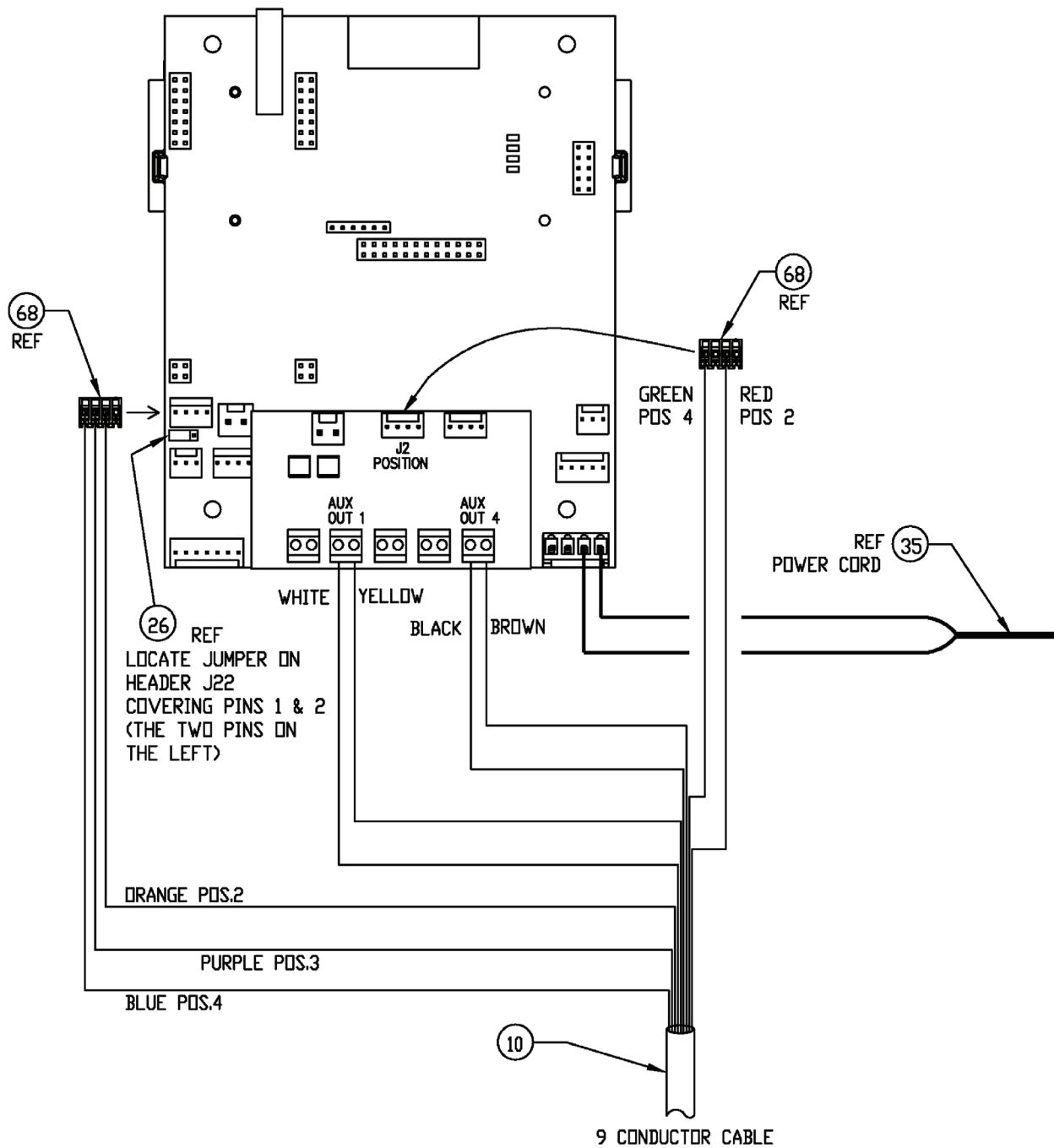


Figure 58. 3900 System Valve Wiring.

Smart Controller Circuit Board Layout

Smart Controller Circuit Board Layout–Front

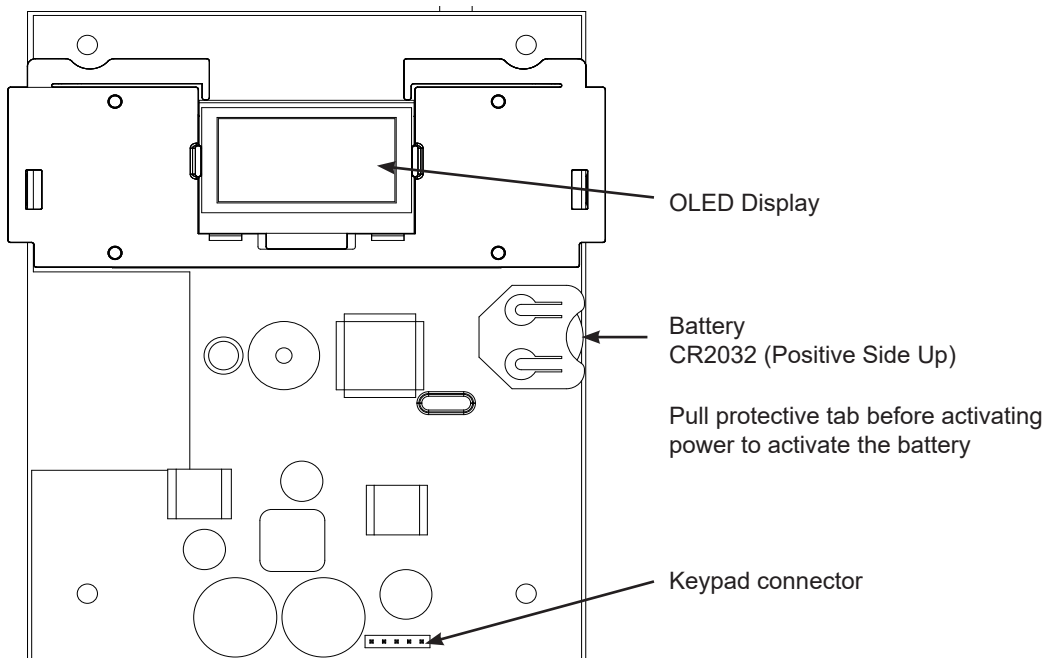


Figure 59. Smart Controller circuit board layout, front view.

Smart Controller Circuit Board Layout–Back

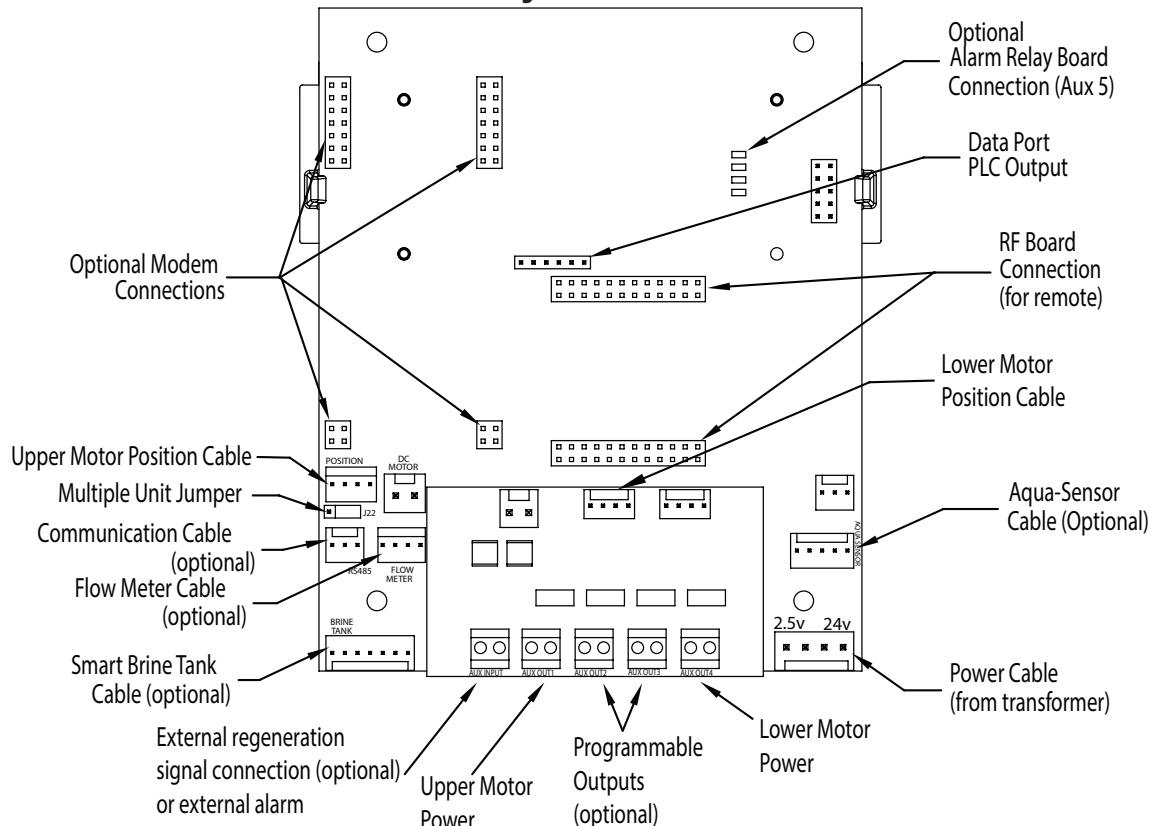


Figure 60. Smart Controller circuit board layout, rear view.

Service Parts

Replacement Softener Tanks

Hi-Flo 3 Model No.	Tank Size/ Valve Size	Replace- ment Tank Part No.	Manifold Part No.	Underbedding Required			Cullex® Resin Required Bags ¹
				Lbs.	Bags	Part No.	
HCE-450-3	30 x 72	01021892	01021751	300	6	00162310	15
HCE-600-3	36 x 72	01021893	01021752	400	8	00162310	20
HCE-900-3	42 x 72	01021894	01021753	450	9	00162310	30
HCE-1200-3	48 x 72	01021895	01021754	500	10	00162310	40
HCE-300-3	24x72	01023952	01046178	130	2	00160710	10
					1	00160707	

¹Each Cullex (P/N 00156001) bag is 1 cubic foot.

Control Valve

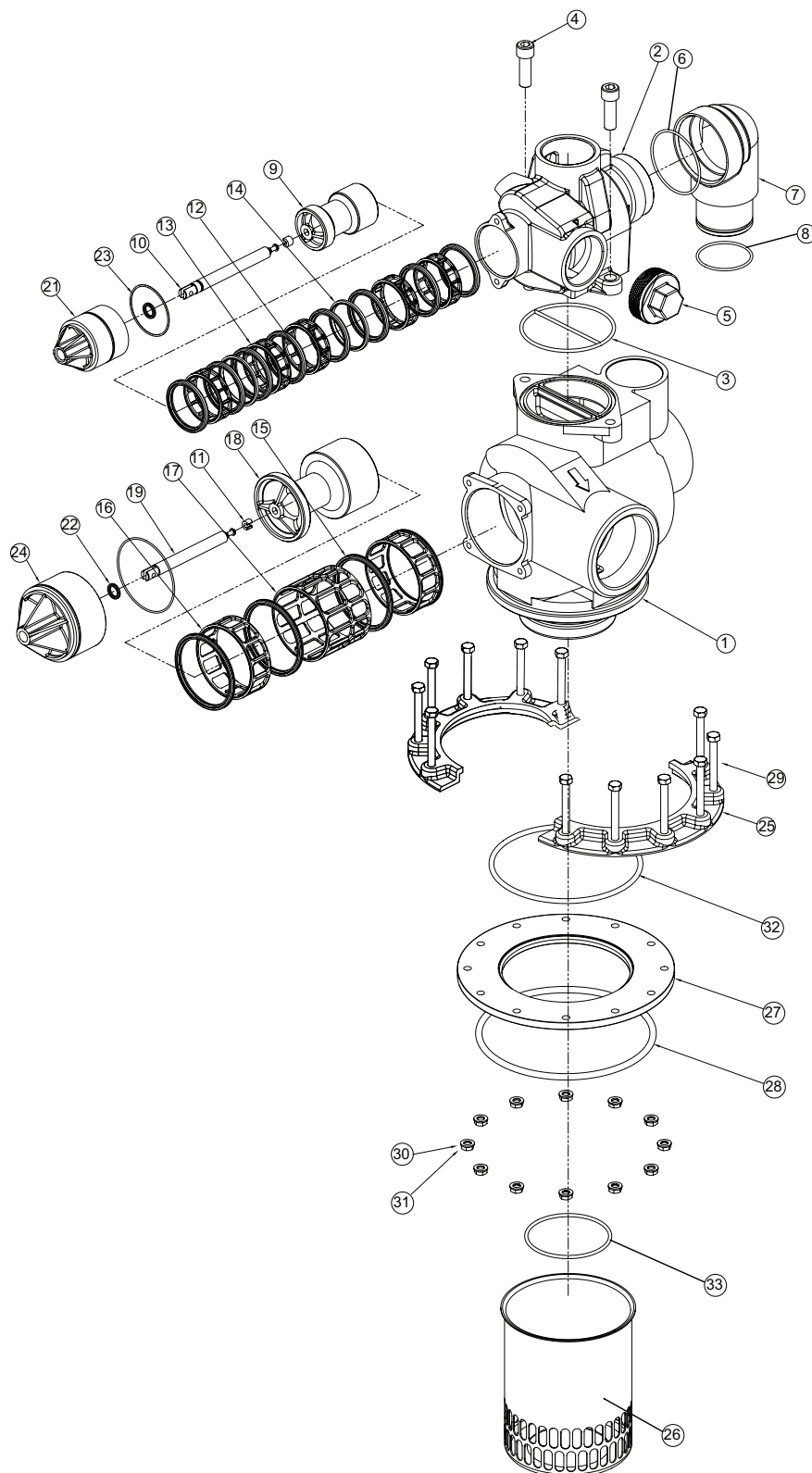


Figure 61. 3900 Control Valve

Control Valve Parts List

Item No.	Culligan Part No.	Description	Qty.	Fleck Part No.
	01021765	Control Valve, Fleck 3900 HWB		
	01021764	Control Valve, Fleck 3900 NHWB		
A	01021770	3900 Upper Seal Kit		60131
B	01021771	3900 Lower Seal Kit		60132
C	01021772	3900 Upper Piston Assembly		60106-00
D	01021773	3900 Lower Piston, Hard Water Bypass		60107-00
E	01021774	3900 Lower Piston, No Hard Water Bypass		60107-10
1		Valve Body, 3900, NPT, Aux Tap	2	16067-02
2		Valve Body, 3150	1	15114
3		Seal, 3150 Adapter Base	1	15112
4		Socket Cap Screw	2	40115
5		Plug, Brass, 2" NPT, 3900 Mach.	1	16066-01
6		O-Ring, 149	1	16078
7		Coupling, Adapter 3900	1	16074
8		O-Ring, 140	1	16077
9	C	Piston, 3150, High Backwash	1	16130
10	C	Piston Rod	1	15125
11	C, D, E	Ring, Piston, Snap	2	14818
12	A	Seal, Piston, 2900/3150	8	11720
13	A	Spacer, 2", 2900/3150	5	10369
14	A	Spacer, Quad Ring, Narrow	2	10368
15	B	Seal, 3900	4	16068
16	B	Spacer, 3900	2	16069
17	B	Spacer, 3900, Long	1	16070
18	D	Piston, 3900, HWBP	1	16071
	E	Piston, 3900, NHWPB	1	16082
19	D, E	Piston Rod	1	16072
20	D, E	O-Ring, 042	1	16076
21	C	Plug, End, 3150, Machined	1	15118-01
22	C	Quad, Ring-112, 560CD	2	11242
23	C	O-Ring, 035	1	14922
24	D	Plug End, Natural, HWBP	1	16073-01
	E	Plug End, Black, NHWPB	1	16073-11
25		Segment, Flange	2	16482
26	01001600	Flow Dispenser, 3900	1	16258
27		Ring, Flange	1	16483
28	01021786	O-Ring, 442	1	16484
29		Screw, Hex HD Cap, 5/16 X 3, 18-8SS	12	16517
30		Washer, Plain, 5/16" X 60 OD	12	18619
31		Nut, Hex, Jam 5/16-18, 18-8SS	12	16346
32		O-Ring, 382	1	16345
33		O-Ring, 238	1	16800
not shown	01021759	Flow Control, 2", 20 GPM		
not shown	01021760	Flow Control, 2", 30 GPM		
not shown	01021761	Flow Control, 2", 35 GPM		
not shown	01021762	Flow Control, 2", 45 GPM		

Control Drive Assembly

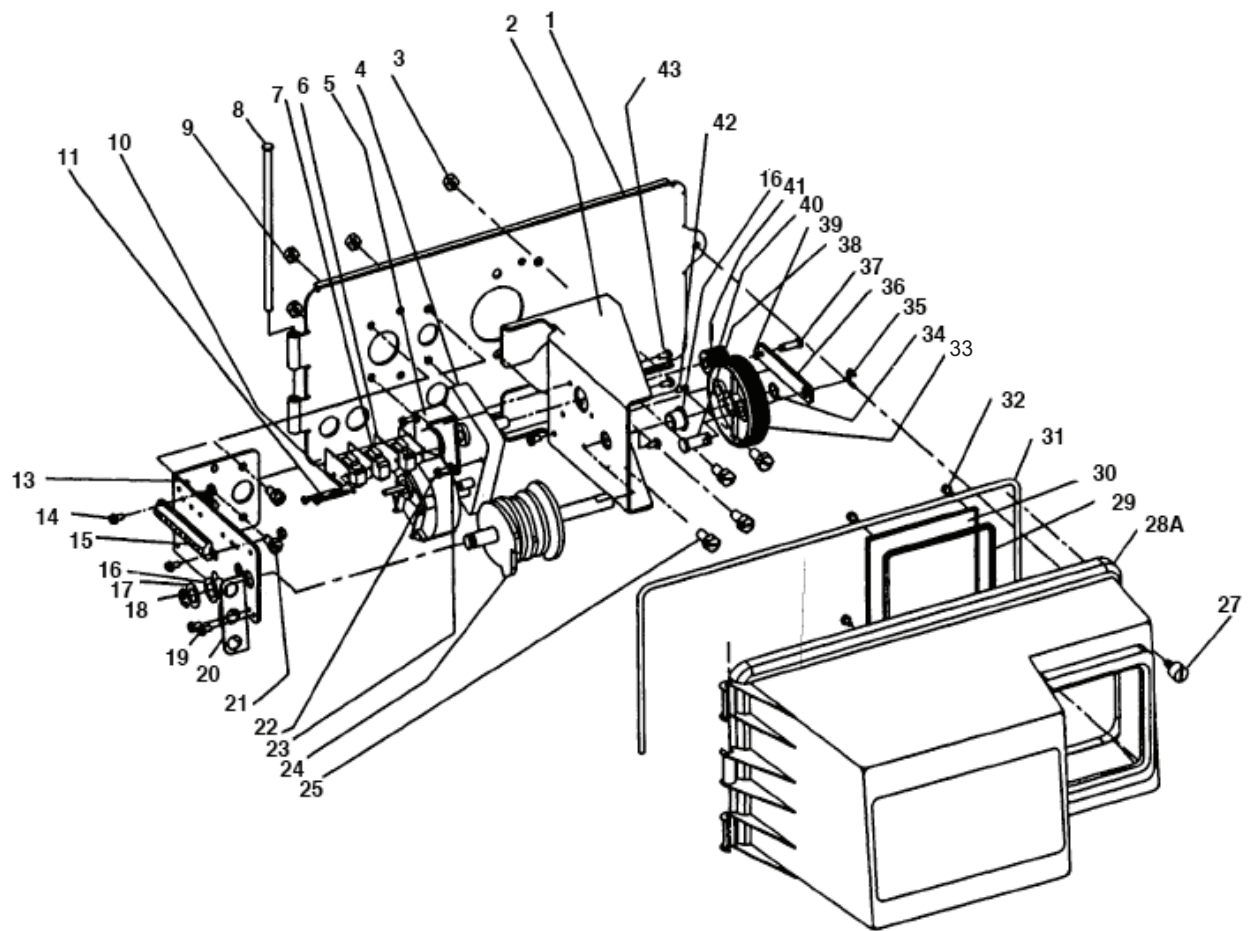


Figure 62. 3-inch control drive assembly.

Control Drive Parts List

Item No.	Culligan Part No.	Description	Qty.	Fleck Part No.
	01021791	Upper Wire Harness, 3900	1	40941
1		Back Plate -01, -02	1	19304-00
2		Bracket, Motor Mounting	1	15120-01
3		Nut, 5/16" (18)	2	16346
4	01021775	3900 Upper & Lower Drive Motor, 24 VAC/DC	1	42581
5		Bracket, Switch Mounting	1	17797
6		Insulator, Switch	4	10302
7	P1003244	Miniature Switch (10-pack)	2	10218
8		Pin, Hinge	1	17845-03
9		Nut, 1/4" (20)	4	11235
10		Lockwasher	2	13365
11		Screw, Pan Head	2	12624
13		Bracket, Brine Side	1	16053
14		Screw, Round Head	2	40133
15		Terminal Block	1	15226*
16		Bushing	2	16052
17		Washer	1	16059
18		Retaining Ring, Bowed "E"	1	16051
21		Screw, Hex Head	4	10231
22		Screw, Hex Head	2	17567
23		Washer, Lock, #8 Internal	2	12288
24	01021787	Cam Assembly—Service After Brine Refill	1	16494-03
25		Screw, Hex Head	3	11224
27		Screw	1	18744
28A		Cover, Black	1	19277-020
29		Seal, Window	1	18615-02
30		Window	1	18745
31		Seal, Cover	1	18716-03
32		Screw	4	19203
33	01021789	Drive Gear	1	16046
34		Retaining Ring	1	16050
35		Retaining Ring "E"	1	11774
36		Drive Link	1	16047
37	see 01021772, 01021773, and 01021774	Pin, Drive Link	1	11709
38		Bearing, Drive Link	1	16048
39	see 01021772, 01021773, and 01021774	Clip	1	11898
40	01021790	Drive Pinion	1	16045
41		Roll Pin	1	11381
42		Screw, Flat Head	1	11080
43		Screw, Hex Head	3	10872

Adapter Control Drive

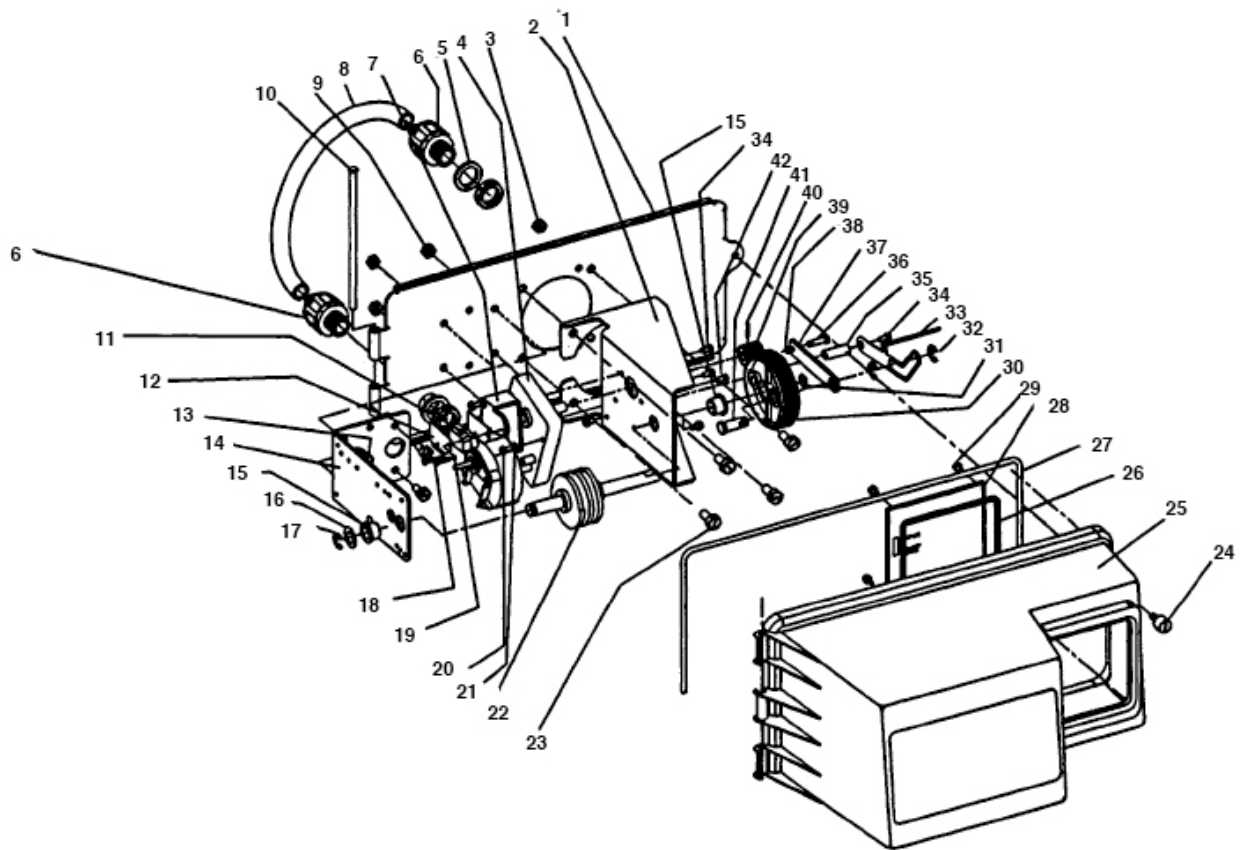


Figure 63. Adapter control drive.

Adapter Control Drive Parts List

Item No.	Culligan Part No.	Description	Qty.	Fleck Part No.
	01021792	Lower Wire Harness, 3900	1	40854
1		Back Plate	1	19305
2		Bracket, Motor Mounting	1	16086
3		Nut, 5/16" (18)	2	16346
4	01021775	Drive Motor, 24 V, 60 Hz	1	42581
5		Washer, Sealing	2	18692
6		Connector, Conduit	2	18691
7		Bracket, Switch Mounting	1	17797
8		Conduit, Interdrive	1	18693
9		Nut, 1/4" (20)	4	11235
10		Pin, Hinge	1	17845-03
11	P1003244	Switch (10-pack)	1	10218
12		Insulator, Switch	2	10302
13		Screw, Hex Head	4	10231
14		Bracket, Brine Side	1	16053
15		Bushing	2	16052
16		Washer	1	16059
17		Retaining Ring, Bowed "E"	1	16051
18		Screw, Pan Head	2	11805
19		Lockwasher	2	13365
20		Screw, Hex Head	2	17567
21		Washer, Lock, Internal #8	2	12288
22	01021788	Cam Assembly	1	16495
23		Screw, Hex Head	4	11224
24		Screw, Cover	1	18744
25		Cover, Black	1	19277-020
26		Seal, Window	1	18615-02
27		Seal, Cover	1	18716-03
28		Window, Indicator	1	19316
29		Screw, Window	4	19203
30	01021789	Drive Gear	1	16046
31		Retaining Ring	1	16050
32		Retaining Ring, "E"	2	11774
33		Indicator	1	19315
34		Screw, Hex Head	4	10872
35		Space, Indicator	1	18726
36		Pin, Drive Link	1	11709
37		Drive Link	1	16047
38		Clip	1	11898
39	01021790	Drive Pinion	1	16045
40		Roll Pin	1	11381
41		Bearing, Drive Link	1	16048-01
42		Screw, Flat Head	2	11080

24", 30", 39" and 42" Brine Systems

Item No.	Part No.	Description	Qty Req.
	01024800	24" x 50" Brine System Complete	
	01024801	30" x 50" Brine System Complete	
	01024802	39" x 48" Brine System Complete	
	01024803	42" x 48" Brine System Complete	
	01019620	Upper Clamp Kit ¹	
	01020618	Brine Valve Rebuild Kit ²	
1		Tank	1
2		Cover	1
3	01019623	Salt Plate Repl 24"	1
	01019624	Salt Plate Repl 30"	1
	01019625	Salt Plate, Screen & Supports 39"	1
	01019626	Salt Plate, Screen & Supports 42"	1
4	01019621	Brine Well	1
5	01019622	Brine Well Cap – 10 pack	1
6	01019627	Brine Valve Repl 24"–42" (3/4")	1
	01019620	Upper Clamp kit for brine valve ¹	

¹Clamp kit includes clamp, spacer, nuts, screws and washer.

²Brine Valve Rebuild kit includes float assembly, guide rod, foot valve gasket, nuts, screws and washers.

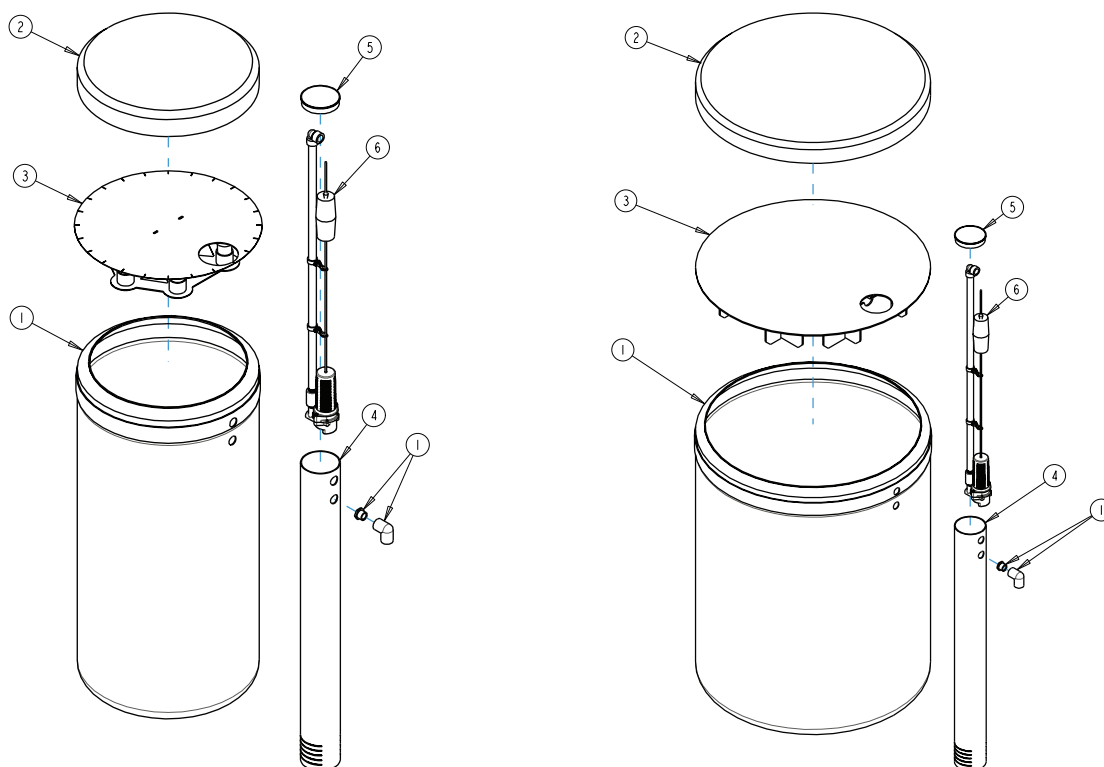


Figure 64. 24"/30" and 39"/42" brine systems.

Brine Valve Subassembly

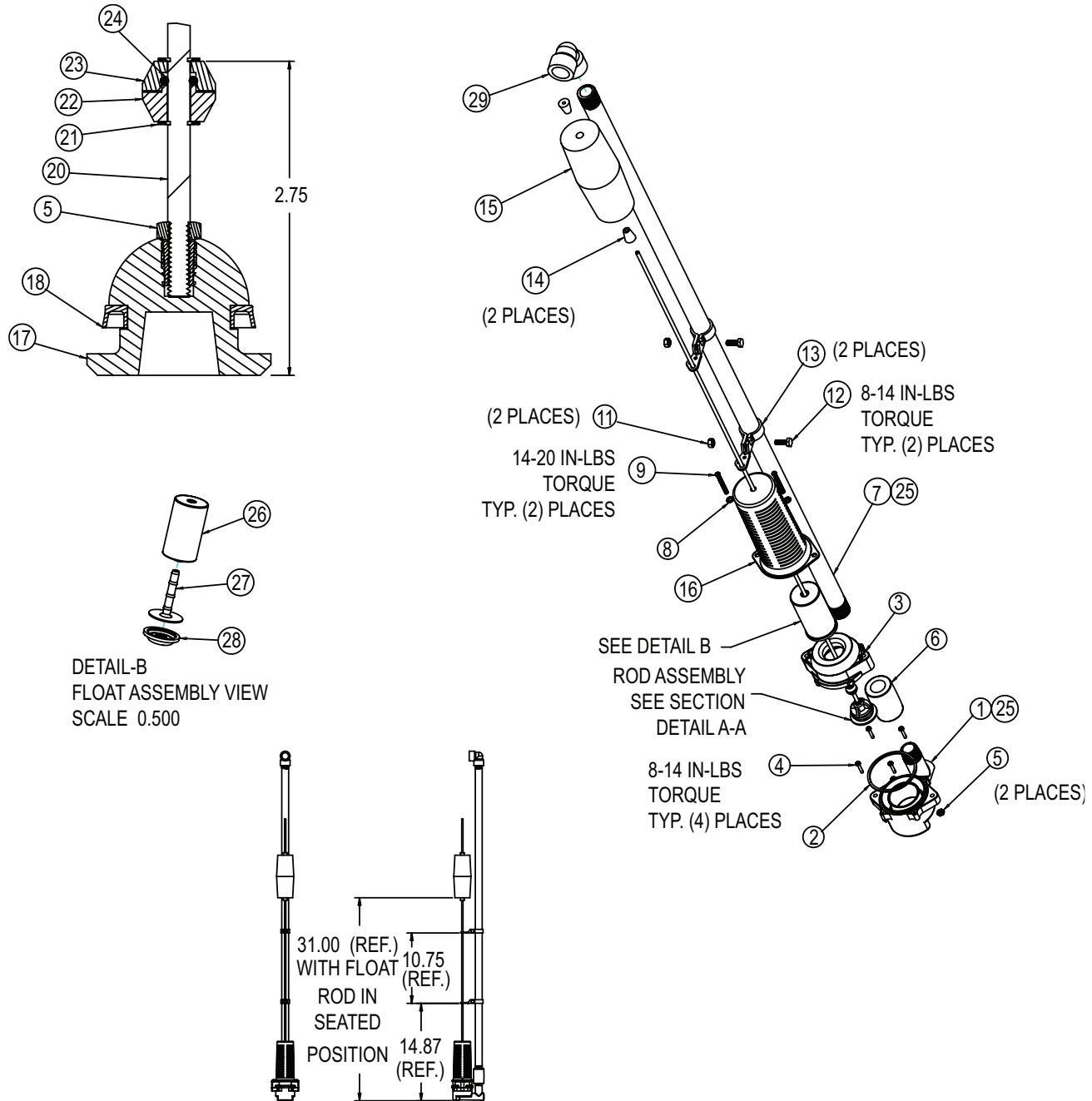


Figure 65. Brine valve subassembly.

Brine Valve Subassembly Parts List

Item No.	Qty.	UOM	Part No.	Description
A		EA	01019627	Brine Valve, Repl, 24"-42" systems w/elbow
B		EA	01020618	Brine Valve Repair Kit - includes items below listed w/"B"
1	1	EA		BASE ASSEMBLY, 3/4" BRINE
2	1	EA	B	GASKET
3	1	EA		CAP, BRINE VALVE
4	4	EA	B	SCREW, #6X3/4, PHILLIPS PAN HD
5	3	EA	B	NUT, 10-32, HEX, 18-8SS
6	1	EA		COUPLING, 3/4", TXT, PVC SCH.80
7	1	EA		PIPE PVC 0.75"NPTX46.750" SCH80
8	2	EA	B	WASHER, #10, TYPE B, SERIES N
9	2	EA	B	SCREW, MACH, #10-32x1-5/8, 18-8SS, HEX HD SLT
11	2	EA	B	NUT, 1/4-20, HEX, 18-8SS
12	2	EA	B	SCREW, CAP, 1/4-20 X 3/4, 18-8SS
13	2	EA	B	GUIDE FLOAT ROD
14	2	EA		STOPPER RUBBER BLACK ONE HOLE
15	1	EA		FLOAT
16	1	EA		STRAINER
17	1	EA	B	REFILL SEAT ASSEMBLY
18	1	EA	B	SEAL, U-CUP, 7/8IDX1-1/4OD
20	1	EA		FLOAT ROD, BRINE VALVE
21	2	EA		E-CLIP, STAINLESS STEEL
22	1	EA		EDUCTOR SEAT BOTTOM
23	1	EA		EDUCTOR SEAT TOP
24	1	EA		O-RING, ARP#008 NITRILE
26	1	EA	B	FLOAT WITH 3/8" DIA. HOLE
27	1	EA	B	STEM, DIAPHRAGM, BRINE VALVE
28	1	EA	B	DIAPHRAGM, NEOPRENE, #783A
29	1	EA		ELBOW, 3/4", TXT, PVC SCH.80

48" and 60" Brine Systems

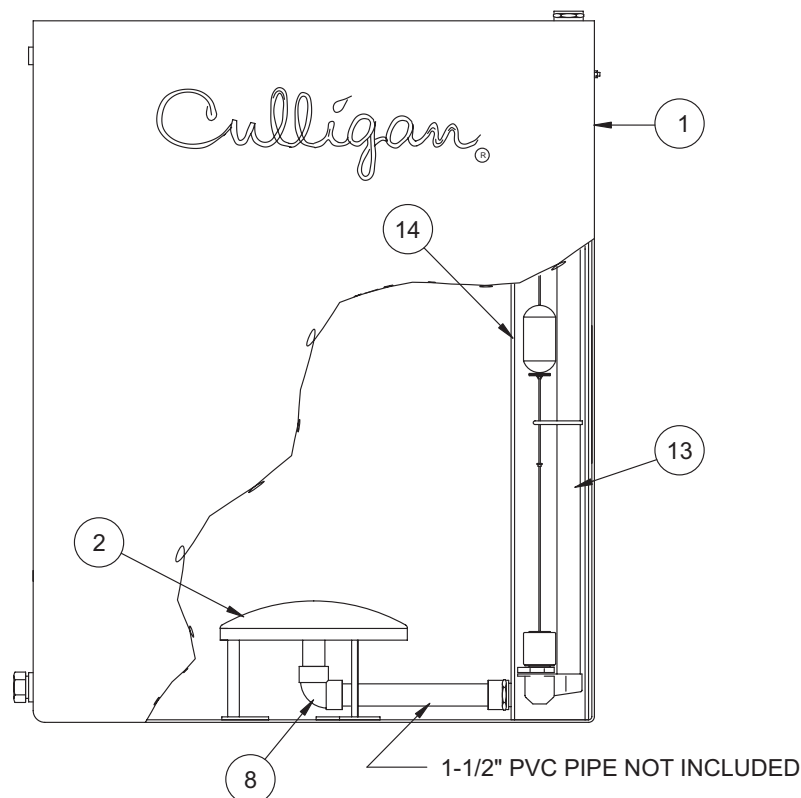
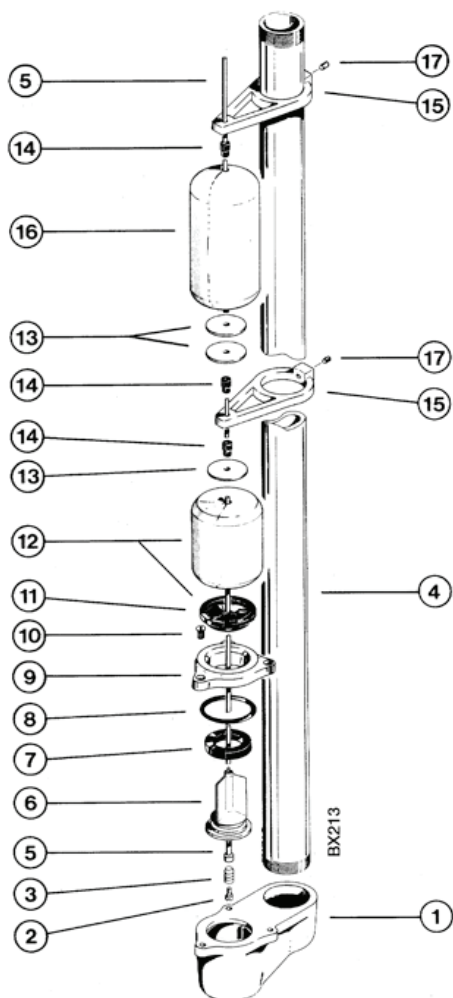


Figure 66. Complete Brine System

Item No.	Qty.	UOM	Part No.	Description
			01017493	Brine System Complete 48 x 60
			01017494	Brine System Complete 60 x 60
			00403782	Kit Parts 1.5" SOC Brine (include item nos. 3–14)
1	1	EA	00403696	TNK FBRGL 48" x 60" W/BRIN
1	1	EA	00403697	TNK FBRGL 60" x 60" W/BRIN
2	1	EA	00403791	Saturator, 16 pad feet
3	2	EA	—	Tee x 0.25", Tube x 0.25", Tube x 0.25", TubeXPP
4	1	EA	—	Clamp Pipe STL ZN PLT 1.5, DCO 2879
5	2	EA	—	Screw, Mach, 1/4"-20 x 1-1/4", Brass, RD HD SLT
6	2	EA	—	Nut, 1/4"-20, Hex, Brass
7	1	EA	—	Washer, Flat, #12, Brass
8	1	EA	—	Elbow, 1-1/2", SxS, PVC SCH 80
9	2	EA	—	Valve Boiler Drain 3/4 MNPT BR
10	1	EA	—	CPLG ADAPT PVC 1.5" SOC x 1.5", SPTI SCHD80
11	1	EA	00X10932	Plug Pipe, 1.5" NPT PVC
12	2	EA	—	Adapter PVC, 1.5" NPTE x 1.5" SOC, Pipe Socket SCHD80 Grey
13	1	EA	00716771	Valve Brine COMM, 1.5" NPT
14	1	EA	00440188	Housing, BRI PVC 6.625" x 6.031", ID x 59.375"

Brine Valve



Item No.	Qty.	UOM	Part No.	Description
		EA	00716771	Brine Valve, 1-1/2", Complete
A		EA	01020656	Kit Brine Valve, 1-1/2" (items 2, 3, 7, 8, 11, 13)
1	1	EA		Valve Body
2	1	EA	A	Screw (avail. only as kit)*
3	1	EA	A	PVC Cylinder (avail. only as kit)*
4	1	EA		Pipe, 1-1/2", PVC
5	1	EA		Float Rod
6	1	EA		Check Valve
7	1	EA	A	Tetraseal (avail. only as kit)*
8	1	EA	A	O-Ring (avail. only as kit)*
9	1	EA		Check Valve Seat
10	3	EA		Screw (package of 10, cat#2100757)
11	1	EA	A	Diaphragm (avail. only as kit)*
12	1	EA		Lower Float, Complete with Diaphragm
13	3	EA	A	Lead Weight (avail. only as kit)*
14	3	EA		Float Stop
15	2	EA		Rod Guide
16	1	EA		Top Float
17	2	EA		Screw

Smart Controller, Remote Mounted

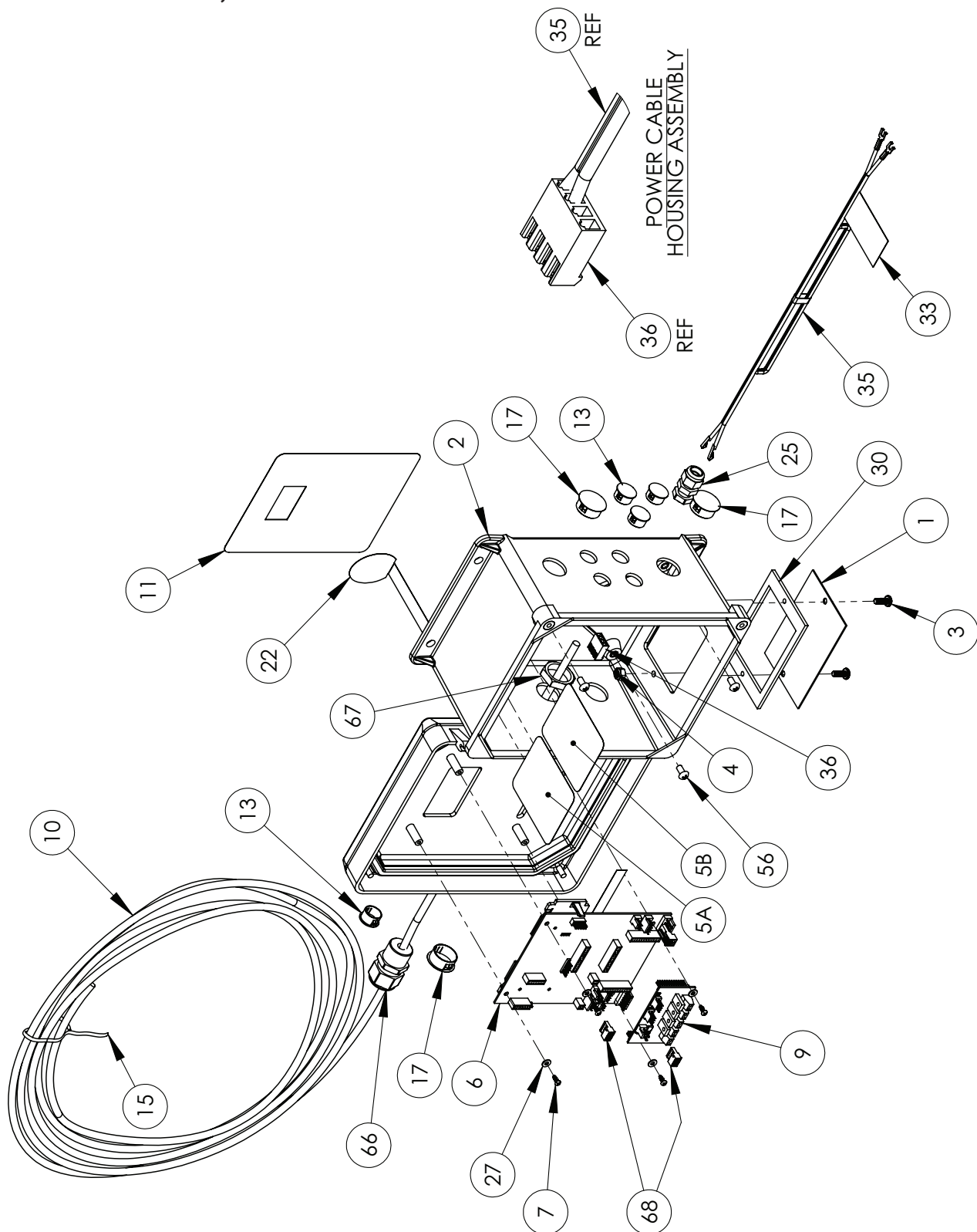


Figure 67. Smart Controller, remote mounted.

Smart Controller Parts List

Item No.	Part No.	Description	Qty
—	01021766	Controller, Hi-Flo 3e, GBE	1
1	01020719	Cover Plate, GBE Enclosure	1
2	01024191	Enclosure, GBE Small	1
3	—	SCREW, MACH, #10-32X1/2, 18-8SS, HEX HD	2
4	—	NUT, #10-32 W/NYLON INSERT	2
5	—	Label, Blank, 3-1/8"x2-3/8"	2
6	01020745	Circuit Board, Main GBE, Softener/Filter	1
7	—	Screw, 4-24 PH Phillips, 18-8 SS Type B, 5/16" Length	4
9	01020748	Circuit Board, Aux I/O, GBE	1
10	—	Cable, 22 AWG, 9 Conductor	20 FT
11	01020493	Decal, GBE Face Plate	1
12	01010255	Wire Harness, meter leads, MVP	1
13	—	Plug, Dome, .625 Hole	4
14	01015089	Connector, Splice, 22-26 AWG	3
17	—	Plug, Dome, .875 Hole	3
22	01020498	Membrane Keypad, Oval w/Connector	1
24	01014897	Transformer, Dual Secondary, 24VAC	1
26	—	Jumper, GBE Circuit Board	1
27	—	WASHER, FLAT, .14", NYLON	4
30	A0710007	Gasket, Pilot Valve	1
35	01017134	Power Cable, Gold	1
36	01017264	Housing, AMP, .156 4 Position	1
56	01000035	SCREW, MACH, #10-32x3/8, BRASS, RD HD PHIL	4
67	01016142	Locknut, 1/2", Nylon	1
68	—	Connector, IDC-100, 4 Position	2

Brine System

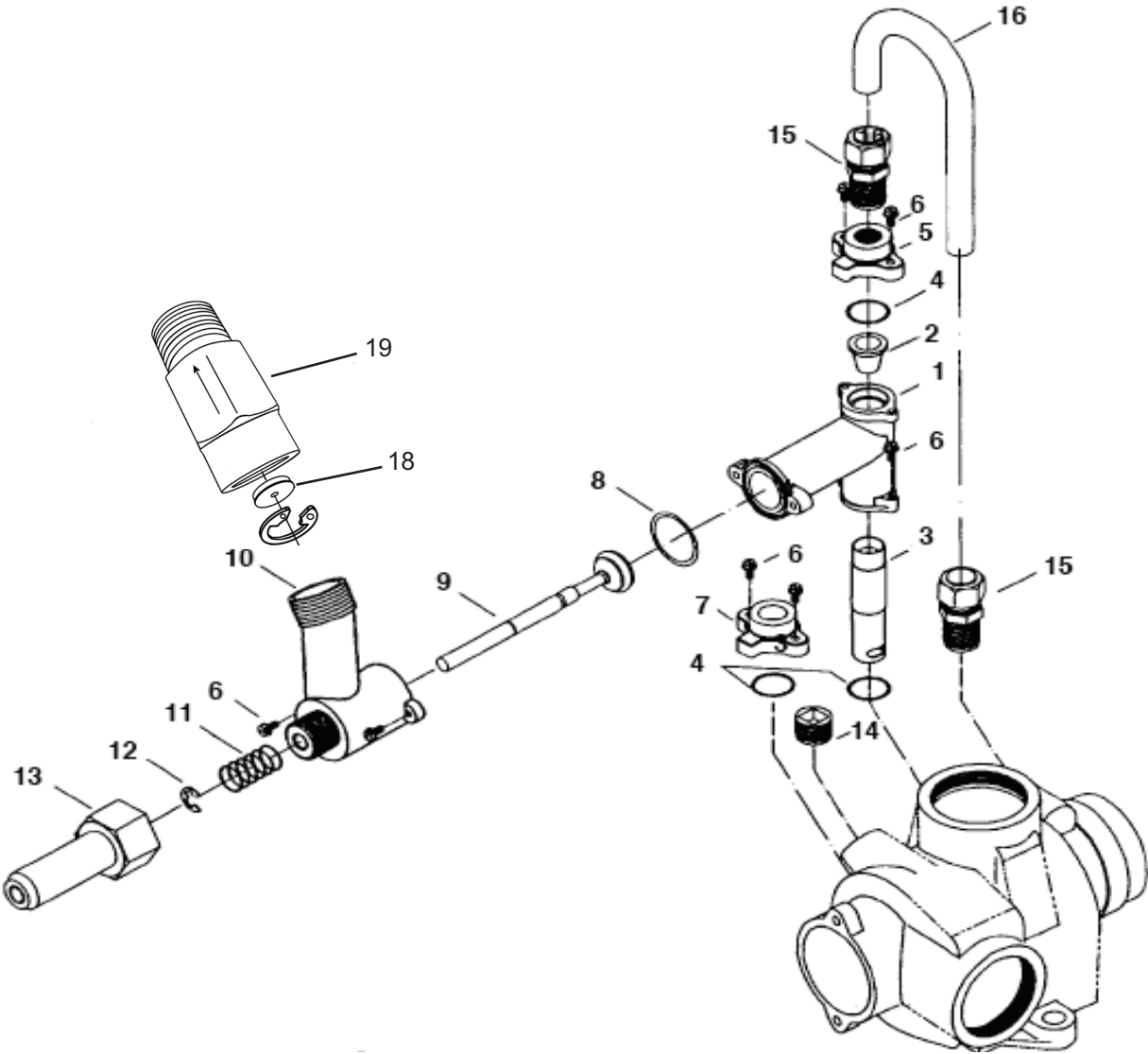


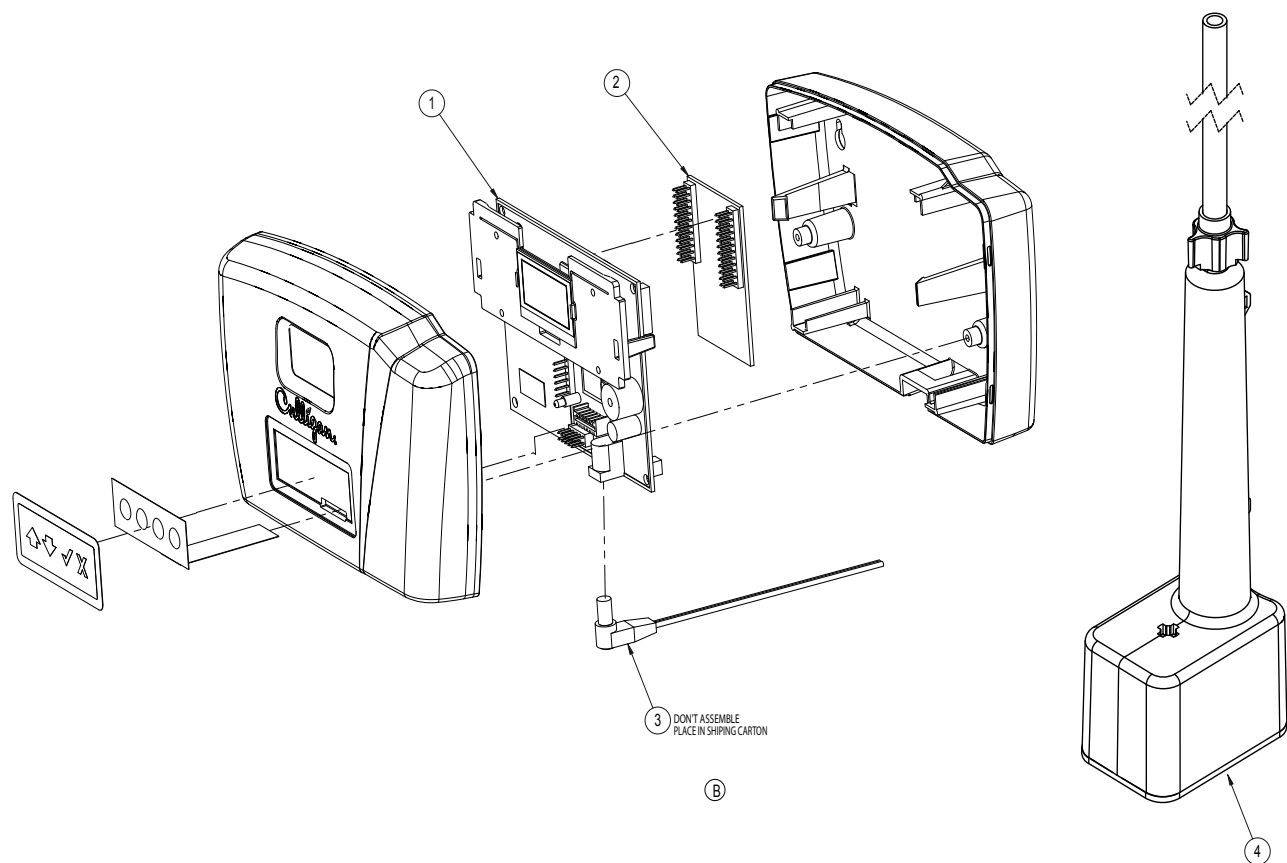
Figure 68. 1800 Brine System

Brine System Parts List

Item No.	Culligan Part No.	Description	Qty.	Fleck Part No.
A	01021776	1800 Brine Valve		60036-02
B	01021777	1800 Injector Assembly		60277-xx
1		Injector Body	1	16340
2(B)	01021782	Injector Nozzle, Size #5 Red		15128-05
	01021783	Injector Nozzle, Size #6 White		15128-06
	01021784	Injector Nozzle, Size #7 Blue		15128-07
	01021785	Injector Nozzle, Size #8 Yellow		15128-08
3	01021778	Injector Throat, Size #5 Red		15127-05

Item No.	Culligan Part No.	Description	Qty.	Fleck Part No.
	01021779	Injector Throat, Size #6 White		15127-06
	01021780	Injector Throat, Size #7 Blue		15127-07
	01021781	Injector Throat, Size #8 Yellow		15127-08
4	B	O-Ring, 116	3	15246
5	B	Injector Cover	1	16341-01
6		Screw, Hex Head	8	12473
7		Cover	1	16341-02
8		O-Ring, 021	1	18879
9	A	Brine Stem Assembly	1	16497-01
10	A	Brine Valve Body	1	18713
11	A	Spring	1	11772
12	A	Retaining Ring	1	11774
13	A	Stem Guide Assembly	1	16498-01
14		Pipe Plug, 1/2 NPT	1	16387
15		Tube Fitting, Straight	2	18702
16		Brine Tube	1	18703
18	01021793	BLFC Washer, 5 GPM		12092
	01021794	BLFC Washer, 6 GPM		17814
	01021795	BLFC Washer, 8 GPM		17943
	01021796	BLFC Washer, 12 GPM		16735
19		BLFC Assembly, 5 GPM	1	
		BLFC Assembly, 12 GPM	1	

Remote Display and Accessories



Remote Display and Accessories Parts List

Item No.	Part No.	Description
	01020553	Remote Display Assembly - 915 MHz
1	01020749	Remote Display Circuit Board, English Replacement
2	01020750	RF Board, 915 MHz
3	01020611	Transformer, 100 VAC - 240VAC
4	01020447	Smart Brine Sensor
Cables and Kits		
	01016327	Communication Cable
	01016342	Communication Cable, Duplex Alternating
	01016333	Duplex Progressive Kit
	01016334	Triplex Progressive Kit
	01016369	Duplex Alternating Kit
	01021402	SBT Extension Cable, 20 ft.
	01021507	PLC-USB Converter Cable
	01021509	PLC-RS485 Converter Cable
	01021508	PLC-RS232 Converter Cable
	01024899	Modbus, Node 12, Softener or Filter 1
	01024900	Modbus, Node 13, Softener or Filter 2
	01024925	Modbus, Profibus Converter Kit
	01025190	Modbus, BACnet Converter Kit
	01023227	Cable, Disc Meter

Appendix A System Data

Hi-Flo® 3e Water Softeners—Flow Rate Data (gpm)

Table 7.

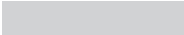
Model	Service			*Suggested Progressive Flow Trip Point	Drain			
	Minimum	Continuous	Peak		Backwash	Brine Draw	Slow Rinse	Fast Rinse
HCE-450-3	10	160	210	160	20	3.13	4.75	20
HCE-600-3	14	185	250	185	30	4	6.5	30
HCE-900-3	19	200	270	200	35	6.63	9.5	35
HCE-1200-3	25	215	280	215	45	9.38	11.5	45
HCE-300-3	7	114	150	114	15	3.13	4.75	15

*The Suggested Progressive Flow Trip Point is simply a suggested flow rate at which point an additional tank will be brought on line if facility flow demand meets this rate. The Culligan GBE Controller will not remove a tank brought on line by attaining the Trip Point unless the flow is <95% of the Trip Point amount for a 30-second period. In the event additional units are not brought on line or off line when desired, simply adjust the programmed Trip Point. Refer to the GBE Programming for Commercial Softeners and Filters (except for HFXN) Manual (P/N 01027295) for more information about the Progressive Flow mode of operation. This manual can be obtained from your local dealer, CPort (www.cport.culligan.com) under the [Technical Service Tab](#) or the iPad Service Tech App.

Hi-Flo 3e Refill Minutes/Salt Dosage/Capacity

Table 8.

Resin Vol (ft³)	15			20			30			40		
Refill flow washer size (gpm)	5			6			8			12		
Resin Tank Dia. (in.)	30			36			42			48		
Refill Min	lbs/ ft³	Dosage	Capacity	lbs/ ft³	Dosage	Capacity	lbs/ ft³	Dosage	Capacity	lbs/ ft³	Dosage	Capacity
5	5.0	75		4.5	90.0		4.0	120.0		4.5	180	
6	6.0	90	300,000	5.4	108.0		4.8	144.0		5.4	216	
7	7.0	105		6.3	126.0	400,000	5.6	168.0		6.3	252	800,000
8	8.0	120		7.2	144.0		6.4	192.0	600,000	7.2	288	
9	9.0	135		8.1	162.0		7.2	216.0		8.1	324	
10	10.0	150	375,000	9.0	180.0		8.0	240.0		9.0	360	
11	11.0	165		9.9	198.0	500,000	8.8	264.0		9.9	396	1,000,000
12	12.0	180		10.8	216.0		9.6	288.0		10.8	432	
13	13.0	195		11.7	234.0		10.4	312.0	750,000	11.7	468	
14	14.0	210		12.6	252.0		11.2	336.0		12.6	504	
15	15.0	225	450,000	13.5	270.0		12.0	360.0		13.5	540	
16				14.4	288.0		12.8	384.0		14.4	576	
17				15.3	306.0	600,000	13.6	408.0		15.3	612	1,200,000
18							14.4	432.0				
19							15.2	456.0	900,000			
20												
21												
22												
23												
24												
25												

 = wet storage

Hi-Flo® 3e Brinemaker Data – 2" Valves

Table 9.

		Brinemaker size									
		30		39		42		48		60	
Cubic feet	Soft Tank Dia	Total lbs.	lbs/ft³	Total lbs.	lbs/ft³	Total lbs.	lbs/ft³	Total lbs.	lbs/ft³	Total lbs.	lbs/ft³
15	30	96.4	6.4	162.9	10.9	188.9	12.6	361.9	24.1	565.5	37.7
20	36	96.4	4.8	162.9	8.1	188.9	9.4	361.9	18.1	565.5	28.3
30	42	96.4	3.2	162.9	5.4	188.9	6.3	361.9	12.1	565.5	18.9
40	48	96.4	2.4	162.9	4.1	188.9	4.7	361.9	9.0	565.5	14.1

*Chart shows max salt dosage for dry storage in total lbs and lbs/ft³

Table 10.

		Brinemaker size									
		30		39		42		48		60	
Mineral Tank	Brine Dia	1200		1800		2400		3600		5700	
Cubic Ft	lbs/ft³	Max Load	# regens	Max Load	# regens	Max Load	# regens	Max Load	# regens	Max Load	# regens
15	6	1200	13.3	1800	20	2400	26.7	3600	40	5700	63.3
	10	620	4.1	1800	12	2400	16	3600	24	5700	38
	15	250	1.1	1190	5.3	1550	6.9	3600	16	5700	25.3
20	6	770	6.4	1800	15	2400	20	3600	30	5700	47.5
	10	375	1.9	1310	6.6	1675	8.4	3600	18	5700	28.5
	15			815	2.7	1180	3.9	3600	12	5700	19
30	6	470	2.6	1410	7.8	2400	13.3	3600	20	5700	31.7
	10			815	2.7	1185	4	3600	12	5700	19
	15					445	1	2880	6.4	5700	12.7
40	6			1115	4.6	1480	6.2	3600	15	5700	23.8
	10					690	1.7	3130	7.8	5700	14.3
	15							2140	3.6	5015	8.4

 = wet storage

Appendix B Data Port Output

Culligan Smart Controller—Data Port Output

The Smart Controller (GBE) is used to control water softeners, filters and commercial RO systems. This controller has the ability to provide status messages to a customer's equipment using RS-232 and RS-485 communication protocols. These protocols are commonly used to send information from the Smart Controller to either a customer's PC or to a building management system or programmable logic controller (PLC). The information is one way in that the Smart Controller can send this information out, but the Smart Controller cannot receive or respond to any commands sent into the communication port. The Smart Controller sends a status message every 60 seconds. The information is sent as a short text (ASCII), comma separated string of letters and numbers.

The information contained in the status message depends upon what type of equipment is being controlled by the GBE.

Single Water Softener or Filter controlled by the Smart Controller

The format of the status message is: CULL,A,B,C,D,E,F,G

Example: CULL,00016524,000051.5,1,00000000,0x0000,1,0329101314

Where the values for the fields A thru F are as follows:

A = total gallons since new

B = current flow rate in gallons per minute (57.2 means 57.2 gallons per minute)

C = Current Status Indicator (0 = initialization, 1=service, 2=prerinse, 3=regen, 4= standby)

D = capacity remaining in gallons

E = Error Flag (see below)

F = 1

G = A ten-digit number representing the date and time (24-hour format)

Error Bit	Meaning
0	Internal Valve Leak
1	Salt Bridging Detected
2	Brine Line Blocked
3	Brine Tank Overfill Error
4	Replace Media Filter
5	No RF Remote Signal
6	AquaSensor Salt Error (possibly low salt or failed education)
7	Motor Homing Error
8	Motor Position Sensor Error
9	Low Salt Level in Brine Tank
10	(not used)
11	AquaSensor Probe Fault (probe has failed, not plugged in or AquaSensor transformer failed)
12	Less than 14 Days Salt

The error flag is sent as a hexadecimal number in the format 0xWXYZ as follows:

W				X				Y				Z			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Each error bit is either 0, meaning that this error is NOT present, or 1, meaning that this error IS present. Each of the four-bit sections (W, X, Y and Z) are then combined into a four digit binary word which is converted to a hexadecimal digit.

As an example, if there are no errors present, then the value would be 0x0000.

If there were a 'Replace Media Filter', 'AquaSensor Salt Err' and 'Motor Position Sensor Error' present then bits 4, 6 and 8 would be set to 1 and all other bits would be 0, respectively.

	W				X				Y				Z			
Error Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Binary	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0
hexadecimal	0				1				5**				0			
Error Flag	0x0150															

*Note that the first two characters of the error flag are always "0x" to signify that this is a hexadecimal number

** In hexadecimal, the number 4 bit equals 1, the number 5 bit equals 2, the number 6 bit equals 4, and the number 7 bit equals 8. Therefore, when you add the #4 bit value to the #1 bit value, you get 5.

So the value of the error flag would be 0x0150 if these three errors were present.

NOTE If the GBE is controlling a filter (instead of a water softener) then the above message definitions are identical, but that error flags 1,2,3,6,9 and 11 will always be zero for a filter.

Progressive Flow System of Smart Controller-Controlled Water Softeners

The format of the status message for a progressive flow network consists of a series of individual lines of information, one line for each of the Smart Controller-controlled softeners. For example, in a triplex progressive flow network, every 60 seconds, the data port on the master unit will send out the following three lines of information:

CULL,A1,B1,C1,D1,E1,1,G1

CULL,A2,B2,C2,D2,E2,2,G2

CULL,A3,B3,C3,D3,E3,3,G3

example:

CULL,00052754,000003.7,1,00009110,0x0000,1,0329101314

CULL,00042674,000003.5,1,00004321,0x0000,2,0329101314

CULL,00010204,000000.0,4,00005444,0x0000,3,0329101314

The 1 at the end of the first line indicates that this line is the status for the Master unit in the progressive flow network. The 2 and 3 on the subsequent lines indicate that this data is for slave unit #1 and slave unit #2, respectively. The information contained on each line is of the same format as described in the Single softener section above.

Electrical Connections

The Culligan Data Cable Connector is terminated with a D-sub9 style female termination. The customer must provide the following pin connections:

Pin	Function
2 (Output)	RD (this line is required even though no data is sent TO the GBE board)
3 (Input)	TD (data coming FROM the GBE board)
5 (Signal gnd)	GND

The data coming from the Smart Controller board is at the following conditions:

Bits Per Second: 9600

Data Bits: 8

Parity: None

Stop Bits: 1

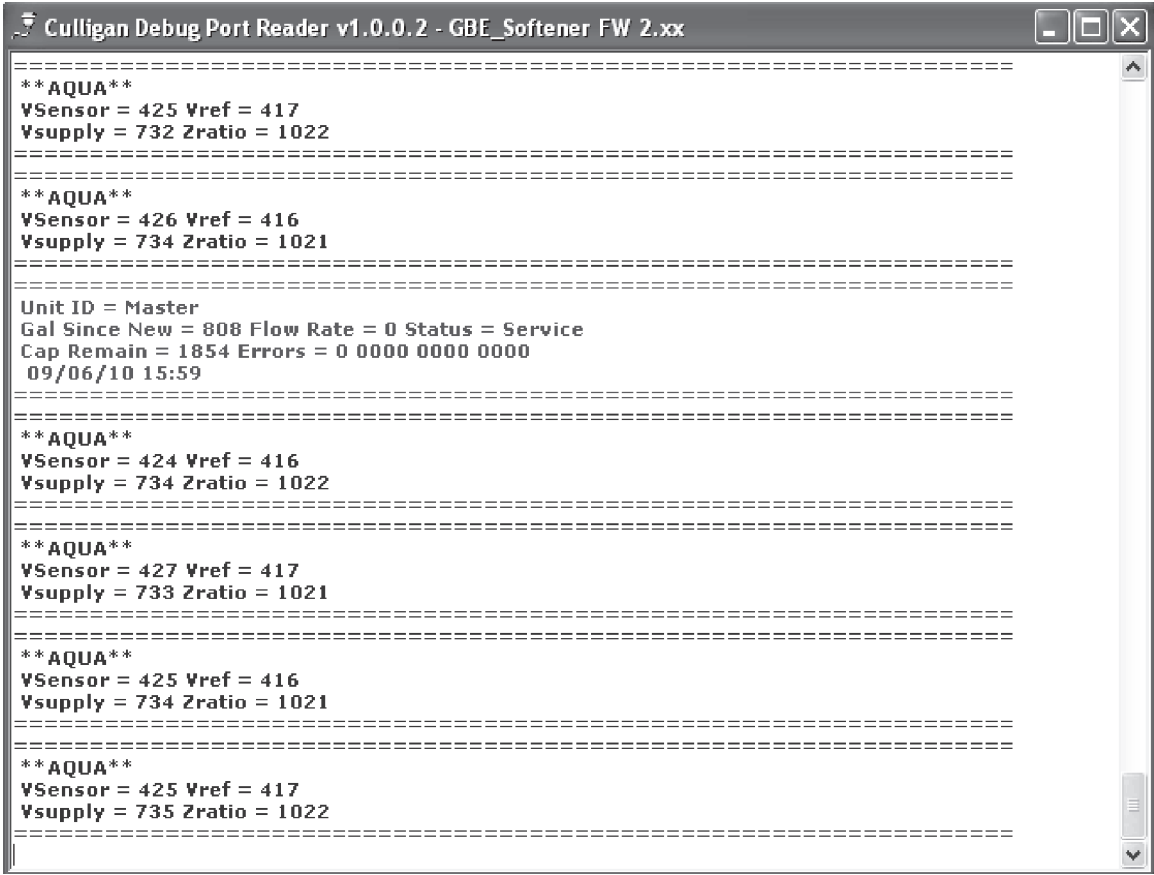
Flow Control: None

Refer to ["Remote Display and Accessories Parts List" on page 58](#) for a list of cables and kits currently available.

Test the Data Port

The Culligan Smart controller is capable of communicating with many different types of equipment including laptop and desktop computers running Microsoft Windows® operating systems. In order to connect the Smart Controller to a computer you will need a USB-to-GBE cable, Culligan P/N 01021507. You will also need to download a installation file from CPort (www.cport.culligan.com) under the Technical Service Tab on the Telemetry pages' subpage called [How to Register and Setup Telemetry](#). The file is called "Setup_Culligan_GBE.EXE". Once you copy the file to your PC, you can double-click on the file to install the USB drivers and the Data Port Output Viewer to your local hard drive. You will be asked which directory you want to copy these files to. You may select any directory. Note: Previous instructions showed how to view the output in Windows' Hyperterminal. Although this is still possible, this program makes the process much more simple.

The instructions for using the program are included with the download. The program is a simple viewer window that shows the decoded messages sent to the debug port. See figure below.



The screenshot shows a window titled "Culligan Debug Port Reader v1.0.0.2 - GBE_Softener FW 2.xx". The window contains a list of decoded messages separated by dashed lines. The messages include sensor readings (VSensor, Vref, Vsupply, Zratio) and unit status information (Unit ID, Gal Since New, Cap Remain, Errors, and a timestamp).

```
=====
**AQUA**
VSensor = 425 Vref = 417
Vsupply = 732 Zratio = 1022
=====

**AQUA**
VSensor = 426 Vref = 416
Vsupply = 734 Zratio = 1021
=====

Unit ID = Master
Gal Since New = 808 Flow Rate = 0 Status = Service
Cap Remain = 1854 Errors = 0 0000 0000 0000
09/06/10 15:59
=====

**AQUA**
VSensor = 424 Vref = 416
Vsupply = 734 Zratio = 1022
=====

**AQUA**
VSensor = 427 Vref = 417
Vsupply = 733 Zratio = 1021
=====

**AQUA**
VSensor = 425 Vref = 416
Vsupply = 734 Zratio = 1021
=====

**AQUA**
VSensor = 425 Vref = 417
Vsupply = 735 Zratio = 1022
=====
```

Appendix C Flow Device K-Factor Data

Meter Type	Installation Fitting Type/Material	Pipe Size NPT	Flow Range (GPM)	K-Factor Gallons	K-Factor Liters	Culligan Part No.	Shaded = Obsolete
Culligan	Turbine, PVC, NPT	0.5"		80	21.1	01021033	
	Turbine, PVC, NPT	0.75"		80	21.1	01021259	
	Tee, Stainless Steel, NPT	1.5"	0.5 - 75	28.5	7.5	01027900	
		2"	1.5 - 180	15.2	4.0	01027901	
		3"	3.5 - 400	6.4	1.7	01027902	
Clack	Tee, Stainless Steel, NPT	1.5"	0.75 - 75	37	9.8	01020408	Replaced by 01027900
	Tee, Stainless Steel, NPT	2.0"	1.5 - 150	20	5.3	01020409	Replaced by 01027901
	Tee, Stainless Steel, NPT	3.0"	3.5 - 350	8	2.1	01021978	Replaced by 01027902
GE/ Autotrol	Turbine, Noryl, Union, NPT	1.0"	0.25 - 40	62	16.4	01018887	
	Turbine, Noryl, Union, SS, NPT	1.5"	5 - 250	15	4	01018954	
	Turbine, Noryl/SS, Union, NPT	2.0"	5 - 250	15	4	01018891	
	Turbine, Noryl/PVC, Union, Soc					01018892	
Fleck	Hi-Flo 22 integral plastic	1.5"	0.5 - 60	78	20.6	01019670	
	Tee, Brass, NPT	1.5"	1.5 - 75	4	1.1	—	
	Tee, Brass, NPT	2.0"	3 - 150	2	0.5	—	
	Tee, Brass, NPT	3.0"	7 - 300	0.67	0.2	—	
 SeaMetrics	Saddle Clamp, Brass Tee, Brass, NPT Sweat, Copper	3.0"	6.6 - 440.6	11	2.9	01009751 01009752 01009753	
	Sweat, Copper	4.0"	11.74 - 783.2	6.5	1.7	01009756	
 GF/Signet Paddlewheel Blue Nut	Tee, Sch. 80, PVC, NPT	1.25"	1.2 - 77	177.2	46.8	D1018838	
		1.5"	1.6 - 106	117.9	31.1	D1018839	
		2.0"	2.7 - 179	66.7	17.6	D1018840	
		2.5"	3.8 - 256	43	11.4	D1018841	
		3.0"	6.0 - 401	26.7	7.1	D1018842	
		4.0"	10.5 - 701	15	4	D1018843	
	Saddle, Sch. 80, PVC	2.5"	3.9 - 256	43	11.4	D1018834	
		3.0"	6.0 - 401	36.7	9.7	D1018835	
		4.0"	10.5 - 701	15	4	D1018836	
		6.0"	16.7 - 1595	8.3	2.2	D1018837	
	Tee, Copper Sweat	1.0"	0.7 - 48	256.4	67.7	D1018822	
		1.25"	1.1 - 75	176.4	46.6	D1018823	
		1.5"	1.6 - 107	115.7	30.6	D1018824	
		2.0"	2.8 - 187	63.4	16.8	D1018825	
	Tee, Galvanized Steel, Sch. 40, NPT	1.0"	0.7 - 44	213	56.3	D1018826	
		1.25"	1.2 - 80	127.7	33.7	D1018827	
		1.5"	1.7 - 110	94.4	24.9	D1018828	
		2.0"	2.8 - 184	58.4	15.4	D1018829	
	Saddle, Sch. 40, Iron	2.5"	4.5 - 298	37.6	9.9	D1018830	
		3.0"	6.9 - 460	23.2	6.1	D1018831	
		4.0"	11.9 - 793	13.3	3.5	D1018832	
		6.0"	27 - 1800	7.2	1.9	D1018833	
	Brazolet, Brass	2.5"	4.0 - 264	37.6	9.9	D1018814	
		3.0"	6.2 - 411	24.3	6.4	D1018815	
		4.0"	10.8 - 716	13.9	3.7	D1018816	
		6.0"	25 - 1624	7.52	2	D1018817	
	Weldolet, Carbon Steel	2.5"	4.0 - 264	37.6	9.9	D1018818	
		3.0"	6.2 - 411	24.3	6.4	D1018819	
		4.0"	10.8 - 716	13.9	3.7	D1018820	
		6.0"	25 - 1624	7.52	2	D1018821	

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