GLASGOW WATER SYSTEM

EQUIPMENT MAINTENANCE SUMMARY SHEET

Equipment: Superior Gas Chorline Equipment	Spec. Section: 11234
Location: Glasgow, Montana	
Mfr.: CTI Chemical Injection Technologies Inc	Phone: 772-461-0666
Address: 4796 S. US 1 Ft Pierce FL 34982	
Area Rep: Industrial Systems	Phone: 406-252-6671
Address: 5527 Holiday Ave, Billings MT 59101	

ELECTRICAL NAMEPLATE DATA

Serial No.:		ID No.:		Model No.:			Fram No.:	
Mfr. No.:	HP:	V:	Amp:	HZ:	Phase:	RPM:	SF:	Duty:
Cat. No.:	Code:	Insl. Cl.:	Design:	Type:	°C Amp:	NEMA des.:	Rating:	Ratio:
Class:		Group:		Staft End Brg:			Opposite End Brg:	
Miscellaneous Nameplate Data:								
Recommended Spare Parts:								
Lubricants: Summer				Winter				

DNA

MECHANICAL EQUIPMENT NAMEPLATE DATA

Serial No.:	ID No.:		Model No.:			Fram No.:
Mfr. No.:	HP:	RPM:	Capacity:	Size:	Code:	Case No:
Cat.:	TDH:	Imp Sz:	Ratio:	Max RPM:	Min RPM:	Lube Inst.:
Belt No.:	CFM:	Form:	Press:	Const.	Assy No.:	Order No.:
Recommended Spare Parts:						
Lubricants: Summer			Winter			

DNA

GLASGOW WATER SYSTEM

RECOMMENDED PREVENTATIVE MAINTENANCE SCHEDULE									
Task No.	Description	Mfr. O&M Ref. Page No.	Frequency						
			D	W	M	Q	S	A	Hours
		NONE							

Chemical Injection Technologies

Installation/Service Bulletin

SUPERIOR Gas Chlorinator/Sulfonator‡ Guide to Installation, Troubleshooting and Maintenance

IMPORTANT!! READ THESE PRECAUTIONS BEFORE PROCEEDING!!!

They are very important for your personal safety, and for proper chlorinator operation.

1. Read these precautions and all related instructions thoroughly and follow them carefully. If you do not understand any of the information, call your local SUPERIOR supplier or Chemical Injection Technologies, Inc. Do not attempt to install or operate any gas chlorination/sulfonation equipment unless you are properly trained.
2. Read the "CHLORINATOR CYLINDER CHANGING PROCEDURE" card supplied with your chlorinator, and be certain you fully understand the information presented on the card. If you do not have the card, contact your local SUPERIOR supplier or Chemical Injection Technologies, Inc. and we will supply one.
3. Make certain all required safety equipment is in place and operational.
4. When performing any maintenance or changing cylinders, Chemical Injection Technologies, Inc. strongly recommends that a gas mask (a pressure-demand type air pack is strongly recommended) should be available in the immediate area of the chlorination equipment and all operating personnel should be properly trained in its use.
5. Chlorine gas or the fumes from chlorine solutions can be lethal in large enough doses. Therefore, you should always have a co-worker observe from a safe location when you are working on any type of chlorination equipment.
6. Avoid breathing the gas or fumes of chlorine solutions and avoid contact with your skin. Work only in a well-ventilated area. Chlorine will bleach clothing.
7. Before working on the chlorination system, make certain that the cylinder valve is shut off. If it seems to be shut off already, open it one quarter turn and immediately close it to make certain that the valve is not frozen in the open position. If the valve stem does not turn easily, you may use the heel of your hand to tap the cylinder wrench. Never use a hammer or other tool to force the valve stem. If you cannot turn the cylinder valve in either direction, always assume it is open. BE POSITIVE THIS VALVE IS CLOSED BEFORE LOOSENING THE CHLORINATOR MOUNTING YOKE OR VALVE CAP. If you are not sure, call your chlorine supplier.
8. Do not use wrenches larger than the standard cylinder wrench and do not hit the wrench with a heavy object to open or close the valve.
9. Do not re-use lead gaskets. THIS IS VERY IMPORTANT! Do not re-use a lead gasket because used gaskets will not properly seal the chlorinator/cylinder connection and will cause leaks.
10. Use only lead gaskets. Other types may contract with temperature variations resulting in the escape of gas.
11. Check for chlorine gas leaks every time the chlorinator is connected or remounted onto the cylinder. Using a plastic squeeze bottle of strong ammonia, approximately ⅓ full, squeeze fumes under the lead gasket connection and around the cylinder valve bonnet and valve stem. A piece of rag or paper towel wetted with ammonia may also be held under the connection. *Do not pour ammonia onto the valve or connection*. A chlorine or Sulfur Dioxide leak will create "smoke-like" fumes similar to cigarette smoke. Correct the leak before proceeding.
12. Open the cylinder valve **¼ to ½ turn only,** and leave the wrench on the cylinder valve when it is open.
13. The rate valve is not a shut-off valve. To shut-off chlorine, use the chlorine cylinder valve.
14. Always use safety chains or clamps to secure the chlorine cylinders so they may not be accidentally tipped over. Protective hoods and valve caps must be in place whenever cylinders are not in use.

NOTE: These instructions are also applicable to SUPERIOR Gas Sulfonators. Just substitute "sulfonator" wherever the word "chlorinator" appears and substitute "sulfur dioxide" wherever "chlorine" appears. Parts for the two types of units, except for the front and back bodies, the diaphragm front and back plates, and the remote meter panel bodies are interchangeable.

‡To prevent reliquification or condensing of Sulfur Dioxide (SO_2) gas in locations where the temperature may fall below 50^0F (10^0C), sulfonator installations should be inside a heated enclosure. DO NOT apply heat directly to chlorine or sulfur dioxide cylinders as this will cause a rapid increase in the gas pressure which could rupture the cylinder.

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Contents

1.0 INSTALLATION

(See Drawing No. 1)

IMPORTANT: Before proceeding, read "**Precautions**"

1.1 Handling of Chlorine Cylinders

Chlorine gas is potentially dangerous. The following rules must always be adhered to:

1.1.1 Never move a cylinder unless the valve protection cap is screwed on tightly.

1.1.2 Locate the cylinders where they will not be bumped or damaged.

1.1.3 A safety chain should be placed around the cylinders and secured to a wall or support.

1.1.4 When the vacuum regulator is mounted directly on the chlorine cylinder valve, the cylinder and chlorinator need not be in a heated room. For outdoor installation, when temperatures exceed 100^0 F., the cylinder should be shaded from direct sunlight.

1.1.5 Do not open the cylinder valve more than ¼ to ½ turn.

Note: The term "Chlorinator", as used in this publication, refers to the Vacuum Regulator, the Remote Meter Tube/Rate Valve Panel, and the Ejector Assembly, as a complete system.

1.2 Mounting Vacuum Regulator

(See Photo No. 1.1)

Follow these steps to mount vacuum regulator on the chlorine cylinder valve.

1.2.1 Unscrew the valve protection cap from the chlorine cylinder.

1.2.2 Check to make sure the cylinder valve is closed. Carefully unscrew the cap nut which covers the chlorine cylinder valve outlet.

1.2.3 Remove any dirt that may be in the valve outlet or on the outlet gasket surface.

1.2.4 Remove all shipping tape & inlet protective cap from the vacuum regulator. (DO NOT remove the porous, white filter which is inserted in the vacuum regulator inlet).

1.2.5 Unscrew the yoke screw until the sliding valve plate can be pushed all the way back.

1.2.6 Place 1/16" thick lead gasket over the chlorine inlet of the vacuum regulator. *Never* use other types of gaskets or gasket materials. ***Never* re-use the lead gasket**. Replace the lead gasket each time the chlorine cylinder is changed.

1.2.7 Mount vacuum regulator on cylinder valve by placing the yoke over the valve, engage the vacuum regulator inlet properly with the valve outlet, and tighten the yoke screw, compressing the lead gasket. Excessive tightening will squeeze the lead gasket out of the joint and should be avoided. Do not open the chlorine cylinder valve until all components are installed. See section 2.0 "Start-Up".

1.3 Installation of Remote Meter Module

1.3.1 Install remoter meter panel right side up in a location that is convenient for the operator and/or affords greatest security. Connect vacuum tubing from the vacuum regulator to the remote meter panel and from the remote meter panel to the ejector as shown in Drawing No. 1.

1.4 Installation of Ejector

(See Photo Nos. 1.2, 1.3, 1.4)

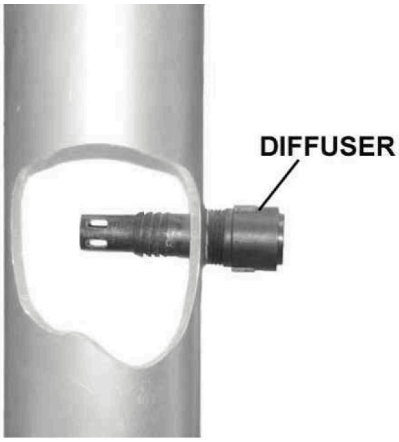
1.4.1 The check valves in the ejector are designed in such a manner that the ejector may be installed in any position.

1.4.2 The point of injection should be carefully chosen so that the water pressure at this point I(back pressure) s as low as possible. Vacuum is created in the ejector by the nozzle which is actually a precision designed venturi. Water pressure to the nozzle must be high enough to overcome the back pressure and create a strong jet in the nozzle.

1.4.3 The standard ejector is designed to withstand static back pressures in excess of 250 psig (17.5 kg/cm^2). However, due to possibilities of water line "torque" in high pressure on-off systems, as well as special booster pump considerations, it is recommended that a factory representative, or Chemical Injection Technologies, Inc. be consulted regarding installation details in systems over 100 psig (7 kg/cm^2).

1.4.4 Generally, the amount of water (GPM) required to operate the ejector depends upon the chlorine flow rate (lbs./24 hrs. or gr./hr.). The higher the chlorine flow rate, the greater the water flow needed.

1.1

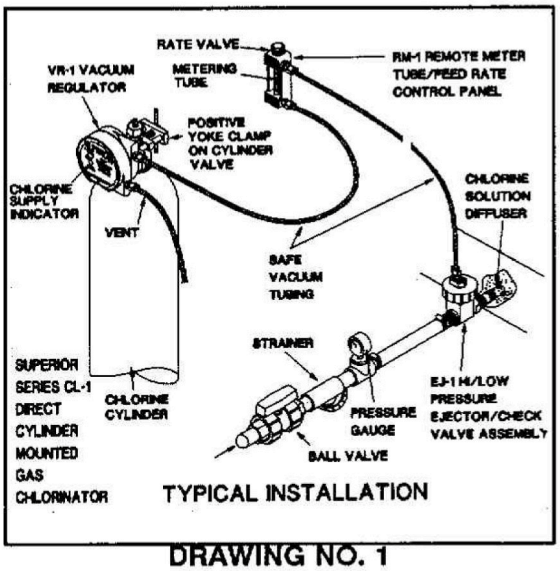


1.2

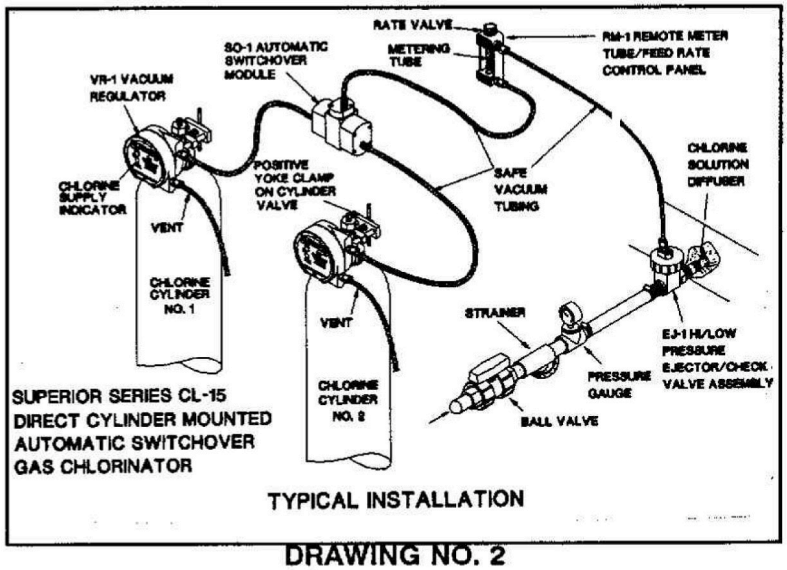
1.3

1.4

1.5

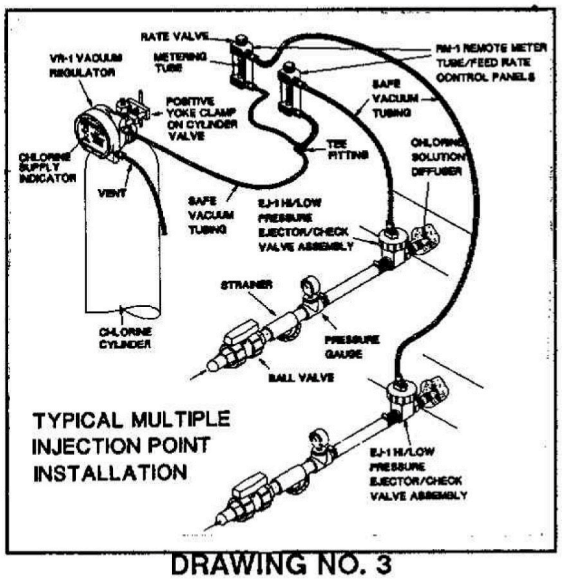


DRAWING NO. 1

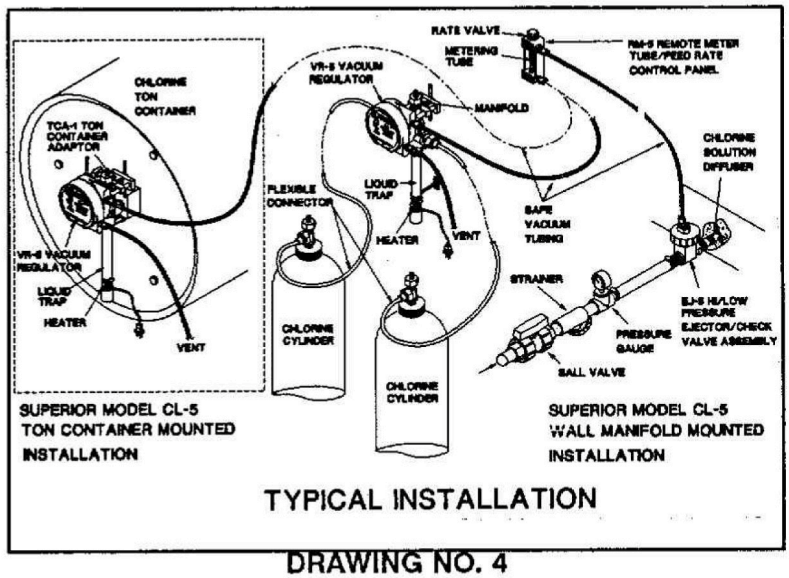


DRAWING NO. 2

Typical Installation Drawings for the various Superior Gas Chlorinator/Sulfonator configurations. These drawings are provided strictly as a guide to help you understand the basic connections and relative placement of the modular assemblies. Each installation has its own unique requirements.



DRAWING NO. 3



DRAWING NO. 4

1.4.5 Ejector water supply pressure must be greater than the pressure into which solution is ejected. The amount of pressure differential may vary with the particular application. Generally, the greater the pressure into

which the chlorine will be injected, the greater the required differential pressure. However, the minimum pressure differential and water flow for your installation should be determined prior to installation and start-up.

1.4.6 Follow these steps for installing close-coupled diffuser and ejector.

a. Unscrew the diffuser from the assembly. *DO NOT* install the diffuser when the ejector is assembled or damage may occur.

b. Put Teflon tape on the 1" pipe threads and screw the diffuser into the pipe. These are high-strength plastic parts, but like all plastic pipe fittings, care should be exercised in tightening. Tighten carefully with properly adjusted wrench. Make sure that the holes in the spray type diffuser are in the main stream. The end of an open type diffuser should not allow strong chlorine solution to come into contact with metal pipe or fittings, as this will cause serious corrosion. (Photo No. 1.2).

c. Place a gasket (GK-125) into the recess on each side of the check valve body. Insert the nozzle through the check valve body (Photo No. 1.3). Hold the check valve body against the diffuser at ¼ turn **COUNTER CLOCKWISE** from its final position (up, down, side- ways).

d. Screw the nozzle into the diffuser, by **HAND ONLY**, until contact is made against both gaskets. Turn the check valve body and the nozzle, at the same time, ¼ turn clockwise to the final, tight position (Photo No. 1.4). Attach water supply hose and tighten clamps. (Photo No. 1.5).

1.4.7 Other types of diffuser and ejector installations may be desired for certain applications:

a. The ejector (nozzle and check valve assembly) may be located near the vacuum regulator. A wall mounting bracket can be provided for the assembly, and the outlet can be supplied with various sizes of adaptors for solution hose or pipe.

b. If the ejector is to be remotely installed with solution piping or hose running to the point of application, be certain to cut off the tip of the diffuser before installing into the pipe or hose. Failure to do this will result in excessive back- pressure being created in the diffuser, causing chlorine feed rate to drop off or stop.

c. The entire diffuser-ejector assembly may be submersed in an open channel or tank.

d. Diffuser tubes with corporation cocks can be supplied for either close coupled or remote ejectors.

e. Special diffusers can be supplied for use with PVC Ball valves.

1.5 Piping of Ejector

1.5.1 For most installations, the ejector water supply line should be brought to within 3-5 feet of the nozzle with rigid copper or iron pipe, or schedule 80 PVC pipe.

1.5.2 A shut-off valve followed by a Y-type strainer and the ejector is desirable as a service tool, and *is highly recommended.*

1.5.3 A pressure gauge installed between the Y-type strainer and the ejector is desirable as a service tool, and is recommended *very strongly*.

1.5.4 Connect hose between the hose adaptor and the ejector nozzle. Clamp the hose securely at both ends with single or double hose clamps.
(Photo No. 1.5).

1.5.5 When rigid piping is used all the way up to the ejector inlet instead of hose, cut off the hose adaptor "barbs" on the nozzle where the 1" NPT threads start. Be certain to install pipe unions to allow maintenance.

1.6 Connecting Vacuum Regulator to Remote Meter and to vent

1.6.1 Appropriate size plastic tubing is normally used for the vacuum line between the vacuum regulator and remote meter; the remote meter and ejector; and for the emergency vent. Use enough length for each line to allow for movement of the vacuum regulator from one cylinder to another.

1.6.2 Remove connector nut from connector and slip onto tube. Push tube onto connector and tighten connector nut *HAND TIGHT*.

1.6.3 Upper connector on chlorinator vacuum regulator is for connecting the vacuum tubing to the bottom connector of the remote meter. The upper connector on the remote meter is for connecting the vacuum tubing to the ejector. The lower connector on the chlorinator vacuum regulator is for vent line exhausting to safe location outside building. An insect screen is provided for the outside of the vent line, and **MUST** be installed to prevent insects from entering the vacuum regulator and causing service problems.

1.7 Automatic Switchover Systems
(See Drawing No. 2.)

Mount vacuum regulators onto separate cylinder valves and install ejector as described above in sections 1.2 and 1.4.

1.7.1 Mount Automatic Switchover Module on wall as near as possible to the chlorine cylinders.

1.7.2 Mount the remote metering tube/rate control panel on wall, preferably between the automatic switchover module and the ejector.

1.7.3 Connect vacuum tubing from the "vacuum" outlet of each vacuum regulator to the tubing connectors on each side of the automatic switchover module.

1.7.4 Connect vacuum tubing from the tubing connector on the top of the switchover module to the tubing connector at the bottom of the remote meter panel, and connect tubing from the top connector of the remote meter panel to the ejector. [Special order "Right/Left" side remote meter panels are available which allow vacuum connectors to be installed on either side of the remote meter panel. Plugs are inserted in the unused fitting holes.]

1.8 Multiple-Point Feed Systems
(See Drawing No. 3)

Mount vacuum regulator onto cylinder as described in section 1.2. Mount each individual ejector as described in section 1.4. Connect vacuum tubing from vacuum regulator to remote meter panels, using tubing connector "Tee's", and from individual meter panels to respective ejectors as shown in Drawing. No. 3.
NOTE: Each ejector must be installed as if it were a completely separate chlorination system, with the proper water flow and differential pressure.

1.9 Additional Installation Suggestions

1.9.1 Many operators find it convenient to install a "hook" on the wall behind the chlorine cylinder, slightly above the vacuum regulator. When changing cylinders, the vacuum regulator can easily be hung on this "hook" while moving new cylinders into place.

1.9.2 A beam-type scale should be used to weigh chlorine cylinders while in use to determine the amount of chlorine remaining.

2.0 START-UP

2.1 Check Ejector

2.1.1 The ejector, with its water supply and solution lines, must be properly installed and operating before checking the chlorinator: *IMPORTANT*: do not connect ejector to the chlorine vacuum tubing before applying water pressure to the ejector assembly. Dirt or debris can become lodged in the check valve during installation. Cycle the ejector on and off several times to insure tight closing. Failure to follow this procedure can cause water to enter the chlorinator, requiring disassembly.

2.1.2 Unless the ejector is creating a vacuum, the chlorinator will not work. Follow these steps:

a. Make sure the plastic vacuum tube is disconnected from the ejector.

b. With the booster pump running, or pressurized water supply connected, open the ejector water supply valve. The ejector should be in operation and creating a vacuum.

c. Put your finger on the vacuum connector opening of ejector and feel the vacuum. This is a strong vacuum and there should be no doubt that a vacuum exists. If there is no vacuum, refer to Section 1.4 and be certain the supply pressure is sufficient and that the nozzle or piping is not plugged. Correct the condition and obtain proper vacuum before proceeding.

d. Be sure that no water is coming out of the vacuum tube fitting when the ejector is shut off. If water is observed leaking past the check valve, see Service Section 5.1 and correct before proceeding.

e. Re-connect the vacuum tube to check chlorinator. Leave the ejector running.

2.2 Check Chlorinator

(Have strong household ammonia and a piece of cloth available to check for chlorine leaks. Avoid breathing the fumes).

2.2.1 With the ejector operating, and the chlorine cylinder still closed, the ball in the metering tube will remain at the bottom. If the ball does not remain at the bottom, or bounces up and down, there is either a leak at the lead gasket where the vacuum regulator connects on the cylinder or a loose connection in the system. Check and correct.

2.2.2 The supply indicator on the face of the vacuum regulator will be visible as RED. Double check by attempting to RESET the indicator. It should NOT be able to be reset.

2.2.3 Close the ejector water supply valve or turn off the booster pump to stop operation of the ejector.

2.2.4 Disconnect the plastic vacuum tube at the vacuum regulator and pull off the tube to allow air to enter system.

IMPORTANT: Before proceeding, read "Precautions".

2.2.5 Re-connect plastic vacuum tube. Open chlorine cylinder valve 1/4 turn and *close immediately*.

2.2.6 Wet small piece of cloth in household ammonia (avoid breathing fumes) and hold below the lead gasket inlet connection and below the cylinder valve bonnet. If chlorine is leaking, a smoke will appear similar to cigarette smoke. Tighten bonnet or replace gasket and eliminate leaks. (**NOTE**: Do not pour ammonia solution on the vacuum regulator or cylinder valve).

2.2.7 Open chlorine cylinder valve 1/4 turn, leave open, and recheck for chlorine leaks.

2.2.8 Turn on water supply valve to ejector and adjust rate valve to desired chlorine flow rate. Flow rate in lbs./24 hrs., or gr./hr. is read on the meter scale at the center of the ball for all flow rates except 200 to 500 PPD which are read at the top of the ball. Don't forget to reset the "Loss of Chlorine" indicator.

NOTE: ***NEVER* use the rate valve to shut off the chlorine supply**. **This valve is for adjusting flow rate while the system is in operation**. ***To shut off chlorine flow close the cylinder valve*.**

3.0 SHUT-DOWN

IMPORTANT: Before proceeding, read "Precautions".

3.1 Shut off water supply valve and/or booster pump.

3.2 Shut off the chlorine cylinder valve - not the rate valve.

3.3 When changing cylinders, follow the procedure on the cylinder changing chart supplied with your SUPERIOR Gas Chlorinator. Make certain that the cylinder valve is closed before removing the vacuum regulator.

Care and Maintenance of Your Superior Gas Chlorinator.

GENERAL

This section covers all phases of service on SUPERIOR Direct Cylinder Mounted Gas Chlorinators. Normally it is not necessary to completely disassemble the chlorinator unless the unit is to be cleaned throughout, or the unit has been severely flooded. **DO NOT DISASSEMBLE THE UNIT MERELY FOR THE SAKE OF DISASSEMBLY**. All units have been factory tested and are in perfect condition when they are shipped.

This text describes some of the things that can cause a chlorinator to stop working. Read it carefully and find out what the problem is before corrective measures are taken.

4.0 TROUBLESHOOTING

SUPERIOR Gas Chlorinators will require minimum service if operated with reasonable care. Problems which could arise are listed below.

4.1 Chlorine Leak

IMPORTANT: Before proceeding, read the "Precautions".

There are four possible points of chlorine pressure leaks. These are not unusual, but if a chlorine leak is detected it should be immediately located and stopped. Even small leaks can create a safety hazard and cause serious corrosion to equipment in the area. Ammonia should be used to detect leaks (as described in 2.2.6 under START-UP).

4.1.1 Chlorine cylinder valve packing.

The chlorine cylinder valve is a high quality valve designed specifically for chlorine service. Chlorine suppliers should service this valve at each filling and leakage at this point is unusual. Should a leak develop, tighten the cylinder valve packing nut without exerting excessive force. If this does not eliminate the leak, close the valve and call the chlorine supplier.

4.1.2 The lead gasket seal between the vacuum regulator and the chlorine cylinder valve.

A leak at this point is caused by:
- Reusing a lead gasket
- Dirt on the gasket surfaces
- Under or over tightened connection
- Installation without a gasket
- Using a "fiber" type gasket (only lead gaskets should be used).

Use a new lead gasket. Make certain the gasket and gasket surfaces are clean and smooth. Tighten clamp, but not excessively. (Photo No. 4.1)

4.1.3 Chlorinator shut-off valve - "Venting"

Chlorine leaking out of the vent is an indication of a leak at the safety shut-off valve. The usual cause is dirt on the valve seat. Test to make certain the problem is a leak at this point.

a. Shut off water supply to ejector-diffuser.

b. Submerge the end of the vent tubing in a glass of water. Continuous bubbling is an indication of a chlorine leak.

c. Before removing the unit from the cylinder, close the cylinder valve, turn on the water supply, and allow the chlorinator to operate until the metering ball drops to the bottom.

d. Refer to section 5.5 under "Service" (cleaning safety shut-off Valve and Seat).

4.1.4 Vacuum Regulator inlet capsule seat (adaptor face seal O-ring OR-103)

Chlorine leaking out between the back body and the yoke assembly, or from the space between the front and back bodies usually indicates a leak at the o'ring seal between the inlet valve capsule and the inlet adaptor. The usual causes are listed below.
See section 5.5 under "Service".

a. Improper tightening of the inlet valve capsule after disassembly.

b. Dirt or impurities on the o'ring or sealing surfaces.

c. Failure to re-install the OR-103 o'ring after disassembly.

d. Damaged or worn OR-103 o'ring.

4.2 Loss of Chlorine Feed

(There are four possible reasons for loss of chlorine feed.)

4.2.1 No vacuum.

This can readily be checked by removing the chlorine gas line at the ejector-diffuser and holding your thumb over the fitting. Suitable vacuum will exert a strong pull. If there is no vacuum, the ejector nozzle may be plugged. Refer to section 5.3 under "Service" (Cleaning the Ejector nozzle).

4.2.2 Insufficient water pressure to operate ejector-diffuser.

This can be readily checked in the same manner as above by holding the thumb over the ejector vacuum fitting.

4.2.3 No chlorine supply.

This should be obvious.
When the chlorine cylinder becomes empty, the metering ball will not indicate chlorine feed and the supply indicator on the vacuum regulator will show RED.

4.2.4 Plugged vacuum regulator inlet filter.

Dirt from the cylinder may completely plug the high-efficiency, porous filter, The filter may be removed for inspection and cleaning. See section 5.5.10 under "Service".

4.2.4 Broken or leaking vacuum line(s).

4.3 Sticky Ball in Remote Meter Tube/Rate Valve Panel

4.3.1 Deposits

a. Chlorine gas may contain traces of organic compounds. These compounds can cause deposits on the ball or the glass tube. The deposit is often sticky, causing the ball to adhere to the surface of the glass. This can cause erratic operation. When this occurs it is necessary to clean the meter tube assembly. The cleaning procedure is outlined in section 5.4 under "Service" (Cleaning Chlorine Meter).

b. Excessive amounts of lubricants applied to o'rings during service re-assembly can cause deposits to form on the metering tube ball and tube walls.

c. The frequency of cleaning depends on a number of factors, Small chlorinators (below 10 PPD or 200 gr./hr.) will require cleaning more often than higher capacity units. The quality of the chlorine and the operating temperature of the installation affect the frequency of cleaning. Our experience indicates that a 10 PPD unit may have to be cleaned as often as every 4 or 5 months or may not require cleaning for several years.

4.3.2 **Moisture in the system**

a. In the normal course of operation, moisture should not be present. However, it is possible in changing cylinders that very moist air could be drawn into the inlet. This can cause the metering tube ball to become "sticky" particularly on the bottom ⅛ to ¼ of the tube.

b. If the chlorinator has been previously "flooded" (see section 4.4) it is possible that all moisture has not been removed from the gas passageways in the vacuum regulator and/or remote meter/rate valve.

c. A severe vacuum leak can allow moist air to enter the system. (see section 4.5).

4.4 Water in Chlorinator - "Flooding"

4.4.1 During chlorinator operation, vacuum draws chlorine gas through the system and water cannot enter the chlorinator. When the system is shut down, water under pressure is prevented from backing up into the chlorinator by means of a back flow check valve. Any water observed in the chlorinator indicates a failure of the back flow check valve to seal properly. If the leak is severe or the check valve is damaged, water may be observed coming out of the "vent" tubing:

a. Shut off the water supply to the ejector and the water in the main, so there is no pressure in the ejector piping.

b. Remove the vacuum tube from the ejector and follow instructions for "Cleaning Ejector Check Valve", Section 5.1 and for "Replacing Ejector Check Valve", Section 5.2, if damage is observed.

c. Close the chlorine cylinder valve and remove the vacuum regulator from the cylinder. Remove the metering tube from the remote meter module and follow instructions in Section 5.4 "Cleaning Rate Adjustment Valve and Metering Tube".

d. Follow instructions for "Disassembly of Vacuum Regulator Body" in Section 5.6 and be certain all moisture is removed before reassembling. Also, be certain no moisture remains in the vacuum tubing between the vacuum regulator and remote meter panel.

e. Follow "Start-Up" procedure in Section 2.

4.5 Vacuum Leaks

4.5.1 For best operation all parts of the chlorinator system should be air-tight, since vacuum leaks will permit air to enter the system. All units are vacuum tested at the factory prior to shipment, therefore, a vacuum leak on a new unit is unlikely. Furthermore, it is very unusual for leaks to develop during operation unless the unit has been disassembled.

4.5.2 A simple test determines whether or not a chlorinator system is free of vacuum leaks. Proceed as follows:

a. Operate the chlorinator normally at any arbitrary chlorine setting.

b. Shut off the chlorine cylinder valve. (It is assumed that the cylinder valve will shut off tightly. A defective valve will give erroneous results).

c. The ball in the chlorine meter should drop to zero. (For very low capacity units this may take as long as 5 minutes). If the ball does not drop to the bottom this indicates a vacuum air leak at some point in the system, usually between the chlorine inlet and the metering tube.

d. When the ball drops to zero, shut off the ejector supply water. Note that the chlorine supply indicator can not be reset to GREEN. With a perfectly tight system this condition will remain. Usually a 5 or 10 minute check is all that is required. If a leak exists in the system, the diaphragm assembly will move allowing the chlorine supply indicator to be reset. If you are unsure about the position of the indicator, remove the "vent" tubing from the lower vacuum tube connector. Using some "soapy" water (water and dishwashing detergent are best) place a soap "bubble" over the connector hole. If the bubble gets larger it indicates that a vacuum leak exists.

4.5.3 The most common cause of vacuum leaks is improper assembly of units that have been taken apart for servicing.

4.5.4 The most common points of leakage are listed as follows:

a. Chlorine metering tube gaskets

If the chlorine meter is not installed straight or the rate valve seat (RV-130) is not tightened properly a leak could develop.

NOTE: Excessive tightening can also cause a leak. Metering tube gaskets can be re-used. However, except for "Lip" type gaskets, they should be turned over to re-use.

b. Rate valve o'rings

Rate valve o'rings (OR-102) may become worn. Fouling of the surfaces might cause abrasion of the o'ring surface.

c. Sealing surface at main diaphragm

An imperfection or speck of dirt on this surface during reassembly may cause a vacuum leak, but SUPERIOR's use of a compression sealing o'ring (OR-108) makes this unlikely.

d. Vacuum tubing and connectors

Check vacuum tubing for cracks, particularly under tubing connector nuts. Check vacuum tubing connectors.

e. Other possible points of leakage which are not as common:

(1) O'ring at inlet capsule (OR-106)
(2) Vent seal on diaphragm (OR-110)

4.6 Failure to Repeat Set Feed Rate

4.6.1 On start-up (where the chlorinator is actuated automatically with water flow) a chlorinator with a dirty meter or rate adjustment valve may not repeat. This is particularly true of low capacity units below 10 PPD chlorine feed rate. Correction of this situation can be accomplished by:

a. Cleaning the rate adjustment valve as outlined in Section 5.4.

b. Cleaning the chlorine meter as outlined in Section 5.4. The frequency of cleaning depends on the quality of chlorine.

4.6.2 Failure to repeat may also occur if the chlorinator has been flooded and moisture remains in the metering and rate adjustment areas.

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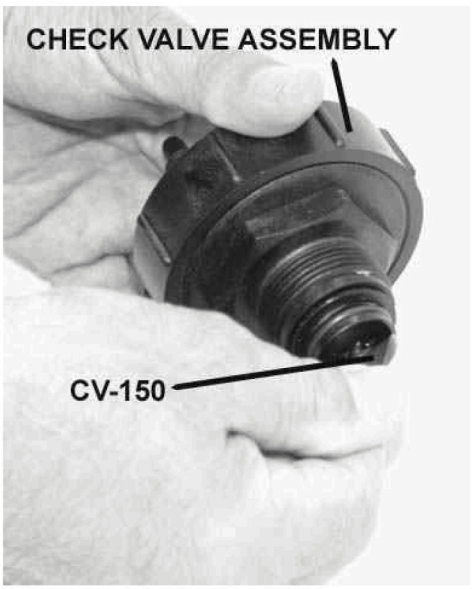

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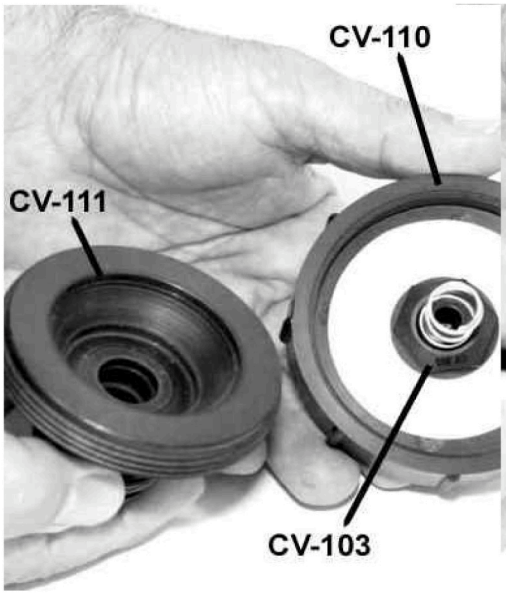

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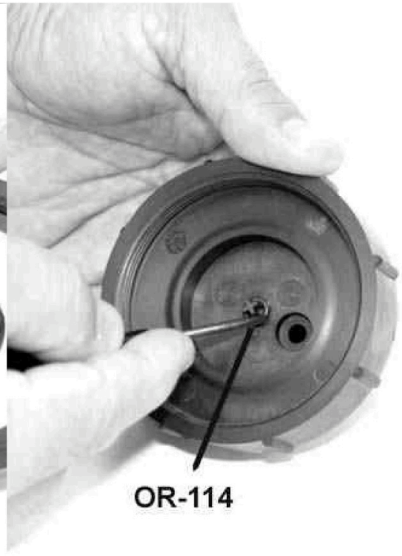

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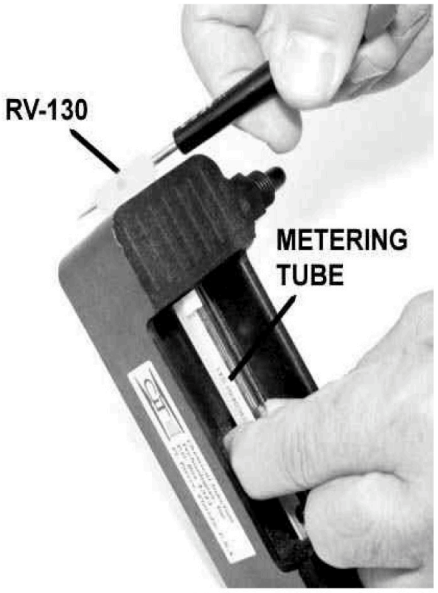

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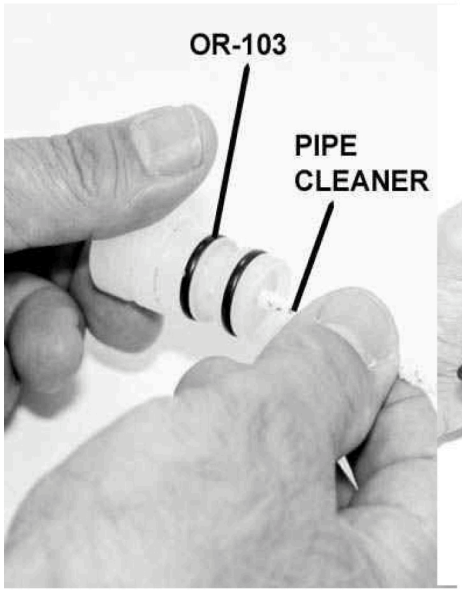

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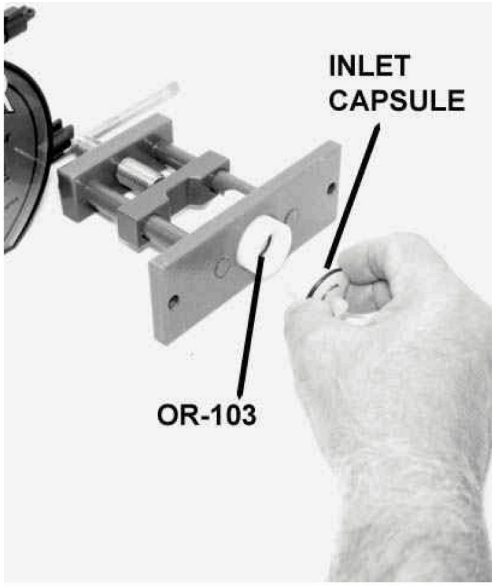

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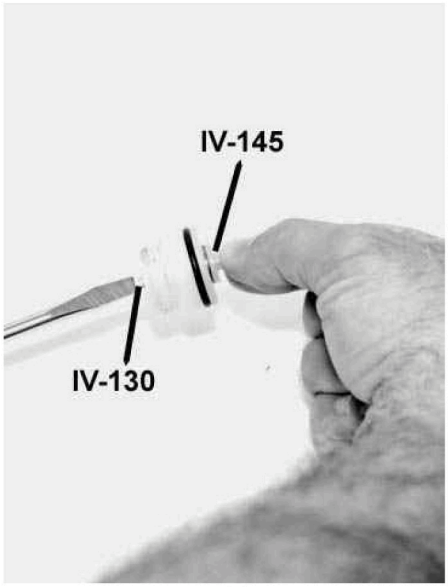

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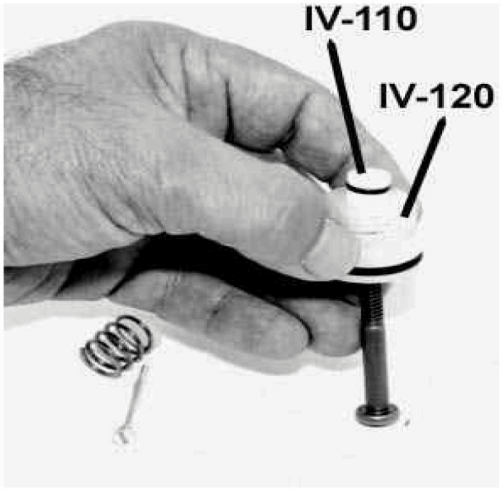

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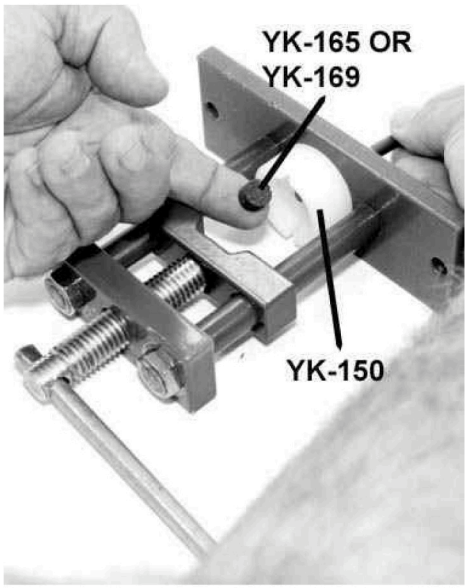

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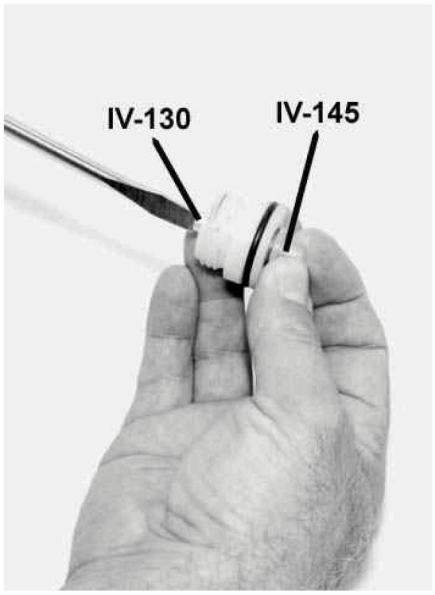

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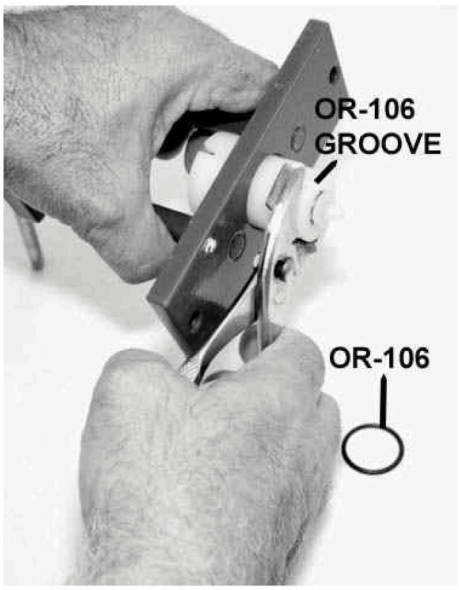

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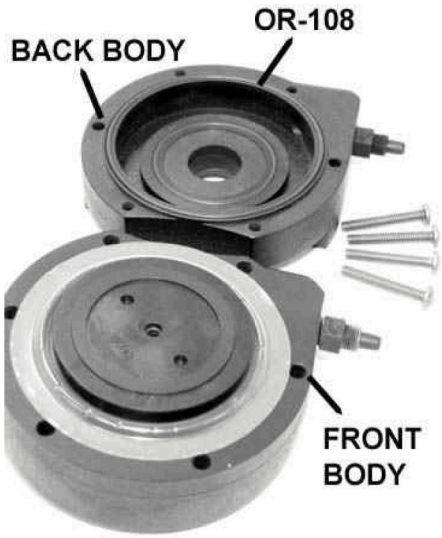

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4.7 Icing of Metering Tube - Liquid Chlorine

4.7.1 If ice is observed forming on the remote meter tube it is a definite indication that liquid chlorine has entered the chlorinator from the cylinder. While this is extremely rare, our experience has shown that chlorine suppliers have been known to overfill chlorine cylinders (rarely) causing liquid to enter the chlorinator. Also, if the cylinder should be tipped over while the chlorinator is operating, liquid may be drawn into the system.

Ton Containers; If the vacuum regulator is mounted directly onto the gas outlet valve of a ton container (using a ton container adaptor), it is possible that the "dip" tube inside the container has been broken off or a hole has developed, allowing liquid chlorine to be drawn into the vacuum regulator instead of gas. Also, check to be certain that the heater on the adaptor is keeping the drip leg warm. It is possible for liquid chlorine that is trapped in the inside "dip" tube of the container to be drawn through the adaptor, when a ton container is first used. Make sure that the regulator is connected to the TOP valve, and that the two valves are aligned vertically.

Wall Manifolds; Gas vapor can condense and form droplets of liquid chlorine, particularly when there is a sudden temperature drop in the flexible connectors. Make sure that the "drip Leg" heater is connected and that the drip leg is warm to the touch. Do not allow cylinders or ton containers to be in an area where they can become warmer than the flexible connectors or manifold piping (example: cylinder placed where sunlight through a window can shine on it but not on the manifold piping).

4.7.2 If the chlorinator has been subjected to liquid chlorine, do the following:

IMPORTANT: Before proceeding, read "Precautions"

a. Shut off the cylinder valve.

b. Leave the ejector running and pulling vacuum on the chlorinator for several minutes.

c. Remove the vacuum regulator from the cylinder.

d. Keeping your face away from the regulator, quickly remove the vacuum tubing from the "vacuum" outlet on the vacuum regulator, to "break" the vacuum lock in the regulator.

e. Re-connect the vacuum tube. Observe that the metering tube ball indicates gas flow (air). The chlorinator will now draw air into the chlorinator inlet and through the chlorinator, vaporizing any remaining liquid. If the metering tube ball drops to the bottom, it means that the vacuum regulator has "locked up" due to excessive air flow rate. If this happens close the rate valve, remove the vacuum tube from the regulator again and quickly reconnect it. Open the rate valve until air flows at a steady rate. Allow the chlorinator to draw air for several minutes.

f. Shut off ejector.

g. Either **OUTDOORS** or in a **WELL-VENTILATED ROOM**, follow instructions for "Disassembly of Vacuum Regulator Body" (Section 5.6). Clean with wood alcohol or Apple Cider vinegar and replace any parts that show signs of chlorine attack.

h. Reassemble and follow **START-UP** procedure in Section 2.

5.0 SERVICE/DISASSEMBLY

IMPORTANT: Before proceeding, read the "Precautions for Personal and Chlorinator Protection" on Page 1.

Before attempting to disassemble any of the SUPERIOR Gas Chlorinator components, refer to Section 4.0 TROUBLE HINTS to isolate the cause of the problem. Below are listed the various sections under SERVICE.

Section 5.1 Ejector check valve - cleaning.

Section 5.2 Ejector check valve - replacement.

Section 5.3 Cleaning/Inspection of ejector nozzle.

Section 5.4 Removing and cleaning chlorine rate adjustment valve and metering tube.

Section 5.5 Cleaning inlet safety shut-off valve and seat.

Section 5.6 Disassembly of vacuum regulator body.

5.1 Ejector Check Valve - Cleaning

5.1.1 Two check valves are installed in the standard ejector assembly to prevent water from backing into the chlorine gas system when the ejector is shut off. (Note: a special "Low Pressure" ejector is sometimes provided for installations where chlorine solution is being applied directly into an open tank - This ejector contains only the Low Pressure check valve. Follow directions that apply only to low pressure check valves). The check valves are designed so that it is extremely difficult for dirt to get under the valves, but dirt can enter from the chlorine side of the valve, or work its way under the valve from the water supply if large amounts of sand or other impurities are present.

To remove and clean the valves:

a. Shut off the water supply to the ejector and the water in the main.

b. Remove vacuum tube.

c. Unscrew the check valve assembly counter-clockwise from the ejector body (EJ-110). Wrench lugs are located on the underside of the check valve assembly if you cannot unscrew it by hand.

HIGH PRESSURE CHECK VALVE:

a. *Carefully* lift the edge of the check valve (CV-150) (Photo No. 5.1) and inspect. Clean both the valve and the seating surfaces with wood alcohol or apple cider vinegar. Do not use any solvents.

b. When re-installing the check valve assembly, put a *small* amount of "Fluorolube" or Dow Corning DC33 silicone grease on the seat o'ring (OR-105) and seat gasket (GK-120) for lubrication.

c. Screw check valve assembly (clockwise) into ejector body. USE NO TOOLS, HAND TIGHTEN ONLY.

d. Pressurize the ejector and cycle several times before reconnecting the vacuum tubing to insure that the check valve is sealing properly.

LOW PRESSURE CHECK VALVE:

a. The low pressure check valve is housed inside the check valve assembly. Any cleaning or service requires disassembling the entire check valve assembly. Unless a leak is observed, or you wish to replace the low pressure check valve seat as preventive maintenance, it is recommended that you do not disassemble the unit. If disassembly is required, follow instructions under "Replacement", below, and always replace the low pressure check valve seat o'ring (OR-114).

5.2 Ejector Check Valve - Replacement

5.2.1 HIGH PRESSURE CHECK VALVE: After inspecting the check valve as described in 5.1 above, if wear or damage is noted, the check valve (CV-150) should be replaced.

a. Grasp the outer edges of the check valve (CV-150) and apply a steady pulling force until the "umbrella" tip pops free. Be certain it is completely removed.

b. Examine the check valve seat sealing surface for deposits and clean with wood alcohol or apple cider vinegar.

c. Check the seat sealing surface with a straight-edge to be certain that it is completely flat. If the center is slightly raised, you will see light under the straight-edge or it will "rock" over the center. If the seat sealing surface is not flat, use a very fine sand- paper or emery cloth on a flat surface (plate glass), and gently move the check valve seat in a *figure 8 pattern only*. Do not rub back and forth or the seat will become distorted.

d. Coat the tip of new check valve with a very light film of DC33 silicone grease. Put the tip of the check valve in the check valve seat hole and using the handle of a screwdriver or other rounded object, push against the center of the check valve until the tip snaps into seat. (Photo No. 5.2).

DO NOT TWIST CHECK VALVE OR DAMAGE MAY OCCUR.

5.2.2 LOW PRESSURE CHECK VALVE: if water has been observed coming out of the vacuum tube fitting on the check valve assembly, it will be necessary to disassemble the check valve housing, and replace the check valve seat o'ring, and possibly the check valve diaphragm if it is damaged.

a. Hold the check valve seat/outlet body (CV-110) with a wrench or place the wrench lugs in a vise. Using a 1 inch open-end wrench, place the wrench on the "outside" of the raised wrench lug on top of the check valve inlet body (CV-111). This is the side into which the vacuum fitting is screwed. Turn the inlet body counter-clockwise to unscrew it.

b. When disassembling, note the position of the diaphragm and spring. Usually, the spring will remain attached to the diaphragm bolt (CV-103). (Photo No. 5.3)

c. Inspect the check valve seat o'ring for dirt or deposits. The o'ring may be cleaned and re-used, but it is recommended that the o'ring be replaced whenever the unit is disassembled. (Photo No. 5.4)

d. Inspect the check valve sealing surface on the diaphragm bolt (CV-103) and clean with wood alcohol or apple cider vinegar.

e. If the diaphragm (CV-104) has been damaged or has been severely distorted, it must be replaced. When re-assembling the diaphragm assembly, be certain that no dirt or debris is on the sealing surfaces of the diaphragm, the diaphragm bolt (CV-103) or nut (CV-105). Be careful when tightening the diaphragm bolt and nut to avoid tearing the diaphragm. (Photo No. 5.5)

f. Re-assemble by placing the spring and diaphragm assembly into the recessed hole in the outlet body (CV-110). Make sure that the diaphragm assembly is centered and carefully place the inlet body (CV-111) over the threads of the outlet body. Hand tighten until resistance is felt. Using a wrench or vise to hold the outlet body, and a 1" open-end wrench on the inlet body (see 5.2.2.a), tighten down the inlet body until snug. DO NOT OVER-TIGHTEN.

5.2.3 Examine seat o'ring (OR-105) and seat gasket (GK-120)for wear or damage and replace if necessary.

5.2.4 When reinstalling the check valve assembly, put a small amount of DC33 silicone grease on the seat o'ring (OR-105) and seat gasket (GK-120) for lubrication. It is recommended that Teflon pipe sealing tape be applied to the threads of the check valve assembly.

5.2.5 Screw check valve seat (clockwise) into ejector body. *USE NO TOOLS. HAND TIGHTEN ONLY*.

5.3 Cleaning/Inspection of Ejector Nozzle

5.3.1 To remove the ejector nozzle for cleaning, the water pressure in the main must first be shut off unless the ejector was initially installed with a valve on the inlet side and a ball valve or corporation stop in the outlet so that isolation of the ejector is possible.

5.3.2 Remove the ejector supply hose and chlorine vacuum tubing from the ejector assembly.

5.3.3 Rotate the complete ejector body counterclockwise, making certain that the solution outlet remains fixed (use wrench if necessary). This loosens the threaded portion of the nozzle from the solution diffuser and simplifies removal.

5.3.4 Unscrew the nozzle (EJ-130). The ejector body, the nozzle and the diffuser (EJ-150) are now separated. (Photo No. 5.6).

5.3.5 Nozzle plugging can be caused by:

a. Piece of foreign material (pipe sealer, stone or dirt accumulation). This can be readily blown out or pushed out very carefully, with a wire in the reverse direction. Do not use sharp tools or alter the size of the orifice in any way.

b. Excess plastic pipe solvent used during initial installation of inlet piping. If such solvent has chemically bonded to the nozzle orifice, the nozzle must be replaced.

c. Build-up of deposit. This could be a chemical build-up of iron, manganese or other material which usually can be removed by immersing the nozzle in muriatic acid and rinsing. CAUTION: Read all warning labels on Muriatic Acid bottle and avoid skin contact. It is recommended that safety goggles or face shield be used when working with any strong acid. Some waters are such that this build-up can cause an ejector to become inoperative every two months. If build-up is excessive and requires constant cleaning, you may consider the possibility of adding "sequestering" chemicals (such as hexametaphosphate) into the ejector water supply line. Consult local regulatory agencies before adding any chemicals to a potable water system.

5.3.6 To re-install the nozzle:

a. Insert the nozzle through the ejector body and fasten to the solution diffuser outlet (EJ-150) using new gaskets (GK-125) on each side of ejector body.

b. Hold the ejector body (EJ-110) against the diffuser at ¼ turn COUNTER-CLOCKWISE from its final position; up, down, sideways, etc. (see installation Section, Photo No. 1.3).

c. Screw the nozzle into the diffuser, BY HAND ONLY, until contact is made against both gaskets.

d. Turn the ejector body and the nozzle, at the same time, ¼ turn clockwise to the final tight position. (See Installation Section, Photo No. 1.3).

e. Re-install the ejector supply hose and chlorine vacuum tubing.

5.3.7 Open all valves and check for proper vacuum. (See Section 2.1).

5.4 Cleaning Chlorine Rate Adjustment Valve and Metering Tube.

5.4.1 Unscrew the rate valve plug assembly (RV-140) from the top of Remote Meter Assembly, (Photo No. 5.7) and pull the plug assembly with steady pressure until it "pops" out of the rate valve seat. (Photo No. 5.8).

5.4.2 Insert a nail or thin screwdriver *through* two of the four holes in the top of the rate valve seat. While holding the chlorine flow metering tube with one hand, turn the seat counter-clockwise. The metering tube will loosen and may be removed, (Photo No. 5.6).

5.4.3 Continue unscrewing the rate valve seat until it is free of its threads. Grasp the rate valve seat and pull up until it pops out.

5.4.4 To clean the rate valve plug (RV-140):

a. Clean the silver tip and shaft using a cloth dipped in lacquer thinner or acetone. CAUTION: Do not use any lacquer thinner or acetone on o'rings. This can cause the material to soften or become damaged.

b. Use a mild solvent, such as alcohol to clean o'rings. Examine the o'rings (OR-102) and make sure they are free of bruises or scratches. Replace if necessary. Use a light film of DC33 silicone grease on the o'rings and threads.

5.4.5 To clean the rate valve seat (RV-130):

a. Use a cotton swab (Q-Tip) with a small amount of wood alcohol and clean out the inside of the rate valve seat.

b. If dirt or deposits have formed in the metering orifice of the rate valve seat, a pipe cleaner dipped in alcohol can be carefully inserted through the orifice and gently moved back and forth. (Photo No. 5.9).

c. Clean the metering tube gasket surface with the cotton swab.

d. Inspect and clean the rate valve seat o'rings (OR-103) with alcohol. Replace if damaged or worn.

5.4.6 To clean the metering tube assembly:

a. Use tweezers or needle nosed pliers and pull out the float stops on each end of the glass tube. MAKE SURE THE METERING BALL IS NOT LOST.

b. Clean the inside of the glass tube with a pipe cleaner using wood alcohol and rinse thoroughly with warm water. Clean the metering ball float.

c. Dry out the glass meter with an air hose. (NOTE: Never use compressed air when the metering ball float is in the tube). If none is available, a hot water rinse will dry out by itself in a few minutes.

d. Re-install ball float and float stops.

5.4.7 Place Teflon pipe tape on threads of the rate valve seat (RV-130)and apply a thin film of DC33 silicone grease to the o'rings. Snap valve seat in place until the threads can engage. Turn the rate valve seat clockwise 1-1/2 turns.

5.4.8 Replace the chlorine metering tube:

a. The metering tube gaskets can usually be re-used. If damaged, replace them. Place one gasket on the bottom of the rate valve seat and one gasket in the recess of the chlorinator body at the bottom of the metering tube area. (NOTE: some sizes of metering tubes use larger "Lip" type gaskets on the top than on the bottom).

b. Center the top of the metering tube under the rate valve seat and center the bottom over the hole in the lower gasket.

c. Using the rate valve removal tool (nail) or pliers tighten (clockwise) the rate valve seat while holding the metering tube in place with numbers of proper scale facing front. Be sure the tube is centered over the gasket holes.

d. When the metering tube no longer can be rotated easily, tighten the rate valve seat another ¼ to ½ turn. Do not over tighten so as to squash the gaskets since this can cause a vacuum leak.

5.4.9 Replace the Rate Valve Plug assembly (RV-140) by placing it into the top of the rate valve seat and gently pushing down until the O-ring pops into the seat and the threads can engage. Tighten down the rate valve a few turns.

5.5 Cleaning Inlet Safety Shut Off Valve and Seat

5.5.1 Remove the two screws holding the yoke body bar (YK-100) to the vacuum regulator body.

5.5.2 Pull the entire yoke assembly from the vacuum regulator body. A clockwise rotation helps if the o'ring seal is tight. It should slip out relatively easily. (Photo No. 5.10)

5.5.3 To disassemble the inlet capsule, turn the inlet adaptor plug (IV-120) counter-clockwise. If the plug is tight, use a narrow pliers but be careful not to damage the adaptor o'ring (OR-106). The end of the valve plug (IV-130) is now exposed (Photo No. 5.11).

5.5.4 Insert a screw driver into the slot in the end of the inlet valve plug (IV-130) and unscrew the inlet vent plug/ spring guide (IV-145). This can often be unscrewed by hand. (Photo No. 5.12). If pliers are necessary make sure the rounded seat surface is not scratched. (NOTE: This assembly is in tension with the inlet spring(IV-160) so be careful not to lose the vent plug/spring guide).

5.5.5 Remove the inlet valve plug (IV-130) and inlet spring (IV-160).

5.5.6 Inspect the sealing surface of the inlet valve seat (IV-110). This surface must be completely free of dirt, nicks, or scratches. A magnifying glass gives a good indication of the quality of the seat. Use a cotton swab dipped in lacquer thinner, acetone or alcohol to carefully clean the seat. DO NOT attempt to clean the seat with a sharp tool. Replace the valve seat if it is not in perfect condition. (Normally it will not be necessary to remove the valve seat from the inlet adaptor plug (IV-120) unless it needs to be replaced). To remove, use one of the chlorinator body screws inserted through the inlet spring side of the adaptor plug. Place the head of the screw against a hard surface and push firmly on the adaptor until the valve seat pops free. (Photo No. 5.13).

5.5.7 Immerse the inlet valve plug (IV-130) and vent plug (IV-150) in lacquer thinner or acetone. Usually a deposit of crystalline organic material or a hard varnish like material will form along the valve stem below the valve seating surface. Wipe the surfaces clean with a clean cloth and inspect the tapered valve sealing surface, and the rounded vent plug sealing surfaces. These surfaces must be completely free of dirt, nicks and scratches.

5.5.8 Clean the inlet adaptor (YK-150) before proceeding with assembly. A small tube or bottle brush (or cotton swab) with lacquer thinner or acetone works well here. Remove and inspect the adapter face seal o'ring (OR-103) before applying any cleaning solvent to the adaptor. Replace the o'ring if scratched or damaged.

5.5.9 The adaptor face seal o'ring (OR-103) and all other parts may be cleaned with a clean cloth dipped in wood alcohol.

5.5.10 The inlet filter disk (YK-165) may be removed for inspection of dirt build-up and for cleaning by pushing a pencil eraser tip through the inlet adaptor (YK-150), (See Photo No. 5.14). Dirt and deposits can usually be removed by immersing the filter in muriatic acid. **CAUTION**: Read all warning labels on muriatic acid container. Use only in a well ventilated area. Avoid skin contact. Do not breath vapors. Safety goggles or face shield should be worn. Dry filter thoroughly with air hose or dryer. If local, state, or federal regulations prohibit storage or use of Muriatic acid at your site, try using some apple cider vinegar. If this does not get the filter clean, then replace the filter.

5.5.11 **TO REASSEMBLE** proceed as follows:

a. Replace the filter in the adaptor inlet using finger pressure.

b. Replace the inlet valve seat (IV-110) and valve seat o'ring (OR-104) if they were removed from the adaptor plug. A *very light film* of DC33 silicone grease should be put on the o'ring and the seat slowly "pumped" into the adaptor plug.

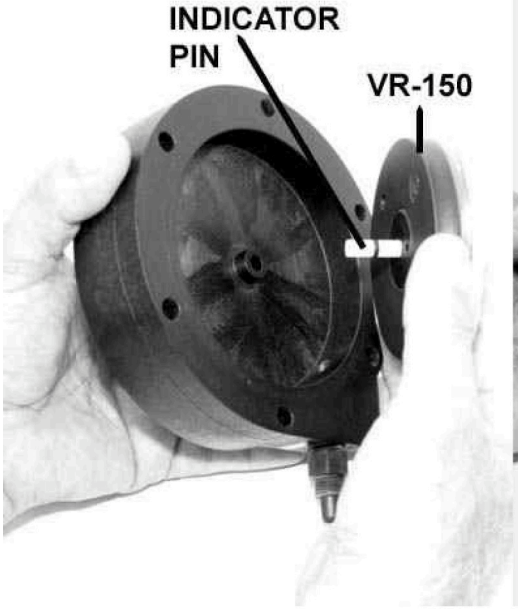
c. Insert the inlet valve plug (IV-130) through the valve seat.

d. Place the inlet adaptor plug with the inlet valve plug facing down on a smooth clean surface and proceed.

e. Insert the inlet spring guide/vent plug onto the inlet spring and snap into place. Insert the inlet spring with guide/vent plug attached, into the inlet adaptor plug recess.

f. Compress the spring guide/vent plug and screw it on to the inlet valve plug a few turns by hand.

g. Place a screwdriver in the inlet valve plug slot, hold the spring guide/vent plug with the other hand and screw down the spring guide/vent plug until the spring guide bottoms on the shoulder of the inlet valve plug. DO NOT OVER-TIGHTEN (Photo No. 5.15). The spring should compress until approximately 1/32" (1mm) of clearance is observed between the top of the adaptor plug and the bottom of the spring guide/vent plug. (NOTE: A screwdriver tip that fits the inlet valve plug slot is a good measuring tool).



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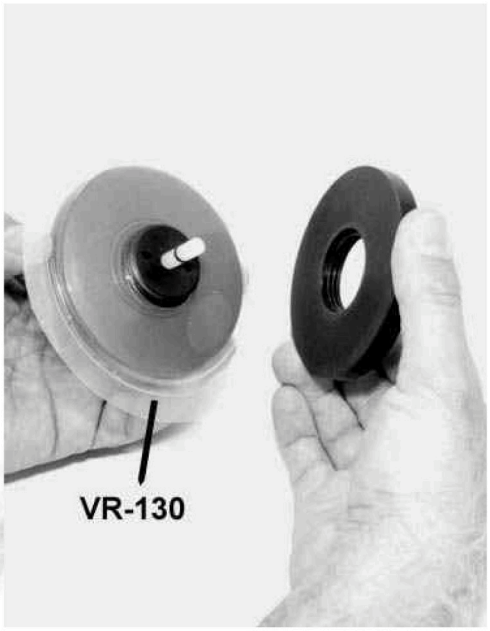

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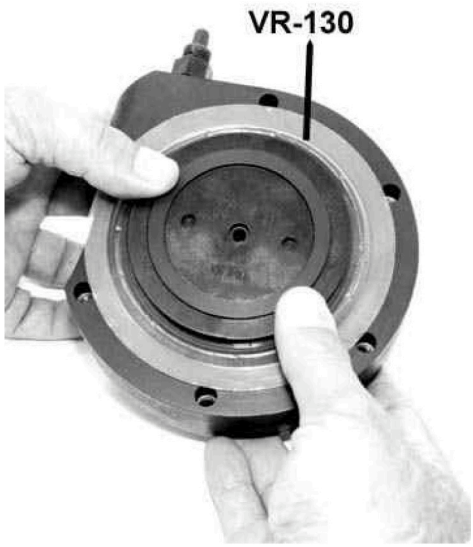

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h. Check alignment of valve stem assembly. It should appear straight when viewed from any direction.

j. Screw the inlet adaptor plug assembly into the yoke assembly, clockwise. Use pliers and tighten until you are certain the plug is bottomed. The plastic used in this plug is very strong, just be careful that you do not damage the inside of the adaptor plug OD sealing o'ring groove. (Photo No. 5.16).

i. Place the adaptor face seal O-ring (OR-103) into the groove in the inlet adaptor.

5.5.12 Put a light film of DC33 silicone grease on the adaptor plug OD sealing O-ring (OR-106). Also put a light film of lubricant on the back body inlet seal (OR-113).

5.5.13 Insert the entire yoke assembly into the chlorinator body using a slight CLOCKWISE ROTATION. DO NOT turn the yoke assembly counter-clockwise as a precaution against unscrewing the inlet safety capsule.

5.6 Disassembly of Vacuum Regulator Body

Normally it is not necessary to completely disassemble the unit unless a thorough cleaning is necessary or parts need replacing.

5.6.1 Remove the yoke assembly as described in Section 5.5.1 and 5.5.2.

5.6.2 If Necessary, remove the two small screws which hold the faceplate onto the front body. Carefully remove the faceplate.

5.63 Remove the four screws which hold the body assembly together and separate the body halves. (Photo No. 5.17).

5.6.4 Grasp the diaphragm back plate (VR-141)* and pull the entire diaphragm assembly out of the front body. (NOTE: VR-140 and VR-160 are assembled as VR-141). If the white indicator pin is sticking in the front body, carefully use a nail to push the pin through from the front of the vacuum regulator. (Photo No. 5.18).

5.6.5 Examine the diaphragm. It is normal for some wrinkles to be present. The diaphragms are made of special, very tough, chlorine resistant material and failure is extremely unlikely.

Should it be necessary to disassemble the diaphragm proceed as follows:

a. Grasp both the front and back diaphragm plates and unscrew them. (Photo No. 5.19). If the plates cannot be unscrewed by hand you may use a vise to clamp one of the plates and use a strap wrench or marine deck plate spanner wrench to unscrew the other.

b. The diaphragm can now be removed. *Note the position of the "convolution" on the diaphragm.* **The raised portion should always face the back of the chlorinator when installed.**

5.6.6 Clean the parts thoroughly using wood alcohol or Apple Cider vinegar.

5.6.7 Carefully inspect all o'rings for damage or wear and replace if necessary.

NOTE: Excessive use of lubricants can cause additional service problems.

5.6.8 Reassemble the unit using the reverse procedure and check the following:

a. Be certain that the main diaphragm seal o'ring (OR-108) is properly seated.

b. Be certain that the diaphragm assembly moves freely in the front body. Press it forward several times to be certain it returns to "neutral position". (Photo No. 5.20).

c. Place the back body (VR-110) on a table with the diaphragm body seal o'ring (OR-108) in place and lower the front body (VR-120)* onto it.

e. Grasp the entire unit and turn it over so the back body is on top and re-assemble the four 1-1/2" (38mm) long screws. These screws should be run in until they just begin to tighten.

5.6.9 Replace the yoke assembly using procedure described in Section 5.5.13, turning it slightly CLOCKWISE as it is inserted.

5.6.10 Tighten all bolts in a criss-cross pattern until they are all snug. Do not over tighten. Sealing is accomplished by the large o'ring between the bodies (OR-108). **THERE SHOULD BE A GAP OF APPROXIMATELY 1/16" (1.6mm) BETWEEN THE TWO BODY HALVES. DO NOT ATTEMPT TO CLOSE THIS GAP BY TIGHTENING THE BODY SCREWS.** (Photo No. 5.21).

IMPORTANT NOTE: DO NOT USE *ANY* LUBRICANT (DC 33 GREASE) ON THE FOLLOWING O-RINGS

OR107
OR-108
OR-109
OR-110

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Chemical Injection Technologies

Installation/Service Bulletin

SUPERIOR AutoValve Series 2000

Electronic Gas Feed Rate Control Valve

(Ver. 3.02/3.00/2.60/2.40/2.32/2.31/2.20/2.10/2.04/2.03/2.02/1.01/1.00)

Table of Contents

1.0 DESCRIPTION

1.1 The SUPERIOR AutoValve Series 2000 Electronic Gas Feed Rate Control Valve is a state-of-the art, micro-processor based device for automatically controlling the feed rate of chlorine / sulphur dioxide / ammonia gas, based on process water flow rate, residual set point, or a combination of these parameters to achieve:

- **Flow Proportioning Control**
- **Residual Control (Including De-Chlorination)**
- **Compound Loop Control**

1.2 The Series 2000 is a flexible instrument, ruggedly designed, with a very user-friendly interface.

1.3 The Valve is designed to operate with virtually any brand of vacuum fed CL_2, SO_2 or NH_3 gas system.

1.4 The electronic components are housed in a rugged plastic enclosure, rated for NEMA 12/13 level protection.

1.5 The Valve components can be remotely mounted up to 20' (6 meters) from the electronics enclosure (note: a special cable may be required for remote installation).

1.6 Separate terminal compartment in the electronics enclosure allows for convenient input/output wiring connections without opening or disturbing the electronics boards.

1.7 Screen display is a 2-line, 16 character, back lighted LCD. It allows easily understood visual indication of specific application parameters.

1.8 A high-torque stepper motor positions the valve in response to input signal changes from an outside source, such as a flowmeter or residual analyzer.

1.9 Standard 4 - 20mA output signal is provided for interfacing with other process monitoring equipment.

1.10 The LCD display allows visual indication of input signal and valve position.

1.11 AutoValve Series 2000 Automatic Valve will operate with any CL_2, SO_2 or NH_3 vacuum operated gas feed system up to 2000 PPD (40 kg/hr).

1.12 Controls provide dosage ratio control, residual set point, manual operation, alarm set points and calibration.

2.0 DEFINING THE THREE CONTROL MODES:

2.1 FLOW PROPORTIONING CONTROL

Flow Proportioning Control is the simplest Control Mode. It involves few program settings, and tends to be the most reliable form of automatic control. It is referred to as "OPEN LOOP" Control Mode, because the action being controlled - the gas feed rate which creates a residual level - is not being monitored and fed back into the control system to determine if the desired action has taken place. Instead, the primary control signal is generated by a water flow meter which constantly measures the amount of water flowing through a treatment system. However, the flow meter cannot determine whether the amount of gas being fed is creating the proper residual level in the treated water.

Therefore, **Flow Proportioning Control** is best suited to treatment systems where the chlorine or sulfur dioxide "demand" of the water remains fairly constant. As the water flow level varies up or down, the control system varies the feed rate of chlorine or sulfur dioxide gas in direct proportion to the change in water flow. If the "demand" of the treated water changes, the residual will also change. This requires a simple adjustment of the "DOSAGE" setting in the controller. Adjusting the dosage setting up or down shifts the gas feed rate up or down, respectively, at any specific water flow rate. After initial AutoValve setup, the dosage is the only setting in the treatment system that needs adjusting.

When the "demand" of the water being treated varies on a frequent basis, you may wish to consider RESIDUAL CONTROL, or COMPOUND LOOP CONTROL, which are discussed below. However, you should understand that use of a water flow meter as the primary control signal source is the most reliable and maintenance-free control signal generating method. Residual analyzers, while more reliable today than just a few years ago, are still much more maintenance intensive, requiring frequent cleaning and calibrating in order to give an accurate output signal to any control device.

2.2 RESIDUAL CONTROL (Chlorination and De-Chlorination)

Residual Control, while somewhat more complicated than Flow Proportioning control, does afford the user more precise control over chlorine or sulfur dioxide (in de-chlorination) residual levels in treatment plants. This is most critical when components of the chlorine or sulfur dioxide "demand" vary, needing a higher or lower dosage rate on a continual basis. A chlorine residual analyzer is required which is capable of **continuous sampling**, rather than **batch sampling**. Amperometric analyzers are the most reliable for control systems, but ORP type analyzers may be used if the analyzer output variables, as well as any interference factors, are fully understood. Most colorimetric type analyzers are not well suited for continuous control systems. While some colorimetric analyzers have programming algorithms which allow a continuous output signal to be produced, a discussion of the AutoValve programming adjustments necessary to synchronize the variables is beyond the scope of this manual.

Because the **Residual Control** system feeds back to the controller the result of any changes made by adjusting the gas feed rate, it is considered a "CLOSED LOOP" type of control system. However, closed loop control systems require more inputs in order to achieve residual control without having a "ping pong" residual level from over-shooting the residual set point. The primary reason for this is that the analyzer "sees" the result of gas feed rate changes on a delayed basis. Time must be allowed for the gas to mix with the treated water and react with the organic constituents in the water before sampling the residual. Therefore, gas feed rate changes must be done in "steps" to allow time for the analyzer and AutoValve controller to "see" what effect each previous change had on the residual level of the treated water. But, how big should the "steps" be, and how often should they occur? Also, as the "steps" bring the residual closer to the "set point", how do we keep the last step from over-shooting the set point, and just bouncing back and forth around the set point (as in a ping pong game)?

It is important to note that when the AutoValve is used for **de-chlorination** with **Sulfur Dioxide gas**, it operates in a inverse manner to a chlorine residual control system. Since the objective in de-chlorination is to drive the chlorine residual to a zero (0) or very low chlorine residual set point by the addition of Sulfur Dioxide Gas, the valve will increase SO_2 feed when the chlorine residual is higher than the set point, and decrease the SO_2 feed rate when the chlorine residual is lower than the set point. This is exactly the opposite of a chlorine residual control system. The controller allows the user to choose the GAS TYPE for both Residual Control and Compound Loop Control Modes.

Fortunately, today's digital control systems allow us to take all of these variables into account, and automatically make the necessary adjustments after the initial parameters are entered into the controller. Let's take a look at the most important variable inputs you will need to understand:

2.2.1 RES FS [RESIDUAL ANALYZER FULL SCALE OUTPUT]

This is simply the residual reading in parts per million (PPM) or milligrams per liter (mg/L) which is represented by the maximum output of your analyzer. Normally, this is the residual level represented by a 20 milliamp analyzer signal output.

CAUTION: if your analyzer has any other type of output signal - millivolts, volts, higher or lower milliamp ranges, etc. - it is likely to be incompatible with the AutoValve, and may cause damage to the controller. It may be possible to use signal conditioners or other means to make the output signal compatible, but Chemical Injection Technologies, Inc. makes no promise or representation that this will be possible.

2.2.2 LAGFIX [LAG TIME SETTING]

"**LAG TIME**" is simply the amount of time, in seconds, that it takes for the chlorine or sulfur dioxide gas injected into the water to reach the analyzer, go through the measuring cell, and send the resulting reading back to the AutoValve controller. This time must be calculated based upon the water flow rate in the system, added to the analyzer's sampling time. Standard tables are available to determine the speed of travel of water in pipes of various diameters with a known water flow rate in gallons per minute, liters per second, etc.

2.2.3 P(GAIN)

The "**P(GAIN)**" variable allows an adjustment of the sensitivity of the controller to residual changes. This adjustment may be used to compensate for the wide variations in treatment system characteristics, which may cause very large, rapid changes in residual, or very small, slow changes in residual. One system may only experience extremely minor fluctuations in demand on a relatively infrequent basis, while another may undergo almost constant demand changes.

NOTE: The DEFAULT setting of 100% will satisfy the vast majority of installations.

We have found it useful to use the following description to explain this concept, even though it is not technically completely accurate. Think of the **P(GAIN)** as a series of concentric, electronic circles around the residual set point value. As the circles get farther away from the center set point, the distance between the circles becomes progressively larger. When the analyzer senses a residual that deviates from the center set point value, the controller checks to see how far away the actual value is from that set point. The signal value will fall within one of the series of "circles". Each of these circular areas represents an amount of change in the valve position for each time the analyzer senses a deviation from the set point; after recovering from the "**LAGFIX**" time delay. The farther away the value is from the set point, the larger the initial change in valve position. Each successive change will be progressively smaller. Thus, the valve will adjust the residual within a reasonable period, without over-shooting the set point and bouncing around it.

However, there are limitations to the controller's ability to balance between quickly adjusting the gas feed rate, but not overshooting the residual set point. For example, if a treatment system experiences frequent, very large changes in demand, and therefore residual, it may take a long time for the controller to step down through many "circles", because the initial deviation is so far away from the set point. This is how the "**P(GAIN)**" variable is used. We can adjust the **P(GAIN)** value higher to make the controller more sensitive to the residual signal and therefore making the distance between the "circles" much greater. This has the effect of reducing the number of "circles" through which the controller must step, in order to reach the set point. The trade-off is that it is more likely that the residual level will overshoot the set point, at least on the first pass.

On a system where the demand is constantly fluctuating, but only by a very small amount, if the **P(GAIN)** were set at a high value, as above, the valve would be constantly moving up and down because every little deviation in the analyzer signal will cause the controller to react. Most treatment systems can handle very minor fluctuations in residual without compliance problems, and constant movement of the AutoValve causes more frequent maintenance and wear. Therefore, setting the **P(GAIN)** to a lower value requires a larger deviation in the residual from the set point before any action is taken by the controller. In effect, the distance between the "circles" is reduced, so that the first deviation point is farther away from the set point, but each successive circle is closer to the next. The trade-off is that a larger residual deviation may take a longer time to reach the set point because the controller must step through many "circles".

The **P(GAIN)** is an error damping adjustment, used to set the controller's sensitivity to residual changes. It is different from Calibration "Damping" because while **CAL DMP** only changes the input signal sampling time, **P(GAIN)** adjusts the actual signal deviation needed to make a change.

2.3 COMPOUND LOOP CONTROL

Compound Loop Control allows the controller to accept two input signals at the same time: one from a water flow meter, and one from a residual analyzer. While it is the most complex control mode, Compound Loop Control is the most effective when not only the demand varies, but the water flow rates also fluctuate significantly.

If a Residual Analyzer signal is the only input, a rapid increase in water flow will quickly dilute the gas dosage, far more rapidly than the analyzer can react and allow the controller to adjust the valve through the residual deviation "steps" discussed above. This would cause a large decrease in residuals for a significant amount of time. Conversely, a rapid decrease in water flow would cause a big "spike" in residuals until the analyzer can react and the controller can compensate.

Likewise, if a water flow meter is the only signal input, changes in demand will cause the constant gas dosage to either over-treat, or under-treat the water. **Compound Loop Control** addresses these situations. Since water flow variations create the most immediate need for a rapid valve response, the AutoValve uses its Flow Proportioning mode as the primary control system. The residual input signal takes the place of an operator making continual residual samples and then adjusting the **DOSAGE** setting. It is like an electronic "hand" pressing the control buttons to adjust the **DOSAGE** setting.

All of the program variables discussed above for Residual Control (and de-Chlorination with SO_2 gas), also apply for Compound Loop Control, with the addition of the "**LAG TYPE**" setting. This allows the **LAG TIME** value which was set for a particular water flow rate to automatically vary as the water flow rate increases or decreases. By allowing **VARIABLE LAG TIME** the analyzer always "sees" the sample after equal mixing has taken place.

For example; if water flow in a pipeline doubles (i.e., a second well pump comes on line) the amount of time it takes for the treated water to reach the analyzer is one-half the previous amount, and the **VARIABLE** setting automatically adjusts the **LAG TIME**. However, in many "open" treatment systems, higher water flow rates do not necessarily increase the speed at which water travels through the system (at least not proportionately) and the **FIXED** setting may be used instead.

3.0 ELECTRONIC AUTOMATIC VALVE CONTROLLER

The electronics enclosure module of the Series 2000 is henceforth referred to as the *CONTROLLER.* The controller accepts the signal from a flowmeter, residual analyzer, or both, and adjusts a motorized valve, which is housed in a separate valve module.

3.1 PHYSICAL INPUTS

3.1.1 FLOW: 4-20 mA floating input through a load resistor of 250 Ohm to local ground.

3.1.2 RESIDUAL: 4-20 mA floating input through a load resistor of 250 Ohm to local ground.

3.1.3 VALVE POSITION: Potentiometer input, approximately 0.25 to 2.25 VDC.

3.2 KEYBOARD INPUTS

3.2.1 Dosage Ratio. Example: fully open = 100% @ 20mA

3.2.2 Flow Mode, Residual Mode, Compound Loop Mode.

3.2.3 Manual position override.

3.2.4 Calibration for VALVE CLOSED.

3.2.5 Calibration for VALVE 25% OPEN

3.2.6 Calibration for VALVE 50% OPEN

3.2.7 Calibration for VALVE 100% OPEN.

3.2.8 Alarm Relay for LOW FLOW, RESIDUAL DEVIATION.

3.2.9 4 - 20mA IN, 4 - 20mA OUT

3.2.10 LAG TIME adjust for Residual & Compound Loop Modes.

3.2.11 CHLORINATION/DE-CHLORINATION (SO_2) control modes.

3.2.12 GAIN sensitivity adjustment for SET POINT deviation.

3.3 OUTPUTS

3.3.1 2.5 VDC valve potentiometer excitation

3.3.2 4 - 20 mA reference to local ground- 600 Ohm drive (maximum)

3.4 ALARM RELAY

3.4.1 Alarm relay contact 10 amps at 120 VAC or 30 VDC resistive load, 5.0 amps at 240 VAC resistive load, unlatching. Adjustable settings for LOW FLOW alarm, and RESIDUAL SET POINT DEVIATION alarm.

3.5 POWER SUPPLY (VOLTAGE)

3.5.1 The operating voltage may be selected by a switch mounted on the main circuit board, located under the display panel: 110 or 220 VAC, 50 or 60 Hertz.

3.5.2 Power is immediately converted to 24 Volts DC for all valve operations.

4.0 INSTALLATION PROCEDURES *(SEE FIGURES IN APPENDIX)*

WARNING

OPERATORS MUST FAMILIARIZE THEMSELVES WITH ALL GAS CYLINDER OR TON CONTAINER HANDLING AND CHANGING PROCEDURES. REFER TO THE LITERATURE SUPPLIED WITH THE GAS FEEDING EQUIPMENT. ADDITIONAL INFORMATION MAY BE SUPPLIED BY THE EQUIPMENT MANUFACTURER OR BY THE GAS DISTRIBUTOR.

Refer to **FIGURE 4.1** in the APPENDIX for a typical AutoValve setup.

4.1 MOUNTING

CAUTION

***** THE SERIES 2000 AUTOVALVE IS NOT DESIGNED FOR OUTDOOR INSTALLATION *****

If circumstances require outdoor installation, the clear controller box cover must be kept closed and the unit must be kept protected from the elements at all times.

4.1.1 The Series 2000 is supplied with a wall mounting sub-panel. The separate modules are attached to the panel by means of pre-positioned fasteners. Modules may also be remotely mounted when special considerations require separating the components.

4.1.2 The panel may be mounted on any vertical surface using the proper installation hardware.

4.1.3 The electronics enclosure, valve module and remote meter panel are shipped pre-installed on the sub-panel (see **FIGURE 4.1** in the APPENDIX). Check all components to insure they are securely fastened. Any or all components may be mounted separately, but it is suggested that the remote gas feed rate flow meter panel be located where it can be seen while adjusting the electronics module. This will make calibration and operation easier.

4.2 WIRING

CAUTION

***** THE SERIES 2000 AUTOVALVE MUST BE PROPERLY GROUNDED *****

Incorrect wiring, the use of inadequate cable, or improper grounding may result in AutoValve malfunction or damage, which will void all warranties.

It is strongly suggested that the power supply be protected from voltage spikes and drops, and especially from lightning strikes. We highly recommend installation of an uninterruptible power supply (UPS) of the type used to protect computers. These are available at electronics, office supply, or home improvement stores at relatively low cost.

DAMAGE DUE TO VOLTAGE SPIKES OR LIGHTNING IS NOT COVERED BY WARRANTY

4.2.1 Installing electrical wiring for the Series 2000 AutoValve requires connection of 4-20mA input signal(s), and 110 VAC, 60 Hz power supply (or optional 220 VAC, 50 Hz).

4.2.2 The AutoValve is shipped with the connecting cable between the electronics module and the valve module, already pre-wired. If the installation requires these components to be separated, an appropriate length and type of cable must be provided and the wiring connections must be rewired according to the WIRING CONNECTIONS diagram (see **FIGURE 4.2** in the APPENDIX for a schematic diagram).

4.2.3 The AutoValve is shipped with watertight strain reliefs installed. However, these may be removed and standard ½" conduit fittings substituted. 18-22 gauge two-conductor shielded cable is recommended for the input signal(s), and 18-20 gauge grounded two-conductor wire for the power supply.

4.2.4 Connect the power supply leads to the terminals as shown on the WIRING CONNECTIONS schematic diagram (see **FIGURE 4.2** in the APPENDIX).

CAUTION

Before wiring the input control device signal(s) to the terminal board refer to the Operator's Manual for each device to make certain that the Flow Meter or Residual Analyzer you are using does NOT generate a VOLTAGE BASED signal (ex: 0 to 5 Volts DC), or you will cause irreparable damage to the controller.

The AutoValve requires a 4 - 20 mA signal to operate in Automatic Mode. If no signal is present for either the Flow meter or Residual meter, the display characters "NoSig%" will flash on the screen when operating in the "RUN" function in any of the three Control Modes.

4.2.5 Connect the 4 - 20mA control signal(s) to the correct terminals. Also connect any necessary output signal wiring and any wiring to alarm device(s) (see **FIGURE 4.2** in APPENDIX).

4.3 VACUUM LINE PIPING

4.3.1 The Series 2000 AutoValve is designed to be installed in the vacuum gas line between the ejector and the remote metering panel or vacuum regulator (if equipped with integral flowmeter). All of the manual flow rate valves in the system must be in the **FULL OPEN** position (see **FIGURE 4.1** in the APPENDIX).

4.3.2 Attach the vacuum tubing from the ejector to the bottom fitting of the valve module, labeled "Vacuum to Ejector". Attach the vacuum tubing from the remote meter panel (or regulator) to the fitting on the side of the valve module. Tighten all vacuum fitting nuts by hand only - **DO NOT USE WRENCHES (SPANNERS) OR PLIERS.**

4.4 START-UP

4.4.1 TESTING FOR VACUUM LEAKS

4.4.1.1 With the ejector operating and the gas cylinder valve still closed, the ball in the metering tube will remain at the bottom. If the ball is not at the bottom, or bounces up and down, there is either a leak at the lead gasket at the vacuum regulator connection on the cylinder valve or a loose vacuum connection in the system. Check and correct.

4.4.1.2 The gas supply indicator on the regulator face should indicate an "out of gas" condition. Double check by attempting to RESET the indicator. It should NOT be able to be reset.

4.4.1.3 Close the ejector water supply valve or turn off booster pump to stop ejector operation.

WARNING

CHEMICAL INJECTION TECHNOLOGIES, INC. STRONGLY RECOMMENDS THAT A GAS MASK (A PRESSURE-DEMAND TYPE AIR PACK IS PREFERRED) BE AVAILABLE AND ALL OPERATING PERSONNEL SHOULD BE PROPERLY TRAINED IN ITS USE. CHLORINE GAS OR THE FUMES FROM CHLORINE SOLUTIONS CAN BE LETHAL IN LARGE ENOUGH DOSES. THEREFORE, YOU SHOULD ALWAYS HAVE A CO-WORKER OBSERVE FROM A SAFE LOCATION WHEN YOU ARE WORKING ON ANY TYPE OF CHLORINATION EQUIPMENT.

4.4.2 TESTING FOR GAS LEAKS

4.4.2.1 Open the gas cylinder valve 1/4 turn and ***close immediately***. The system should now be full of gas just below atmospheric pressure.

4.4.2.2 Using the recommended testing method for the gas being fed (see below), check all fittings and connections as well as the body seams and seal areas of the AutoValve.

4.4.3 RECOMMENDED GAS TESTING METHODS

4.4.3.1 **CHLORINE & SULFUR DIOXIDE**: Fill a small plastic squeeze bottle about 1/4 full with a strong ammonium hydroxide solution and squeeze vapor from the bottle at each fitting and seam. DO NOT POUR AMMONIA SOLUTION ON THE EQUIPMENT. Instead of a squeeze bottle, a small piece of cloth wetted with ammonia solution can be held under each connection. If chlorine or sulfur dioxide is leaking, a white smoke will appear similar to cigarette smoke.

4.4.3.2 **AMMONIA**: Fill a small plastic squeeze bottle about 1/4 full with a strong chlorine bleach solution and squeeze vapor from the bottle at each fitting and seam. DO NOT POUR BLEACH SOLUTION ON THE EQUIPMENT. Instead of a squeeze bottle, a small piece of cloth wetted with the Bleach solution can be held under each connection. If ammonia is leaking, a white smoke will appear similar to cigarette smoke.

4.4.4 POWERING UP THE CONTROLLER

NOTE

***** FACTORY DEFAULT SETTINGS ARE BUILT INTO THE AUTOVALVE UNIT *****

If you encounter any calibration or setting difficulty causing a "LOCKUP" condition, turn off the AC power to the controller, wait 15 seconds to power-down the capacitors, then hold down the F4 button while turning on the AC power again. Wait until the screen says "FACTORY DEFAULT", then release the F4 button and wait until the main menu appears. Previous AutoValve calibration will be lost. Re-calibrate per ***SECTION 5.0*** *instructions.*

If the AC power to the controller is left off for periods of up to six months, the system should return to the previous function point with no re-calibration required.

CAUTION

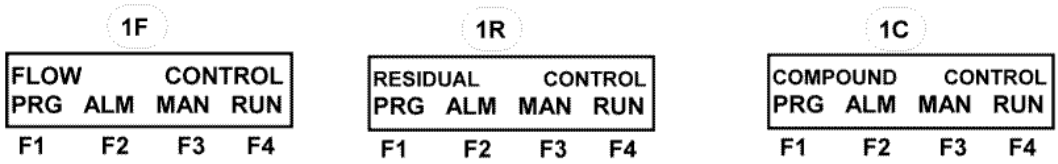
DURING A POWER OUTAGE (ONLY), THE AUTOVALVE MAY BE MANUALLY REPOSITIONED BY TURNING THE EXPOSED GEARS BY HAND. DO NOT TURN THE EXPOSED GEARS OR SHAFTS AGAINST BY HAND WHILE THE UNIT IS POWERED. THIS MAY CAUSE HARDWARE DAMAGE, WHICH IS NOT COVERED BY WARRANTY.

4.4.4.1 When all of the previous installation & startup procedures have been completed, then apply main power to the AutoValve controller.

4.4.4.2 A series of opening screens will appear with information about the firmware version, etc.

4.4.4.3 After a few seconds the main control screen will appear, if this is the first time you have powered up the controller and have not previously turned off power in the “RUN” condition.

The main control screen will show the Control Mode which was last set: either FLOW, RESIDUAL, or COMPOUND LOOP [1F, 1R or 1C] (see the screens below).



NOTE

If this is not the first time you are turning on power to the AutoValve, the opening screen will default to the last screen which was open before the power was turned off - normally FLOW CONTROL, which is set at the factory (unless requested otherwise).

4.4.4.4 Proceed to **SECTION 5.1** for instructions regarding use of the PASSWORD SYSTEM.

4.4.4.5 Set the Control Mode you wish to use: FLOW, RESIDUAL or COMPOUND, following the instructions in **SECTION 5.2**.

5.0 PROCEDURES COMMON TO ALL CONTROL MODES

*(See the Menu System Flow Diagram in the **APPENDIX** for a complete overview, and to help in navigating through the various levels of the AutoValve user interface. All menus shown in this manual are numbered to correspond with menus on the Menu System Flow Diagram).*

5.1 PASSWORDS (*READ CAREFULLY*)

5.1.1 The SUPERIOR AutoValve has a two (2) level password protection system built into the user interface menu structure. One password can be set for programming operations, and another (or the same) password can be set to allow changes in alarm set points, or residual or flow dosage set points. This allows supervisory and/or management personnel to choose whether or not to allow access to some or all operations personnel. It is designed to prevent unauthorized persons from changing the programming settings (calibration & residual settings), the alarm settings, and the dosage & residual setpoints. Either of these passwords may be independently set, or may both be the same.

5.1.2 **IMPORTANT!!!** Once a password has been set, it cannot be changed unless the old password is entered first. It is strongly suggested that a master copy of all passwords be kept in a secure place. If any password is forgotten, you will be effectively locked out of that section of the menu system. If passwords are not available and changes must be made, the controller will have to be returned to the factory to be "unlocked".

5.1.3 FACTORY DEFAULT PASSWORDS

Default AutoValve passwords, as supplied from the factory, are all set at "0000". **IMPORTANT!!!** It is strongly recommended that new passwords (different from the factory default "0000") be entered as soon as possible to prevent unauthorized setting of a password which will lock out supervisory personnel.

5.1.4 PASSWORD ENTRY SCREENS

All password entry screens are identical in appearance: see "PASSWORD" Menu [2]. When you first encounter the password entry menu, it will appear with the number "0" as the first digit, and an asterisk (✱) in place of the last three digits. You must enter each digit by using the F1 & F2 keys to scroll up & down from 0 to 9. When the proper number appears, press the NXT key (F4). The next number can now be entered in the same manner, pressing the NXT (F4) key when correct. After all four numbers are entered the screen will automatically open the next Menu.

2

PASSWORD 0 ★★★			
UP↑	DWN↓	ESC	NXT
F1	F2	F3	F4

5.1.5 PASSWORD SET/CHANGE SCREENS

5.1.5.1 The two password change screens "SET PW" [26A], are used in an identical manner to the "PASSWORD" Menu [2], above. The asterisk is replaced by a question mark (**?**). The password change menu, "SET NEW PASSWORD" [26], is always shown when exiting from the PROGRAMMING function, or from the ALARM SET function. Pressing the ESC key (F3) aborts the new password setting and exits to the Main Menu [1].

26

SET NEW PASSWORD			
		YES	NO
F1	F2	F3	F4

26A

SET PW 0 ? ? ?			
UP↑	DWN↓	ESC	NXT
F1	F2	F3	F4

5.1.5.2 After the last digit is entered, pressing the ENT key (F4) shows the "NEW PASSWORD STORED" menu [26B, or 33], and then automatically exits to the Main Menu [1].

26B

NEW PASSWORD STORED			
F1	F2	F3	F4

5.1.6 **FUNCTIONS PROTECTED BY PASSWORDS**

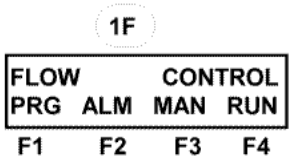
5.1.6.1 PROGRAM Password
CALIBRATION
PROGRAM PARAMETERS
SET MODE

5.1.6.2 ALARM Password
ALARM SET POINT
DOSAGE SET POINT
RESIDUAL SET POINT

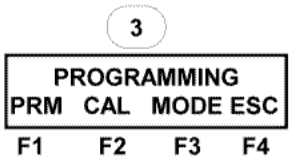
5.2 SET CONTROL MODE

When you view the opening Menu [1F, 1R, or 1C], if the Control Mode shown is not the one you wish to use, proceed as below. If the Control Mode is correct, then skip to **SECTION 5.3 CALIBRATION**.

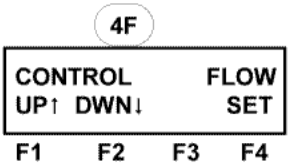
5.2.1 From the opening Menu [1F, 1R, or 1C], press the PRG key (F1).



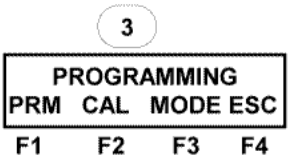
5.2.2 AFTER entering the password (see **SECTION 5.1.4 - PASSWORD ENTRY**) the "PROGRAMMING" Menu [3] opens. Press the MODE key (F3).



5.2.3 The "CONTROL MODE" Menu [4F, 4R, or 4C] opens (Menu 4F shown here). Press the UP (F1) or DWN (F2) key to cycle through the three Control Modes and choose FLOW, for **Flow Proportioning**, RES for **Residual Control**, or COMP for **Compound Loop Control**. When the desired Control Mode is shown, press the SET key (F4).



5.2.3 You will exit back to the "PROGRAMMING" Menu [3], for that Control Mode.



5.3 CALIBRATION

NOTE

AUTOVALVE SERIES 2000 CALIBRATION IS PERFORMED AT THE FACTORY AND IS USUALLY NOT REQUIRED AT INSTALLATION & SETUP FOR THE GREAT MAJORITY OF SYSTEMS.

If you are unsure of whether you need to calibrate your Autovalve before use, contact your dealer or Chemical Injection Technologies, Inc for further assistance.

There are two types of calibration which can be performed:

1. **VALVE LINEARITY** & **SPAN**
2. **INPUT/OUTPUT (I/O) SIGNAL**

VALVE LINEARITY & **SPAN Calibration** is performed at the factory and is generally not needed in the field for most system installations and setups - except if the motorized valve is disassembled or if the AutoValve is restarted in FACTORY DEFAULT mode (by holding the F4 key while turning on power until "FACTORY DEFAULT" appears) - then calibration is required. See instructions in **SECTION 5.3.1 - VALVE LINEARITY & SPAN CALIBRATION.**

INPUT/OUTPUT (I/O) SIGNAL Calibration is performed at the factory and is generally not needed in the field for most installations and setups - except if the milliamp signal generated by your Water Flowmeter or Residual Analyzer does not read 4.0 mA at 0% Flow or Residual, and 20.0 mA at maximum Flow or Residual - then calibration is required. See instructions in **SECTION 5.3.2 - INPUT/OUTPUT CALIBRATION**.

5.3.1 VALVE LINEARITY & SPAN CALIBRATION

Valve Calibration involves matching four (4) separate gas feed rates with their respective water flow meter and/or residual analyzer mA input signals. This automatically allows the valve to determine the linear range between the maximum gas flow desired at the maximum range of the water flow meter, and the "zero flow" point of the gas feed and water flow meter.

IT IS VERY IMPORTANT that the AutoValve system (including the valve plug and remote meter) be sized within a range that is consistent with the maximum expected water flow and gas dosage. If you are unsure of any of these items, contact your dealer or Chemical Injection Technologies, Inc.

NOTE

***** FOR VALVE CALIBRATION, THE GAS FEED SYSTEM MUST BE IN OPERATION *****

Be certain that the ejector is producing sufficient vacuum and that the vacuum ejector is connected to an open gas supply valve.

Valve calibration should only be done with the dosage level set at 100% (FACTORY DEFAULT).

*The gas feed rate (and valve position) should be measured by reading the **remote metering tube**. DO NOT attempt to read the "OPEN" / "CLOSE" markings on the clear plastic cover over the valve shaft - these markings are not calibrated and are for reference purposes only.*

CAUTION

DURING A POWER OUTAGE (ONLY), THE AUTOVALVE MAY BE MANUALLY REPOSITIONED BY TURNING THE EXPOSED GEAR WHEEL BY HAND. DO NOT TURN ANY EXPOSED GEARS OR SHAFTS BY HAND WHILE THE UNIT IS POWERED. THIS MAY CAUSE HARDWARE DAMAGE WHICH IS NOT COVERED BY WARRANTY.

5.3.1.1 From the opening Main Menu [1] press the PRG key (F1).

1F

FLOW			CONTROL
PRG	ALM	MAN	RUN
F1	F2	F3	F4

5.3.1.2 The "PASSWORD" Menu [2] opens. Enter password: see **SECTION 5.1**. After the last password digit is entered, press the ENT key (F4), which will open the "PROGRAMMING" Menu [3].

2

PASSWORD	0	★	★ ★
UP↑	DWN↓	ESC	NXT
F1	F2	F3	F4

5.3.1.3 From the "PROGRAMMING" Menu [3] press the CAL key (F2). This opens the "CALIBRATE" Menu [5].

3

PROGRAMMING			
PRM	CAL	MODE	ESC
F1	F2	F3	F4

5.3.1.4 From the "CALIBRATE" Menu [5], press VLV key (F1), which opens the "SELECT POINT" Menu [6].

5

CALIBRATE			
VLV	OUT	IN	ESC
F1	F2	F3	F4

5.3.1.5 Start by calibrating the "0%" point. This is displayed when you first enter the "SELECT POINT" Menu [6], but you may press the UP or DWN keys to change the percentage point. Press the ADJ key (F3).

6

SELECT	PNT		0%
UP↑	DWN↓	ADJ	ESC
F1	F2	F3	F4

5.3.1.5.1 The "ADJUST PNT 0%" Menu [7] opens. This Menu allows you to <u>electrically</u> adjust the valve position so that the gas flow rate corresponds to the feed rate when the input signal is at 0%.

7

ADJUST	PNT		0%
UP↑	DWN↓	POS	EXT
F1	F2	F3	F4

5.3.1.5.2 Pressing the UP, DWN or POS keys at this point will take you to a Sub-Menu [7A].

7A

ADJUST	PNT		0%
UP↑	DWN↓	SET	EXT
F1	F2	F3	F4

Holding the UP or DWN keys changes the valve position and gas feed rate continuously. Once you have positioned the valve approximately, you can press the UP or DWN keys repeatedly to make fine adjustments.

As a shortcut, pressing the POS key (POSITION) will QUICKLY MOVE the valve to the "test" position, which will normally be close to the setting being tested. However, once you press the UP or DWN keys you can no longer use this shortcut, since you are immediately taken to Sub-Menu [7A].

5.3.1.5.3 When the gas feed rate indicated on the remote meter tube is at the correct 0% feed rate, press the SET key (F3), which will take you back to the "SELECT PNT" Menu [6].

6

SELECT	PNT		0%
UP↑	DWN↓	ADJ	ESC
F1	F2	F3	F4

NOTE

YOU MUST SET AT LEAST THE 0% AND 100% VALVE POSITIONS; HOWEVER, IT IS HIGHLY RECOMMENDED THAT <u>ALL FOUR</u> VALVE POSITIONS BE SET WHENEVER CALIBRATING THE AUTOVALVE.

If you do not set at least the 0% and 100% positions, an error message: "CALIBRATION ERR: NO SPAN EST" will be displayed, followed by the message, "RESTORING LAST CALIBRATION".

Note that the "100%" feed rate position <u>does not</u> necessarily mean a reading of 100% full-scale on the gas remote meter. It refers to the gas feed you expect to be using when the water flow meter input mA signal is at 100%. This also applies for the 25% & 50% feed rate positions as well.

5.3.1.6 The procedure for calibrating the remaining valve settings is identical to that just performed for the "0%" point (see **SECTION 5.3.1.5**).

From the "SELECT PNT" Menu [6], **REPEAT** the same calibration procedure as before for the 25%, 50%, and 100% feed rate positions. Press the UP or DOWN keys to change the feed rate position ("X%"). Menus [8],[9],[10] and Sub-Menus [8A],[9A],[10A] will all open in turn.

5.3.1.7 After calibrating all four valve positions (after pressing the SET (F3) key for the last set point) you return to the "SELECT PNT" Menu [6].

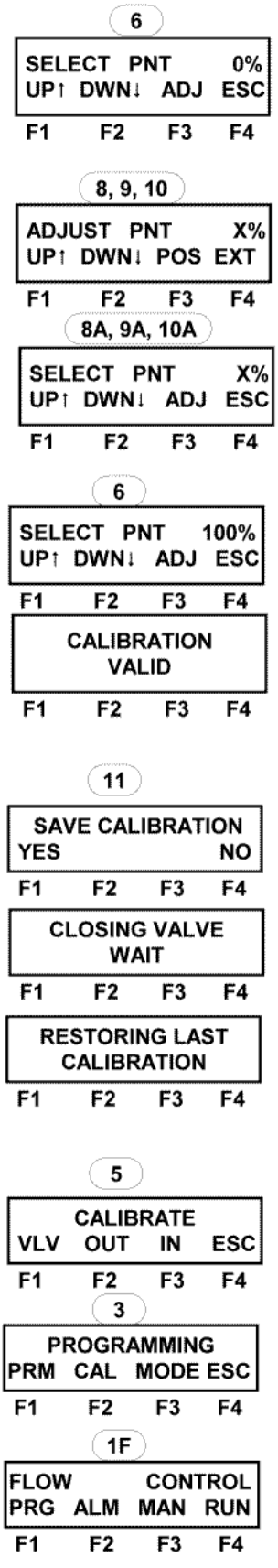
Press the ESC key (F4). The "CALIBRATION VALID" screen will show briefly, then the system goes to the "SAVE CALIBRATION" Menu [11].

5.3.1.8 From the "SAVE CALIBRATION" Menu [11], press the YES key (F1) to accept the calibration procedure. If you decide that you would like to retain the previous calibration press the NO key (F4).

5.3.1.8.1 Pressing the YES key (F1) shows the "CLOSING VALVE WAIT" Screen, the valve will run down to the 0% position, and then the system will go to the "CALIBRATE" Menu [5].

5.3.1.8.2 Pressing the NO key (F4) shows the "RESTORING LAST CALIBRATION" Screen, and the system will go to the "CALIBRATE" Menu [5].

5.3.1.9 Press the ESC key (F4) on the "CALIBRATE" Menu [5], and then press the ESC key (F4) on the "PROGRAMMING" Menu [3] to exit out to the Main Control Menu [1].



5.3.2 INPUT SIGNAL CALIBRATION

NOTE

INPUT SIGNAL CALIBRATION IS PERFORMED AT THE FACTORY AND IS NOT REQUIRED FOR MOST SYSTEM INSTALLATIONS & SETUPS.

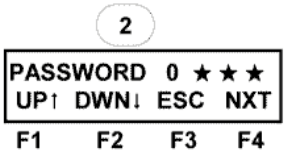
This procedure calibrates <u>both</u> Flow Signal input and Residual Analyzer Signal input, regardless of the Control Mode. If only a Flow Signal input is connected, there is no need to calibrate the Residual Signal input, and vice versa. You must calibrate both inputs only for Compound Loop Control Mode.

Calibration of Input and Output signals requires the use of accurate electronic test instruments. Calibration of Input & Output signals should only be performed by experienced electronics technicians. The following technical information is for general information only - it implies no warranty of any kind.

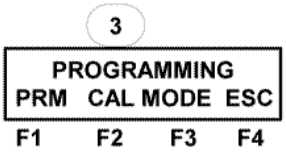
CAUTION
DO NOT APPLY ANY VOLTAGE PRODUCING ELECTRONICS TO THE INPUT TERMINALS. THEY ARE DESIGNED FOR 4-20 mA SIGNAL ONLY.

5.3.2.1 From the opening Main Menu [1] press the PRG key (F1).

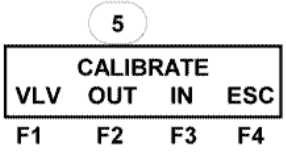
5.3.2.2 The "PASSWORD" Menu [2] opens. Enter password: see **SECTION 5.1**. After the last password digit is entered, press the ENT key (F4), which will open the "PROGRAMMING" Menu [3].



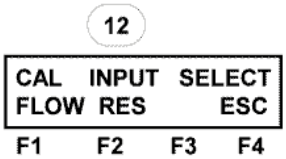
5.3.2.3 From the "PROGRAMMING" Menu [3] press the CAL key (F3).



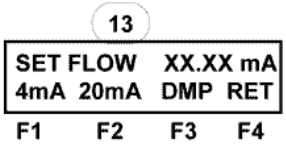
5.3.2.4 The "CALIBRATE" Menu [5] opens. Press the IN key [F3].



5.3.2.5 The "CAL INPUT SELECT" Menu [12] opens. To calibrate the **FLOW METER INPUT** signal press the FLOW key (F1).

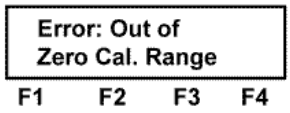


5.3.2.5.1 The "SET FLOW" Menu [13] opens. The XX.XX mAC reading will show the mA input signal from your test device source. Set the source signal at 4 mA, then press the 4mA key (F1) to store the signal into memory. Set the source signal at 20mA, then press the 20mA key (F2) to store the signal into memory.

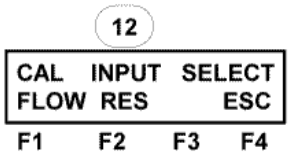


NOTE

If the test device signal differs greatly from the 4 mA setting, a "ERROR: OUT OF ZERO CAL. RANGE" message is displayed. Likewise for a "ERROR: OUT OF SPAN CAL. RANGE" message at the 20 MA setting. Check the test device to ensure the correct signals are being generated.



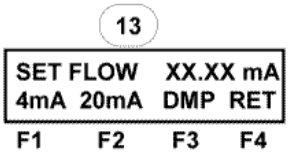
5.3.2.5.2 When the inputs are set for both 4mA and 20mA settings, press RET key (F4) to go back to the "CAL INPUT SELECT" Menu [12].



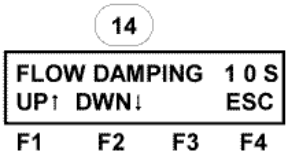
NOTE

Under normal operating conditions, there is no need to adjust the Flow Damper factory setting. Before adjusting, it is recommended that you contact Chemical Injection Technologies, Inc. for assistance.

5.3.2.5.2.1 From the "SET FLOW" Menu [13], you may adjust the input signal sensitivity "Damper", by pressing the DMP key (F3).

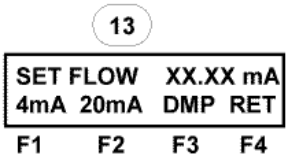


After pressing the DMP key (F3) the "FLOW DAMPING" Menu [14] opens.

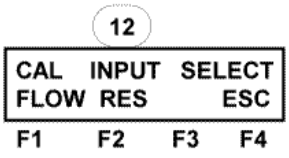


The flow damper adjusts the sensitivity of the valve electronics to changes in the input mA flow signal. The higher the number shown, the less sensitive the valve will be to small changes in the input flow signal. The lower the number shown, the more sensitive the valve will be to small changes in the input flow signal.

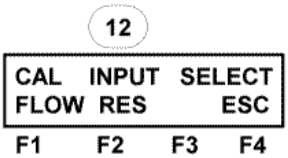
5.3.2.5.2.2 Press the SET key (F4] to return to the "SET FLOW" Menu [13].



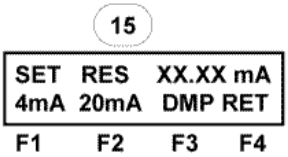
Press the RET key [F4] to go back to the "CAL INPUT SELECT Menu [12].



5.3.2.6 To calibrate the **RESIDUAL ANALYZER INPUT** signal press the RES key (F2) on the "CAL INPUT SELECT" Menu [12].



5.3.2.6.1 The Residual Analyzer procedure is identical to the Flow Meter procedure, except for the "SET RES" Menu [15] name.



Follow the same instructions in **SECTION 5.3.2.5** which were used to calibrate the Flow Meter Input signal.

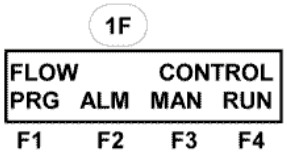
5.3.3 OUTPUT SIGNAL CALIBRATION

NOTE
OUTPUT SIGNAL CALIBRATION IS PERFORMED AT THE FACTORY AND IS NOT REQUIRED FOR MOST SYSTEM INSTALLATIONS & SETUPS.

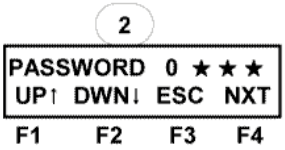
Calibration of Input and Output signals requires use of accurate electronic test instruments. Calibration of Input & Output signals should only be performed by experienced electronics technicians. The following technical information is for general information only. It implies no warranty of any kind.

CAUTION
DO NOT APPLY ANY VOLTAGE PRODUCING ELECTRONICS TO OUTPUT TERMINALS. THEY ARE DESIGNED TO SEND A 4-20 mA SIGNAL ONLY.

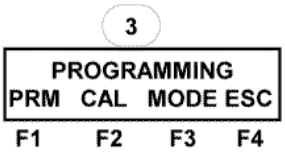
5.3.3.1 From the opening Main Menu [1] press the PRG key (F1).



5.3.3.2 The "PASSWORD" Menu [2] opens. Enter password: see **SECTION 5.1**. After the last password digit is entered, press the NXT key (F4), which will open the "PROGRAMMING" Menu [3].

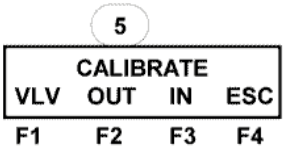


5.3.3.3 From the "PROGRAMMING" Menu [3] press the CAL key (F3).

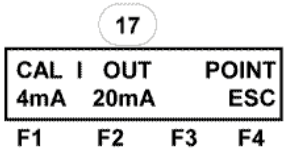


5.3.3.4 The "CALIBRATE" Menu [5] opens. Press the OUT key (F2).

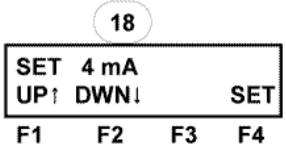
At this point you must have an accurate mA current meter connected across the "OUT 4-20mA" output terminals.



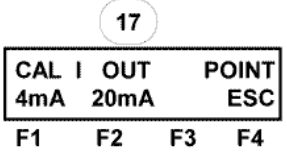
5.3.3.5 The "CAL I OUT POINT" Menu [17] opens. Press the 4mA key (F1).



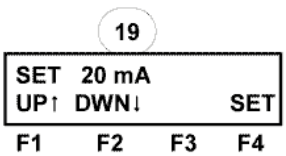
5.3.3.5.1 The "SET 4mA" Menu [18] opens. Press the UP (F1) or DOWN (F2) keys until the meter reads 4mA. Press the SET key (F4).



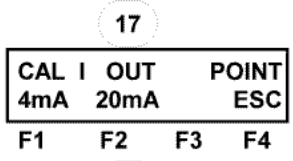
5.3.3.5.2 The "CAL I OUT POINT" Menu [17] opens. Press the 20mA key (F2).



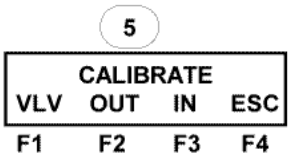
5.3.3.5.3 The "SET 20mA" Menu [19] opens. Press the UP (F1) or DOWN (F2) keys until the meter reads 20mA. Press the SET key (F4).



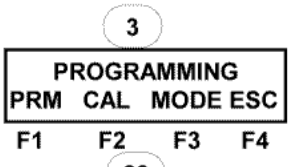
5.3.3.5.4 The “CAL I OUT POINT” Menu [17] opens.

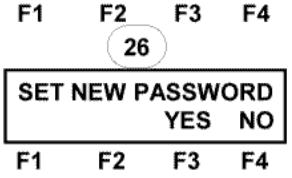


Press the ESC key (F4) to return to the “CALIBRATE” Menu [5].

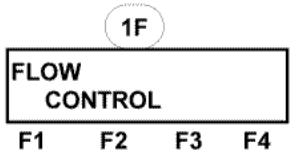


Press the ESC key (F4) again to return to the “PROGRAMMING” Menu [3].





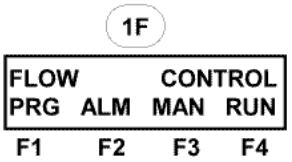
Press the ESC key (F4) and exit through the “SET NEW PASSWORD” Menu [26], back to the Main Menu [1].



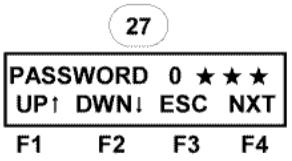
5.4 ALARM SET POINTS

The AutoValve Series 2000 is designed to allow you to set independent alarm conditions for Low Flow Signal and Residual Deviation, depending on the Control Mode. When an alarm condition, or “event”, occurs, a relay is energized which either opens or closes a set of contacts on the Terminal Board. You may choose whether you wish these contacts to be Normally Open (N/O) or Normally Closed (N/C) when the relay is *NOT* energized by an alarm “event”. These contacts can be used as a switch to turn on an external device requiring up to 240 VAC. See the **WIRING DIAGRAM (FIGURE 4.2)** in the **APPENDIX** for an example.

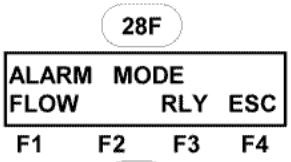
5.4.1 From the opening Main Menu [1] press the ALM key (F2).



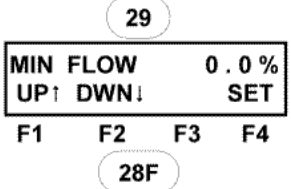
5.4.2 The “PASSWORD” Menu [27] opens. Enter password: see **SECTION 5.1.** After the last password digit is entered, press the NXT key (F4).

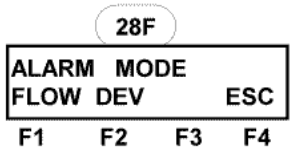


5.4.3 The “ALARM MODE” Menu [28] opens. You may choose one of two alarm set points, depending on the Control Mode, and whether you wish the alarm contacts to be Normally Open (NO) or Normally Closed (NC):



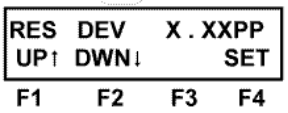
5.4.3.1 **FLOW (F1)** will open the “MIN FLOW” Menu [29], in the Flow Control and Compound Loop Control Modes. You can set the percentage (%) of maximum water flow input signal at which you wish the alarm relay to be activated, by pressing the UP (F1) or DOWN (F2) keys. When the minimum flow percentage is correct, press the SET key (F4). This will take you back to the “ALARM MODE” Menu [28].





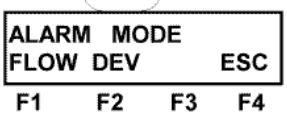
5.4.3.2 **DEV (F2)** opens the Residual Deviation "RES DEV" Menu [30], in the Residual Control and Compound Loop Control Modes. You can set the amount of deviation from the Residual Set Point, in Parts per Million (PPM or mg/L), at which you wish the alarm relay to activate by pressing the UP (F1) or DOWN (F2) keys.

30



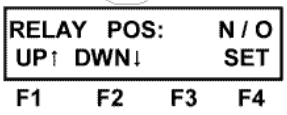
When the Residual Deviation amount is correct, press the SET key (F4) to return back to the "ALARM MODE" Menu [28]

28R

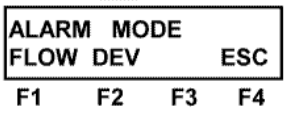


5.4.3.3 **RLY (F3)** will open the "RELAY POLARITY" Menu [39], in all Control Modes. When an alarm condition, or "event", occurs, a relay is energized which either opens or closes a set of contacts on the Terminal Board. You may choose whether you wish these contacts to be Normally Open (N/O) or Normally Closed (N/C) when the relay is *NOT* energized by an alarm "event". Press the UP (F1) or DOWN (F2) keys to change the contact status to N/O or N/C **(NOTE: The factory default setting is N/O**). When the RELAY status is correct, press the SET key (F4) to return to the "ALARM MODE" Menu [28]

39



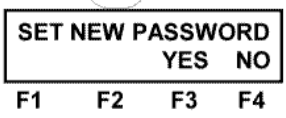
28R



5.4.4 To exit Alarm Mode, press the ESC key (F4) on "ALARM MODE" Menu [28].

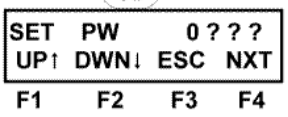
5.4.5 The "SET NEW PASSWORD" Menu [31] opens. If you do not wish to change the password for the ALARM section and the RUN section of the program, press the NO key (F4). This will exit back to the opening Main Menu [1].

31



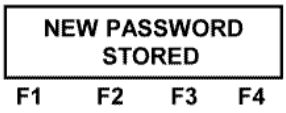
5.4.5.1 If you wish to set a new password, press the YES key (F3). This will open the "SET PW" Menu [32]. Use the UP (F1) or DWN (F2) keys to change the digits. When correct, press the NXT key (F4) to move to the next digit.

32

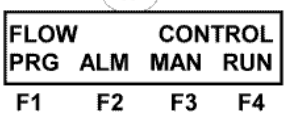


When all four digits are correct, pressing the (F4) key will show the "NEW PASSWORD STORED" screen [33] and exit back to the opening Main Menu [1].

33



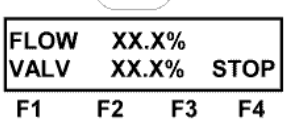
1F



5.4.6 **ALARM INDICATION**

When an alarm "event" occurs (LOW FLOW or RESIDUAL DEVIATION) and the alarm relay is activated, the screen display shows the parameter causing the alarm by "FLASHING" the value on the automatic run mode screen [38F, 38R or 38C]. A LOW FLOW Alarm screen [38F] is shown as an example at right.

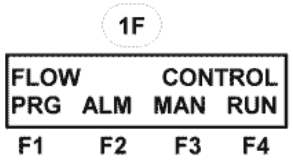
38F



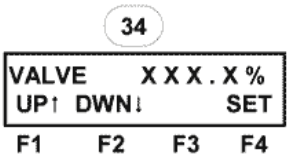
6.0 MANUAL CONTROL

6.1 The SUPERIOR AutoValve Series 2000 can also be operated in MANUAL mode. When using the Manual Control mode, all input signals are ignored.

6.2 You may enter the Manual Control mode from any of the three (3) automatic control opening Main Menus [1F, 1R, or 1C]. Press the MAN key (F3).

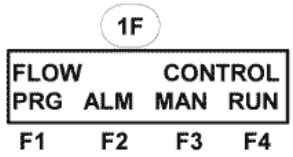


6.3 The "VALVE" Menu [34] opens. You may adjust the valve position to change the gas feed rate to any point you require by pressing the UP (F1) or DWN (F2) keys.

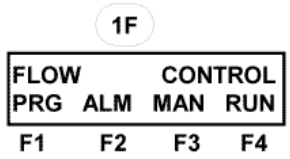


The valve position setting will move very slowly at first, then it will move much more quickly to allow you to rapidly approach the desired value. Then press the UP (F1) or DWN (F2) keys repeatedly to make fine adjustments to the value.

6.4 Pressing the SET key (F4) will exit the "VALVE" Menu [34] and take you back to the opening Main Menu [1F, 1R, or 1C]. The valve will continue to feed gas at the rate which was set in the MANUAL mode, until the RUN key (F4) is pressed to return to Automatic Control.



7.0 FLOW PROPORTIONING CONTROL



Follow the procedures in this section AFTER you have set the Control Mode to FLOW. See **SECTION 5.2 - SET CONTROL MODE**, if your opening Main Menu [1] does not indicate FLOW CONTROL [1F] as shown at right.

Read instructions for PASSWORDS, CALIBRATION, and ALARM SET POINTS - see **SECTION 5.0 - PROCEDURES COMMON TO ALL CONTROL MODES** before use.

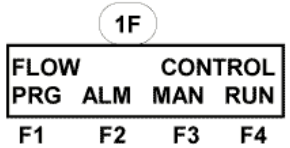
7.1 CALIBRATION

NOTE

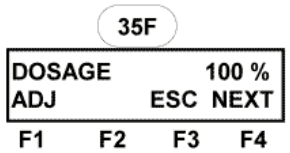
AUTOVALVE SERIES 2000 CALIBRATION IS PERFORMED AT THE FACTORY AND IS USUALLY NOT REQUIRED PRIOR TO USE, UNLESS THE 100% FEED RATE FOR YOUR SYSTEM DIFFERS FROM THE MAXIMUM FEED RATE OF THE METERING TUBE YOU ARE USING.

VALVE LINEARITY & SPAN Calibration should be performed if the motorized valve is disassembled, or if restarting the AutoValve in FACTORY DEFAULT mode (by holding the F4 key while turning on power until "FACTORY DEFAULT" shows on screen). See **SECTION 5.3** for Calibration instructions if required.

7.2 RUN

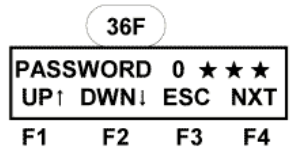


7.2.1 From the "FLOW CONTROL Menu [1F], press the RUN key (F4).



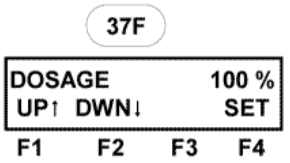
7.2.2 The "DOSAGE" Menu [35F] opens, which allows you to choose whether to change the current dosage setting, or go directly to the automatic Flow Proportioning Control operation "FLOW" Menu [38F], described below.

7.2.2.1 To change the current DOSAGE setting, press the ADJ key (F1).



7.2.2.1.1 The "PASSWORD" Menu [36F] opens. Enter the password - see **SECTION 5.1.4 - PASSWORD ENTRY SCREENS**

7.2.2.1.2 After entering the last password digit, and pressing the F4 key the "DOSAGE" Menu [37F] opens.



7.2.2.1.3 Use the UP (F1) or DWN (F2) keys to adjust the Dosage Setting to any number between 50% and 200%, covering a 4 to 1 range. See **SECTION 2.1 - FLOW PROPORTIONING CONTROL** for a full discussion of "Dosage".

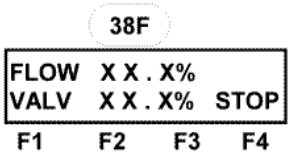
NOTE

The FACTORY DEFAULT setting is 100%, representing a 1:1 ratio.

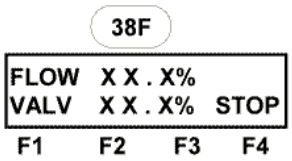
This is the setting where all initial valve adjustments should be made.

If the residual levels are either too high or too low, the dosage can be lowered or raised, respectively. The controller will automatically adjust the gas feed range to the dosage change. Keep in mind that if the water flow reaches 100% of the flow meter's capacity, and the 20 mA input signal has been calibrated to the maximum gas feed rate available for your valve, then increasing the dosage above 100% will NOT allow the valve to properly adjust the gas feeding range. This is because the valve will "top out" at the maximum feed rate of the valve plug before the feed rate required by the flow meter input signal is reached.

7.2.2.1.4 When the DOSAGE setting is correct, press the SET key (F4). This will open the FLOW Menu [38F].



7.2.3 At FLOW Menu [38F] the valve is in **Automatic Flow Proportioning Control**.



7.2.3.1 The input signal from the water flow meter will be shown next to FLOW as a percentage of the maximum flow rate measured by the flow meter.

7.2.3.2 The valve position will be shown next to VALV as a percentage of the maximum calibrated valve opening.

7.2.3.3 It is important that you understand the relationship of the FLOW and VALV values shown on Menu [38F].

At a DOSAGE setting of 100%, the two percentages shown will always be equal AFTER the valve adjusts to any change in water flow. When the water flow changes, the FLOW value will immediately increase or decrease, then the VALV value will start to increase or decrease until it matches the FLOW value.

HOWEVER, when the dosage setting is changed to some value other than 100%, then the VALV value will NOT MATCH the FLOW value, but will be offset by the dosage setting.

Examples:

At a Dosage setting of 100%, if the FLOW value is 50%, then the VALV value will also show as 50%.

At a dosage setting of 200%, the VALV value will increase to 100%.

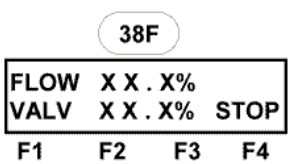
At a dosage setting of 75% the VALV value will only show 37.5%.

NOTE

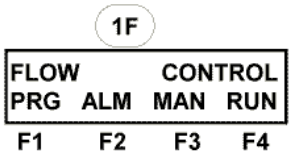
If you have previously used the Autovalve in Residual or Compound Loop Control Modes, or if you entered these Control Modes and then switched to back to Flow Proportioning Mode, it is likely that the Dosage Setting will change. This is because the other Control Modes automatically make adjustments by varying the Dosage Setting. The Dosage Setting in any one Control Mode will be carried over into all of the other Control Modes.

IF YOU EXPECT THE FLOW AND VALVE VALUES TO MATCH, BUT THEY DO NOT, CHECK THAT YOUR DOSAGE SETTING IS AT 100%.

7.3 STOP



7.3.1 To exit the Automatic Valve Control mode from the FLOW Menu [38F] press the STOP key (F4).



7.3.2 This will take you back to the main “FLOW CONTROL” Menu [1F].

8.0 RESIDUAL CONTROL (Chlorination and De-Chlorination)

Follow the procedures in this section AFTER you have set the Control Mode to RES. See **SECTION 5.2 SET CONTROL MODE**, if your opening Main Menu [1] does not indicate RESIDUAL CONTROL [1R], shown at right.

1R

RESIDUAL		CONTROL	
PRG	ALM	MAN	RUN
F1	F2	F3	F4

Read instructions for PASSWORDS, CALIBRATION, and ALARM SET POINTS - see **SECTION 5.0, PROCEDURES COMMON TO ALL CONTROL MODES**, before use.

8.1 CALIBRATE

NOTE

AUTOVALVE SERIES 2000 CALIBRATION IS PERFORMED AT THE FACTORY AND IS USUALLY NOT REQUIRED PRIOR TO USE.

VALVE LINEARITY & SPAN Calibration should be performed if the motorized valve is disassembled, or if restarting the AutoValve in FACTORY DEFAULT mode (by holding the F4 key while turning on power until "FACTORY DEFAULT" shows on screen). See **SECTION 5.3** for Calibration instructions.

8.2 PROGRAM

You must make certain settings in the PROGRAMMING section which tell the AutoValve about your specific installation.

The FACTORY DEFAULT settings SHOULD NOT always be used as an indicator of "ideal" settings, although in some instances they MAY happen to be correct for your installation. See the NOTES in each section.

The PROGRAMMING section for **Residual Control Mode** is also used for **Compound Loop Control Mode** with the use of VARIABLE LAG setting.

8.2.1 From the main "RESIDUAL CONTROL" Menu [1R] press the PRG key (F1).

1R

RESIDUAL		CONTROL	
PRG	ALM	MAN	RUN
F1	F2	F3	F4

8.2.2 The "PASSWORD" Menu [2] opens. Enter the password (see **SECTION 5.1.3 - PASSWORD ENTRY SCREENS**, for instructions).

2

PASSWORD		0 ★ ★ ★	
UP↑	DWN↓	ESC	NXT
F1	F2	F3	F4

8.2.3 After entering the last password digit, and pressing the F4 key the "PROGRAMMING" Menu [3] opens. Press the PRM key (F1).

3R

PROGRAMMING			
PRM	CAL	MODE	ESC
F1	F2	F3	F4

8.2.4 This enters you into several Settings Menus (see the **Menu Flow Diagrams** in the Appendix), which you may scroll through by using the UP (F1) and DWN (F2) keys.

Within each of these Settings Menus you can choose to enter a Sub-Menu in order to change the Setting value. Sub-Menus are similar to the Setting Menus, but instead of the ESC (F4) key, they have a SET (F4) key and do not have a ADJ (F3) key.

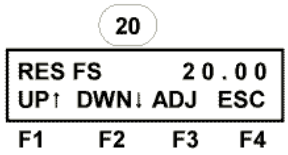
When you leave the Settings Menus, the program remembers the last Menu you exited, and returns to that Menu the next time you enter Settings. Each Settings Menu is discussed in the order in which it appears.

NOTE

The first Menu may not appear on your screen in the order shown, but the Menus will cycle back again as you scroll. Press the ESC (F4) key on any Setting Menu to exit back to the "PROGRAMMING" Menu [3]

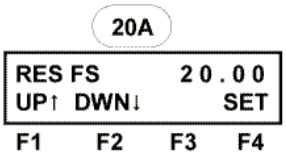
8.2.4.1 **RES FS** [20]

The "RES FS" Menu [20] refers to RESIDUAL FULL SCALE. You must set the maximum chlorine residual level which your analyzer indicates at 20 mA output. The residual level is shown as Parts Per Million (PPM), which also indicates Milligrams per Liter (mg/L).



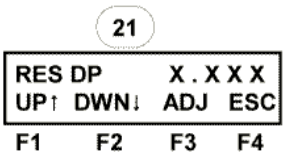
8.2.4.1.1 To change "RES FS" setting, press the ADJ (F3) key.

8.2.4.1.2 The "RES FS" Adjustment Sub-Menu [20A] opens. Use the UP (F1) or DWN (F2) keys to change the setting. When correct, press the SET (F4) key to exit to the "RES FS" Setting Menu [20].



8.2.4.2 **RES DP** [21]

The "RES DP" Menu [21] allows you to change the number of decimal points used in setting the residual. This number can be set from ZERO decimal points up to THREE decimal points.

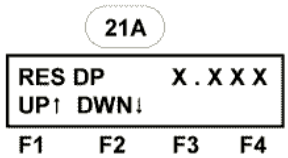


NOTE

Changing the number of decimal points affects all Residual Setpoints and readouts. If you change decimal points, you must also adjust Residual Setpoint and Residual Full Scale Setting.

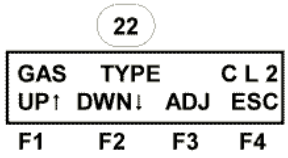
8.2.4.2.1 To change "RES DP" setting press the ADJ (F3) key.

8.2.4.2.2 The "RES DP" Adjustment Sub-Menu [21A] opens. Use the UP (F1) or DWN (F2) keys to change the setting. When correct, press the SET (F4) key to exit to the "RES DP" Setting Menu [21].



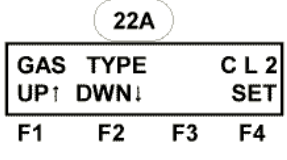
8.2.4.3 **GAS TYPE** [22]

The "GAS TYPE" Menu [22] selects if you are feeding Chlorine or Sulfur Dioxide gas. If you choose Sulfur Dioxide (SO_2), the AutoValve is automatically in DE-CHLORINATION control mode.



8.2.4.3.1 To change the "GAS TYPE" setting press ADJ (F3).

8.2.4.3.2 The "GAS TYPE" Adjustment Sub-Menu [22A] opens. Use the UP (F1) or DWN (F2) keys to change the setting. When correct, press the SET (F4) key to exit to "GAS TYPE" Setting Menu [22].



8.2.4.4 **P(GAIN)** [23]

The "P(GAIN)" Menu [23] allows you to choose the sensitivity of the controller to residual changes. If you are unfamiliar with this concept, read **SECTION 2.3.3 P(GAIN)**, for a detailed explanation.

The P(GAIN) can be set anywhere within a range of 0% to 1000%.

23

P (GAIN)	1 0 0 %
UP↑ DWN↓ ADJ	ESC
F1 F2 F3	F4

NOTE

The FACTORY DEFAULT 100% setting is the best starting point *from which to observe the control system's response to residual variations and then make further adjustments if needed.*

Lowering this value reduces the sensitivity, while increasing the value makes the controller react more quickly, but in bigger steps.

If residual levels rise too much before the control system brings them back to the set point, try increasing the P(GAIN) setting. If residual levels are fluctuating up and down around the set point, then try decreasing the P(GAIN) setting.

8.2.4.4.1 To change the "P(GAIN)" setting press ADJ (F3).

8.2.4.4.2 The "P(GAIN)" Adjustment Sub-Menu [23A] opens. Use the UP (F1) or DWN (F2) keys to change the setting. When correct, press the SET (F4) key to exit to the "P(GAIN)" Setting Menu [23].

23A

P (GAIN)	1 0 0 %
UP↑ DWN↓	SET
F1 F2 F3	F4

8.2.4.5 **LAGFIX** [24]

The "LAGFIX" Menu [24] allows you to set the time, in seconds, that it takes for the chlorine or sulfur dioxide gas injected into the water to reach the analyzer, go through the measuring cell, and send the resulting reading back to the AutoValve controller. This value must be calculated based upon the water flow rate in the system, added to the analyzer sampling time. Standard tables are available to determine the speed of travel of water in pipe of various diameters with known water flow rate in gallons per minute, liters per second, etc. The controller will wait this amount of time before making its next adjustment.

24

LAGFIX	1 S
UP↑ DWN↓ ADJ	ESC
F1 F2 F3	F4

NOTE

*The **LAGFIX** Setting is very important for obtaining the maximum control performance of your Series 2000 Autovalve.*

8.2.4.5.1 To change the "LAGFIX" setting press ADJ (F3).

8.2.4.5.2 The "LAGFIX" Adjustment Sub-Menu [24A] opens. Use the UP (F1) or DWN (F2) keys to change the setting. When correct, press the SET (F4) key to exit to the "LAGFIX" Setting Menu [24].

24A

LAGFIX	1 S
UP↑ DWN↓	SET
F1 F2 F3	F4

8.2.4.6 **DEADBAND** [DB]

DB

DEADBAND			0.00
UP↑	DWN↓	ADJ	ESC
F1	F2	F3	F4

The "DEADBAND" Menu [DB] allows you to set the amount of set point deviation, in PPM, which occurs before the controller will react and start taking corrective action. If this value is set at zero (0), the valve will react to minute variations in the residual input signal and may result in constant "hunting" around the set point.

> ***NOTE***
> ***A 0.01 or 0.02 PPM setting usually gives satisfactory results.***
> *If you experience too much valve movement around the set point, set the DEADBAND at a higher number until satisfied.*

8.2.4.6.1 To change the "DEADBAND" setting, press ADJ (F3).

DB1

DEADBAND			0.00
UP↑	DWN↓		SET
F1	F2	F3	F4

8.2.4.6.2 The "DEADBAND" Adjustment Sub-Menu [DB1] opens. Use the UP (F1) or DWN (F2) keys to change the setting. When correct, press SET (F4) key to exit to "DEADBAND" Setting Menu [DB].

> ***NOTE***
>
> *The following two Settings Menus, "**DROPOUT**" and "**LQD CLR**", are very rarely used. They will appear while scrolling through the Settings Menus for Series 2000 AutoValves with firmware version 3.02A/B or later.*
>
> ***Their pre-set FACTORY DEFAULT values should never be changed,** UNLESS specifically recommended for your system installation. If you have any questions, please contact Chemical Injection Technologies.*

8.2.4.7 **DROPOUT**

DROPOUT			0.00
UP↑	DWN↓	ADJ	ESC
F1	F2	F3	F4

The "DROPOUT" Menu allows you to set a minimum signal input (in PPM) below which the controller sees a "Null Input" for the measurement variable. This causes the controller to revert to its default programmed Control Mode for that event; i.e., FLOW PROPORTIONAL or MANUAL Control.

The FACTORY DEFAULT setting of 0.00 is recommended unless specifically advised otherwise for your system installation.

8.2.4.8 **LQD CLR**

LIQ CLR			0hr
UP↑	DWN↓	ADJ	ESC
F1	F2	F3	F4

The "LQD CLR" Menu allows users of a SUPERIOR VacuFeed™ Liquid Chemical Feed System to set parameters for their system.

The FACTORY DEFAULT setting of 0hr should be used for all systems other than a LIQUID FEED system. Refer to Chemical Injection Technologies Installation/Service Bulletin 4006, Appendix C - Special AutoValve Programming, for more information.

3

PROGRAMMING			
PRM	CAL	MODE	ESC
F1	F2	F3	F4

8.2.5 After all PROGRAM Settings have been completed, press the ESC key (F4) on any Settings Menu to exit the Settings Menu and return to the "PROGRAMMING" Menu [3].

1R

RESIDUAL		CONTROL	
PRG	ALM	MAN	RUN
F1	F2	F3	F4

8.2.6 Press ESC (F4) again to exit through the "SET NEW PASSWORD" Menus (**SECTION 5.1.5**) to return to the main "RESIDUAL CONTROL" Menu [1R].

8.3 RUN

8.3.1 From the "RESIDUAL CONTROL Menu [1R], press the RUN key (F4).

1R
RESIDUAL CONTROL
PRG ALM MAN RUN
F1 F2 F3 F4

8.3.2 The "RES SP" Menu [35R] (Residual Set Point) opens. This Menu allows you to choose whether to change the current Residual Set Point, or go directly to the **Automatic Residual Control** operation "FLOW" Menu [38R], described below.

35R
RES SP X.XXX PPM
ADJ ESC NEXT
F1 F2 F3 F4

8.3.2.1 To change the current **Residual Set Point**, press the ADJ key (F1).

36R
PASSWORD 0 ★★★
UP↑ DWN↓ ESC NXT
F1 F2 F3 F4

8.3.2.1.1 The "PASSWORD" Menu [36R] opens. Enter the password (see **Section 5.1.3 PASSWORD ENTRY SCREENS**, for instructions).

8.3.2.1.2 After entering the last password digit and pressing the F4 key the "RES SP" Menu [37R] opens.

37R
RES SP X.XXX PPM
UP↑ DWN↓ SET
F1 F2 F3 F4

8.3.2.1.3 Use the UP (F1) or DWN (F2) keys to adjust the Residual Set Point. The setting can be any number between 0 and the Residual Full Scale setting (RES FS).

8.3.2.1.4 When the Residual Set Point value is correct, press the SET (F4) key. This will open the RES Menu [38R].

38R
RES X.XX SP X.XX
FLOW X.XX% STOP
F1 F2 F3 F4

8.3.3 At the RES Menu [38R] the valve will be in **Automatic Residual Control**.

38R
RES X.XX SP X.XX
FLOW X.XX% STOP
F1 F2 F3 F4

8.3.3.1 The Residual analyzer input signal (RES) is shown in Parts per Million (PPM). The **Residual Set Point** (SP) is shown in Parts per Million (PPM). When there is a difference between these two values, the AutoValve will change the gas feed rate to compensate.

8.3.3.2 The valve position is shown next to VALV as a percentage of the maximum calibrated valve opening.

8.4 STOP

8.4.1 To exit the Automatic Valve Control Mode from the RES Menu [38R] press the STOP key (F4).

38R
RES X.XX SP X.XX
FLOW X.XX% STOP
F1 F2 F3 F4

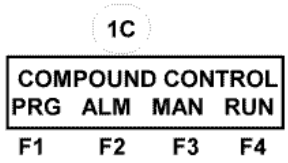
8.4.2 This will take you back to the main "RESIDUAL CONTROL" Menu [1R].

1R
RESIDUAL CONTROL
PRG ALM MAN RUN
F1 F2 F3 F4

9.0 COMPOUND LOOP CONTROL (Chlorination and De-Chlorination)

Compound Loop Control differs only slightly from RESIDUAL CONTROL, in terms of the operator interface. The "behind the scenes" algorithms and other programming (firmware) will not be apparent. Therefore, this section only deals with the few added procedures which are not already covered in **SECTION 8.0 - RESIDUAL CONTROL**. Every topic already discussed in **SECTION 8.0 - RESIDUAL CONTROL** applies equally to COMPOUND LOOP CONTROL.

Follow the procedures in this section after you have set the Control Mode to COMP. See **SECTION 5.2 SET CONTROL MODE**, if your opening Main Menu [1] does not indicate COMPOUND CONTROL [1C] (shown at right).



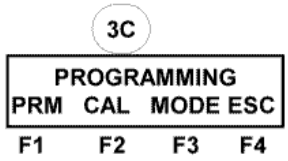
Read the instructions for PASSWORDS, CALIBRATION, and ALARM SET POINTS - see **SECTION 5.0, PROCEDURES COMMON TO ALL CONTROL MODES**, before use.

9.1 PROGRAM

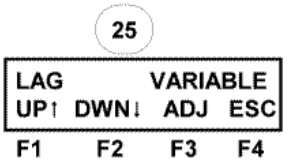
All of the program variables discussed above for Residual Control, including the discussion on De-Chlorination with SO_2 gas, also apply for **Compound Loop Control**, except for the addition of the "**LAG**" type setting. This allows the **LAG TIME** value which was set for a particular water flow rate, to be automatically varied as the water flow rate increases or decreases. By allowing **VARIABLE** LAG TIME the analyzer always "sees" the sample after equal mixing times have taken place.

For example; if the water flow in a pipeline doubles (i.e., a second well pump comes on line) the amount of time it takes for the treated water to reach the analyzer is one-half the previous amount, and the **VARIABLE** setting will automatically adjust the **LAG TIME**. However, in many "open" treatment systems, higher water flow rates do not necessarily increase the speed at which water travels through the system (at least not proportionately) and the **FIXED** setting may also be chosen.

9.1.1 Follow **SECTION 8.2.4 - RESIDUAL CONTROL PROGRAMMING**, starting from the PROGRAMMING Menu [3].



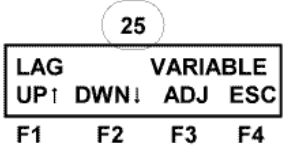
9.1.1.1 After pressing the PRM key (F1) and making any adjustments to the settings shown in RESIDUAL CONTROL, you will see the "LAG" Menu [25]. You may choose a FIXED LAG TIME, or a VARIABLE LAG TIME as mentioned above. To change the method of setting LAG TIME, press the ADJ key (F3).



9.1.1.2 The "LAG" Adjustment Sub-Menu [25A] opens. Use the UP (F1) or DWN (F2) keys to change setting between VARIABLE and FIXED. When the setting is correct, press the SET (F4) key to exit to the "LAG" Setting Menu [25].

9.1.2 If you choose a FIXED LAG TIME , then the LAG Menu [25] will appear as LAG FIXED and no other settings need to be made.

9.1.3 If you choose a VARIABLE LAG TIME, then the LAG Menu [25] appears as LAG VARIABLE.

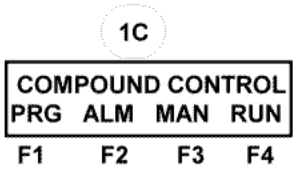


When choosing settings for **VARIABLE LAG TIME**, you must know what the lag time ("LAGVAR") will be at a given water flow rate ("FLOW@VAR"), so that the analyzer always "sees" the sample after equal mixing times have taken place.

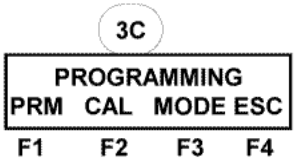
For example; if you set the variable lag time for a percentage of maximum water flow, you must know (or calculate) the lag time (in seconds), at that flow rate.

Let's assume for your system that it requires a lag time of 10 seconds for the treated water sample to reach the analyzer at 50% of the maximum flow rate.

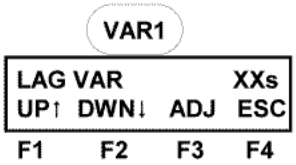
T**wo (2) new Menus** are added to the Settings Menus to allow these values to be set. Start from the opening Main Menu [1C] (in COMPOUND CONTROL).



Press the PRG key (F1) to enter the "PROGRAMMING" Menu [3C], then press the PRM key (F1) to enter into the Settings Menus. Use the UP (F1) and DWN (F2) keys to scroll through the Menus until you reach the following two Menus.

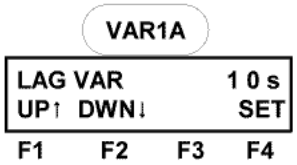


9.1.3.1 **LAG VAR** [VAR1]



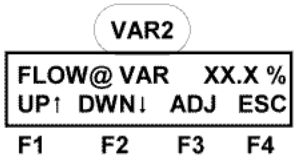
9.3.1.1.1 The "LAG VAR" Menu [VAR1] allows you to choose the Lag Time you use to set the Variable Lag. Press the ADJ (F3) key.

9.3.1.1.2 The "LAGVAR" Adjustment Sub-Menu [VAR1A] opens.



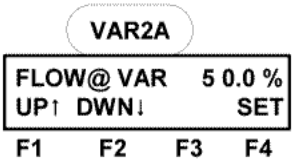
Use the UP (F1) or DWN (F2) keys to change the Lag Time, in seconds, at the water flow you choose for this setting. When the setting is correct (10 sec), press the SET (F4) key to exit to the "LAG VAR" Setting Menu [VAR1].

9.1.3.2 **FLOW@VAR** [VAR2]



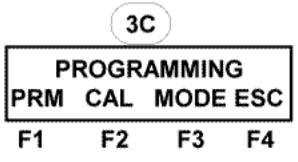
9.1.3.2.1 The "FLOW@VAR" Menu [VAR2] allows you to choose the water flow, in percentage of maximum, which corresponds to the LAG VAR [VAR1] time which you set above. To change this setting press the ADJ (F3) key.

9.1.3.2.1 The "FLOW@VAR" Adjustment Sub-Menu [VAR2A] opens.

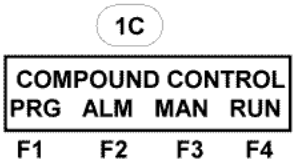


Use the UP (F1) or DWN (F2) keys to change the Water Flow Rate, in percentage of maximum, at the Lag Time you chose (50.0%). When the setting is correct, press the SET (F4) key to exit to the "FLOW@VAR" Setting Menu [VAR2].

9.1.4 After all PROGRAM Settings are complete, press the ESC key (F4) on any of the Settings Menus. This will exit the Settings section and return to the "PROGRAMMING" Menu [3].

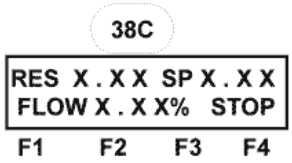


9.1.5 Press ESC (F4) to exit through the "SET NEW PASSWORD" Menus (see **SECTION 5.1.5**) to reach the main "COMPOUND CONTROL" Menu [1C].



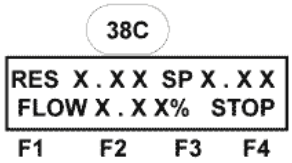
9.2 RUN

All RUN functions are the same in COMPOUND LOOP MODE as in RESIDUAL CONTROL MODE. Follow the procedures in **SECTION 8.3**. When you view the RES Menu [38C], you will also see a FLOW indication, which shows the percentage of the maximum gas feed rate as the flow meter input signal varies.

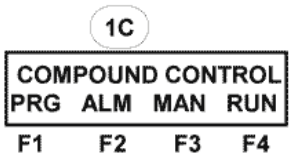


9.3 STOP

9.3.1 To exit the Automatic Valve Control Mode from the RES Menu [38C] press the STOP key (F4).



9.3.2 This will take you back to the main "COMPOUND CONTROL" Menu [1C].



NOTE

If you have specific questions regarding Compound Loop Control programming for your system, please contact your local distributor or Chemical Injection Technologies for further assistance.

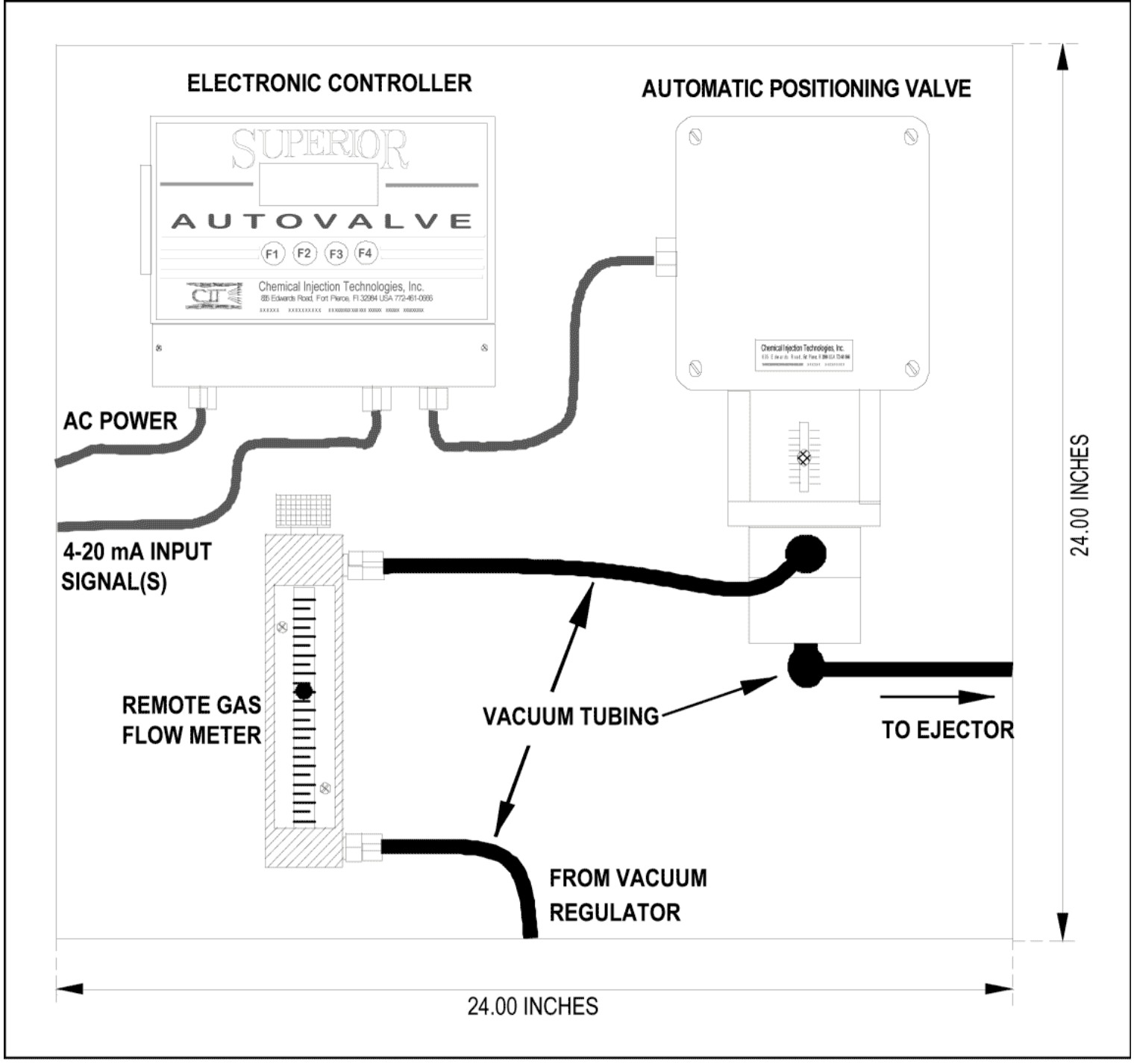


FIGURE 4.1

SUPERIOR
AutoValve Assy

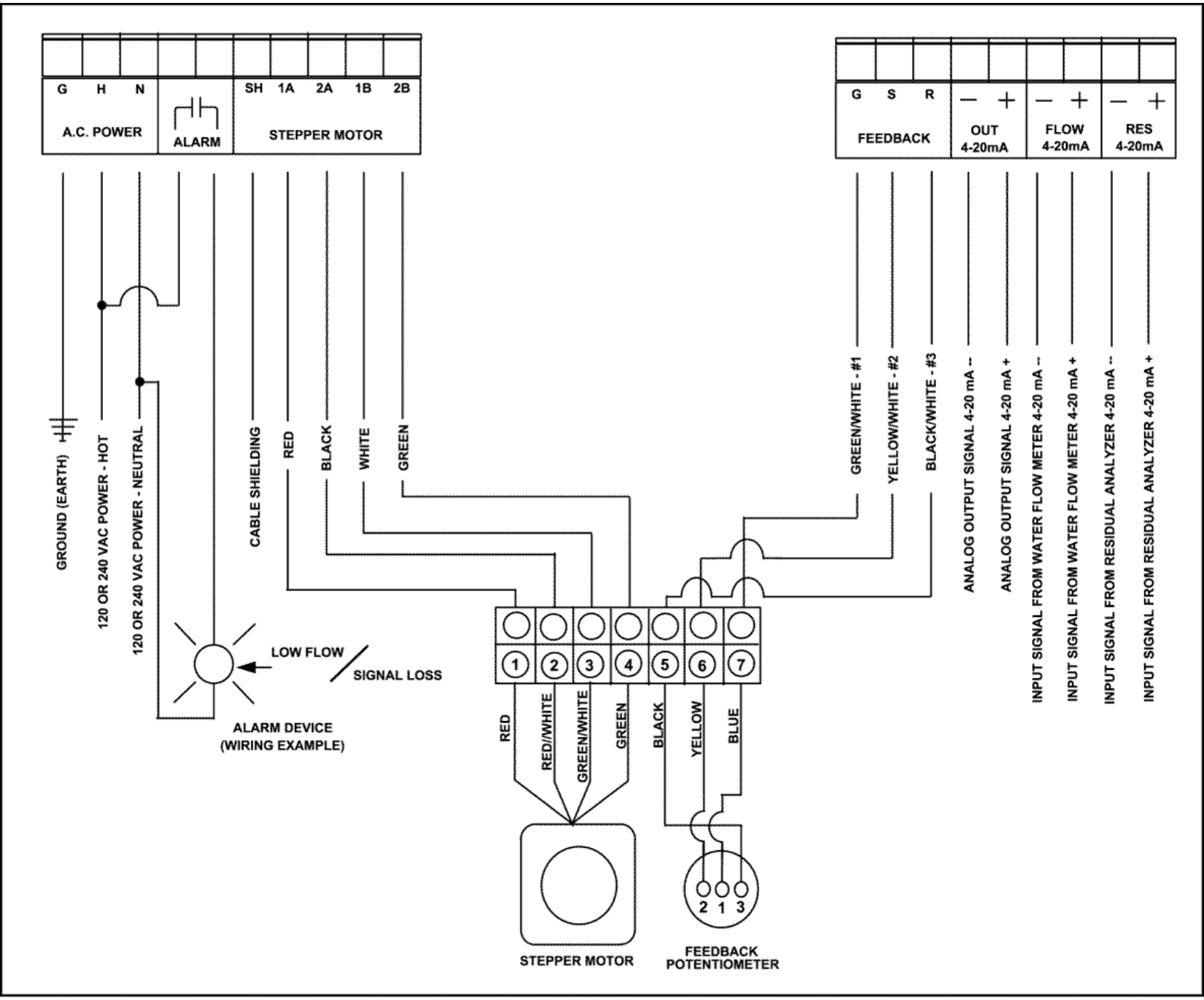
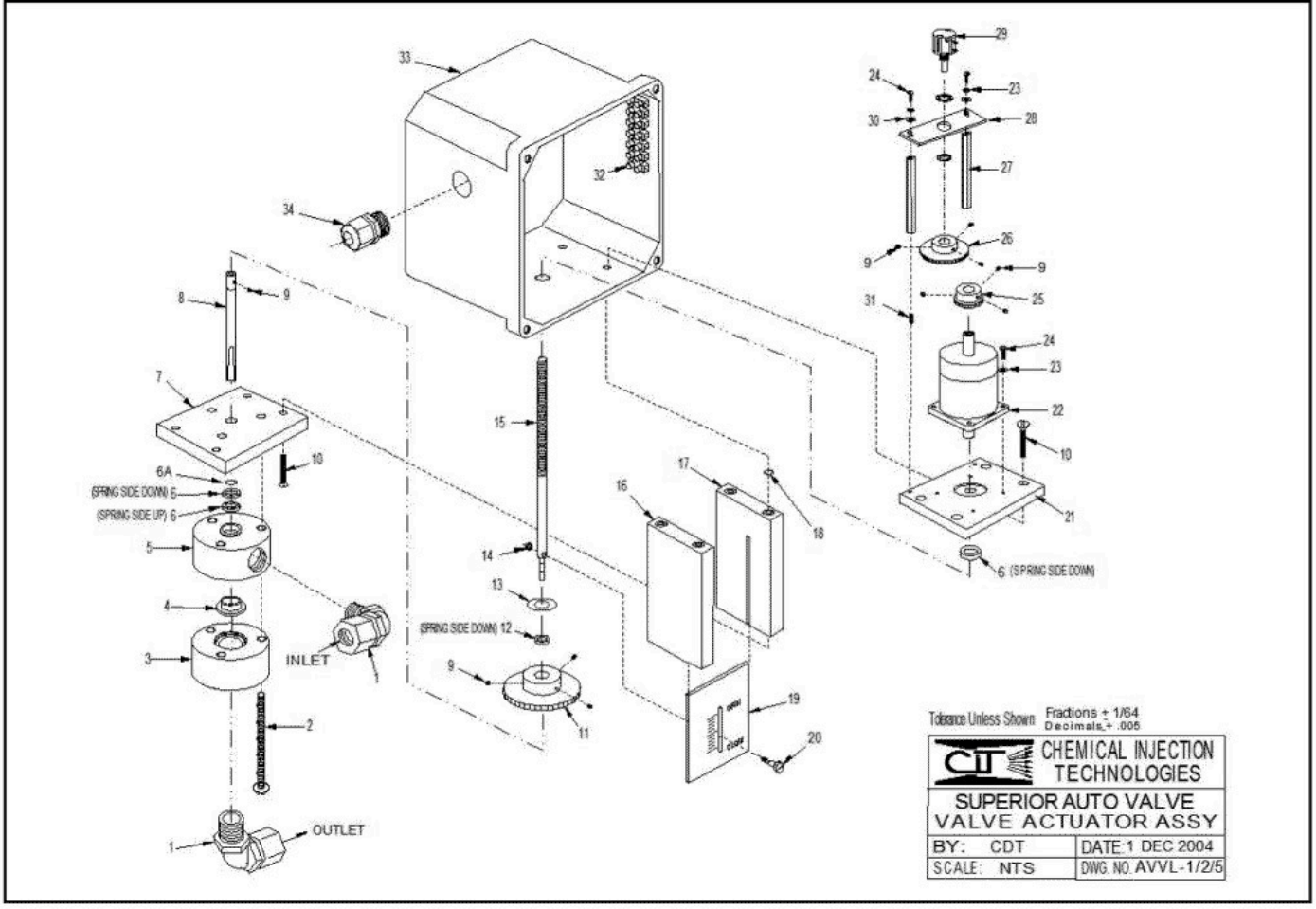


FIGURE 4.2

Simplified Wiring Schematic for AutoValve Assy



Key	QTY	DESCRIPTION	PART NO
1	2	1/4" TUBE X ½" NPT ELL TO 100PPD (2	TU-157
	2	½" TUBE X ½" NPT ELL TO 200 PPD (5 KG/HR)	TU-256
	2	5/8" TUBE X ½" NPT ELL TO 500 PPD (10	TU-556
2	3	1/4-20 UNC X 3 ½" SS RND HEAD MACH	AV-105
3	1	VALVE COVER	AV-001
4	1	VALVE ORIFICE	AV-003
5	1	VALVE BODY	AV-002
6	2	SPRING-ACTIVATED PTFE SEAL (3/8" I.D.)	AV-030
6A	1	VALVE BODY O-RING SEAL	OR-115
7	1	VALVE BODY MOUNTING PLATE	AV-014
8	1	VALVE PLUG ASSEMBLY TO 10PPD(200	AV-200-10
	1	VALVE PLUG ASSEMBLY TO 25PPD(500	AV-200-25
	1	VALVE PLUG ASSEMBLY TO 50PPD(1000	AV-200-50
	1	VALVE PLUG ASSEMBLY TO 100PPD (2	AV-200-100
	1	VALVE PLUG ASSEMBLY TO 200PPD (5	AV-200-200
	1	VALVE PLUG ASSEMBLY TO 500PPD (10	AV-200-500
9	9	4-40 UNC X 3/16" SS SET SCREW	AV-104
9A	1	4-40 UNC X 3/16" TITANIUM SET SCREW	SV-104T
10	8	10-24 UNC X 1 1/4" SS FLAT HD MACH SCREW	AV-101
11	1	HAND WHEEL	AV-008
12	1	SPRING-ACTIVATED PTFE SEAT (1/4" ID)	AV-031
13	1	PTFE FRICTION WASHER	SP-160
14	1	6-32 UNC SS HEX NUT	AV-120
15	1	LEAD SCREW	AV-007
16	1	VALVE SUPPORT PLATE, RIGHT SIDE	AV-016
17	1	VALVE SUPPORT PLATE, LEFT SIDE	AV-017
18	4	SEAL, SUPPORT PLATE TO HOUSING BOX	OR-114
19	1	GUIDE PLATE	AV-009
20	1	INDICATOR SHOULDER SCREW (6-32 UNC)	AV-010
21	1	MOTOR MOUNTING PLATE	AV-015
22	1	LINEAR ACTUATOR MOTOR	AV-100
23	6	SS LOCK WASHER	AV-130

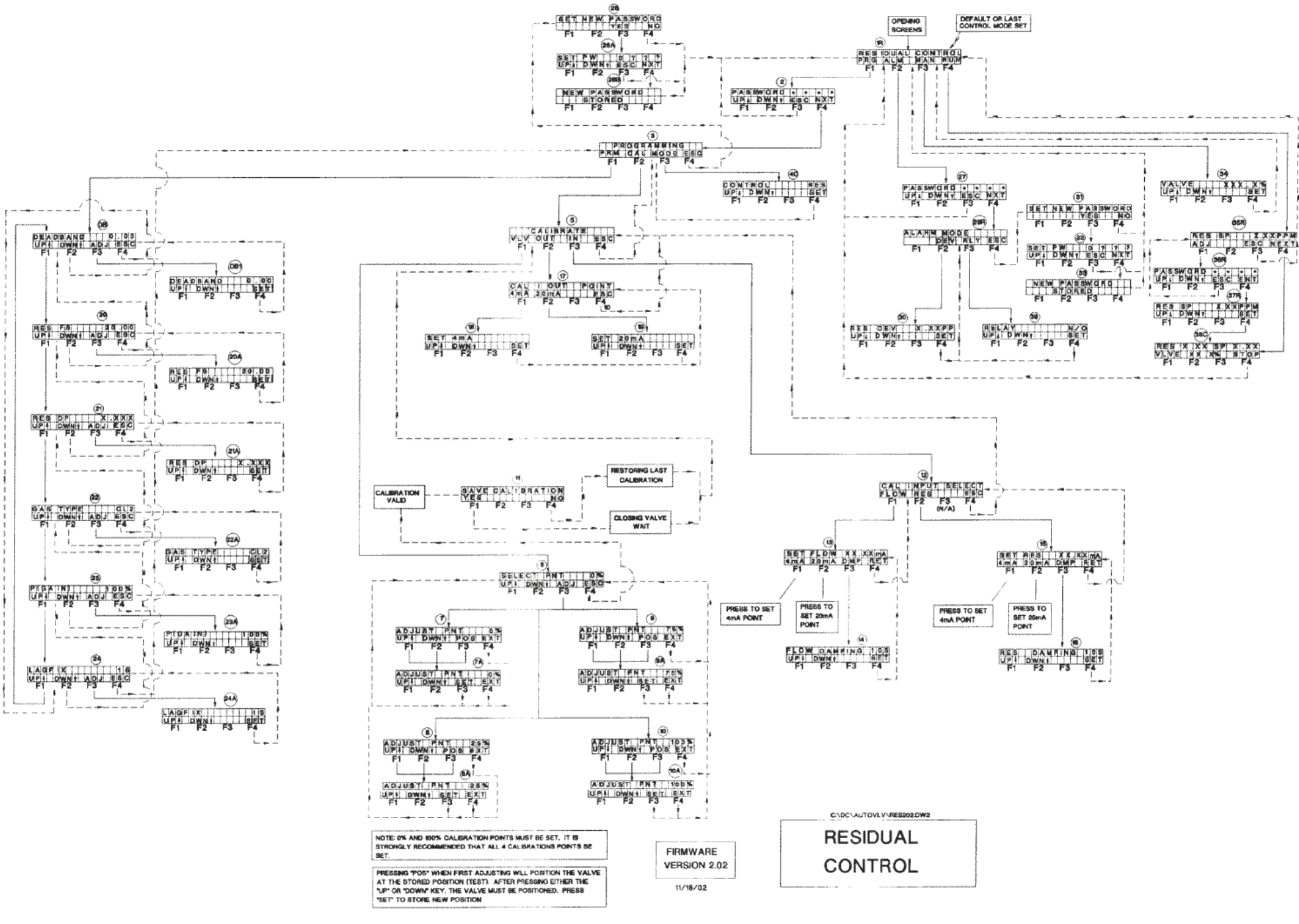
Key	QTY	DESCRIPTION	PART NO
24	6	SS PAN HEAD MACHINE SCREW	AV-102
25	1	FEEDBACK PINION GEAR	AV-012
26	1	FEEDBACK SPUR GEAR	AV-013
27	2	HEX STANDOFF	AV-060
28	1	FEEDBACK POTENTIOMETER MNTNG PLATE	AV-011
29	1	FEEDBACK POTENTIOMETER	AV-050
30	2	SS FLAT WASHER	AV-131
31	2	SS SET SCREW	AV-103
32	1	TERMINAL STRIP (7-POSITION)	AV-045
33	1	MOTOR HOUSING BOX	AV-040
34	1	½" STRAIN RELIEF LIQUID-TIGHT	STC-EL-112

***NOTE: KEY NO.s 4 & 8 (AV-003 & AV-200) *MUST* BE ORDERED AS A MATCHED SET TO ASSURE PROPER TOLERANCE.**

CHEMICAL INJECTION TECHNOLOGIES

SUPERIOR AUTOVALVE VALVE ACTUATOR ASSEMBLY

BY: CDT	DATE: 1 DEC '04
SCALE: NTS	DWG NO: AVVL-1/2/5



NOTE: 0% AND 100% CALIBRATION POINTS MUST BE SET. IT IS STRONGLY RECOMMENDED THAT ALL 4 CALIBRATIONS POINTS BE SET.

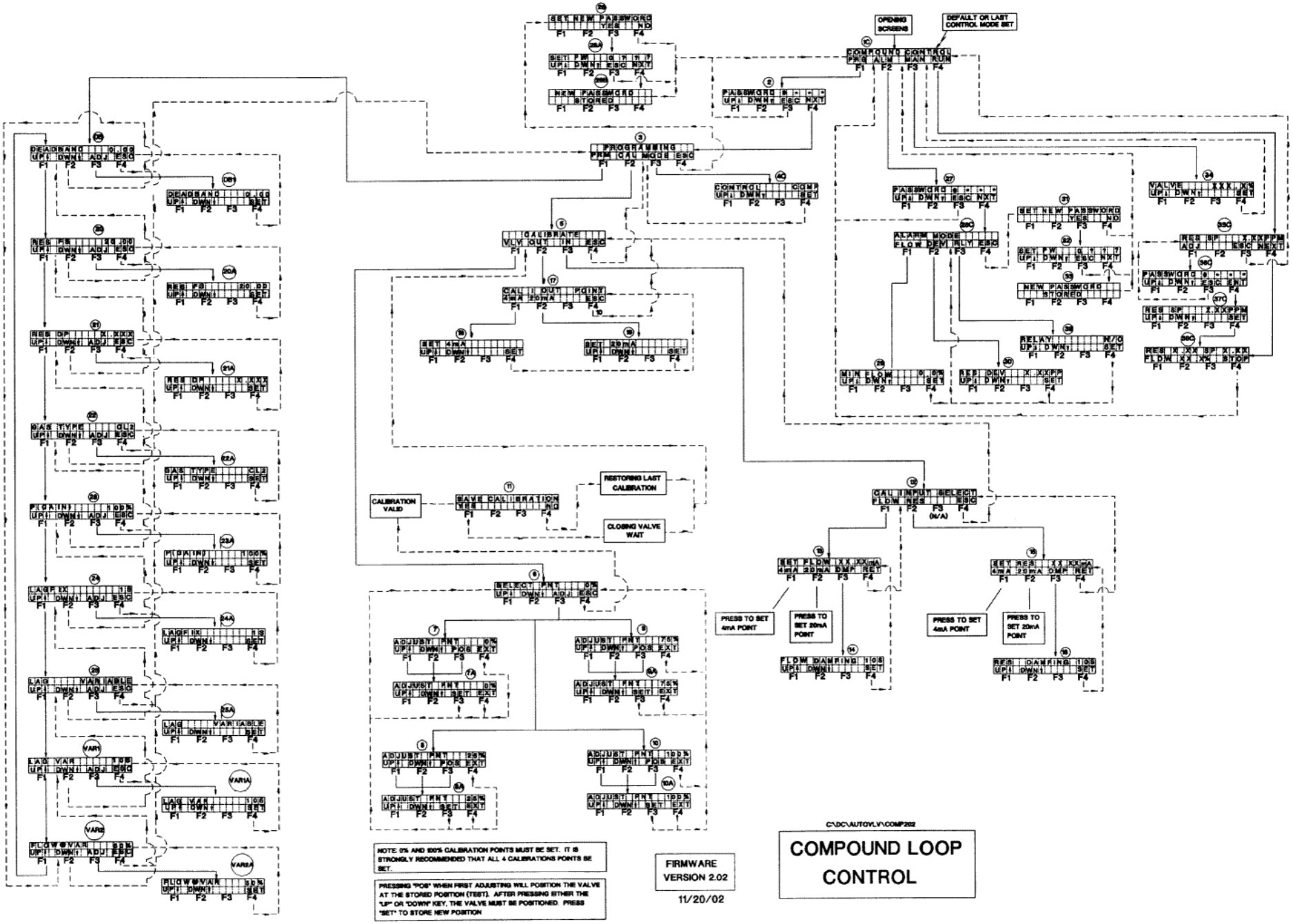
PRESSING "POS" WHEN FIRST ADJUSTING WILL POSITION THE VALVE AT THE STORED POSITION (TEST). AFTER PRESSING EITHER THE "UP" OR "DOWN" KEY, THE VALVE MUST BE POSITIONED. PRESS "SET" TO STORE NEW POSITION

FIRMWARE VERSION 2.02

11/18/02

C:\DC\AUTOVLV\RES202.DW2

RESIDUAL CONTROL


OPENING SCREENS
DEFAULT OR LAST CONTROL MODE SET
COMPOUND CONTROL
PROGRAMMING
CALIBRATE
SELECT PNT
ADJUST PNT
CAL INPUT SELECT
SET FLOW XX.XXmA
SET RES XX.XXmA
PRESS TO SET 4mA POINT
PRESS TO SET 20mA POINT
FLOW DAMPING
RES DAMPING
CALIBRATION VALID
SAVE CALIBRATION
RESTORING LAST CALIBRATION
CLOSING VALVE WAIT
ALARM MODE
RELAY
MIN FLOW
RES DEV
VALVE
RES SP
PASSWORD
SET NEW PASSWORD
NEW PASSWORD STORED
CONTROL COMP
DEADBAND
RES FB
RES DP
GAS TYPE
GAIN
LAG FIX
LAG VARIABLE
FLOW@VAR
NOTE: 0% AND 100% CALIBRATION POINTS MUST BE SET. IT IS STRONGLY RECOMMENDED THAT ALL 4 CALIBRATIONS POINTS BE SET.
PRESSING "POS" WHEN FIRST ADJUSTING WILL POSITION THE VALVE AT THE STORED POSITION (TEST). AFTER PRESSING EITHER THE "UP" OR "DOWN" KEY, THE VALVE MUST BE POSITIONED. PRESS "SET" TO STORE NEW POSITION
FIRMWARE VERSION 2.02
11/20/02
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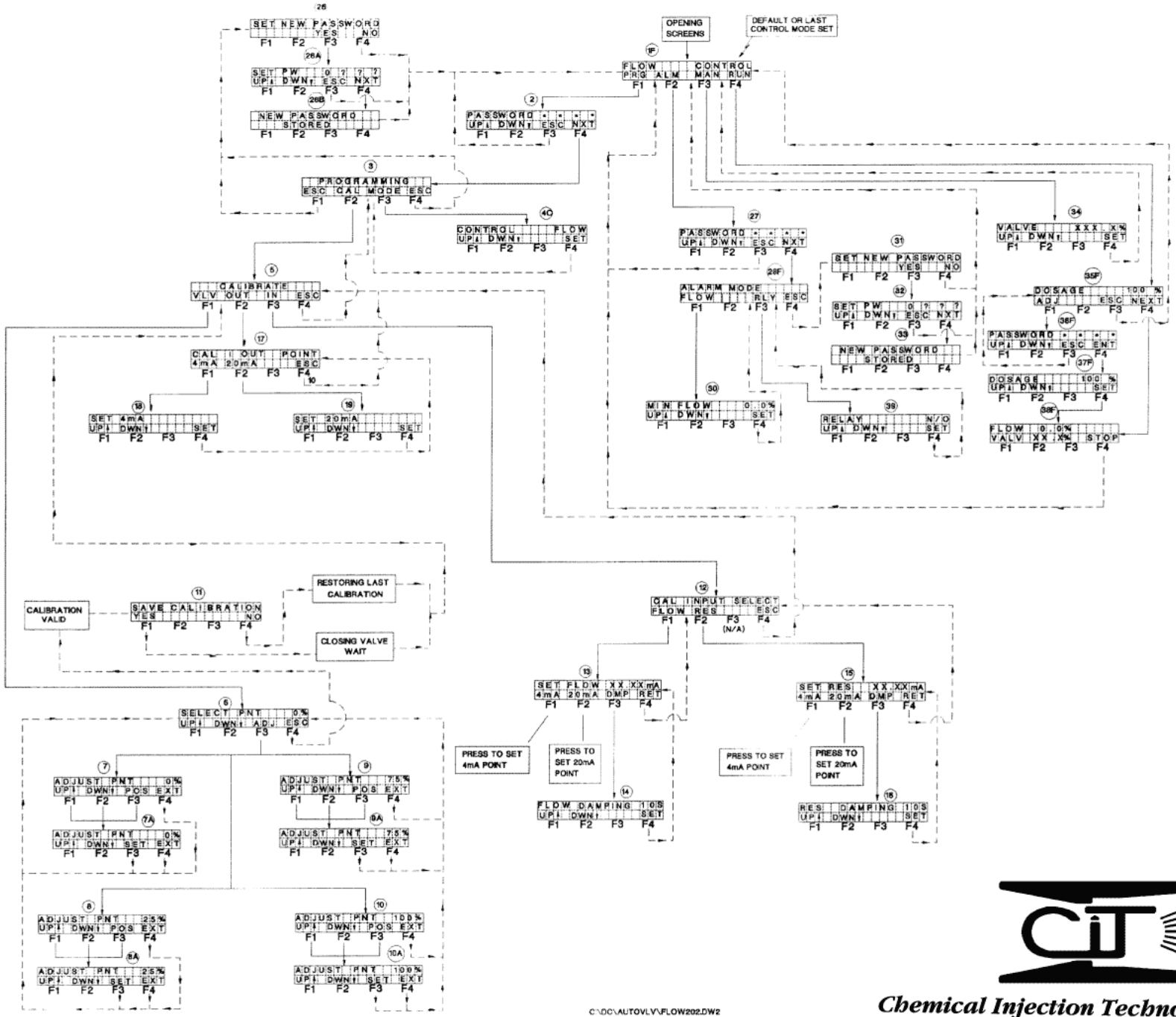
COMPOUND LOOP CONTROL



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FIRMWARE VERSION 2.02

11/20/02

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FLOW PROPORTIONING CONTROL

Chemical Injection Technologies, Inc.
835 Edwards Road, Ft. Pierce, FL 34982 USA
Tel.: (772) 461-0666 Fax: (772) 460-1847
Email: Superior@chlorinators.com
www.chlorinators.com

SPECIFICATION
SUPERIOR™ AutoValve Series 2000 Automatic Gas Feed Rate Control Valve (Models AV-1/2/5)

The Automatic (Chlorine, Sulfur Dioxide, Ammonia) Gas control valve shall be the SUPERIOR™ AutoValve Model _____, manufactured by Chemical Injection Technologies, Inc., Ft. Pierce, Florida, and shall have a maximum capacity of _____ pounds per day (gr/hr) of (Chlorine, Sulphur Dioxide, Ammonia) Gas feed, and shall be equipped with a variable area gas flow meter of _____ pounds per day (gr/hr).

The AutoValve shall be a micro-processor based device for automatically controlling the feed rate of (chlorine, sulphur dioxide, ammonia) gas, based on process water flow rate, residual set point, or a combination of these parameters to achieve: Flow Proportioning Control, Residual Control, or Compound Loop Control. The AutoValve shall incorporate all three (3) control modes as standard, without the need for added programming, PC boards, or any other upgrades. A De-Chlorination control mode shall be incorporated in the controller programming.

The valve shall consist of three (3) component assemblies, mounted on a sturdy, corrosion-proof plastic panel suitable for wall mounting. The valve components shall include an electronic controller, a motorized valve, and a variable area flow meter with integral manual gas feed rate valve. All components shall be constructed of materials resistant to the corrosive effects of the gas being fed, and all electronics shall be housed in NEMA-4, gas tight housings.

ELECTRONIC CONTROLLER:
The controller shall be capable of either 110 VAC or 220 Vac, 60/50 Hz operation by use of an internally mounted toggle switch. No jumpers or separate "add-on's" shall be required to change the operating voltage. Operating voltage to the PC board and the motorized valve shall be reduced to 12 Volts DC by a high grade transformer immediately upon entering the controller. All functions, settings and options, shall be accessible through the operator interface panel for ease of operation and for operator safety, and no internal jumpers or dipswitches shall be used for operator control.

Operator interface shall be through a 2-line, alphanumeric 16 character, back lighted LCD display, with integral 4-button keypad. All keypad buttons shall be assigned to menu variables. All menus and variables shall be displayed in easily understood English words. No codes or references requiring external lookups shall be permitted. A terminal compartment, separate from the PC boards, shall be provided in the electronics enclosure to allow convenient external wiring connections without opening or disturbing the electronics boards. The electronics enclosure shall have a minimum rating of NEMA 4X.

The controller shall incorporate two levels of password protection to allow separate, authorized personnel access to programming functions and/or parameter set points, if desired. Non-authorized personnel shall be restricted to setting manual or automatic control modes. In operating (run) mode, the display shall indicate both the input signal level and the valve plug position. Any alarm condition or input/output error shall cause the display backlight to flash on/off as a visual alert.

Controller software shall incorporate operator selectable 4, 5, or 11 point linearization calibration to allow for individual installation requirements.

INPUTS AND OUTPUTS

Input signal(s) shall be 4-20 mA standard (1-5 Volt DC option with jumper setting). Terminals shall be provided for input signals from both a water flow meter and residual analyzer. A 4-20 mA output signal, proportional to gas feed rate, shall be provided as standard, for interfacing with other process monitoring equipment or control systems. The controller shall allow setting of two independent alarm conditions for Low Flow Signal and for Residual Deviation. An alarm condition shall energize a relay, the polarity of which shall be user selected as normally open or normally closed, for a set of contacts on the terminal board. The contacts shall be of the "dry" type (non-energized), up to 240 VAC.

MOTORIZED VALVE

The automatic motorized valve assembly shall have all electrical components housed in a NEMA-4X enclosure. All materials of the valve assembly exposed to the process gas or to atmosphere surrounding the valve shall be constructed of materials resistant to any corrosion by the gas. All exterior metal parts shall be constructed of Titanum. The valve sub-assembly shall be separated from the motor/electrical enclosure by a at least a 3" (76mm) air gap.

The valve shall use a bi-directional rotary hybrid stepping motor with a step angle of 1.8° and step accuracy of ±3%. The valve plug shall be of linearized design and shall have a minimum travel of 1.0 inches (25mm) for 0% to 100% of maximum gas feed rate to allow for maximum accuracy and adjustability. Minimum feed rate turndown shall be 10:1 or better for any valve feed range. Feed rate accuracy shall be ±4% or better. A feedback potentiometer shall be connected to the valve shaft by direct gear drive for precise valve positioning. An operator accessible thumbwheel shall be attached the valve shaft for emergency valve positioning in the event of power failure.

GAS FLOW METER

The Automatic Valve system shall incorporate a variable area gas flow meter attached directly to the AutoValve mounting board. The flow meter shall be visible to operating personnel when calibrating procedures are being performed, allowing "one-man" calibration. The flow meter panel shall incorporate a manual feed rate control valve to allow for manual bypass control in the event of power failure or valve maintenance and repair. Minimum calibrated feed rate of the AutoValve system shall be $1/20^{th}$ of maximum flow meter scale (20:1 turndown ratio).

Chemical Injection Technologies

Product/Specification Bulletin

SUPERIOR™ Gas Chlorinator Series CL-1
Direct Cylinder Mounted - All Vacuum

GENERAL DESCRIPTION

The SUPERIOR™ Series CL-1 Gas Chlorinator is a state-of-the-art, vacuum-operated, solution feed type which mounts directly on a chlorine cylinder valve. The chlorinator is mounted onto the chlorine cylinder valve using a very heavy-duty, positive yoke clamp connection. A chlorine gas flow meter panel indicates the amount of chlorine being fed and may be located wherever it is safest and most convenient. Chlorine flow rate is manually adjusted and the design permits easy addition of a number of automatic flow rate control devices. A high efficiency, water operated ejector produces the vacuum necessary to operate the system. The ejector assembly contains a back-flow check valve system to prevent pressurized water from entering the chlorinator. A spring-opposed diaphragm vacuum regulator controls the chlorine gas flow rate and also acts as the safety shut-off valve.

FEATURES

The SUPERIOR™ Series CL-1 represents the most modern design technology coupled with the very best materials available to create an outstanding, user friendly piece of equipment. It is designed with user safety as a primary concern.

1. A new ultra-thick, fluoroplastic yoke coating gives superior corrosion resistance, won't crack, peel or chip. Chlorine will not diffuse through it to cause coating bubbling and peeling.

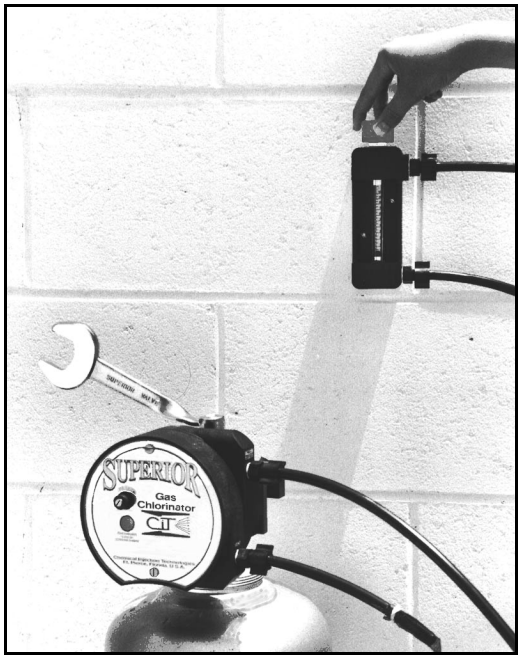
2. All molded parts are fiber-glass reinforced ABS plastic, designed for superior strength, warp- resistance and chlorine resistance.

3. The rate valve "Seat" is pure fluoroplastic and will not swell, stick or become brittle with age or exposure to liquid chlorine.

4. All external bolts and nuts are Titanium for complete corrosion resistance..a SUPERIOR™ exclusive. There are no stainless steel or monel nuts and bolts to corrode and freeze up in the presence of moist chlorine gas.

5. Extra heavy-duty outlet threads on the ejector diffuser prevents accidental breakage from over-tightening or "bumping" of the ejector assembly.

6. The "Universal" ejector diffuser allows use of high pressure solution hose, direct ejector mounting in mains, or in-line piping with rigid solution pipe.



7. Easier to service and perform routine maintenance, with standard size wrench lugs provided on all screwed-together ejector parts. No more pipe wrenches to accidentally tear and scrape plastic surfaces.

8. All vacuum fitting holes are heavily reinforced to prevent the possibility of cracking from over-tightening fittings.

9. "Dual-pressure" check valve is standard on all SUPERIOR™ gas Chlorinators. Proven high back-pressure unitized check valve design protects against sudden surges up to 300 PSIG while a spring-loaded diaphragm check provides positive shutoff even when there is no back-pressure to force the seat closed.

10. PVDF vacuum tubing fittings are standard..another SUPERIOR™ exclusive. "User friendly" design makes it easy to attach tubing, and to tighten or loosen ferrule nuts without tools.

11. Fewer parts, combined with SUPERIOR™ materials and a SUPERIOR™ design gives you a SUPERIOR™ Gas Chlorinator.

FLOW METER CAPACITIES

SUPERIOR's™ modular design concept allows the chlorine gas indicating meter and flow rate control valve to be located wherever it is most convenient for the operator, and also in the safest location. Variable area flow metering tubes are available with dual English/Metric scale maximum capacities of 0.8, 1.5, 4, 10, 25, 50 and 100 pounds per 24 hours of chlorine gas, as well as 15, 30, 75, 200, 500, 1000 and 2000 grams per hour, respectively. All metering tubes are interchangeable and may be changed in the field without special tools.

MODULAR DESIGN

SUPERIOR™ Gas Chlorinators have been designed to give the maximum flexibility in system installation. Each component of the chlorinator, vacuum regulator, metering tube panel, and ejector can be placed wherever it is safest and most convenient for operating personnel. The regulator may be mounted on the chlorine cylinder in a safe storage area while the remote meter tube panel is placed in an easily accessible place since it operates completely under vacuum. The ejector can be located wherever plumbing and/or hydraulic conditions make it most desirable. Modular design also makes it easy and inexpensive to expand or upgrade the system.

MATERIALS OF CONSTRUCTION

One of SUPERIOR™'S major competitive advantages is the use of the finest, strongest and most durable materials available. Extensive use of Fluoroplastics and fiberglass reinforced thermo-plastics allow SUPERIOR™ Gas Chlorinators to withstand attack by chlorine in any form and to give the longest operational life. Many parts are guaranteed for the life of the equipment against chlorine damage.

SYSTEM OPERATION

The vacuum regulator is securely clamped onto the chlorine cylinder valve. Water under pressure flows through the ejector at high velocity which causes a strong vacuum to be created. This opens the check valves in the ejector assembly and transmits a vacuum signal through the remote meter tube/rate valve panel and back to the vacuum regulator. When the vacuum reaches a pre-set level, the diaphragm in the regulator moves to open the chlorine inlet safety valve, permitting gas to flow from the chlorine cylinder. The spring-opposed diaphragm and inlet valve regulate the vacuum at this point.

Chlorine gas passes through the remote flow meter panel and rate control valve to the ejector. The gas mixes with the ejector water and is discharged through the diffuser into the water being treated.

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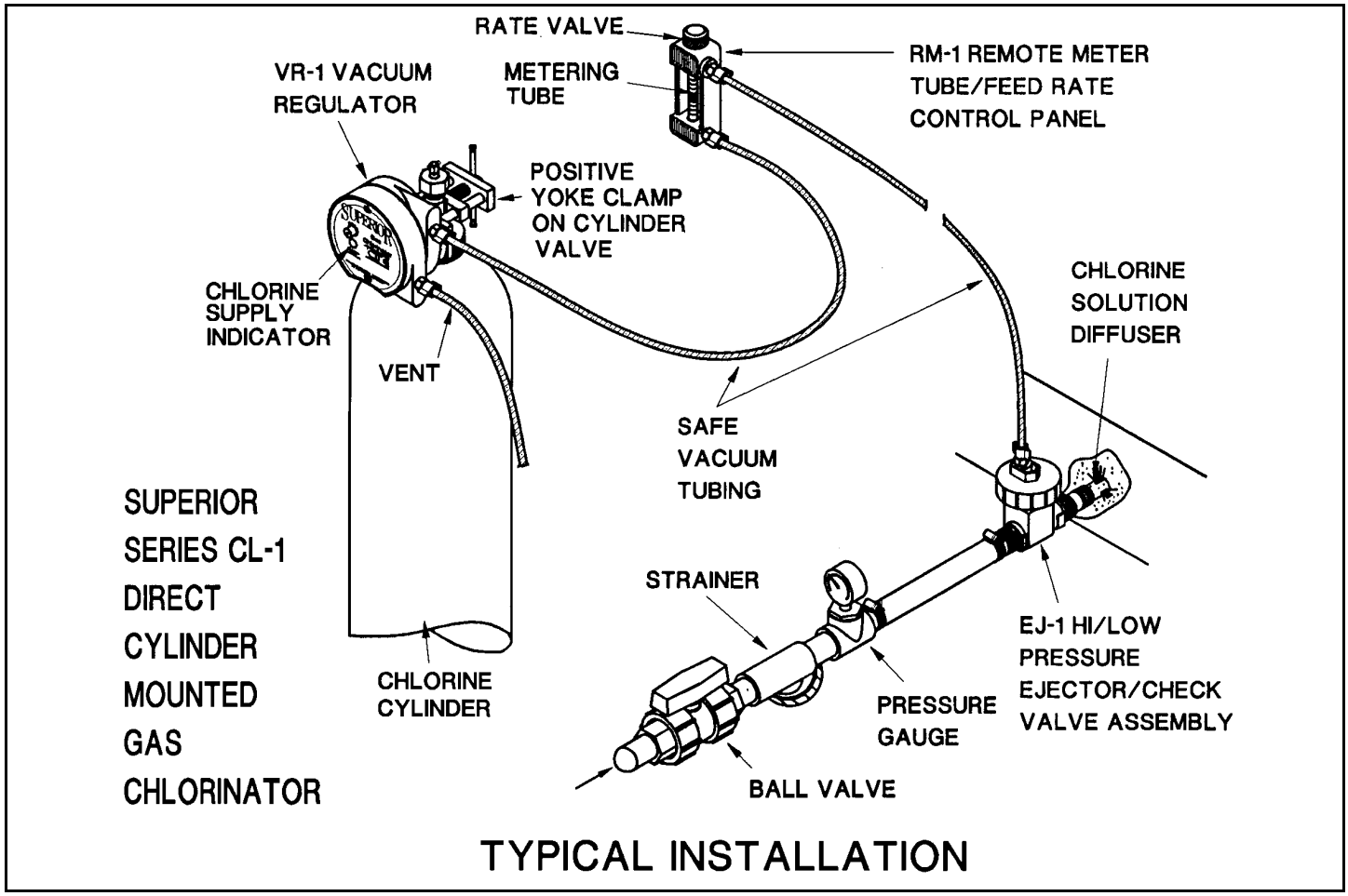

TYPICAL INSTALLATION

SPECIFICATIONS

The chlorinator shall be SUPERIOR™ MODEL CL-1 manufactured by Chemical Injection Technologies, Inc., Ft. Pierce, Florida, and shall have a maximum capacity of _____ pounds per day (gr/hr)of chlorine feed and shall be equipped with a chlorine flow meter of _____ pounds per day (gr/hr).

The chlorinator shall be of modular design consisting of a vacuum regulator, flow meter/rate valve panel, and ejector/check valve. Each of these assemblies shall be capable of being individually located wherever safety and/or operator convenience dictates.

The vacuum regulator shall mount directly on the cylinder valve by means of a positive yoke type clamp having an integral tightening screw with slide bar handle. No wrenches or other tools shall be required to mount or dismount the vacuum regulator from the cylinder. The cylinder valve/chlorinator inlet adaptor shall be constructed of corrosion-proof fluoroplastic material which shall be inert to the effects of wet, dry or liquid chlorine. The inlet safety shut-off/vacuum regulating valve shall be of capsulated design, easily removable as a unit from the outlet side of the yoke. A fluoroplastic filter shall be installed in the vacuum regulator inlet and shall be capable of removing impurities greater than 25 microns. A pressure relief valve shall be incorporated into the vacuum regulator to prevent pressure from building up in the system. All external screws and nuts shall be made of Titanium to prevent corrosion.

The flow meter/rate control valve panel assembly shall be separate from the vacuum regulator and ejector assemblies and shall be capable of mounting wherever it is safest and most convenient for operating personnel. The panel shall be constructed of fiberglass reinforced thermoplastic material and shall incorporate a flow rate control valve made of fluoroplastic material which is inert to the corrosive effects of chlorine. The rate valve metering tip shall be constructed of metal which is completely impervious to the effects of wet, dry or liquid chlorine attack. Design shall provide for full closing of the rate valve without engaging the control surfaces, to prevent damage. Minimum calibrated feed rate shall be 1/20th of maximum flow meter scale (20:1 turndown ratio). Accuracy shall be ±2% of maximum.

Vacuum shall be created by a fixed-throat venturi/ejector system connected directly to the chlorine solution diffuser. A dual high-pressure/low-pressure check valve system shall prevent water from entering the gas system. The ejector assembly shall be capable of withstanding water pressure up to 300 PSIG (20.7 Bars). A universal-type chlorine solution diffuser shall be provided which shall allow close-coupling of the ejector to a water main, use of flexible solution hose or rigid solution pipe without the use of special adaptors.

STANDARD ACCESSORIES

25 ft. - 3/8" Vent & vacuum tubing
10 - Lead cylinder connection gaskets
1 - Cylinder Wrench
1 - Vent insect screen

OPTIONAL ACCESSORIES AVAILABLE

Inlet Water Assembly	Gas Masks
Wall manifold kits	Gas Detectors
Booster pumps	Scales
Residual Analyzers	Gauges
Automatic Controls	Chlorine Comparators
Ton Container Adaptors	Others Available

OTHER SUPERIOR™ SYSTEMS AVAILABLE

VACUFEED LIQUID CHEMICAL FEED SYSTEMS
AUTOMATIC SWITCHOVER GAS CHLORINATORS
MULTIPLE-POINT GAS CHLORINATORS
200 POUNDS PER DAY (5 KG/HR)
500 POUNDS PER DAY (10 KG/HR)
GAS SULFONATORS (DECHLORINATOR)
AMMONIATORS
AUTOMATIC FLOW PROPORTIONING
AUTOMATIC RESIDUAL CONTROL

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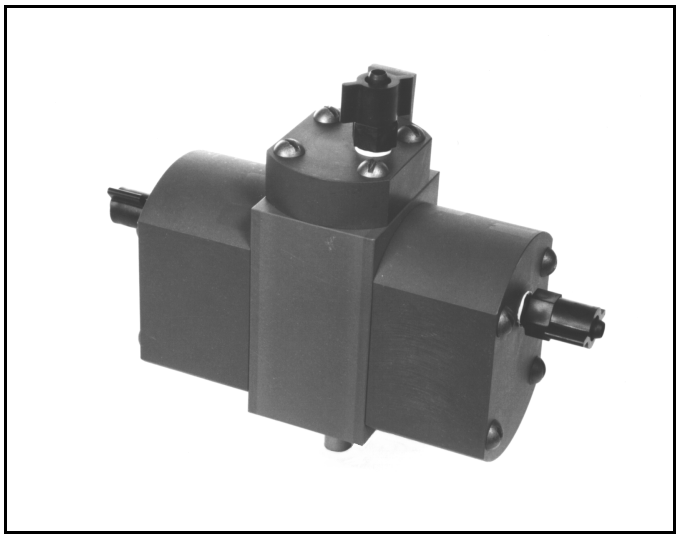
Chemical Injection Technologies

Product/Specification Bulletin

SUPERIOR™ Modular Automatic Switchover Gas Chlorinator, Series CL-15 Direct Cylinder Mounted - All Vacuum

GENERAL DESCRIPTION

The SUPERIOR™ Series CL-15 Modular Automatic Switchover Gas Chlorinator is a state-of-the-art, totally vacuum-operated system designed to automatically switch chlorine feed from an empty cylinder to a full cylinder. The Series CL-15 allows round-the-clock chlorination without being concerned about running out of chlorine when the system is unattended. Series CL-15 chlorinators are of the vacuum-operated solution feed type designed to mount directly on chlorine cylinder valves. A vacuum operated switchover module is mounted on the wall and connected to both chlorine vacuum regulators. A chlorine gas flow meter panel indicates the amount of chlorine being fed and may be located wherever it is safest and most convenient. Chlorine flow rate is manually adjusted and the design permits easy addition of a number of automatic flow rate control devices. A high efficiency, water operated ejector produces the vacuum necessary to operate the system. The ejector assembly contains a back-flow check valve system to prevent pressurized water from entering the chlorinator. A spring-opposed diaphragm vacuum regulator controls the chlorine gas flow rate and also acts as the safety shut-off valve.



FEATURES

The SUPERIOR™ Series CL-15 represents the most modern design technology coupled with the very best materials available to create an outstanding, user friendly piece of equipment. It is designed with user safety as a primary concern.

1. A new ultra-thick, fluoroplastic yoke coating gives SUPERIOR™ corrosion resistance, won't crack, peel or chip.

2. All molded parts are fiber-glass reinforced ABS plastic, designed for SUPERIOR™ strength, warp-resistance and chlorine resistance.

3. The rate valve "Seat" is pure fluoroplastic and will not swell, stick or become brittle with age or exposure to liquid chlorine.

4. All external bolts and nuts are Titanium for complete corrosion resistance..a SUPERIOR™ exclusive.

5. Extra heavy-duty outlet threads on the ejector diffuser prevents breakage from over-tightening or "bumping" of the ejector assembly.

6. Easier to service and perform routine maintenance, with standard size wrench lugs provided on all screwed-together ejector parts.

7. All vacuum fitting holes are heavily reinforced to prevent the possibility of cracking from over-tightening fittings.

8. "Dual-pressure" check valve is standard on all SUPERIOR™ gas Chlorinators. Proven high back-pressure unitized check valve design protects against sudden surges up to 300 PSIG while a spring-loaded diaphragm check provides positive shutoff even when there is no back-pressure to force the seat closed.

9. Switchover Module has been totally re-designed to prevent sticking, misalignment or wear on internal parts. Up to 20% fewer parts than other designs means greater reliability.

10. Automatic Reset - The SUPERIOR™ Modular Automatic Switchover Gas Chlorination system requires no manual reset of the switchover module once the empty source is replaced with a new source.

11. Fewer parts, combined with SUPERIOR™ materials and a SUPERIOR™ design gives you a SUPERIOR™ Gas Chlorinator.

FLOW METER CAPACITIES

SUPERIOR'S modular design concept allows the chlorine gas indicating meter and flow rate control valve to be located wherever it is most convenient for the operator, and also in the safest location. Variable area flow metering tubes are available with dual English/Metric scale maximum capacities of 0.8, 1.5, 4, 10, 25, 50 and 100 pounds per 24 hours of chlorine gas, as well as 15, 30, 75, 200, 500, 1000 and 2000 grams per hour, respectively. All metering tubes are interchangeable and may be changed in the field without special tools.

MATERIALS OF CONSTRUCTION

One of SUPERIOR™'S major competitive advantages is the use of the finest, strongest and most durable materials available. Extensive use of Fluoroplastics and fiberglass reinforced ynthermo- plastics allow SUPERIOR™ Gas Chlorinators to withstand attack by chlorine in any form and to give the longer operational life. Many parts are *guaranteed for the life of the equipment* against chlorine damage.

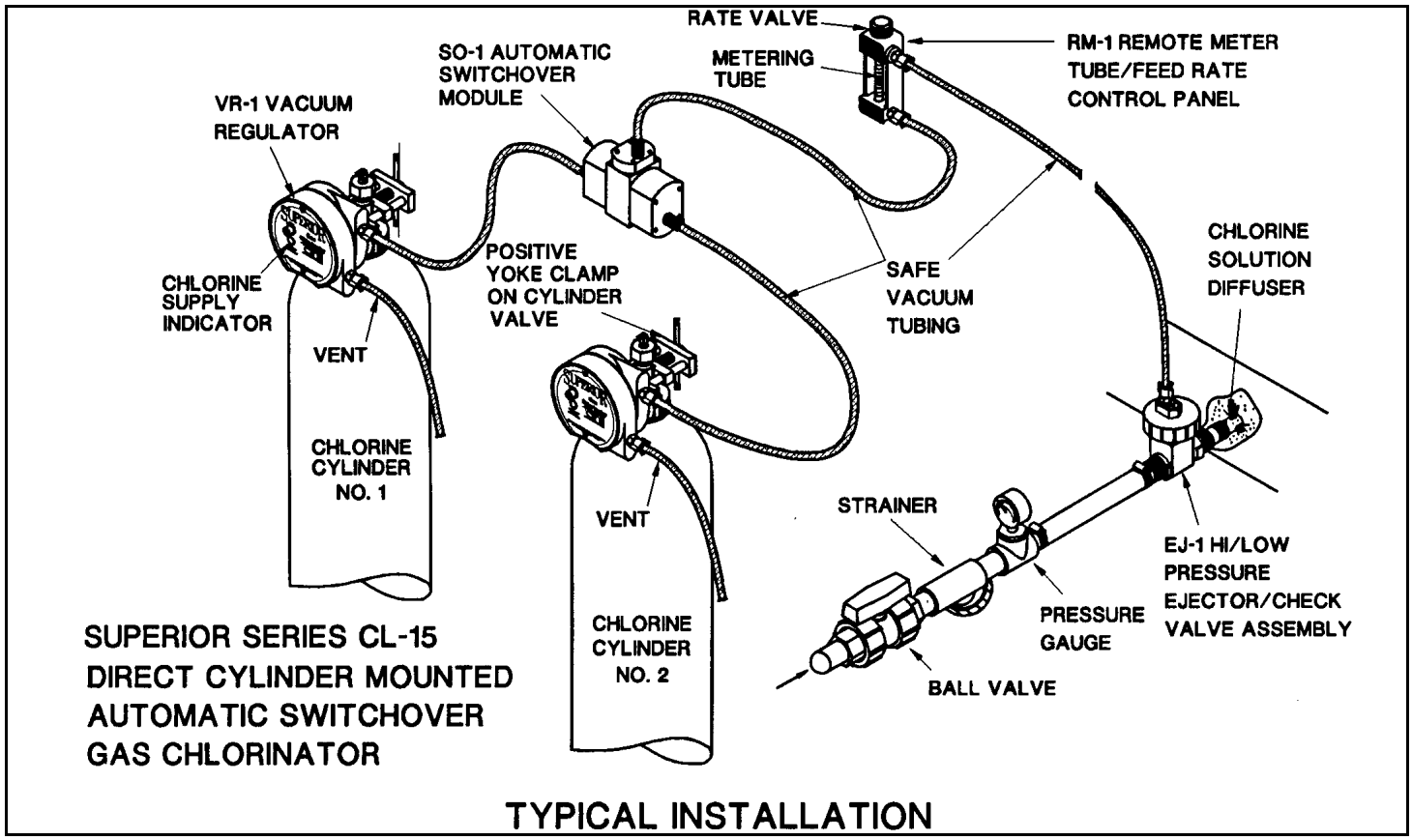
SYSTEM OPERATION

The vacuum regulators are securely clamped onto the chlorine cylinder valves. Vacuum tubing connects each regulator to the wall mounted automatic switchover module. A single piece of vacuum tubing connects the outlet of the module to the wall mounted remote meter tube/rate valve panel. The ejector is connected to the remote meter panel with a single piece of vacuum tubing.

Water under pressure flows through the ejector at high velocity causing a strong vacuum to be created. This opens the check valves in the ejector assembly and transmits a vacuum signal through the remote meter tube/rate valve panel, through the switchover module and back to the vacuum regulator. When the vacuum reaches a pre-set level, the diaphragm in the regulator moves, opening the chlorine inlet safety valve, and permits gas to flow from the chlorine cylinder. The spring-opposed diaphragm and inlet valve regulate the vacuum at this point.

Chlorine gas passes through the automatic switchover module, remote flow meter panel and rate control valve to the ejector. The gas mixes with the ejector water and is discharged through the diffuser into the water being treated.

When the chlorine supply is depleted in one source, vacuum starts to increase in the system creating a differential across the diaphragm in the switchover module. This overcomes a spring loaded toggle assembly and the unit then switches over permitting chlorine gas to flow from the full source.



TYPICAL INSTALLATION

SPECIFICATIONS

The chlorinator shall be SUPERIOR™ MODEL CL-15 manufactured by Chemical Injection Technologies, Inc., Ft. Pierce, Florida, and shall have a maximum capacity of _____ pounds per day (gr/hr)of chlorine feed and shall be equipped with a chlorine flow meter of _____ pounds per day (gr/hr).

The chlorinator shall be of modular design consisting of two (2) vacuum regulators, one (1) vacuum operated switchover module, one (1) flow meter/rate valve panel, and one (1) ejector/check valve. Each of these assemblies shall be capable of being individually located wherever safety and/or operator convenience dictates.

The vacuum regulators shall mount directly on the chlorine cylinder valves by means of a positive yoke type clamp having an integral tightening screw with slide bar handle. No wrenches or other tools shall be required to mount or dismount the vacuum regulator from the chlorine valve. The chlorine valve/chlorinator inlet adaptor shall be constructed of corrosion-proof fluoroplastic material which shall be inert to the effects of wet, dry or liquid chlorine. The inlet safety shut-off/vacuum regulating valve shall be of capsulated design, easily removable as a unit from the outlet side of the yoke. A fluoroplastic filter shall be installed in the vacuum regulator inlet and shall be capable of removing impurities greater than 25 microns. A pressure relief valve shall be incorporated into the vacuum regulator to prevent pressure from building up in the system. All external screws and nuts shall be made of Titanium to prevent corrosion.

The switchover module shall be vacuum operated and shall be factory pre-set, not requiring field adjustment. The module shall automatically change chlorine feed from an empty chlorine cylinder to a full cylinder, with no manual resetting required after switchover has been made and the empty cylinder replaced.

The flow meter/rate control valve panel shall be capable of mounting wherever it is safest and most convenient for operating personnel. The panel shall be constructed of fiberglass reinforced thermoplastic material and shall incorporate a flow rate control valve made of fluoroplastic material which is inert to the corrosive effects of chlorine. The rate valve metering tip shall be constructed of metal which is completely impervious to the effects of wet, dry or liquid chlorine attack. Design shall provide for full closing of the rate valve without engaging the control surfaces, to prevent damage. Minimum calibrated feed rate shall be 1/20th of maximum flow meter scale (20:1 turndown ratio). Accuracy shall be ±2% of maximum.

Vacuum shall be created by a fixed-throat venturi/ejector system connected directly to the chlorine solution diffuser. A dual high-pressure/low-pressure check valve system shall prevent water from entering the gas system. The ejector assembly shall be capable of withstanding water pressure up to 300 PSIG (20.7 Bars). A universal-type chlorine solution diffuser shall be provided which shall allow close-coupling of the ejector to a water main, use of flexible solution hose or rigid solution pipe without the use of special adaptors.

STANDARD ACCESSORIES

50 ft. - Vent & vacuum tubing
20 - Lead cylinder connection gaskets
1 - Cylinder Wrench
1 - Vent Insect Screen

OPTIONAL ACCESSORIES AVAILABLE

Inlet Water Assembly	**Gas Masks**
Wall manifold kits	**Gas Detectors**
Booster pumps	**Scales**
Residual Analyzers	**Gauges**
Automatic Controls	**Chlorine Comparators**
Ton Container Adaptors	**Others Available**

OTHER SUPERIOR™ SYSTEMS AVAILABLE

MULTIPLE-POINT GAS CHLORINATORS
200 POUNDS PER DAY (5 KG/HR)
500 POUNDS PER DAY (10 KG/HR)
GAS SULFONATORS (DECHLORINATOR)
AMMONIATORS
AUTOMATIC FLOW PROPORTIONING
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E-Mail:superior@chlorinators.com
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Chemical Injection Technologies

Installation/Service Bulletin

SUPERIOR™ Gas Detector Series SLD
Single & Dual Channel

This manual covers both single and dual channel SUPERIOR Gas Detectors, and applies to all gasses for which sensors are available. Some instructions apply only to Dual Channel (two sensors) MODEL SLD-2 detectors, and are so noted. **IMPORTANT NOTE:** *Chemical Injection Technologies, Inc.* ***recommends the use of an UPS (Uninterruptible Power Supply)*** *connected directly to the main AC power supply and then running the Series SLD Gas Detector directly from the UPS device. These devices are readily available wherever computers are sold. They offer complete functioning of all features in the event of power loss, as well as excellent power surge and lightning protection. An optional internal battery backup is available, but like all other similar types of instrumentation, these internal backup power supplies only allow limited functions, to conserve power, and do not offer any surge or lightning protection.*

TECHNICAL SPECIFICATIONS

Power supply: 115 or 230 VAC, 50/60 Hz, single phase (user selectable by internal switch)

Power consumption: 12 watts

Sensor Input: 4-20 mA DC, current loop

Loop voltage: 15 VDC, short circuit protected

Sensor output: 4-20 mA DC

Maximum load: 600Ω

Gas Sensors Available: chlorine, sulfur dioxide, ammonia, ozone

Relays:
Maximum current rating: 5 amps (resistive)
Maximum voltage: 250VAC/30VDC

Maximum Distance between controller & sensor(s): 1000 ft. (305 meters)

Operating temperature: 32°F to 122°F (0°C to 50°C)

Expected sensor operating life: Two years in air (decreases with exposure to measured gasses)

Models: SLD-1 = Single Channel
SLD-2 = Dual Channel

QUICK START GUIDE

INSTALLATION:

1). Mount the SUPERIOR Series SLD Controller/Monitor at eye level. Mount the sensor(s) 12" (30.5 cm) off the floor in the area(s) where the gas level is to be monitored. The SUPERIOR Series SLD is supplied with 25 ft. (7.6 meters) of 2-wire cable, for each sensor. Sensor(s) may be located up to 1000 ft. (305 meters) from the controller/monitor.

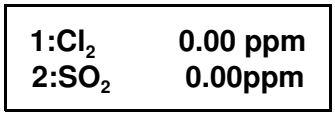
2). Standard cable(s) is attached at the factory. If it is necessary to disconnect a cable, in order to run through walls or conduit, etc., note the connections so they can be re-connected properly. If in doubt, consult the wiring and connection diagrams at the back of this manual.

3). Turn on AC power to the controller/monitor. On power-up, a two (2) minute delay is started to allow the sensor device(s) time to stabilize, which prevents false alarms. First, the countdown timer is

SENSOR STABILIZE
2:00

displayed and then the main run screen is displayed.

4). The **MAIN RUN SCREEN** will display both channels if they are enabled in Model SLD-2, or just the single channel if the unit is Model SLD-1. Detector is ready to operate. To change or adjust options & settings, see the following:



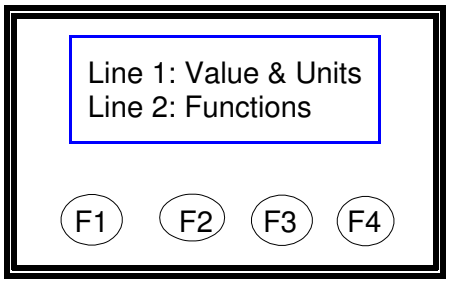
(Model SLD-2 Shown)

Table of Contents

SUPERIOR Series SLD Gas Detector OPERATION:

DISPLAYS:

The display is a backlit LCD (Liquid crystal display) consisting of two (2) lines each containing a maximum of sixteen (16) characters. The top line displays a selected value along with its engineering units. The bottom line normally provides function labels for the four (4) pushbuttons located below the functions. The functions are linked to the specific menu being displayed, and will vary depending on the necessary operator input. The push buttons are labeled F1, F2, F3, and F4.



MAIN MENU

1). Press any function button on the Main Run screen and immediately release. The MAIN MENU will appear for approximately four (4) seconds, and after 4 seconds the display will return to the main run screen. You may push any of the function buttons again if the MAIN MENU screen reverts to the main run screen before you choose one of the function buttons.

ALM = Allows operator to set both the low level (Warning) and high level (Danger) alarm set points, for each channel. The alarm set points are password protected. Factory default settings are: DANGER = 1 PPM, WARNING = 3 PPM.

LOG = Allows operator to view the EVENT LOG which records each time the gas level goes above a set point. It will also log any accesses to the CALIBRATION/PARAMETER programs if changes are made. Up to 256 events can be logged . Events cannot be cleared.

TEST = Energizes all relays to test the alarm devices.

CFG = Allows operator, with password access, to calibrate the sensor inputs, and the monitor analog outputs. It also allows access to the program parameters and "real time" clock time & date settings.

F1	ALM	Go to ALARM: SELECT CHANNEL MENU
F2	LOG	Go to PRESS PUSHBUTTON TO VIEW LOG menu
F3	TEST	ALL RELAYS ENERGIZED
F4	CFG	Go to CALIBRATION/CONFIGURATION MENU (CAL/CFG)

ALARM: SELECT CHANNEL MENU

1). NOTE: On Model SLD-1 Single Channel Gas Detector, the screen will automatically default to the SELECT ALARM menu for Channel 1. For Model SLD-1, skip the table below and proceed directly to the CH1 SELECT ALARM MENU table.

F1	CH1	Go to CH1 SELECT ALARM MENU
F2	CH2	Go to CH2 SELECT ALARM MENU
F3		
F4	ESC	Go back to ALARM SELECT CHANNEL MENU

CH1 SELECT ALARM MENU:
Select either the WARNING (Low Level) or DANGER (High Level) alarm Set Points to be adjusted. After you choose either WARN or DNGR, the actual SET POINT menu will open. Push the UP or DWN function keys to change to respective alarm set point. When the set point shown is correct, press ENT to return to the CH1 SELECT ALARM MENU.

F1	WARN	Go to CH1 WARNsp Menu
F2		
F3	DNGR	Go to CH1 DNGRsp Menu
F4	ESC	Go back to ALARM: SELECT CHANNEL menu

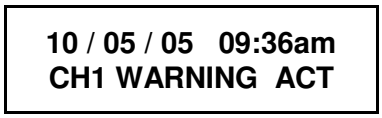
CH2 SELECT ALARM MENU: (MODEL SLD-2 ONLY)
SAME AS CHANNEL 1 SELECT ALARM MENU, ABOVE.

NOTE: To exit the ALARM SETTINGS area, press ESC until you return to the MAIN RUN SCREEN.

EVENT LOG

When the LOG function key (F2) is pressed on the Main Menu, the PRESS PB TO VIEW menu displays:

PRESS PB TO VIEW, MENU:
Up to 256 Events are logged and can be viewed on the display. All alarm conditions, sensor failure, loss of sensor signal, and calibration/parameter accesses will be logged, with time and date. Pressing the UP or DWN function keys will take you to the most recent or earliest event in the log, respectively. Pressing the F4 function key will take you back to the MAIN RUN SCREEN.



TEST

Pressing the TEST menu choice from the MAIN MENU will energize all relays, in order to test the functioning of lights, horns, or any other signaling devices connected to the Gas Detector. This will NOT check any of the sensor circuits, and is not intended, in any way, to test either the ability of the sensor to detect a gas, nor to check the sensor output level.

CALIBRATION & CONFIGURATION

From the MAIN MENU press the CFG function key (F4). This will open the CAL/CFG MENU.

CAL/CFG MENU
CAL PARM T&D ESC

F1	CAL	Press CAL to enter a password screen, then to the CALIBRATE MENU.
F2	PARM	Press Parm to enter a password screen, then to the Set Parameters area.
F3	T&D	Press T&D to set the Time and Date for the system.
F4	ESC	Press ESC to enter a SET CAL/CFG PASSWORD screen.

CALIBRATION:

NOTE: To calibrate the Series SLD Gas Detector, you will need test instruments and a knowledge of instrumentation test procedures. A device generating a 4-20mA signal output is required to calibrate the analog input, and a Digital Multi-Meter (DMM) is required to calibrate analog output signals. SEE SUPERIOR SERIES SLD WIRING DIAGRAMS AT THE BACK OF THIS MANUAL AND WIRE THE 4-20mA SIGNAL GENERATOR AS SHOWN FOR "CALIBRATOR WIRING". **THE SENSOR SHOULD NOT BE CONNECTED TO THE INPUT TERMINALS WHILE PERFORMING THIS CALIBRATION**.

CALIBRATE MENU:
From the CAL/CFG MENU press CAL function key (F1) and you will be prompted to enter a password (default is 0000). Use the UP and DWN keys to change the value of the first digit, then press the NXT key to move to the next digit. After you have entered the last correct digit, press NXT to enter the CALIBRATE MENU. Pressing ESC will take you back to the CAL/CFG MENU.

PASSWORD 0 ★ ★ ★
UP↑ DWN↓ ESC NXT

CALIBRATE MENU
IN OUT ESC

F1	IN	Go to CALIBRATE INPUTS menu
F2	OUT	Go to CALIBRATE OUTPUTS menu
F3		
F4	ESC	Return to the CALIBRATE MENU

CALIBRATE INPUTS MENU:
From the CALIBRATE MENU screen Press the IN (F1) key. The CAL INPUTS menu appears. Choose Channel 1 or Channel 2 (SLD-2 Only).

CAL INPUTS
CH1 CH2 ESC

F1	CH1	Set Channel 1 ZERO and SPAN.
F2	CH2	Set Channel 2 ZERO and SPAN (Model SLD-2 Only).
F3		
F4	ESC	Return to CALIBRATE MENU.

CALIBRATE ANALOG INPUT CH1 SCREEN:
With the 4-20mA signal generating device wired as shown in the wiring diagram at the back of this manual under CALIBRATOR WIRING, the current analog input is displayed in the top right of the screen. Calibrate the zero and full scale value.

```
CH1          X . X X ppm
ZRO SPAN           ESC
```

CALIBRATE ANALOG INPUT CH2 SCREEN: (Model SLD-2 Only)
Repeat procedure shown above for Channel 1.

CALIBRATE OUTPUTS MENU:
From the CALIBRATE MENU screen Press the OUT (F2) key. The CAL OUTPUTS menu appears. Choose Channel 1 or Channel 2 (SLD-2 Only).

```
     CAL   OUTPUTS
CH1   CH2          ESC
```

F1	CH1	Set Channel 1, 4mA & 20 mA analog output.
F2	CH2	Set Channel 1, 4mA & 20 mA analog output (Model SLD-2 Only).
F3		
F4	ESC	Return to CALIBRATE MENU.

CALIBRATE ANALOG OUTPUT CH1 SCREEN : (NOTE: procedure is identical for Channel 2, on Model SLD-2 only.
A Digital Multi-Meter (DMM) is required to proceed with calibration. Attach a DMM as shown in the wiring diagram at the back of this manual, under "CH1 OUTPUT LOAD". Press the function key under 4mA or 20mA to enter setup screen.

```
 CH1   OUTPUT CAL
4mA  20mA          ESC
```

F1	4mA	Press to enter 4mA output setup screen
F2	20mA	Press to enter 20mA output setup screen
F3		
F4	ESC	Return to CAL OUTPUTS menu

SET 4 mA ANALOG OUTPUT:
Press the 4mA function key (F1) on the Channel 1 or 2 OUTPUT CAL screen. The 4mA ADJUST screen for that channel will open. With the DMM attached, and the range set for mA including 4 - 20 mA, adjust the reading on the DMM using the UP or DWN keys until it reads 4mA. Then press the ENT (F4) key. Press the key under ENT (F4) to enetr the new value and return to the analog output calibration screen.

```
CH1  OUT  4mA  ADJ
UP↑    DWN↓
```

F1	UP	Press to drive analog output up. View on DMM.
F2	DWN	Press to drive analog output down. View on DMM.
F3		
F4	ENT	Press ENT to set the new value and return to the CH1 (or2) OUTPUT CAL screen.

SET 20 mA ANALOG OUTPUT:
Press the 20mA function key (F1) on the Channel 1 or 2 OUTPUT CAL screen. The 20mA ADJUST screen for that channel will open. With the DMM attached, and the range set for mA including 4 - 20 mA, adjust the reading on the DMM using the UP or DWN keys until it reads 20mA. Then press the ENT (F4) key. Press the key under ENT (F4) to enter the new value and return to the analog output calibration screen.

```
CH1  OUT  20mA  ADJ
UP↑    DWN↓
```

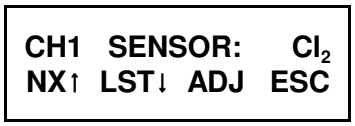
F1	UP	Press to drive analog output up. View on DMM.
F2	DWN	Press to drive analog output down. View on DMM.
F3		
F4	ENT	Press ENT to set the new value and return to the CH1 (or2) OUTPUT CAL screen.

SET PARAMETERS (PARM):

From the CAL/CFG MENU, press the PARM function key (F2). If you have not previously entered the password from the CAL/CFG MENU, you will be prompted to enter a password (default is 0000). Use the UP and DWN keys to change the value of the first digit, then press the NXT key to move to the next digit. After you have entered the last correct digit, press NXT to enter the series of Parameters screens.. Pressing ESC will take you back to the CAL/CFG MENU. The first Parameter screen that will display is the **CH1 SENSOR:** Gas Choice menu. All Parameter Settings menus contain an UP and DWN function key choice. These allow you to scroll through the various parameters. When you press the PARM key and enter the password, you are always taken directly to the CH1 SENSOR: selection screen. Press the NX↑ (Next) key to scroll forward through the menus, and the LST↓(Last) key to scroll back to the previous menu. Pressing the ESC function key (F4) from any Parameter menu will exit back to the CAL/CFG MENU screen.

SET CHANNEL 1 GAS SENSOR TYPE:

If you wish to change the type of Gas Sensor attached to the Channel 1 Input, press the ADJ function key (F3): This will open the Channel 1 Gas Sensor choice sub-menu. Using the UP or DWN function keys, you can scroll through the Gas Sensor Types which are supported by the Series SLD. You must choose a sensor gas which matches the the sensor connected to the Channel 1 input terminals.



F1	UP	Press to scroll up through the gas sensor types: Cl_2, SO_2, NH_3, O_3
F2	DWN	Press to scroll down through the gas sensor types: Cl_2, SO_2, NH_3, O_3
F3		
F4	ENT	Press ENT to enter the new value and return to the CH1 SENSOR type menu.

SET CHANNEL 1 RANGE:

From the CH1 SENSOR type menu, press NX↑ function key (F1). The Set Range menu displays. Press ADJ function key (F3) to change the Sensor Range. The Range choice sub-menu opens. Select the sensor range, in PPM (mg/l) using the UP or DWN keys.

- **This should match the sensor exactly to ensure a stable display.**
- This also limits the alarm set points.
- The sensor can be calibrated to any value at or below this setting.

F1	UP	Press to increase setting.
F2	DWN	Press to decrease the setting
F3		
F4	ENT	Press ENT to enter the new value and return to the CH1 RANGE menu.

SET CH1 ANALOG OUTPUT FULL SCALE (AOFS):

From the CH1 RANGE menu, press NX↑ function key (F1). The CH1 AOFS: menu displays. This sets the concentration in PPM (mg/l) that represents a 20mA analog output. An analog output of 4mA is always zero (0) PPM (mg/l). Press ADJ function key to change the AOFS setting. The AOFS choice sub-menu opens. Select the AOFS using the UP or DWN keys.

F1	UP	Press to increase setting.
F2	DWN	Press to decrease setting.
F3		
F4	ENT	Press ENT to enter the new value and return to the CH1 AOFS menu

SET CHANNEL 2 GAS SENSOR TYPE: *Model SLD-2 Only*
SEE CHANNEL 1 INSTRUCTIONS, ABOVE. YOU MAY CHOOSE THE SAME OR A DIFFERENT GAS SENSOR TYPE AS CHANNEL 1.

SET CHANNEL 2 RANGE: *Model SLD-2 Only*
SEE CHANNEL 1 INSTRUCTIONS, ABOVE.

SET CH2 ANALOG OUTPUT FULL SCALE (AOFS): *Model SLD-2 Only*
SEE CHANNEL 1 INSTRUCTIONS, ABOVE.

SET WARNING RELAY OPERATION (K1 & K3 Terminals)
Scroll through the Parameter settings menus to the WARN RLY: menu. This parameter sets the warning relay (low level) operation. You may choose a number of "Energized" and De-Energized" criteria for the relay. If you are not familiar with electronic control circuits, we recommend that you do not change the setting from the default "OFF/ACK". Press the ADJ function key (F3) to change the setting. Using the UP & DWN keys, scroll through the choices as shown in the table below:

RELAY SETTING	RELAY ENERGIZED	RELAY DE-ENERGIZED
OFF/ACK (Default)	INPUT>=SP	INPUT < SP *OR* Acknowledged by USER
ON/ACK	INPUT>=SP	INPUT < SP - When the user acknowledges the alarm condition, any noise or visual alarms attached to the Warning relay are silenced but the relay remains energized until the alarm condition no longer exists.
NO ACK	INPUT>=SP	INPUT < SP NOTE: attached alarms are not sounded for active set point conditions.
LATCH	INPUT>=SP	User must acknowledge or clear the alarm to de-energize the contacts.
OFF	NEVER	Always

SET WARNING RELAY POLARITY (N/C OR N/O):
Scroll through the Parameter settings menus to the WARN RLY POL: menu. This parameter sets the polarity of the warning relay to either Normally Open (N/O) or Normally Closed (N/C). Press the ADJ function key (F3) to change the setting. Press the UP or DWN keys to toggle between N/O and N/C. The default setting is N/O.

SET WARNING RELAY DELAY:
Scroll through the Parameter settings menus to the WARN DLY: menu. This value, in seconds, sets the time the warning alarm condition must be detected before it is indicated on the display and the warning relay is activated. It is set in one (1) second increments. The default setting is zero (0) seconds. Press the ADJ function key (F3) to change the setting. Press the UP or DWN keys to increase or decrease the delay seconds.

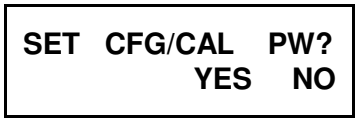
SET DANGER RELAY OPERATION (K2 & K4 terminlas)
Scroll through the Parameter settings menus to the DNGR RLY: menu. This parameter sets the danger relay (high level) operation. You may choose a number of "Energized" and De-Energized" criteria for the relay. If you are not familiar with electronic control circuits, we recommend that you do not change the setting from the default "OFF/ACK". Press the ADJ function key (F3) to change the setting. Using the UP & DWN keys, scroll through the choices as shown in the table below:

RELAY SETTING	RELAY ENERGIZED	RELAY DE-ENERGIZED
OFF/ACK (Default)	INPUT>=SP	INPUT < SP *OR* Acknowledged by USER
ON/ACK	INPUT>=SP	INPUT < SP - When the user acknowledges the alarm condition, any noise or visual alarms attached to the Warning relay are silenced but the relay remains energized until the alarm condition no longer exists.
NO ACK	INPUT>=SP	INPUT < SP NOTE: attached alarms are not sounded for active set point conditions.
LATCH	INPUT>=SP	User must acknowledge or clear the alarm to de-energize the contacts.
OFF	NEVER	Always

SET DANGER RELAY POLARITY (N/C OR N/O):
Scroll through the Parameter settings menus to the DNGR RLY POL: menu. This parameter sets the polarity of the danger relay to either Normally Open (N/O) or Normally Closed (N/C). Press the ADJ function key (F3) to change the setting. Press the UP or DWN keys to toggle between N/O and N/C. The default setting is N/O.

SET DANGER RELAY DELAY:
Scroll through the Parameter settings menus to the DNGR DLY: menu. This value, in seconds, sets the time the danger alarm condition must be detected before it is indicated on the display and the danger relay is activated. It is set in one (1) second increments. The default setting is zero (0) seconds. Press the ADJ function key (F3) to change the setting. Press the UP or DWN keys to increase or decrease the delay seconds.

EXITING THE CALIBRATION/CONFIGURATION SECTION



Pressing the ESC key from the various menus in this section will take you back to the CAL/CFG MENU. If you previously entered the CALIBRATION or PARAMETERS sections and you press the ESC key (F4) from the CAL/CFG menu, you will be asked if you wish to change the password..
The SET CFG/CAL PW? sceen will display. Pressing the NO key (F4) will exit back to the **MAIN RUN SCREEN**. If you press the YES key (F3), you will be asked to enter a new password. After entering the new password, you will exit back to the **MAIN RUN SCREEN**.

OPTIONS

IMPORTANT NOTE: The options section contains settings and choices that rarely need to be changed. There are no visible screens or menu choices that will prompt you to enter the OPTIONS Section. To enter the OPTIONS Section, the MAIN RUN SCREEN must be displayed. Press and HOLD the F4 key for at least four (4) seconds. A password screen will display. Enter the password, as previously instructed. The following screens will appear, and you may scroll from one setting menu to the next using the NX↑ (F1) or LST↓ (F2) function keys:

SET THE SCREEN LANGUAGE:
Currently, the menus are available in both ENGLISH and FRENCH. From the LANGUAGE: screen, press the ADJ function key (F3) to change this setting. When the screen containing UP and DWN key choices is displayed, you may toggle between the available languages using those keys. Press ENT when the language you wish to choose is displayed.

LANGUAGE: ENGLISH
NX↑ LST↓ ADJ ESC

ENABLE THE INTERNAL BATTERY OPTION:
If your Series SLD Gas Detector was supplied with the INTERNAL BATTERY Option installed, you may toggle this backup battery function ON (YES) or OFF (NO). If you Series SLD does not have an internal battery backup installed, do *not* set this option to "YES".

BATTERY: NO
NX↑ LST↓ ADJ ESC

POWER DOWN - WHEN ON BATTERY POWER
If your Series SLD Gas Detector was supplied with the INTERNAL BATTERY Option installed, you may toggle this OPTION on OR off. When ON, this parameter permits you to power down the detector by pressing and holding the F2 button when it is running on backup battery power. The message "POWER DOWN" is displayed for a few seconds before the detector is turned off. If there is a problem with the hardware (battery backup option not installed, or batteries not attached), the message "HARDWARE FAULT - POWER DOWN CKT" is displayed. To power up the detector on battery power, press and hold the F1 button for greater than two seconds and release.

POWER DOWN: YES
NX↑ LST↓ ADJ ESC

ENABLE THE REMOTE ACKNOWLEDGMENT:
Your Series SLD Gas Detector was supplied with a REMOTE ACKNOWLEDGMENT feature. You will be able to connect an external, remote, momentary contact button to the terminal connections marked SW IN and COM. From the REMOTE ACK: screen press the ADJ function key (F3) to toggle this REMOTE ACKNOWLEDGMENT Option between YES or NO. If the REMOTE ACKNOWLEDGMENT option is not installed, changing this setting will not make any change in the operation.

REMOTE ACK: NO
NX↑ LST↓ ADJ ESC

ENABLE THE FLASHING BACKLIGHT FOR ALARM ACKNOWLEDGMENT SCREEN:
Scroll to the FLASH ACK: screen. This setting allows the backlight to FLASH when the alarm acknowledgment screen is displayed. FROM the FLASH ACK: screen press the ADJ function key (F3) to toggle between YES or NO. Default setting is YES.

FLASH ACK: YES
NX↑ LST↓ ADJ ESC

DISABLE THE INTERNAL BUZZER:
Scroll to the BUZZER: screen. This setting enables or disables the local alarm buzzer. From the BUZZER: screen press the ADJ function key (F3) to toggle between OFF or ON.

BUZZER: OFF
NX↑ LST↓ ADJ ESC

ENABLE EVENT LOGGING:
Scroll to the LOG: screen. This setting enables or disables alarm/event logging. It is recommended that the default ON setting be allowed. From the LOG: screen press the ADJ function key (F3) to toggle between YES or NO. Default setting is YES.

LOG: ON
NX↑ LST↓ ADJ ESC

ENABLE THE SENSOR LIFE TIMER:
Scroll to the SENSOR LIFE: screen. This setting enables or disables a two (2) year timer that will alert the operator that it is time to change the gas sensor. This relies on the time & date function to be set properly. Sensors should be replaced every two (2) years - A warning screen will appear if this function is enabled, to alert the operator that it is time to change the sensor. It will appear only once until the instrument is powered again. When the user enters the channel input calibration screen, he/she is prompted to answer Y/N if the sensor is new. From the SENSOR LIFE: screen press the ADJ function key (F3) to toggle between YES or NO. Default setting is NO.

SENSOR LIFE:
NX↑ LST↓ ADJ ESC

SET THE CALENDAR REMINDER:
Scroll to the CAL REMINDER: screen. This setting allows you set a number of days to alert the user that the sensor should be checked and/or calibrated. This is strictly for user convenience and does not affect operation in any way. From the CAL REMINDER: screen press the ADJ function key (F3) to change the setting. Press the UP or DWN keys to scroll through the choices of number of days. The settings available are: OFF, 31, 62, 92, 183, or 365. Default setting is OFF.

CAL REMINDER: OFF
NX↑ LST↓ ADJ ESC

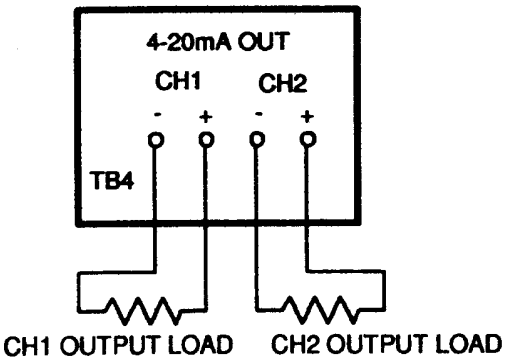
EXITING THE OPTIONS SECTION
Pressing the ESC key from the various menus in this section WILL START THE EXIT PROCESS. If you have changed any settings, you will be prompted to SAVE CHANGES. If you see the SAVE CHANGES screen, press YES to save or NO to return all settings to the previous condition. If you have not made any changes, the SAVE CHANGES screen will not display. A SET OPTIONS PW (Password) screen will display prompting you to set a new password if desired.

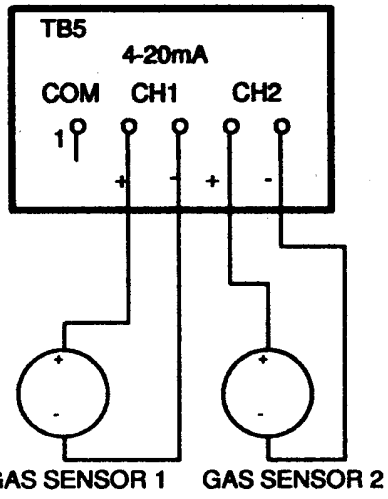
ERROR MESSAGES

K6 ALARM RELAY
The K6 alarm relay (see wiring diagram on Page 11) will energize when any of the following Error Messages are displayed:

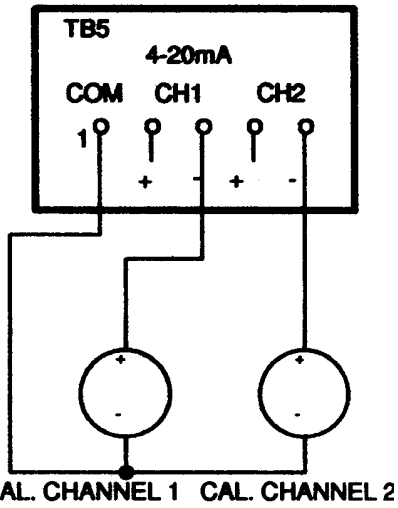
ERROR MESSAGE	PROBLEM
SENSOR SHORT	Sensor leads are shorted or the sensor is possibly reversed.
BATT REV / SHORT	Battery is reversed or the wires are shorted together.
BATTERY LOW	Battery energy is low.
BATTERY DEAD	Battery energy is completely drained.
BATTERY MISSING	Battery option is enabled but no battery is being detected.
HARDWARE FAULT-POWER DOWN CKT	Battery backup optional circuitry is not installed, but POWER DOWN" and "BATTERY" options are enabled.

NOTE: The K5 relay terminal is non-functional; reserved for future design use.

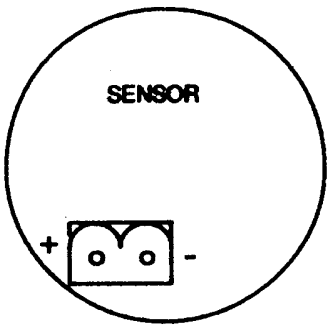


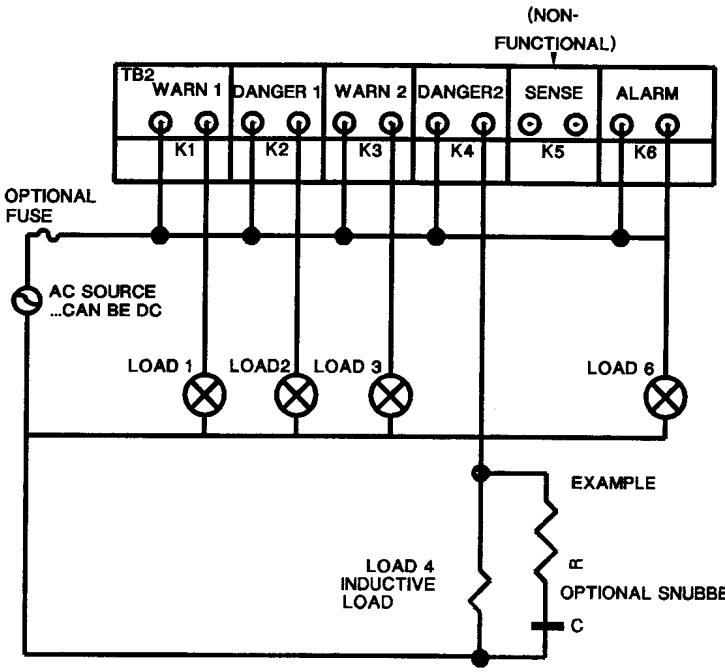


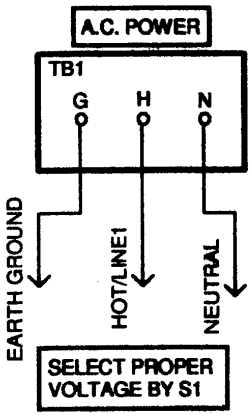
SENSOR WIRING



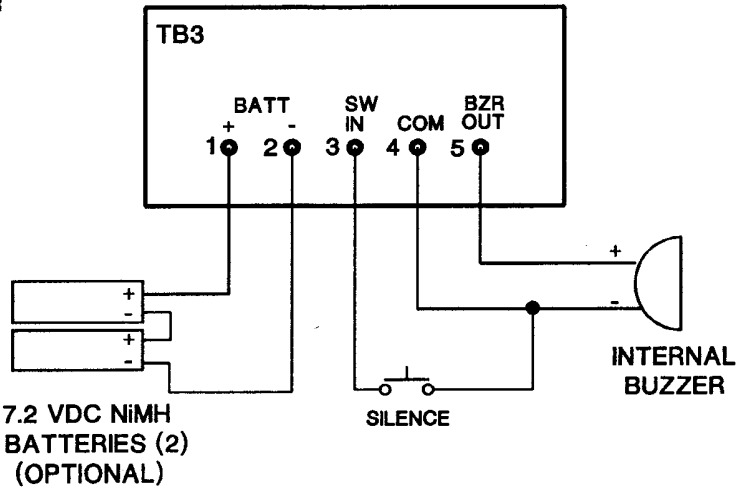
CALIBRATOR WIRING

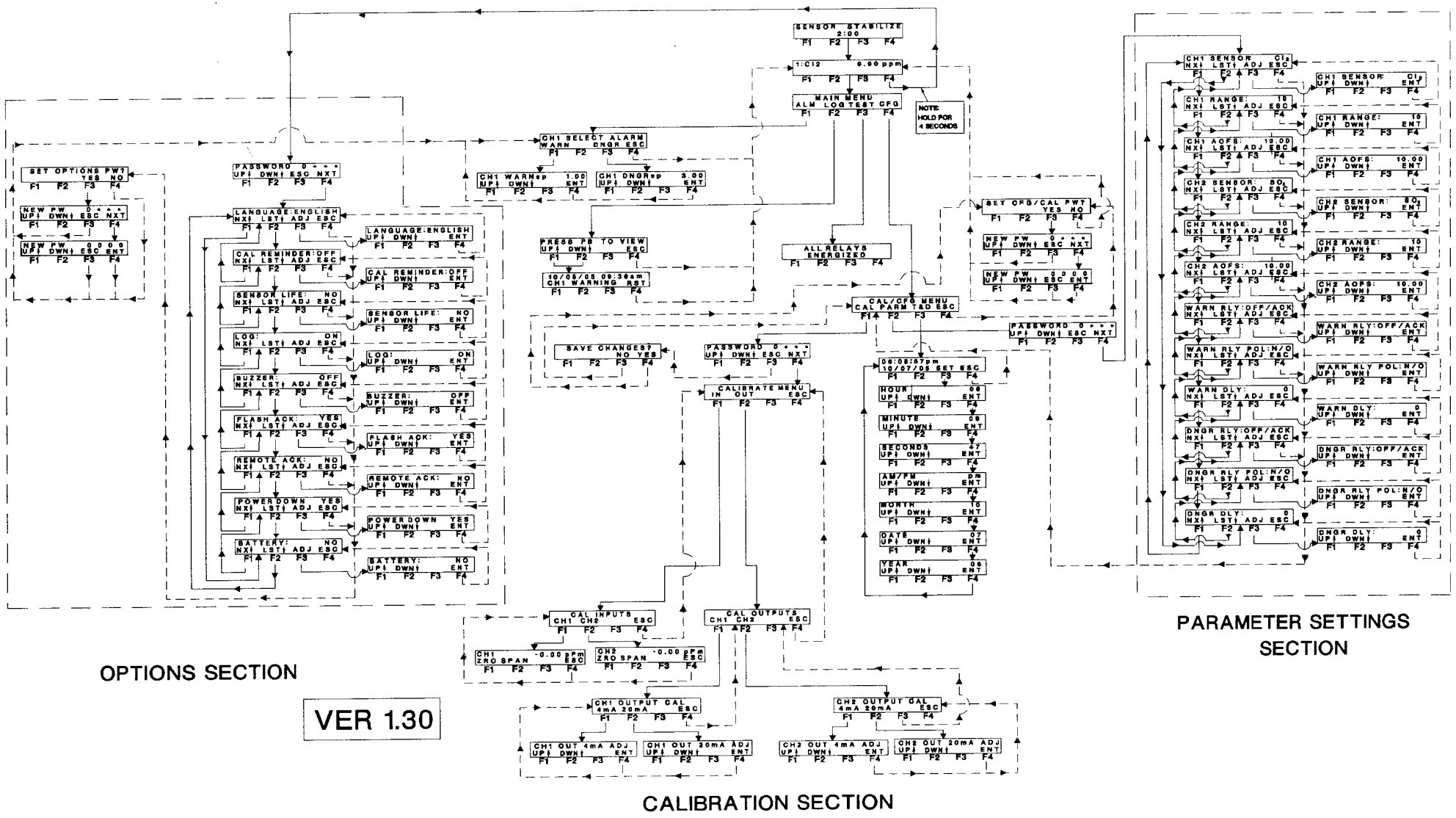






BATTERY, SWITCH & INTERNAL BUZZER CONNECTIONS





OPTIONS SECTION

VER 1.30

PARAMETER SETTINGS SECTION

CALIBRATION SECTION

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Website: www.chlorinators.com

Chemical Injection Technologies

Product/Specification Bulletin

SUPERIOR™ Gas Detector Model SLD-1
Single Channel (One Gas)

- Event alarm log records up to 256 events, with time and date, which can be viewed on the display or downloaded from the optional serial port.
- Sensor life and calibration reminder timers.
- 4-20 mA gas level monitor output.
- Password protection for all parameter settings.
- High, Low, Latching and Non-Latching alarm relays.
- Two level alarm settings for "Warning" and "Danger" gas levels.
- All alarm relays are user adjustable for N/O, N/C, Latch or Non-Latch.
- Remote alarm acknowledgment of any alarms up to 250 ft. (76 meters) from the controller.
- Flashing backlight screen when alarm acknowledgment is required.

GENERAL DESCRIPTION

The SUPERIOR™ Model SLD-1 Gas Detector is a state-of-the-art, microprocessor controlled instrument capable of detecting Chlorine, Sulfur Dioxide, Ammonia, and Ozone gasses at levels far below the threshold of human awareness. SUPERIOR™ Single Point Gas Detectors are an "operator friendly" and economical way to protect personnel and property. The detector will monitor gas levels well below OSHA requirements, and activate warning devices when threshold levels are reached.

The Model SLD-1 Gas Detector consists of a Controller/Alarm module, and a remote gas sensor module which can be located up to 1000 feet (305 meters) away from the controller. The sensor responds immediately to the presence of gas, and recovers very quickly when the gas has cleared. The controller/alarm module is housed in a NEMA-4X enclosure. Many features which are extra cost options in other gas detectors, are standard with the SLD-1.

FEATURES

- User-friendly key pad interface with functions indicated by individual menu display screens.
- 16-character by 2-line display, with green LED back light for easy reading, even in low light areas.
- NEMA-4X controller enclosure.
- 95 dB internal alarm horn

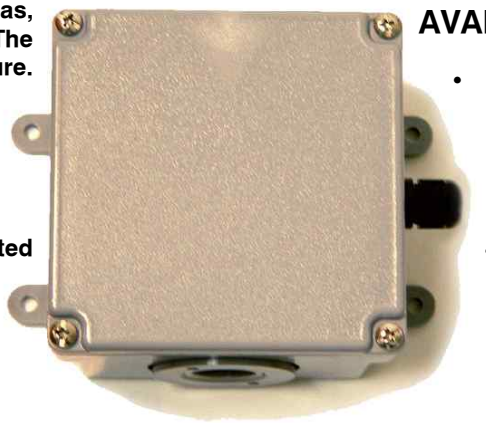
APPLICATION

The SUPERIOR™ Model SLD-1 is designed for use in:

- Wastewater treatment plants
- Water purification plants
- Swimming pools
- Cooling towers - air scrubbers
- Food and beverage processing
- Chemical processing

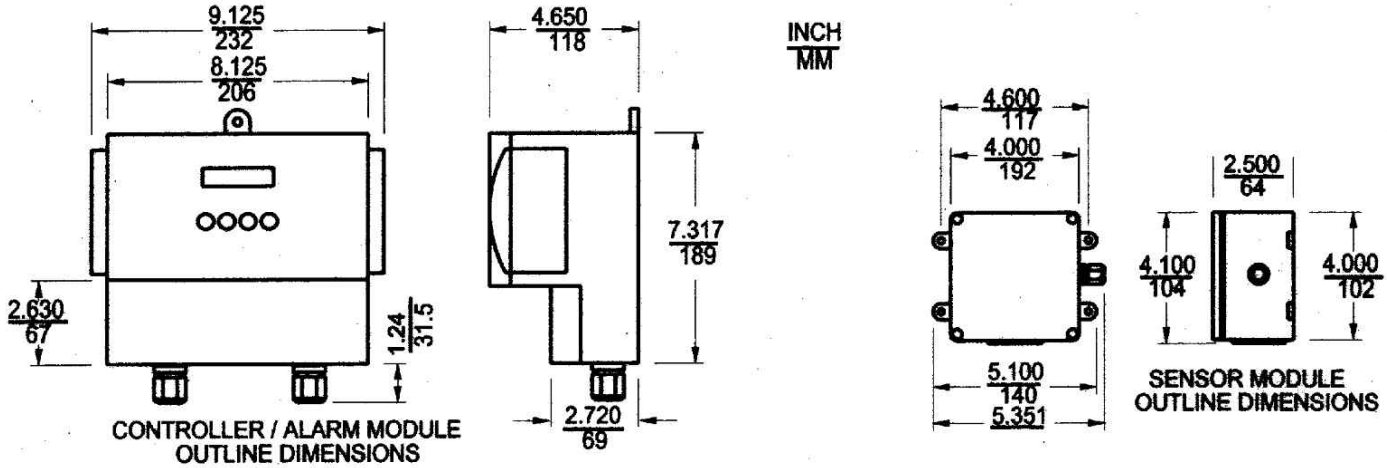
SUPERIOR™ design provides ease of operation with top performance. The SUPERIOR™ Series SLD-1 Gas Detector can be placed where most convenient for the operator for ease of use while the gas sensor can be placed in the monitored environment up to 1000 feet (305 meters) away.

Materials used in manufacturing the SUPERIOR™ Series SLD-1 Gas Detectors have been carefully selected for their superior quality and performance in situations and conditions far more extreme than conditions to be encountered in actual use.



AVAILABLE OPTIONS

- Internal Battery backup with charger. An external UPS may also be used to allow full function operation over extended power outages.
- RS232 serial port for downloading data.



TECHNICAL SPECIFICATIONS

Sensor Inputs (Analog Inputs)

Maximum Number of Gas Sensors:	One
Gas Sensor Signal:	Current Loop (4-20- mA)
Loop Voltage:	15V, short circuit protected
Maximum Sensor Distance:	1000 ft. (305 meters)

Sensor Outputs (Analog Outputs)

Signal Type:	4-20 Ma
Voltage Compliance:	12V
Maximum Load:	600Ω
Minimum Load:	0Ω
Number of Outputs:	One

Relays & I/O

Type:	Form-A (N/O)
Maximum Current Rating:	5A (resistive)
Suppression Voltage:	275 V, 10J, MOV
Quantity:	250VAC/30VDC
	3 (1 Danger, 1 Warning, 1 Alarm)
Remote Acknowledgment Switch:	Yes
Horn Output:	Yes:10-24V

Computer & Display

Microcontroller:	68HC12 type
ROM:	128k, FLASH
ROM Upgradable in Field:	Yes
Real-Time Clock:	Yes
RS232 Port:	2 (one standard, one optional)
Display:	LCD, 2-Line, 16 char./line, backlit
Pushbuttons:	Four, tactile dome type

Power Supply

A.C. Line Voltage (115V):	85V - 130V
A.C. Line Voltage (230V):	170V - 250V
Power:	12W
Optional D.C. Supply:	Sealed NiMH

Environmental

Operating Temperature:	32°F to 122°F (0°C to 50°C)
Humidity:	2%, non-condensing

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Chemical Injection Technologies

Product/Specification Bulletin

SUPERIOR™ Model VAS-3
Digital Chlorine Vacuum Alarm Switch

GENERAL DESCRIPTION

The SUPERIOR™ Series VAS chlorine vacuum alarm switches are designed to alert gas chlorinator users when either of two critical situations arise:

1. HIGH VACUUM ALARM - indicates that the supply of chlorine gas has been interrupted. Either the chlorine supply is empty, or the chlorine cylinder valve has been shut off. In either case there is no chlorine gas entering the system.

2. LOW VACUUM ALARM - indicates that the ejector is not producing sufficient vacuum to operate the system, or a leak has occurred somewhere in the system.

Either of these situations will indicate that your system is not being chlorinated. The VAS alarm switch can be connected to a number of standard devices that will sound a loud audible alarm, send a signal via telephone lines, stop pumps or close valves, or any combination of these devices.

It is very important that operations personnel have a quick, reliable monitoring device to tell them if the critical chlorinating process has been interrupted. Many states now require vacuum level monitoring devices on all public water supply gas chlorination systems. The SUPERIOR™ Series VAS vacuum alarm switches meet or surpass these requirements.

Series VAS-3 alarm switches have a large LED vacuum level readout. The alarms will "latch" automatically after 10 seconds of alarm condition. Once latched, the alarm must be manually reset.

PRINCIPLE OF OPERATION

Gas chlorinators operate within a range of vacuum levels. The vacuum is produced by a water operated venturi (the ejector). When sufficient vacuum is present, a spring-opposed diaphragm in the vacuum regulator, pushes the inlet valve open and allows gas to flow into the system. The flow rate of chlorine is regulated by an adjustable valve. In a standard chlorine system the VAS switch is located between the flow rate valve and the ejector.(See typical installation)

The vacuum level in this area will always be higher than in the vacuum regulator because of the restriction of the rate valve. Since the regulator opens at approx. 4 inches of vacuum, this "monitored" area will always be above 5 inches when the system is operating. Therefore, the Low vacuum switch is preset at 5 inches of vacuum. If the ejector becomes plugged, the water supply is shut off, or a break occurs in the vacuum tubing, the vacuum level will fall below 5 inches and an alarm contact will be made.

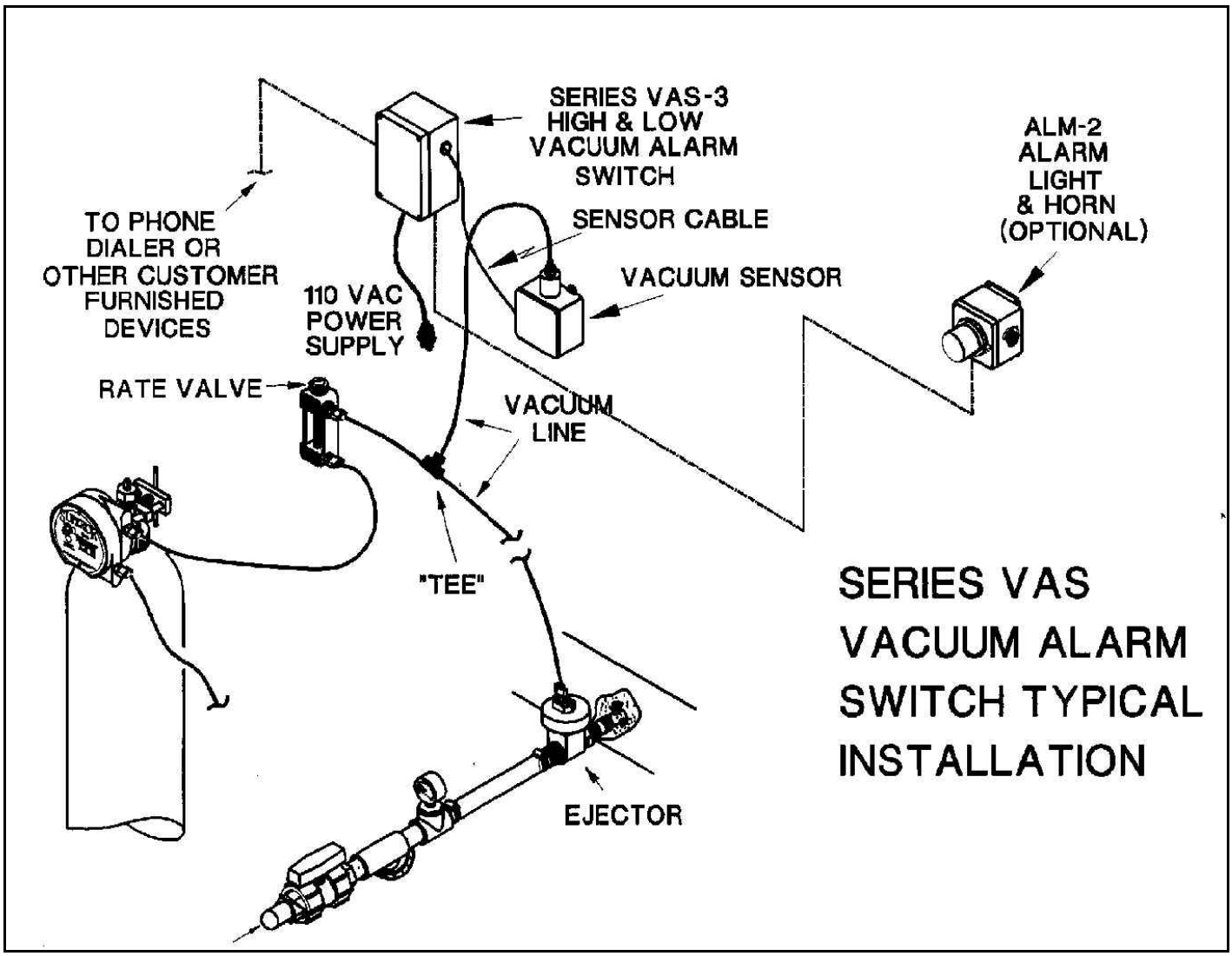
Under normal operating conditions the ejector will produce approximately 27 inches of vacuum, if there is no chlorine flowing through the system. When chlorine gas flows through the regulator and rate valve, the vacuum level will always be below this "shutoff" point. Therefore the VAS high vacuum switch is preset at 20 inches of vacuum. If the chlorine supply is emptied or the valve is shut off, vacuum will rise to the "shutoff" level and an alarm contact will be made. In some installations, the ejector hydraulic conditions may not allow "shutoff' vacuum to reach these levels. In such cases the alarm set points can be easily adjusted on-site to operate within the limits of the system.

Both switches are time delayed to eliminate false alarms which may result from vacuum spikes or delays which can occur, particularly when the operation of the chlorinator is controlled by the on / off cycling of a booster pump. The time delay can be manually set from 0 to 60 seconds.

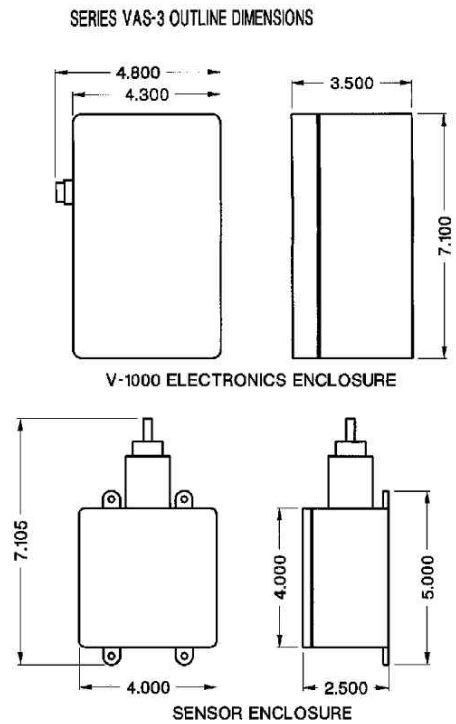
The unit is housed in a NEMA 4X U.L. listed fiberglass enclosure, and can be mounted outdoors. The vacuum sensor is housed in a separate enclosure with an oil based chlorine protection device. The sensor enclosure is connected to the alarm housing by electric cable.

OPTIONAL ALARM MODULE

An optional horn and strobe light alarm signaling module, MODEL ALM-2, is available for connection to the VAS-3. The 95 decibel horn is easily heard from hundreds of feet away, while the strobe light is highly visible and attention getting.



DIMENSIONS



SPECIFICATIONS

Enclosure: fiberglass NEMA 4X
Power: 115VAC, 60 Hz (220VAC, 50Hz available)
Alarm relays: NO\NC Type
240V AC @ 5 amps resistive
115V AC @ 5 amps general use
30V DC @ 5 amps general use
Analog Output:
voltage: 0 to 3 VDC
current: 0 to 3 ma DC
Reset switch: IP 65 protection.
External connectors: IP 68 protection.
Indicators:
vacuum: 3 digit digital LED display.
alarms: 3 LED indicators/HIGH, Low and Latch.
polarity: 1 LED indicator for pressure.
Temperature range (system):
storage: -30 C to 70 C.
operating: -20 C to 50 C.
vacuum temperature range: -40 C to 50 C.

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SUPERIOR

VAS-3

VACUUM MONITORING SYSTEM

INSTALLATION AND USER'S GUIDE

VAS-3 O&M Manual, Revision 0, 01 March 2010

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Table of Contents

Section 1 Introduction

The VAS - 3 is a full-featured vacuum monitoring system. The system uses the latest in integrated circuit technology, which allows a compact design, accuracy and reliability. The VAS - 3 features both high and low vacuum detection, separate high, low and latch alarm relays, three digit display of vacuum in inches of Hg., LED status indicators and a analog output. The high and low alarm levels are user adjustable along with a variable delay timer. The enclosure has a NEMA 4X rating; therefore it can be mounted outside. Applications include loss of chlorinating in water and wastewater treatment, pool pump monitoring, automotive test equipment and many others.

Section 2 Inventory

The following items are included with the VAS - 3:

1. V1000. Contains the electronics housed in a NEMA 4X enclosure.

2. Sensor enclosure with oil based protection device.

3. Two watertight fittings used for running the power and alarm wires from the control box to the alarms.

4. ¼" tube fitting attached to the oil based protection device.

5. Power cord.

6. Instruction manual.

7. Warning label attached to the oil based protection device.

Section 3 Specifications

Input voltage: 115V AC 60 Hz @ 0.1 amps [220 V AC, 50 Hz Optional]
Alarm relays: NO\NC Type
240V AC @ 5 amps resistive
115V AC @ 5 amps general use
30V DC @ 5 amps general use

Gas\Fluid compatibility: System includes a protection device that uses a chemically inert synthetic oil compatible with chlorine, sulfur dioxide, and ammonia gas.

Enclosure: . . . . . NEMA 4X rated

Vacuum measurement range: . . . . . 0 to 30 in. Hg.

Low alarm range: . . . . . 0 to 15 in. Hg.

High alarm range: . . . . . 15 to 30 in. Hg.

Over pressure: . . . . . 50 PSI.

Delay timer: . . . . . 1 to 100 sec.

Analog output:
voltage: . . . . . 0 to 3 VDC.
current: . . . . . 0 to 3 ma DC.

Reset switch: . . . . . IP 65 protection

External connectors: . . . . . IP 68 protection

Indicators:
vacuum: . . . . . 3 digit digital LED display
alarms: . . . . . 3 LED indicators/High, Low and Latch
polarity: . . . . . 1 LED indicator for pressure

Temperature range (system):
storage: . . . . . -30 C to 70 C
operating: . . . . . -20 C to 50 C
vacuum temperature range: . . . . . -40 C to 50C

Humidity: . . . . . Relative 0 to 90% noncondensing

(Specifications are subject to change without notice.)

Section 4 Operation Basics

Digital Display

The three-digit display represents the real time vacuum pressure in inches of Hg. Minimum vacuum equals 00.0 and the maximum vacuum reading, depending on altitude, is approximately 30.9 inches.

LED Indicators

The V1000 has four LED indicators; High, Low, Latch and Polarity. See Fig. 1 for their locations.

High LED Indicator

This LED indicates that the vacuum pressure exceeds the preset High Alarm set point.
NOTE: This indicator is real time, i.e., it does not wait for the delay timer to time out.

Low LED Indicator

This LED indicates that the vacuum pressure is below the preset Low Alarm set point. This LED indicator is also real time.

Latch LED Indicator

When either the high or low indicators are active, this starts the delay timer. If the alarm is active longer than the preset delay time, then the latch LED indicator will become active. This indicator stays active until the manual reset button (see Fig. 2) is pushed. This indicator implies that either an alarm has occurred or is still active. If the latch indicator is on and the High/Low indicators are off, then an alarm condition has occurred, but is not active now. If either the High or Low indicators are active, then this represents that the alarm condition is still active.
NOTE: The High or Low alarm relays do not become active until the latch alarm indicator is on.

Polarity LED Indicator

When this LED is on this indicates that the V1000 is measuring pressure. The digital display shows this pressure in inches of Hg. pressure.

Alarm Relays

The V1000 has three alarm relay outputs. The alarm relays do not become active until the delay timer times out, which causes the latch alarm indicator to become active. The three alarm relays are general purpose and can be used for exterior alarms, load switching or phone monitoring.
Note: Do not exceed relay specifications.

High Alarm Relay

The High Alarm relay becomes active from a high alarm condition after the delay timer times out. This relay stays active as long as the alarm condition exists. Once the alarm condition goes away, this relay becomes inactive.

Low Alarm Relay

The Low Alarm relay becomes active from a low alarm condition after the delay timer times out. This relay stays active as long as the alarm condition exists. Once the alarm condition goes away, this relay becomes inactive.

Latch Alarm Relay

When either the High or Low Alarm relays become active and the delay time is over the latch alarm relay also becomes active. This is indicated by the Latch Alarm indicator. This relay stays active until the manual reset button is pushed (see Fig. 2).

NOTE: In some applications, like gas chlorination in water and wastewater treatment, special attention needs to be given to the electrical hookup. If your vacuum source under normal operation is cycled on and off, as is the case when the vacuum is created only when a well pump is operating, then the 115V AC (or 220 V AC, optional) power to the VAS - 3 should be switched on and off with the well pump. This will prevent a low alarm condition when the pump is off.

Section 5 Installation

Installation should only be performed by a licensed electrician. Follow any local, state or other applicable codes that apply when installing this unit.
THIS UNIT SHOULD BE WIRED TO A GROUND FAULT RECEPTACLE.
CAUTION: HIGH VOLTAGE COULD EXIST INSIDE THIS UNIT. DISCONNECT ALL POWER BEFORE INSTALLATION.

Opening Unit

Remove the four plastic screws to open the unit. The printed circuit board contains static sensitive parts, so the installer should wear a grounding strap when handling the board.

Enclosure Mounting

IMPORTANT: This unit contains two enclosures. The larger one contains the electronics (V1000) and the smaller one contains the sensor. The two enclosures are permanently connected together by a low voltage wire. The sensor enclosure contains an oil based protection device that is filled with a special fluid. The protection device has a cap over the ¼" fitting to prevent the oil from leaking out during shipping and installation. **THE SENSOR ENCLOSURE MUST BE MOUNTED IN AN UPRIGHT POSITION TO PREVENT THE FLUID FROM LEAKING OUT.** Once the unit is securely mounted in an upright position, the cap over the ¼" fitting can be removed.

The recommended mounting method for the VAS - 3 is to use four mounting holes located where the 4 plastic screws are that hold down the lid. Use the box as a template for mounting (see Fig. 2).

NOTE: THE VAS - 3 SHOULD NOT BE MOUNTED WHERE SUNLIGHT CAN DIRECTLY ENTER THE TRANSPARENT COVER.

The printed circuit board is designed to have power come ln from the bottom of the box. Remove the knockouts that are needed for power entry. Two watertight fittings are provided for the power and alarm line. If the board must be removed to install a watertight fitting, care must be taken in handling the board.
NOTE: IF YOU RUN CONDUIT INTO THE BOX AND DO NOT USE THE WATERTIGHT FITTINGS, YOU MUST USE A SEALANT TO SEAL AROUND THE CONDUIT CONNECTION.

Install the printed circuit board after the connectors have been installed. Use the four #6 screws provided to mount the board in the box and tighten only to a snug fit. **DO NOT OVER TIGHTEN (see Fig. 2)**

Vacuum Line and Reset Switch

Connect your ¼" vacuum hose to the ¼" barb fitting attached to the protection device. The reset switch is prewired to the board reset terminals.

Power and Alarm Wiring

CAUTION: BE SURE POWER IS DISCONNECTED BEFORE HANDLING ANY WIRES.
WARNING: IMPROPER WIRING TO THIS UNIT CAN DAMAGE UNIT AND COULD CAUSE SERIOUS BODILY INJURIES. OVER PRESSURE ON THIS UNIT IS RATED AT 50 PSI. EXCEEDING THIS PRESSURE CAN CAUSE A RUPTURE OF THE SENSOR. See Fig. 1 for typical electrical wiring. Connect 115V AC (or 220 V AC, optional) to the connector location labeled HOT, NEU and GND.
NOTE: A surge arrestor is recommended on the AC power line to prevent damage from lightning strikes or other power surges. The alarms can be hooked up in many ways. Be sure the relay specifications are not exceeded. The relay outputs are labeled HIGH ALARM, LOW ALARM and LATCH ALARM. Remember the latch alarm will stay active until the reset button is pushed.

Note: NO = Normally open contact
NC = Normally closed contact
COM = Relay common

Section 6 Set up and Calibration

The VAS - 3 comes preset at the following default levels:

Delay:	50 sec.
Low Alarm:	5 in. Hg.
High Alarm:	25 in. Hg.

The following Is a procedure for changing these values. See Fig. 1 for the location of the adjustment pots.
CAUTION: HIGH VOLTAGE EXISTS INSIDE THE UNIT.

Delay Adjustments

The delay time is adjustable from approximately 1 second to 100 seconds. To adjust the delay, insert a small screwdriver into pot R24 rotate until the desired delay is achieved. The delay value is printed on the board.

Low level Alarm

The Low Level alarm is adjustable from approximately 0.0 to 15 inches of Hg. To adjust the low level, insert a screwdriver into pot R19 and rotate it to the desired level. MIN = 0 and MAX = 15 inches of Hg.
NOTE: If you want to disable the low alarm, turn the pot counter clockwise until it stops.

High Level Alarm

The High Level alarm is adjustable from approximately 15 to 30 inches of Hg. To adjust the high level, insert a screwdriver into pot R16 and rotate it to the desired level. MIN = 15 inches of Hg. and MAX = 30 inches of Hg.
NOTE: If you want to disable the high alarm, turn the pot clockwise until it stops.

Alternate Method for Accurate High/Low Level Adjustment

If a high degree of accuracy is required, then use the procedure in the following example:

Example: If you desire a high level alarm at 26.3 inches of Hg.

1. Adjust your vacuum level until the digital readout reaches 26.3.
2. Rotate the high level alarm pot full R16 counter-clockwise.
3. Then, rotate the high level alarm pot R16 clockwise slowly until the high level LED comes on. This represents the correct adjustment for 26.3 inches of Hg.

This method can be used for low level adjustment, except the rotation of the low level alarm pot R19 is reversed.

Analog Output

The VAS - 3 has an analog output, which will allow the vacuum to be remotely monitored. The connection for this is located in the upper left section of the printed circuit board (see Fig. 1). Two spade lugs are provided for the connection. They are labeled GND for ground and OUT for the output. The output is capable of sourcing 0 to 3 VDC or 0 to 3 ma. If a 4 to 20 ma loop is required, a signal conditioner can be used to convert the output. These are available from many sources.

Maintenance and Callbratlon

Once the VAS - 3 has been in operation for approximately one week, the unit should be checked for the correct zero reading. This is the reading when no vacuum is present. Ideally, the zero reading would be 00.0. However, due to the ambient temperature, some variation is normal. If the zero reading is over 00.7 then an adjustment is needed. The zero adjustment pots are located in the upper right hand comer of the board. One of the pots, if looked at from,the middle of the board, is rotated all the way to the right and the other pot is rotated to approximately the 12:00 position. The pot that is close to the 12:00 position is the pot to adjust. Slowly turn this pot to get the zero reading as close to 00.0 as you can. This will end the zero calibration. If the reading still does not read 00.0 then slowly adjust the other pot until a reading of 00.0 is set.
NOTE: AT LEAST ONE OF THE POTS MUST ALWAYS BE ROTATED ALL THE WAY TO THE RIGHT.

Once a month the system should be functionally tested. This testing should include all relays, LED indicators, delay timer and vacuum level accuracy. To perform this test adjust your vacuum level up and down to cause the high and low alarms to engage. The delay timer and reset can also be tested in the same manner. At this time, inspect the board for any corrosion or loose wires. If corrosion is present check all fittings for a snug fit.
DO NOT ATTEMPT TO CLEAN ANY CORROSION FROM THE BOARD. HIGH VOLTAGE EXISTS ON THE BOARD.
Corrosion can only be removed by a trained technician. The outside of the enclosure can be cleaned with warm water and a damp cloth.

LIMITED WARRANTY

THE MANUFACTURER. warrants this product to be free from defects in material and workmanship for a period of one (1) year from the date of the first consumer purchase.

Except as specified below, this warranty covers all defects in materials or workmanship in this product. The following are NOT covered by the warranty:

1. Any product on which the serial number has been defaced, modified or removed.

2. Damage, deterioration or malfunction resulting from:
   a. Accident, misuse, abuse, neglect, fire, water, lightning or any other acts of Nature.
   b. Any unauthorized product modification or failure to follow instructions supplied with the product.
   c. Repair or attempted repair by anyone not authorized by THE MANUFACTURER.
   d. Any shipment of the product.
   e. Any other causes which do not relate to a product defect.

LIMITATION OF IMPLIED WARRANTIES

ALL IMPLIED WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE LENGTH OF THIS WARRANTY.

EXCLUSION OF DAMAGES

THE MANUFACTURER'S LIABILITY FOR ANY DEFECTIVE PRODUCT IS LIMITED ONLY TO THE REPAIR OR REPLACEMENT OF THE PRODUCT AT OUR OPTION. THE MANUFACTURER SHALL NOT BE LIABLE FOR:

1. DAMAGE TO OTHER PROPERTY CAUSED BY ANY DEFECTS IN THIS PRODUCT, DAMAGES BASED UPON INCONVENIENCE, LOSS OF USE OF THE PRODUCT. LOSS OF TIME, OR
2. ANY OTHER DAMAGES, WHETHER INCIDENTAL, CONSEQUENTIAL OR OTHERWISE.

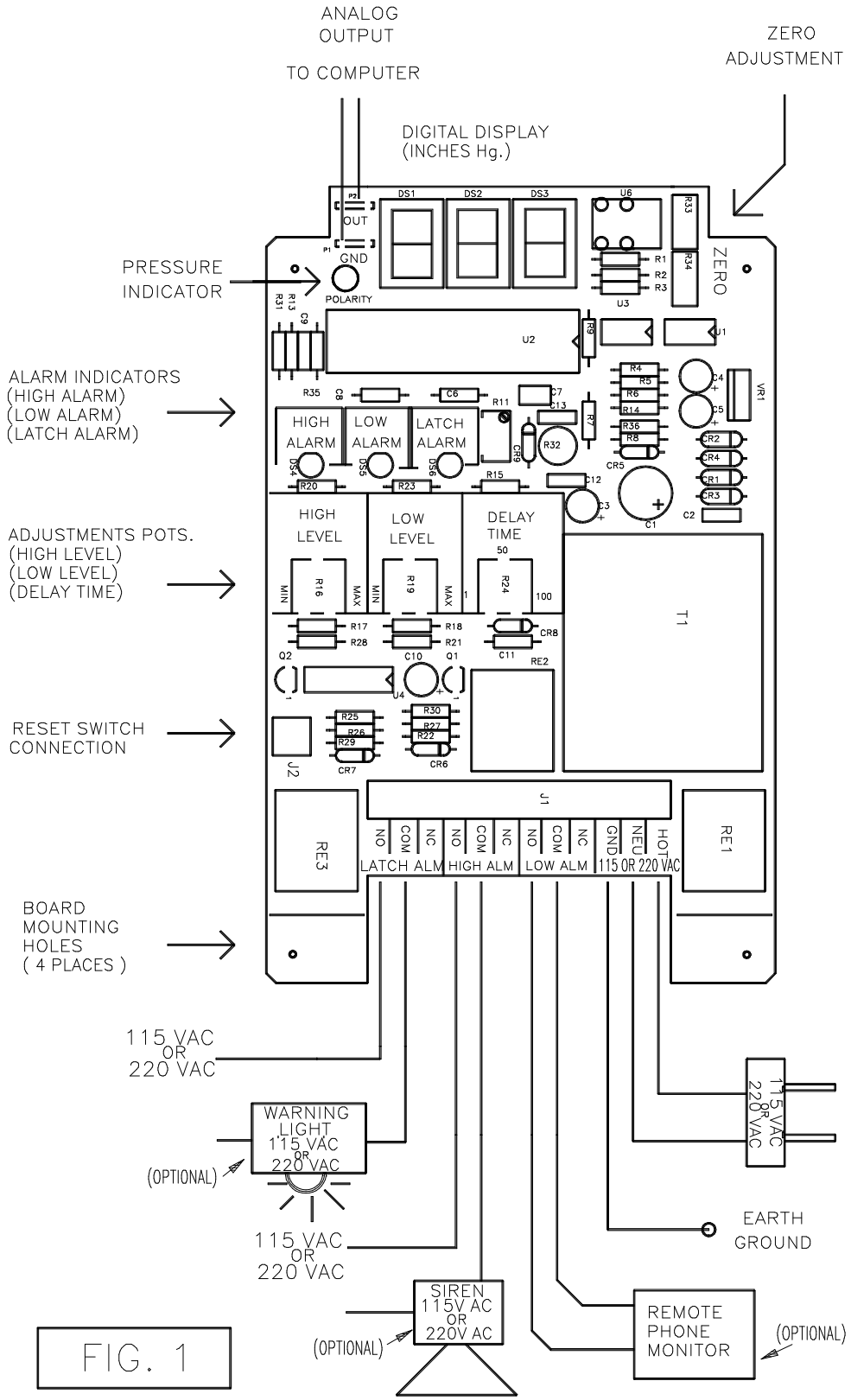
ANALOG OUTPUT
TO COMPUTER
ZERO ADJUSTMENT
DIGITAL DISPLAY (INCHES Hg.)
PRESSURE INDICATOR
ALARM INDICATORS (HIGH ALARM) (LOW ALARM) (LATCH ALARM)
ADJUSTMENTS POTS. (HIGH LEVEL) (LOW LEVEL) (DELAY TIME)
RESET SWITCH CONNECTION
BOARD MOUNTING HOLES (4 PLACES)
HIGH ALARM
LOW ALARM
LATCH ALARM
HIGH LEVEL
LOW LEVEL
DELAY TIME
LATCH ALM
HIGH ALM
LOW ALM
115 OR 220 VAC
115 VAC OR 220 VAC
WARNING LIGHT 115 VAC OR 220 VAC
(OPTIONAL)
115 VAC OR 220 VAC
EARTH GROUND
SIREN 115V AC OR 220V AC
(OPTIONAL)
REMOTE PHONE MONITOR
(OPTIONAL)

FIG. 1

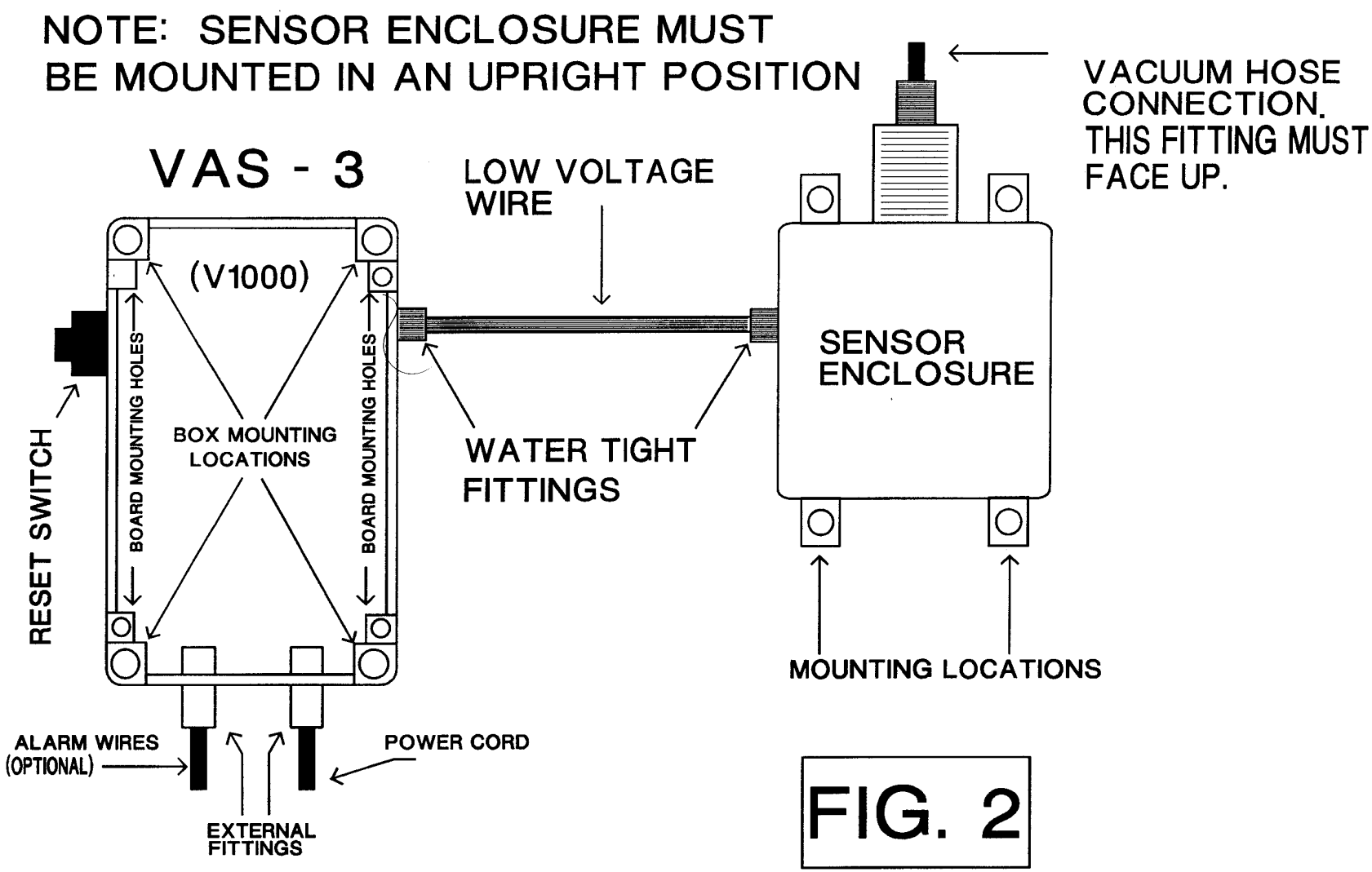
NOTE: SENSOR ENCLOSURE MUST
BE MOUNTED IN AN UPRIGHT POSITION
VAS - 3
(V1000)
LOW VOLTAGE
WIRE
VACUUM HOSE
CONNECTION.
THIS FITTING MUST
FACE UP.
SENSOR
ENCLOSURE
RESET SWITCH
BOARD MOUNTING HOLES
BOX MOUNTING
LOCATIONS
BOARD MOUNTING HOLES
WATER TIGHT
FITTINGS
MOUNTING LOCATIONS
ALARM WIRES
(OPTIONAL)
POWER CORD
EXTERNAL
FITTINGS

FIG. 2

SUPERIOR

VAS-3

VACUUM MONITORING SYSTEM

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