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REGAL SMARTVALVE™

Models 7001 and 7006

Flow Proportional Control

Model 7001.....Flow Proportional Control (10 to 500 PPD)
 Model 7006.....Flow Proportional Control (1000/2000 PPD)

NOTE: For Ammonia Service, add "A" after the Model Number. Maximum Capacity: 100 PPD NH₃

INTRODUCTION

As population increases, municipal water and wastewater treatment facilities must also increase in size in order to supply and treat the greater demand for water. As the plants increase in size, so do the distribution and piping systems carrying this water to and from the population. These piping systems cover many, many miles making it difficult to maintain suitable disinfection and stable residuals using chlorine and sulfur dioxide feeders with manual gas flow rate adjusting valves.

The REGAL SMARTVALVES™ discussed in this bulletin solve the problem whenever varying water flows need to be treated by accurately providing the correct ratio of chemical to water at all times. **NO WASTED CHEMICAL.** The REGAL SMARTVALVE includes a digital display that allows the operator to view the instantaneous water flow rate being treated at any given moment or, the instantaneous gas feed rate in lbs. per day of chemical feed.

IMPORTANT NOTES

- All software including design, appearance, algorithms, and source codes are copyrighted and owned by Chlorinators Incorporated.
- The entire contents of this manual **MUST** be read and understood prior to installing and operating this equipment.
- DO NOT** discard this instruction manual upon completion of the installation as this manual contains information essential to the safe handling, operation, and maintenance of this equipment.
- Additional instruction manuals are available at nominal cost from Chlorinators Incorporated.
- Plastic pipe or tubing connector fittings may be broken or damaged if tightened excessively. **HAND TIGHTEN ONLY.**
- For optimum operation, the installation should be indoors so that the minimum and maximum temperature limitations as listed in the "TECHNICAL SPECIFICATIONS" section of this manual are not exceeded.

WARNINGS

- This equipment is suitable for use only with the gases specified. **DO NOT USE THIS EQUIPMENT WITH OTHER GASES.** Such use can result in failures having hazardous consequences.
- This equipment is designed FOR VACUUM SERVICE **ONLY.**
- To insure proper and safe operation of this equipment, use only REGAL parts. The use of non-REGAL parts can result in equipment failures having hazardous consequences and voids the REGAL warranty and insurance coverage.
- Maintenance should be performed by competent personnel familiar with this type of equipment, such as Chlorinators Incorporated themselves.
- It is essential that all external wiring be done exactly as shown on the wiring diagrams depicted in this manual. Incorrect wiring or improper grounding of this equipment **WILL** cause improper operation and presents a safety hazard.
- Field wiring **MUST** conform to national and local electrical codes.
- DISCONNECT POWER BEFORE** removing the cover or servicing this equipment.
- ALWAYS** make sure that the cover is in place and securely fastened to prevent the entry of moisture, water, or corrosive gases and also to eliminate the potential for electric shock.
- Any equipment powered by AC line voltage presents a potential shock hazard. Installation and servicing of this equipment should only be attempted by qualified electronics technicians.
- This non-metallic enclosure **DOES NOT** automatically provide grounding between the conduit connections. Grounding **MUST** be provided as part of the installation.
- Damage to the circuit boards or internal components incurred by drilling the enclosure for field wiring or connecting power lines to low voltage signal terminals voids the warranty.
- Changing parameter settings and selections **WILL** affect the operation of this equipment. If unsure, consult Chlorinators Incorporated **BEFORE** changing parameters or selections.

CHLORINATORS INCORPORATED ONE (1) YEAR LIMITED WARRANTY

Chlorinators Incorporated (hereinafter called "C.I.") sets forth the following warranties with respect to its REGAL Series 7000 SMARTVALVE™. This warranty does not apply to the purchase of spare parts or other services performed by C.I. or its authorized dealers. This represents the entire agreement between C.I. and Buyer (also referred to as "end-user") and shall apply unless modified in writing and signed by a C.I. Officer, and this warranty and its intended terms shall supersede any prior negotiations, correspondence, understandings, or agreements, written or oral. The Buyer agrees to and accepts all terms of this warranty by its contracting for or acceptance of C.I.'s products, and forms or other documents or statements issued by Buyer or any other person shall not modify or otherwise affect any of the following terms. Buyer should be aware that reseller must rely entirely upon Chlorinators Incorporated's warranties, or assume their own responsibility.

The following states C.I.'s entire warranty and represents Buyer's exclusive remedy with respect to its product. Such warranties are expressly given in lieu of any other warranty, expressed or implied, including but not limited to those of merchantability and fitness for a particular purpose. This expressed warranty or any other warranty implied by law shall not cover defects due to accident, improper use, or non-compliance with C.I.'s operating and maintenance, assembly, installation manual and instructions.

Recommendations and advice as to specifications, capabilities, design, installation, engineering, application, and use of products are provided as an accommodation and are intended only as suggestions. C.I. assumes no liability for such recommendations and advice and they are not to be construed as constituting any warranty, expressed or implied.

TERMS OF WARRANTY

C.I. warrants its REGAL Series 7000 SMARTVALVE™ for a period of one (1) year from date of shipment from C.I. Date of shipment from the factory shall be determined solely on the basis of the serial code affixed to the SMARTVALVE's enclosure. The serial number contains a date code. All serial numbers are also registered by Chlorinators Incorporated as to date of shipment, model number, accessories, options, and billing name. If the serial number is missing, defaced, changed, or in any way rendered unreadable, Chlorinators Incorporated shall, at its option, have the right to declare the warranty void. If the serial number does not match the registered model number as to, but not limited to, such items as accessories or options, the same shall apply.

The warranty shall apply against material defects in components and workmanship occurring in the course of manufacture. Buyer's sole remedy for breach of said warranty shall be, at C.I.'s option, either repair or replacement of any unit which is received by C.I. at its plant in Stuart, Florida (shipping charges prepaid by buyer), within the time period set forth above and which is found by C.I. to be defective by reason of manufacture.

Notwithstanding the foregoing, C.I. shall not be liable to Buyer for damages, including personal injury or death to any person or persons, or claims of any kind by a third party or property damage or loss of business or profits. In no event shall C.I. be liable to Buyer for consequential or accidental damages of any kind, even if C.I. was aware of the possibility of such damages. There are no remedies except those set forth. Further, that there are no other authorized warranty repair facilities other than those at the Chlorinators Incorporated factory in Stuart, Florida.

EXCLUSIONS

The following are considered external environmental factors beyond the control of C.I., and which may cause damage and/or need for service which will be specifically excluded from this warranty (i.e., not a material defect in components and workmanship occurring in the course of manufacture).

1. Damage by extraneous causes such as fire, water, lightning, chemical or galvanic attack, etc.
2. Damage to the circuit boards or internal components incurred by drilling the enclosure for field wiring.
3. Damage due to the connection of power lines to low voltage signal terminals.
4. Physical damage due to force, dropping, misuse or other abuse.
5. Use other than that as described in this Instruction Manual (misapplication).
6. Repair by someone other than Chlorinators Incorporated.
7. Improperly installed.
8. This warranty **DOES NOT** cover wear items subject to periodic replacement such as sensors, generating cells, fuses, batteries, o-rings, gaskets, seals, packing, etc.

The exclusions listed above are provided for purposes of clarification, and are not intended to, in any way, limit or eliminate other possible exclusions.

NO OTHER WARRANTIES

Unless otherwise explicitly agreed in writing, and signed by a C.I. officer, it is understood that this is the only written warranty given by C.I. for the systems and components stated.

The dealers or representatives of C.I. may not make verbal representations that add, modify or change the written warranties contained herein or change the extent and nature of C.I.'s liability. In no event shall C.I. be liable for direct, consequential, special, incidental or punitive damages of any kind with respect to the product, including but not limited to those which may allegedly arise out of breach of warranty, breach of contract, negligence, strict liability, or any other law, governmental regulation, or court decision, except as provided herein.

PRECAUTIONS FOR PERSONAL AND SYSTEM PROTECTION

1. Read these and all related instructions thoroughly and follow them carefully.
2. Make certain all required safety equipment is in place and operational.
3. Whether it is required or not, a gas mask (DEMAND TYPE AIR PACK) should be available in the immediate area of the gas feed equipment and all operating personnel should be properly trained in its use. OPERATORS SHOULD NOT ENTER AREAS WHERE CHLORINE EXISTS, UNESCORTED.
4. Chlorine, Sulfur Dioxide, and Ammonia gas or the fumes from Chlorine, Sulfur Dioxide, and Ammonia solutions can be lethal in large enough doses. Always have a coworker observe from a safe location when you are working on any part or component of the gas feed system.
5. Avoid breathing the gas fumes of Chlorine, Sulfur Dioxide, and Ammonia solutions and AVOID contact with your skin. Work only in a well ventilated area.
6. Before working on the gas feed system, make certain that the cylinder/container/manifold valve(s) are shut off. If the cylinder/container/manifold valve(s) seem to be shut off, open them one quarter turn, and immediately close them again to make certain they are not frozen in the open position. If you cannot turn the valve(s) in either direction, ALWAYS ASSUME THEY ARE OPEN, and call your chemical supplier.
7. Do not use wrenches larger than the standard cylinder/container wrench (approximately 8" long) and DO NOT hit the wrench with a heavy object to open or close the valve.
8. Do not reuse lead gaskets. They may not seal properly thereby permitting the release of gas.
9. Use only lead gaskets. Other types may contract with temperature variations resulting in the escape of gas.
10. Check for gas leaks every time the vacuum regulator(s) are connected or remounted onto the cylinder/container/manifold valve.
11. The rate valve IS NOT a shut-off valve. To shut off the gas supply, CLOSE THE CYLINDER/CONTAINER/MANIFOLD VALVE(S).

IMPORTANT:

Please mail or fax this registration form to establish your warranty.

REGAL Registration Card

REGAL REGISTRATION CARD

IMPORTANT: To further establish your warranty and to enable us to contact you should the need arise, please fill out this card and return it promptly. Please do it now. Thank you.

Chlorinators Incorporated, Stuart, FL is the only authorized Warranty Repair facility for REGAL GAS DETECTORS/SMARTVALVES.

PLEASE PRINT, THANK YOU

Gas Detector/SMARTVALVE Serial No.(s)* 1. _____ 2. _____

*Serial No. plate located inside unit on the right

Purchased From _____

Your Name _____ Title _____

Organization _____

Mailing Address _____

City _____ State _____ Zip _____

Phone (_____) _____ Ext. _____

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1.0 INTRODUCTION

IMPORTANT

This section is intended as a guide to aid in the selection and basic application of **AUTOMATIC GAS FEED CONTROL SYSTEMS** for **FLOW PROPORTIONAL CONTROL**. It is not intended to be all inclusive as each application and installation is unique and requires careful thought and planning to achieve proper control.

The “Typical Installation Drawings” included in this manual are intended to show only the basic REGAL system components, their location with respect to each other, the chemical flow path, and the proper routing and connection of the AC power, DC analog, and digital signal lines.

A proper installation will include many additional items (NOT SHOWN) such as: additional gas feed system components, supply and back pressure gauges, gas cylinder/container scales, shut-off valves, unions, etc.

REGAL Series 7000 SMARTVALVES™ are system components used to automatically regulate the magnitude of gas feed rate from a REGAL gas feed system. The REGAL SMARTVALVE is only one component of a complete REGAL gas dispensing system.

NOTE

For general information, installation instructions, service procedures, etc. on the gas dispensing system, see the appropriate REGAL Instruction Manual furnished with that system.

GENERAL

There are many ways to control the output of a REGAL gas feed system. The most often used method of control is manual whereby the operator of the system makes manual feed rate adjustments whenever necessary. Sometimes, however, the system to be treated cannot utilize manual control because either the process water flow rate and/or the quality of the process water is continually changing. These systems require an **AUTOMATIC GAS FEED CONTROL SYSTEM** to maintain proper residual levels. Automatic Gas Feed Control Systems for **FLOW PROPORTIONAL CONTROL ONLY** are described below and pictured on the Typical Installation Drawings noted.

FLOW PROPORTIONAL CONTROL (Drawing No. 1) REGAL MODEL 7001 OR 7006 SMARTVALVE

Flow proportional control is the most often used form of automatic control. A mainline flowmeter with transmitter having a 4 - 20 mA dc output provides the input signal directly to the REGAL SMARTVALVE. A 4 mA signal represents ZERO water flow (and therefore ZERO gas feed) while 20 mA represents maximum water flow rate and therefore maximum gas feed rate based on the system's maximum capacity and the required dosage setting. The gas feed rate is proportional to the water flow rate being measured by the mainline flowmeter.

In all flow proportional control systems, the required DOSAGE must be manually set by the user based on residual analysis. FLOW PROPORTIONAL CONTROL SYSTEMS WORK WELL ON SYSTEMS WHERE THE CL₂, SO₂ OR NH₃ DEMAND IS CONSTANT EVEN THOUGH THE WATER FLOW RATE VARIES.

NOTES

1. If the CL₂, SO₂ or NH₃ demand varies due to water quality, flow proportional control **WILL NOT** work. **Contact Chlorinators Incorporated.**
2. Make sure the mainline flow meter being used for control is measuring the same instantaneous flow rate changes the gas feed system is treating.

2.0 INSTALLATION

(See Drawing No. 1)

The REGAL Series 7000 SMARTVALVE is only part of a complete gas feed system. Check to be sure that all required system components are present and in good working order. If necessary, refer to the Instruction Manual furnished with the REGAL gas feed system.

NOTES

1. The entire contents of this manual **MUST** be read and understood prior to installing and operating this equipment.
2. **DO NOT** discard this instruction manual upon completion of the installation as this manual contains information essential to the safe handling, operation and maintenance of this equipment.
3. Plastic pipe and tubing connector fittings and/or equipment may be broken or damaged if tightened excessively. **HAND TIGHTEN ONLY.**

If the REGAL SMARTVALVE is being added to an existing REGAL gas feed system, some changes to system components MAY BE required to ensure proper operation. CONSULT CHLORINATORS INCORPORATED.

A) LOCATION OF COMPONENTS (See Drawing No.1)

The REGAL Series 7000 SMARTVALVE is designed for wall mounting using appropriate fasteners. Installation should be at eye level, in clear view, and easily accessible.

IMPORTANT

For optimum operation, the installation should be indoors so that the minimum and maximum temperature limitations as listed in “SPECIFICATION SECTION 7.0” ARE NOT exceeded.

WARNING

ALWAYS make sure that the cover is in place and securely fastened to prevent the entry of moisture, water or corrosive gases and also to eliminate the potential for electric shock.

B) PIPING

All REGAL SMARTVALVES to 500 PPD have 1/2" NPT inlet and outlet openings and are furnished with the appropriate size tubing connectors installed to match the capacity of the gas feed system.

All REGAL SMARTVALVES at 1000/2000 PPD have 1" PVC unions installed. Vacuum piping on these high capacity systems is BY OTHERS and is generally 1" minimum SCH. 80 rigid PVC piping. Larger piping size may be required if long distances between the components are necessary.

The SMARTVALVE is installed in the vacuum piping between the Remote Metering Panel Assembly and the Ejector.

NOTES

1. The inlet fitting of the SMARTVALVE can be rotated if necessary on 90 degree centers for proper alignment of the vacuum fitting with the other system components. SEE SERVICE SECTION 6.0.
2. Use Teflon tape on all threaded plastic connections to prevent galling of the threads, provide for a vacuum tight seal and facilitate easy removal when necessary.
3. **DO NOT** overtighten fittings as damage to the fittings and/or system components could occur. **HAND TIGHTEN ONLY.**

C) ELECTRICAL INTERCONNECTIONS (See Drawing No.3)

WARNING

1. It is essential that all external wiring be done exactly as shown on the wiring diagrams depicted in this manual. Incorrect wiring or improper grounding WILL cause improper operation.
2. All wiring and fusing MUST conform to the NATIONAL ELECTRIC CODE and any locally applicable codes.
3. AVOID ELECTRICAL SHOCK - **DO NOT** connect power wiring at the source distribution panel until ALL wiring connections have been made in the SMARTVALVE and the cover is securely fastened in place.
4. Servicing of this equipment should only be attempted by qualified electronics technicians or Chlorinators Incorporated themselves.
5. Chlorinators Incorporated has designed state-of-the-art voltage surge suppressor components and RFI/EMI filtering circuits (where necessary) into the electrical circuitry of each electronic device we manufacture. These internal components provide a last line of defense to absorb electrical surges and spikes – in most cases, before they cause irreparable damage. If the surge suppressors are sacrificed while protecting the equipment, **THEY HAVE DONE THEIR JOB.**

For the best possible protection, **EXTERNAL** surge suppression devices should be a normal part of all electronic component installations. These should be placed on all incoming ac power circuits and where applicable, on all incoming dc signal lines. These devices MUST be chosen and sized properly (particularly those used on 4 - 20 mA dc signal lines) to assure maximum protection and to make sure the suppressor itself does not overload the line resulting in loss of signal. **CONSULT CHLORINATORS INCORPORATED AS NECESSARY.**

NOTE

Power and signal lines MUST be run in separate electrical conduits to prevent signal interference. The branch circuit should be protected by a fuse or a circuit breaker and contain an easily accessible disconnect switch.

3.0 OPERATING THE SMARTVALVE

NOTE

The display automatically dims after 10 minutes have expired if no keypad use has occurred. Pressing any keypad button will automatically brighten the display.

The REGAL SMARTVALVE is calibrated and configured when shipped from the factory. When the SMARTVALVE is turned on for the first time, it is in the OPERATING mode and the Main Operating Screen appears.

The **TOP LINE** displays water flow and lets the user know if the valve is in automatic (**AUTO**) or manual (**MANL**) control mode.

The **BOTTOM LINE** displays valve information and points out the **MENU** key used to access the **OPERATING MODE SUB-MENU**. The sub-menu reverts back to the **OPERATING** screen if no keypad button is pressed within 10 seconds.

The **OPERATING MODE SUB-MENU** allows the user to set and/or change the following parameters.

A) DOSAGE

Press the **DOSE** button; then use the **UP** or **DOWN** buttons to increase or decrease the dosage value. Press the **ENTER** button to accept the new setting and return to the **MAIN OPERATING SCREEN**.

B) ALARM SET POINTS

Press the **ALARM** button to view or change the setting of alarm points.

NOTE

Relay action is established in the **CONFIGURATION mode**. See Section 5.0 if needed.

- 1) Press the **ADJ** button if a change is needed; then use the **UP** or **DOWN** buttons to increase or decrease the alarm **SET POINT**. Press the **ENTER** button to accept the new value.
- 2) Press the **NEXT** button to view the setting of any additional alarm **SET POINTS**; then follow the procedure in "1" above to set new values.

C) AUTO VS. MANL (MANUAL) OPERATION

Press the **MANL** button to place the valve in the electric manual mode of operation. When in the manual mode;

- 1) Press the **VALV** button; then use the **OPEN** or **CLOSE** buttons to set the gas feed rate,
or
- 2) Use the "thumbwheel" to manually set the gas feed rate.
- 3) Press the **ESC** button to return to the **MAIN OPERATING SCREEN**.

During a **FLOW** or **VALVE** alarm event, the designator (**FLOW** or **VALVE**) changes to **LOW** or **HIGH** for 1 second out of each 4 second interval and the appropriate relay activates accordingly.

As the **MAIN OPERATING SCREEN** example above shows, the display presents both WATER FLOW RATE and VALVE GAS FEED RATE information. At start-up, the dealer or user should check to assure the VALVE GAS FEED RATE value shown on the SMARTVALVE reasonably matches the gas feed rate presented on the metering tube of the REGAL Gas Feed System. ALWAYS READ THE **CENTER** OF THE BALL FLOAT.

NOTES

1. If the values match to the users satisfaction, no further action is required.
 2. If the values **DO NOT** match to the users satisfaction, the SMARTVALVE should be linearized. **If you wish to linearize the valve, proceed to CAL VALVE on page 8.**
-

4.0 ENGINEERING MODE

All parameters in the Engineering Mode have been set by factory technicians prior to shipment. To access and make any necessary changes, proceed as follows:

A) ENTERING THE ENGINEERING MODE

Press and hold the two right keypad buttons simultaneously for approximately five seconds until the Top Line of the display screen reads **ENTER ENGINEERING PW (password) OXXX**. When entering the Engineering Mode for the first time, simply press the **NEXT** keypad button three times until the factory default password (**O000**) appears. Then press **ENT** (Enter) and the first parameter screen CAL AIN1 will appear. To make changes to this or any other Engineering parameter, follow the individual instructions below. The parameters are listed in the order in which they appear while in the Engineering Mode.

B) ENGINEERING PARAMETERS

- 1) **CAL AIN1** (Calibrate Analog Input)
The analog input has been Factory Calibrated and should not need re-calibration. However, if it proves necessary to re-calibrate, an accurate 4-20 milliamp signal generator is required.
 - a) Connect the 4-20 milliamp signal generator to Terminals #1 and #2 in the Junction Box (See Drawing No. 3) located on the left side of the SMARTVALVE's monitor. Be sure to observe correct polarity.

- b) Press the **ADJ** (Adjust) keypad button, then press the **ZERO** button. The displayed number represents the Flow Rate.
- c) Apply 4.0 milliamps to the input terminals; then press the **ZERO** keypad button. The displayed number should now be "0".
- d) Apply 20.0 milliamps to the input terminals; then press the **SPAN** keypad button.
- e) Press **UP** or **DOWN** as necessary until the displayed value matches the Flow Full Scale number programmed into the **FLOW RANGE** parameter in the Configuration Mode.
- f) Press **ENT** (Enter) to accept the new calibration. Press **NEXT** to proceed to the next parameter CAL AOUT.

2) CAL AOUT (Calibrate Analog Output)

- a) This procedure requires the connection of an accurate digital VOM meter Terminals #4 and #5 in the Junction Box located on the SMARTVALVE's monitor. Be sure to observe correct polarity.
- b) Press the **ADJ** (Adjust) keypad button.
- c) Press the **4 mA** button. The display on the digital VOM meter should read 4.00 mA. If not, use the **UP** or **DOWN** buttons as necessary until it does; Then press **ENT** (Enter).
- d) Press the **20 mA** keypad button. The display on the digital VOM meter should read 20 mA. If not, use the **UP** or **DOWN** buttons as necessary until it does. Then press **ENT** (Enter).
- e) Press **ENT** (Enter) to accept the new calibration.
- f) Press **NEXT** to proceed to VALVE CAL.

3) VALVE CAL (Valve Calibration Points)

Determines the number of points used for the Linearization Curve and the choices are 2, 5, 6, 11 and 15. Factory setting is five (5) points representing 1) 0%, 2) 25%, 3) 50%, 4) 75% and 5) 100%. To change:

- a) Press **ADJ** (Adjust).
- b) Press **UP** or **DOWN** to reach desired number.
- c) Press **ENT** (Enter) to accept value and return to the Engineering screen.
- d) Press **NEXT** to proceed to CAL VALVE.

4) CAL VALVE (Calibrate (Linearize) Valve)

The following example is based on a factory set, five (5) point linearization curve and a REGAL Gas Feed System configured at 100 PPD.

- a) Press the **ADJ** (Adjust) keypad button and the SMARTVALVE will drive to its zero position. The display screen shows ZERO gas feed rate in conjunction with the ZERO reading in the metering tube.

IMPORTANT

Mechanical Zero of the valve plug has been set at the factory and should not require re-setting. However, if the ball continues to float in the metering tube after the SMARTVALVE has driven to its ZERO position, refer to Section 6A on page 10 to make the necessary adjustments.

- b) Press the **NEXT** keypad button and the SMARTVALVE will drive open to its 25% (25 PPD) position.
 - 1) Press the **ADJ** (adjust) keypad button. Compare the reading of the ball float located in the metering tube to the PPD reading shown above.
 - 2) If the readings match, press **ENT** (Enter).
 - 3) If the readings do not match, press the **UP** or **DOWN** buttons accordingly until the ball float in the metering tube matches the displayed value in PPD. Then press **ENT** (Enter).
- c) Press the **NEXT** keypad button once again and the SMARTVALVE will drive open to its 50% (50 PPD) position. Compare the readings and make any necessary adjustments as explained for the 25% position.
- d) Press the **NEXT** button and the SMARTVALVE drives to its 75% (75 PPD) position. Compare the readings and make any necessary adjustments.
- e) Press the **NEXT** button and the SMARTVALVE drives to its 100% (100 PPD) position. Compare the readings and make any necessary adjustments.
- f) To double check all the readings, continue to press the **NEXT** button and the SMARTVALVE will drive to each position in reverse order until it returns to ZERO.

Linearization is now complete.

5) VALVE SPEED

Refers to the seconds per revolution of the SMARTVALVE's motor as it drives the valve plug to make adjustments to the gas feed rate. Choices are: 0.5, 1.0, 1.5, 2.0, 3.0, 5.0, 7.5 and 10.0. Factory setting is 1.5 seconds. To change:

- a) Press **ADJ** (Adjust).
- b) Press **UP** or **DOWN** until the desired value is reached.
- c) Press **ENT** (Enter) to accept value.
- d) Press **NEXT** to proceed to VALVE HYS.

6) VALVE HYS (Valve Hysteresis)

Establishes the number of motor steps that must be seen by the micro-controller before an adjustment is made. The main purpose is to save wear and tear on the motor and the feedback potentiometer. The choices are given in percentages which are: Off, .06, .13, .25, .38, .50, .75, 1.00 and 2.00. Factory setting is .13%. To change:

- a) Press **ADJ** (Adjust).
- b) Press **UP** or **DOWN** to reach the desired value.
- c) Press **ENT** (Enter) to accept value and return to the Engineering Screen.
- d) Press **NEXT** to proceed to FAIL OPERATION.

7) FAIL OPERATION

Allows a choice of how the valve will respond to a loss of the analog input signal. Selections are HOLD or DROP. HOLD will keep the Feed Rate at its current amount while DROP will drive the value to ZERO gas feed rate. To change:

- a) Press **ADJ** (Adjust).
- b) Press **UP** or **DOWN** to choose one or the other.
- c) Press **ENT** (Enter) to accept and return to the Engineering Screen.
- d) Pressing **NEXT** at this point will return you to the first Engineering parameter CAL AIN1.

C) EXITING THE ENGINEERING MODE

You may EXIT the Engineering Mode at any time by Pressing the **ESC** (Escape) button as it appears with each parameter. After pressing Escape, you will then be asked if you would like to:

- 1) ENTER A NEW PASSWORD?
 - a) To KEEP the existing password, simply press **NO** and you will return to the Main Operating Screen.

OR

- b) To CHANGE the existing password, press **YES** and proceed as follows:

- 1) Set the First Digit by pressing the **UP** button repeatedly until the desired number appears. Then press **NEXT**.
- 2) Set the Second, Third and Fourth Digits in the same manner.
- 3) Once the Fourth Digit is set, simply press **ENT** (Enter) to lock in the new password and return to the Main Operating Screen.

NOTE

If any changes were made while in the Engineering Mode, you will also be asked if you would like to **SAVE CHANGES?** Simply press YES or NO accordingly and you will return to the Main Operating Screen.

5.0 CONFIGURATION MODE

The CONFIGURATION mode is used to set the basic valve parameters. Most of the parameters have already been set at the factory based on information provided at the time of purchase. However, some parameters must be set in the field at system start-up. A complete list of parameters for the Configuration Mode is located on the following pages.

A) ENTERING THE CONFIGURATION MODE

Press and hold the **#4** keypad button for approximately five seconds at which time the TOP LINE of the PLED screen will read **ENTER CFG PW** (password) **OXXX**. The factory set password is **O000**. Press the **NEXT** keypad button three times until all four zeroes appear. Press the same button which will now read **ENT** (enter) and you are in the Configuration Mode with the TOP LINE displaying the first parameter. Proceed to the list of Configuration Parameters on the next page to continue.

NOTE

When EXITING the Configuration Mode at any time, you will be asked if you would like to change to a NEW Configuration Password. Follow the same steps as used above under **EXITING THE ENGINEERING MODE**.

NOTE

If any changes have been made while in the Configuration Mode, you will be asked to **SAVE CHANGES?** Press **YES** or **NO** accordingly and you will return to the Main Operating Screen.

B) CHANGING PARAMETERS IN THE CONFIGURATION MODE

1) FLOW UNITS

The choices of flow rate units are GPM (gallons per minute), % (percentage), MGD (million gallons per day), L/s (liters per second), m3s (cubic meters per second) or m3d (cubic meters per day). To change, simply press **ADJ** (adjust), then press **UP** or **DOWN** to scroll to the appropriate selection and press **ENTER**. Then press **NEXT** to proceed to the next parameter. Factory set at GPM.

NOTE

After each parameter has been set, it will be understood (unless noted otherwise) that the **NEXT** (or **LAST**) keypad button must be pressed to advance (or return) to the following parameter. Then press **ADJ** (adjust) followed by **UP** or **DOWN** to change that particular setting. Press **ENTER** to accept the change and proceed to the next parameter.

2) FLOW RANGE

Used to set the Maximum water flow according to the selected Flow Units.

3) FLOW AVERAGE

Allows averaging of the Flow input signal for noise reduction. This helps minimize wear and tear on the stepper motor and feedback potentiometer. The selections are 0.2, 0.4, 0.6, 0.8, 1, 2, 3, 5, 8 and 10 seconds. Factory set at 1 second.

4) VALVE UNIT

Units used to monitor and regulate the Feed Rate. Choices are PPD (lbs. per day), g/h (grams per hour) and kgh (kilograms per hour). Factory set in PPD.

5) VALVE FS

Valve Full Scale: This setting will be equivalent to the capacity of the REGAL Gas Feed System. Factory calibrated as specified on the Purchase Order.

6) SP1, SP2, SP3

Set Points 1 through 3 are used to establish parameters for the alarm relay functions. The first parameter for each set point is the **MODE** which will be displayed as **SP1 MODE**, **SP2 MODE**, etc.

The choices of **MODE** settings are **HIGH**, **LOW** or **OFF**. Simply press adjust (**ADJ**), then up or down to make your selection. Then press **ENTER** followed by **NEXT** to accept the **MODE** and continue on to the next set point parameter.

NOTE

If **OFF** is selected for the **MODE**, no further parameters will be displayed for that particular Set Point. Simply press **NEXT** to continue on to the following Set Point.

However, if the **HIGH** or **LOW** Mode setting is selected for a specific set point. the following parameters will be displayed in reference to that point. The following list pertains to set point one (**SP1**). After all parameters have been set for **SP1**, the menu will continue on to set point two (**SP2**), then set point three (**SP3**).

a) SP1 SOURCE

Sets alarm source to either **FLOW** (Water Flow), **VALVE** (Valve Plug Position) or **RESIDUAL**.

b) SP1 RELAY

There are three relays to choose from (**K1**, **K2** or **K3**). They may be used in any combination with the three set points. In other words, all three points may be placed on the same relay; divided between two relays or divided between all three relays.

c) SP1 DELAY

Allows user to set a time delay before the chosen relay activates. Can be set from 0 to 60 seconds. Factory setting is 2 seconds.

d) SP1 Hysteresis

Sets Dead Band around the relay activation point. For example: if the chosen relay is for low water flow and a 2% hysteresis is set, the relay will activate when the water flow drops to or below the alarm set point. However, the relay will not deactivate until the water flow rate increases to 2% or above that point. The factory setting is 2%.

6.0 SERVICE – MECHANICAL END OF SMARTVALVE

It is recommended that the SMARTVALVE be returned to Chlorinators Incorporated for all service/repair to assure that it is put back into service in accordance with factory specifications. However, if it is necessary to service the SMARTVALVE in the field, REGAL parts must be used to help prevent equipment failure which may have hazardous consequences. The use of parts other than REGAL will void any warranty and insurance coverage.

The only mechanical service that is typically required on the job site involves setting the valve plug at true ZERO or cleaning/replacing the valve plug and seat. The instructions for each are as follows:

A) CHECKING/SETTING MECHANICAL ZERO Use Drawing No. 7 or 8 as a Guide

The mechanical zero position of the valve plug was set at the factory and should not need resetting unless servicing of the SMARTVALVE is necessary or, if a change in capacity is needed. To check or set mechanical zero, proceed as follows.

- 1) Enter the **ENGINEERING MODE**, as previously, by **simultaneously pressing and holding the right TWO keypad buttons for approximately 4 seconds**.

The Factory Password is set to **0000**. Enter the factory password by using repeated presses of the **NEXT** keypad button; then press the **ENT** (enter) keypad button and the first parameter appears.

NOTE

Use new password if factory set password was changed.

- 2) Use repeated presses of the **NEXT** keypad button to scroll to the **CAL VALVE** parameter.

- 3) Press the **ADJ** (adjust) keypad button and the SMART-VALVE drives to its zero position.

NOTE

If the valve plug is adjusted TOO LOW on the lead screw shaft, the gas feed system's rotameter will indicate zero when in fact, the valve plugs metering area is actually below the TRUE ZERO point. If the valve plug is adjusted TOO HIGH on the shaft, the rotameter will indicate a feed rate above zero.

- 4) With "0 PPD" presented on the PLED display, loosen lock nut #7139 that holds valve plug #7105 or #7106 in position on the lead screw shaft #7109.
- 5) The top of the valve plug is machined square to accommodate a standard 11/32" open end wrench. Use the wrench to move the valve plug up or down the lead screw shaft until the float in the gas feed system's metering tube just begins to lift off its bottom float stop.
- 6) Then slowly and carefully rotate the valve plug in the opposite direction until the float just sits on the bottom float stop. **THIS IS THE VALVE PLUG "ZERO" POSITION.**
- 7) Tighten lock nut #7139 against the top of the valve plug to prevent further movement of the plug on the shaft. See pages 8 and 9 under **CAL VALVE** and linearize the SMARTVALVE.

B) VALVE BODY (Drawing No. 7 or 8)

The valve body should only be disassembled if there is a leak or evidence of excessive inaccuracy of gas feed rate. Whenever the valve body is disassembled, it is good practice to check the valve plug and seat for dirt, impurities, nicks, scratches, etc., and to replace the spring loaded seals and o-rings.

- 1) Turn off electric power to the SMARTVALVE.
- 2) With the gas feed system operating, rotate the manual feed rate adjustment knob (#7116) to set the gas feed rate (as indicated by the rotameter) to ZERO. The indicator pin (#7113) slot should now be aligned with the "zero" or bottom line of the scale located on the indicator plate (#7117).

NOTE

This is the mechanical zero position of this valve plug and will be used as a starting point when resetting zero should it become necessary to remove and/or replace the valve plug.

- 3) Remove the four (4) 10-24 x 2 1/2" long screws (#7131) while holding the bottom valve body (#7103 or #7104) to the top body (#7101 or #7102).
- 4) Carefully slide the bottom valve body (#7103 or #7104) off the valve plug (#7105 or #7106) and set aside. **MAKE SURE THE VALVE PLUG SEAT (#7107 OR #7108) DOES NOT BECOME DAMAGED.**

- 5) Carefully slide the top valve body (#7101 or #7102) off the valve plug (#7105 or #7106) and set aside.

IMPORTANT

The valve plug **SHOULD NOT** be removed unless it has become damaged and must be replaced or, if it is necessary to change the capacity of the system.

- 6) Visually examine the valve plug (particularly the tapered portion) under a magnifying glass if necessary. If severe scratches, scores, or nicks are detected, the valve plug should be replaced.
- 7) If the valve plug needs to be cleaned, use warm water and wash thoroughly until all deposits are removed. Rinse with clear water and dry completely.

IMPORTANT

DO NOT use sharp tools or alter the diameter (OR THE TAPER) of the valve plug in any way.

- 8) Carefully remove the valve seat (#7107 or #7108) from top body (#7101 or #7102). Visually examine the valve seat under a magnifying glass. **THE VALVE SEAT IS A PRECISION MACHINED PART AND THE METERING ORIFICE MUST BE CLEAN AND ROUND TO PROVIDE A TIGHT FIT AROUND THE VALVE PLUG.**

NOTE

If the valve seat needs to be cleaned, remove the two o-rings (#7124 or #7125 and #7126) and set them aside. Clean the valve seat using warm water until all deposits are removed. Rinse with clear water and dry completely. **HANDLE WITH EXTREME CARE.**

IMPORTANT

DO NOT use sharp tools or alter the valve seat in any way.

- 9) Clean the top and bottom valve bodies with warm water or a rag soaked in denatured alcohol and dry thoroughly.
- 10) Check and/or replace the spring loaded seal (#7128 or #7130) in top body (#7101 or #7102).
- 11) Install two (2) new #7124 or (#7125 and #7126) o-rings on valve seat (#7107 or #7108).
- 12) Reassemble the valve body by reversing steps 3 through 5.

7.0 SPECIFICATIONS

Maximum Gas Feed:

10 – 2000 PPD for Chlorine
10 – 500 PPD for Sulfur Dioxide
10 – 100 PPD for Ammonia

Power Requirements:

Field selectable 115/230 VAC \pm 15%, Single Phase
Operating frequency is 50 or 60 Hz

Fusing:

1/4A @ 230V, 1/2A @ 115V (Time Delay, 250V)

Power Consumption:

45 Watts absolute minimum

Input Signal:

4-20 milliamps DC (unpowered)

Input Impedance:

250 Ohms

Output Signal:

4-20 milliamps DC, 12 Volt compliance (600 Ohms) isolated and powered

Micro-Controller:

MC9S12 with 128kB EEPROM, 2kB EEPROM,
8kB SRAM, 16 Bit

Display:

20 character, 2-line, Polymer LED (PLED)

Relays:

Three (3) each. 10A, 250 VAC

Environmental Limits:

32°F to 120°F (0°C to 50°C)

Calibration Accuracy:

\pm 0.25% from zero

Speed of Response:

Variable and field selectable between 0.5 and 10.0 seconds per revolution of motor

Operating Range:

10:1

Pushbuttons:

Four (4) key array – integrated into the overlay

Control Modes:

Automatic, electric manual, manual

Dosage Ratio:

4:1 keypad adjustable

Serial Communications:

OPTIONAL. Isolated RS232/RS422/RS485 (2/4-Wire) module

Stepper Motor:

Unipolar (5/6-wire). 12 Volt, 1A/winding (Size 23)

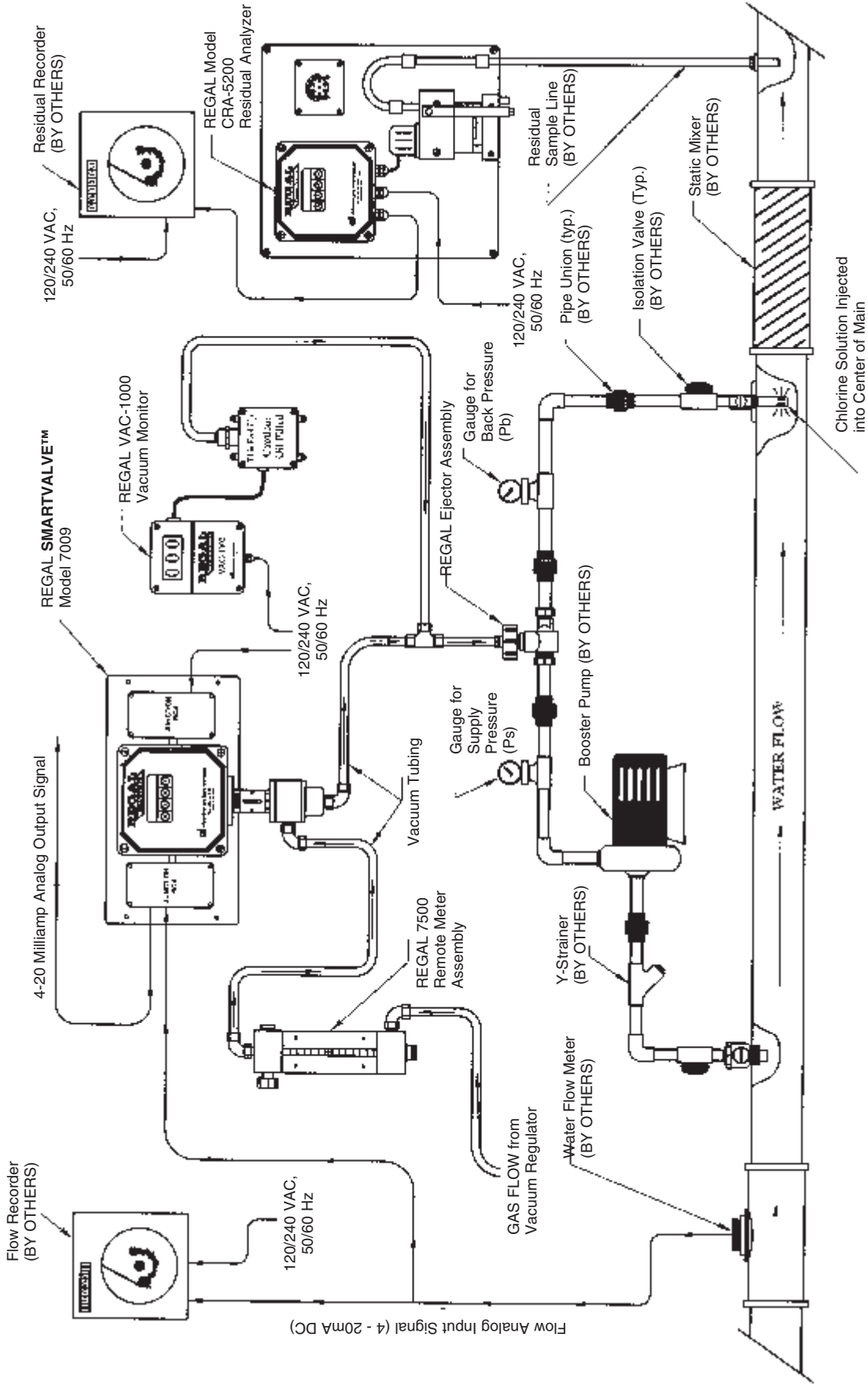
Enclosure Ratings:

NEMA 4X (Monitor and J-Boxes)

Shipping Weight:

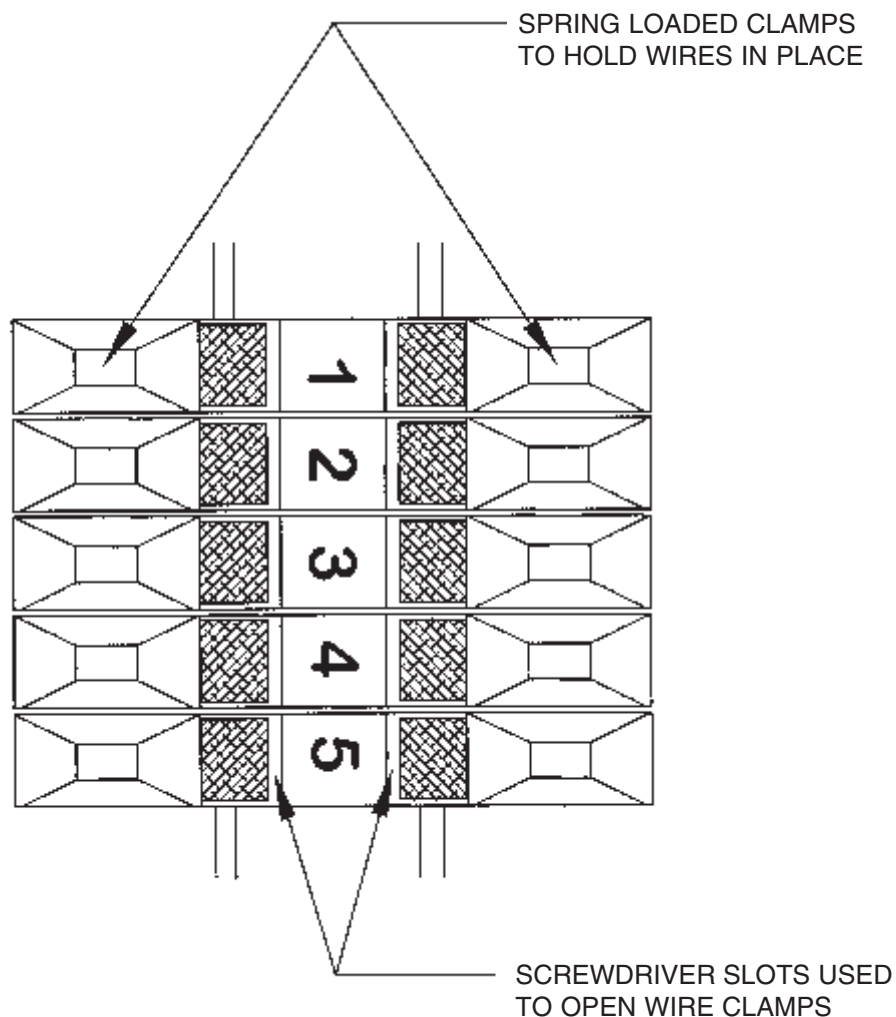
18 lbs.

DRAWING NO. 1 — TYPICAL SYSTEM INSTALLATION DRAWING
Flow Proportional Control - Feed Forward or Open Loop



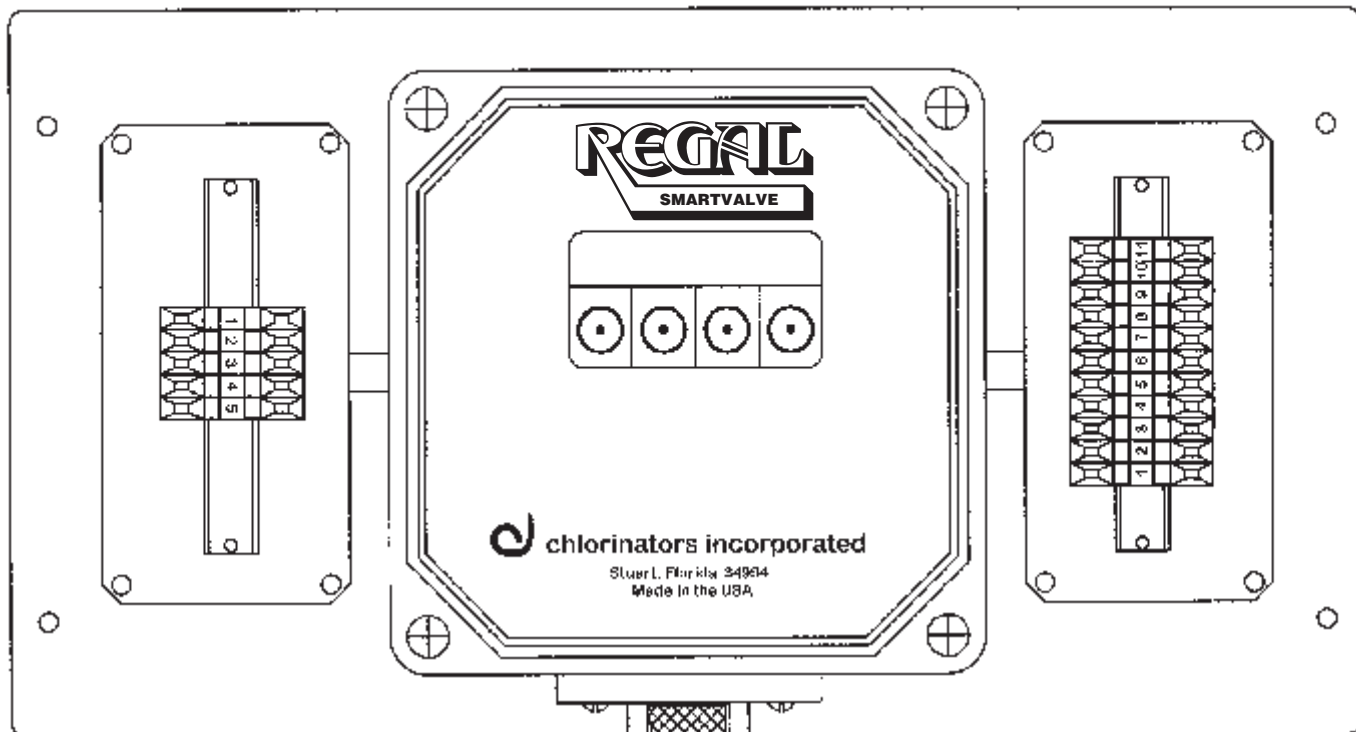
NOTE:
 The sole purpose of this drawing is to show the gas flow path through the REGAL System components and the order in which these components are connected.

DRAWING NO. 2 — USING REGAL TERMINAL STRIPS
Terminal Strips Located in SMARTVALVE Junction Boxes



Place the blade of a small screwdriver (such as the rate valve tool supplied with your REGAL chlorinator system) into the slot and tilt the screwdriver in the direction of the terminal number. This will open the clamp and allow the wire to be inserted. Remove the screwdriver and the clamp will close to hold the wire in place.

DRAWING NO. 3 — TERMINAL STRIP DESIGNATIONS
Flow Proportional Control
Models 7001 and 7006



LEFT SIDE JUNCTION BOX

- 1 - Flow Signal Input (Pos)
- 2 - Flow Signal Input (Neg)
- 3 - Flow Signal Input (Shield)
- 4 - Analog Output (Pos)
- 5 - Analog Output (Neg)

NOTES:

- 1. Input and Output Signals are 4-20 mA

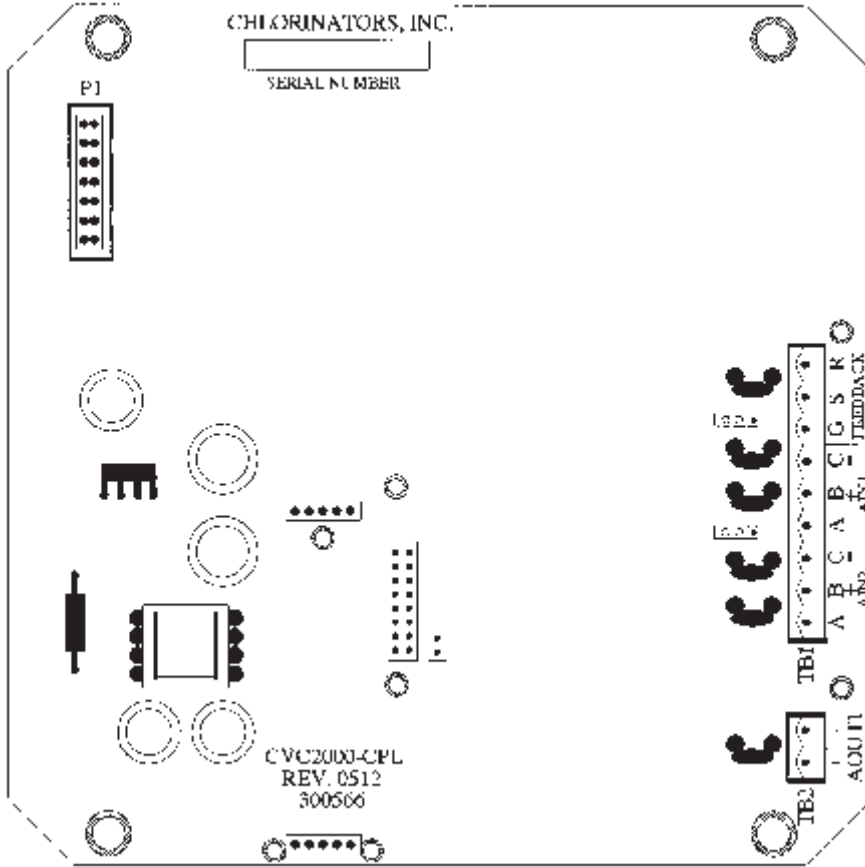
RIGHT SIDE JUNCTION BOX

- 1 - "L" - See Note 1
- 2 - "N" - See Note 1
- 3 - Ground - See Note 1
- 4 - N/O Relay K1
- 5 - Com Relay K1
- 6 - N/C Relay K1
- 7 - N/O Relay K2
- 8 - Com Relay K2
- 9 - N/C Relay K2
- 10 - N/O Relay K3
- 11 - Com Relay K3

NOTES:

- 1. Terminals 1, 2 and 3 are 120/240 VAC 50/60Hz, single phase incoming power supplies.

DRAWING NO. 4 — DISPLAY CIRCUIT BOARD
Part Number 7070

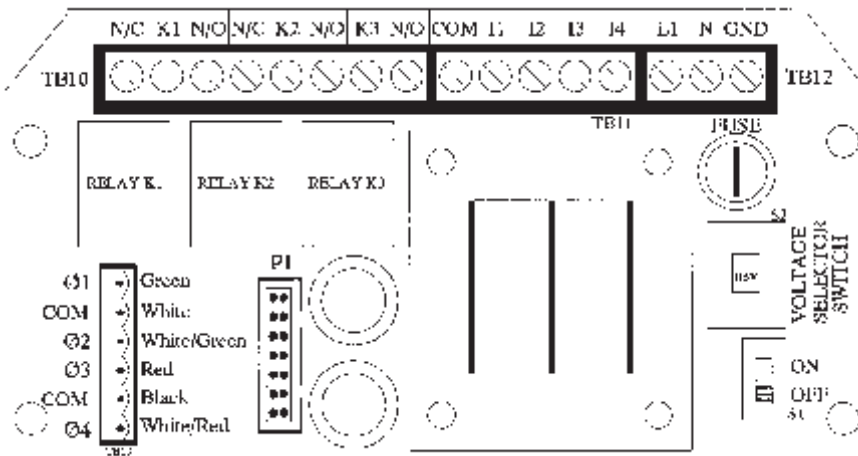


NOTE:

All wiring connections to this circuit board are made at the factory prior to shipment.

See Drawing No. 3 for "Field Wiring."

DRAWING NO. 5 — POWER/RELAY CIRCUIT BOARD
Part Number 7071



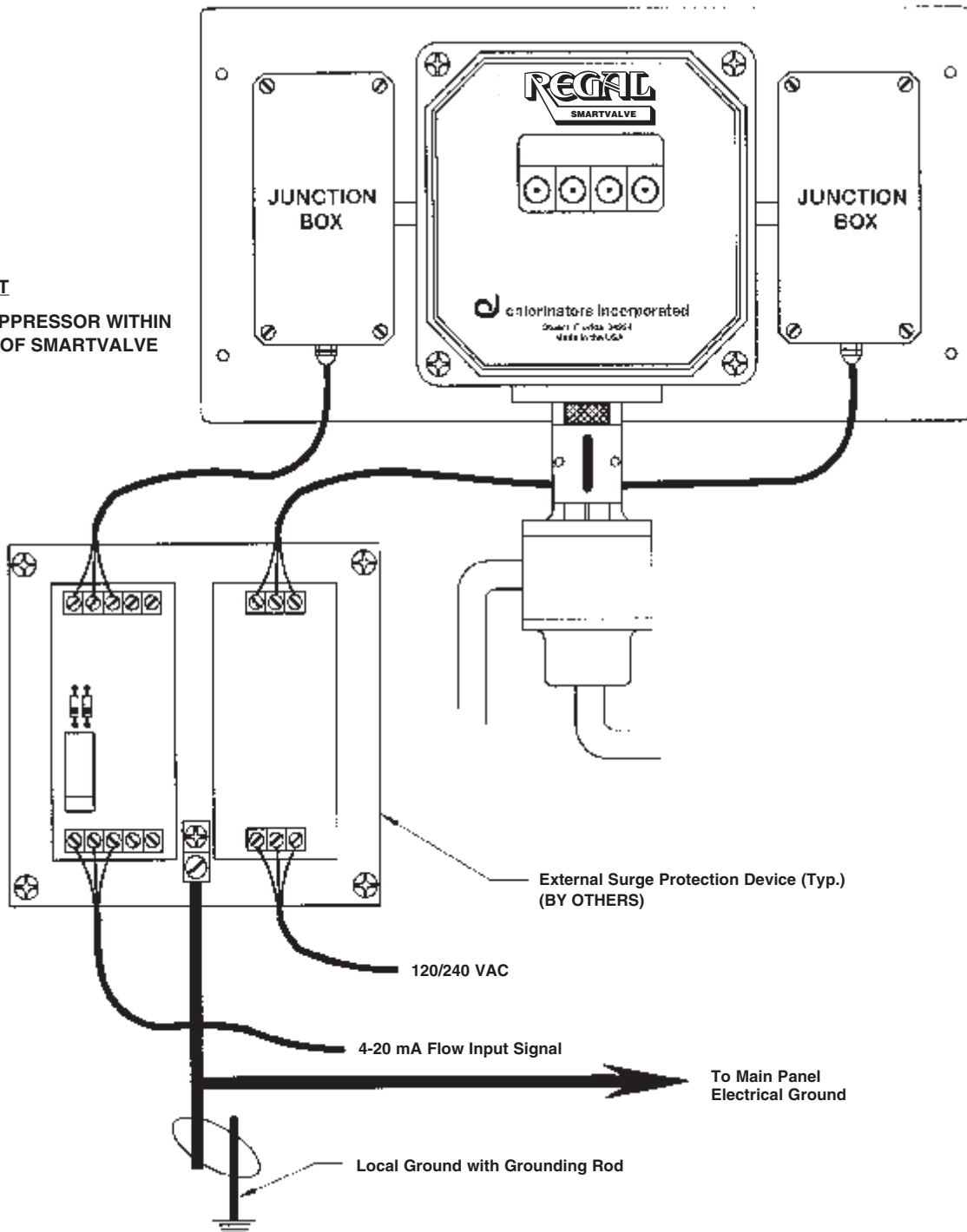
NOTE:

All wiring connections to this circuit board are made at the factory prior to shipment.

See Drawing No. 3 for "Field Wiring."

DRAWING NO. 6 — USE OF EXTERNAL SURGE SUPPRESSORS
Consult manufacturer of surge suppressor for installation and wiring specifics

IMPORTANT
MOUNT SUPPRESSOR WITHIN
TWO FEET OF SMARTVALVE



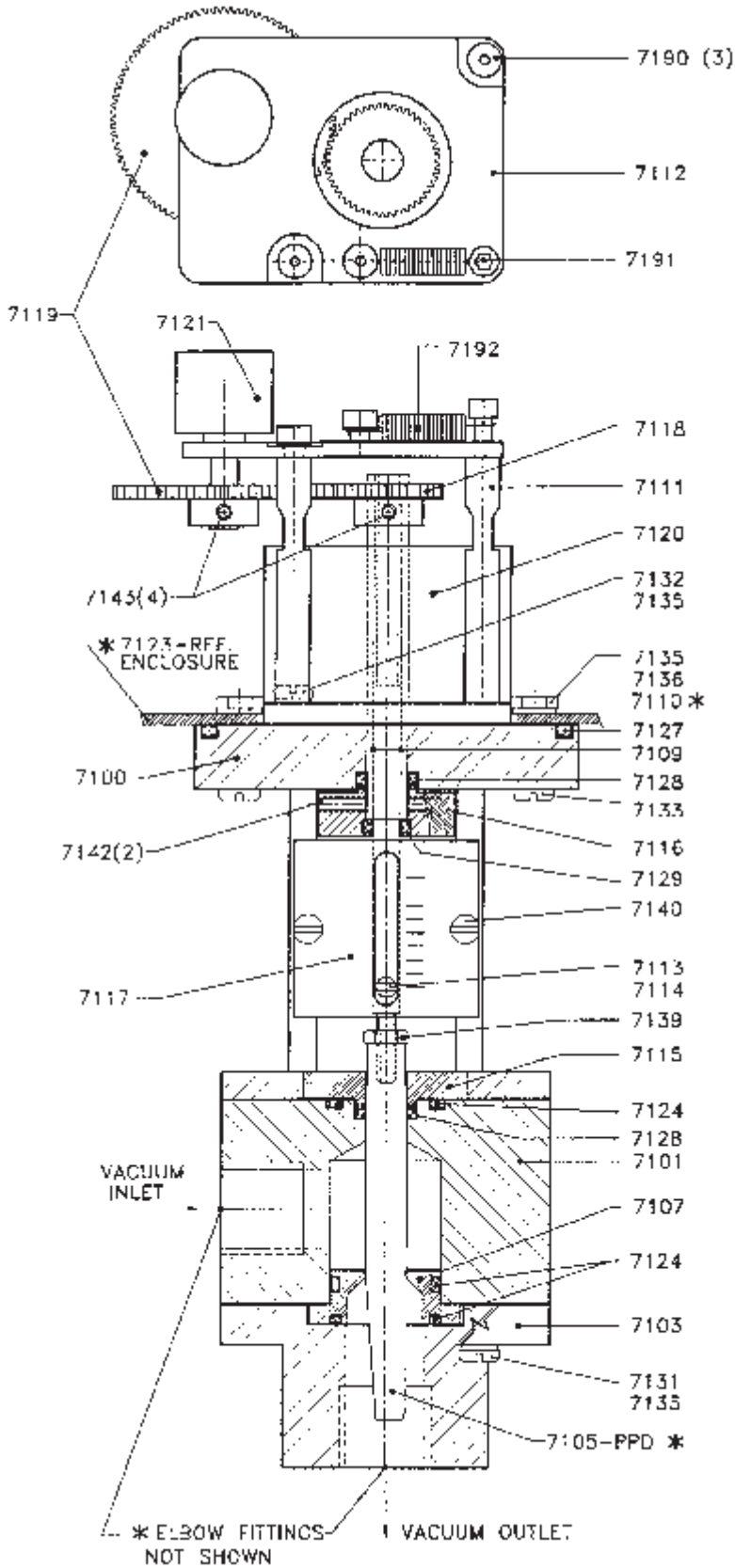
IMPORTANT

Consult the manufacturer of the transient voltage surge suppression device for proper wiring of inputs and outputs. Analog and digital output signals should also be protected.

NOTES:

1. Surge protection devices **MUST** be grounded locally with a grounding rod and also at the main panel electrical ground.
2. Surge protection devices should clamp the 4-20 mA signal lines at 8-10 Volts, D.C. maximum.

DRAWING NO. 7 — CONTROL VALVE ASSEMBLY
Part Number 7003 - 10 to 500 PPD

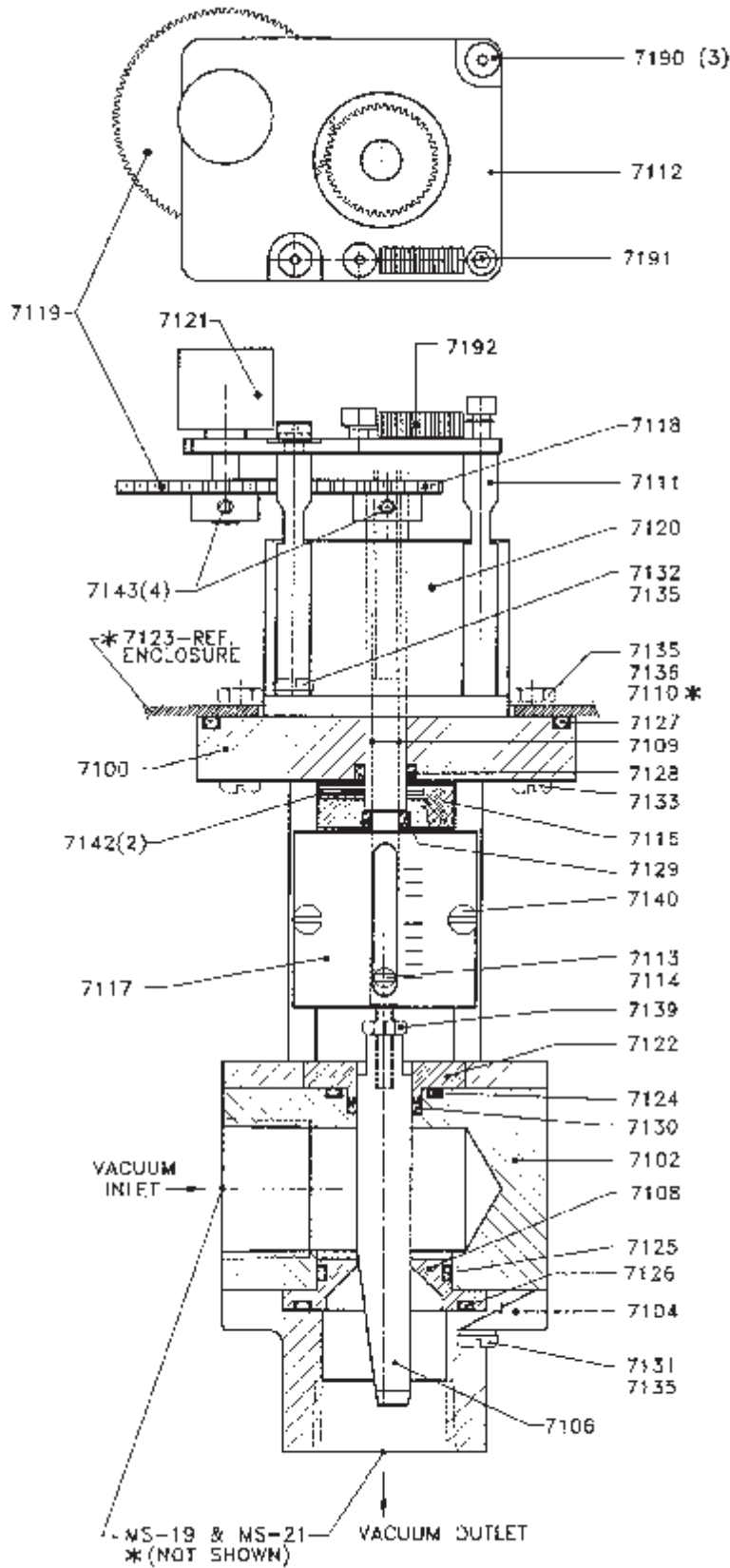


Part No.	Quantity	Description
7100	1	Yoke
7101	1	Top Body
7103	1	Bottom Body
7105 *	1	Valve Plug (PPD)
7107	1	Valve Seat
7109	1	Lead Screw
7110 *	1	Nut Plate (not shown)
7111	3	Standoff
7112	1	Mounting Plate
7113	1	Indicator Screw
7114	1	Indicator Nut
7115	1	Guide/Retainer
7116	1	Knob/Knurled
7117	1	Indicator Plate
7118	1	Driver Gear
7119	1	Follower Gear
7120	1	Stepper Motor
7121	1	Potentiometer
7124	3	S-405 "O" Ring
7127	1	S-414 "O" Ring
7128	2	Seal
7129	1	Seal
7131	4	Screw-#10-24 X 2 1/2
7132	1	Screw-#10-24 X 1/2
7133	4	Screw-#10-32 X 1 with "O" Ring
7135	5	#10 Lock Washer
7136	3	#10-32 Nut
7139	1	#8-32 Nut
7140	2	Screw-#6-32 X 1/4
7142	2	#6-32 Set Screw X 3/8
7143	4	#6-32 Set Screw X 1/4
7190	3	Shoulder Screw
7191	1	Cap Screw
7192	1	Spring
- *	2	Elbow Fitting (PPD)
ZZ-275		3/8 OD Tube (10-100 PPD)
ZZ-276		1/2 OD Tube (250-PPD)
ZZ-277		5/8 OD Tube (500-PPD)

***NOTES:**

- P/N 7105 valve plug
 7105 - 1 for (10 & 25 PPD)
 7105 - 3 for (50 & 100 PPD)
 7105 - 5 for (250 & 500 PPD)
- P/N 7110 not shown.
 1/8 x 7/16 x 2 1/4
- P/N 7123 is not part of this assembly.

DRAWING NO. 8 — CONTROL VALVE ASSEMBLY
Part Number 7004 - 1000/2000 PPD

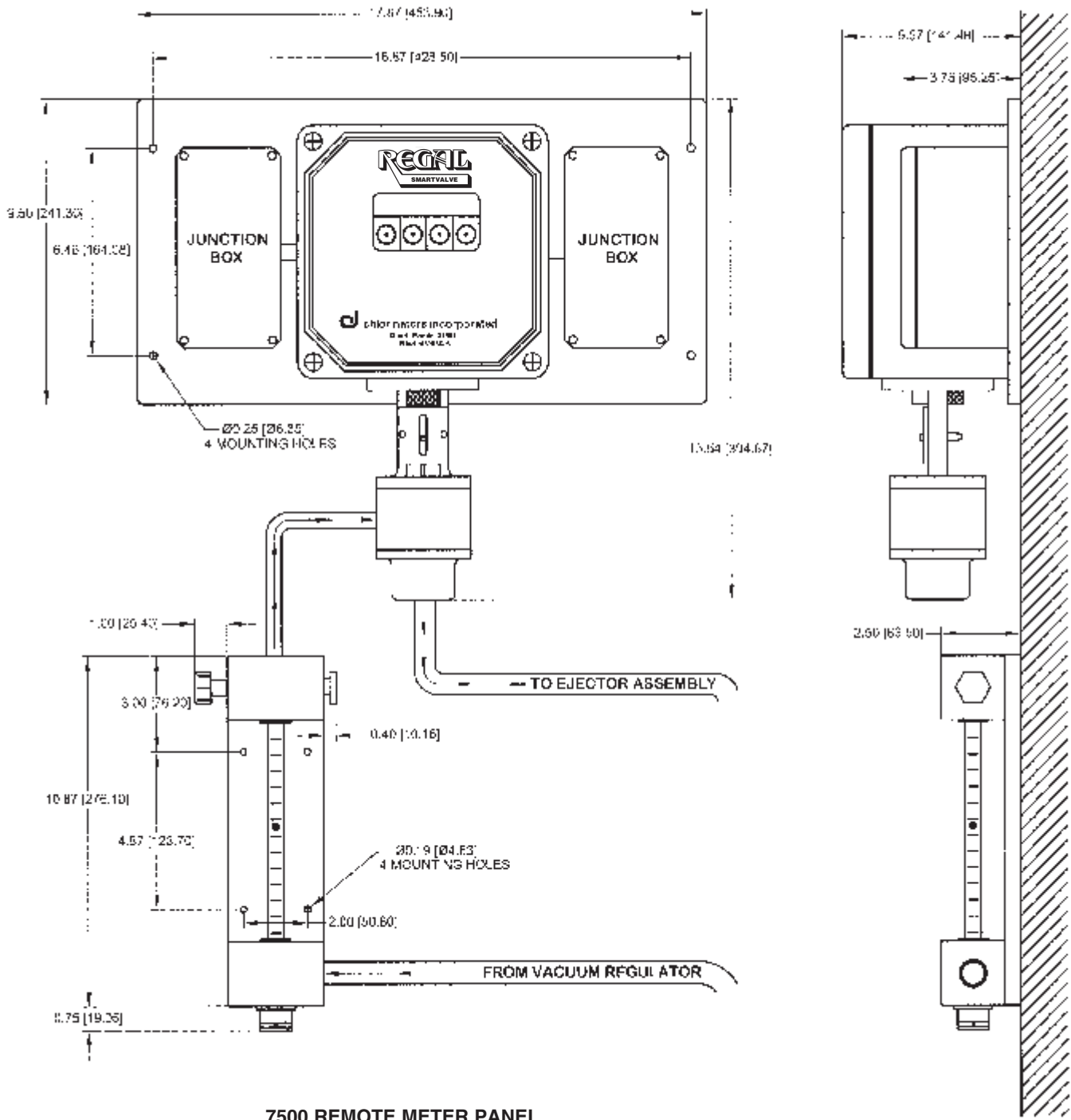


Part No.	Quantity	Description
7100	1	Yoke
7102	1	Top Body
7104	1	Bottom Body
7106	1	Valve Plug
7108	1	Valve Seat
7109	1	Lead Screw
7110 *	1	Nut Plate
7111	3	Standoff
7112	1	Mounting Plate
7113	1	Indicator Screw
7114	1	Indicator Nut
7116	1	Knob/Knurled
7117	1	Indicator Plate
7118	1	Driver Gear
7119	1	Follower Gear
7120	1	Stepper Motor
7121	1	Potentiometer
7122	1	Guide/Retainer
7124	1	S-405 "O" Ring
7125	1	S-415 "O" Ring
7126	1	S-407 "O" Ring
7127	1	S-414 "O" Ring
7128	1	Seal
7129	1	Seal
7130	1	Seal
7131	4	Screw-#10-24 X 2 1/2
7132	1	Screw-#10-24 X 1/2
7133	4	Screw-#10-32 X 1 with "O" Ring
7135	5	#10 Lock Washer
7136	3	#10-32 Nut
7139	1	#8-32 Nut
7140	2	Screw-#6-32 X 1/4
7142	2	#6-32 Set Screw X 3/8
7143	4	#6-32 Set Screw X 1/4
7190	3	Shoulder Screw
7191	1	Cap Screw
7192	1	Spring
MS19 *	2	1" NPT Union
MS21 *	2	1" NPT Close Nipple

***NOTES:**

1. P/N 7110 not shown.
1/8 x 7/16 x 2 1/4
2. P/N 7123 is not part of this assembly.
3. MS19 and MS21 fittings not shown.

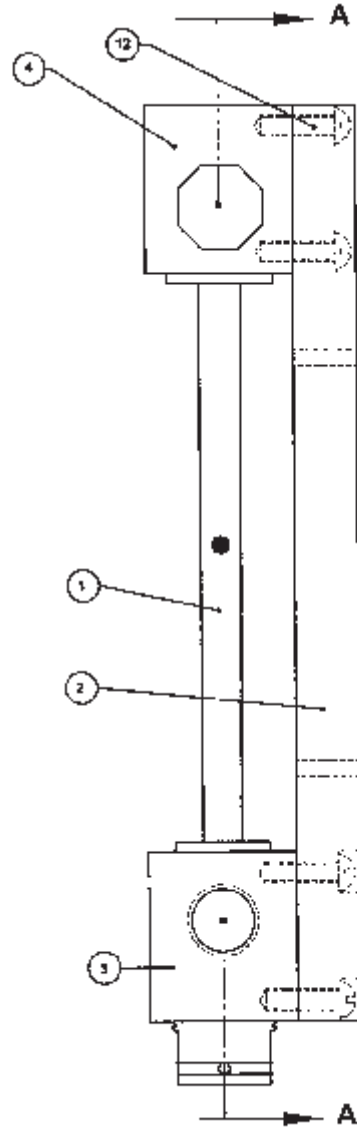
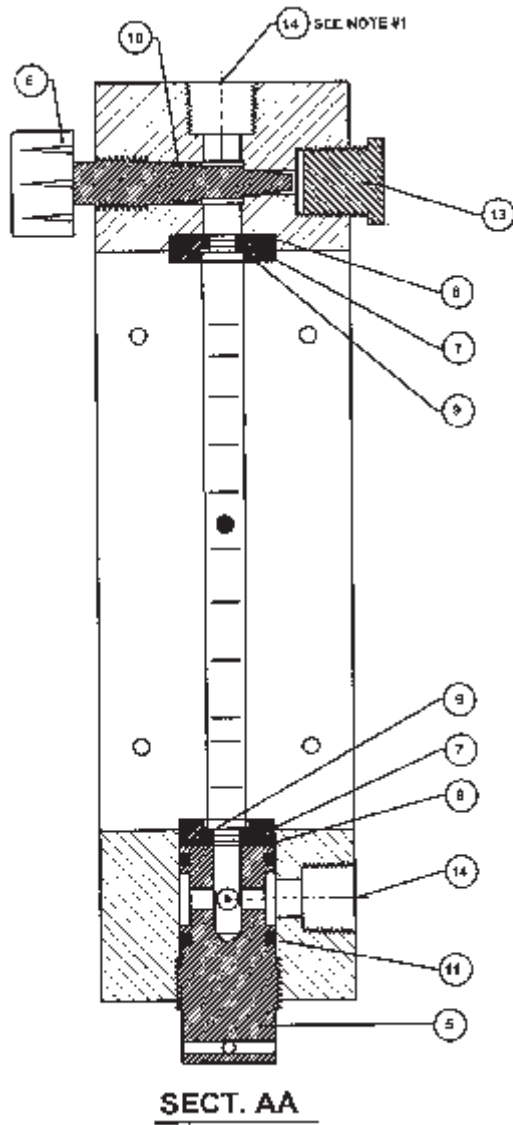
DRAWING NO. 9 — ENGINEERING DATA SHEET
Series 7000 SMARTVALVE™ Dimensions



7500 REMOTE METER PANEL

DIMENSIONS = INCHES [mm]

DRAWING NO. 10 — 7500 REMOTE METER PANEL ASSEMBLY
For 10/ to 500 PPD Systems



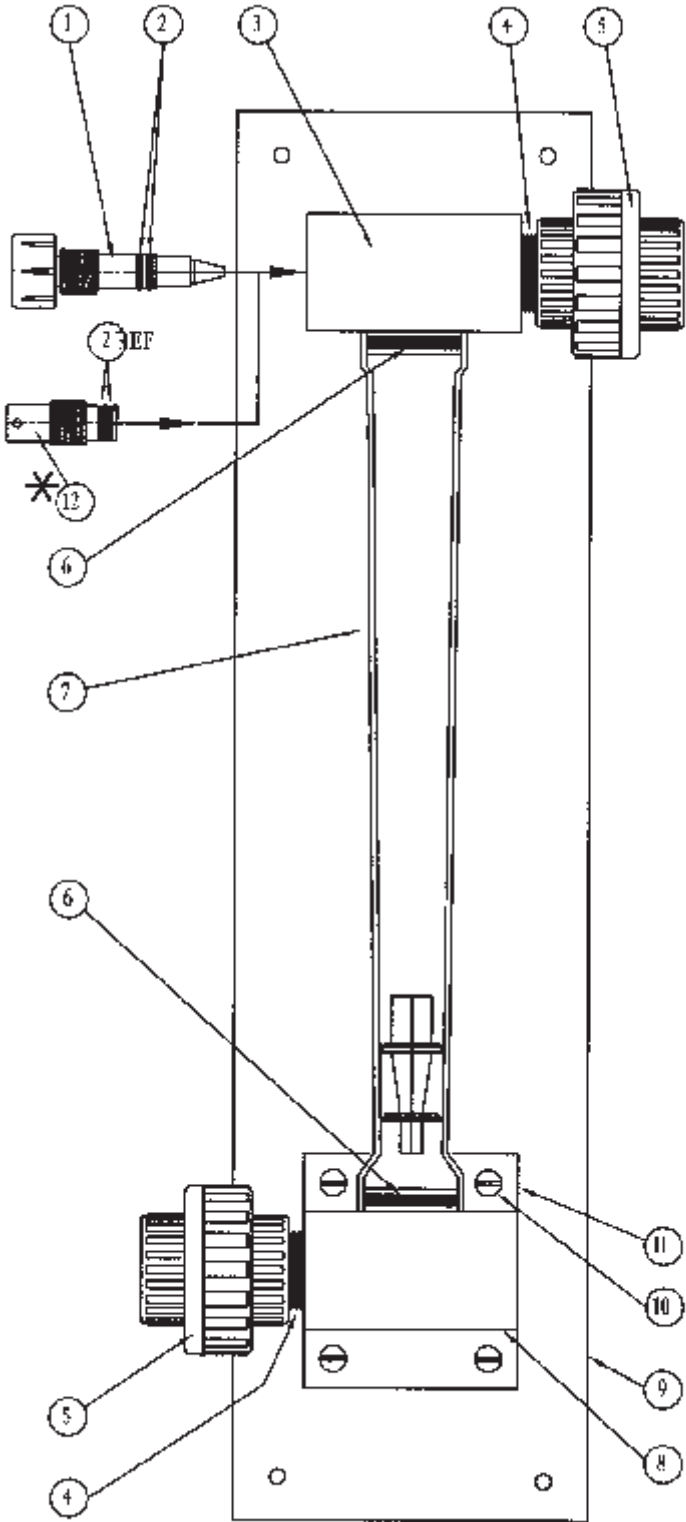
Ref No	Part No.	Quantity	Description
1	See Chart	1	Meter Tube Assembly
2	7502	1	Base Plate
3	7503	1	Bottom Block
4	7504	1	Top Block
5	7505	1	Meter Tube Plug
6	RV-831	1	Rate Valve Plug Assembly
7	See Chart	2	Top and Bottom Bushing
8	G-700	2	Top and Bottom Bushing Gasket
9	See Chart	2	Top and Bottom Meter Tube Gasket
10	S-403	2	Rate Valve Plug O-Ring
11	S-406	2	Meter Tube Plug O-Ring
12	Z-815	4	Screw, 1/4-20 x 1" Long
13	ZZ-278	1	Plug, 1/2" NPT
14	See Chart	2	Tube Fitting, Elbow (Not Shown)

REF NO.	10 PPD (200 gms/hr)	25 PPD (500 gms/hr)	50 PPD (900 gms/hr)	100 PPD (1900 gms/hr)	250 PPD (5000 gms/hr)	500 PPD (10 kg/hr)
1	7501-10	7501-25	7501-50	7501-100	7501-250	7501-500
7	7507	7508	7508	7508	7509	7510
9	G-701	G-702	G-702	G-702	G-703	G-704
14	ZZ-275	ZZ-275	ZZ-275	ZZ-275	ZZ-276	ZZ-277

NOTE

If system is using 1000 PPD or 2000 PPD Remote Metering Panel Assembly, refer to the Instruction Manual for information on these high capacity gas feed systems.

DRAWING NO. 11 — REMOTE METER PANEL ASSEMBLY
For 1000/2000 PPD Systems

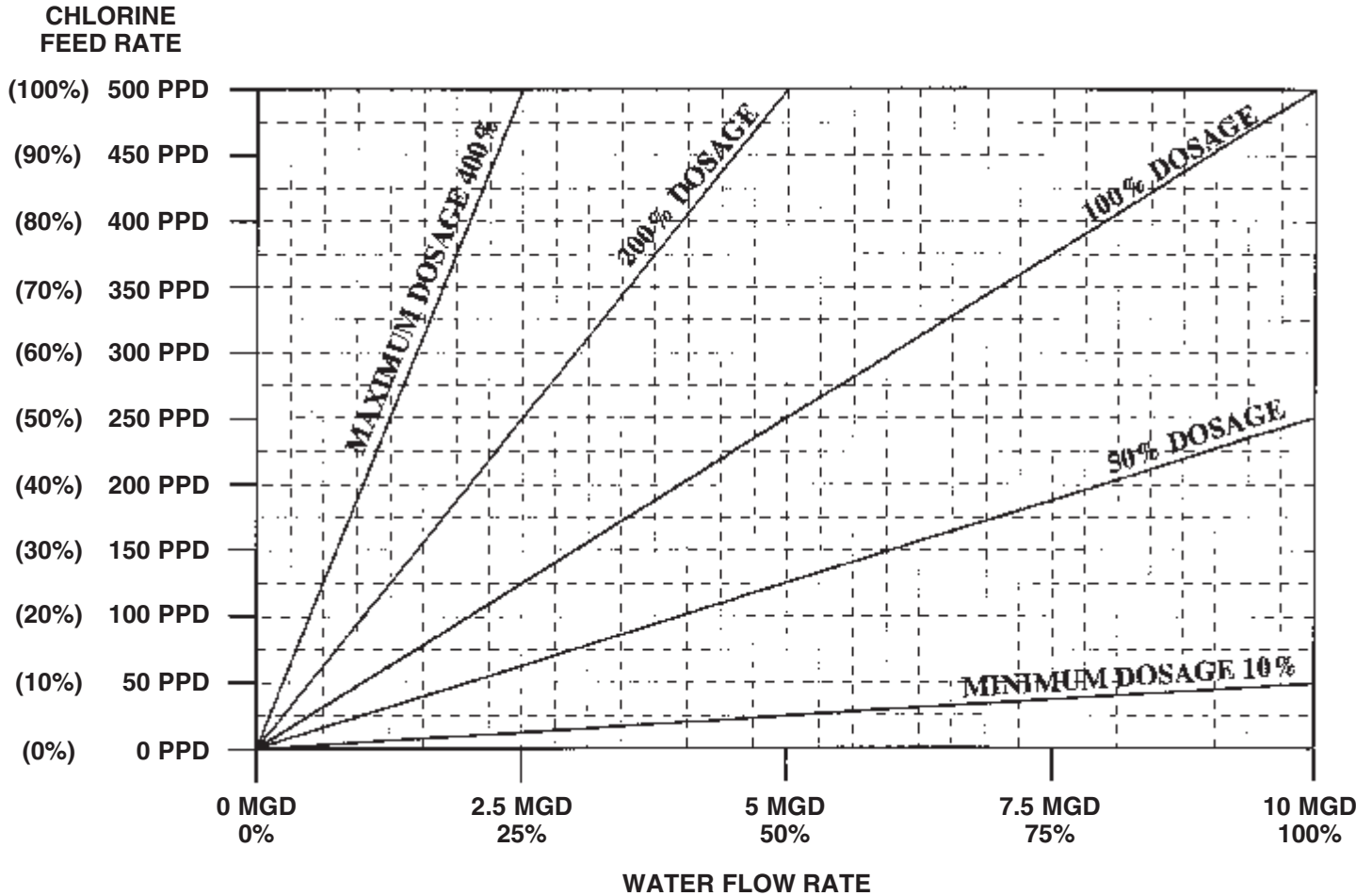


Ref. No.	Part No.	Quantity	Description
1	RV-825	1	Rate Valve Plug Assembly 1000/2000 PPD (20/40 Kg/Hr) (For Manual control only)
2	S-803	2	Rate Valve Stem Seal
3	RV-810	1	Rate Valve Seat Block
4	MS-21	2	1" NPT Close Nipple
5	MS-19	2	1" NPT Union
6	S-801	2	Metering Tube Seal
7		1	Metering Tube/Float Assembly
	A-2100		1000 PPD (20 Kg/Hr)
	A-2200		2000 PPD (40 Kg/Hr)
8	RV-814	1	Flow Meter Inlet Block
9	D-2000	1	Back Panel
10	Z-815	12	Mounting Screws
11	D-2001	1	Base Plate for RV-814
12	RV-824*	1	Rate Valve Seat Plug with (2) S-803 Seals

NOTES

1. Include Chlorinator Serial Number and Capacity on order.
- *2. RV-824 rate valve seat plug with two S-803 seals supplied with SMARTVALVE at 1000/2000 PPD only.

DRAWING NO. 12 — DOSAGE EXPLANATION



The dosage adjustment is used to set (or change) the ratio of chemical gas flow rate with respect to the process variable (Water Flow Rate) and the water quality (Demand). When using a flow proportional system, 100% dosage is achieved when the chemical feeder is operating at 100% of its feed rate based on an incoming flow meter signal representing 100% of water flow rate. As long as this ratio is maintained, the dosage is 100%.

EXAMPLE (See above graph):

A 500 PPD maximum feed chlorinator must operate at 500 PPD to treat a maximum water flow rate of 10 MGD. If the water flow rate decreases to 5 MGD (50%), the SMARTVALVE™ will automatically decrease the chlorinator gas feed rate to 250 PPD (50%) which is still 100% dosage.

In actual plant and system operation, however, the actual "required" dosage is rarely 100%. Because of this, the SMARTVALVE™ is designed to provide a wide range of dosage adjustment (10% - 400%) and is easily set by the system operator via the keypad.

1. At dosage settings greater than 100%, proportionality is lost at some water flow rate less than the designed maximum rate. If the dosage setting is increased to 200% for example, proportional control is only maintained up to 50% of water flow rate because at these conditions, the feeder is already at its maximum and cannot further respond to water flow rate requirements above 50%.

2. At dosage settings less than 100%, a portion of the operating range of the feeder is sacrificed. If the dosage setting is decreased to 50% for example, the upper 50% of the feeder's metering tube cannot be used.

Reasonable dosage adjustments of a properly sized flow proportional system are normal. Excessive and extreme adjustments could be the result of an under- or oversized system requiring a change in overall system capacity. At a minimum, this usually requires changing the SMARTVALVE's valve plug and the metering tube in the gas feeder unit. **ADDITIONAL COMPONENTS MAY ALSO BE NEEDED.**

chlorinators incorporated

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