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REGAL SMARTVALVE™

Models 7009 and 7010

Flow Proportional Control, Residual Control, Compound Loop Control and Feed Forward Dechlorination

Model 7009.....10 to 500 PPD
Model 7010.....1000/2000 PPD

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 manual chlorine and sulfur dioxide gas feed systems.

The REGAL SMARTVALVES™ discussed in this bulletin solve the problem whenever varying water flows and/or varying water quality need to be controlled accurately and automatically providing the correct ratio of chemical to water at all times. NO WASTED CHEMICAL. These REGAL SMARTVALVES include an integral dedicated controller which can be configured for Flow Proportional, Residual, Compound Loop or Feed Forward Dechlorination control schemes.

IMPORTANT NOTES

1. All software including design, appearance, algorithms, and source codes are copyrighted and owned by Chlorinators Incorporated.
2. The entire contents of this manual **MUST** be read and understood prior to installing and operating this equipment.
3. **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.
4. Additional instruction manuals are available at nominal cost from Chlorinators Incorporated.
5. Plastic pipe or tubing connector fittings may be broken or damaged if tightened excessively. **HAND TIGHTEN ONLY.**
6. 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

1. 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.
2. This equipment is designed FOR VACUUM SERVICE **ONLY.**
3. 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.
4. Maintenance should be performed by competent personnel familiar with this type of equipment, such as Chlorinators Incorporated themselves.
5. 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.
6. Field wiring **MUST** conform to national and local electrical codes.
7. **DISCONNECT POWER BEFORE** removing the cover or servicing this equipment.
8. **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.
9. 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.
10. This non-metallic enclosure **DOES NOT** automatically provide grounding between the conduit connections. Grounding **MUST** be provided as part of the installation.
11. 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.
12. 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. _____

CONTENTS

IMPORTANT:

Fill out and mail or fax the form on the reverse side to establish your warranty.

REGAL® GAS CHLORINATOR

CHLORINATORS INCORPORATED
1044 SE Dixie Cutoff Road
Stuart, FL 34994-3436

PLACE STAMP HERE

DRAWINGS AND PARTS LIST

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Drawing No. 2	Typical Installation of Residual Only Control
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Drawing No. 4	Typical Installation of Feed Forward Dechlorination
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IMPORTANT: THE ENTIRE CONTENTS OF THIS MANUAL MUST BE READ AND UNDERSTOOD PRIOR TO INSTALLATION, STARTUP, AND OPERATION OF THIS EQUIPMENT. ALSO, 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 THE EQUIPMENT.

1.0 INTRODUCTION

REGAL Series 7000 SMARTVALVES are used to AUTOMATICALLY regulate the feed rate of a REGAL gas dispensing system. The Models (**7009** and **7010**) covered in this manual can be used to feed either chlorine (CL_2) or sulfur dioxide (SO_2) gas. These models may be configured to control a variety of automatic systems including: **A)** Flow Proportional Control, **B)** Residual Only Control, **C)** Compound Loop Control, **D)** Feed Forward De-chlorination or **E)** Chloramination. A brief description of each of these systems is included below.

MODEL 7009 is used for 10 PPD (200 gm/hr) to 500 PPD (10 kg/hr) systems.

MODEL 7010 is used for 1000 PPD (20 kg/hr) and 2000 PPD (40 kg/hr) systems.

A) FLOW PROPORTIONAL CONTROL
(See Drawing No. 1)

Flow Proportional Control is used in systems where the water flow varies but the quality of the water remains the same. In this control scheme, a water Flow Meter, located in the main water line, continuously transmits a 4-20 milliamp signal to the SMARTVALVE indicating variations in the water flow rate. The SMARTVALVE then responds by automatically adjusting the chemical feed rate in direct PROPORTION to the water flow.

B) RESIDUAL ONLY CONTROL
(See Drawing No. 2)

Residual Only Control is used in applications where the water flow remains constant but the quality of the water varies. In this Control Scheme, a chlorine residual analyzer, located downstream from the SMARTVALVE, transmits a 4-20 milliamp signal indicating variations in the chlorine residual level. The SMARTVALVE responds by automatically adjusting the chlorine feed rate to maintain the desired residual level.

C) COMPOUND LOOP CONTROL
(See Drawing No. 3)

Compound Loop Control is a combination of both Flow Proportional and Residual Only control schemes. It is used when both the water flow rate AND water quality vary. In this control scheme, both a water flow meter and a chlorine residual analyzer are used to signal the SMARTVALVE to make any necessary adjustment(s) to the gas feed rate. The initial signal is transmitted from the upstream water flow meter to the SMARTVALVE which responds by adjusting the gas feed rate in proportion to the water flow rate. The secondary signal is transmitted from the downstream residual analyzer to the SMARTVALVE which responds by making further adjustment, if necessary, to maintain the desired residual level.

D) FEED FORWARD DECHLORINATION
(See Drawing No. 4)

In this control scheme, two SMARTVALVES are used; one to feed chlorine to disinfect the water; and one to feed sulfur dioxide to remove any remaining chlorine residual from the treated water. The SMARTVALVE used for chlorination is located upstream from the residual analyzer and the SMARTVALVE used for de-chlorination is located downstream. An upstream flow meter sends a signal to both valves which regulate the chemical feed rates in proportion to the water flow. The residual analyzer signal is sent to the chlorination (upstream) valve to make a more precise adjustment, if necessary, to maintain the proper chlorine residual level. The dechlorination (downstream) valve simultaneously receives the analyzer signal and then adjusts the sulfur dioxide gas feed rate to reduce (or remove) any remaining chlorine residual prior to discharge of the water.

E) CHLORAMINATION
(See Drawing No. 5)

Although the REGAL Model 7009/7010 SMARTVALVE does not offer “CHLORAMINATION” as a specific, selectable Control Scheme, the SMARTVALVE is still a commonly used component in this type of system. Therefore, we have included a basic guideline to provide a better understanding of the chloramination process and the installation of this type of system.

The Chloramination water disinfection process is becoming a more common application in large water treatment facilities where distribution may cover several square miles, thus requiring water flow through long distances of pipeline(s). Due to chlorine’s aggressive, rapid reaction with both organics and non-organics, it can sometimes be difficult to maintain a FREE chlorine residual that lasts long enough to reach the point(s) of distribution. In comparison, CHLORAMINES offer an alternative, less aggressive disinfectant that reacts more slowly and remains in the distribution system longer. Chloramines also help reduce the formation of disinfection by-products such as trihalomethanes (THM).

Chloramines are formed during a reaction between chlorine (CL_2) and ammonia (NH_3) which creates a combined residual that consists predominantly of monochloramine. A Chloramination system is used to promote the formation of chloramines by combining the use of a REGAL chlorine (CL_2) gas feed system and a REGAL ammonia (NH_3) gas feed system. The fully automatic system illustrated in this bulletin, requires the use of two REGAL SMARTVALVES, one for ammonia and one for chlorine. The chlorination SMARTVALVE adjusts its feed rate based upon a signal(s) from either, or both, a water flow meter and residual analyzer. The chlorine feed rate (output) signal is then transmitted to the ammonia SMARTVALVE (Model 7001A) which simultaneously adjusts its feed rate proportional to a preset ratio of ammonia to chlorine.

2.0 DESIGN AND INSTALLATION CONSIDERATIONS

A) THE IMPORTANCE OF MIXING

Complete and rapid mixing of the chemical solution at the point of application CANNOT BE OVERSTATED. Without proper mixing, control will be erratic and unacceptable due mainly to the chemical’s tendency to stratify (horizontally and vertically), even around bends and sharp corners. A quick, thorough mix will enhance the chemical contact time resulting in more constant, stable residual readings.

In potable water applications, if the chemical solution is injected into a full, turbulent flowing pipeline, a complete mix should occur within a matter of seconds and a relatively short distance (10-20 times the pipe's diameter). It is very important that the chemical solution be injected into the center one-third of the pipeline. Under variable flow conditions such as open channels or pipelines that are not flowing full, external mixing devices (static mixers, mechanical mixers, flash mixers, propeller mixers, etc.) are necessary to ensure a complete, thorough mix. These devices should always be located just after the chemical injection point and, to prevent off-gassing and corrosion, it is ESSENTIAL that the chemical solution be injected directly into the water stream, NOT above it.

B) THE IMPORTANCE OF LAG TIMES

(See Drawing Nos. 2, 3, 4, and 5)

In a closed loop system, it is extremely important to keep the total system hydraulic lag time within acceptable parameters, resulting in slow, non-erratic deviations and a smooth adjustment cycle for the SMARTVALVE when responding to the residual analysis. In systems with variable water flow, the lag time will also vary. Under laminar flow conditions, such as open channel wastewater applications, the TOTAL system lag time should always be kept as short as possible (less than 5 minutes) when the system is operating at average (50 %) water flow. Keep in mind that the lag time will increase as the water flow decreases and vice versa.

The total system lag time is generally the sum of three individual times (**T1, T2,** and **T3**) as illustrated in drawing Nos. 2, 3, 4, and 5. T1 and T3 are FIXED lag times and T2 can be either FIXED OR VARIABLE.

1) **T1** is the time it takes for the chemical solution to travel from the throat of the ejector to the point of application. Keep this time as short as possible by installing the ejector close to the application point.

2) **T2** is the time it takes for the chemical solution to mix with the water and travel to the sampling point of the analyzer. This time will vary ONLY if the water flow varies.

3) **T3** is the time it takes for the water sample to travel from the point it is drawn to the sampling cell of the analyzer. This time should be kept as short as possible by installing the analyzer close to the sample point.

   NOTE: AN EFFECTIVE WAY OF MEASURING THE SYSTEM LAG TIME IS EXPLAINED LATER IN THIS BULLETIN UNDER SYSTEM STARTUP (SECTION 7.0).

C) THE IMPORTANCE OF PROPER SIZING OF SYSTEM COMPONENTS

Use the following guideline to properly size the system components.

1) The REGAL Gas Feed System should be sized so the average gas feed rate falls within the middle third of the system's capacity (maximum feed rate).

2) The Residual Analyzer should be sized so the established set point falls as close as possible to the midpoint (12mA) of a 4-20mA analog signal range. e.g. - If the residual set point is 1.00 PPM, the best size analyzer would have a range of 0 (4mA) to 2.00 (20mA) PPM.

3) The water flow meter and transmitter must be sized, or scaled, so the maximum water flow coincides with the maximum feed rate (capacity) of the SMARTVALVE.

D) TRANSIENT VOLTAGE SURGE SUPPRESSION

(See Drawing No. 9)

In order for automatic control systems to operate properly, the individual components must have "clean" signals that are free of accumulated transients and protected against electrical power surges. Electrical surges travel along AC lines, data lines, analog signal lines, communication lines, and virtually any conductor they can find. A powerful surge can totally destroy solid state circuits and their components. Therefore, it is essential to install external power conditioning equipment such as surge suppressors and filters. REGAL SMARTVALVES should be protected with suppression devices placed on the incoming AC power line and on the incoming DC analog signal lines. The analog signal lines for flow inputs and residual analyzer inputs should provide a voltage clamp at a maximum of 12 volts.

3.0 INSTALLATION

The REGAL Models 7009 and 7010 SMARTVALVES are just one component in a REGAL complete gas feed system. Therefore, it is essential for all other system components to be in proper operating condition prior to installation. If the REGAL SMARTVALVE is being added to an existing gas feed system, some changes to system components may be required to ensure proper function. Refer to the Instruction Bulletin provided with your REGAL gas feed system for more information. Also feel free to contact your local REGAL dealer or Chlorinators Incorporated directly.

IMPORTANT: When shipped from the factory, the REGAL Model 7009 or 7010 SMARTVALVE will be sized to the capacity specified by the customer at the time of purchase. If the capacity needs to be changed for any reason, the Valve Plug size, Remote Meter Panel, and other system components may also need to be changed. Consult your REGAL dealer or Chlorinators Incorporated for further assistance.

NOTE: It is highly recommended to use exclusively REGAL components to ensure proper, consistent function of the system.

A) LOCATION OF COMPONENTS

(See Drawing Nos. 1, 2, 3, 4, and 5)

The REGAL SMARTVALVE should be wall mounted at eye level in an area where it is easily accessible and provides a clear view for easy operation. For optimal performance, the installation should be indoors so that temperature limitations are not exceeded. SEE SPECIFICATIONS.

IMPORTANT: Make sure the enclosure cover is in place and securely fastened to prevent the entry of moisture or corrosive gases while also eliminating the possibility of electric shock.

B) PIPES, TUBING, AND FITTINGS

All REGAL SMARTVALVES from 10 to 500 PPD are furnished with appropriate size connectors to match the capacity of the gas feed system. The SMARTVALVES with capacities of 1000 and 2000 PPD are furnished with PVC unions to be used with 1- inch Schedule 80 PVC piping (supplied by others). Larger size piping may be required if long distances between components are necessary.

The SMARTVALVE is connected to the vacuum tubing (or piping) between the gas feed systems remote metering panel assembly and the ejector as shown on the drawings in this manual.

NOTE: The following installation guideline is a very basic description of how to interconnect all the system components. A more efficient method that allows quick and easy conversion of the system to full manual operation is illustrated on drawing No. 6.

On a STANDARD (non-switchover) system:

1) Connect a suitable length of tubing (or pipe) from the regulator's VACUUM (outlet) fitting to the remote metering panel assembly's BOTTOM (inlet) fitting.

2) Connect another length of tubing from the TOP (outlet) fitting of the remote metering panel to the SMARTVALVE'S inlet fitting, located on the side of the valve plug enclosure.

3) Connect a length of tubing from the outlet (bottom) fitting of the SMARTVALVE to the vacuum fitting of the ejector assembly.

4) Finally, connect a suitable length of tubing to the bottom (vent) fitting of the vacuum regulator. Route the tubing to a safe outdoor location with the end pointing down and covered with bug screen.

On an automatic SWITCHOVER system:

1) Connect a suitable length of tubing (or pipe) from each regulator's vacuum (outlet) fitting to the side fittings on the pressure relief valve.

2) Connect a length of tubing from the top fitting of the pressure relief valve to the remote metering panel assembly's BOTTOM (inlet) fitting.

3) Connect a length of tubing from the TOP (outlet) fitting of the remote metering panel to the SMARTVALVE'S inlet fitting located on the side of the valve plug enclosure.

4) Connect a length of tubing from the SMARTVALVE'S bottom (outlet) fitting to the vacuum fitting on the ejector assembly.

5) Finally, connect a length of tubing from the bottom connection of the pressure relief valve, routing it outside with the end facing down and protected with bug screen.

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.

2) Use Teflon tape on all threaded plastic connections to prevent galling of the threads; provide a vacuum tight seal; and facilitate easy removal when necessary.

3) DO NOT over tighten fittings as damage to the fittings and system components could occur. HAND TIGHTEN ONLY.

C) ELECTRICAL INTERCONNECTIONS

(See Drawing Nos. 7 and 8)

1) It is essential that all external wiring be done exactly as shown on the wiring diagrams in the manual. Incorrect wiring or improper grounding WILL cause operational problems.

2) All wiring and fusing MUST conform to the National Electric Code as well as any local 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 done by qualified electronics technicians or by Chlorinators Incorporated.

5) EXTERNAL surge suppression devices should also be a normal part of all electronic component installations. These devices should be placed on all incoming AC power circuits and, where applicable, on all incoming DC signal lines. They MUST be chosen and sized properly (especially when used on 4-20mA DC signal lines) to assure maximum protection while preventing the surge suppressor itself from overloading the line resulting in signal loss.

6) State-of-the-art voltage surge suppressor components and RFI/EMI filtering circuits are integrated into the electrical circuitry of each electronic device. However, these internal components are in place only as a last line of defense to absorb electrical surges and spikes before they cause irreparable damage.

7) Power and signal lines MUST be run in separate electrical conduits to prevent signal interference.

8) The branch circuit should be protected by a fuse or a breaker with an accessible disconnect switch.

4.0 GENERAL INFORMATION PRIOR TO START-UP

IMPORTANT: Once installation is complete and BEFORE AC power is applied to the SMARTVALVE, make sure the internal power switch located on the 7071 Power Supply Board is in the ON (upward) position. Also confirm that the voltage (115 vs. 230) switch is set to your specification. See Drawing No. 11.

AFTER the power and voltage switch positions have been confirmed, AC power may be applied to the SMARTVALVE. When first powered up, the SMARTVALVE will be set in the OPERATIONAL MODE of the Factory Default FLOW (Flow Proportional) Control Scheme. Since the water flow input signal is not yet activated, the TOP LINE of the SMARTVALVE display screen will read: **AIN1 (FLOW) LOSS**

Simply press the far right keypad button (**ACK**) to acknowledge the loss of signal.

The TOP LINE of the screen will then display: **FLOW------% MANL**, which represents the water flow in percentage and also indicates the SMARTVALVE is set for Manual (**MANL**) Operation.

The BOTTOM LINE of the screen will display: **VALVE 0.0 PPD MENU**, representing the gas feed at zero PPD (lbs. per day) along with the Operational Mode Menu button. If the valve is factory set for metric scale, the feed rate will be in grams (g) or kilograms (kg) per hour (h).

IMPORTANT: As previously mentioned, the SMARTVALVE is in the OPERATIONAL MODE of the factory default FLOW (Flow Proportional) Control Scheme. However, since the OPERATIONAL procedure varies depending on which CONTROL SCHEME the system requires, the FIRST step necessary is to proceed to Section 5.0 (ENGINEERING MODE) and select the proper Control Scheme for your system. After making this selection, continue on to ALL remaining Engineering parameters.

5.0 ENGINEERING MODE

NOTE: The keypad buttons will sometimes be referred to in left to right numerical order (**#1, #2, #3, #4**) for easy reference.

A) TO ENTER THE ENGINEERING MODE

1) Simultaneously press and hold the #3 and #4 keypad buttons for approximately five seconds until the TOP LINE of the display screen reads: **ENT ENG PW 0 * * *** (Enter Engineering Password).

2) Press the **NEXT** keypad button three times until the factory default password (**0 0 0 0**) appears. Then press **ENT** (enter) to accept.

3) The TOP LINE will now display the first Engineering parameter: **OPERATION---FLOW** which is used to select the preferred system Control Scheme.

NOTE: To properly set this and all remaining Engineering parameters, proceed to the following list which includes a full explanation with instructions for each parameter. The parameters are listed in the order they appear while in the Engineering Mode and they are applicable to all Control Schemes, with two noted exceptions pertaining to parameters No. 2 and 3.

B) ENGINEERING PARAMETERS

1) **OPERATION**
OPERATION allows the user to choose the Control Scheme appropriate for their system. The selections are:

a) **FLOW** (Flow Proportional Control)

b) **RES** (Residual Only Control)

c) **CLC** (Compound Loop Control)

d) **FEED FWD** (Feed Forward Dechlorination)

To make your selection, press **ADJ** (adjust). Use the **UP** or **DOWN** buttons to scroll to the desired selection. Press **ENTER** to accept. Then press **NEXT** to proceed to the following parameter.

2) **CAL AIN1 (FLOW)**
CALIBRATE ANALOG INPUT NO. 1 is for the Water Flow Meter Input. This input has been factory calibrated and should not need adjustment prior to startup.

NOTE: This parameter is NOT available for RESIDUAL ONLY Control.

3) **CAL AIN3 (RES)**
CALIBRATE ANALOG INPUT NO. 3 is for the Residual (RES) Analyzer Input. This input has been factory calibrated and should not need adjustment prior to start-up.

NOTE: This parameter is NOT available for FLOW PROPORTIONAL Control.

4) **CAL AOUT**
CALIBRATE ANALOG OUTPUT – The analog OUTPUT may be used to transmit the SMARTVALVE output (Gas Feed Rate) signal to another device(s). The output has been factory calibrated and should not need adjustment prior to start-up.

NOTE: As mentioned, parameters No. 2, 3, and 4 have been factory calibrated and should not need adjustment prior to startup. However, if recalibration should prove necessary in the future, refer to Section 9.0 (Maintenance).

5) **VALVE CAL PTS**
VALVE CALIBRATION POINTS refers to the number of points (in percentage) used to Linearize (calibrate) the SMARTVALVE to coincide with the Remote Metering Tube. The selections are: 2, 5, 6, 11, or 15. Factory setting is 5, which represents: 0, 25, 50, 75, & 100 percent of the system capacity. To change the setting, press **ADJ** (adjust). Scroll **UP** or **DOWN** to the desired selection. Press **ENTER** to accept. Press **NEXT** to proceed to the following parameter.

6) **CAL VALVE**
CALIBRATE (LINEARIZE) VALVE - The SMARTVALVE is linearized at the factory prior to shipment. HOWEVER, it is recommended to check the linearization when the system is first started up. This will be covered in more detail in Section 7.0 (SYSTEM STARTUP).

7) **VALVE SPEED**
VALVE SPEED allows the user to vary the speed of the SMARTVALVE stepper motor as it moves the position of the Valve Plug to adjust the Gas Feed Rate. The selections refer to seconds per revolution. Choices are: 0.5, 1.0, 1.5, 2.0, 3.0, 5.0, 7.5, & 10.0. Factory setting is 1.5.

NOTE: To change this and all remaining Engineering parameters, simply press **ADJ**. Scroll **UP** or **DOWN** to the desired value. Press **ENTER** to accept. Press **NEXT** to proceed to the following parameter.

8) **VALVE HYS**
VALVE HYSTERESIS places a “dead band” around the input signal(s) to limit response to minor signal variations. This helps prevent wear and tear on the stepper motor and feedback potentiometer. Selections in percentage are: Off, 0.06, 0.13, 0.25, 0.38, 0.50, 0.75, 1.00 and 2.00 %. Factory setting is 0.13 %.

9) **FAIL OPERATION**
FAIL OPERATION allows the user to choose how the SMARTVALVE will respond to a loss of the analog input signal(s). Selections are **HOLD** or **DROP**. HOLD will keep the Feed Rate at its current level and DROP will lower the Feed Rate to Zero. **NOTE:** For compound loop and feed forward control, both (Flow and Residual) input signals must be lost for the Fail Operation parameter to take effect. This will be explained in greater detail in Section 8.0 (OPERATIONAL MODE).

NOTE: FAIL OPERATION is the final parameter to check/change before exiting the Engineering Mode.

C) TO EXIT THE ENGINEERING MODE

1) Press **ESC** (Escape).

2) After pressing Escape, you will be asked if you would like to **ENTER NEW ENG PWD** (Enter a new Engineering Password?).

3) Press **NO** to keep the existing password and to return to the Main Operating Screen.

4) Press **YES** to change the password. The TOP LINE of the display will read: **NEW ENG PW 0 ? ? ?**

   a) Press the **UP** or **DOWN** keypad button(s) repeatedly until the preferred FIRST digit is displayed. Then press **NEXT** to accept the new value.

   b) The number 0 will appear as the second digit. Once again, use **UP** or **DOWN** to scroll to the preferred number. Then press **NEXT** to accept and continue to the third digit.

   c) Repeat the same steps to select the third and fourth digit.

   d) Finally, press **ENT** (Enter) to accept the New Password and return to the Main Operating Screen.

   NOTE: At this time, if any changes to the settings were made while in the Engineering Mode, you will be asked if you want to **SAVE CHANGES?** Press **YES** or **NO** accordingly and you will return to the Main Operating Screen.

IMPORTANT: Once all Engineering parameter settings have been confirmed, proceed directly to the next section (6.0 CONFIGURATION MODE) to check and/or change the Configuration parameter settings.

6.0 CONFIGURATION MODE

The Configuration Mode is used to set the basic valve parameters. Each parameter MUST be checked and/or changed prior to placing the system into operation. Simply enter the configuration mode as explained below and the parameters will be displayed individually in the order they are listed. The list includes a detailed description of each parameter along with the settings and control schemes that apply. **IMPORTANT:** Only the configuration parameters that apply to the selected Control Scheme will be accessible, therefore, confirm that the proper Control Scheme has been chosen in the Engineering Mode before proceeding with the configuration parameter settings.

A) TO ENTER THE CONFIGURATION MODE

1) Press and hold the far right (**#4**) keypad button for approximately five seconds and you will be asked to enter the Configuration Password. The TOP LINE of the screen will read: **ENTER CFG PW 0 * * *** .

2) Press the **NEXT** keypad button three times until the factory default password (**0 0 0 0**) is displayed.

3) Press **ENT** (Enter) and the first Configuration Parameter (**FLOW UNITS**) will appear.

B) CONFIGURATION PARAMETERS
(Page 11)

NOTE: The far right columns of the parameters list designate the control scheme(s) that apply to each parameter.

The abbreviations are:

1) **FP** (Flow Proportional)

2) **RO** (Residual Only)

3) **CL** (Compound Loop)

4) **FF** (Feed Forward)

CONFIGURATION PARAMETERS

PARAMETER	DESCRIPTION AND SETTINGS	CONTROL SCHEMES* FP	RO	CL	FF
1) FLOW UNITS	The Water FLOW UNITS are available in **%** (percent), **GPM** (gallons per minute), **MGD** (million gallons per day), **L/s** (liters per second), **m3s** (cubic meters per second), and **m3d** (cubic meters per day). Factory set in %. **NOTE: To change this parameter and any other Configuration parameter, simply press (ADJ) adjust. Use the UP and DOWN buttons to scroll to the preferred selection. Press ENTER to accept, then press NEXT (or LAST) to continue to the following parameter.**	**YES**	**NO**	**YES**	**YES**
2) FLOW RANGE	Sets the maximum WATER flow according to the selected FLOW UNITS. Since the factory setting for Flow Units is percent, the FLOW RANGE is set to **100** (%).	**YES**	**NO**	**YES**	**YES**
3) FLOW AVERAGE	Allows the Flow Signal to be averaged over a specific time period before the SMARTVALVE makes any adjustments. This helps prevent wear and tear on the stepper motor and feedback potentiometer. The settings available are 0.2, 0.4, 0.6, 0.8, 1, 2, 3, 5, 8 & 10 seconds. Factory set at **1**.	**YES**	**NO**	**YES**	**YES**
4) RES UNITS	Residual Units are measured in PPM (parts per million) or mg/L (milligrams per liter). Factory set in **PPM**.	**NO**	**YES**	**YES**	**YES**
5) RES RANGE	The Residual Range MUST be set identical to the range of the chlorine residual analyzer. Factory set at **3.00** PPM.	**NO**	**YES**	**YES**	**YES**
6) RES AVERAGE	Residual Average allows the residual analyzer signal to be averaged over a specific time frame prior to any adjustment to the gas feed rate. The available settings are 0.2, 0.4, 0.6, 0.8, 1, 2, 3, 5, 8, & 10 seconds. Factory set at **1**.	**NO**	**YES**	**YES**	**YES**
7) VALVE UNITS	Units used to monitor and regulate the gas feed rate. The choices are PPD (lbs. per day), g/h (grams per hour) and kg/h (kilograms per hour). Factory setting is **PPD**.	**YES**	**YES**	**YES**	**YES**
8) VALVE FS	Valve Full Scale is the maximum gas feed rate (capacity) of the SMARTVALVE which must be identical to the capacity of the overall system including the remote metering tube. **IMPORTANT:** The SMARTVALVE is sized to the customer's specification at the time of purchase. If the Full Scale of the SMARTVALVE needs to be changed, the valve plug and other system components may also need to be changed.	**YES**	**YES**	**YES**	**YES**

CONFIGURATION PARAMETERS

PARAMETER	DESCRIPTION AND SETTINGS	CONTROL SCHEMES* FP	RO	CL	FF
9) SP1 MODE	SET POINT ONE MODE refers to the first of THREE available alarm Set Points. The Set Point Mode is used to activate alarm devices (if desired) and designate what condition the alarm represents. The selections are: **OFF, LOW,** or **HIGH**. If the SET POINT MODE setting is left in the factory default OFF position, no additional parameters will be made available for that particular alarm set point. However, if LOW or HIGH Mode is selected, the alarm is activated and the first of four (A thru D) Set Point parameters will be displayed as follows.	**YES**	**YES**	**YES**	**NO**
	A) **SP1 SRC** (SET POINT ONE SOURCE) refers to the source of the alarm. The choices, depending on which Control Scheme is active, will be FLOW (water flow level), VALVE (gas feed rate) and RES (Residual level). **NOTE:** When using Feed Forward (**FF**) Control, alarm set points are only available for the Chlorination (upstream) valve to eliminate the possibility of conflicting settings with the De-chlorination (downstream) valve.	**YES**	**YES**	**YES**	**NO**
	B) **SP1 RELAY** (SET POINT ONE RELAY). There are three (**K1, K2,** and **K3**) relay switches available on the SMARTVALVE's Power Supply Board (7071). Each active alarm Set Point MUST be assigned to one relay. Each relay may be used for more than one set point.	**YES**	**YES**	**YES**	**NO**
	C) **SP1 DELAY** (SET POINT ONE DELAY) allows the user to set a time delay from when the alarm set point level is reached until the alarm actually turns on. The range available is 0 to 60 seconds. Factory setting is 0.	**YES**	**YES**	**YES**	**NO**
	D) **SP1 HYS** (SET POINT ONE HYSTERESIS) allows the user to set a level above (or below) the set point that the source must return to before the alarm turns off. This setting is based upon the units used to measure the alarm source. e.g.- If the water FLOW level is the alarm source and the range is in percentage (%) with a LOW level set point of 10%, a 2% hysteresis setting would require the water level to reach 12% before the alarm turns off. Factory setting is 0.	**YES**	**YES**	**YES**	**NO**
10) SP2 MODE	SET POINT TWO MODE is used to activate (or de-activate) alarm Set Point No. 2. As is the case with Set Point No.1, the choices are: **OFF, LOW,** or **HIGH**. The factory setting (OFF) will de-activate the alarm and LOW or HIGH will activate it. If the alarm is activated, follow the same steps explained for alarm Set Point No. 1.	**YES**	**YES**	**YES**	**NO**
11) SP3 MODE	SET POINT THREE MODE. Follow the same steps as explained for Set Points No. 1 and 2.	**YES**	**YES**	**YES**	**NO**
12) LOCK CTRL PARM	LOCK CONTROL PARAMETERS is the final parameter in the Configuration Mode. It is used to allow (or deny) access to the Control Parameters from the OPERATIONAL MODE. Selecting **NO** (factory setting) allows access to the parameters. Selecting **YES** denies access. **NOTE:** The Control Parameters are used exclusively for systems set up for Compound Loop OR Residual Only Control. They are explained in detail in the next section (7.0 System Startup).	**NO**	**YES**	**YES**	**NO**

C) TO EXIT THE CONFIGURATION MODE

Follow the same steps as explained in Section 5C (TO EXIT THE ENGINEERING MODE).

7.0 SYSTEM START-UP

After all wiring and plumbing has been completed, and the Engineering and Configuration parameters have been confirmed, the system is ready for startup. After exiting the Configuration Mode, the SMARTVALVE will be in the OPERATIONAL MODE of the selected Control Scheme.

Once the system is up and running, the TOP LINE of the SMARTVALVE display screen will read either the water **FLOW** rate or the chlorine residual (**RES**) level, depending on the active Control Scheme. The ball float in the remote metering tube should read the same gas feed rate as shown on the bottom line of the SMARTVALVE display screen. ALWAYS READ THE CENTER OF THE BALL FLOAT.

IMPORTANT: The REGAL 7500 Remote Meter Panel MUST be configured for AUTOMATIC control.

A) LINEARIZING (CALIBRATING) THE SMARTVALVE

IMPORTANT: As previously mentioned, the SMARTVALVE has been calibrated (linearized) at the factory, however, it is still recommended that the user/installer checks and becomes familiar with the linearization process at startup, especially if all system components HAVE NOT been supplied by Chlorinators Incorporated. To check the linearization, proceed as follows:

1) ENTER THE ENGINEERING MODE as explained in Section 5.0.

2) Once in the Engineering Mode, scroll to the **CAL VALVE** parameter.

   NOTE: This Linearization process will be based upon the factory set, 5-point linearization curve. To confirm this setting, check the previous Engineering parameter, **VALVE CAL PTS** (Valve Calibration Points).

3) While observing the ball float in the Remote Metering Tube, press the **ADJ** (adjust) keypad button and the SMARTVALVE will start to drive to the ZERO feed rate position. The ball should come to rest on the bottom stop of the metering tube at exactly the same time the motor stops driving.

4) The Top Line of the SMARTVALVE display screen will show a ZERO VOLTAGE reading of **0.45 V**.

   NOTE: A voltage reading from **0.41** to **0.49** is acceptable.

   IMPORTANT: If for some reason the voltage reading falls outside of the acceptable range, contact Chlorinators Incorporated for assistance.

5) Once the correct ZERO voltage reading has been confirmed, press the **NEXT** keypad button and the SMARTVALVE will automatically open to the second linearization point which represents **25%** of the system's Full Scale (capacity). e.g.- For a 50 PPD system, 25% would be **12.5 PPD**.

6) If the reading on the metering tube panel equals the reading on the SMARTVALVE display screen, press **ENTER** and proceed to step 8.

7) If the readings **DO NOT** match, press **ADJ** (adjust). Use the **UP** and **DOWN** keypad buttons to move the ball float to the correct (**12.5 PPD**) reading on the metering tube. Once the value matches the reading on the display, press **ENTER** to accept.

8) Press **NEXT** and the SMARTVALVE will automatically open to the third linearization point representing 50% of the valve's capacity. e.g.- 50% of a 50 PPD system equals 25 PPD.

   NOTE: Follow the same procedure described in steps 6 and 7 to complete the 50% point. Then continue on to the fourth linearization point (75%) and the fifth linearization point (100%).

9) Linearization is now complete. Press **ESC** (escape) which accepts the Linearization and returns you to the Engineering parameter, **CAL VALVE**. Press **ESC** (escape) a second time to exit the Engineering Mode.

   IMPORTANT: IF THE SYSTEM IS BEING USED FOR FLOW PROPORTIONAL CONTROL OR FEED FORWARD DECHLORINATION, ALL NECESSARY STEPS HAVE BEEN COMPLETED TO START OPERATING THE SMARTVALVE. PROCEED TO SECTION 8.0 (OPERATIONAL MODE). HOWEVER, IF THE SYSTEM IS TO BE USED FOR RESIDUAL ONLY OR COMPOUND LOOP CONTROL, THE CONTROL PARAMETERS LISTED BELOW MUST BE SET PRIOR TO OPERATION.

B) SETTING CONTROL PARAMETERS

As mentioned, the Control Parameters are used exclusively for system's using COMPOUND LOOP (**CL**) or RESIDUAL ONLY (**RO**) Control and are accessible from the OPERATIONAL MODE of either of these Control Schemes. To access these parameters, proceed as follows:

Press and hold the far left (**#1**) keypad button for approximately 5 seconds until the first Control Parameter, **RES CTRL GAIN** (Residual Control Gain), is displayed. **NOTE:** Make sure you have UNLOCKED the Control Parameters in the Configuration Mode.

Use the following list to view and/or make changes to this and all other Control Parameters. They are listed in the order they will appear with a complete explanation including the settings and applicable Control Scheme(s). ONLY the parameters for the active Control Scheme will be accessible. Setting these parameters is done the same as described for the Configuration parameters: Press **ADJ** (adjust). Scroll **UP** or **DOWN** to the desired selection. Press **ENTER** to accept.

CONTROL PARAMETERS

PARAMETER	DESCRIPTION	CONTROL SCHEMES* RO	CL
1) RES CTRL GAIN	Residual Control Gain establishes how aggressively the controller responds when making corrections to maintain the residual Set Point level. The higher the gain is set, the larger and more frequent the corrective action will be. Too high a setting may lead to excess “up and down” adjustments to the feed rate, whereas, too low a setting may cause slow, insufficient adjustments. The setting is in percentage (0.1 to 100). Factory set at 20%.	**YES**	**YES**
2) RES CTRL LIM	Residual Control Limit places a “band” around the waterflow (primary) signal to prevent the over (or under) feeding of gas due to a possible drifting, inaccurate, residual (secondary) signal. e.g. - Using a 50 PPD system. If the water flow units are in percentage and the present water flow is 40 %, the primary feed rate would be 20 PPD. Therefore, a 10% residual control LIMIT will restrict the OVERALL gas feed rate to +/- 10% of the primary feed rate. Since 10% of the valve’s 50 PPD capacity is 5 PPD, the output would be limited to a range of 15 to 25 PPD. **NOTE:** The setting range is 0 to 25%. Factory set at 20%. **IMPORTANT: As explained in Section 2B, the TOTAL system lag time (T1 + T2 + T3) refers to the time from when the chemical solution exits the ejector assembly until the time that the residual water sample reaches the wet cell of the residual analyzer. Depending on the Control Scheme, the lag time will be either FIXED or VARIABLE. The final three Control Parameters listed below are used to provide the necessary data for the controller to calculate, and compensate for the lag time prior to making adjustments. NOTE: An effective and relatively easy method of setting these parameters is explained in detail in the next section (SETTING THE LAG TIME).**	**NO**	**YES**
3) FIXED LAG TIME	The total system lag time becomes FIXED when there is no variation in the water flow (T2). Therefore, this parameter applies strictly to Residual Only Control which has a FIXED water flow. The time setting is in seconds.	**YES**	**NO**
4) VAR LAG TIME	Variable Lag Time. The total system lag time is variable only when the water flow (T2) is variable. Compound Loop Control systems have variable water flow, therefore,variable lag time. The time setting is in seconds.	**NO**	**YES**
5) FLOW @ VAR LAG	Flow at Variable Lag refers to the rate the water is flowing when the total lag time is measured. This value sets the necessary “span” to establish the range of minimum to maximum lag times. The value MUST be set based on the Flow UNITS and Flow RANGE selected in the Configuration Mode.	**NO**	**YES**

C) SETTING THE LAG TIME

IMPORTANT: For best results with Compound Loop Control systems, the lag time should be measured when the water is at its AVERAGE daily flow rate.

1) Press **ESC** (escape) to exit the Control Parameters and return to the Main Operating Screen.

   If the SMARTVALVE is configured for COMPOUND LOOP CONTROL, the TOP LINE will display the water **FLOW** rate and also indicate if the valve is set for automatic (**AUTO**) or manual (**MANL**) operation. Press the select (**SEL**) keypad button, then press **RES** (residual) to display the residual reading (**PPM**) in place of the water flow reading. Also, if it is set for **AUTO** operation, press **SEL** a second time, then press **MANL** (manual).

   OR

   If the SMARTVALVE is configured for RESIDUAL ONLY CONTROL, the TOP LINE will display the residual (**RES**) level in **PPM** (parts per million) and indicate if the valve is set for automatic (**AUTO**) or manual (**MANL**) operation. If set for **AUTO**, press the **MENU** button, then press **MANL** (manual).

2) Based upon the Residual Range (**RES RANGE**) that was set in the Configuration Mode, a residual level Set Point (**SP**) must be established. Press the **SEL** (select) button, then press the **MENU** button. Press **SP** (set point), scroll **UP** or **DOWN** to the preferred set point value, then press **ENT** (enter) to accept. Finally, press **ESC** (escape) to return to the main operating screen.

3) The next step is to "balance" the system by manually adjusting the gas feed rate until the displayed residual reading matches the residual SET POINT value. Start by pressing the **VALVE** button. Then use the **OPEN** and **CLOSE** buttons to gradually adjust the system into balance. **NOTE:** This process may take a significant amount of time, depending on the size of the system.

4) For Residual Only Control systems, proceed to step No. 5. HOWEVER, for Compound Loop Control systems, the water FLOW rate must also be recorded prior to proceeding to the next step. To do so, press the **MENU** button, then press **FLOW** and the water level will be displayed in the selected Flow Units. Record the level. Then press **MENU** a second time and press **RES** to display the residual reading again. Proceed IMMEDIATELY to step 5.

5) While observing the displayed residual reading, "upset" the system by manually increasing or decreasing the gas feed rate by a substantial amount while simultaneously starting an accurate timing using a stop watch.

6) Closely observe the residual reading on the screen until it begins to reflect the upset condition. At that point, immediately record the timed value in seconds. Once recorded, manually adjust the gas feed rate again to get the system back into balance.

7) Once the system is in balance, press and hold the No. 1 keypad button to access the Control Parameters again. For Residual Only Control. **ENTER** the recorded time as the **FIXED LAG TIME**. For Compound Loop Control, **ENTER** the recorded time as the **VARIABLE LAG TIME**.

8) Finally, for Compound Loop Control, proceed to the **FLOW @ VAR LAG** parameter and **ENTER** the previously recorded water flow rate. **NOTE:** Also, check the current water flow rate to make sure it has not varied much (+/- 5%) during the timing process. If so, the process must be repeated.

   NOTE: Relocation of the sample point to achieve accurate results is not uncommon and may require significant time and trial.

   Once all control parameters have been set and produce the necessary results, proceed to section 8.0 (OPERATIONAL MODE).

   NOTE: At this time, it is also recommended to re-enter the configuration mode and lock the control parameters to prevent unauthorized access.

8.0 OPERATIONAL MODE

Each of the four Control Schemes available for the Model 7009 and 7010 SMARTVALVES has separate OPERATIONAL MODE PARAMETERS and settings which are explained below. These parameters may be changed by the operator at any time, regardless if the valve is set in the **MANL** (manual) or **AUTO** (automatic) operational mode. The currently active mode (**AUTO** or **MANL**) will always be indicated on the far right, TOP LINE of the display.

To change the operational mode, simply press the **MENU** or **SEL** (select) button. ONLY the mode which is not in use will be shown on the BOTTOM LINE of the display. Press the keypad button (No. 3) of the displayed mode to make the change. The main operating screen will now show the selected mode on the TOP LINE.

IMPORTANT: When the valve is set in the manual (MANL) operational mode, the gas feed rate may be adjusted in one of the four following ways, depending upon the condition.

1) **Fully Electric** – In the event of loss of the analog input signal(s), use the keypad buttons and the digital display. Simply press the **VALVE** button. Then use the **OPEN** and **CLOSE** buttons to adjust the gas feed rate accordingly.

2) **Electric Manual** – If the remote meter assembly is temporarily out of service, use the thumbwheel and digital display. **IMPORTANT:** To avoid gear damage and possibly upset the electrical zero setting, it is ESSENTIAL to place the valve in **MANL** operation PRIOR to turning the thumbwheel. Also, be sure to bypass the remote meter assembly by connecting the vacuum tubing from the vacuum regulator directly to the SMARTVALVE inlet fitting.

3) **Manual** – In the event of power loss, use the thumb-wheel and remote metering tube. To adjust the feed rate, simply turn the thumbwheel while using the remote meter ball float as a guide.

4) **Fully Manual** – To temporarily bypass the SMARTVALVE entirely, use the remote meter rate valve assembly. **NOTE:** The remote meter rate valve assembly MUST first be changed to manual operation. See drawing No. 6.

OPERATIONAL MODE PARAMETERS

A) FLOW PROPORTIONAL CONTROL

The Dosage and Alarm Set Point(s) are the only Operational parameters for Flow Proportional Control.

1) **DOSAGE** – The dosage setting allows the user to adjust a ratio of the gas feed rate with respect to both the VARIABLE water flow and the NON-VARIABLE water quality. Settings are 0.0 to 4.0. Factory setting is 1.0.

   NOTE: For a better understanding of DOSAGE, refer to page 35 and drawing No. 18.

   a) To view or change the Dosage setting, press the **MENU** button, then press **DOSE**.

   b) Use the **UP** and **DOWN** buttons to reach the preferred value. Press **ENTER** to accept and automatically return to the Main Operating Screen.

2) **ALARM Set Point(s)** – If any alarms were activated in the Configuration Mode, the alarm Set Point Levels MUST then be set (or changed) in the Operational Mode. If no alarms have been activated, the **ALARM** selection will not appear when the **MENU** button is pressed. The alarm set points available for Flow Proportional Control are **VALVE** (gas feed rate) or **FLOW** (water flow).

   a) To set, or change, the active alarm levels, press the **MENU** button, then press **ALARM**. The display will read the set point number (**SP1, SP2** or **SP3**); followed by the source (**FLOW** or **VALVE**); followed by the level (**LOW** or **HIGH**) in the applicable units.

   b) To change the level, press **ADJ** (adjust). Use the **UP** and **DOWN** buttons to display the preferred value. Then press **ENTER** to accept.

   c) Press **NEXT** to proceed to any additional activated Set Points.

   d) Follow the same instructions for all Set Points. Then press **ESC** (escape) to return to the main operating screen.

B) RESIDUAL ONLY CONTROL

The Residual Set Point (**SP**) and **ALARM** Set Point(s) are the only Operational parameters available for Residual Only Control.

1) **RES SP** (Residual Set Point) is the preferred level of chlorine residual to be maintained by the system. To set the value, press **MENU**, then press **SP**. The TOP LINE will read **RES SP** (residual set point) and the present value. Use the **UP** and **DOWN** buttons to set the desired level. Press **ENTER** to accept and automatically return to the main operating screen.

2) **ALARM Set Point(s)** – The available Alarm Set Points for Residual Only control are **VALVE** (gas feed rate) and/or **RES** (residual level). To set or make changes, follow the steps explained for the Flow Proportional Control alarm set points.

C) COMPOUND LOOP CONTROL

Compound Loop Control provides the option to monitor either the water **FLOW** rate or the residual level (**RES**) on the TOP LINE of the main operating screen. To select the preferred display, simply press **SEL** (select) followed by **RES** or **FLOW**. The additional Operational Mode parameters for Compound Loop Control are the residual level set point (**RES SP**) and any active **ALARM** set point(s).

1) **RES SP** (residual set point) – To change the chlorine residual set point (**SP**), simply press **SEL** followed by **MENU**. Then press the **SP** (set point) button. **RES SP** and the current value will appear. Use the **UP** and **DOWN** buttons to set the desired level. Press **ENTER** to accept and return to the main operating screen.

2) **ALARM Set Point(s)** – The available Alarm Set Points for Compound Loop Control are **VALVE** (gas feed rate), **FLOW** (water flow), and **RES** (residual level). To set or make changes, follow the same steps explained for the Flow Proportional Control alarm set points.

   IMPORTANT: The dosage is automatic when the system is set up for Compound Loop Control. However, if the signal from the chlorine residual analyzer should be lost, the SMARTVALVE will automatically convert the system to operate exclusively in Flow Proportional Control, at which time, the dosage (DOSE) parameter will be made available for the operator. Likewise, if the signal from the water flow meter is lost, the system will automatically be converted to Residual Only Control and the applicable parameters will be made available. In either case, the active Control Scheme (RES or FLOW) will be displayed on the TOP LINE of the screen, flashing repeatedly to indicate the loss of signal.

D) FEED FORWARD DECHLORINATION

Feed Forward Dechlorination also provides the option of monitoring either the water **FLOW** rate or the residual (**RES**) level on the TOP LINE of the main operating screen. To select the preferred display, simply press **SEL** (select) followed by **RES** or **FLOW**. The only additional Feed Forward dechlorination parameter is the multiplier (**MULT**).

1) **MULT** (multiplier) – The multiplier setting allows the user to adjust the gas feed rate with respect to BOTH the variable water flow and the variable residual level. The setting is in percentage ranging from 0 to 400 %. The factory setting is 100%. To adjust the value, press **SEL** (select) followed by **MULT**. Use the **UP** and **DOWN** buttons to set the preferred value. Press **ENTER** to accept and automatically return to the main operating screen.

NOTE: No ALARM set points are made available for the dechlorination (downstream) SMARTVALVE to prevent settings which may conflict with the chlorination (upstream) SMARTVALVE.

IMPORTANT: As explained for compound loop control, if the input signal from either the flow meter or the residual analyzer is lost, the system will automatically be converted to the alternate control scheme.

9.0 MAINTENANCE

A) CALIBRATING THE ANALOG INPUT(S)

IMPORTANT: The preferred Flow and/or Residual Units and Ranges MUST be preset in the Configuration Mode prior to calibrating the analog input(s).

As explained in Section 5.0 (Engineering Mode), the two 4-20 mA analog Inputs (**AIN 1** and **AIN 3**) have been factory calibrated. If re-calibration becomes necessary, an accurate 4-20 mA signal generator is required. To begin calibration, enter the Engineering Mode and proceed as follows:

1) In the Junction Box located on the left side of the Main Enclosure, connect the 4-20 mA signal generator to Terminals **#1** (positive) and **#2** (negative) for **AIN1 (FLOW)** or to Terminals **#6** (positive) and **#7** (negative) for **AIN3 (RES)**.

2) Scroll to the appropriate calibration parameter, **CAL AIN1 (FLOW)** or **CAL AIN3 (RES)**.

3) Apply 4.0 milliamps to the input terminals and then press the **ADJ** (adjust) button.

4) The displayed value should be **0.00**, representing either zero water flow (**AIN1**) or zero chlorine residual level (**AIN3**). Press **ZERO** which will then establish the 4mA signal as the zero value.

5) Now apply 20.0 milliamps to the terminals. To set the maximum Water Flow (**AIN1**) OR maximum Chlorine Residual Level (**AIN3**) equal to 20 mA, press the **SPAN** button. Use the **UP** and **DOWN** buttons to set the true value based on the applicable units. Then press **ENTER**.

6) This completes the calibration process.

7) After both (if applicable) analog inputs have been calibrated, press **ESC** (escape) to return to the Engineering parameter list. Press **ESC** a second time and **SAVE CHANGES** to return to the main operating screen.

B) CALIBRATING THE ANALOG OUTPUT

The analog output has been factory calibrated. If re-calibration proves necessary, an accurate digital VOM (volt ohm meter) is required. Proceed as follows:

1) In the junction box located on the left side of the Main Enclosure, connect the VOM to Terminals **#4** (positive) and **#5** (negative).

2) Scroll to the **CAL AOUT** (calibrate analog output) parameter and press **ADJ** (adjust).

3) Press the **4mA** keypad button and the digital display on the VOM should also read **4.00** mA.

4) If the values do not match, use the **UP** and **DOWN** buttons until the VOM displays **4.00** mA. Then press **ENTER** to accept.

5) Press the 20 mA keypad button and the VOM digital display should read 20.0 mA.

6) If values do not match, use the **UP** and **DOWN** buttons until the VOM displays 20.0 mA. Then press **ENTER** to accept. Calibration is complete.

7) Press **ESC** (escape) to return to the Engineering parameters list. Press **ESC** a second time and **SAVE CHANGES** to return to the main operating screen.

C) SETTING MECHANICAL ZERO

(See Drawing Nos. 12 & 13).

The mechanical zero valve plug position has been set at the factory and should not need resetting unless the SMARTVALVE is being serviced or a change in the system capacity is necessary.

NOTE: An 11/32" open end wrench is needed to set the mechanical zero valve plug position.

To change the valve plug position, enter the Engineering Mode as explained in Section 5.0 and then proceed as follows:

1) Scroll to the **CAL VALVE** parameter and press the **ADJ** (adjust) button.

2) After the motor stops turning and the SMARTVALVE displays a "**0**" PPD gas feed rate, the metering tube ball float will still be floating or fully rested on the bottom float stop.

   NOTE: Confirm that the Zero Voltage reading on the TOP LINE of the display falls in the acceptable range of **0.41** to **0.49** volts. If it falls outside the range, do not proceed further. Contact Chlorinators Incorporated.

3) After the zero voltage has been confirmed, loosen the lock nut (#7139) that is holding the valve plug (#7105 or 7506) in position on the lead screw shaft (#7109).

   NOTE: The top of the valve plug is also squared to accommodate the 11/32" wrench.

4) IF THE BALL IS FLOATING, use the wrench to turn the valve plug to the LEFT which will move it DOWN the lead screw shaft. The ball will begin to drop slowly. Just as it touches and comes to rest on the bottom stop of the metering tube, STOP turning the valve plug. This is the mechanical zero valve plug position. Carefully hold the valve plug in position and secure it using the lock nut.

   OR

   IF THE BALL IS ALREADY RESTING on the bottom float stop, turn the valve plug to the RIGHT to move it UP the lead screw shaft. Keep turning it until the ball begins to lift off of the bottom stop. Then slowly turn the valve plug back to the LEFT until the ball just touches and comes to rest on the float stop. Carefully hold the valve plug and tighten the lock nut. Mechanical zero is now set.

5) After mechanical zero is set, follow the remaining steps under **CAL VALVE** to complete LINEARIZING THE SMARTVALVE as explained in Section 7.0 (System Startup).

10.0 SPECIFICATIONS

Maximum Gas Feed:
10-2000 PPD for Chlorine
10-500 PPD for Sulfur Dioxide

Power Requirements:
Field selectable 115/230 VAC ±15%, Single Phase
Operating frequency 50/60 Hz

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

Power Consumption:
45 Watts absolute.maximum

Input Signals:
4-20 milliamps DC

Input Impedance:
250 Ohms

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

Micro-Controller:
MC9S12 with 128kB FEEPROM, 2kB EEPROM, 8kB SRAM, 16 Bit

Display:
20-character, 2-line, LCD

Decimal Point Setting:
0, 0.0, 0.00

Operator Interface:
Four button keypad integrated into overlay

Relays:
Three (3) each, 10A 250 VAC

Calibration Accuracy:
±0.25% from zero

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

Control Modes:
Automatic, manual electric and manual

Operating Range:
10:1

Environmental Limits:
32 to 120°F (0 to 50°C)

Serial Communications:
OPTIONAL Isolated RS232/RS422/RS485 (2/4-Wire) module

Stepper Motor:
Unipolar (5/6-Wire), 12 Volt, 1 A/winding, Size 23

Gain Setting:
0.1 to 100

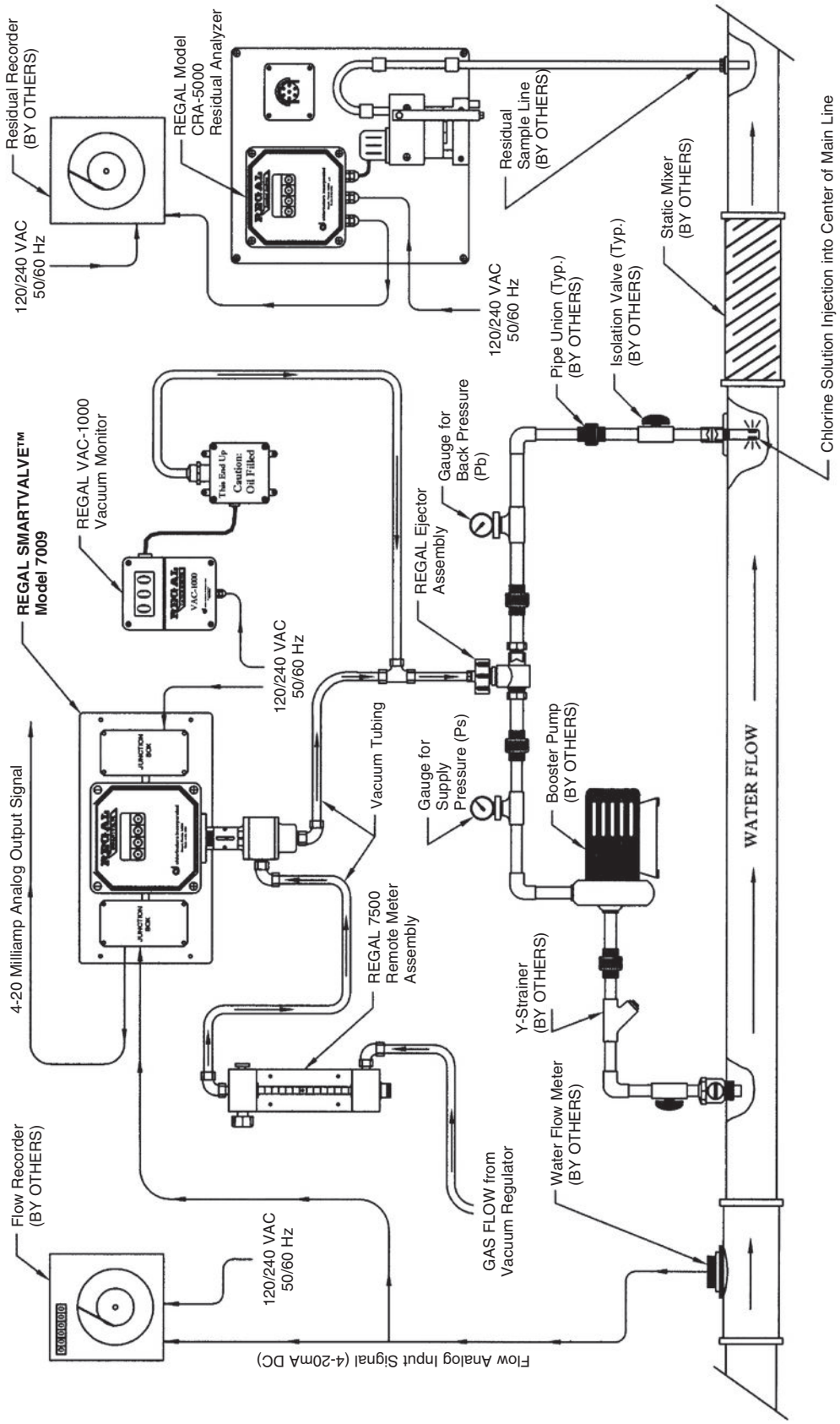
Lag Time Setting:
1 - 7200 seconds

Residual Full Scale Setting:
0.1 to 100 PPM

Residual Input Signal Filtering:
0.0 to 20.0 seconds

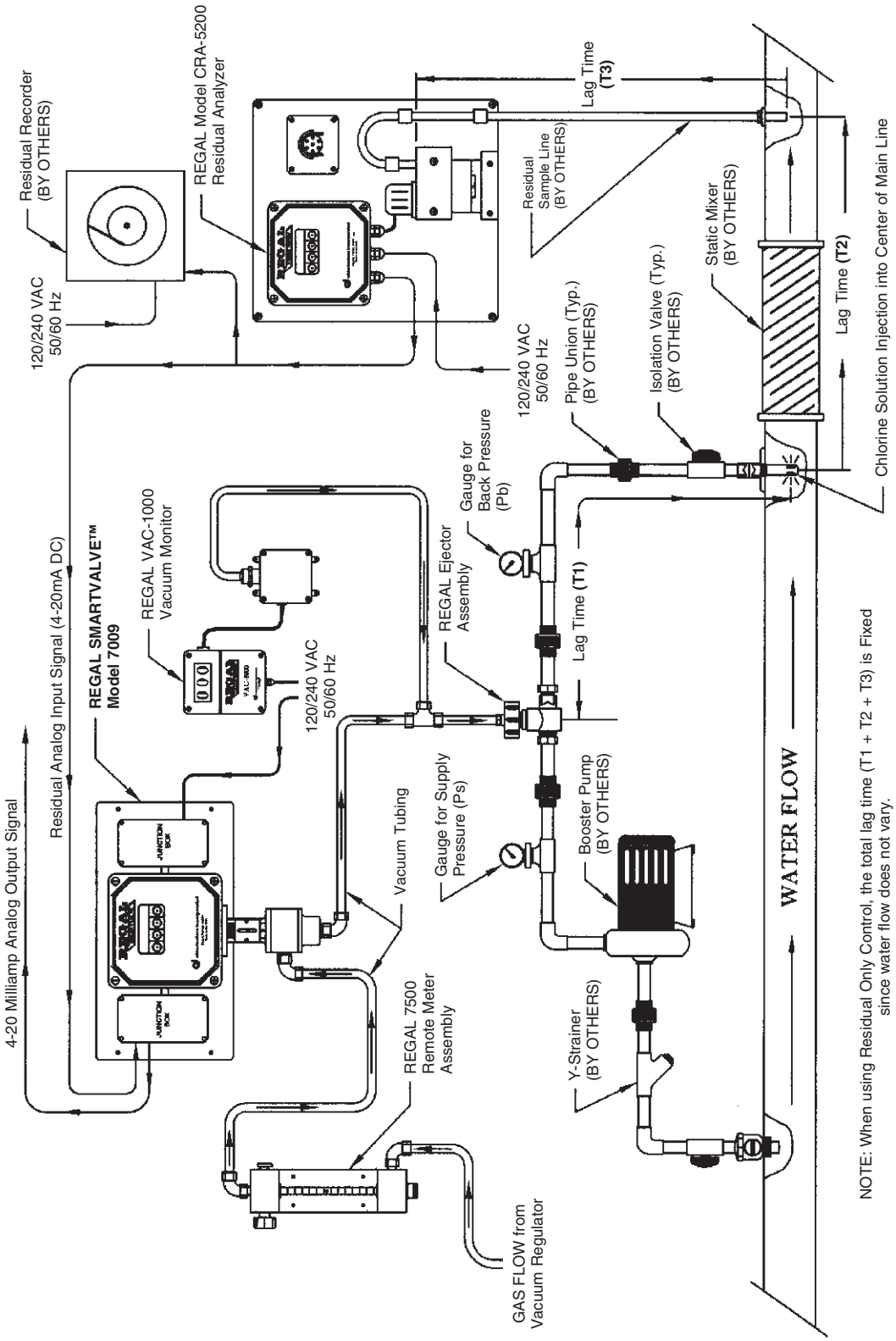
Shipping Weight:
18 Lbs.

DRAWING NO. 1 — TYPICAL INSTALLATION
Flow Proportional Control System



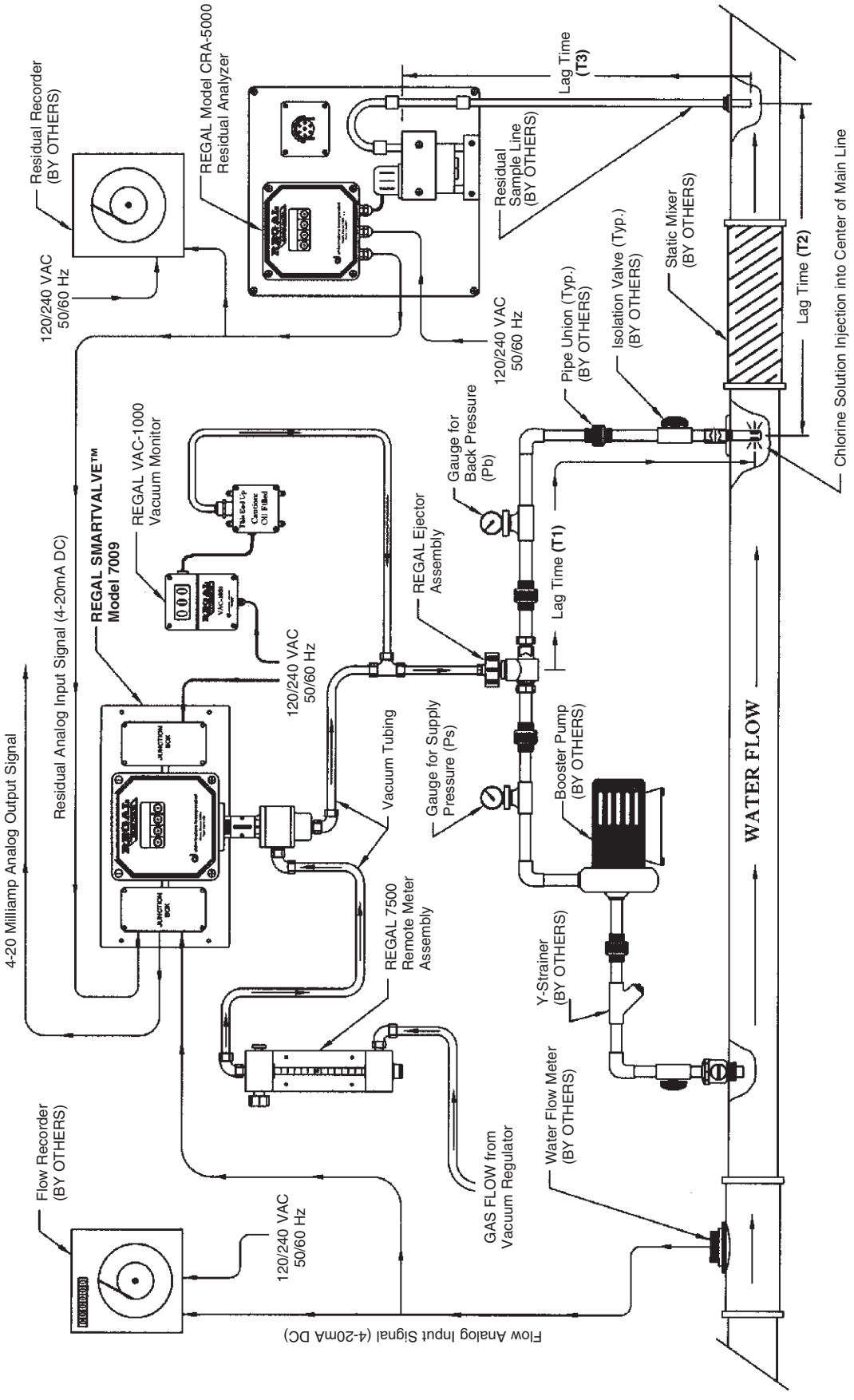
NOTE:
The sole purpose of this drawing is to show the gas flow path through the REGAL System components and the order in which these components are connected.

DRAWING NO. 2 — TYPICAL INSTALLATION
Residual Only Control System



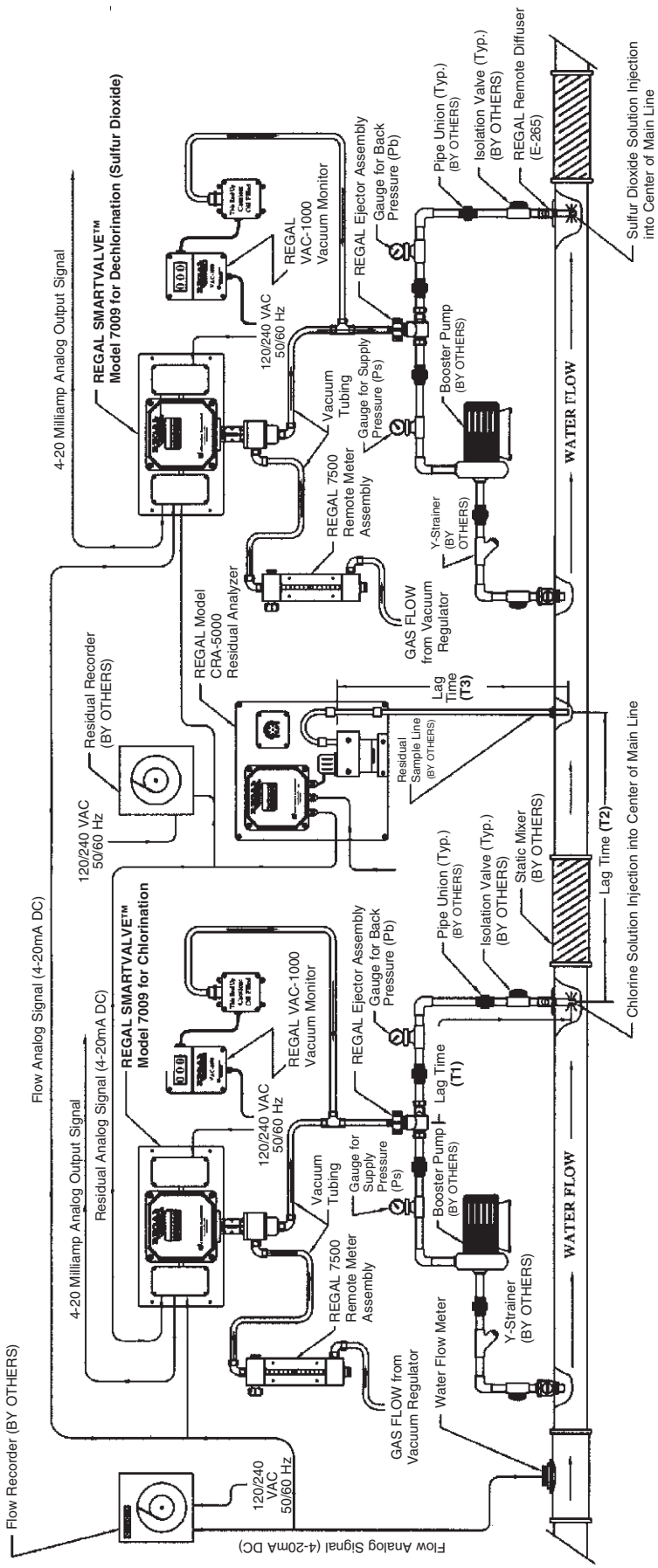
NOTE:
The sole purpose of this drawing is to show the gas flow path through the REGAL System components and the order in which these components are connected.

DRAWING NO. 3 — TYPICAL INSTALLATION
Compound Loop Control System



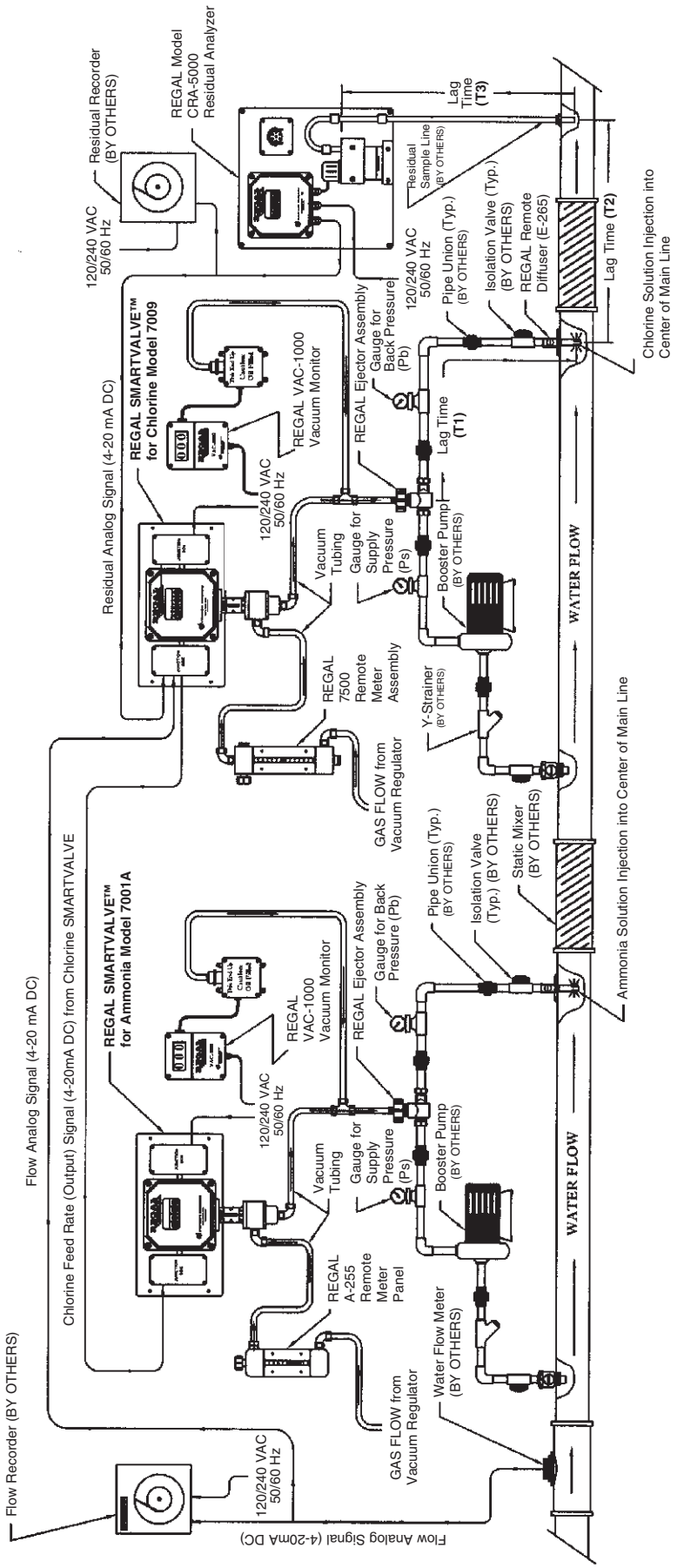
NOTE:
The sole purpose of this drawing is to show the gas flow path through the REGAL System components and the order in which these components are connected.

DRAWING NO. 4 — TYPICAL INSTALLATION
Compound Loop Control Chlorination System with Feed Forward Dechlorination



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.

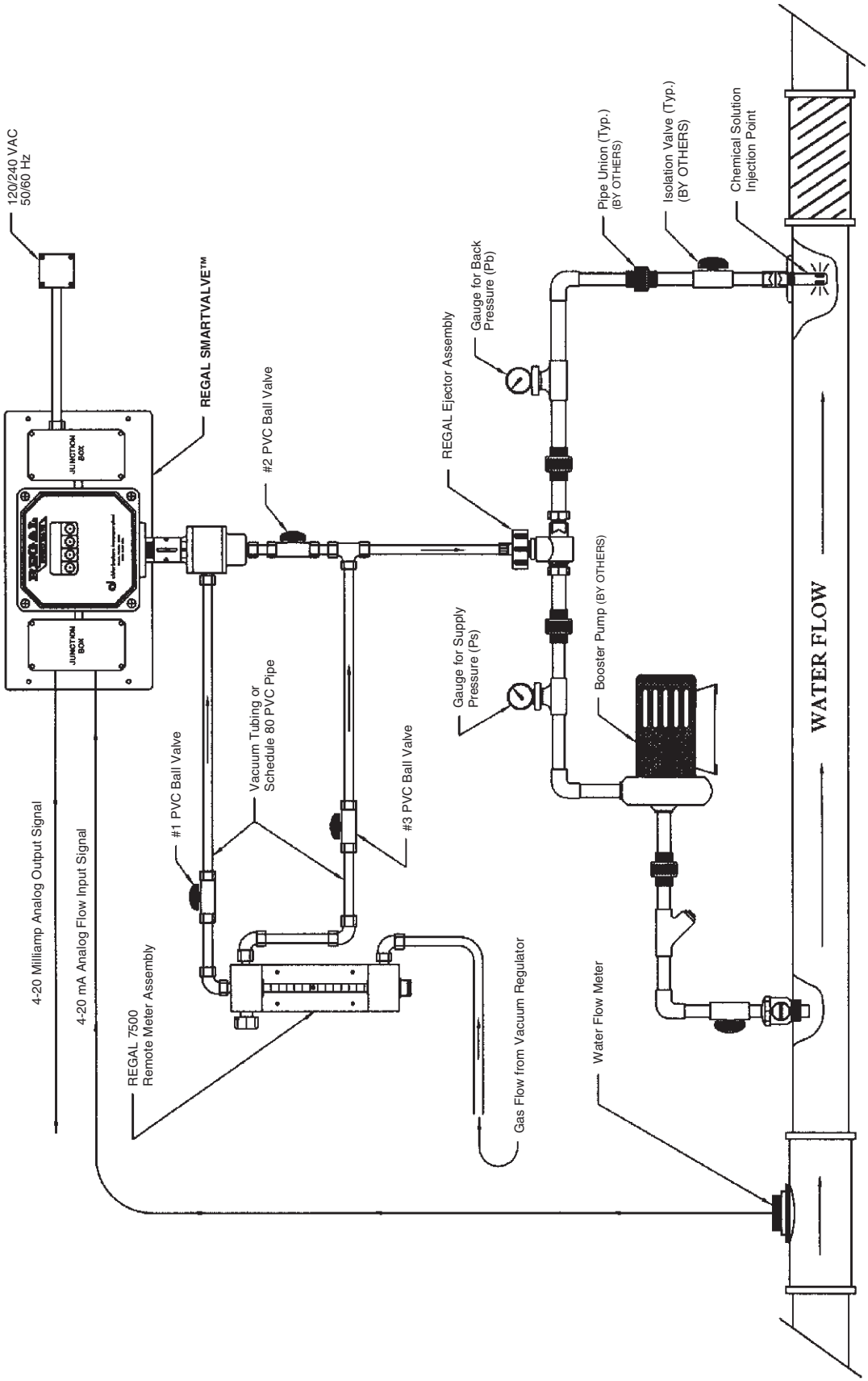
DRAWING NO. 5 — TYPICAL INSTALLATION
Automatic Gas Feed System for Chloramination



System Example: Using the theoretical ratio of 4:1 (chlorine to ammonia) and assuming a 100 PPD chlorination system is needed, a 25 PPD ammoniator would be used. In order to always maintain the 4:1 ratio, the milliamp signal to the ammoniator CANNOT be series looped from the water flowmeter signal because the chlorine residual analyzer and controller circuitry are continually varying the chlorinator dosage to compensate for changing chlorine demand. Instead, the 4-20 milliamp signal to the ammoniator MUST be based on the chlorinator's valve plug position. The manual dosage adjustment on the flow proportional ammoniator can then be used to maintain the chemical ratio of 4:1. If the theoretical ratio of 4:1 is not correct for the system in question, the chlorine to ammonia ratio can be increased by decreasing the dosage setting and vice versa.

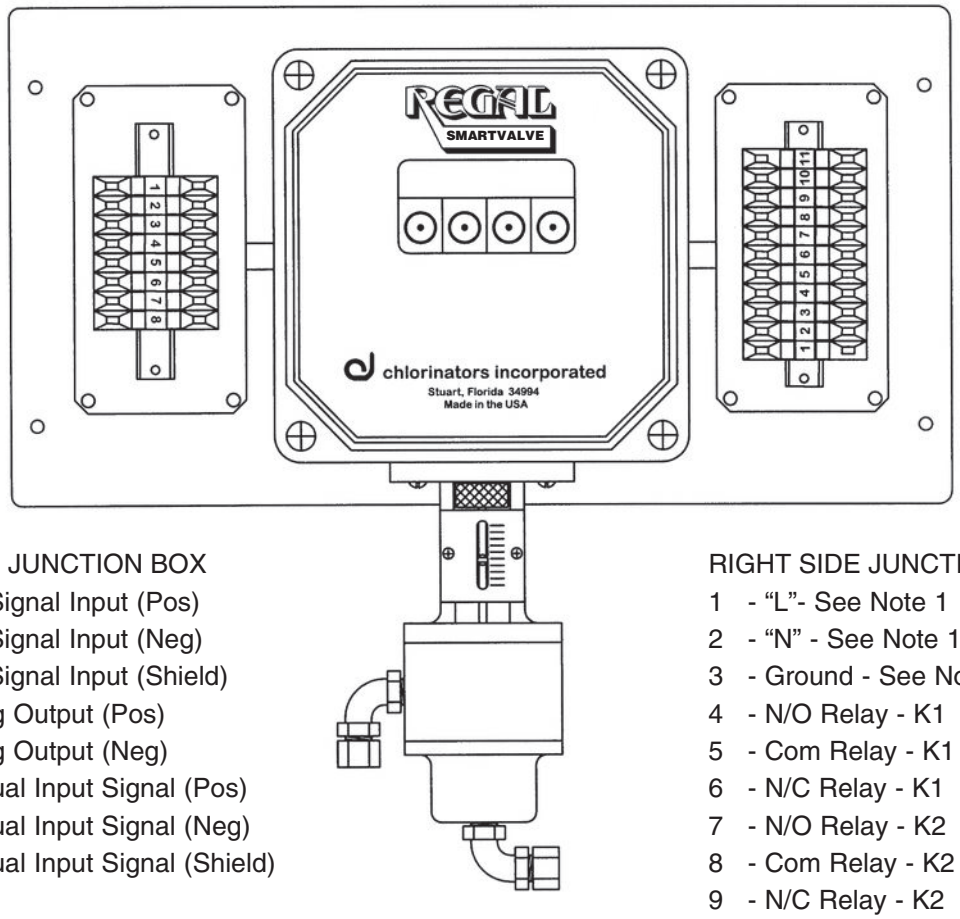
NOTE:
The sole purpose of this drawing is to show the gas flow path through the REGAL System components and the order in which these components are connected.

DRAWING NO. 6 — SMARTVALVE™ INSTALLATION to Provide BOTH Manual and Automatic Operation



1) For Automatic Operation, open ball valves #1 and #2. Close Valve #3.
2) For Manual Operation, close ball valves #1 and #2. Open Valve #3.

DRAWING NO. 7 — TERMINAL STRIP DESIGNATIONS
Compound Loop Control
Models 7009 and 7010



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)
6 - Residual Input Signal (Pos)
7 - Residual Input Signal (Neg)
8 - Residual Input Signal (Shield)

NOTE:
Input and Output signals are 4-20mA

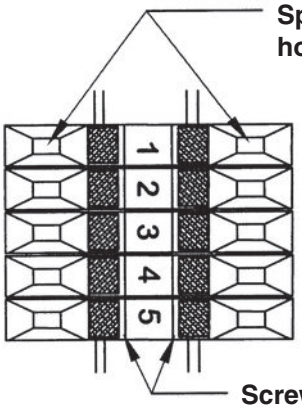
RIGHT SIDE JUNCTION BOX

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

NOTE:

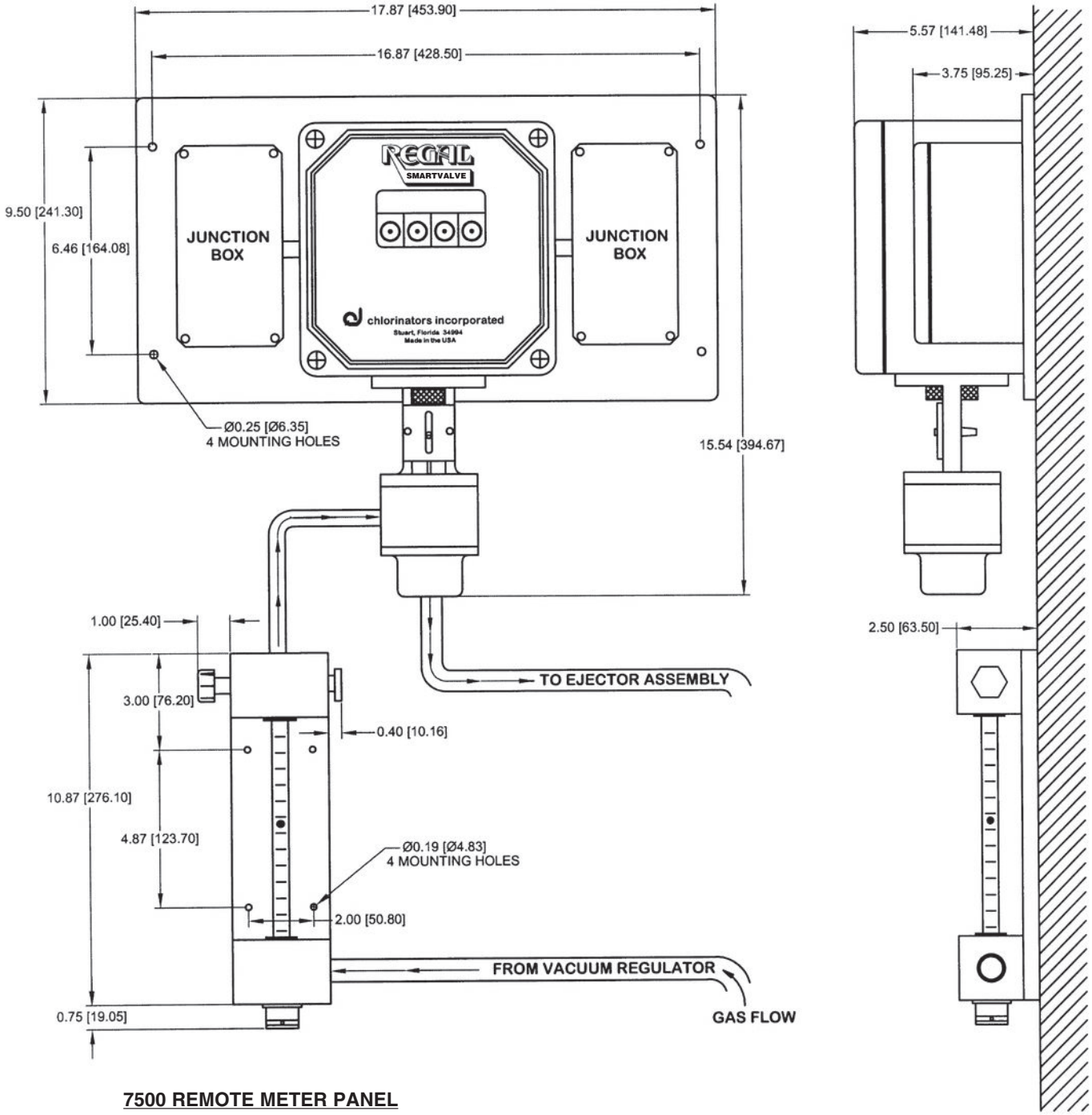
1. Terminals 1, 2 and 3 are 120/240 VAC, 50/60Hz, single phase incoming power supplies.

DRAWING NO. 8 — INSTRUCTIONS FOR USING TERMINAL STRIPS
Located in Junction Boxes of the REGAL SMARTVALVE™



Place the blade of a small screwdriver **(such as the rate valve tool supplied with the 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.

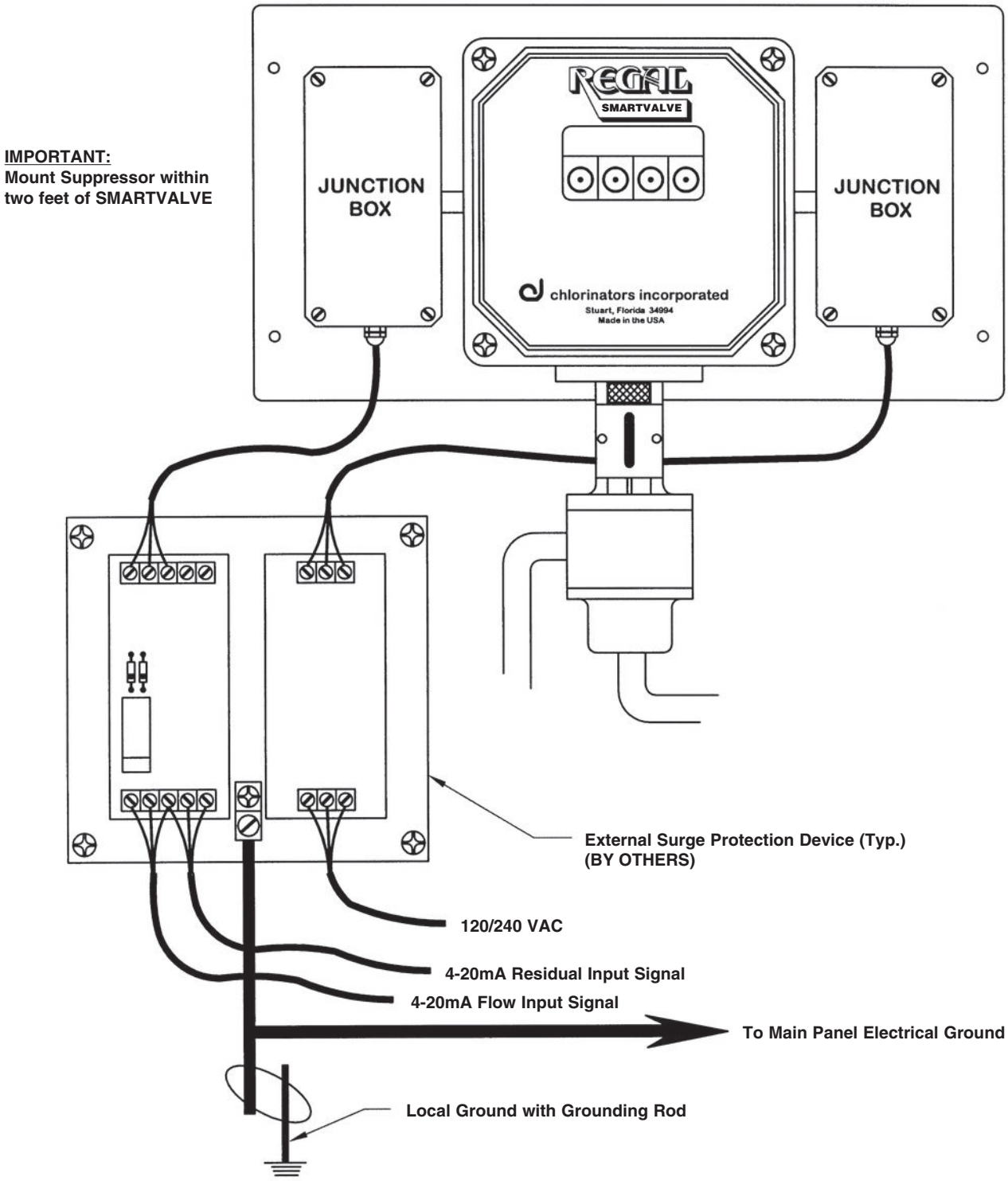
DRAWING NO. 9 — ENGINEERING DATA SHEET
Series 7000 SMARTVALVE™ Dimensions



7500 REMOTE METER PANEL

DIMENSIONS = INCHES [mm]

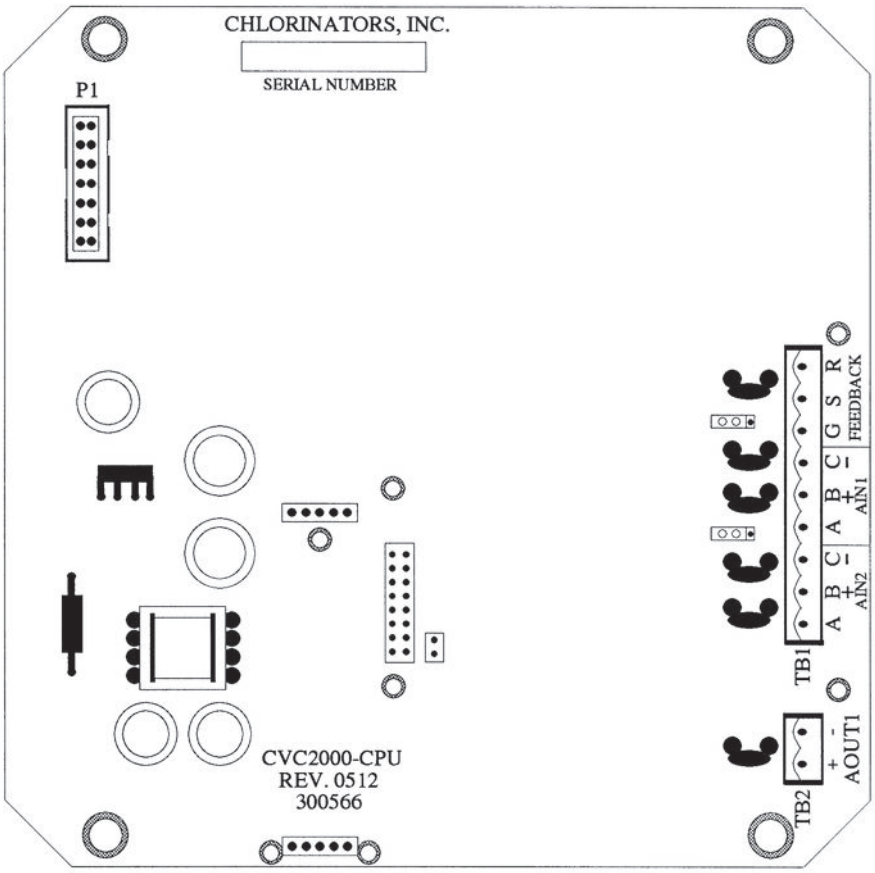
DRAWING NO. 10 — USE OF EXTERNAL SURGE SUPPRESSORS
Consult manufacturer of surge suppressor for installation and wiring specifications



IMPORTANT:
Consult the manufacturer of the transient voltage 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 4-20mA signal lines at 12 Volts maximum.

DRAWING NO. 11 — DISPLAY CIRCUIT BOARD
Part Number 7070

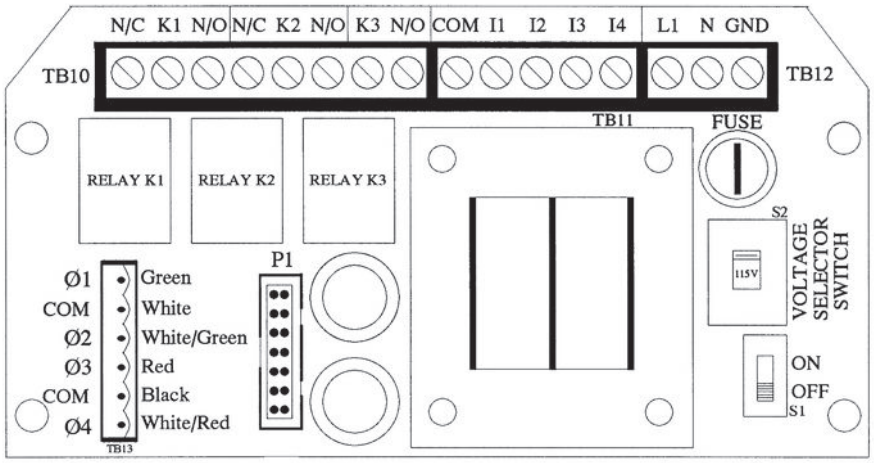


NOTE:

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

See Drawing No. 3 for "Field Wiring."

POWER/RELAY CIRCUIT BOARD
Part Number 7071

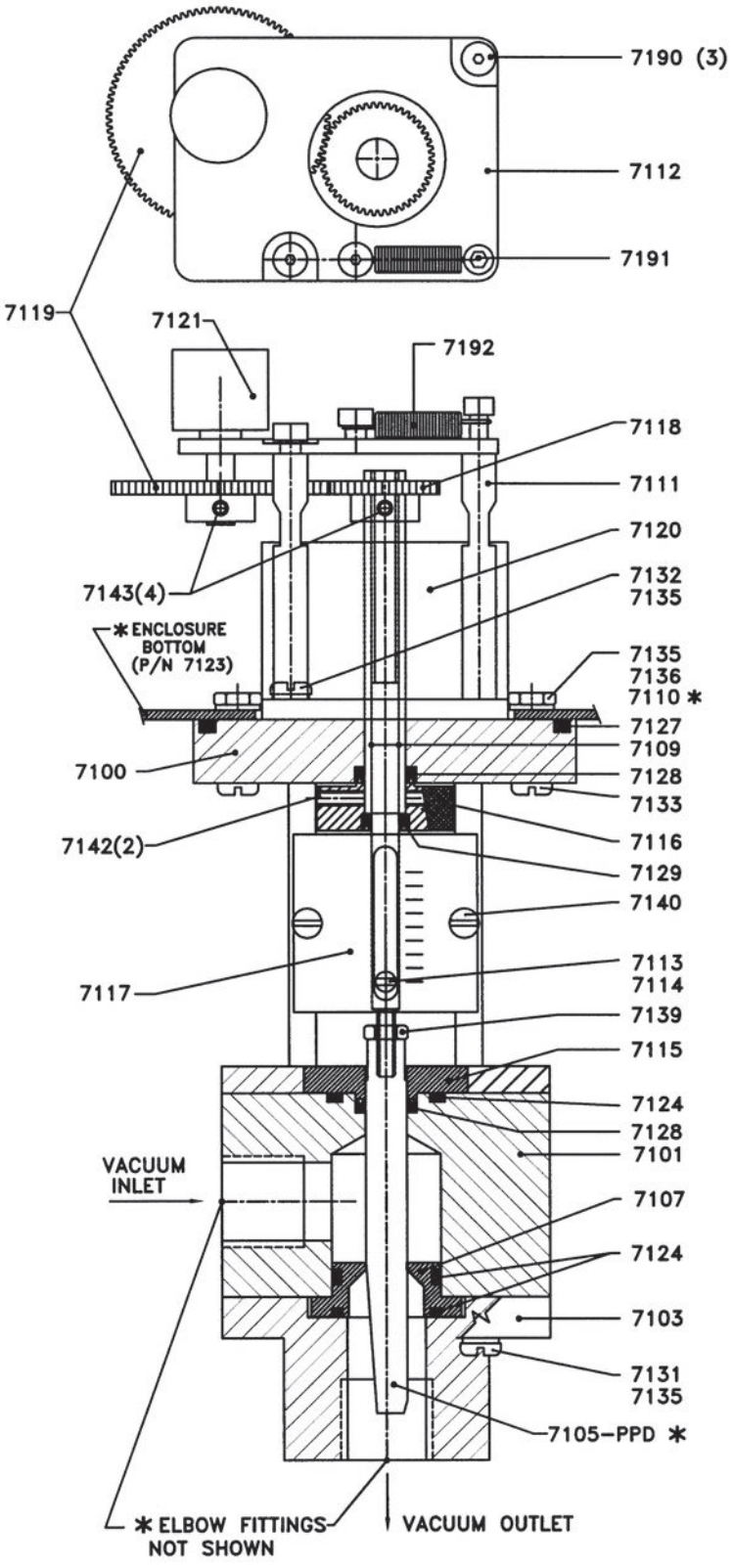


NOTE:

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

See Drawing No. 3 for "Field Wiring."

DRAWING NO. 12 — CONTROL VALVE ASSEMBLY for 10 to 500 PPD (Part Number 7003)

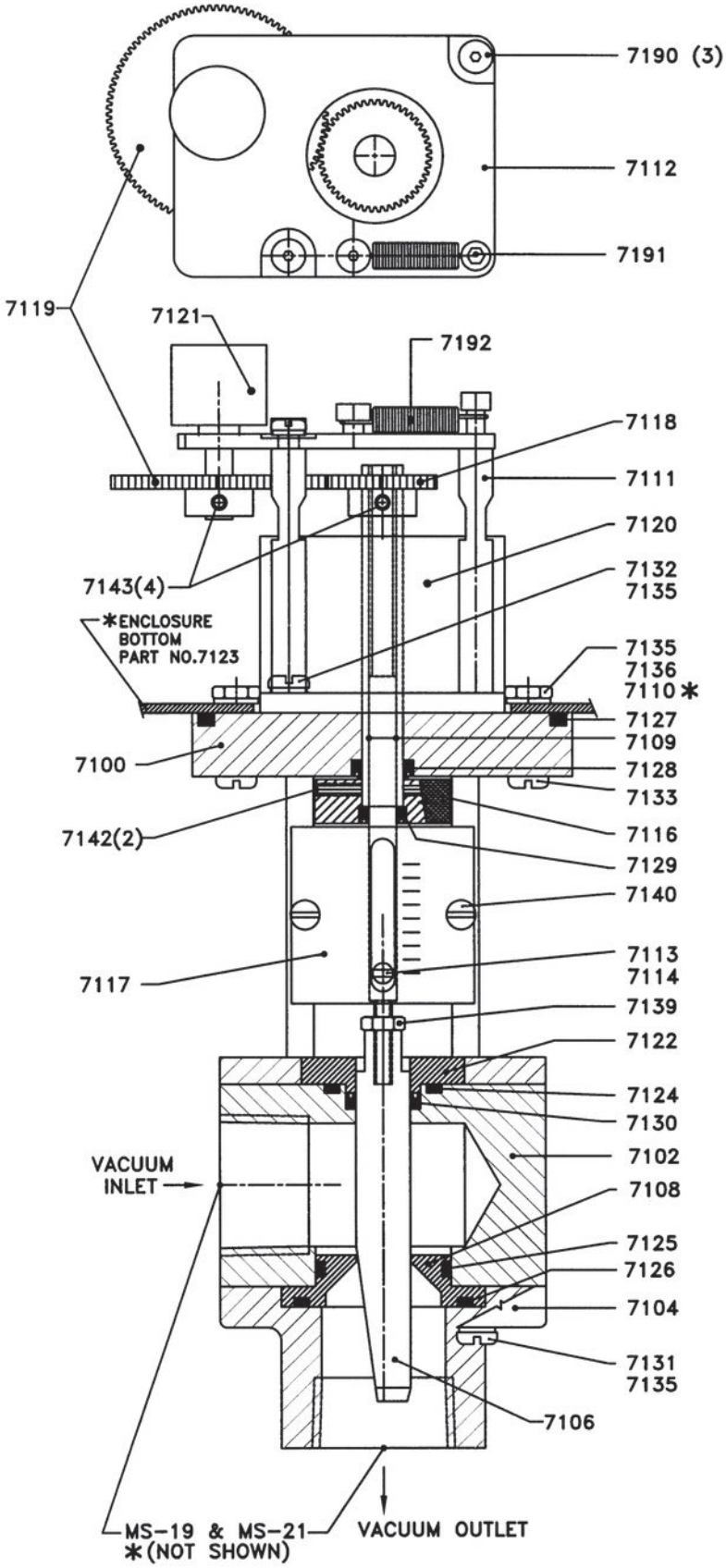


Part No.	Quantity	Description
7100	1	Yoke
7101	1	Top Body
7103	1	Bottom Body
7105 *	1	Valve Plug (PPD)
7107	1	Valve Seat
7109	1	Lead Screw
7110 *	1	Nut Plate (not shown)
7111	3	Standoff
7112	1	Mounting Plate
7113	1	Indicator Screw
7114	1	Indicator Nut
7115	1	Guide/Retainer
7116	1	Knob/Knurled
7117	1	Indicator Plate
7118	1	Driver Gear
7119	1	Follower Gear
7120	1	Stepper Motor
7121	1	Potentiometer
7124	3	S-405 “0” Ring
7127	1	S-414 “0” 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:**

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

DRAWING NO. 13 — CONTROL VALVE ASSEMBLY for 1000/2000 PPD (Part Number 7004)

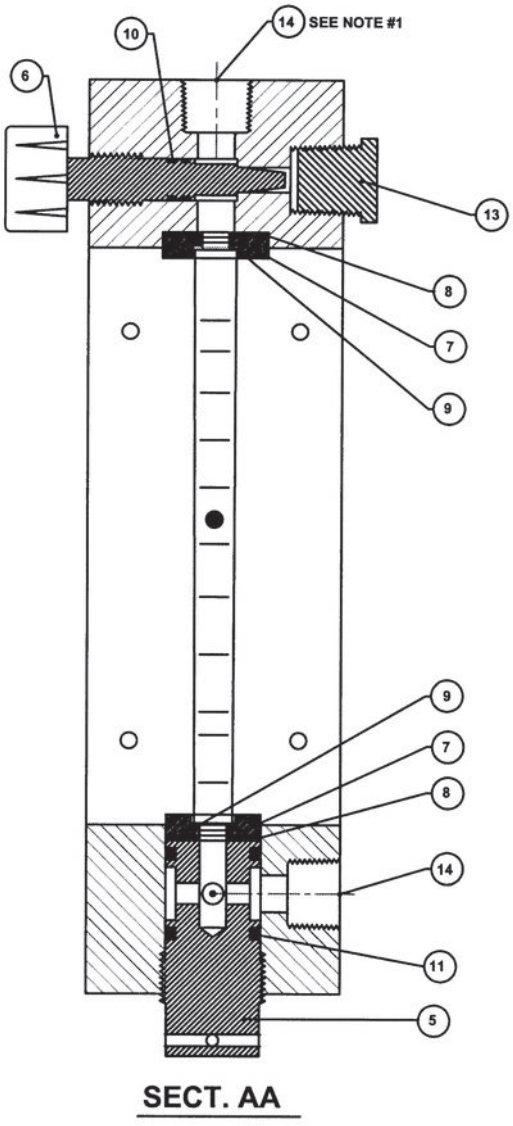


Part No.	Quantity	Description
7100	1	Yoke
7102	1	Top Body
7104	1	Bottom Body
7106	1	Valve Plug
7108	1	Valve Seat
7109	1	Lead Screw
7110 *	1	Nut Plate
7111	3	Standoff
7112	1	Mounting Plate
7113	1	Indicator Screw
7114	1	Indicator Nut
7116	1	Knob/Knurled
7117	1	Indicator Plate
7118	1	Driver Gear
7119	1	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

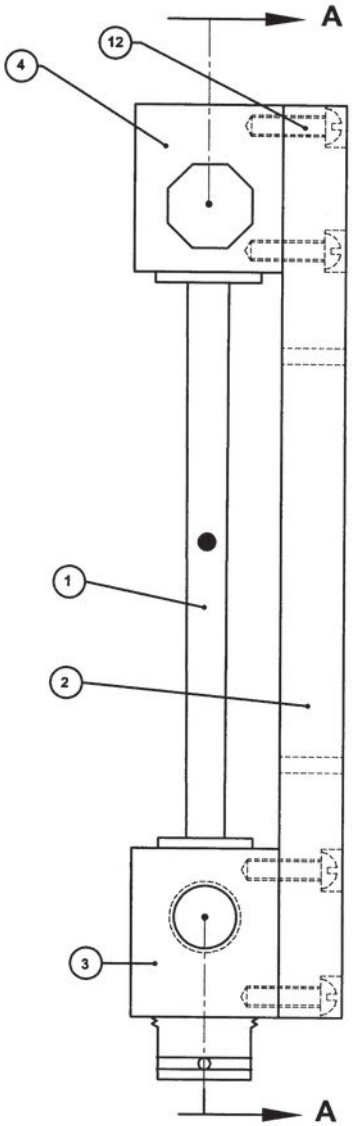
***NOTES:**

1. P/N 7110 not shown. 1/8 x 7/16 x 2 1/4
2. Partial View of the mounting section of the bottom enclosure (P/N 7123). Not part of this assembly.
3. MS19 and MS21 fittings not shown.

DRAWING NO. 14 — 7500 REMOTE METER PANEL ASSEMBLY for 10 to 500 PPD Systems for CL_2 and SO_2 only



SECT. AA

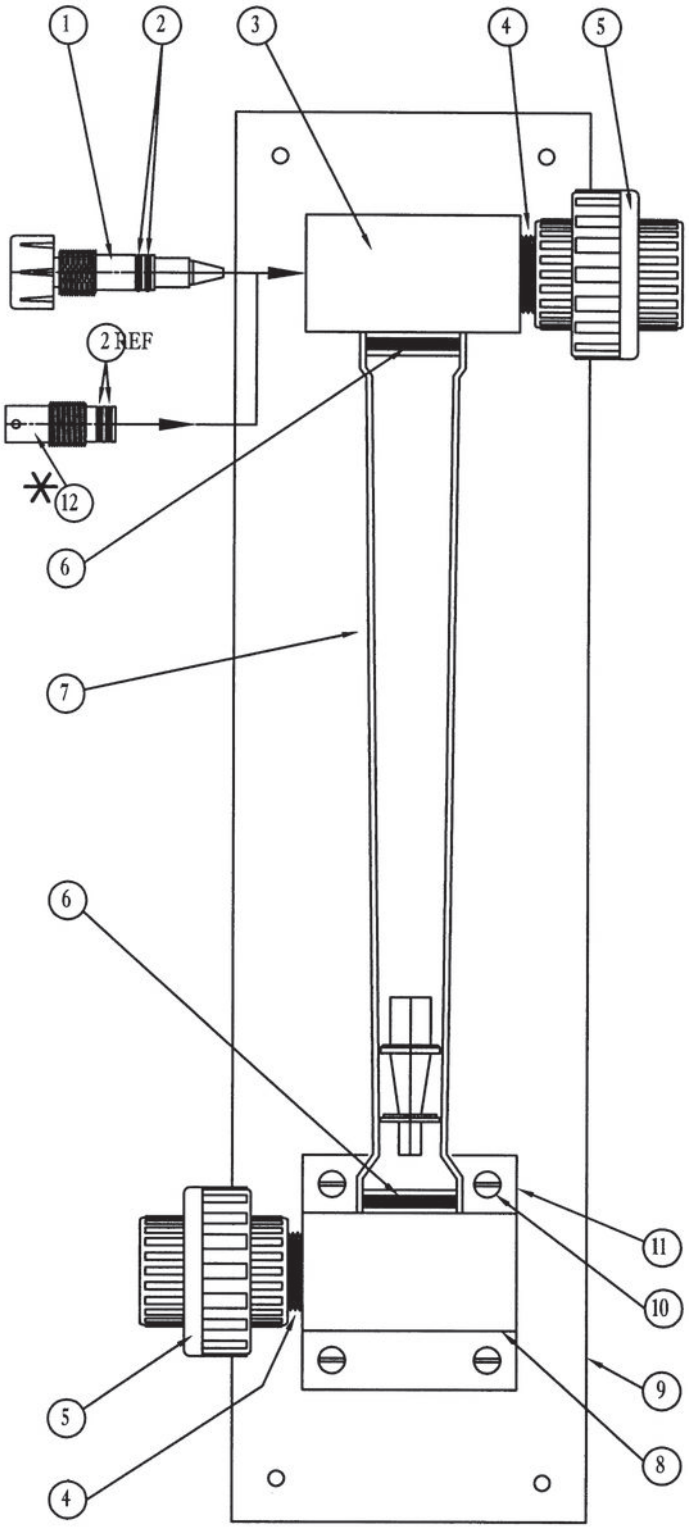


Ref. No.	Part No.	Quantity	Description
1	See chart	1	Meter Type Assembly
2	7502	1	Base Plate
3	7503	1	Bottom Block
4	7504	1	Top Block
5	7505	1	Meter Tube Plug
6	RV-831	1	Rate Valve Plug Assembly
7	See chart	2	Top and Bottom Bushing
8	G-700	2	Top and Bottom Bushing Gasket
9	See chart	2	Top and Bottom 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. 15 — REMOTE METER PANEL ASSEMBLY for 1000/2000 PPD Systems



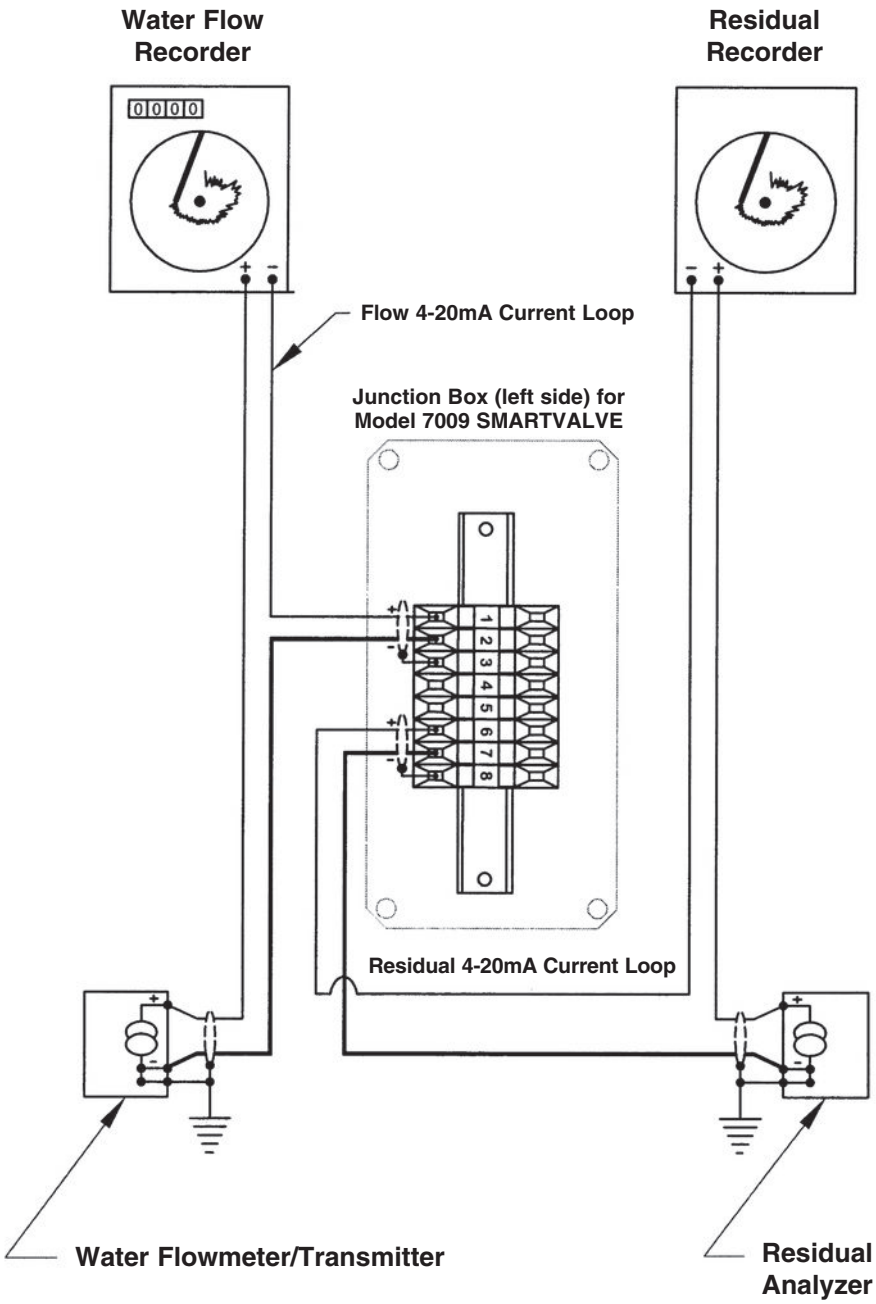
Ref. No.	Part No.	Quantity	Description
1	RV-825	1	Rate Valve Plug Assembly 1000/2000 PPD (20/40 Kg/Hr) (For Manual control only)
2	S-803	2	Rate Valve Stem Seal
3	RV-810	1	Rate Valve Seat Block
4	MS-21	2	1" NPT Close Nipple
5	MS-19	2	1" NPT Union
6	S-801	2	Metering Tube Seal
7		1	Metering Tube/Float Assembly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

NOTES:

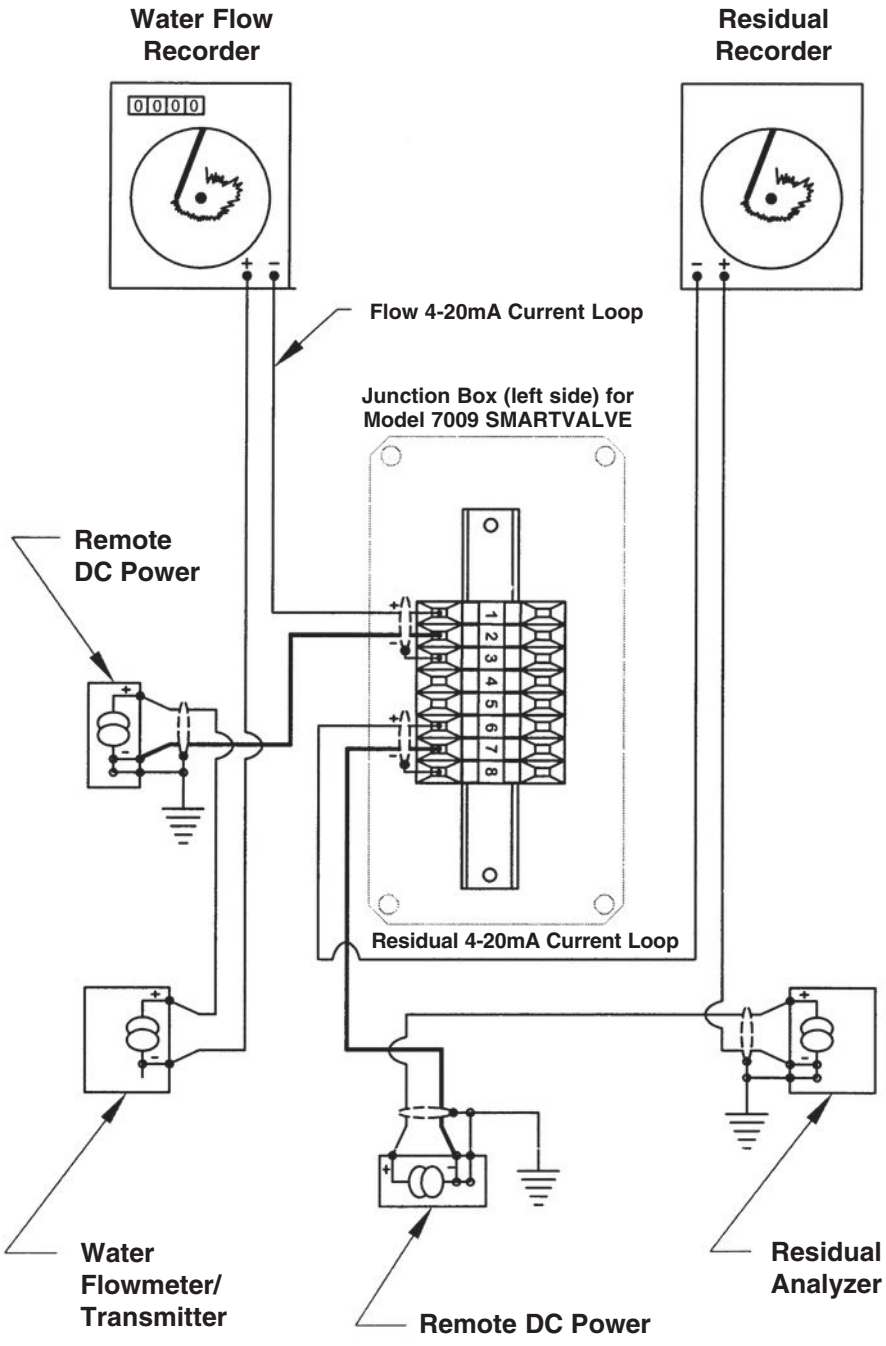
1. Include Chlorinator Serial Number and Capacity on order.

*2. RV-824 rate valve seat plug with two S-803 seals supplied with SMARTVALVE at 1000/2000 PPD only.

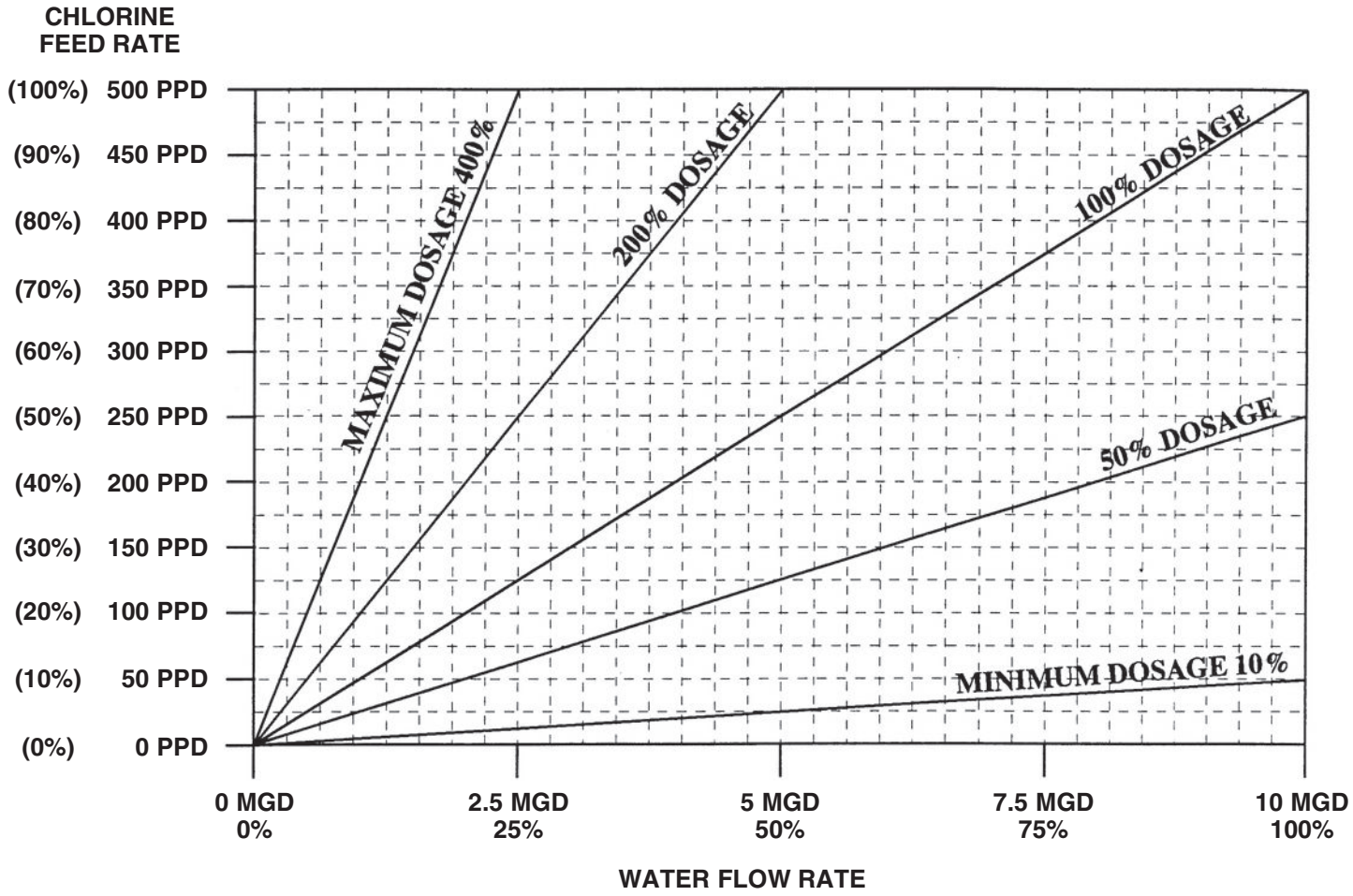
DRAWING NO. 16 — SIGNAL CONNECTION SCHEME
When Flowmeter and Analyzer Provide Analog Loop Power



DRAWING NO. 17 — SIGNAL CONNECTION SCHEME
When Flowmeter and Analyzer DO NOT Provide Analog Loop Power



DRAWING NO. 18 — 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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