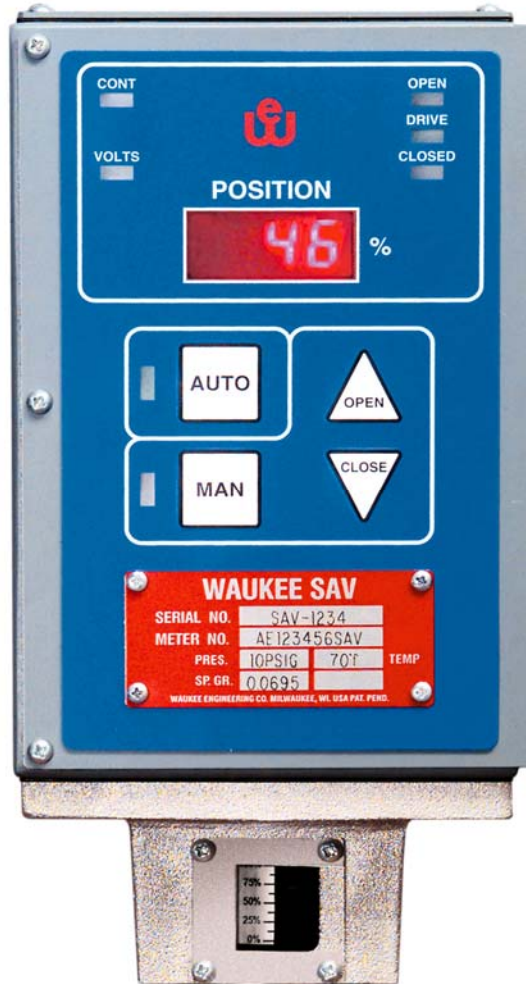




# WAUKEE ENGINEERING

## Stand Alone Valve (SAV)

### Installation And Operation Manual



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## NOTICE

This manual contains important safety information and should be read and understood by all installation personnel and all users of this equipment.

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# TABLE OF CONTENTS

<b>INTRODUCTION</b> .....	<b>4</b>
<b>CONTROL VALVE OVERVIEW</b> .....	<b>5</b>
<b>SPECIFICATIONS</b> .....	<b>6</b>
<b>INSTALLATION</b> .....	<b>7</b>
FLO-METER INSTALLATION .....	7
IN-LINE CONTROL VALVE (ICV) INSTALLATION .....	8
SAV CONTROL VALVE INSTALLATION .....	9
WIRING GUIDELINES.....	10
LOCATION OF SAV WIRING.....	10
<b>WIRING DIAGRAMS</b> .....	<b>11</b>
TERMINAL BLOCK WIRING DIAGRAM .....	11
QUICK DISCONNECT WIRING DIAGRAM.....	12
<b>TYPICAL WIRING FORMATS</b> .....	<b>12</b>
<b>TYPICAL SOLENOID VALVE WIRING</b> .....	<b>13</b>
<b>CIRCUIT PROTECTION</b> .....	<b>14</b>
<b>OVERVIEW OF SAV</b> .....	<b>15</b>
OPERATOR INTERFACE.....	15
INSIDE THE SAV .....	16
<b>OPERATION</b> .....	<b>16</b>
MANUAL MODE .....	16
AUTOMATIC MODE .....	17
POWER FAILURE OPERATION MODE.....	17
PERCENT POSITION DISPLAY .....	17
PROGRAMMING MODE .....	18
<b>THUMBWHEEL ADJUSTMENT</b> .....	<b>22</b>
<b>ADDITIONAL FEATURES</b> .....	<b>22</b>
DIRECT/REVERSE ACTING MODE .....	22
ERROR CODES .....	23
<b>AUTOMATIC CONTROL RANGE SETUP</b> .....	<b>24</b>
SETTING THE SPAN.....	24
SETTING THE ZERO.....	24
<b>TROUBLE SHOOTING GUIDE</b> .....	<b>25</b>
<b>APPENDIX "A" - DRAWINGS</b> .....	<b>28</b>

## Table of Figures

FIGURE 1 - SAV FLO-METER .....	7
FIGURE 2 - IN-LINE CONTROL VALVE .....	8
FIGURE 3 - IN-LINE CONTROL VALVE REMOVAL OF SAV .....	8
FIGURE 4 - IN-LINE CONTROL VALVE REMOVAL OF VALVE .....	8
FIGURE 5 - SAV CONTROL VALVE.....	9
FIGURE 6 - SAV TERMINAL BLOCK.....	11
FIGURE 7 - QUICK DISCONNECT WIRING .....	12
FIGURE 8 - TYPICAL WIRING DIAGRAM .....	12
FIGURE 9 - AUXILIARY WIRING DIAGRAM .....	12
FIGURE 10-12 - TYPICAL SOLENOID VALVE WIRING.....	13
FIGURE 13 - IMPROPERLY WIRED SOLENOID VALVE.....	14
FIGURE 14- OPERATOR INTERFACE .....	15
FIGURE 15 - INSIDE THE VALVE-TRONIC.....	16
FIGURE 16 -AUTOMATIC OPERATION 0 TO 50% .....	17
FIGURE 17 - AUTOMATIC OPERATION 100 TO 50% .....	17
FIGURE 18 - SPAN ADJUSTMENT POTENTIOMETER.....	24

## Index of Tables

TABLE 1- WIRING CONTACTS DESCRIPTION .....	11
TABLE 2- AUXILIARY WIRING CONTACTS DESCRIPTION.....	11
TABLE 3 - QUICK DISCONNECT WIRING .....	12

# INTRODUCTION

## The Purpose of this Manual

Thank You for Purchasing a SAV Flow Control Valve. This Manual shows you how to install, wire and maintain Waukee's SAV. It also helps you understand how to interface it to other devices in a control system. This manual contains important information and should be read and understood by all individuals who install, use or service this equipment.

## Supplemental Manuals

The 2004 "Waukee-Tronic Installation and Operation" Manual and 904 "Installation and Operation of Waukee Flo-Meters" Manual contain technical information as well as precautions about Waukee Flo-Meter's.

## Technical Support

We strive to make our manuals the best in the industry. We rely on your feedback to let us know if we are reaching our goal. If you cannot find the solution to your particular application, or, if for any reason you need technical assistance, please call us at:

**414-462-8200**

Our technical support group will work with you to answer your questions. They are available Monday through Friday from 8:00 A.M. to 4:30 P.M. Central Standard Time. We also encourage you to visit our web site where you can find technical and non-technical information about our products and company.

<http://www.waukeemeters.com>  
<http://www.group-upc.com>

If you have a comment, question or suggestion about any of our products, services, or manuals, please e-mail or contact us by phone.

## Conventions Used



When you see the "exclamation point" icon in the left-hand margin, the paragraph to its immediate right will be a warning. This information could prevent injury, loss of property, or even death in extreme cases. Any warning in this manual should be regarded as critical information that should be read in its entirety. The word **WARNING** or **CAUTION** in boldface will mark the beginning of the text.

### Field Device

Refers to any device the SAV connects to that accepts or sends a 4-20mA signal. (Ex. PLC, Chart Recorder, Controller)

# CONTROL VALVE OVERVIEW

The Waukee SAV Control Valve is a flow controller specifically designed to control the fluid flow through a Waukee Flo-Meter.

## Principle of operation

The SAV is a motorized valve specifically designed to control flow by valve position. A linear stepper motor adjusts the position of a needle within an orifice to control valve position. An internal precision linear potentiometer is used to sense the position of the valve.

The SAV Control Valve is microprocessor based and compares a flow control signal (4-20 mA represents zero to full scale flow) to the position signal produced by a linear potentiometer connected to the stepper motor's drive shaft. If there is no difference between the control signal and the actual valve position, the system is "satisfied" and the motor does not drive. If the valve position is different from the control signal, the system will tell the motor to drive up or down until the valve position matches the control signal. The SAV is programmed to automatically "ramp" to a set point smoothly to limit "under" and "over shoot".

The system is factory "tuned" to each flow specification to provide smooth control action. The system's response and control is limited by the response of the customer-supplied controller, inlet pressure, flow range, gas type and downstream restrictions. If necessary, the SAV may be "field tuned" for a variety of applications.



**WARNING: This unit contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures refer to an applicable ESD protection handbook.**



**WARNING: The Valve on this unit is not designed for positive shut-off. Valves may leak gas into equipment and cause asphyxiation or poisoning to personnel within confined space. If positive shut-off is desired install a mechanical valve prior to the flo-meter and verify that it is shut-off prior to servicing equipment attached to the unit.**

## SPECIFICATIONS

The SAV Control Valve offers the following features:

- Control Feedback diagnostic Indicators
- PID Style Control
- Shut off contacts to close the valve by opening a remote switch or contact
- Low Limit contacts which close when the valve is fully closed
- Top limit contacts which close when the valve is fully open
- Auto/Manual contacts which are closed when the valve is fully open
- Built in set-point generator which allows the unit to function from an internal set-point

**Operating Voltage:** 24 VDC +/- 10%

**Power Consumption:** 500 mA

**Signal Input:** 4 -20 mA Standard Current Loop

**Relay contact ratings:** All 1.0 A@30VDC

**Maximum Operating Temperature:** 150F (65°C)

**Minimum Operating Temperature:** 32°F (0°C)

# INSTALLATION

## Flo-Meter Installation

The 904"Installation and Operation of Waukee Flo-Meters" manual contains instructions on the proper installation of the Flo-Meter. Refer to Figure 1 for reference and read all CAUTIONS and WARNINGS before proceeding.

The SAV Flo-Meter is shipped as a complete unit as shown in Figure 1. Before installing the Flo-Meter, carefully remove the Guard Assembly, to achieve this lay the unit on its side on a work bench or table. Then hold the Guard Assembly with one hand, while unscrewing the union nut counter clockwise with the other hand to loosen it.



**CAUTION:** Once the Guard Assembly is loose from the Flo-Meter make sure to pull the Guard from the Flo-Meter straight back off the float rod assembly. Moving the Guard to one side or another during removal may result in damage to the float rod assembly.

Once the Guard Assembly is free from the Flo-Meter, THE FLOAT ROD MUST NOT BE BENT OR DAMAGED IN ANY WAY. INACCURATE REDING MAY RESULT IF FLOAT ROD IS BENT. Remove the Float Rod Assembly and store it in a safe location until Flo-Meter body is mounted. Remove the red tape from the float rod and insert the float rod assembly into the Flo-Meter body. Then remove the sight glass tube from the Guard Assembly and fill the tube with Waukee Flo-Meter Oil so that the level of oil is approximately one (1) inch from the top. **Note:** Do not put oil in the sight glass tube of meters used for **oxygen** or **methanol** service. Oxygen Flo-Meters should be run dry, or with distilled water. Flo-Meters for Methanol service will automatically fill the sight glass tube with Methanol when in service. Place the sight glass tube back into the Waukee-Tronic, making sure the sight glass tube o-ring is properly seated, and then carefully install the Waukee-Tronic on to the Flo-Meter.



**WARNING:** Do not fill the sight glass tube with Flo-Meter oil on meters used for oxygen service. Use of oil may cause fire or explosion. Serious personal injury may result from fire or explosion.

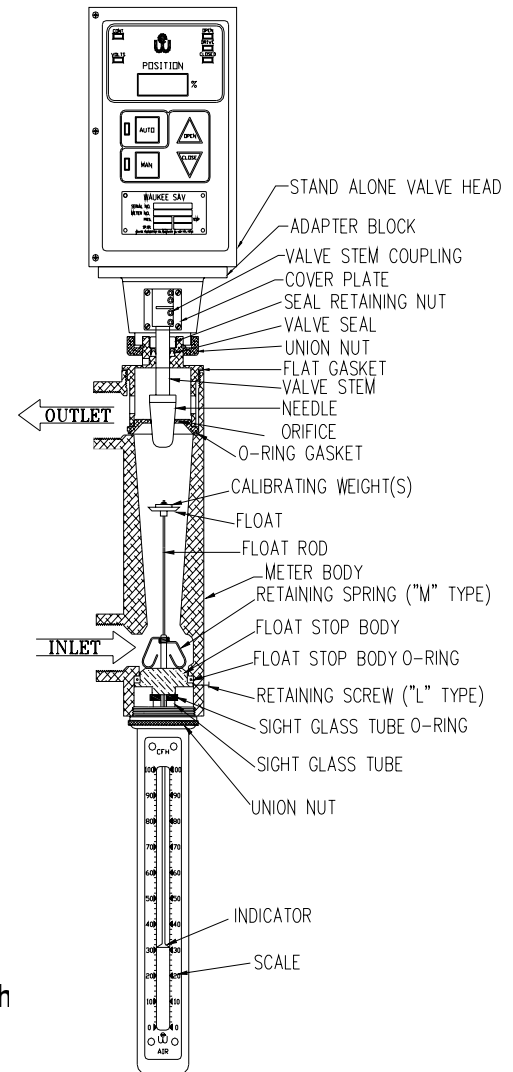


Figure 1

**Note:** If the SAV is shipped separately to be installed in an existing Flo-Meter, please refer to the "SAV Control Valve Installation".

## In-Line Valve Installation

The Unit is shipped as a complete unit as shown in Figure 2. Ensure to plumb the SAV with the arrow on the side of the unit pointing in the direction of the flow.

During installation, setup, and normal operation it is not necessary to disassemble the SAV Control Valve from the Valve Body. If the SAV requires repair or maintenance and must be taken apart please review the following instructions for proper removal of the SAV from the Valve Body. Refer to Figure 3

1. Remove the Four (4) access window cover plate screws.
2. Remove the access widow cover plate and valve position scale.
3. Loosen the valve stem coupling lower hex head set screw.
4. Loosen the valve body union nut.
5. Carefully separate the SAV from the valve body

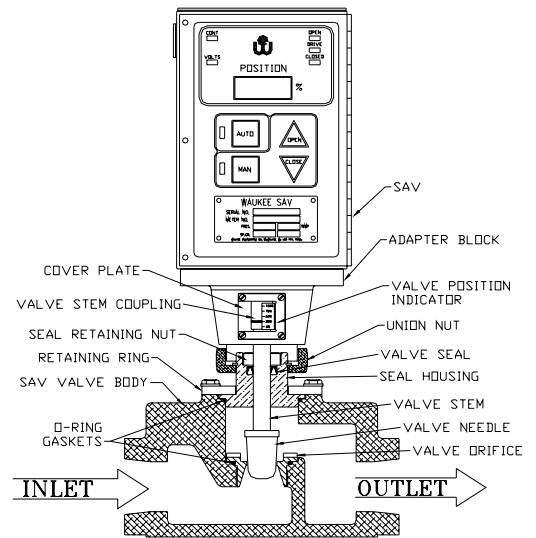


Figure 2

Once the SAV is removed, you can service the valve if needed by disassembling it. To disassemble the valve for servicing: Refer to Figure 4

1. Remove the six (6) retaining bolts
2. Carefully lift the valve out of the body
3. Inspect seals and replace if necessary.
4. Clean valve body with a mild degreaser if needed
5. Reassemble the unit once all service is performed.



**CAUTION:** Before performing any service work, remove power from SAV Control Valve and ensure gas supply is turned off.

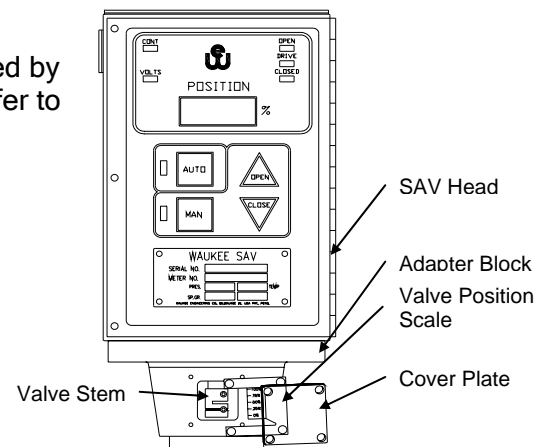


Figure 3

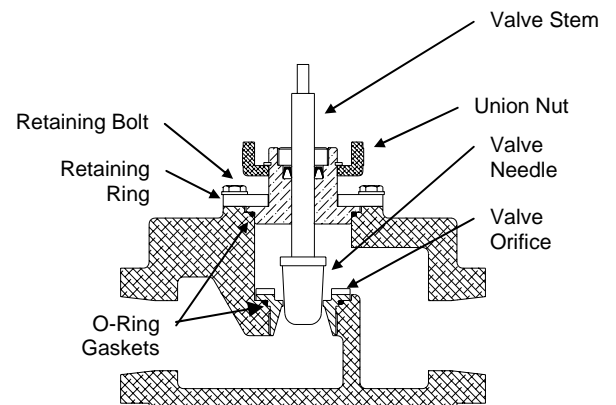


Figure 4



## SAV Control Valve Installation

The following instructions are for installing a SAV Control Valve onto an existing Waukee Flo-Meter. Please refer to Figure 5.

1. First remove the valve assembly from the SAV as follows:
  - i. Remove the Four (4) access window cover plate screws and the access window cover plate.
  - ii. Loosen the valve stem coupling lower hex head set screw.
  - iii. Loosen the valve body union nut.
  - iv. Carefully separate the valve body assembly from the adapter block.
  - v. Set the SAV and valve body assembly aside.
2. Remove the cap or manual valve from the existing Flo-Meter using the valve tool provided.
3. Inspect the top of the Flo-Meter and remove any of the following if present: Valve orifice, orifice gasket or valve spring.
4. Insert the “O-Ring” into the top of the Waukee Flo-Meter. Ensure that the “O-Ring” is seated flat against the “shelf” of the Flo-Meter.
5. Insert the orifice on top of the “O-Ring” and ensure that the “O-Ring” is still seated properly.
6. Screw the valve body assembly into top of the Flo-Meter using the valve tool. Tighten until the flat gasket is seated in the Flo-Meter body.



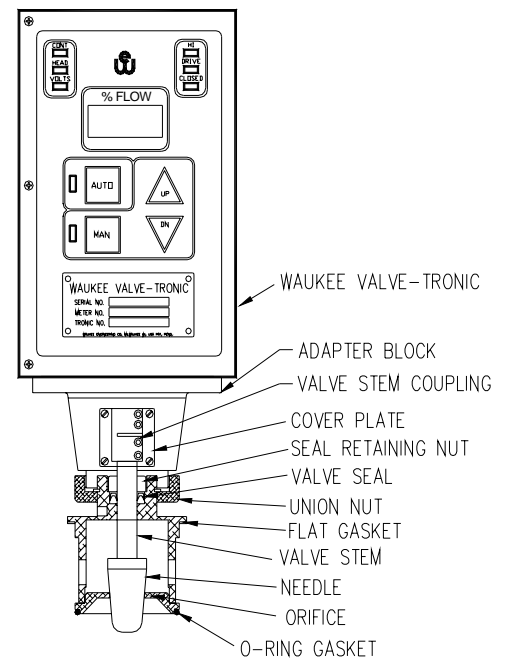
**CAUTION: Do not over tighten as damage to the threads may occur.**

7. Install the SAV onto the valve body assembly. Carefully align the valve stem coupling to the valve stem.



**CAUTION: Do not force the SAV onto the valve stem.**

8. Tighten the union nut by hand until there is little or no play between the valve body assembly and SAV.
9. Tighten the valve stem coupling lower hex head set screws.
10. Replace the access window cover plate and Four (4) access window cover plate screws.



**Figure 5**

## Wiring Guidelines

Your company may have guidelines for wiring installation. If so, you should check those before you begin the installation. Here are some general things to consider:

- Use the shortest wiring route whenever possible.
- Use shielded wiring and ground the shield at the Field Device end. **DO NOT** ground the shield at both the SAV and Field Device.
- Do not run the signal wiring next to large motors, high current switches, or transformers. This may cause noise problems.
- Route the wiring through an approved cable housing to minimize the risk of accidental damage. Check local and national codes to choose the correct method for your application.
- Be sure to leave enough slack in the cables to allow easy removal of the Waukee-Tronic and Valve-Tronic from the Flo-Meter for maintenance. If seal tight or similar conduit is used, be sure to provide an adequate loop of conduit for maintenance access.



**CAUTION:** To reduce the risk of electrical shock and also to prevent damage to the SAV and the Field Device the SAV is connecting to. It is advised to turn off the supply power to the SAV and Field Device before connecting or disconnecting any wires.

## Location of SAV Wiring

The Standard SAV Control Valve wiring terminals are located at the top of the SAV Control unit under the top cover. Remove the Four-(4) top cover screws and top cover to access the wiring terminals. The wiring terminals are a combination screw terminal/quick disconnect arrangement. The terminal block(s) may be removed by loosening the two screws located on either side of the terminal blocks. **Note:** Be sure to feed your wiring through suitable bushings in the knockout(s) before wiring the terminal blocks. All connections to the unit should be made in accordance with Figure 6 and Tables 1&2. Use 18 or 20 AWG wire for all connections.

If SAV is equipped with the optional Quick Disconnect plug, the quick disconnect plug is a 19 pin plug pre-wired with two cables. The cables are as follow: One 7 Conductor Cable that contains all the power, control, and feedback signal wiring and one 9 conductor cable that includes all the relay logic wiring. Refer to Figure 7 and Table 3. The Quick Disconnect plug can be added to any new or existing SAV's. The Part Number for the Quick Disconnect cable assembly is 1-3481\*

**Note:** For "S" series of Flo-Meter's add a "-S" after the part number.

# WIRING DIAGRAMS

## Terminal Block Wiring Diagram

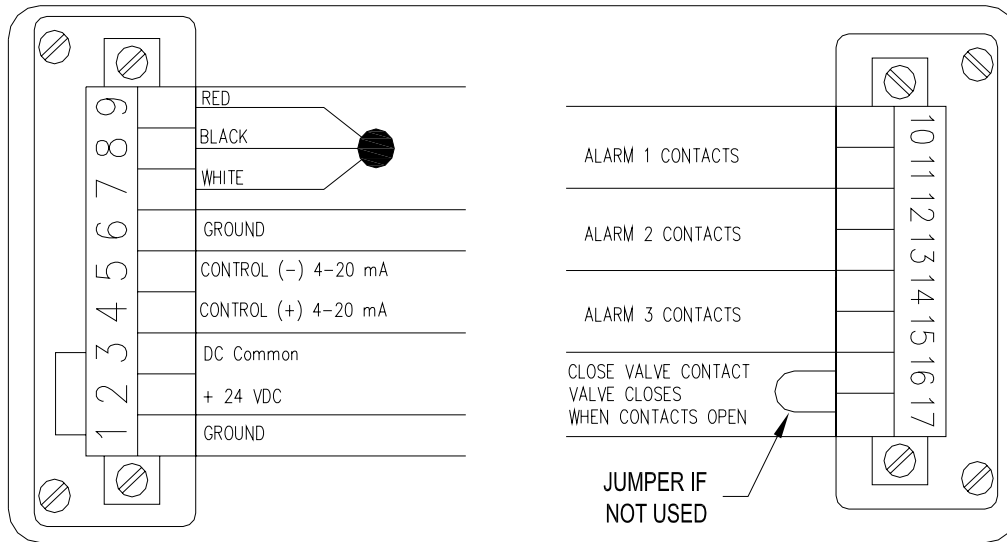


Figure 6

Table 1

Contact	Description
1	Ground
2	+ 24 VDC
3	DC Common
4	+ 4 to 20 mA Control Signal from Field Device
5	- 4 to 20 mA Control Signal from Filed Device
6	Not Connected
7	Feedback from Linear Potentiometer (White)
8	Feedback from Linear Potentiometer (Black)
9	Feedback from Linear potentiometer (Red)

Table 2

Contacts	Description
10&11	Alarm 1 (1.0 A@30VDC, N.O. Relay Contacts)
12&13	Alarm 2 (1.0 A@30VDC, N.O. Relay Contacts)
14&15	Alarm 3 (1.0A@30VDC, N.O. Relay Contacts)
16&17	Unconditional "Close Valve" contacts, Valve drives closed and remains closed until circuit is complete (contacts 16 and 17 are closed), Shipped jumped

# Quick Disconnect Wiring Diagram

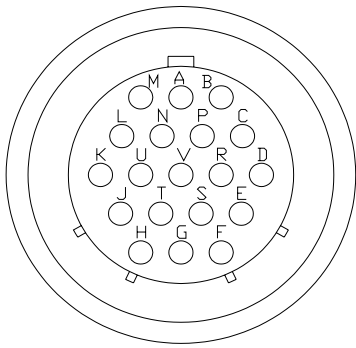


Figure 7

SAV Terminal Number	Quick-Disconnect Terminal Number	Wire Color	Signal
1	A	BROWN	Ground
2	B	RED	+24VDC Power
3	C	BLACK	DC Common
4	D	BLUE	+4...20 mA Control
5	E	ORANGE	-4...20 mA Control
8	H	GREEN	No Connection
9	J	WHITE	No Connection
10	K	BLUE	Alarm 1 Common
11	L	YELLOW	Alarm 1 N.O. Contact
12	M	VILOET	Alarm 2 Common
13	N	ORANGE	Alarm 2 N.O. Contact
14	P	BLACK	Alarm 3 Common
15	R	WHITE	Alarm 3 N.O. Contact
16	S	RED	Close Valve Control Contacts
17	T	BROWN	Close Valve Control Contacts

Table 3

## TYPICAL WIRING FORMTS

The figures shown below are for typical wiring configurations.

### Typical Wiring

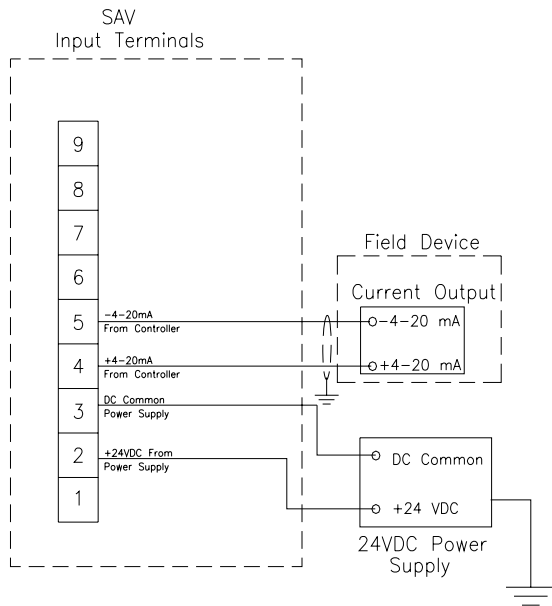


Figure 8

### Auxiliary Contact Wiring



**WARNING: The Auxiliary contacts are rated for 1.0A @30VDC. Use of an external relay is highly recommended. Excessive current draw on these contacts will result in damage to the SAV control board.**

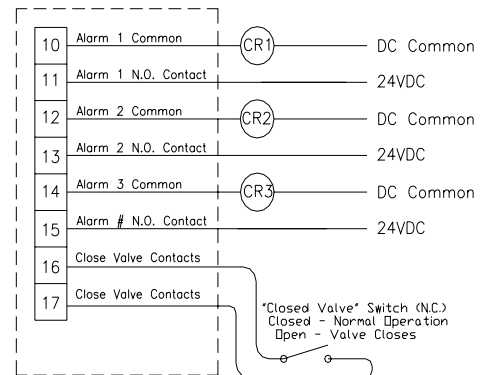


Figure 9

# TYPICAL SOLENOID VALVE WIRING

There are many combinations of wiring configurations when connecting a solenoid valve to a SAV Flo-Meter. The figures shown below are typical wiring diagrams when using a N.C. (Normally Closed) Solenoid.

Figure 10 does not require a set of N.C. (Normally Closed) contacts from a controller as shown unless desired. Alarm 3 contacts must be programmed to engage when low limit switch is met (P16 = "LLA") for proper operation. Operation is as follow: when the control signal goes to 4mA the motor will drive the valve closed until the Low Limit Switch is met which closes contacts 14 & 15 "Solenoid Contacts" and energize the relay to close the solenoid valve.

Figure 11 requires one set of N.C. (Normally Closed) contacts and one set of N.O. (Normally Open) contacts from a controller. Both outputs from the controller should be setup to engage at the same time. Operation is as follow: When solenoid valve contacts are opened the solenoid valve will close and stop flow instantaneously and at the same time contacts 16 & 17 "Closed Valve Contacts" are opened and the Valve-Tronic drives fully closed.

Figure 12 requires one N.O. (Normally Open) set of contacts from a controller and operates the same manner as Figure 9. (Note: When contacts 16 & 17 are opened the SAV will lock up until these contacts are closed.)



**CAUTION:** When using a solenoid valve be sure to select the proper solenoid configuration for fail safety (N.O. or N.C.)

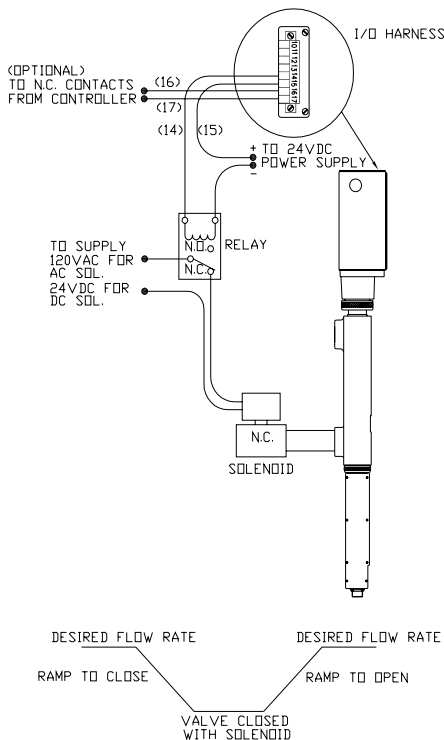


Figure 10

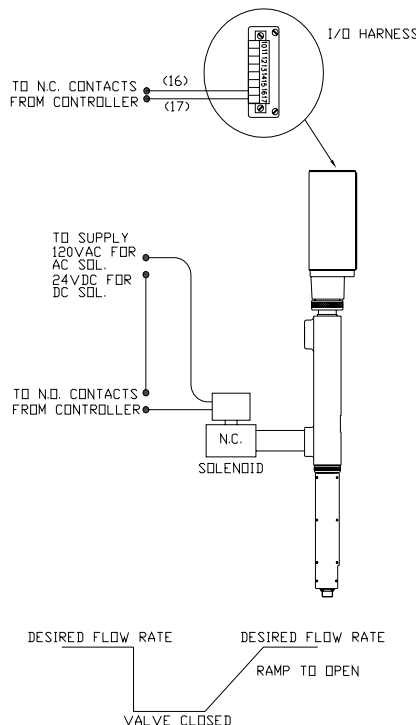
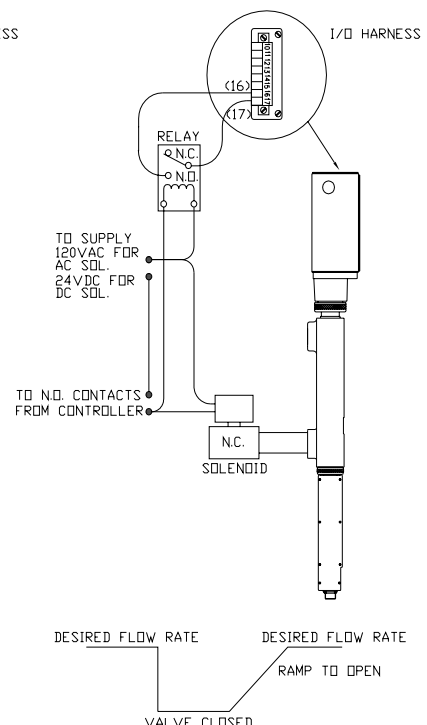


Figure 11



Figures 12

## Improperly Wired Solenoid Valve



**Caution:** Do Not connect a solenoid valve to a SAV Flo-Meter as shown in Figure 13. Damage may occur to float rod assembly due to spiking.

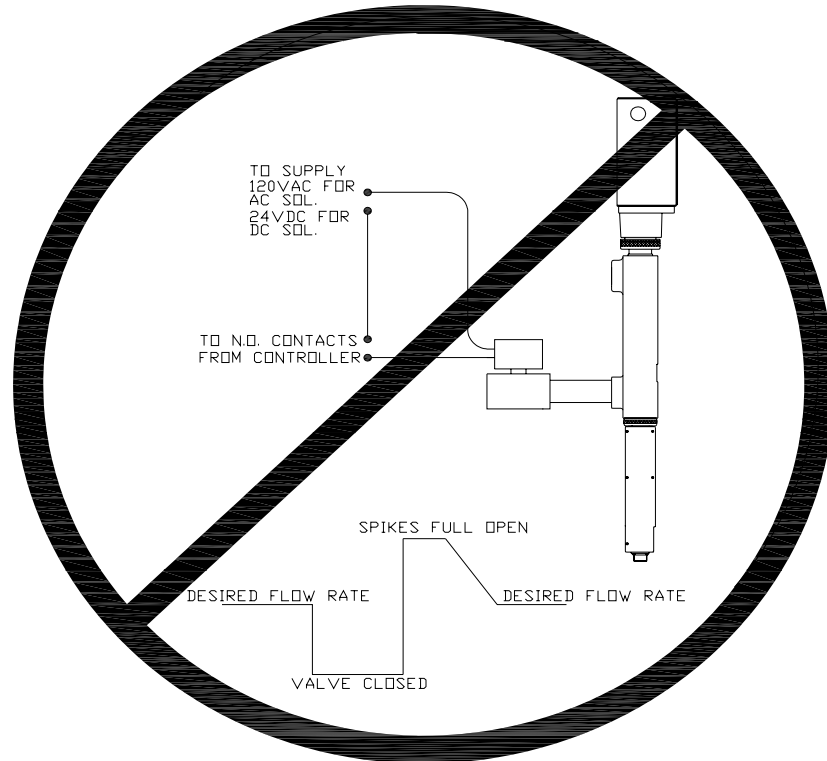


Figure 13

## CIRCUIT PROTECTION

The SAV is equipped with a circuit breaker. This circuit breaker automatically resets after the fault is removed and power is recycled to the unit.

# OVERVIEW OF SAV

## Operator Interface

1. **Control loop Diagnostic Indicator** - Illuminates when the control loop is broken or if the signal is below 3.5 mA or above 20.5 mA. "1 Second Flashes" when "Internal Set-point mode is selected.
2. **VOLTS** - N/A
3. **Automatic Mode Selection Key** - Valve position is automatically controlled.
4. **Automatic Mode Indicator** - Illuminated when in Automatic mode.
5. **Manual Mode Selector Key** - Valve position is controlled by Open/Close keys.
6. **Manual mode Indicator** - Illuminated when in Manual mode.
7. **Open Indicator** - Illuminates when valve is physically at full open travel. "1 Second Flashes" during motor drive to indicate motor is driving the valve open.
8. **Motor Drive Indicator** - Illuminates when motor is driving. Indicator will "pulse" at various rates when in operation to indicate relative motor drive speed.
9. **Closed Indicator** - Illuminates when valve is approaching closure. "1 Second Flashes" during motor drive to indicate motor is driving the valve closed.

10. **% Position Display** - Indicates valve position in percent of automatic control range.  
Used during programming mode to change parameters of the valve.  
Informs the operator of any errors or alarms
11. **"Open" valve drive selector key.**  
When pressed and held the motor will start driving the valve open at the low speed and ramp to the high speed.
12. **"Close" valve drive selector key.**  
When pressed and held the motor will start driving the valve closed at the low speed and ramp to the high speed.
13. **SAV Identification Plate** - Identifies the unit and rated conditions the unit was manufactured to meet.

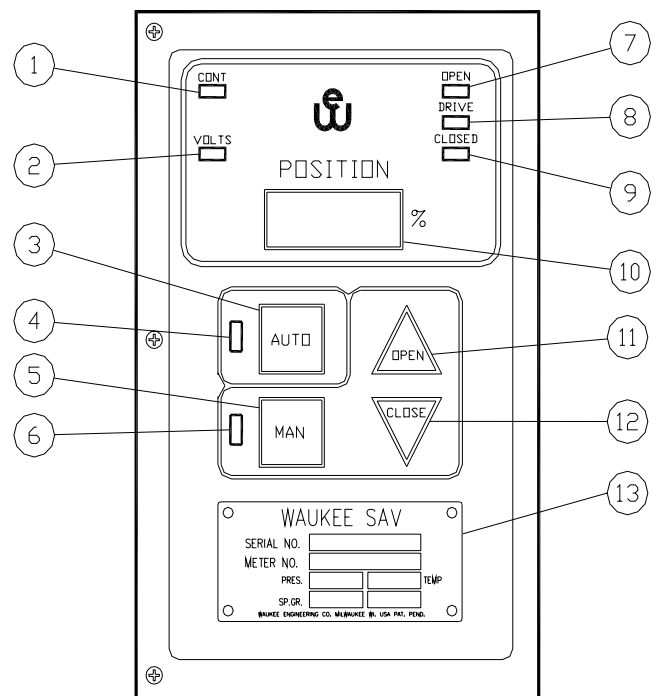


Figure 14

## Inside the SAV

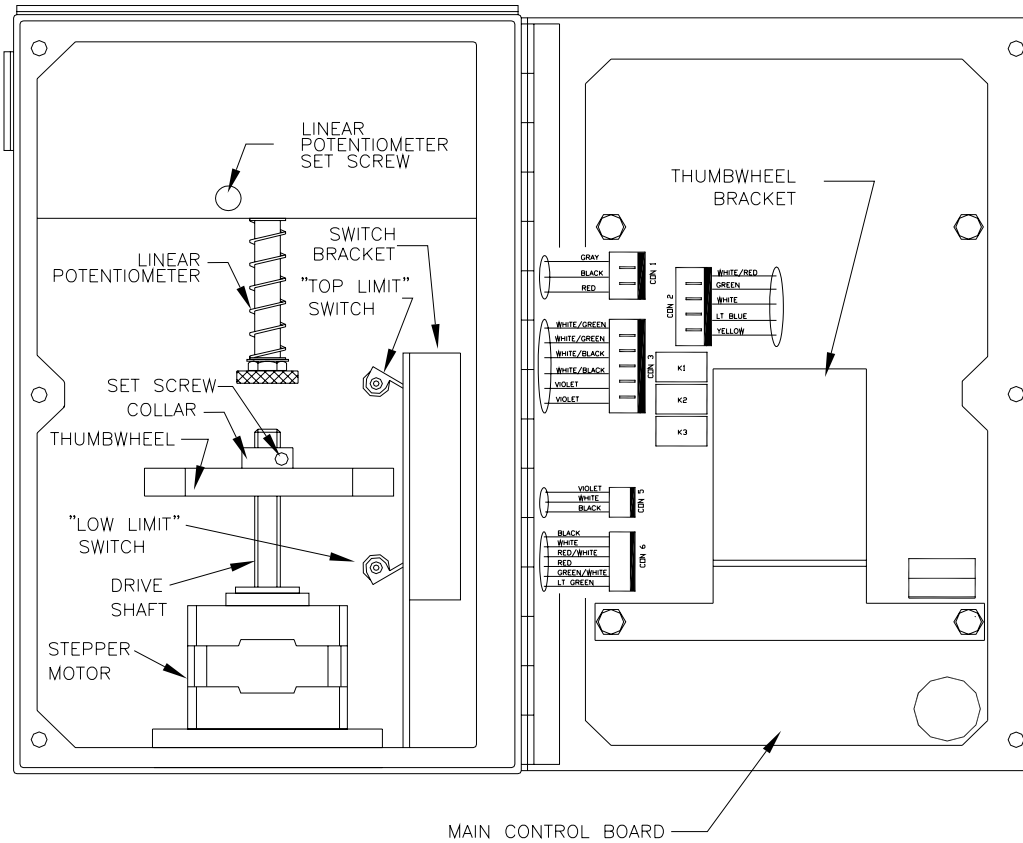





Figure 15


## OPERATION

### Manual Mode

When In Manual Mode the Manual mode indicator will be illuminated and the % Position display will indicate the position of the valve within the automatic control range in percent of flow.


In the Manual mode, the  /  drive keys will drive the motor and thus drive the valve open or closed when pressed.

If the  key is pressed and held the motor will start driving the valve at the Low speed and slowly ramp to the High speed driving the valve open until the valve reaches it's physical top limit, the "Open" indicator will illuminate and the motor will stop driving.

If the  key is pressed and held the motor will start driving the valve at the Low speed and slowly ramp to the High speed driving the valve closed until the valve reaches it's closed position resulting in the "Closed" indicator illuminating.



## Automatic Mode

The “Automatic mode” is initiated by pressing the  mode key. In this mode, the SAV will control valve position based on the control signal supplied to terminals 4&5.

When the flow is at zero and the set-point is changed to 50% the SAV will start in the “High Speed” mode and as it approaches set-point it will start to ramp the motor to the “Low Speed” and stop driving once within the “Dead Band”. Refer to Figure 16.

If the flow is at 100% and the set-point is changed to 50% The SAV will start in the “High Speed Mode” and ramp the motor to the “Low Speed” as it approaches set-point and stop driving once within the “Dead Band” Refer to Figure 16.

Both Figure 16 and 17 show a Dead Band of  $\pm 1.0\%$  which means the SAV will not make any corrections when the flow is between 120CFH and 130CFH this prevents the motor from premature failure due to continue movement.

**Note:** When power is supplied to the SAV, the unit will begin operation in the previously selected mode.

## Power Failure Operation Mode

In the event that power is lost to the SAV, the front cover of the unit may be opened and the manual thumb wheel may be used to adjust the flow rate. Clockwise rotation of the thumb wheel will close the valve and counter clockwise rotation will open the valve. Refer to Figure 15 for location of thumbwheel.

## Percent Position Display

The % Position Display is a three digit LED display that informs the operator of the valve position, represented in %. Where 0% = Closed and 100% = Full Open. It also serves as the programming display during setup.

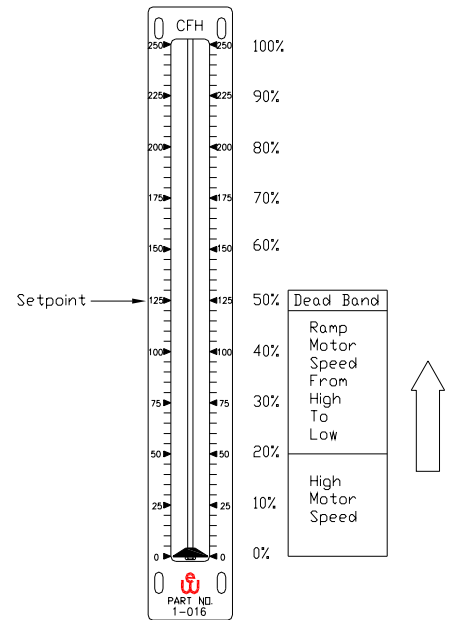


Figure 16

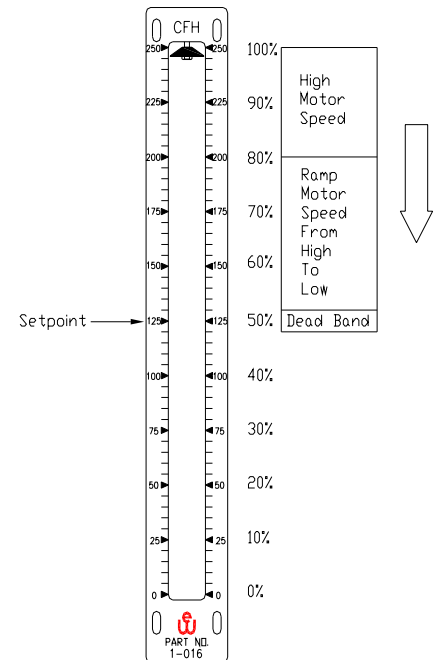








Figure 17










## Programming Mode

There are two separate programming menus. The first menu (Menu A) is accessible by pressing , ,  keys all at the same time.

The second menu (Menu B) is accessible by pressing , ,  keys all at the same time.

When the CONT, OPEN, CLOSED, AUTO, and MAN indicators are all illuminated you are in the programming menu and the % Position display will toggle with “P x” and the value of the parameter (Note: x equals the current parameter number)



### Menu A


- **HIGH SPEED** (*Parameter - 1*) - High Motor Speed  
Display flashes “P 1” and the “Current Value”  
Value can be changed from “0” to “100”, where “0” is the slowest speed, and “100” is the fastest by pressing the  or  key.  
Press  key to go to the next parameter.
  
- **LOW SPEED** (*Parameter - 2*) - Low Motor Speed  
Display flashes “P2” and the “Current Valve”  
Value can be changed from “0” to “100”, where “0” is the slowest speed, and “100” is the fastest by pressing the  or  key.  
Press  key to go to the next parameter.
  
- **DEAD BAND** (*Parameter - 3*) - Band from set-point that the SAV is satisfied. For an explanation of this parameter see “Operation” - “Automatic Mode” pg.18  
Display flashes “P3” and the “Current Valve”  
Value can be changed from “0.0” to “5.0”, where “0.0” is the lowest dead band (+/- 0%), and “5.0” is the highest (+/- 5%) by pressing the  or  key.  
Press  key to go to the next parameter.

- **RAMP SPEED BAND** (*Parameter - 4*) - % Position from Set-point that the SAV starts to ramp from the “High Speed” to “Low Speed”

Display flashes “P4” and the “Current Valve”

Value can be changed from “0” to “35”, where “0” is no ramp to low speed and “35” is the largest band setting (+/-35% around the set point).

Pressing  or  keys changes the SPEED RAMP START.

Press  key to go to the next parameter.


- **MANUAL MODE LOCKOUT** (*Parameter - 5*) - Locks the unit in Automatic mode.

Display flashes “P5” and “Current Setting”

Setting can be changed by pressing the  or  key, where:



Enb - “Manual” Mode enabled - **Default Setting**


dSb - “Manual” Mode disabled

Press  key to go to the next parameter.

## Menu B


- **ZERO VALVE POSITION** (*Parameter - 10*) - Sets the 0% Position. **Note: This parameter should only be changed when the 100% position is adjusted.** For additional information on setting this parameter go to “Automatic Control Range Setup” Pg 24.

Display flashes “P 10” and the “Current Value” To set, press  and  keys simultaneously until display reads “0”

Press  key to go to the next parameter.


- **DIRECT/REVERSE ACTING MODE** (*Parameter -11*) - Changes mode of operation. For additional information on setting this parameter go to “Additional Features” - “Direct/Reverse Acting Mode”

Display flashes “P 11” and the “Current Value”

Setting can be changed by pressing the  or  key, where:



dA - “Direct” Acting Mode - **default setting**

rA - “Reverse” Acting Mode

Press  key to go to the next parameter.

- **SPLIT RANGE CONTROL** (*Parameter - 12*) - Sets the Control Signal range.


Display flashes “P12” and “Current Setting”

Setting can be changed by pressing the  or  key, where:

”420” - 4-20mA Control Signal Range - **Default Setting**



“412” - 4-12mA Control Signal Range


“122” - 12-20mA Control Signal Range

Press  key to go to the next parameter..

- **VALVE SEATING TIME DELAY** (*Parameter -13*) - Amount of time the valve drives closed once the “Low Limit Switch” is meet.

Display flashes “P13” and the “Current Value”

Value can be changed from “0” to “40” seconds by pressing the   
or  key.

Press  key to exit and return to normal operation.

- **ALARM 1 TYPE** (*Parameter -14*) - Select event to trigger alarm 1 (Contacts 10&11)

Setting can be changed by pressing the  or  key, where:

“dSb” - Disabled - **Default Setting**

“Au” - Auto/Manual Mode - triggers when unit is in the “manual” mode


“HLA” - High Limit Alarm - triggers when “top limit switch” is met

“LLA” - Low Limit Alarm - triggers when “low limit switch” is met

“Err” - Error Alarm - triggers when an error occurs

“HFA - High Flow Alarm - triggers when the flow is above “High Flow Alarm” Set-point (Parameter 18)

“LFA - Low Flow Alarm - triggers when the flow is below “Low Flow Alarm” Set-point (Parameter 19)

Press  key to go to the next parameter.

- **ALARM 2 TYPE** (*Parameter -15*) - Select event to trigger alarm 1 (Contacts 12&13)

Setting can be changed by pressing the  or  key, where:

“dSb” - Disabled - **Default Setting**

“Au” - Auto/Manual Mode - triggers when unit is in the “manual” mode


“HLA” - High Limit Alarm - triggers when “top limit switch” is met

“LLA” - Low Limit Alarm - triggers when “low limit switch” is met

“Err” - Error Alarm - triggers when an error occurs

“HFA - High Flow Alarm - triggers when the flow is above “High Flow Alarm” Set-point (Parameter 18)

“LFA - Low Flow Alarm - triggers when the flow is below “Low Flow Alarm” Set-point (Parameter 19)

Press  key to go to the next parameter.

- **ALARM 3 TYPE** (*Parameter -16*) - Select event to trigger alarm 1 (Contacts 14&15)

Setting can be changed by pressing the  or  key, where:

“dSb” - Disabled - **Default Setting**

“Au” - Auto/Manual Mode - triggers when unit is in the “manual” mode


“HLA” - High Limit Alarm - triggers when “top limit switch” is met

“LLA” - Low Limit Alarm - triggers when “low limit switch” is met

“Err” - Error Alarm - triggers when an error occurs

“HFA - High Flow Alarm - triggers when the flow is above “High Flow Alarm” Set-point (Parameter 17)


“LFA - Low Flow Alarm - triggers when the flow is below “Low Flow Alarm” Set-point (Parameter 18)

Press  key to go to the next parameter.

- **HIGH FLOW ALARM SET-POINT** (*Parameter -17*) - Set-point to trigger a High Flow Alarm. **NOTE:** Alarm 1,2 or 3 must be set to “HFA” for alarm to trigger

Display flashes “P17” and the “Current Value”


Value can be changed from “0” to “100” % by pressing the  or  key.

Press  key to go to the next parameter.

- **LOW FLOW ALARM SET-POINT** (*Parameter -18*) - Set-point to trigger a Low Flow Alarm. **NOTE:** Alarm 1,2 or 3 must be set to “LFA” for alarm to trigger.

Display flashes “P18” and the “Current Value”

Value can be changed from “0” to “100” % by pressing the  or  key.

Press  key to exit and return to normal operation.

## THUMBWHEEL ADJUSTMENT

The Thumbwheel adjustment is critical in the operation of the SAV. If the Thumbwheel does not make contact with the “Low Limit Switch” it could cause undesirable operation. The Thumbwheel is set at the factory to engage the “Low Limit Switch” at about 5% of flow. For an overview of the location of these components see Figure 15.

In the event that you are experiencing problems with the valve sticking or you are not satisfied with the operation of the “Low Limit Switch” you will need to adjust the thumbwheel. To achieve this, start with the SAV in the Manual mode and drive the valve to the lowest valve position. Then loosen the set screw located on the thumbwheel collar. Once the thumbwheel is free you will be able to slide it up and down on the drive shaft. Adjust the thumbwheel until it just engages the “Low Limit Switch” then tighten the set screw to secure the thumbwheel in place. Test the adjustment by driving the valve until the “Closed” Indicator light extinguishes, then drive the valve closed and note at what % flow the “Closed” Indicator Illuminates. If you are satisfied with the operation of the thumbwheel, the unit can be returned to normal operation, if you are unsatisfied reset the thumbwheel again as described above until satisfied with its operation.

## ADDITIONAL FEATURES

### Direct/Reverse Acting Mode

The SAV is capable of operating in either “Direct” or “Reverse” acting modes. In “Direct” acting mode a 4mA control signal corresponds to the 0% Automatic Control Position while a 20mA control signal sends the SAV to the 100% Automatic Control Position. In “Reverse” acting mode a 4 mA control signal corresponds to the 100% Automatic Control Position while a 20mA control signal sends the Valve-Tronic to the 0% Automatic Control Position as indicated in the following chart:

Direct Acting Mode		Reverse Acting Mode	
Control Signal	Automatic Control Position	Control Signal	Automatic Control Position
4mA	0 %	4mA	100 %
12mA	50%	12mA	50%
20mA	100%	20mA	0%

**Note:** The SAV is factory preset to “Direct” Acting Mode.

## Error Codes

The SAV Control Valve not only includes visual diagnostic light indicators to aid with troubleshooting, but it also displays error codes when a problem arises. When the SAV Control Valve detects an error it will display each error code for a few seconds as “E $\underline{x}$ ” (Note: “x” equals the error code) and continue to cycle until all errors are resolved. Below is a table of error codes and what they are.

Error Code	Problem
E1	Feedback Potentiometer signal low or open (Contacts 7,8,9)
E2	Feedback Potentiometer signal out of range (Contacts 7,8,9)
E3	Control Input below 3.5mA or open (Contacts 4&5)
E4	Control Input loop above 20.5mA (Contacts 4&5)
CLd	Closed Valve Contacts are open (Contacts 16&17)
AL1	Alarm 1 has tripped
AL2	Alarm 2 has tripped
AL3	Alarm 3 has tripped

# AUTOMATIC CONTROL RANGE SETUP



The SAV may be set to operate between any desired low and high valve positions. The SAV in Automatic mode will then control valve position within this range base on a 4-20mA control signal. To set the “Zero” and “Span” of the SAV simply perform the following steps:

**Note: always start by setting the span first.**

## Setting The Span

1. Start with the SAV in the Manual Mode by

pressing the  key.

2. Use the  or  keys to drive the valve to the desired high position (Span).
3. Remove the Top Cover which is held in place with four (4) #2 Phillips head screws.
4. Locate the “Span Adjustment” potentiometer in the top of the SAV control box.
5. Turn the “Span Adjustment” potentiometer either clockwise to increase the displayed %Position or counterclockwise to decrease the % Position. Until the % Position Display reads “100” **Note: if display shows E2 it is above 100%, turn the potentiometer counterclockwise to get a reading.**
6. Once the span is set the zero must be set. Proceed to “Setting The Zero”

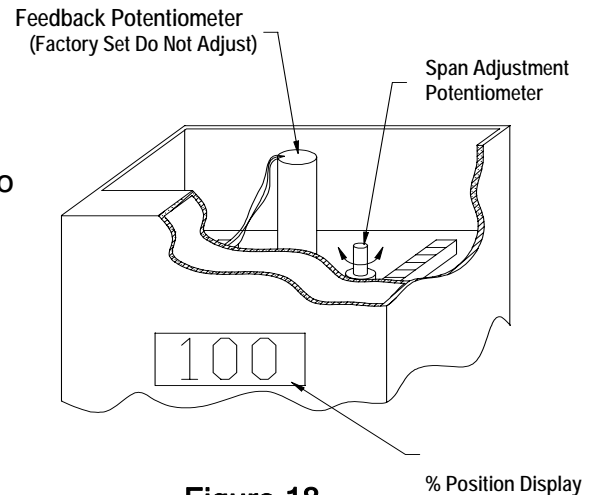








Figure 18

## Setting The Zero

1. With the SAV in Manual Mode, use the  key to drive the valve fully closed.
2. Enter the programming mode “Menu B” by pressing the , ,  keys simultaneously.
3. Once in the programming mode the display will show “P10” and the “current value”, to set this parameter for the “Zero” press the  and  keys simultaneously until the value in this parameter is “0”
4. The SAV is now ready to operate between the set “Zero” and “Span” If the top cover was removed, it can be reinstalled and the SAV is ready for operation.



# TROUBLE SHOOTING GUIDE

PROBLEM	SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
SAV does not operate.	The % Flow display is dark.	Loss of 24 VDC power and/or polarity reversal.  Circuit Breaker tripped  Power supply voltage is less than 21VDC.	Check 24VDC supply.  Check all electrical connections.  Cycle power to reset circuit breaker
SAV does not operate in "AUTO" or "MANUAL" mode.	The Flow indicator on the Flo-Meter remains at a constant flow even while the "OPEN/CLOSE" button is operated in Manual Mode.  Display Reads "CLd"	Loose motor connection  Failed Stepper Motor  Terminals 16 & 17 are open	Check the motor connector and wires.  Send back to Waukee for repair  Check for closure between terminals 16 & 17
SAV does not operate in "AUTO" mode and the valve position or flow rate does not change.	The "CONT" light is "ON".  Display Reads "E3" or "E4"	Loss of control signal on terminals 4 & 5  Control Signal to terminals 4 & 5 is above 20.5mA	Check Field Device output signal (4-20 mA) to terminals 4 & 5.  Check wiring between Field Device and Valve-Tronic
SAV is working flawlessly in "MAN" mode.	In Manual mode the SAV controls the flow rate.	Reversed signal polarity on terminals 4 & 5	Check polarity on terminals 4 & 5.
No gas flow observed on Flo-Meter	SAV "OPEN" position indicator may be "ON"	Blockage in the gas line before or after the Flo-Meter.  Loss of gas supply.	Check for closed valves (solenoids). Check gas supply
"CLOSED" Limit indication light does not work.	"LOW" light is "OFF" even when valve is fully closed.  Valve may be sticking	"Thumbwheel is out of adjustment.  Loose limit switch connector or faulty switch	Adjust the thumbwheel as described on pg. 22  Check the limit switch connector and wires.
Display reads E2	Display reads E2	Signal from feedback potentiometer is higher than 100%	Adjust the Zero and Span of the SAV Valve
Display reads E1	Display reads E1	Signal from feedback potentiometer is lower than set % Low Position	Follow instructions on page 24 for setting the valves zero % Flow Position.
Intermittent blinking of indicators and % Position display, Especially during valve operation	"CONT" indicator flashes intermittently and % Position flashes zero	Power supply unable to provide enough current.  24VDC wiring not proper gauge wire.	Bigger power supply may be needed.  Install 18-20AWG Shielded Cable

<b>SAV stops controlling and appears to be in Programming Mode</b>	“CONT”, “OPEN”, “CLOSED”, “AUTO”, “MAN” LIGHTS ALL ILLUMINATED	Leaky Ignition Transformer	Use Shielded cable with shield grounded on Field Device end only!!
	“%Flow” display toggles between “P_” and “Number”	RF Noise	Follow wiring guidelines on pg 10
			Find and replace leaky Ignition Transformer

**EXPRESS WARRANTY ON WAUKEE EQUIPMENT**

WAUKEE warrants its products for a period of one (1) year from date of shipment from WAUKEE to the original purchaser to be free from defects in material and workmanship under normal recommended use, service, inspection and maintenance. Normal recommended use, service inspection and maintenance mean:

1. Not to be used in excess of nor below the rated capacity, pressures and temperature ranges specified in the applicable quotation, purchase order, acknowledgment, marketing literature, nameplate(s), specification sheet or the Installation, Operation, Inspection and Maintenance Manual (THE MANUAL);
2. Using only clean liquids or gases (only liquids in liquid Flo-Meters and only gases in gas Flo-Meters); air and fuel gases used in mixing equipment to be clean and free of solids all as further explained in THE MANUAL; and
3. Installation, operation, inspection and maintenance in compliance with THE MANUAL; and
4. The WAUKEE products being used only in:
  - a. Ambient environments lower than 132° Fahrenheit (54° Celsius) unless specifically designed and so labeled by WAUKEE for higher temperatures; and
  - b. Non-corrosive environments; and
  - c. Completely protected from moisture, rain, snow or other outside environments; and
  - d. Not to be used below 32° Fahrenheit (0° Celsius) unless special precautions are taken for low temperature conditions as shown in THE MANUAL.
5. Being used only for applications permitted by THE MANUAL or other WAUKEE literature or special applications approved in a separate written authorization by WAUKEE.

**WARRANTY EXCEPTIONS**

This Warranty does not apply to damage caused by any or all of the following circumstances or conditions:

1. Freight damage;
2. Parts, accessories, materials or components not obtained from nor approved in writing by WAUKEE;
3. Any consequential or incidental damages including but not limited to loss of use, loss of profits, loss of sales, increased costs, arising from the use of any product, system or other goods or services manufactured, sold or provided by WAUKEE;
4. Misapplication, misuse and failure to follow THE MANUAL or other literature, instructions or bulletins (including drawings) published or distributed prior to THE MANUAL.

The exclusive remedy under this Warranty or any other express warranty is the repair or replacement without charge for labor and materials of any WAUKEE parts found upon examination by WAUKEE to have been defective. Since certain WAUKEE equipment is heavy, bulky and not deliverable by U.S. mail or other parcel service, WAUKEE equipment may be returned only upon written consent of WAUKEE and then only to the location designated by WAUKEE. Generally such consent will be given only upon the condition that the customer assume and prepay all carrier charges and responsibility for damage in transit. Purchasers of WAUKEE products, equipment, goods or services waive subrogation on all items covered under their own or any other insurance.

**DISCLAIMER**

THIS WARRANTY IS EXCLUSIVE. WAUKEE EXPRESSLY DISCLAIMS ANY AND ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY PURPOSE.

No person, including any dealer, seller or other representative of WAUKEE is authorized to make, on behalf of WAUKEE, any representations beyond those contained in WAUKEE literature and documents or to assume for WAUKEE any obligations or duties not contained in this Warranty and Warranty Policy.

WAUKEE reserves the right to make design and other changes, modifications or improvements to its products, services, literature or systems, without any obligation, to furnish or install same on any previously sold or delivered products or systems.

#### **LIMITATION OF LIABILITY**

It is expressly agreed that the liability of WAUKEE is limited and WAUKEE does not function as an insurer. The purchaser and/or user agree that WAUKEE is not liable for loss, harm or damage due directly or indirectly to any occurrence or consequences therefrom. If WAUKEE should be found liable to anyone on any theory (except any express warranty where the remedy is set forth in Section 2 of this Warranty and Warranty Policy) for loss, harm or damage, the liability of WAUKEE shall be limited to the lesser of the actual loss, harm or damage or the purchase price of the involved WAUKEE equipment or service when sold (or when service performed) by WAUKEE to its customer. This liability is exclusive and regardless of cause or origin resulting directly or indirectly to any person or property from:

1. The performance or nonperformance of any obligations set forth in this Warranty and Warranty Policy;
2. Any agreement including specifications between WAUKEE and the customer;
3. Negligence, active, passive or otherwise of WAUKEE or any of its agents or employees;
4. Breach of any judicially imposed warranty or covenant of workmanship, durability or performance; and
5. Misrepresentation (under the Restatement, common law or otherwise) and/or strict liability involvement.
6. Liability for fraud-in-the-inducement.

#### **INFORMATION NECESSARY TO OBTAIN TECHNICAL ASSISTANCE.**

For WAUKEE to appropriately respond to a request for assistance or evaluation of customer or user operating

difficulty. Please provide at a minimum the following information:

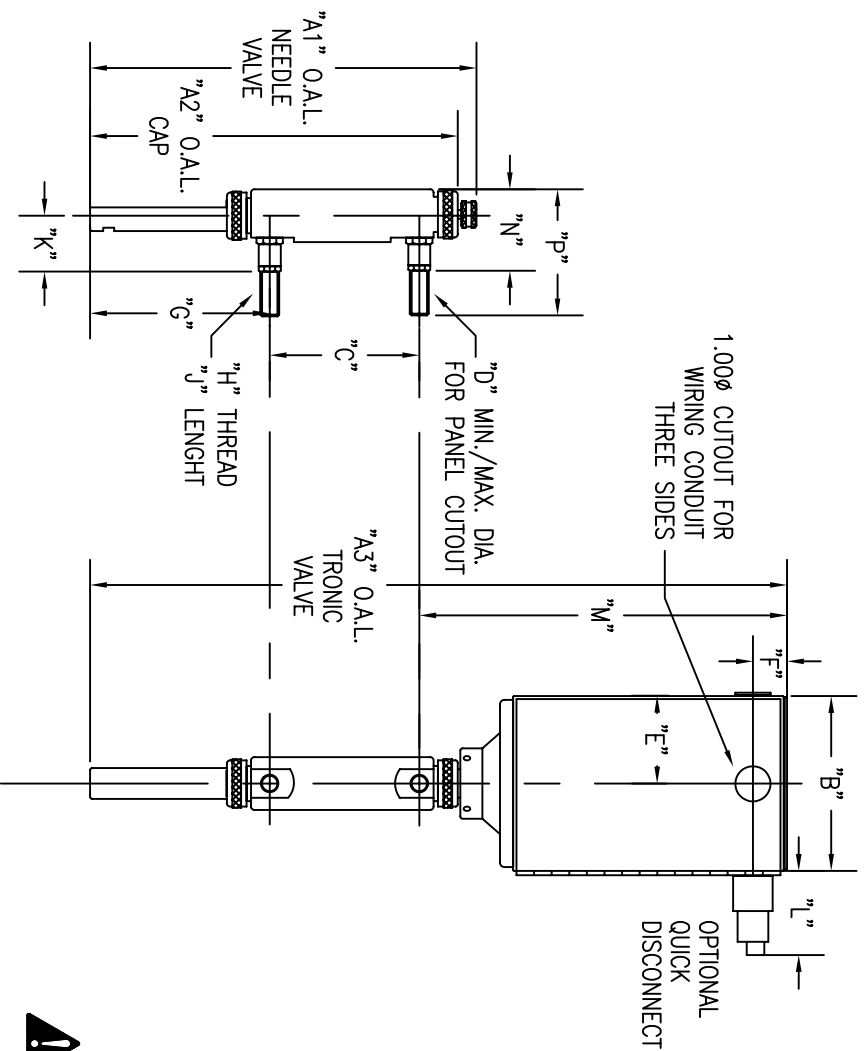
1. Serial number and type or model of meter, compressor or other equipment and all other data shown on the nameplate and on the specific component which appears to be involved in the difficulty;
2. The date and from whom you purchased your WAUKEE equipment and your purchase order number.
3. State your difficulty, being sure to mention at least the following:
4. Application.
5. Input pressure where Flo-Meters or compressors are involved.
6. Condition of filters, strainers or screens, upstream or downstream of the WAUKEE equipment.
7. Gas or liquid temperatures and other ambient conditions at the time of the difficulty.
8. Type of lubrication being used (if any) - give specifics.
9. Any other relevant pressures including gauge readings both upstream and downstream of the WAUKEE equipment.
10. All electrical information available.
11. Performance activity.
12. Any other pertinent information. If a sketch would help explain the difficulty, please include one.

#### **WARRANTY FIELD SERVICE**

If warranty Field Service at the request of the purchaser or user is rendered and the difficulty is found not to be with WAUKEE's product, the purchaser shall pay the time and expense (at the prevailing rate at the time of the service) of WAUKEE's field representative(s). Charges for service, labor and other expenses that have been incurred by the purchaser, its customer or agent without written approval of WAUKEE will not be accepted. The OEM or other reseller is responsible for transmitting installation and operating instructions, THE MANUAL or other service literature supplied by WAUKEE with the equipment.

# APPENDIX "A" - DRAWINGS

# DIMENSION SHEET FOR S01-S07 STANDARD FLO-METER'S



DIM.	S01 - S07
A1	10.98
A2	10.45
A3	19.80
B	5.00
C	4.25
D	.63/.75
E	2.50
F	.88
G	5.10
H	1/4" NPT
J	1.00
K	1.60
L	5.00
M	10.45
N	2.32
P	3.60



## CAUTION

WAUKEE VALVES ARE FOR FLOW CONTROL ONLY, NOT FOR TIGHT SHUT OFF.  
 INSTALL A GAS COCK, SOLENOID VALVE OR MANUAL VALVE AHEAD OF  
 FLO-METER FOR TIGHT SHUT-OFF OR MAINTENANCE PURPOSES.  
 DO NOT EXCEED PRESSURE SHOWN ON METER NAMEPLATE.

REF. NO.:

DIRECTORY: WT

NOTE: DWG. NOTES FROZEN IN "INFO" LAYER



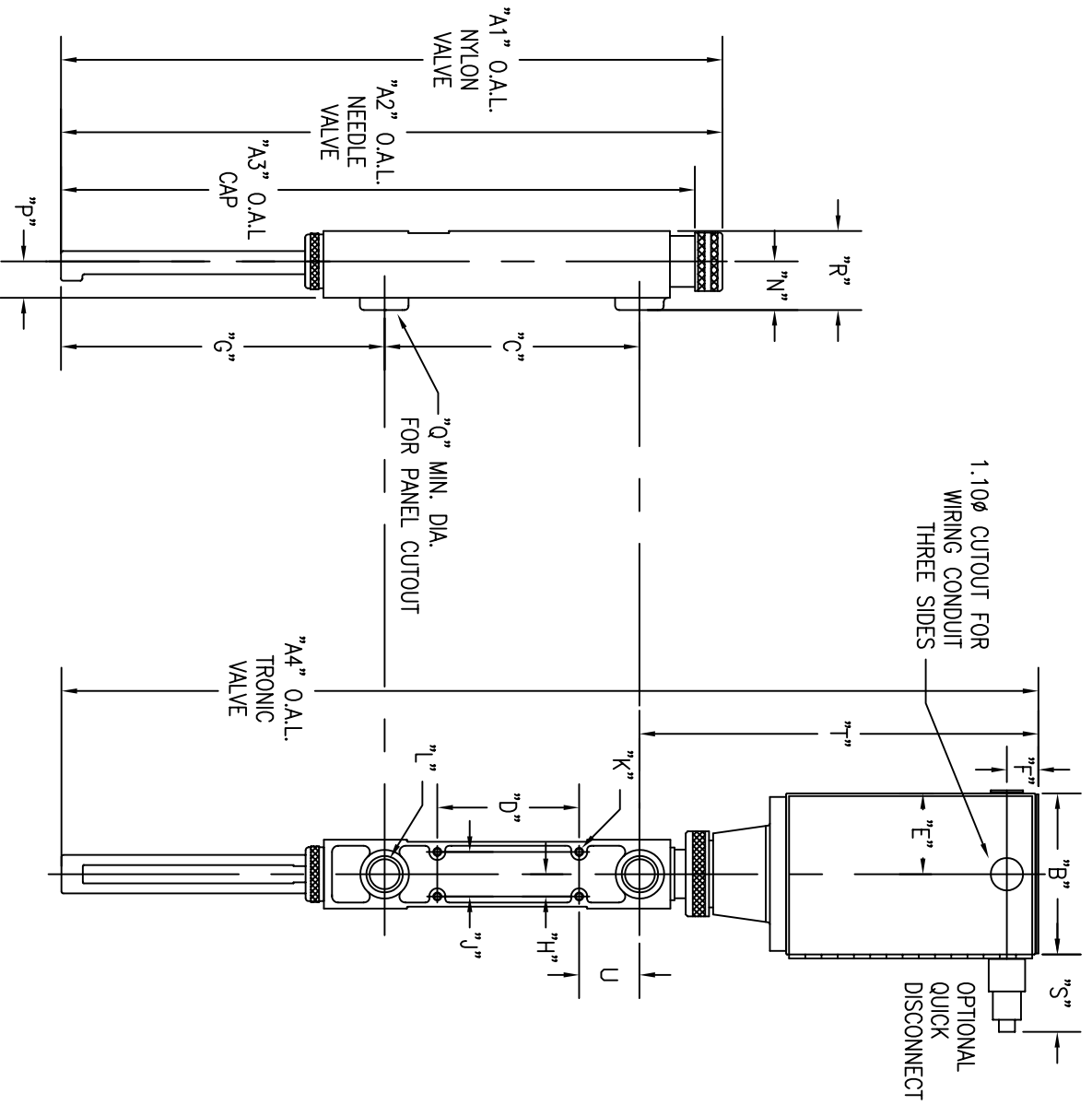
**WAUKEE ENGINEERING CO., INC.**

5600 West Florist Avenue, Milwaukee, Wisconsin 53218 U.S.A.  
 Phone: (414) 462-8200 Fax: (414) 462 7022

BULLETIN NO.:

2-2150

# DIMENSION SHEET FOR M01-M11 & L01-L09 STANDARD FLO-METER'S



DIM.	M01 - M07	M08 - M11	L01 - L03	L04 - L06	L07	L08 - L09
A1	20.09	21.05	30.17	31.14	34.75	37.96
A2	21.14	21.78	30.64	32.06	N/A	N/A
A3	19.34	20.16	21.12	30.31	32.46	35.52
A4	30.12	31.00	39.91	41.10	43.04	46.47
B	5.00	5.00	5.00	5.00	5.00	5.00
C	7.88	8.38	12.00	12.62	14.63	16.13
D	4.38	4.38	6.50	6.50	6.50	4.31
E	2.50	2.50	2.50	2.50	2.50	2.50
F	.88	.88	.88	.88	.88	.88
G	9.97	9.84	15.12	15.25	15.35	15.88
H	.69	1.00	1.00	1.12	1.12	1.12
J	1.38	2.00	2.00	2.25	2.25	2.25
K	1/4-20	1/4-20	1/4-20	1/4-20	5/16-18	3/8-16
L	3/4" NPT	1 1/4" NPT	1 1/4" NPT	2" NPT	3" NPT	4" NPT
M	1.75	2.25	3.00	3.81	5.25	6.50
N	1.50	2.00	2.56	2.49	3.31	4.00
D	2.00	2.00	2.00	2.00	2.00	2.00
P	1.12	1.15	1.28	1.62	2.31	3.00
Q	1.75	2.50	2.25	3.12	4.75	6.00
R	2.44	3.06	3.84	4.19	5.72	7.09
S	5.00	5.00	5.00	5.00	5.00	5.00
T	12.30	12.79	12.79	13.22	14.35	15.17
U	1.81	2.31	2.69	3.31	5.36	7.75



CAUTION

WAUKEE VALVES ARE FOR FLOW CONTROL ONLY, NOT FOR TIGHT SHUT OFF.  
INSTALL A GAS COCK, SOLENOID VALVE OR MANUAL VALVE AHEAD OF  
FLO-METER FOR TIGHT SHUT-OFF OR MAINTENANCE PURPOSES.  
DO NOT EXCEED PRESSURE SHOWN ON METER NAMEPLATE.

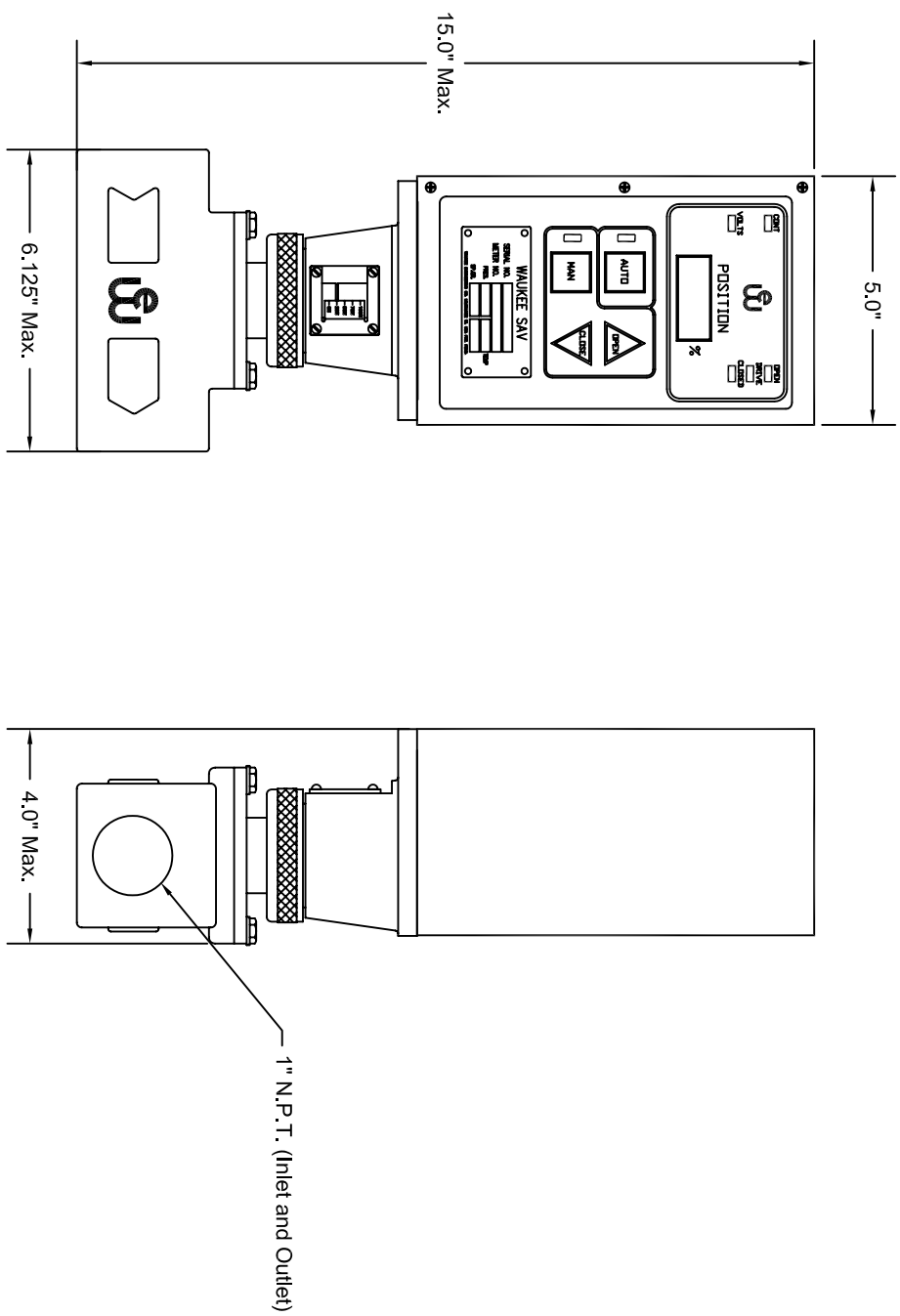
REF. NO.:                      DIRECTORY: WT                      NOTE: DWG. NOTES FROZEN IN "INFO" LAYER

WAUKEE ENGINEERING CO., INC.

5600 West Florist Avenue, Milwaukee, Wisconsin 53218 U.S.A.  
Phone: (414) 462-8200 Fax: (414) 462 7022

BULLETIN NO.:  
2-2149

# OVERALL DIMENSION SHEET FOR 1" INTELLIGENT CONTROL VALVE



REF. NO.:

DIRECTORY: SAV

NOTE: DWG. NOTES FROZEN IN "INFO" LAYER



**WAUKEE ENGINEERING CO., INC.**

5600 West Florist Avenue, Milwaukee, Wisconsin 53218 U.S.A.  
 Phone: (414) 462-8200 Fax: (414) 462 7022

BULLETIN NO.:  
 2-1959-R1



**WAUKEE ENGINEERING COMPANY, INC.**  
5600 West Florist Avenue, Milwaukee, WI 53218, U.S.A.  
Phone: (414) 462-8200 Fax: (414) 462-7022  
e-mail: [sales@waukeemeters.com](mailto:sales@waukeemeters.com)  
web: [www.waukeemeters.com](http://www.waukeemeters.com)  
[www.group-upc.com](http://www.group-upc.com)