



WAUKEE ENGINEERING

Ratio Control Valve

Installation And Operation Manual



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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INTRODUCTION

The Purpose of this Manual

Thank You for Purchasing a Ratio Control Valve. This Manual shows you how to install, wire and maintain Waukee's Valve-Tronic. 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:

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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>
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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 Ratio Control Valve connects to that accepts or sends a 4-20mA signal. (Ex. PLC, Chart Recorder, Controller)

CONTROL VALVE OVERVIEW

The Waukee Ratio Control Valve is a ratio controller specifically designed to control the fluid flow through a Waukee Flo-Meter. It requires the use of two fluid Flo-meters to maintain the ratio of the fluids used. The Primary Flo-Meter will have a Ratio Control Valve and a Waukee-Tronic and a secondary Flo-Meter with have a Waukee-Tronic.

Principle of operation

The Waukee Ratio Control Valve is microprocessor based and compares the flow feedback signal from the secondary Waukee-Tronic Flo-Meter to the flow feedback signal from the primary Waukee-Tronic Flo-Meter. If the ratio between the two flo-meter's differs from the set-point, it will adjust the flow on the primary Flo-Meter until the set-point ratio is equal to the ratio of the feedback signals from the primary and secondary Flo-Meter's. The Ratio Control Valve uses PID control 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 Ratio Control Valve 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.



WARNING: Flo-Meter must be earth grounded. Ungrounded Flo-Meters may become a source of Ignition.

SPECIFICATIONS

The RCV offers a series of features which allow it to be integrated with furnace and generator control equipment to provide completely automatic ratio control and feedback. These features include:

- Selectable input control - The Ratio Control Valve control input can be used to set the ratio from an external controller or connected to a Dew Point controller for trim control.
- PID 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
- Ratio deviation alarm
- Diagnostic indicators and error codes for ease of troubleshooting.

Operating Voltage: 24 VDC +/- 10%

Power Consumption: 50 mA

Signal Input: 4 -20 mA Standard Current Loop

Signal Output (from Waukee-Tronic): 4-20mA Isolated 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 Ratio Control Flo-Meter is shipped as a complete unit as shown in Figure 1. Before installing the Flo-Meter, carefully remove the Waukee-Tronic Flow Sensor, to achieve this lay the unit on its side on a work bench or table. Then hold the Waukee-Tronic unit with one hand, while unscrewing the union nut counter clockwise with the other hand to loosen it.



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

Once the Waukee-Tronic 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 Waukee-Tronic 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.

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

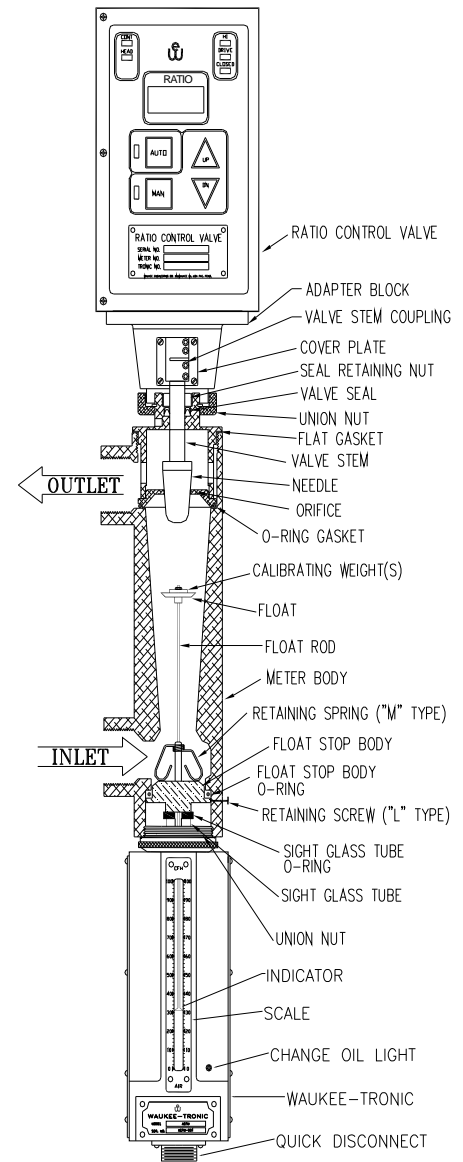


Figure 1

Ratio Control Valve Installation

The following instructions are for installing a Ratio Control Valve onto an existing Waukee Flo-Meter. Please refer to Figure 2.

1. First remove the valve assembly from the Ratio Control Valve 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 Valve-Tronic 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 Ratio Control Valve onto the valve body assembly. Carefully align the valve stem coupling to the valve stem.



CAUTION: Do not force the Ratio Control Valve onto the valve stem.

8. Tighten the union nut by hand until there is little or no play between the valve body assembly and Valve-Tronic.
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.

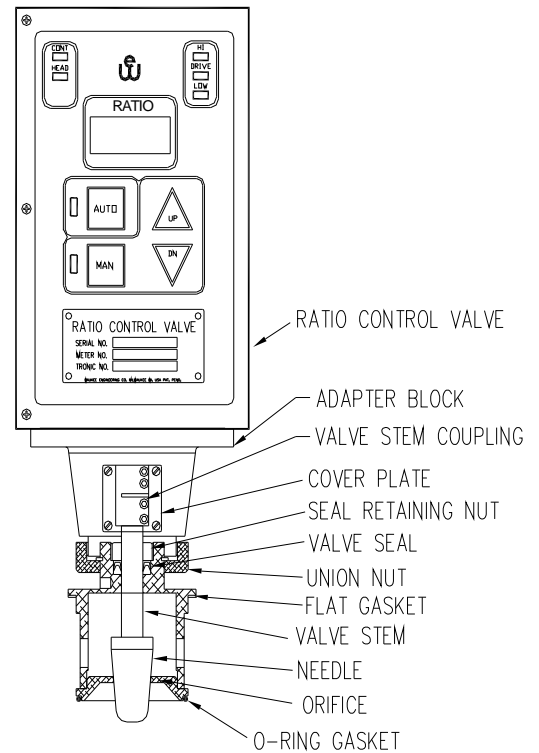


Figure 2

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 Ratio Control Valve 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 Ratio Control Valve 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 Waukee-Tronic, Ratio Control Valve and the Field Device the Waukee-Tronic is connecting to. It is advised to turn off the supply power to the Waukee-Tronic, Ratio Control Valve and Field Device before connecting or disconnecting any wires.

Location of Ratio Control Valve Wiring

The Standard Ratio Control Valve wiring terminals are located at the top of the Ratio Control Valve 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 Figures 5-7 and Tables 1&2. Use 18 or 20 AWG wire for all connections.

If Ratio Control Valve is equipped with the optional Quick Disconnect plug, the quick disconnect plug is a 19 pin plug pre-wired with four cables. The cables are as follow: Two 4 conductor cables with a pre-wired plug on the end, One for the Primary Waukee-Tronic and the other for the secondary Waukee-Tronic. One 4 Conductor Cable that contains all the power and one 9 conductor cable that includes all the relay logic wiring. Refer to Figure 4 and Table 3. The Quick Disconnect plug can be added to any new or existing Ratio Control Valves. The Part Number for the Quick Disconnect cable assembly is 1-3482*

Note: For “S” series of Flo-Meter’s add a “-S” after the part number.

WIRING DIAGRAMS

Terminal Block Wiring Diagram

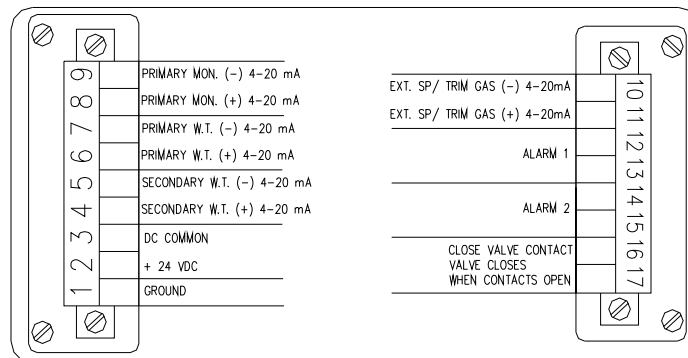


Figure 3

Table 1

Contact	Description
1	Ground for Shield
2	+ 24 VDC
3	DC Common
4	+ 4 to 20 mA Signal from Secondary Waukee-Tronic
5	- 4 to 20 mA Signal from Secondary Waukee-Tronic
6	+ 4 to 20 mA Signal from Primary Waukee-Tronic
7	-4 to 20 mA Signal from Primary Waukee-Tronic
8	+4 to 20 mA Primary Waukee-Tronic Monitor Loop Signal (shipped jumpered to pin 9)
9	-4 to 20 mA Primary Waukee-Tronic Monitor Loop Signal (shipped jumpered to pin 8)

Table 2

Contacts	Description
10	+4 to 20mA Control Signal (External Set-point / Trim Control)
11	-4 to 20mA Control Signal (External Set-point / Trim Control)
12&13	Alarm 1 (1.0 A@30VDC, N.O. Relay Contacts)
14&15	Alarm 2 (1.0 A@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

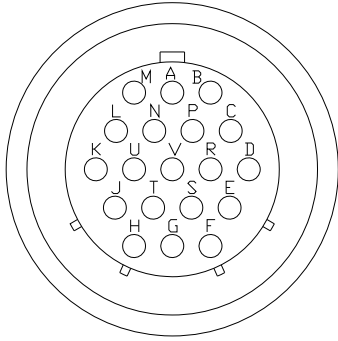


Figure 4

<i>RCV Term Number</i>	<i>Quick-Disconnect Terminal Number</i>	<i>Wire Color</i>	<i>Signal</i>
1	A	-	Ground for shield
2	B	RED	+24VDC Power
3	C	BLACK	DC Common
8	H	GREEN	+4..20 mA Primary Waukee-Tronic Monitor
9	J	WHITE	-4..20 mA Primary Waukee-Tronic Monitor
4	D	GREEN	+4..20 mA Signal from Secondary Waukee-Tronic
5	E	WHITE	-4..20 mA Signal from Secondary Waukee-Tronic
-	U	BLACK	DC Common for Secondary Waukee-Tronic
-	V	RED	+24VDC for Secondary Waukee-Tronic
6	F	GREEN	+4..20 mA Signal from Primary Waukee-Tronic
7	G	WHITE	-4..20 mA Signal from Primary Waukee-Tronic
-	U	BLACK	DC Common to Primary Waukee-Tronic
-	V	RED	+24VDC to Primary Waukee-Tronic
10	K	BLUE	+4-20mA External Set-point / Trim Control Input
11	L	YELLOW	-4-20mA External Set-point / Trim Control Input
12	M	VILOET	Alarm 1 Common
13	N	ORANGE	Alarm 1 N.O. Contact
14	P	BLACK	Alarm 2 Common
15	R	WHITE	Alarm 2 N.O. Contact
16	S	RED	Close Valve Contact
17	T	BROWN	Close Valve Conatct

Table 3

CIRCUIT PROTECTION

The Ratio Control Valve is equipped with a circuit breaker. This circuit breaker automatically resets after the fault is removed and power is recycled to the unit. The Waukee-Tronic is equipped with fuse protection as well, refer to Waukee-Tronic manual for location and fuse replacement.

TYPICAL WIRING FORMATS

The figures shown below are for typical wiring configurations. If connecting the Ratio Control Valve for stand alone ratio control, refer to Figure 5. If connecting the Ratio Control Valve to a controller for remote ratio set-point or trim control, refer to Figure 6. For alarm contact wiring, refer to Figure 6.

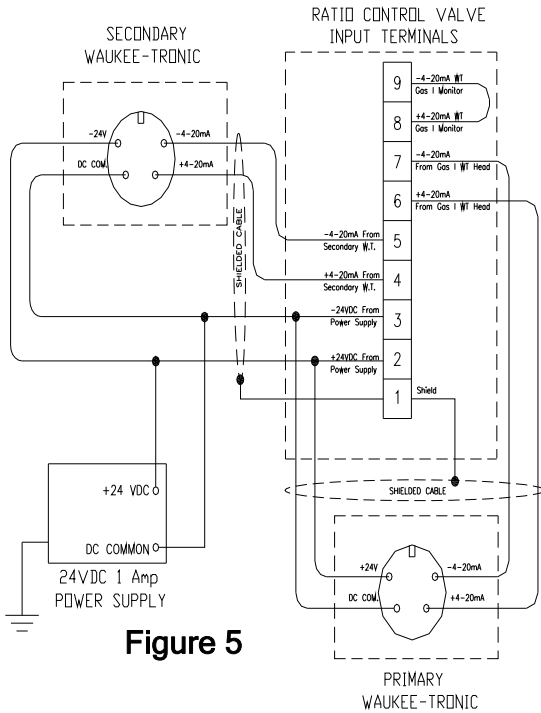


Figure 5



WARNING: The Alarm 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 Ratio Control board.

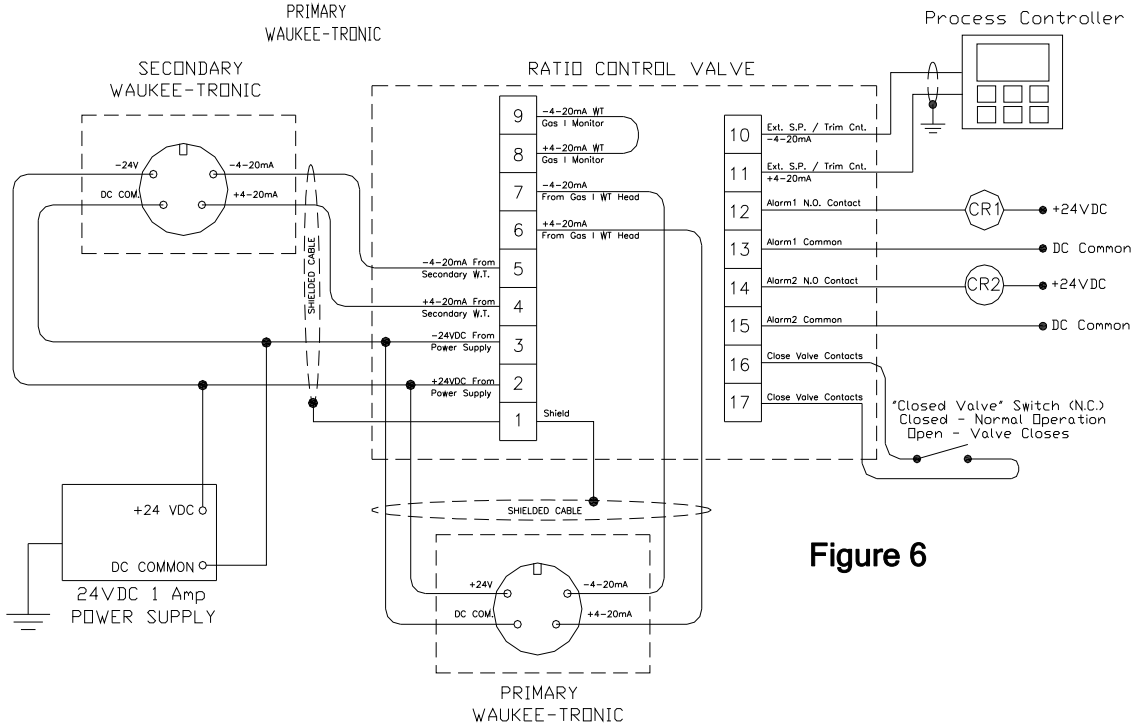


Figure 6

OVERVIEW OF RATIO CONTROL VALVE

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.
2. **Waukee-Tronic flow sensor loops diagnostic Indicator**
“Illuminates” when the Primary Waukee-Tronic feedback loop is broken or if the signal is below 3.5mA or above 20.5mA.
“1 Second Flashes” when the Secondary Waukee-Tronic feedback loop is broken or if the signal is below 3.5mA or above 20.5mA
3. **Automatic mode selector key**
Valve position is automatically controlled.
4. **Automatic mode indicator**
Illuminated when in Automatic mode.
4. **Manual mode selector key**
Valve position is controlled by UP/DN keys.
5. **Manual mode indicator**
Illuminated when in Manual mode.
7. **Hi Indicator**
“Illuminates” when valve is physically at full open position
“1 Second Flashes” during motor drive to indicate motor is driving the valve open
8. **Motor Drive Indicator**
Indicator will “pulse” at various rates when in operation to indicate relative motor drive speed.
9. **Low Indicator**
“Illuminates” when valve is physically closed.
“1 Second Flashes” during motor drive to indicate motor is driving the valve closed.
10. **Ratio display**
Displays actual ratio between the two Waukee-Tronic Flow Sensors.
Used during programming mode to change parameters of the valve.
Informs the operator of any errors or alarms.
11. **“UP” valve drive selector key.**
- 12 **“DN” valve drive selector key.**
13. **Ratio Control Valve Identification Plate**
Identifies the unit and rated conditions the unit was manufactured to meet.

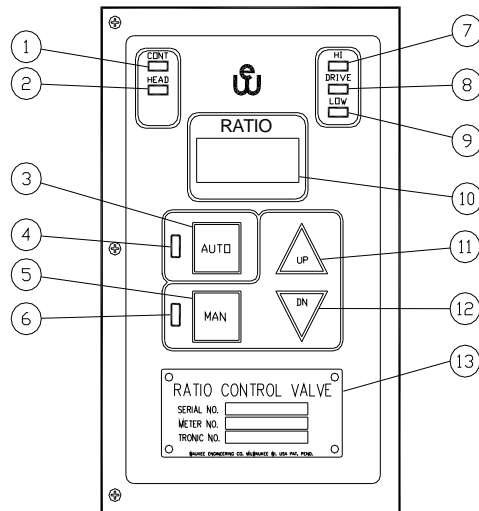


Figure 7

Inside the Ratio Control Valve

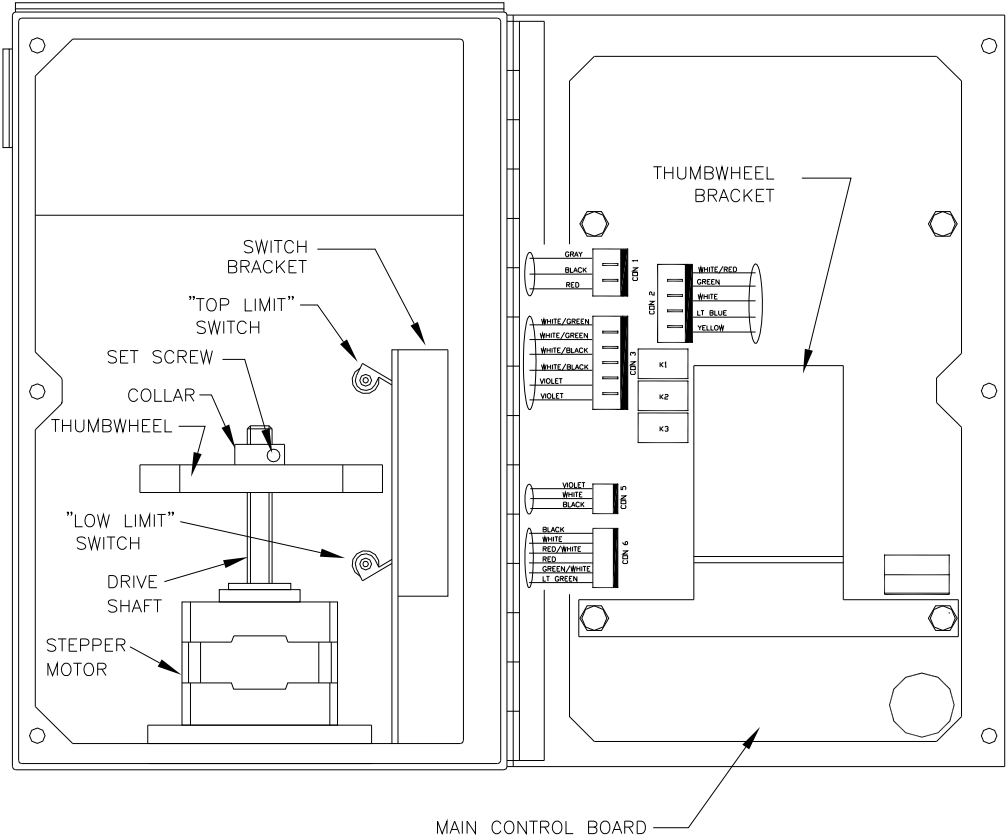






Figure 8


OPERATION


Manual Mode

When In Manual Mode the Manual mode indicator will be illuminated and the Ratio display will indicate the ratio between the two Waukee-Tronic flow sensors.


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

When the  or  key is pressed and held, the motor speed starts slow and then gradually picks up speed until the key is released.

If the  key is pressed and held until the valve reaches it's physical top limit, the "Top Limit" indicator will illuminate and the motor will stop driving.

If the  key is pressed and held until the valve reaches its physical bottom limit (closed), the "Low" indicator will illuminate.

Automatic Mode

The “Automatic mode” is initiated by pressing the  mode key. In this mode, the Ratio Control Valve will control ratio based on either the external control signal or internally set set-point.

When the flow is at zero on the Primary Waukee-Tronic Sensor and the Secondary Waukee-Tronic Sensor has a flow of 350CFH and the set-point is 2.8:1. The Ratio Control Valve will start driving the valve open on the Primary Flo-Meter. The PID in the Ratio Control Valve will start the motor at a high speed and as it approaches the required flow of 125CFH for the Primary Flo-Meter, it will start to ramp the motor to a lower speed and stop driving once the ratio between the Primary Flo-Meter and the Secondary Flo-Meter is equal to the set-point and within the “Dead Band”. Refer to Figure 9.

Figure 9 shows a Dead Band of $\pm 1.0\%$ which means the Ratio Control Valve will not make any corrections when the flow is between 120CFH and 130CFH this prevents the motor from premature failure due to continue movement.

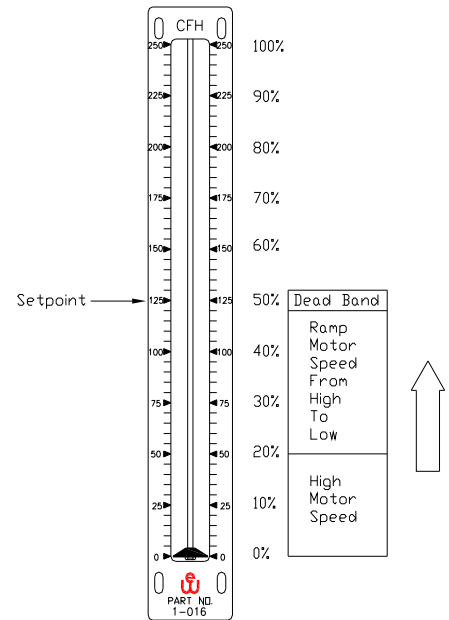


Figure 9

Failure Modes

In the event that the feedback loops from the Primary or Secondary Waukee-Tronic were to fail, the Ratio Control valve will maintain the last valve position and will not make any corrections to the ratio until the problem is resolved.




The Control Input (Contacts 10&11) failure mode depends on the mode of operation selected in Parameter 13 “Control Input Mode”. Failure mode is as follow:




Parameter 13 = “rSP” (Remote Ratio Set-point) when the input fails the Ratio Control Valve will maintain the last valve position before the failure occurred and will not make any corrections to the ratio until the problem is resolved.

Parameter 13 = “C” (Trim Control) when the input fails the Ratio Control Valve will continue to control ratio based on the set-point set in the “Set-point” parameter. See “Additional Features” in this manual for setting the set-point.

In the event that power is lost to the Ratio Control Valve, 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 8 for location of thumbwheel.

Programming Modes



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, HIGH, LOW, AUTO, and MAN indicators are all illuminated you are in the programming menu and the Ratio display will toggle with "P x" and the value of the parameter (Note: "x" equals the current parameter number)



Menu A


- **GAIN** (*Parameter - 1*) - Regulates the stepper motors position in proportion to the error signal (the difference between Process Variable and Set-point)

Valve can be changed from 0 to 100% by pressing the  or  key.



Press  key to go to the next parameter.


- **RESET** (*Parameter - 2*) - Regulates the stepper motors position to the size of the error and the time the error has existed (The amount of corrective action depends on the value of proportional gain)

Valve can be changed from 0.00 to 50.0 minutes by pressing the  or  key.



Press  key to go to the next parameter.


- **RATE** (*Parameter - 3*) - Regulates the stepper motors position in proportion to the rate of change of the error. (The amount of corrective action depends on the value of proportional gain.)

Valve can be changed from 0.0 to 10.0 minutes by pressing the  or  key.



Press  key to go to the next parameter.


- **FILTER** (*Parameter - 4*) - Filters the input signals from the Waukee-Tronic flow sensors

Value can be changed from 0.0 to 10.0 by pressing the  or  key.

Press  key to go to the next parameter.

- **DEAD BAND (Parameter -5)** - Band from Ratio set-point that the Ratio Control Valve is satisfied. (ex. If the set-point is 2.8:1, a value of 0.20 would be a band of 3.0 to 2.6)

Value can be changed from “0.00” to “0.50” by pressing the  or  key.
NOTE: a value of “0.00” may result in premature failure of the motor.


Press  key to go to the next parameter.

- **MANUAL MODE LOCKOUT (Parameter - 6)** - Locks the unit in Automatic mode.



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.



- **VALVE SCALING FACTOR (Parameter - 7)** - Scale of control valve (**Note: Do not change unless instructed by the manufacture**)


Value can be changed from 0.15 to 1.00, where “0.15” is the smallest scale, and “1.00” is full scale by pressing the  or  key.

Press  key to exit and return to normal operation



Menu B


- **METER SCALER (Parameter - 10)** - Ratio of Secondary Flo-Meter Scale to Primary Flo-Meter Scale

Value can be changed from “0.00” to “9.99” by pressing the  or  key. This value is calculated as follow: Meter Scaler = Scale of Secondary Waukee-Tronic Flo-Meter / Scale of Primary Waukee-Tronic Flo-Meter. (ex. 1000CFH/500CFH = 2.0)



Press  key to go to the next parameter.


- **TRIM SCALER (Parameter - 11)** - % of Primary fluid to use for trim control

Value can be changed from “0” to “25%” by pressing the  or  key.
(ex. When set to a value of “10%” the max amount of primary fluid added to the ratio is 10% of the set-point.)



Press  key to go to the next parameter.


- **VALVE SEATING TIME** (*Parameter - 12*) - Amount of time the valve drives closed once the “Low Limit Switch” is met.

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



Press  key to go to the next parameter.


- **CONTROL INPUT MODE** (*Parameter - 13*) - Selects how control input terminals 10&11 will function.

Setting can be changed by pressing the  or  key, where:
“rSP” - Remote ratio set-point - 4mA will equal 0.0:1 and 20mA will equal 25.0:1
“C” - Trim Control (Note: Base ratio set via set-point parameter accessible by pressing and holding the “AUTO” key for 5 seconds.) - **Default Setting**



Press  key to go to the next parameter.


- **ALARM 1 TYPE** (*Parameter - 14*) - Selects event to trigger alarm 1 (Contacts 12&13)

Setting can be changed by pressing the  or  key, where:
“HLA” - High Limit Alarm - triggers when “top limit switch” is met - **Default Setting**
“LLA” - Low Limit Alarm - triggers when “low limit switch” is met
“Err” - Error Alarm - triggers when an error occurs
“rdA” - Ratio Deviation Alarm - triggers when the ratio deviates from set-point



Press  key to go to the next parameter.


- **ALARM 2 TYPE** (*Parameter - 15*) - Selects event to trigger alarm 2 (Contacts 14&15)

Setting can be changed by pressing the  or  key, where:
“HLA” - High Limit Alarm - triggers when “top limit switch” is met
“LLA” - Low Limit Alarm - triggers when “low limit switch” is met - **Default Setting**
“Err” - Error Alarm - triggers when an error occurs
“rdA” - Ratio Deviation Alarm - triggers when the ratio deviates from set-point

Press  key to go to the next parameter.

- **RATIO DEVIATION ALARM BAND** (*Parameter - 16*) - Band from set-point before an alarm triggers (ex. If the set-point is 2.8:1, a value of 0.20 would be a band of 3.0 to 2.6 anything outside this band will trigger the alarm) **NOTE:** Alarm 1 or 2 must be set to “rdA” for alarm to work.

Value can be changed from “0.00” to “1.00” 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 Ratio Control Valve. 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 8.

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 Ratio Control Valve 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 “Low Limit Indicator” light goes “OFF” then drive the valve closed and note when the “Low Limit 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

Control Input Mode Selection (Contacts 10&11)

The Ratio Control Valve is capable of controlling ratio by one of the two methods below:

- ❖ When Parameter 13 “Control Input Mode” is set to “rSP” the ratio set-point is determined by a 4-20mA signal applied to contacts 10&11 where 4mA equals 0.00:1 and 20mA equals 25.0:1.
- ❖ When Parameter 13 “Control Input Mode” is set to “C” the ratio set-point is set by pressing and holding the  key for 5 seconds. Once in set-point mode the ratio display will toggle between “SP” and the “Current Set-point” Use the  or  key to change this value to the desired set-point. Once the desired Set-point is entered press the  key to exit this parameter and return to normal operation.

Contacts 10&11 can be used for trim control, the amount of trim is set via parameter 11 “Trim Scaler”, refer to “Programming Mode” section of this manual for setting of this parameter.

ERROR CODES

The Ratio 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 Ratio Control Valve detects an error it will display each error code for a few seconds as “Ex” (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	Primary Waukee-Tronic loop below 3.5mA or open (Contacts 6&7)
E2	Primary Waukee-Tronic loop above 20.5mA (Contacts 6&7)
E3	Control Input below 3.5mA or open (Contacts 10&11)
E4	Control Input loop above 20.5mA (Contacts 10&11)
E5	When Primary Waukee-Tronic input is below 4.5mA and top limit switch is met (Indicates that the fluid flow is blocked)
E6	Secondary Waukee-Tronic loop below 3.5mA or open (Contacts 4&5)
E7	Secondary Waukee-Tronic 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

APPLICATION NOTES

For optimum performance of the Ratio Control Valve it is strogly advised to follow the notes below regarding the application of intended use.

Endothermic Gas Generator

When using the Ratio Control Valve with a generator it is advised to have a separate regulated gas supply to the burners used for heating of the retort and a separate regulated gas supply to the Ratio Control Valve Flo-Meter. Using the same regulated gas supply for both the burners and Ratio Control Valve will result in pressure variations to the gas Flo-Meter and may result in difficulty in controlling ratio and in turn proper dew point.

The Ratio Control Valve is dependent on the feedback signals from both the Air and Gas Waukee-Tronic Flo-Meters. For proper ratio control the oil in these Flo-Meters must be kept clean. It is advised that you setup a maintenance program for these Flo-Meters to keep your generator running trouble free. To reduce maintenance intervals make sure that the Air filter is located as far away from any dusty areas and that the proper filter element is being used.

TROUBLE SHOOTING GUIDE

PROBLEM	SYMPTOMS	PROBABLE CAUSE	RECOMMENDED ACTION
Ratio Control Valve does not operate.	The Ratio display is dark. Waukee-Tronics may be 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
Ratio Control Valve does not operate in "AUTO" or "MANUAL" mode.	The Flow indicator on the Primary Flo-Meter remains at a constant flow even while the "UP/DN" 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
No fluid flow observed on Flo-Meter	Ratio Control Valve "High" 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
"LOW" Limit indication light does not work.	"LOW" light is "OFF" even when valve is fully closed. Valve may be sticking	"Low limit" switch is out of adjustment. Loose limit switch connector or faulty switch	Adjust the thumbwheel as described on pg. 21 Check the limit switch connector and wires.
Intermittent blinking of indicators and ratio display, Especially during valve operation	"CONTROL" indicator flashes intermittently and % Flow 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
Ratio Control Valve stops controlling and appears to be in Programming Mode	"CONT", "HIGH", "LOW", "AUTO", "MAN" LIGHTS ALL ILLUMINATED "Ratio" display toggles between "P_" and "Number"	Leaky Ignition Transformer RF Noise	Use Shielded cable with shield grounded on Field Device end only!! Follow wiring guidelines on pg 9

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



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