

## MODEL FC FLOW CONTROLLER



**Electronics Inc.**  
*Shot Peening Control*

### Electronics Inc.

56790 Magnetic Drive

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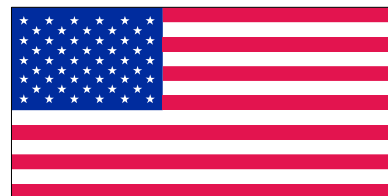
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Made in the **USA**

## FC Controller

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### 1. PRODUCT DESCRIPTION

The Model FC Shot Flow Controller will measure and control the flow rate of steel shot passing through a special, normally-closed, magnetic valve called a MagnaValve. A digital display is provided for indications of shot flow rate. A 0-10Vdc output signal, representing flow rate, is available for remote indication or strip-chart recording. High and low alarms are set to bracket the requested shot flow rate. The alarm bandwidth is adjustable from the front panel. Either local (front panel), or remote (0-10Vdc) set point commands may be used.

### 2. THEORY OF OPERATION

The desired flow rate command, or "set point", is compared to the actual flow rate and a power signal is sent to the MagnaValve to achieve desired flow rate. If the desired flow rate is not achieved within an adjustable time period, then a high/low alarm relay will be triggered. This output signal may be used to inhibit further machine operations and signal the operator. The FC Controller is used with a MagnaValve that has a built-in flow rate sensor. This MagnaValve incorporates a preamplifier circuit that provides a 0-5Vdc output signal back to the FC Controller.

### 3. PRELIMINARY ADJUSTMENTS

For location of adjustments see (Figure-Item) as noted.

- a. Apply power to unit.
- b. The display should read 00 during a no-flow condition. Check the signal input at Terminals 17 & 18 for the flow sensor input from the MagnaValve. Confirm 0Vdc at the no-flow condition. If the input signal is 0Vdc but the display does not show "00", adjust the "ZERO" trimpot until "00" appears on the display
- c. For automatic machine cycle, place the "Mode" switch to the left for the ready mode (1-11). When a 115VAC "Enable" signal is received, the **ENABLE** LED indicator (1-2) on the front panel will light and activate the valve output. The red **VALVE** (1-3) LED will blink at 8-Hertz (8 times per second). Adjust the flow rate **SETPPOINT** knob (1-9) to desired flow rate. The display (1-4) is usually scaled in pounds/minute, but may be scaled in Kg/minute.
- d. Adjust the **ALARM BAND** (2-7), typically 10% of full scale by pushing the **DISPLAY SWITCH** (1-10) to the left to exhibit the alarm bandwidth in the display. The alarm bandwidth is +/- of this value and it follows the set point command.
- e. Adjust the **ALARM DELAY** time (2-6) from 0-10 seconds. A typical setting is 5 seconds.

### 4. FLOW RATE CALIBRATION

Calibration of the display range may be required. The standard factory setting is 20.0-pounds/minute full scale to match the model 578 MagnaValve. Other full-scale values may be used with different MagnaValves.

MagnaValve Model	Maximum Flow Rate	FC Display Full Scale
477 or 577	2 pounds/minute	2.00
478 or 578	20 pounds/minute	20.0
479 or 579	100 pounds/minute	100.0
480 or 580	200 pounds/minute	200
490 or 590	300 pounds/minute	300
VLP+ (with sensor option)	1000 pounds/minute	1000

- a. To change the full-scale range of the digital display place the control into the local mode of operation. (1-7)
- b. Turn **SETPOINT** knob (1-9) on the front panel counter-clockwise to 0%.
- c. Push and hold the display switch (1-10) to right. The display should read zero. If it does not read zero, contact the factory for assistance.
- d. Turn the set point knob (1-9) on the front panel full clockwise to 100%.
- e. Push and hold the display switch (1-10) to right. Adjust "Display Range-Coarse/Fine" trim pots (2-8) and (2-9), to achieve the desired full-scale flow rate range for the display to match the MagnaValve rating.
- f. To check the flow accuracy you must perform a catch and weigh test. Run shot through the MagnaValve for 1 minute and catch it in a container. Weigh the shot. This is the pounds/minute flow rate. If shot weighs more than the display amount, turn the span trim pot at the **MagnaValve** clockwise. If shot weighs less than indicated amount, turn the span trim pot at the **MagnaValve** counter-clockwise. Repeat the trial to confirm calibration.

The FC Controller span is factory set to translate the 0-5Vdc MagnaValve signal to 0-10Vdc levels for the controller. ***Shot flow rate calibrations should be made at the MagnaValve, not at the controller.***

**DO NOT ADJUST THE FC CONTROLLER SPAN. CALL THE FACTORY FOR ASSISTANCE!**

## 5. OPERATION

Operation consists of controlling shot flow rate through the MagnaValve and transmitting an alarm signal when flow rate is above or below the desired flow range. The output voltage for the MagnaValve is controlled by a servo loop by comparing the set point command to the actual shot flow rate.

- a. **SETPOINT** - To set desired flow rate, turn the set point knob and push Display Switch (1-10) to the right to read desired set point in the digital display. This will show the set point for either "Local" or "Remote" modes of operation. Release the Display Switch and the actual flow rate will again be displayed. The set point may be adjusted during use. It is optional (not necessary) to push the Display Switch to the right while changing the set point during normal operation.
- b. **ENABLE** - The FC controller can be automatically activated by a 90-115VAC remote "enable" signal when the mode switch (1-11) is in the "Ready" position (push to the left). The mode switch can be placed in the "off" position, the "On" position for manual operation, or the "Ready" position for automatic operation.
- c. **ALARM** - The alarm bandwidth is adjustable from 0 to 50% of full scale and is factory set at 5%. The customer may readjust to another value if desired. The alarm circuit is activated when the servo is "on" and the control is "Enabled". When the control is enabled the "Enable" LED.(1-2) will be lighted). The mid-point of the alarm band automatically follows the set point setting. The servo switch (1-11) must be on (up) for the alarms to function.

- d. **ALARM BAND** - The flow set point is also the  $\pm$  alarm mid-point. The alarm bandwidth, usually set at  $\pm 5\%$ , will track the flow set point. For example: with 1 pound/minute alarm bandwidth and a set point of 12 pounds/minute the alarms would be active below 11 and above 13 pounds/minute. Changing the set point to 15 would change the alarms to 14 and 16 pounds/minute automatically. The alarm bandwidth of  $\pm 1$  stays fixed until the alarm bandwidth is changed (see figure 2-7).
- e. **ALARM TIMER** - When the control is "enabled" and in automatic servo mode, the "High" (1-5) or "Low" (1-6) alarm light will come on if flow rate goes above or below the alarm limits. An adjustable timer, labeled "ALARM DELAY" (2-6) which is adjustable from 0 - 10 seconds, will start each time the "High" or (Low) lights come on. If the fault lasts longer than the timer setting the "High" (or "Low") lights will get brighter and the "High" (or "Low") alarm relay contacts will transfer and latch. The alarm will stay on after the "Enable" signal is removed until the alarm is reset.
- f. **ALARM RESET** - Activating the alarm-reset circuit (90-115VAC applied to Terminal #14) will cancel the alarm relay and the alarm "High" or ("Low") LED will go off. Continuous application of the reset signal will disable or inhibit the alarm output signal. The alarms are automatically reset upon receipt of each new "Enable" command.
- g. **REMOTE SETPOINT** - There are two conditions required for use of the remote setpoint. The set point "Local/Remote" switch (2-12) must be down in the remote mode. A yellow LED (1-8) on the front panel indicates operation in the remote mode. Apply a 0 - 10 Vdc analog remote set point command signal to the remote input, Terminal #10. A 0Vdc signal will correspond to a 0% flow rate command and 10 Vdc signal will correspond to a 100% flow rate. To verify the set point command, push and hold the display switch (1-10) to the right. The remote command may come from a remote pot or any 0 - 10Vdc signal source. An internal reference 10Vdc voltage for a (customer supplied) remote potentiometer (10k OHM) is available at Terminal #4.
- h. **MODE SWITCH** - The mode switch, (1-11) is used to turn the control "on" or "off" or to accept a remote "Enable" while in the "Ready" mode.
- i. **RECORDER OUTPUT**- An analog voltage recorder output signal Terminal #20 with a 0 - 10Vdc range is available to operate a strip-chart recorder or analog input card in data loggers. The minimum load on this output is 10K Ohms. Shielded cable (20AWG or larger gage) should be used and the shield should be connected to rear chassis of the FC control. This analog output signal is heavily filtered with a capacitor to provide noise immunity. Additional noise filtering may be necessary at the input terminals of your analog input card to prevent erroneous readings.
- j. **MAGNAVALVE** - During operation of the MagnaValve a red LED labeled Valve (1-3) will be on, showing that power is sent to the MagnaValve. The MagnaValve also has an LED on the valve driver junction box to show this function. This LED will pulse with the duty cycle (on time to off time ratio). A low duty cycle will provide a low flow rate and the Valve LED will be relatively dim. A long, or continuously on, duty cycle will provide for a high flow rate. At 100% duty cycle the Valve LED is constantly on and the permanent magnet field is completely canceled and no magnetic field exists in the MagnaValve and shot will fall freely through the valve. The MagnaValve has no moving parts.

## 6. STABILITY ADJUSTMENTS - (SERVO STABILITY)

The servo adjustments have been factory set to typical settings and the customer may fine-tune to optimize the speed of response if desired. Since there are many factors that determine system stability, these adjustments should be made slowly.

- a. **SERVO GAIN** - This adjustment sets the gain of the error amplifier over a range of 1% to 100%. Most systems may operate at 50% (full clockwise) for high gain. If a system is unstable, then reduce the gain to 25%.
- b. **SERVO RESET** - This adjustment determines the speed at which the output signal increases to achieve desired flow rate. A 75% value is set at factory for typical applications. Turning the servo reset clockwise will make it respond faster and turning it counter-clockwise will make it respond slower.

If the shot flow rate is not steady it will be necessary to perform a simple test. Place the "Servo" switch (2-11) down in its "off" position. Enable the control and slowly increase the set point from 0% until flow display reads your desired value. If the shot flow rate is still unstable then system itself is unstable. Since the control is in manual mode, if flow rate is unstable, then the machine itself is causing a problem, not the servo adjustments (The servo is off.). Refer to the Trouble-Shooting Section 12.

## 7. SPARE PARTS LIST

There are no spare parts for the FC controller. A spare controller should be purchased for an emergency or Electronics Inc. should be contacted for repair service.

## 8. WARRANTY

- a. Electronics Incorporated warrants this product to be free from defect in material and workmanship for a period of two years from the date of shipment. Defective units must be returned to Electronics Incorporated with shipping costs prepaid. Call for a Return Authorization Number and shipping instructions. Electronics Incorporated will repair or replace a defective unit at its option. No consequential liability is assumed. No other warranty, including merchantability or fitness for purpose, applies or is expressed or implied.
- b. Warranty work is only available at the factory. On-site service or start-up assistance is available at extra cost to the customer. See Section IX.
- c. Caution: Any customer attempts to modify or repair the product during the warranty period will terminate the warranty. Standard technician labor rates will be quoted prior to repair work.

## 9. SERVICE / START-UP ASSISTANCE

Service is an option available at the time of purchase or as required by customer. A purchase order is required prior to making a service call.

## 10. UPGRADES - REVISIONS

Design improvements are constantly being made to our products. Please contact Electronics Incorporated for details. When ordering spare units, please refer to model number and serial number of each unit.

## 11. AUTO-ZERO FEATURE

An auto-zero feature is available to maintain a true zero reading during the no-flow condition. This circuit monitors the flow signal and forces it to zero whenever the "Enable" is absent. A blue LED indicates that the auto-zero is active.

## 12. TROUBLE-SHOOTING GUIDE

### 1. SYMPTOM: Unstable operation.

If display indicates flow rate variations of more than 5%, check for the following:

- a) Air leaks - nozzle, hose, valve, etc.
- b) Pressure regulator malfunction (may be pulsing).
- c) Contaminated shot (dust, oil, water, and broken shot).
- d) Blast hose restricted during nozzle movement.

To determine if instability is caused by the shot peening machine or by the controller, put the servo switch (2-11) down in the off position. Turn on the machine and slowly increase the set-point until the display reads the desired flow rate. Since the servo mode is off, the controller is acting like a power supply to the MagnaValve with no flow rate feedback information. If the flow rate is unstable, the cause originates in the machine. If the flow rate is stable with the servo off, then the servo needs to be readjusted. Refer to Section VI Stability Adjustments.

### 2. SYMPTOM: Display reads high value and does not change.

- a) Wiring defect in the cable to the MagnaValve pre-amplifiers. Check voltages at Terminals #17 and #18 for proper connection to MagnaValve.
- b) Be sure MagnaValve is installed right side up (see flow arrow).
- c) Check to see if the lower portion of the MagnaValve is full of shot due to hose blockage etc.

### 3. SYMPTOM: Set point (front panel SETKNOB) does not control flow rate.

- a) Green LED (1 - 7) "Local" should be on for local set point knob operation.
- b) "Enable" signal must be present (Terminal #3). Also, the "Enable" LED must be lighted (1-2).
- c) MagnaValves operate using a magnetic field and have no moving parts. High differential air pressure in air peening applications or suction in wheel peening applications, may force shot through the valve. This symptom is characterized by having shot flowing when valve is off (red valve LED=off). For direct pressure air-peening systems, be sure air pressure in the pressure pot is equal to boost air supply. This will eliminate the differential air pressure that can force shot through the MagnaValve.
- d) MagnaValve valve driver module may be defective. The output current setting is listed on the valve driver module. Check the valve current with an ammeter in series with the wire lead from the controller to the valve driver module. Contact factory for assistance.

### 4. SYMPTOM: No alarm relay contact output.

- a) "Enable" *must* be on (1 - 2).
- b) "Servo" *switch* must be on (up) (2 - 11).
- c) "High" (1-5) or low (1-6) Alarm LED must be on (bright) for alarm relay contact to transfer.
- d) Check  $\pm$  alarm bandwidth; it may be too large.
- e) Check wiring from the terminals:
- f) "High" Alarm Relay Contact
- g) "Common" Alarm Relay Contact
- h) "Low" Alarm Relay Contact
- i) "Alarm Reset" signal, (115VAC) should be absent from terminal #14.

5. **SYMPTOM: Cannot achieve any flow, or flow rate is very low.**

- a) "Enable" light must be on (1 -2).
- b) Set point command must be present (check set point using toggle switch to right).
- c) Red LED "Valve" should be bright and blinking or constantly on. An internal circuit breaker has tripped if it is dim, Check for short circuit valve wiring at Terminals #7 and #8. To reset the circuit breaker, remove and re-apply the "Enable" signal.
- d) Check Red LED at MagnaValve junction box, if it is not "on", check for a wiring problem. If it is "on" measure the current going to the valve driver module. It should be approximately equal to the valve driver current written on the valve driver module label.
- e) Check for contamination in or above MagnaValve, especially check for water, oil, or dust mixture in the shot, or other obstructions.
- f) MagnaValve or valve driver module may be defective. To check, remove the MagnaValve from the machine (keep wires attached). "Enable" the output and get red LED valve "on" at 100% duty cycle. When Valve LED is on, the magnetic field inside the MagnaValve should be perfectly canceled. No shot should stick inside the MagnaValve. If any shot sticks to the valve, then either the valve driver module or the MagnaValve is defective. Measure the dc current going to the valve driver module in the red wire. This should be approximately 0.5 to 0.7 Amps dc. Compare your measurement to the value written on the label of the valve driver module. If your reading is not within 10%, then the valve driver is defective or not adjusted properly. Try adjusting the drive current to the listed value, if the current does not change with adjustment then the valve driver module is defective and must be replaced. Be sure the replacement valve driver is pre-calibrated to the same value as the original module. If your reading is within 10% of the original valve driver calibration, the valve driver module is OK but the valve is defective.

6. **SYMPTOM: High flow alarm or flow continues when the set point is reduced or the "Enable" is turned off.**

The MagnaValve is leaking shot. This is usually caused by pressure difference above and below the valve. Direct pressure air blast systems: The boost air pressure must be equal to the pressure vessel pressure. Gravity fed (suction) air blast systems: The suction induced by some venturi nozzles is quite large. Be sure there is a large (1/2") aspiration air inlet near the bottom of the MagnaValve. The shot needs air to convey it to the nozzle. Older practice was to "choke" the shot like a carburetor to get a richer flow rate. Since the MagnaValve acts more like a fuel injector, this choking is not required.

7. **SYMPTOM: Shot flow rate is erratic or unstable.**

- a) New installations - refer to servo adjustments.
- b) Old installations - machine worked fine until recently.
- c) Check shot for cleanliness.
- d) Check shot for cleanliness.
- e) Check shot for cleanliness.
- f) Do not adjust servo adjustments.
- g) Call the factory for advice.

**NOTE:** This category is the most challenging to troubleshoot. Shot cleanliness and foreign objects are usually the problem. Items such as: wire (from identification tags), welding rod, nuts-bolts from machine or screen separators, masking tape, razor blades, milk cartons, cigarette butts, etc., seem to find their way to the valve. Remove the MagnaValve and inspect it for contamination. Be sure the shot hopper does not have contamination.



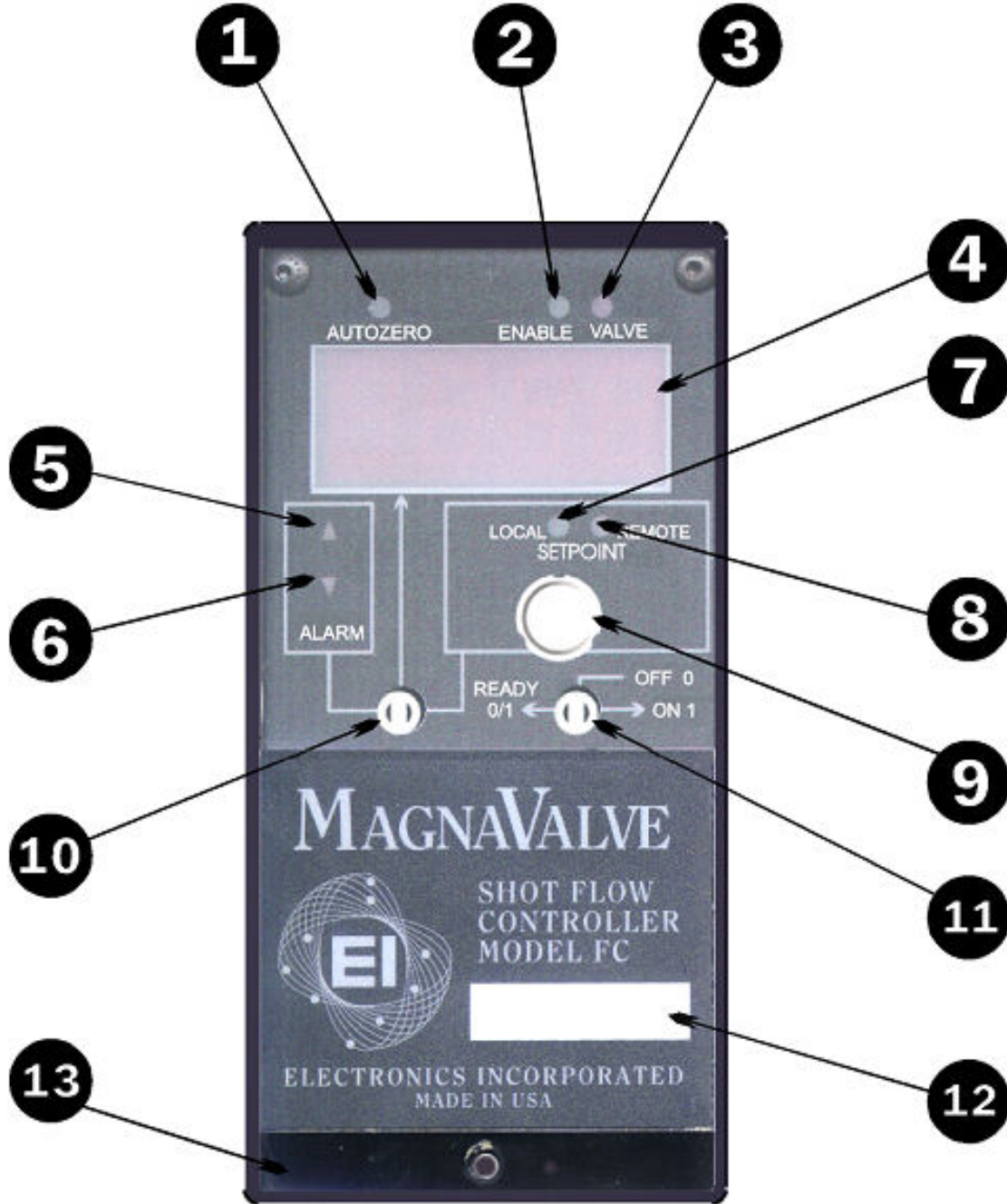
**13. MAINTENANCE:** There is no maintenance required for the FC controller other than calibration tests as needed by user.

#### **14. FIGURE 1 FRONT PANEL (Operator Controls)**

<b>ITEM</b>	<b>DESCRIPTION</b>
1.	<b>AUTO-ZERO</b> - This LED indicator is on when the Auto-Zero function is forcing the display to zero. The valve "Enable" must be off for this function to operate. The Auto-Zero may be disabled, see figure 2.
2.	<b>ENABLE</b> - This LED indicator will be on if the mode switch is "on" or "ready" and the customer applies 115VAC to Terminal #3 (control enable).
3.	<b>VALVE</b> - This LED indicator shows power output to the MagnaValve at a fixed 8 Hertz rate and variable duty cycle.
4.	<b>DIGITAL DISPLAY</b> - Indicates the shot flow rate. Pushing the Display Switch (1-11) to the right displays the set point command instead of the flow rate. Pushing the display switch to the left displays the $\pm$ alarm bandwidth.
5.	<b>HIGH ALARM</b> - This LED indicator will be on when the control is enabled and if the flow rate is more than the high alarm trip point. It gets brighter at the expiration of alarm time delay and the high alarm relay contact will close.
6.	<b>LOW ALARM</b> - This LED indicator will be on when the control is enabled and if flow rate is less than the low alarm trip point. It gets brighter at expiration of the alarm time delay and the low alarm relay contact will close.
7.	<b>LOCAL</b> - This LED indicator shows that the control is in the local mode and the set point knob below it will command the shot flow rate. When this indicator is on the remote mode indicator is off.
8.	<b>REMOTE</b> - This LED indicator shows that the control is in the remote mode and a remote analog 0-10 Vdc command is expected at terminal #10. The Set point knob is not active when the remote LED is on.
9.	<b>SETPOINT KNOB</b> - This knob will set the desired shot flow rate and the midpoint of the alarm bandwidth when the control is in local mode (local LED indicator must be on). Push Display Switch to the right to display the set point.
10.	<b>DISPLAY SWITCH</b> - Push to the left to read the alarm bandwidth. Push to the right to read set point command. When in the center the flow rate (lbs./min or amps) is displayed.
11.	<b>MODE SWITCH</b> - This switch determines the controller mode of operation. Right = Forced on Middle = Forced off Left = Ready (waiting for 115VAC "Enable" signal from machine at terminal #3)
12.	<b>DECAL</b> - Model Number is shown on this decal. Space is provided for customer annotation.

13. **CALIBRATION DECAL** - Customer may place a calibration decal here to restrict access to the internal adjustments normally made by technicians only.

**FIGURE 1. FRONT PANEL - Operator Controls**

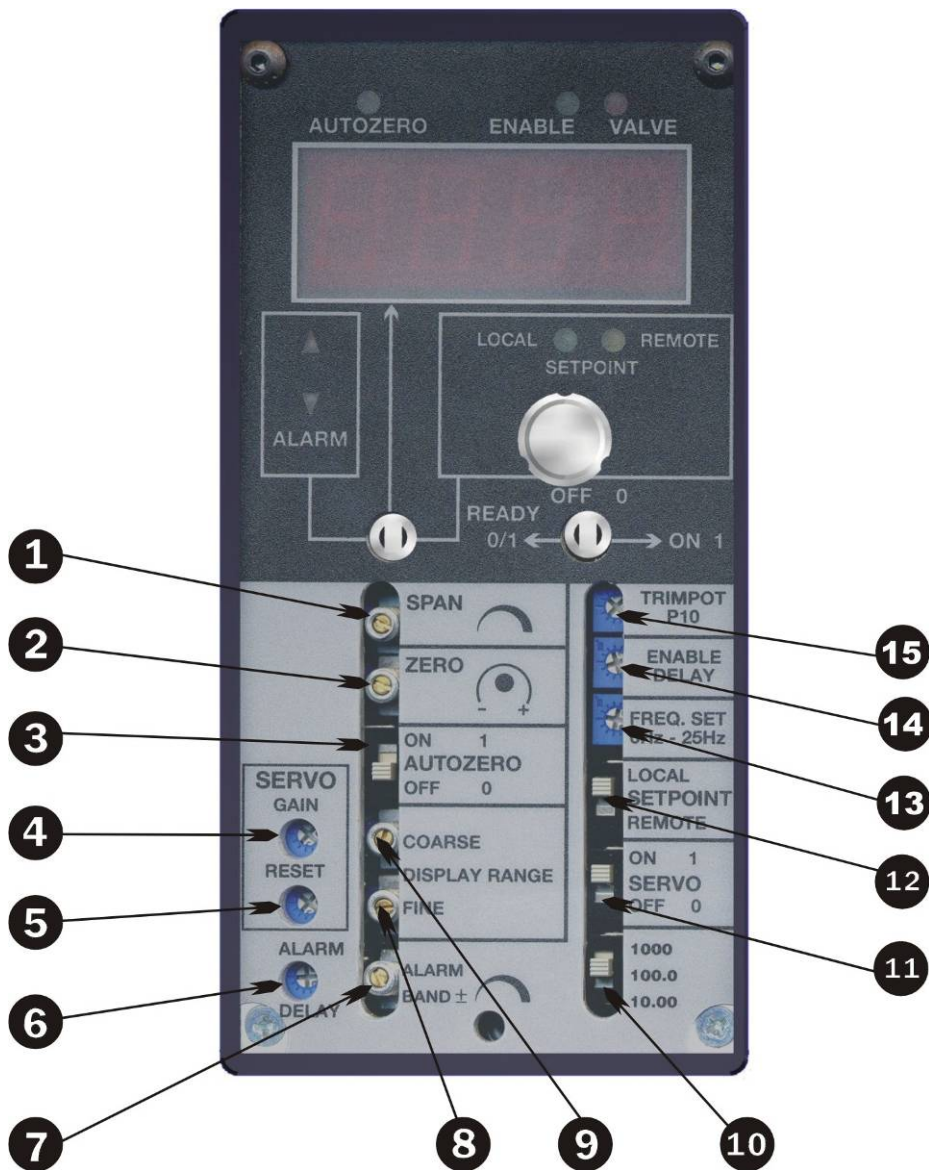


## 15. FIGURE 2 FRONT PANEL (Technician Adjustments)

ITEM	DESCRIPTION
1.	<b>SPAN</b> - Used to adjust the amplitude of the feedback signal and is factory set to convert 0-5Vdc to 0-10Vdc. Flow calibration adjustments for catch and weigh test should be made at the MagnaValve. <b>Please do not adjust the SPAN. This is a factory adjustment. Do not remove the calibration sticker.</b>
2.	<b>ZERO</b> - Used to adjust the input signal on the Digital Display to zero during a no flow condition. .
3.	<b>AUTO-ZERO SWITCH</b> - Will activate or deactivate the Auto-Zero function. Auto-Zero forces the Digital display to zero whenever the enable signal is off. The Auto-Zero blue LED indicator will show that it is active. It may not be necessary to zero the display using the "ZERO" trimpot when switching the Auto-Zero "On" or "Off".
4.	<b>SERVO GAIN</b> - Used to adjust the gain of the error amplifier in the servo. High gain requires less error to cause servo correction. Turn clockwise for more gain. If gain is too high the servo may be unstable.
5.	<b>SERVO RESET</b> - Used to adjust the speed of servo response. Faster reset allows faster response to an error condition. Turn clockwise for faster reset. If Reset is too fast the servo may be unstable.
6.	<b>ALARM DELAY TIME</b> - Used to set the time allowed before the alarm relay contact will operate. The "High" or "Low" alarm LED's will go to a bright condition when this timer expires. The range is 0-10 seconds.
7.	<b>ALARM BANDWIDTH</b> - Used to set the width of the alarm zone. Turn fully counter-clockwise for 0% alarm bandwidth or clockwise for increasing alarm bandwidth up to $\pm 50\%$ . The alarm midpoint follows the command setpoint. Push the display switch to left to display alarm bandwidth.
8.	<b>DISPLAY RANGE FINE</b> - Used to adjust the Digital Display range to the full-scale range desired. Turn clockwise for larger values.
9.	<b>DISPLAY RANGE COARSE</b> - Used to adjust the Digital Display range to the full-scale range desired. Turn clockwise for larger values.
10.	<b>DIGITAL DISPLAY DECIMAL POINT</b> - Switch is used to choose the decimal point position in the Digital display. Choices are: 1000/100.0/10.00.
11.	<b>SERVO SWITCH</b> - Used to control the servo. Up is "on" for automatic servo control. Down is "off" for manual operation. The alarms do not function and no flow rate servo correction is provided when the servo is off.
12.	<b>SETPOINT LOCAL/REMOTE</b> - Used to select whether the setpoint command comes from the front panel knob or from an external remote analog 0-10 Vdc command.

13. **FREQUENCY ADJUST**- Factory set at 8 Hertz. Used to adjust the frequency of the pulse output signal to the MagnaValve. The new 1xxx series MagnaValves can be set to 8-20 Hertz.
14. **ENABLE DELAY** - Used to adjust the time delay (0-10sec.) from receipt of enable signal until valve output. Useful in direct pressure blasting machines to allow air pressure to stabilize prior to starting the valve. For suction blast or wheel-blast machines this should be set to zero or fully counter-clockwise.
15. **N/A** -Used for future application.

**FIGURE 2. FRONT PANEL - Technician Adjustments**



## 16. SPECIFICATIONS for P/N 999234

Power: 115 Vac, 50/60 Hertz, 50VA No internal fuse (1 Amp recommended)

Inputs: Flow Sensor Voltage Input (0-5 Vdc)  
 Remote Command setpoint (0-10 Vdc)  
 Enable (115 ±5v 50/60 Hz)  
 Alarm Reset (115 ±5v 50/60 Hz)

Output: Valve Power: 50 Vdc PWM at 8-20 Hertz  
 Recorder Analog Output: 0-10 Vdc  
 Alarm Relay Contacts: MAX. (125 Vac 60Vdc @ 1 Amp)  
 Excitation Voltage: +/- 12 Vdc @ 100mAmp  
 Reference Voltage: +10.00 Vdc @ 10mAmp

Weight: 5 Lbs. (2.2Kg)

Display Range: 0 - 1999

Decimal Pts: 1000 / 100.0 / 10.00

Alarm Band: 0 - 50% of full scale

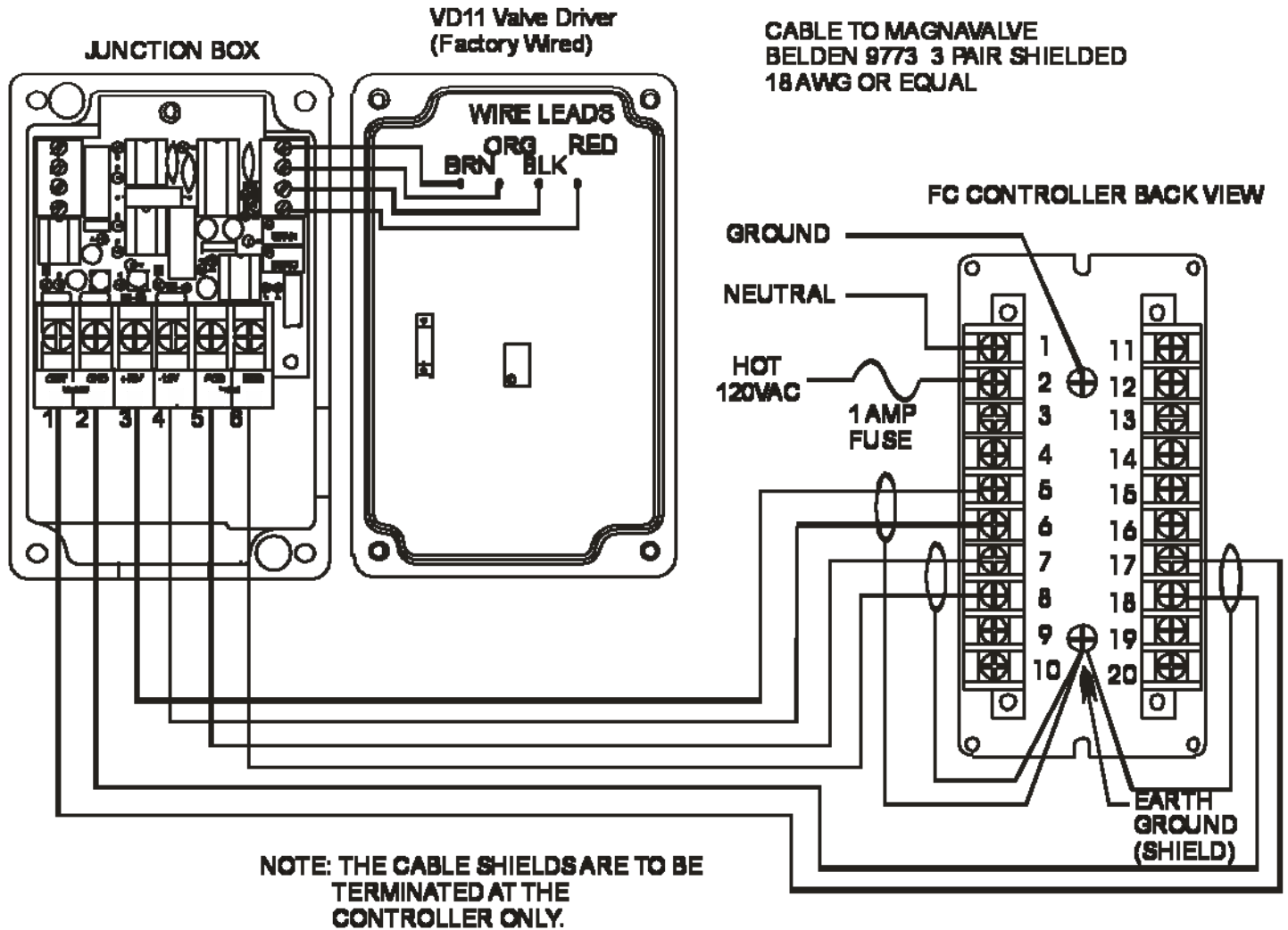
Alarm Delay: 0 - 10 Seconds

Auto-Zero: +/- 20% of full scale



# 17. WIRING CONNECTIONS for P/N 999234

## WIRE CONNECTIONS FOR AN FC FLOW CONTROLLER TO THE FOLLOWING VALVES: 577, 578, 579, 580, 590, AND ALL 15XX SERIES VALVES



**18. SPECIFICATIONS for P/N 999234.B**

Power: (90-120VAC @ 60Hz) (110-120VAC @ 50Hz), 25VA  
 Inputs: Voltage Signal Input (0-5 Vdc)  
 Remote Command Setpoint Input (0-10 Vdc)  
 Enable (90-120VAC @ 60Hz) (110-120VAC @ 50Hz)  
 Alarm Reset (90-120VAC @ 60Hz) (110-120VAC @ 50Hz)

Outputs: Valve Power: 50 Vdc PWM at 6-25 Hertz  
 Recorder Analog Output: 0-10 Vdc  
 Alarm Relay Contacts: 120VAC @ 1A  
 Excitation Voltage: +/-12Vdc @ 100mA  
 Reference Voltage: +10Vdc @ 10mA

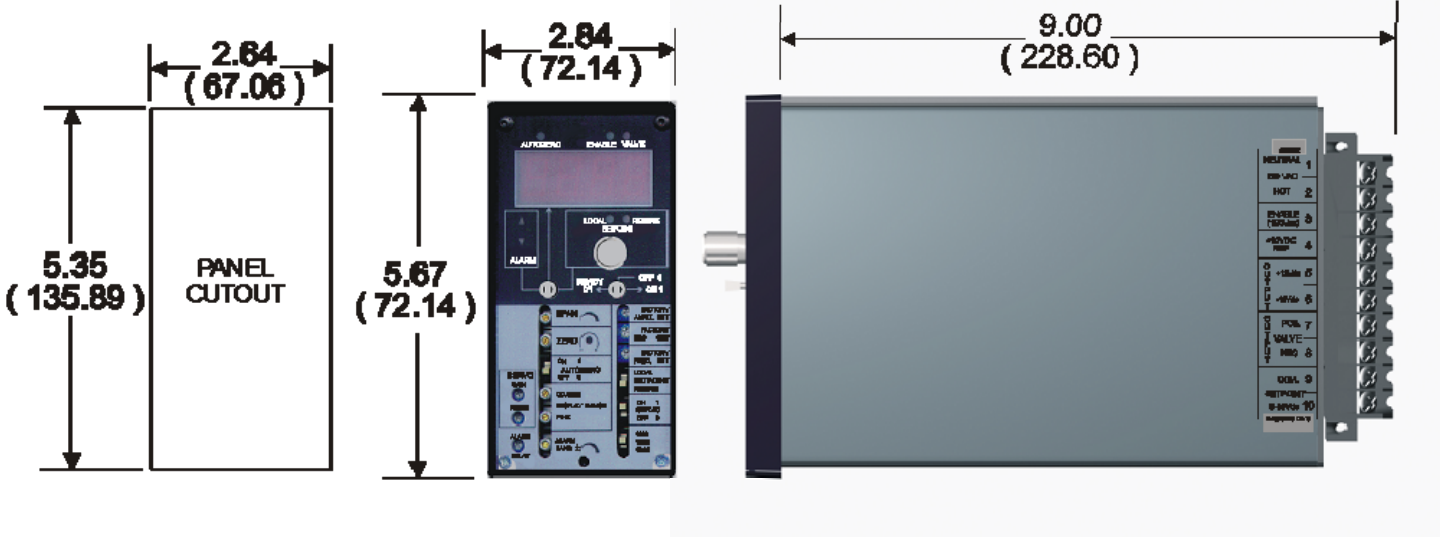
Weight: 5 Lbs. (1.8 kg)

Display Range: 0 - 1999 counts

Decimal Places: 1000 / 100.0 / 10.00

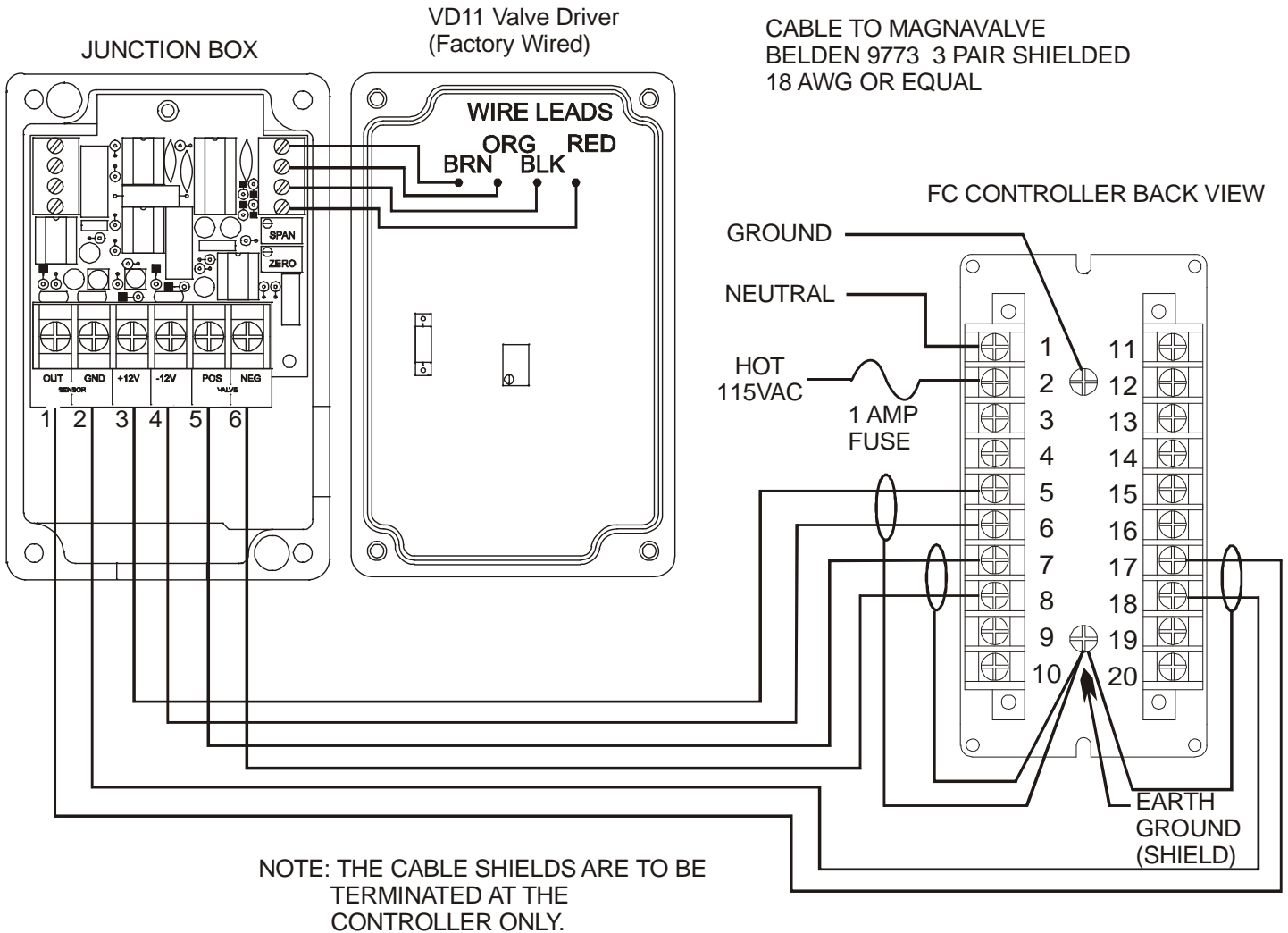
Alarm Band: 0 - 50% of full scale

Alarm Delay: 0 - 10 Seconds



## 19. WIRING CONNECTIONS for 999234.B

### WIRE CONNECTIONS FOR AN FC FLOW CONTROLLER TO THE FOLLOWING VALVES: 577, 578, 579, 580, 590, AND ALL 15XX SERIES VALVES





## 20. SPECIFICATIONS for P/N 999234.C

Power: 115 Vac, 50/60 Hertz, 50VA No internal fuse (1 Amp recommended)

Inputs: Flow Sensor Voltage Input (0-5 Vdc)  
 Remote Command setpoint (0-10 Vdc)  
 Enable (115 ±5v 50/60 Hz)  
 Alarm Reset (115 ±5v 50/60 Hz)

Output: Valve Power: 50 Vdc PWM at 6-25 Hertz  
 Recorder Analog Output: 0-10 Vdc  
 Alarm Relay Contacts: MAX. (125 Vac 60Vdc @ 1 Amp)  
 Excitation Voltage: +/- 12 Vdc @ 100mAmp  
 Reference Voltage: +10.0 Vdc @ 10mAmp

Weight: 5 Lbs. (2.2Kg)

Display Range: 0 - 1999

Decimal Pts: 1000 / 100.0 / 10.00

Alarm Band: 0 - 50% of full scale

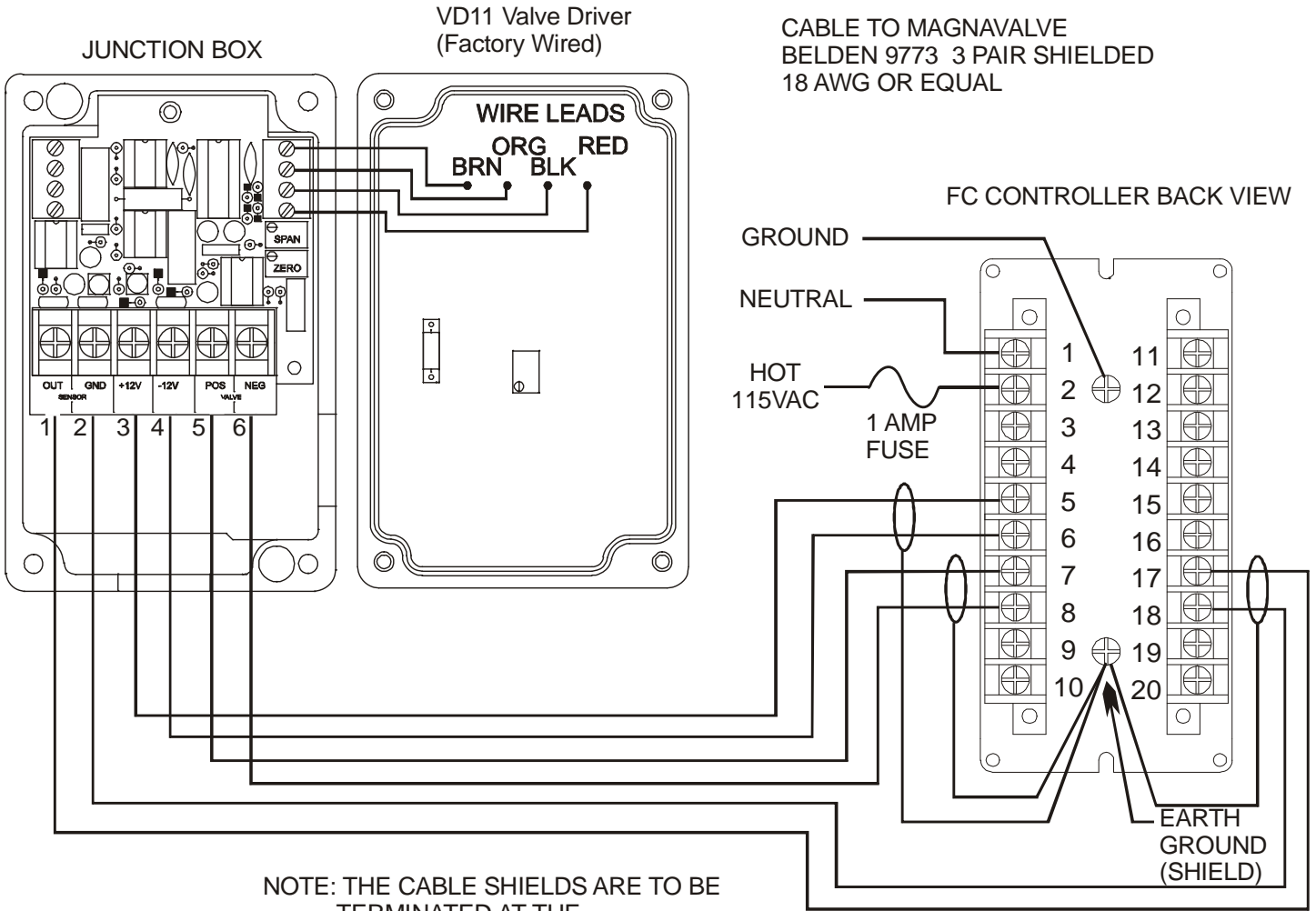
Alarm Delay: 0 - 10 Seconds

Auto-Zero: +/- 20% of full scale



**21. WIRING CONNECTIONS for P/N 999234.C**

**WIRE CONNECTIONS FOR AN FC FLOW CONTROLLER TO THE FOLLOWING VALVES:  
577, 578, 579, 580, 590, AND ALL 15XX SERIES VALVES**



NOTE: THE CABLE SHIELDS ARE TO BE TERMINATED AT THE CONTROLLER ONLY.

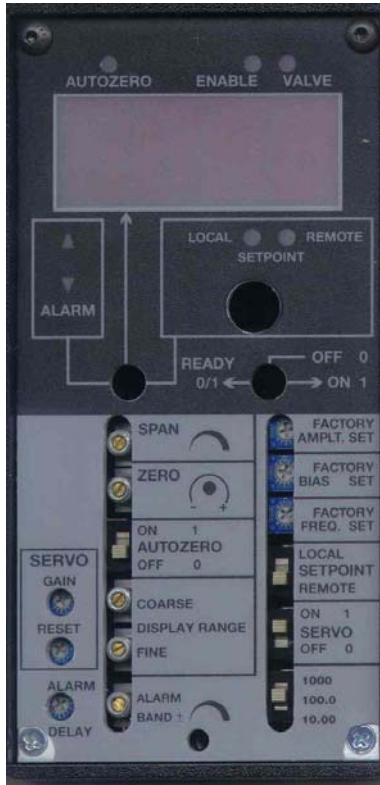


## 22. REAR TERMINAL STRIP LEGEND

- |                                     |                                      |
|-------------------------------------|--------------------------------------|
| 1. Power Neutral (115Vac)           | 11. High Alarm Relay Contact         |
| 2. Power Hot (115Vac)               | 12. Common Alarm Relay Contact       |
| 3. Enable Input (115Vac)            | 13. Low Alarm Relay Contact          |
| 4. (+) 10Vdc Reference Output       | 14. Alarm Reset Input (115Vac)       |
| 5. (+) 12Vdc Excitation Output      | 15. No Connection                    |
| 6. (-) 12Vdc Excitation Output      | 16. No Connection                    |
| 7. (+) MagnaValve Output            | 17. Voltage Input (0-5Vdc)           |
| 8. (-) MagnaValve Output            | 18. Input Common                     |
| 9. Circuit Common                   | 19. Circuit Common                   |
| 10. Remote Setpoint Input (0-10Vdc) | 20. Recorder Output Signal (0-10Vdc) |

**NOTE: Green screw for earth-chassis ground on back panel is provided for cable shields (screens).**

## 23. CONTROLLER POWER REQUIREMENTS

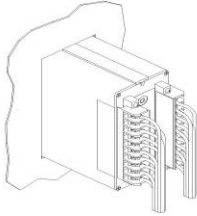
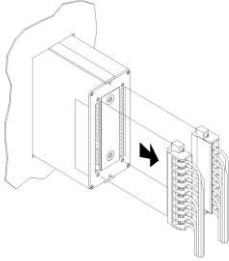
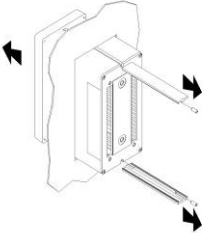
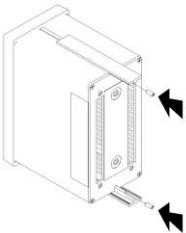
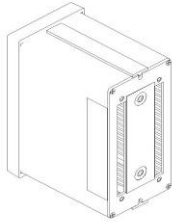
The model AC, FC and MC controllers were originally designed to operate from 120VAC (version A). In late 2001 a design change was made to accommodate 90-240 Vac European applications (version B). Then, in 2002, for USA requirements, we upgraded the domestic version only, to version C. See notes below for the serial number ranges.

		
Version A	Version B	Version C
<b>120VAC</b> (replaced by version C) <b>NOT AVAILABLE</b>	<b>90-240VAC Range</b> <b>NOT AVAILABLE</b>	<b>115VAC</b> <b>ONLY</b>
S/N prior to 01219	S/N 01219-001 to 02279-129	S/N 02279-130 and up
NOTE: Relay contacts are rated 120VAC	NOTE: Relay contacts are rated 120VAC	NOTE: Relay contacts are rated 115VAC

Serial Number description: S/N 12345-678

Digits 1-2 are for year, (01=2001, 02=2002, etc.)  
 Digits 3-5 are manufacturing batch lot number

## 24. HOW TO RETURN A CONTROLLER FOR REPAIR

<p>1</p>  <p>Installed in panel. Turn "Off" all power sources to controller before going to step 2.</p>	<p>2</p>  <p>Remove terminal blocks and leave wires attached.</p>
<p>3</p>  <p>Remove Rails and Rail Mounting Screws. Slide controller forwards.</p>	<p>4</p>  <p>Slide Rails back on and install the Rail Mounting Screws.</p>
<p>5</p>  <p>Controller is ready to return.</p>	<p>6</p> <p>Call 1-574-256-5001 ask for a Returns Goods (RG) Number (#)</p> <p>Ship controller with RG # to:</p> <p>Electronics Incorporated 56790 Magnetic Drive Mishawaka, IN 46545</p>

END OF MANUAL