24Vdc MAGNAVALVES FOR WHEEL BLAST MACHINE SHOT FLOW CONTROL

Models included in this manual:
LP-24-S 800 Kg/min 1800 Lbs/min

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Made in the USA
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODUCT DESCRIPTION</td>
<td>3</td>
</tr>
<tr>
<td>THEORY OF OPERATION</td>
<td>3</td>
</tr>
<tr>
<td>LOCATION OF ADJUSTMENTS</td>
<td>3</td>
</tr>
<tr>
<td>PRELIMINARY ADJUSTMENTS</td>
<td>3</td>
</tr>
<tr>
<td>INSTALLATION</td>
<td>4</td>
</tr>
<tr>
<td>GENERAL WIRING DIAGRAM</td>
<td>5</td>
</tr>
<tr>
<td>GENERAL SPECIFICATIONS</td>
<td>6</td>
</tr>
<tr>
<td>BASIC WIRING CONNECTIONS TO PLC</td>
<td>6</td>
</tr>
<tr>
<td>PLC W/SERVO AND MAGNAVALVES</td>
<td>7</td>
</tr>
<tr>
<td>FRONT PANEL DESCRIPTION</td>
<td>7</td>
</tr>
<tr>
<td>OPERATION</td>
<td>8</td>
</tr>
<tr>
<td>FRONT PANEL</td>
<td>8</td>
</tr>
<tr>
<td>VD13HT DATA</td>
<td>9</td>
</tr>
<tr>
<td>GENERAL DIMENSIONS</td>
<td>11</td>
</tr>
<tr>
<td>CALIBRATION</td>
<td>12</td>
</tr>
<tr>
<td>SPARE PARTS LIST</td>
<td>21</td>
</tr>
<tr>
<td>MAINTENANCE</td>
<td>21</td>
</tr>
<tr>
<td>TROUBLE-SHOOTING GUIDE</td>
<td>22</td>
</tr>
</tbody>
</table>
1. PRODUCT DESCRIPTION
The redesigned 24V Series MagnaValves provide improved performance and reliability with an easier calibration mode. MagnaValves regulate the flow of ferrous media in abrasive blast cleaning and shot peening machines. The LP-24-S valves have a magnetic control section (upper portion) and a shot flow rate sensing section (lower portion). This system of control makes the valve useful in both Open Loop and Closed Loop systems. The flow rate capacity determines the size of the valve, either in lbs/min. or in kg/min. The LP-24-S Series of MagnaValves find their use in wheel-blast applications.

Specifying calibration in lb/minute or kg/minute, as well as type and size of shot with order.

2. THEORY OF OPERATION
MagnaValves have no moving parts, they rely upon very strong permanent magnets and cancellation electromagnets to regulate the flow rate of shot. A signal from a shot flow controller, model FC-24, will provide the appropriate control signal for flow rate. The customer supplies an external 24Vdc power source required to power both the MagnaValve and FC-24 controller. The internal circuitry accepts a 0-10Vdc control signal and converts this signal to a proportional duty-cycle control of the output signal for shot flow. As the shot falls through the lower sensing portion of the valve, a 0-10Vdc signal is generated and sent back to the FC-24 controller as a flow feedback signal. The controller compares this feedback signal to the requested shot flow rate and adjusts the output signal and sends it back to the MagnaValve to complete the closed-loop cycle of control.

3. LOCATION OF ADJUSTMENTS
All of the adjustments are accessible from the front of the MagnaValve (see figure on page 13 for details). It is inadvisable to change the factory settings. The identification label shows the rated flow range. The calibrated valve produces a 10Vdc output signal at the specified range, be it calibrated for kg/min or lb/min.

4. PRELIMINARY ADJUSTMENTS
There are no preliminary adjustments required but, after installation, it is recommended that the zero adjust on the valve be fine-tuned. The valve is tested and calibrated at the factory prior to shipment. The product label lists the full-scale range of the valve as well as the media type and size.
5. INSTALLATION

Mount the MagnaValve in a vertical position with an adequate supply of media above it. Be sure that the valve can be easily removed to clear any debris or contaminants that may become lodged in the valve. A slide gate shut-off above the valve will allow valve removal without the need to empty the shot hopper.

The MagnaValve must be mounted in a vertical position, paying attention to the "flow arrow" decal on the outer housing. Mounting the valve at more than 5 degrees from vertical will promote rapid wear of the internal flow path and may also restrict the maximum flow rate. Mounting the valve in the non-vertical position is not recommended.

NOTICE: Failure to maintain shot quality may affect valve performance. Excessive dust, fines, broken shot, oil, water, etc., may reduce or completely stop shot flow.

Vacuum generated by a wheel may cause erratic performance of the valve. A special air aspiration ring has been built into the valve to reduce the wheel-vacuum effect.
Make connection from power supply directly to the MagnaValve to prevent high current voltage drops.
Use 18 AWG or larger wire size for connections to the controller.
Be sure the power supply is regulated and capable of 2Amp (50VA) output.

**General Wiring**

**BASIC WIRING CONNECTIONS 24VOLT SERIES FLOW CONTROL MAGNAVALVES**

- **Valve #1**
- **Valve #2**
- **Junction Box**
- **Main Panel**
- **Control #1**
- **Control #2**

**Wiring Connections FC-24**

1. 0Vdc
2. Remote Set Point input 0-10Vdc
3. 0Vdc
4. Enable Input (24Vdc)
5. 0Vdc
6. Process Input (0-10Vdc)
7. Process Input (0-10Vdc)
8. Servo Output (0-10Vdc)
9. Enable Output (24Vdc)
10. 0Vdc
11. 0Vdc
12. Alarm Reset (24Vdc)
13. High Alarm relay Contact
14. Relay Contact Common
15. Low Alarm relay Contact
16. Flow OK relay Contact
17. 0Vdc
18. Recorder Output (0-10Vdc)
19. Power (24Vdc)
20. 0Vdc

**Wiring Connections LP-24-S**

1. White 0-10Vdc Out
2. Process 0Vdc
3. Green 0Vdc
4. Orange 0-
**GENERAL SPECIFICATIONS FOR 24V SERIES MAGNAVALVES**

### SENSOR

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>LED'S</td>
</tr>
<tr>
<td>Enable</td>
<td>Command</td>
</tr>
<tr>
<td>Output</td>
<td>0 - 10Vdc</td>
</tr>
<tr>
<td>Adjustments</td>
<td>Zero, Span</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 3%</td>
</tr>
</tbody>
</table>

*Using S-110 Cast Steel Shot

See MagnaValve Data Sheet for more Details

### VALVE

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>+24Vdc @ 2A</td>
</tr>
<tr>
<td>Calibration</td>
<td>1800 lbs/min</td>
</tr>
<tr>
<td>Max. Pressure</td>
<td>100 PSI</td>
</tr>
<tr>
<td>Media</td>
<td>Steel shot</td>
</tr>
<tr>
<td>Mode</td>
<td>Normally closed</td>
</tr>
<tr>
<td>Temp. Range</td>
<td>40 - 120 F/ 5 - 50 C</td>
</tr>
</tbody>
</table>

**CONTROL**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>0-10Vdc Into 100K</td>
</tr>
<tr>
<td>Enable</td>
<td>24Vdc @ 10mA</td>
</tr>
</tbody>
</table>

See MagnaValve Data Sheet for more Details

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**BASIC WIRING CONNECTIONS 24VOLT FLOW CONTROL MAGNAVALVES TO PLC**

[Diagram of wiring connections]

Note: Cable from Junction box to Main Panel not to exceed 50FT. Use 18 AWG or larger wire size.
24Vdc MagnaValves with built-in flow sensors operate with the model FC-24 control. These controls provide the servo loop the function to set and maintain the shot flow rate. They can receive an analog 0-10Vdc signal from a customer supplied remote analog voltage for the set point or they can operate independently without customer computer interface.

24Vdc MagnaValves can be used with customer supplied servo loop software as shown in the diagram above. The PID sends a control signal (0-10Vdc) directly to the MagnaValve along with the 24Vdc Enable signal.

**Servo Loop Theory:**
A setpoint command is generated at (1) to establish the desired flow rate in pounds/minute or Kg/minute with 10Vdc representing 100% of the MagnaValve calibrated flow range. The PID function (2) will compare the setpoint to the feedback signal(5) from the MagnaValve (4). The PID output (3) will start at 0Vdc and slowly increase towards 10Vdc. The PID output continues to increase until the MagnaValve feedback signal (5) matches the setpoint value (1). At this time the PID signal (3) will hold its value to maintain the requested flow rate.

**Example:** If the required flow rate is 18 pounds/minute (90% of 0-20 pound/minute calibrated capacity of the MagnaValve), the PID function would generate a slowly increasing output voltage which results in a slowly increasing shot flow rate and, therefore, a slowly increasing feedback signal (5). When the setpoint signal and feedback signal are equal, the PID output will hold its present value and the required shot flow rate will be maintained.

The PID output (3) is analogous to a car’s cruise control. The driver will not need to know the exact position of the gas pedal to make the car move at 55 mph. When the car goes up-hill, the gas pedal will move forward to maintain 55 mph. As the car goes downhill the gas pedal will move back to maintain 55 mph. In a similar manner, the exact voltage coming from the PID amplifier (3) is not important as long as the valve maintains 18 lbs/min. flow rate.

**6. VALVE SENSOR FRONT PANEL DESCRIPTION**
The front panel of the Valve Sensor contains the four LED’s used for diagnostics. To gain access to the factory adjustments, remove the large knurled screw on the front cover. Please refer all adjustments to qualified personnel. Changing the gain will affect the valve calibration accuracy and should only be done when catch-and-weigh test results are available. See figure 1 for additional information.
7. OPERATION
Signals used to operate the MagnaValve originate at the FC-24 Controller. There are three conditions necessary for correct operation. See figure 1 for additional information.
7.1 Power – Continuously apply the 24 Vdc power to the valve. The valve requires 1.4 amps for operation and a power supply rated at 50 VA. The voltage should be 24 ± 2 Vdc.
7.2 Enable – Use the 24 Vdc ENABLE signal to activate the valve.
7.3 Input Signal – The analog 0-10 Vdc input signal must be above 0.25 Vdc as a minimum flow command signal.

8. VALVE SENSOR FRONT PANEL

Zero – Turn adjustment until both LED’s are OFF or blinking. This will set the output signal to zero ± .050 Vdc during no-flow.

Gain – This section controls the amplification or gain of the sensor signal. It has been factory set (see label for flow range). If the gain is changed it will be necessary to run a one minute catch-and-weigh test to confirm the calibration. The full scale output signal is set to 10 Vdc for calibration flow range. (1800lbs/min.)

Note: Be sure only one gain switch is selected (up position). Use the “Gain Adjust” for fine adjustments.

Valve Pulse – This is located on the back of the VD-13-HT mounted on the LP valve. This is the rate at which the valve dispenses shot, similar to a heart beat rate. It is factory set to match the best flow characteristics of the media (cast steel, cut wire or micro-bead). Typical operation is set at 8 Hertz.

Program Port
This is used for advanced calibration. An optional cable is needed to use this function. The PA-24 Program Cable.
P/N: 980090

Test Socket – This socket provides access to diagnostic voltages.

1. 0-10 Vdc Input
2. 0-10 Vdc Output
3. Sensor Frequency
4. 24 Vdc Supply
5. N/A
6. 0 Vdc Common
Diagnostic LED’s

**VALVE ON** – This is located on the VD-13-HT mounted on the LP valve. When this LED is on, the electromagnet is receiving power. When the LED is off, the permanent magnets will hold or block the shot flow. When the LED is fully on the valve is on for full capacity flow rate. When the LED is blinking, the electromagnet is regulating the shot flow.

**Vin > 0.25 Vdc** - This LED indicates that the valve is receiving an analog signal input greater than 0.25 Vdc. When this LED is off there is no media flow allowed. The input signal range is 0-10 Vdc. At 10 Vdc the valve will “open” to full capacity, which is usually 10% to 50% higher than the calibrated range. The relationship between the 0-10 Vdc input signal and actual flow rate is nonlinear. The output signal 0-10 Vdc signal is linear and this makes accurate regulation by the FC-24 control possible.

**24Vdc ENABLE** – This LED indicates that the valve is receiving a 24 Vdc Enable signal. When this LED is off the valve is inhibited, and no shot will flow. This feature is an on-off action so there is no need to disable or remove the 0-10 Vdc input signal.

**24 Vdc Power** – This LED indicates that 24 Vdc is available to operate the electromagnets for media flow. It should always be available and able to supply 2 Amps. If the LED is blinking the supply is out of recommended operating range +/- 2VDC (22-26VDC). If the LED is Green then there is a valve failure, please call factory.

*All of the LED’s must be on in order to have media flow.*
The VD13(HT) Valve Driver Module regulates current to the magnavalve solenoid to provide proper cancellation of the permanent magnetic field. When the green VALVE ON LED is on, the cancellation current reduces the magnetic field to zero, allowing the shot to flow through the valve.

The factory setting for the current is recorded on the product label affixed to the valve driver module. When replacing a Valve Driver Module, the new unit must be adjusted to the same cancellation current as the faulty module. See the calibration instructions for more information.

**Basic Operation:**

When the VD13(HT) Valve Driver Module is connected to a 24Vdc supply, the red POWER LED will remain lit if the supply voltage is within ±2 Vdc.

A 24Vdc ENABLE Signal and a 0.25 Vdc to 10 Vdc Flow Signal must be present for the valve to activate.

The Flow Signal must be more than 0.25Vdc for yellow Vin LED to light.

The VALVE ON LED will blink when valve is regulating media. When valve is completely open the LED will fully stay on.
SET-UP

Calibration Method 1

1. Adjust control for 100% output (green LED constantly on).
2. Adjust trimpot on valve driver until magnetic field goes to zero.
3. Verify neutral field, no shot should stick to inside of valve.

Calibration Method 2

1. Adjust control for 100% output (green LED constantly on).
2. Adjust trimpot on valve driver until the current on the old valve driver is achieved.
   (Measure current on Test Points)
3. Verify neutral field, no shot should stick to inside of valve.

Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage:</td>
<td>24 Vdc</td>
</tr>
<tr>
<td>Output Current:</td>
<td>0 - 2.0 Amps</td>
</tr>
<tr>
<td>Power Dissipation:</td>
<td>48W (max)</td>
</tr>
<tr>
<td>Connections:</td>
<td>Removable Screw Terminals</td>
</tr>
<tr>
<td>Magnavalve Models:</td>
<td>LP/VLP-24</td>
</tr>
</tbody>
</table>

These Test Points are used to measure current. Measure the DC Volt setting across a 0.5 ohm shunt and multiply by 2 for the value.

The Pulse Rate trimpot adjusts the value of flow rate which is indicated by the speed of the flashing VALVE ON LED. This rate is set in the factory, but if the flow rate on the valve is unstable (fluctuates), turn this trimpot to improve performance.
GENERAL DIMENSIONS

Dimensions in millimeters:
- 11.4
- 14.65
- 4.50
- 5.00
- 5.50
- 8.0
- 9.00
- 10.00
- 10.5
- 17.70
9. CALIBRATION
Each MagnaValve is factory calibrated to flow according to customer specification when the valve is at maximum range, using the size and type of shot specified by the customer. To recalibrate the MagnaValve, do so by using a catch-and-weigh test. This test allows Media to flow through the valve for a timed period, usually one minute. Weigh the shot and compare the weight to the requested amount. Make fine adjustments at the MagnaValve Gain adjustment knob. Note: Full-scale outputs of the valve for kilogram calibrations or pound calibrations are 10Vdc. Change the flow range from 1800lbs/min to 1500lbs/min just by typing 1500 instead of 1800. The following Advanced Calibration Procedure explains how to change the calibration range.

Advanced Calibration

Introduction
Use the model PA-24 program cable (Part #980097) on the 24 Volt series Rev. A MagnaValves and the model 599-24 Rev. A series of shot flow sensors. This module is user-configurable using any computer with the Windows operating system. The user can make calibration tests to establish a linear output.

A special data cable from Electronics Inc. will provide the link to the laptop. To communicate with the valve, use any serial COM port cable to connect your computer to our special data cable.

Hooking up RS-232 COM port
1. Use the special PA-24-DC cable from Electronics Inc.
2. Connect a standard serial cable to the COM port on your PC.
3. Connect the other end of serial cable to the special data cable.
4. Run HyperTerminal from Windows.
   (Programs>Accessories>Communications>HyperTerminal.)
5. Use these settings:

   Baud=19200
   PARITY=N
   BITS=8
   Hardware=None
Push the button on our special data cable and the following text will appear on your computer:

“Press any key to start Terminal Program”

Press a key and the following screen will appear.
This Home Screen is an information center.

All 24V products using this control board have the ability to store data in 5 different tables. This allows the use of different media types and sizes without recalibration.

**Table Number:** The first line of the screen has the table number in use. It is possible to add special labels to the table, such as S-230, to help identification.

**Flow Limit:** The second line indicates the maximum calibrated flow rate for the valve. This sets the output voltage to 10Vdc when the valve is flowing 20lb/min.

**Valve Capacity:** This gives the maximum flow of the valve with the selected shot size.

It also displays the following:
- **Current Temp.**
- **Max. Temp.**
- **Total Run Time.**
- **Pwr Cycles** (Number of times the valve has been powered on and off.)

A letter or number precedes all changeable functions. Press the appropriate letter/number to change the function or to change screens.

2) Calibration Screen
3) Setup Screen

Press 3 and the following screen appears.
A) Decimal Location:
Purpose: To change the resolution of the display. There are 2 modes that toggle when the A key is selected.
   1. 999.99 for Air Valves.
   2. 9999.9 for Wheel Valves.

B) Std/Metric:
Purpose: To change the display from lb/min. to kg/min. by pressing the B key.

C) Auto Zero on/off
Purpose: To activate or deactivate the auto-zero function. The auto-zero routine will establish zero output voltage automatically thus accommodating minor output signal voltage changes that occur with time or temperature.

Function: To turn auto-zero function on or off press “C” repeatedly.

Auto-zero on:
When the valve is not enabled: The unit will automatically establish a zero output signal unless the sensor detects a signal greater than 10%. This identifies an abnormal end-of-cycle condition indicating possible malfunction, such as a sensor not purging at end of a cycle.

When the valve is enabled: The unit will hold its last established value. Auto-zero off disables this feature.
E) Zero Lock on/off

**Purpose:** To activate or deactivate the zero lock feature. This feature will establish and maintain a zero output voltage even if the sensor detects 0-10% signal level. An invalid output signal may occur due to metallic dust accumulation within the sensor. Suppress invalid output signals by turning on the zero lock.

**Function:**
- **Zero Lock on:**
  - **PA-24 NOT enabled and sensor signal is <10%:** the output signal will be 0.0Vdc.
  - **PA-24 ENABLED:** output signal is normal (i.e. no influence on output signal).

- **Zero Lock off:**
  - **PA-24 NOT ENABLED:** No effect on output signal.
  - **PA-24 ENABLED:** No effect on output signal.

F) External Table Select

**Purpose:** to activate or deactivate the remote table selection function (this requires extra cable for RTA remote table access)

**Function:** to turn the function on or off, select “F”.

- **Enabled:** The valve will check for voltage at the binary inputs and select the proper table to load. If there is no voltage detected or no cable present, the valve uses the last programmed table. Please see the datasheet or manual for more info on binary inputs.
- **Disabled:** Will disable this feature on the valve and the table will have to be selected using default table #1 or this program for any other table.

G) Enable Terminal While Running

**Purpose:** When this is on and the PA-24 cable is plugged into the valve, start the program by simply hitting a key. There is no need to push the button on the cable. The Windows Terminal program must be running for this to work. When this function is off use the button on the cable must be used to start the terminal program.
Press 2 and the following screen appears.

A) View Setpoint List
Displays the present values stored in the Table. The following screen will appear.

This displays the present table name (S-230) and maximum flow setting. These values may be copied and pasted into an Excel spreadsheet or text file for storage or data logging.

PWM: The percentage of valve opening.
Catch lb/min.: The actual weight caught in one minute.
Sensor signal: The percent of measured signal during the catch test.
B) **Add Setpoint to List**
*Purpose:* Ten additional setpoints may be added for calibration. There are 10 factory setpoints at 10% increments starting at 15% ending with 100%. For more accuracy, use this function to add additional percent points up to 80%.

C) **Remove Setpoint from List.**
*Purpose:* Use this function to remove unwanted setpoints from list. If the valve is very linear.

D) **Edit Catch Values**
*Purpose:* Use to change the actual catch weights in the list. Use to this entry to manually enter data from a spreadsheet or text file.

E) **Edit Sensor values**
*Purpose:* Use to change the actual sensor readings in the list, or manually enter data from a spreadsheet or text file.

F) **ReName Table (6-char)**
*Purpose:* Used to give each of the 5 tables a unique name (i.e. shot size being used). (S-70, S-230)

G) **Set Flow Limit**
*Purpose:* To change valve calibration. This is the amount the valve will flow when a 10Vdc signal is sent from the valve.

**Valve Capacity:**
*Purpose:* This is the maximum flow the valve can do with the selected shot size.

H) **Table Number**
*Purpose:* to provide five separate lookup tables. This allows the user to store calibration data for five different shot types or sizes.

**Function:** To sequentially access the five tables select “H”.
I) Perform Catch Test

*Purpose:* To perform the internal catch and weigh calibration procedure. When pressed the following screen will appear.

Y) Backup this Table

*Purpose:* Use this function to copy the data to a backup location after performing a complete calibration on the unit.

Z) Restore Table from Backup

*Purpose:* Use this function to restore the calibration data to the last good stored calibration.
A) **Table Number:**
   Purpose: Allows the user to change to 1 of 5 tables for data entry.

B) **Test Duration:**
   Purpose: When selected, this will toggle to 10, 20, 30, and 60-second flow tests.

C) **Setpoint:**
   Purpose: This selects the setpoint percentage for the testing. This will display the present setpoint from the list starting with the highest. It will show the latest catch weight in the list and the sensor signal measured during the test.

D) **Start THIS test:**
   Purpose: Activating this function starts the valve flowing at the applied setpoint for the requested amount of time. The following screen will appear during the test.
   Note: To perform this test a Enable signal must be sent to the valve from the control so the Enable led on VD13-HT is on. This signal may be maintained for all tests.

When prompted at the end of the catch test, enter the actual weight caught and press enter. This returns to the following screen.
The results of the test are displayed under Results:

This will also show the error between the present value in the table and test results. If the test results are valid, select F) to enter the data.

F) Enter Catch Data
   Purpose: Select to enter test results into memory. Failing to select F) after each test results in data loss, because it is not automatically stored in memory after each test.

E) Start Remote Test
   Purpose: Start the selected test remotely using the Enable signal to the valve. This will test the valve under actual flow conditions.

G) View Table
   Purpose: Displays the present values stored in present Table.

Note: All setpoint values are factory set to requested shot size and flow rate.

10. SPARE PARTS LIST
   There are no spare parts for this series of MagnaValves

11. MAINTENANCE
   The only regular scheduled maintenance for a MagnaValve is annual recalibration.
12. TROUBLE-SHOOTING GUIDE

The primary trouble-shooting is accomplished by reporting the status of the 4-LED indicators on the valve. They must all be ON in order for media to flow. If all of the LED’s are ON but there is no media flow, check the following:

12.1 Is the mechanical valve (for direct pressure applications) functioning?
12.2 Is there media available from the hopper?
12.3 Is there any blockage above or below the Magna Valve or at the wheel?
12.4 Is the magnetic field completely cancelled when the red LED is ON? Check this by removing the valve from the machine and applying the proper signals for 100% flow. Does all shot fall from valve?

If the problem cannot be found please have the following information when calling for assistance.

Company Name: _____________________
Contact Name: _____________________
Phone # : _____________________

1. Type of system: ______________
2. Number of Valves on the machine? _____
3. Controller Model: ______________
4. Valve Model: ______________
5. Media Type (cast, cut wire, grit, etc…) __________
6. Media Size: ______________
7. Wheel Size (HP): __________
8. Flow Rate lbs/min.: __________
9. Cycle time: ______________
10. Time between cycles: __________
11. Wheel Dia. : ______________
12. Wheel RPM : ______________
13. Feed Hose length: ______________
14. Is there a shut off valve above the Magna Valve or below?  Above _____
              Below _____

Make note of LED indicators on the control and Magna Valve.

How do the led indicators react during the blast cycle?

Does the controller display go to zero or idle amps at the end of the blast cycle?

Fax: 574-256-5222
Phone: 574-256-5001