

678-24 MagnaValve®

**600 Series MagnaValve®**  
*for Air-Blast Machines*

*The Smart Valve with SteadyFlow Technology*

# Instruction Manual



56790 Magnetic Drive, Mishawaka, Indiana 46545 USA • 1-800-832-5653 or (574)256-5001 • [www.electronics-inc.com](http://www.electronics-inc.com)

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## Safety Notices

Good safety practices must be followed when operating and handling the MagnaValve®. Improper usage could result in damage to the product or personal injury.

- Please note: The MagnaValve emits magnetic fields that can be harmful to people who wear pacemakers.
- The MagnaValve operates with internal air pressure. Refer all servicing to qualified personnel.
- Power off the FM-24 Monitor or FC-24 Controller and the MagnaValve before connecting or disconnecting the MagnaValve.

# Product Overview

The 600 Series MagnaValves\* are normally closed magnetic valves that regulate the flow of steel shot and cut wire media in air blast machines. A 600 Series MagnaValve is a Smart Valve with SteadyFlow Technology—it has an embedded webpage, a built-in sensor that measures flow rate, a built-in servo, and a flow rate jump-to feature that provides accurate and repeatable flow rates. The Flow Jump-To feature starts media flow at the desired flow rate instead of ramping up to the desired rate.

**Note:** To take advantage of the advanced technology in a 600 Series MagnaValve, it should be used with a FM-24 Monitor or a PLC.

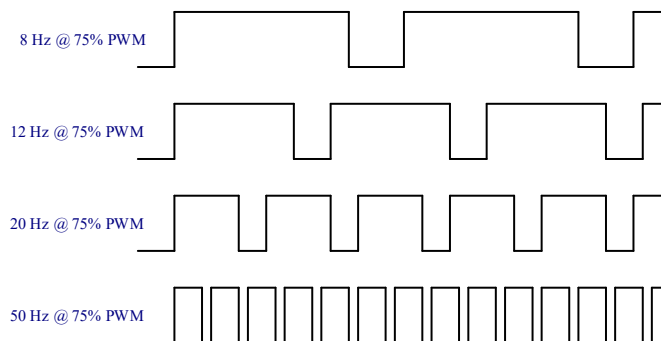
The MagnaValve can be factory calibrated for various media types and sizes. It will be calibrated for the media type, size, and flow rate specified on the purchase order.

## Principle of Operation

The low-maintenance construction of the 600 Series MagnaValve features a rare earth permanent magnet for normally closed operation and an electromagnet for controlling shot flow rates. When no power is applied to the MagnaValve, the permanent magnet stops all flow. If the power is interrupted for any reason, the permanent magnet securely holds the shot. With power applied, the magnetic field is neutralized and the shot is allowed to flow through the valve.

Media flow through the 600 Series MagnaValve is controlled by PWM (Pulse Width Modulation). This means that the media flow through the 600 Series MagnaValve is fully turned ON and then fully turned OFF at a fixed frequency. To change the flow rate, the duration ratio of ON time to OFF time is changed. PWM is typically measured in percent where a 75% PWM refers to the media flowing 75% of the time and the media is not flowing 25% of the time for the given frequency.

In the 600 Series MagnaValve, the PWM frequency is referred to as Pulse Frequency and when the servo is turned OFF the Setpoint is directly linked to the PWM percentage.



# Installation

The following items are required for the installation of a 600 Series MagnaValve®.

Pipe Fitting Requirements	Models 676-677	Models 678-679	Models 680-690
Assortment of NPT Short Nipples and other NPT Pipe Fittings	1"	1 ¼"	2"
Two (2) NPT Pipe Unions	1"	1 ¼"	2"
One (1) Mixing Tee	1"	1 ¼"	2"

- Thread sealant (Teflon® tape)
- Other fittings as required
- A 150% capacity manual shut-off valve mounted above the MagnaValve for maintenance
- For direct pressure applications only – an automatic shut-off valve mounted below the MagnaValve

## Installing and Uninstalling Pipe Fittings

It is essential to attach and remove pipe fittings to and from the MagnaValve correctly so as not to break the valve body or the pipe from the valve. Below are some examples of proper procedures when installing or uninstalling pipe fittings.

Do NOT use the valve body as a wrenching surface. This can break the valve.



Do NOT mount the valve into a vise and use a single pipe wrench on the pipe fitting to install or uninstall pipe fittings.



Do use two pipe wrenches—one on the valve pipe and one on the pipe fitting—to install or uninstall the fitting.



Do mount the pipe fitting into a vise and use one pipe wrench on the valve pipe to install or uninstall the pipe fitting.



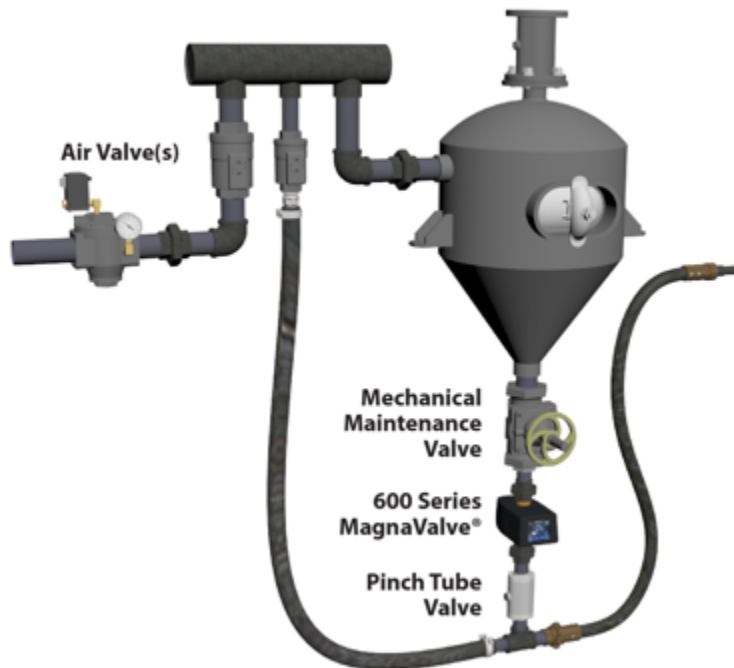
## Critical Requirements for Direct Pressure Machine Applications

The following are critical requirements for the installation and operation of the 600 Series MagnaValve® on a direct pressure machine. Failure to follow these steps could result in damage to the MagnaValve and void its warranty.

### Installation

To correctly install a 600 Series MagnaValve on a direct pressure machine, perform the following steps.

- Install a mechanical maintenance valve above the MagnaValve
- Install a pinch tube valve below the MagnaValve
- The mechanical maintenance valve and pinch tube valve must be rated at 150% of the maximum media flow rate of the MagnaValve
- Ensure there are no air leaks between the pressure pot and the mixing tee



**NOTE:** The air hold off should not exceed 5 psi, and the pressure differential must remain below 3 PSI. The installation of a pinch valve, as shown here, with a proper start and stop sequence will allow this accommodation.

### Operation

The following steps must be followed in sequence when starting and stopping a blast cleaning or shot peening cycle.

To start the blast/peen cycle	To stop the blast/peen cycle
1. Turn on the air valve(s)	1. Turn off the MagnaValve
2. Wait 10 seconds for the air to stabilize	2. Close the pinch tube valve
3. Open the pinch tube valve	3. Wait 10 seconds while the media clears the blasting hose
4. Turn on the MagnaValve	4. Turn off the air valve(s)

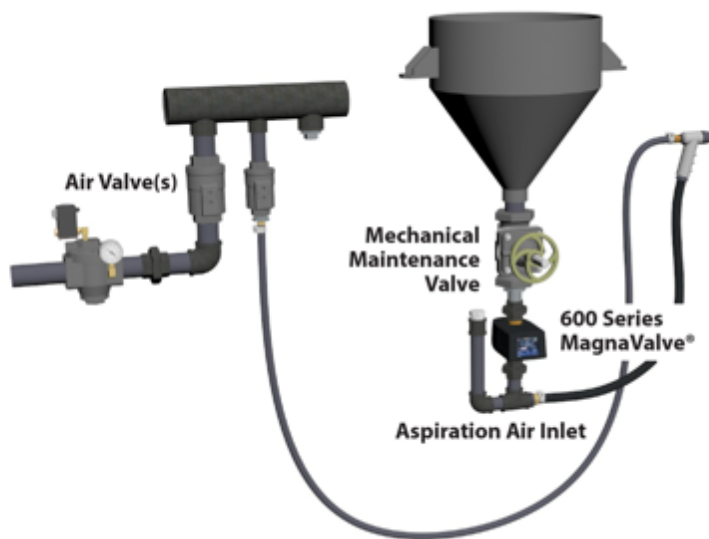


## Critical Requirements for Suction Blast Machine Applications

The following are critical requirements for the installation and operation of the 600 Series MagnaValve® on a suction blast machine. Failure to follow these steps could result in damage to the MagnaValve and void its warranty.

### Installation

- Install a mechanical maintenance valve above the MagnaValve
- The mechanical maintenance valve must be rated at 150% of the maximum media flow rate of the MagnaValve
- Install aspiration air inlet below the MagnaValve
- The aspiration air inlet must be large enough to supply adequate air volume to allow conveyance of the media to the nozzle
- Ensure there are no air leaks between the pressure pot and the mixing tee



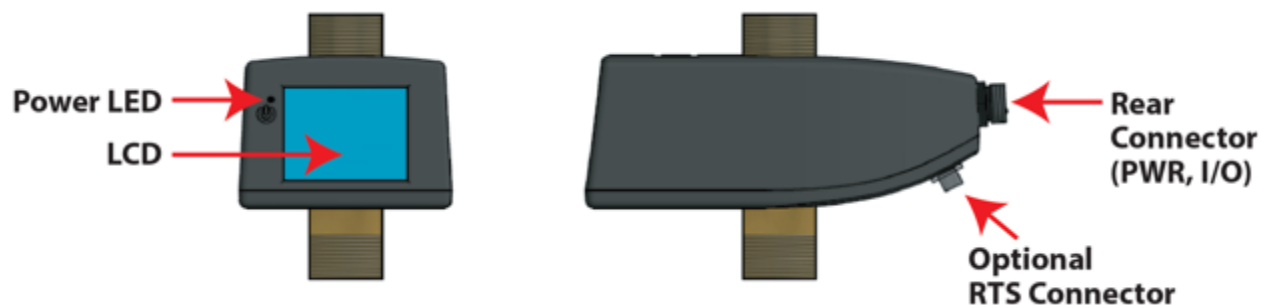
### Operation

The following steps must be followed in sequence when starting and stopping a blast cleaning or shot peening cycle.

To start the blast/peen cycle	To stop the blast/peen cycle
1. Turn on the air valve(s)	1. Turn off the MagnaValve
2. Wait 10 seconds for the air to stabilize	2. Wait 10 seconds while the media clears the blasting hose
3. Turn on the MagnaValve	3. Turn off the air valve

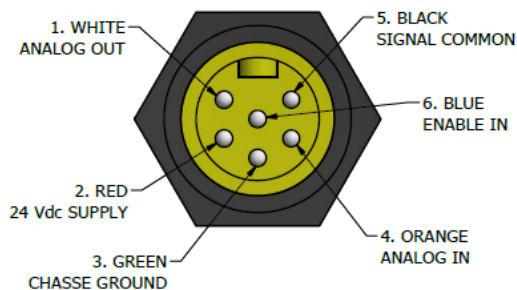
## Electrical

The 600 Series MagnaValve® is equipped with a rear connector that contains the necessary power, analog I/O, and enable lines for normal operation of the MagnaValve. The RTS (Remote Table Select) version of the 600 Series MagnaValve includes an additional connector for the RTS control line. The figure below shows the location of these two connectors.



### Rear Connector

The rear connector is the primary communication link between either a PLC or a FM-24 and the 600 Series MagnaValve. The connector contains the following signals: power, ground, analog input / output, and enable (see illustration below). These signals will control the MagnaValve during operation. Each signal's function will be discussed in detail in the following sections.



*Rear connector and pin out*

#### Rear Connector Pin Functions

Wire	Function	Voltage
Red	24 Vdc Supply	24 Vdc
Black	Supply Common	0 V
Green	Chassis Ground	0 V
Orange	Analog Input	0 – 10 V or 4 – 20 mA
White	Analog Output	0 – 10 V or 4 – 20 mA
Blue	Enable Input	24 Vdc

## 24 Vdc Supply

### Power Requirements per MagnaValve®

Parameter	Value	Tolerance
Voltage	24 Vdc	±10 %
Current	2 Adc per connected valve	1.75 Adc min

The 24 Vdc Supply Input consists of two wires on the rear connector, the Supply Input (RED wire), and the Signal Common (BLACK wire). The Supply Input and the Signal Common provides power to the 600 Series MagnaValve. It is requested that the customer provide a DC supply capable of 2.0 amps of current for each 600 Series MagnaValve connected to the supply. The 600 Series MagnaValve, when flowing 100%, typically has a current draw of 0.8 A to 1.3 A. The requested 2.0 A supply is meant to handle surge currents while the 600 Series MagnaValve is pulsing.

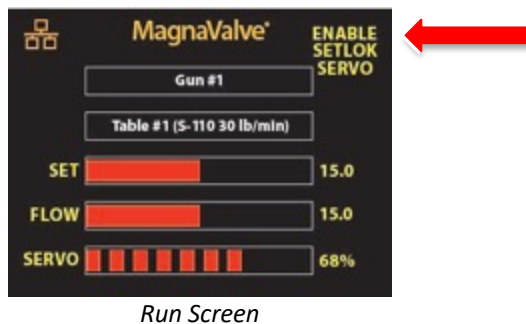
## Enable Input

### Enable Input Requirements

Parameter	Value	Tolerance
Voltage	24 Vdc	30.0 V to 14.7 V
Current	2.07 mA	2.59 mA to 1.27 mA
HIGH IN	Flow Media	14.7 V to 30.0 V
LOW IN	NO Flow Media	0.0 V to 5.9 V

The Enable Input commands the 600 Series MagnaValve to start flowing media. The input is pulled LOW (0.0 V) for the NO flow condition and driven HIGH (24 V) for the media flow condition.

Applying 24 Vdc to the Enable Input causes media to start flowing. Upon applying 24 Vdc to the Enable Input, the Enable indicator illuminates.



## Analog Input

### Analog Input requirements

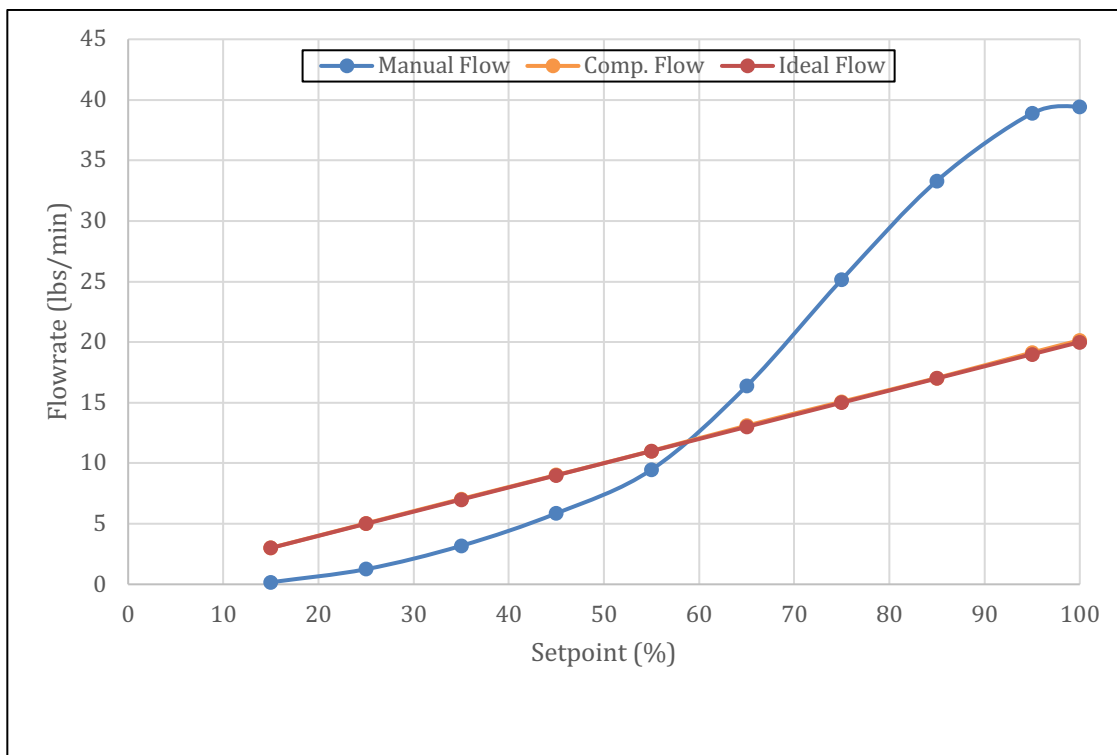
Parameter	Value
Voltage Input	0 V to 10 V
Current	0 A to 672 $\mu$ A

The Analog Input is the flow request signal. The Analog Input can be set for voltage control (0 – 10 Vdc) or current control (4 – 20 mA) through the embedded webpage.

The Analog Input has two operational modes. If the 600 Series MagnaValve's internal Servo is turned ON, the Analog Input is the Setpoint Input. Where 0 Vdc / 4 mA input represents 0 lb/min of media flow and 10 Vdc / 20 mA input represents a request for the Full-Scale Value, this is the maximum flow rate for which the valve is calibrated.

If the 600 Series MagnaValve's internal Servo is turned OFF, the Analog Input controls the 600 Series MagnaValve® in the open-loop mode. While in the open-loop mode, the 0 Vdc / 4 mA to 10 Vdc / 20 mA input signal translates to 0% to 100% PWM output signal to the valve driver. For an input of 0 Vdc / 4 mA, the valve will turn ON 0% or 0 lb/min of flow. For an input of 10 Vdc / 20 mA, the valve will turn on 100 % or the maximum flow capability of the 600 Series MagnaValve.

**Note:** The open-loop flow rate of the 600 Series MagnaValve is non-linear. An example is shown below. The blue graph is the open-loop (Servo turned OFF), and the orange graph is closed-loop (Servo turned ON). In this example, the maximum flow rate with the Servo turned OFF is 40.5 lb/min and is non-linear. The maximum flow rate with the Servo turned ON is 30.0 lb/min and is linear. To see the open and closed-loop flow rate profile of your 600 Series MagnaValve, refer to the Calibration Certificate shipped with the 600 Series MagnaValve.



## Analog Output

### Analog Output requirements

Parameter	Value
Voltage Output	0 V to 10 V
Current	0 mA to 10 mA
Rload_max	1 k $\Omega$

The Analog Output is the scaled representation of the flow rate through the sensor. The Analog Output can be set for voltage output (0 – 10 Vdc) or current output (4 – 20 mA) through the embedded webpage.

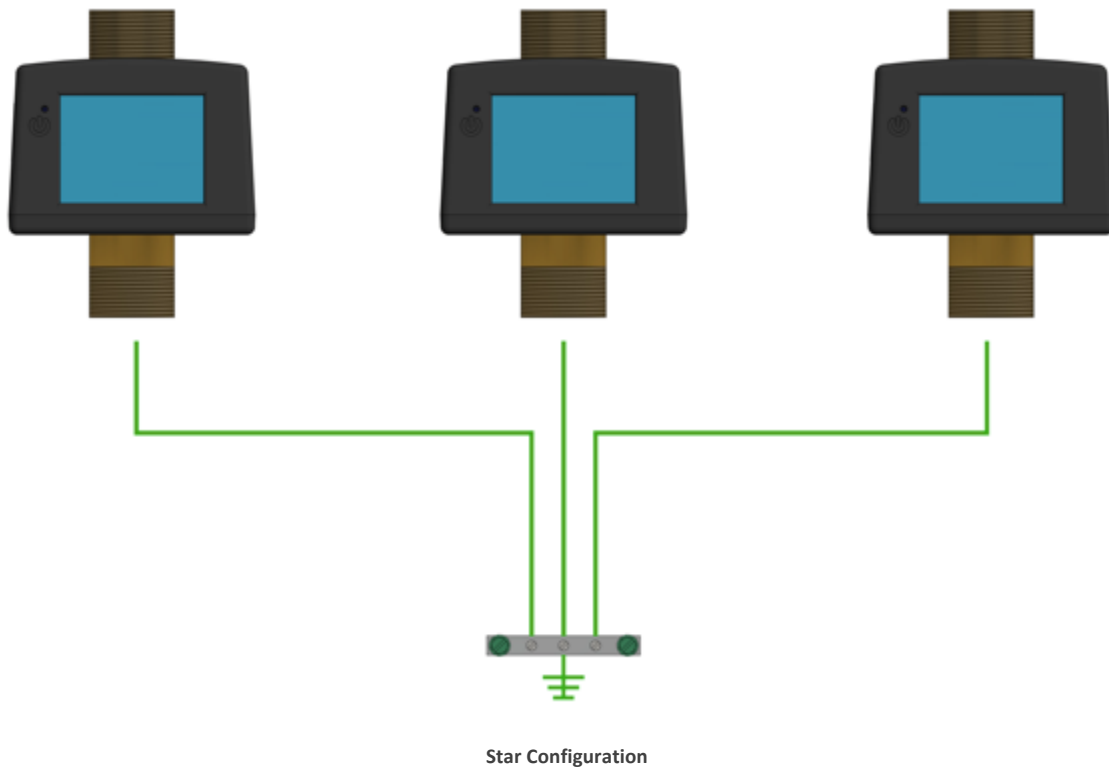
Unlike the Analog Input, the Analog Output maintains the same scaling regardless of the MagnaValve's internal Servo setting. The Analog Output is scaled such that 0 Vdc / 4 mA output represents 0 lb/min of media flow, and 10 Vdc / 20 mA output represents the Full-Scale Value—this is the maximum flow rate for which the valve is calibrated.

**Note:** If the flow rate exceeds the calibrated flow rate, the Analog Output Voltage increases beyond 10 Vdc to a max of approximately 11 Vdc.

## Chassis Ground

The Chassis Ground (GREEN wire) in the rear connector provides a dedicated path for high-voltage transients to dissipate without disrupting critical signals or creating damage to internal circuitry. The Chassis Ground also provides a ground path for any ESD events that may happen on the pipe, ethernet connector, and Rear Connector.

The Chassis Ground must be connected to good earth ground. If multiple 600 Series MagnaValves are installed, it is recommended that the Chassis Ground be tied to the earth ground in a star configuration, see image below. This means that each 600 Series MagnaValve® has a direct path to the earth ground. The Chassis Ground (GREEN wire) and Signal Common (BLACK wire) must **NOT** be connected at any point.



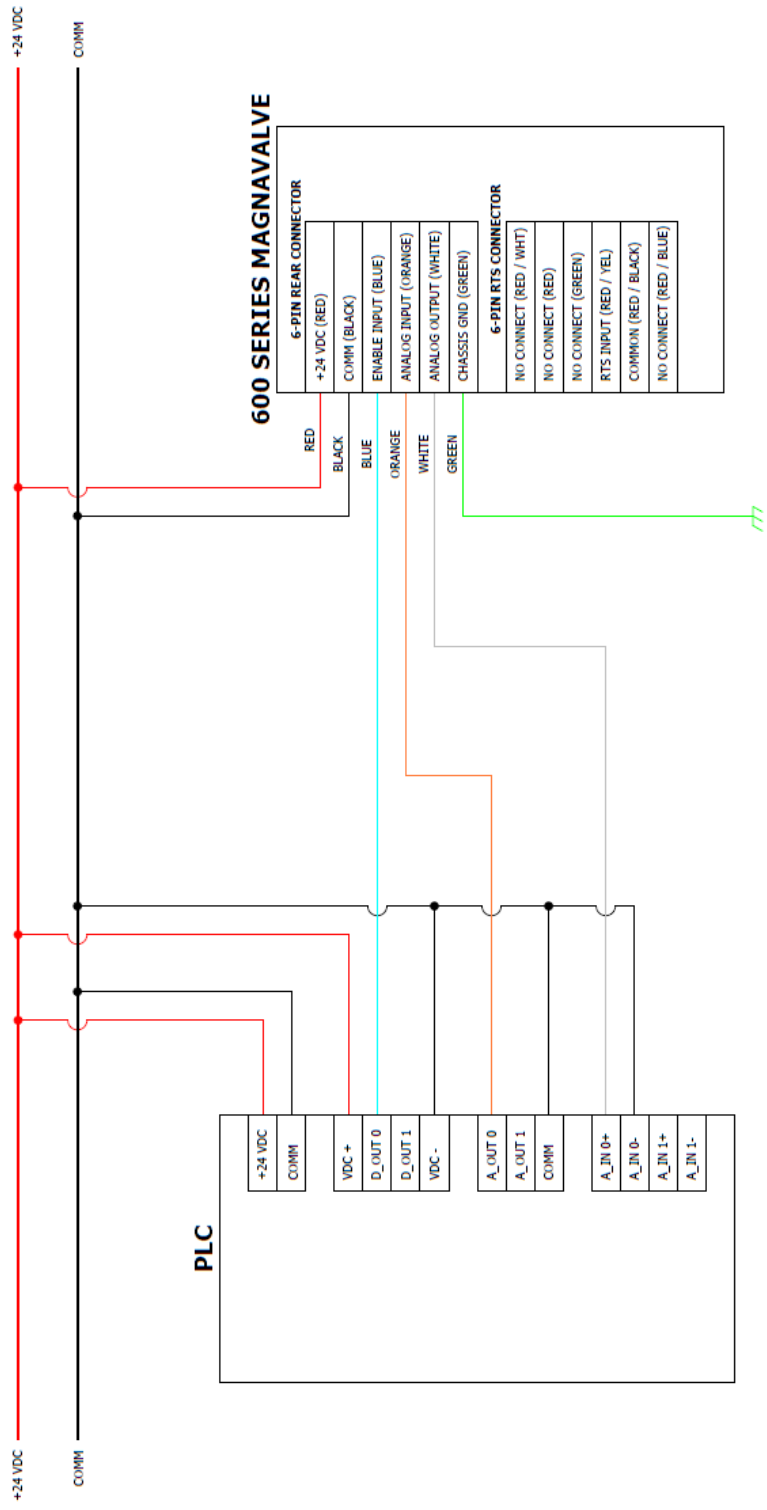
## Wiring

When connecting the 600 Series MagnaValve® to the 24 Vdc supply, avoid daisy-chaining devices with the 600 Series MagnaValve. It is recommended that all 600 Series MagnaValves attach to the 24 Vdc power buss directly (star configuration). This will reduce possible interference with other 600 Series MagnaValves and other electronics.

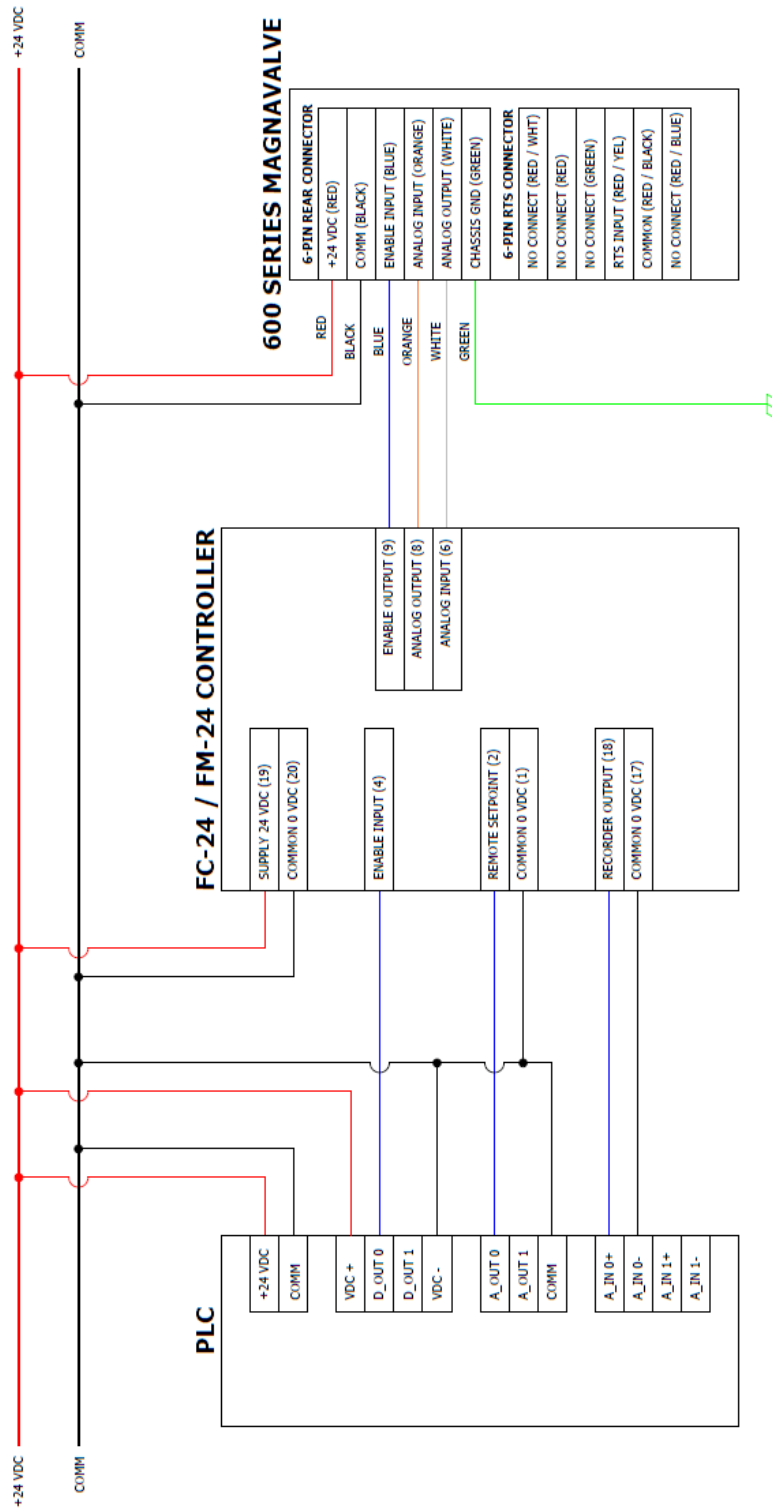
The chassis ground from each 600 Series MagnaValve must be attached directly to a clean earth ground (star configuration).

To reduce EMI issues, run all 600 Series MagnaValve wiring and DC supply wiring away from AC lines and signals.

## Wiring a 600 Series MagnaValve Directly to a PLC



## Wiring a 600 Series MagnaValve® Directly to a FC-24 / FM-24





## RTS (Remote Table Select)

### RTS input requirements

Parameter	Value
Voltage	0 Vdc - 10 Vdc
Current	0 $\mu$ A - 12 $\mu$ A

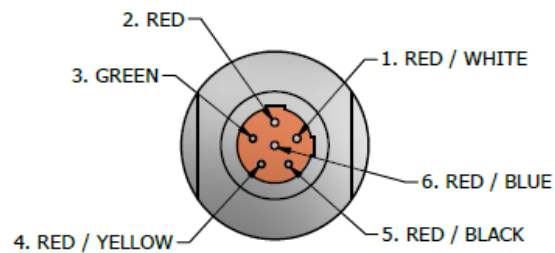
With a single analog input, located on the RTS connector, one of nine tables can be selected. The table below shows the analog voltage that selects the table.

### RTS Voltage Ranges

Voltage Range	Table #
0 Vdc - 1.5 Vdc	Table 1
1.5 Vdc - 2.5 Vdc	Table 2
2.5 Vdc - 3.5 Vdc	Table 3
3.5 Vdc - 4.5 Vdc	Table 4
4.5 Vdc - 5.5 Vdc	Table 5
5.5 Vdc - 6.5 Vdc	Table 6
6.5 Vdc - 7.5 Vdc	Table 7
7.5 Vdc - 8.5 Vdc	Table 8
8.5 Vdc - 10 Vdc	Table 9

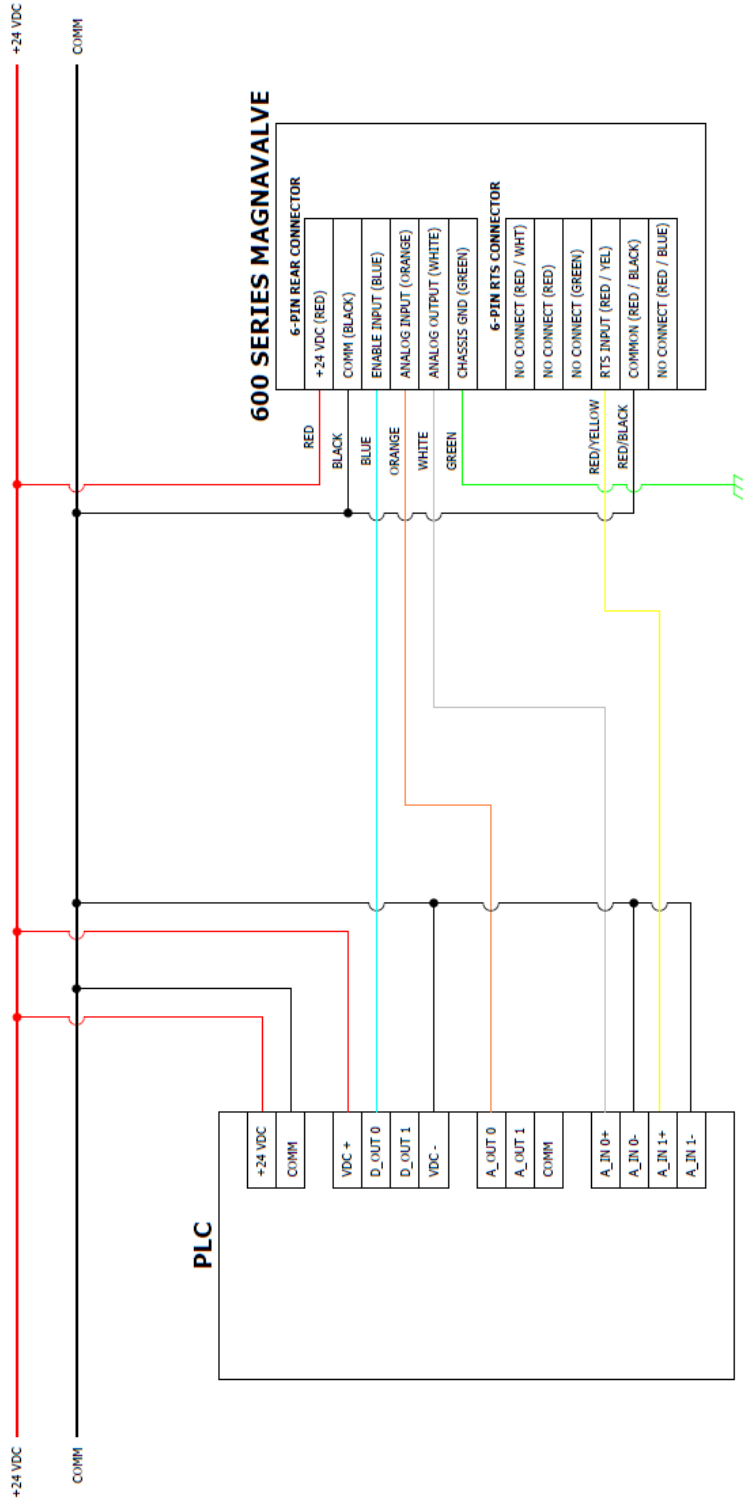
### RTS Cable Pinout

Wire - Pin #	Table 1
Red / White - Pin 1	NC
Red - Pin 2	NC
Green - Pin 3	NC
Red / Yellow - Pin 4	0 - 10 Vdc
Red / Black - Pin 5	0 V
Red / Blue - Pin 6	NC



*RTS connector and pin out*

# RTS Wiring



# MagnaValve Operation – Quick Start

## Flowing Media Using a PLC

This section describes the basic operation of the 600 Series MagnaValve® when wired directly to a PLC.

The 600 Series MagnaValve comes from the factory with the following settings.

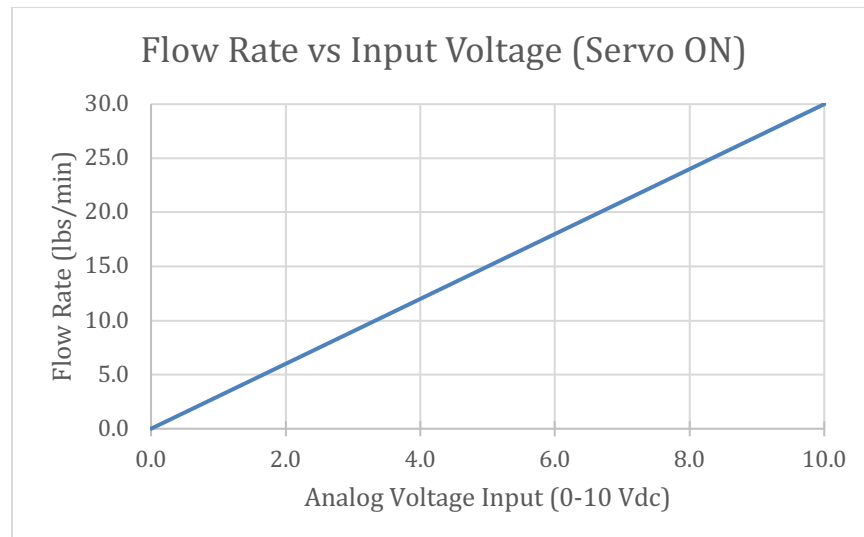
- Servo – Enabled
- Setpoint Lock – Enabled
- Servo Delay – 30

Use the following steps to start and control media flow from a PLC using the factory settings listed above.

1. Wire the 600 Series MagnaValve to the PLC as shown in the Electrical section.
2. Apply 24 Vdc supply to the 600 Series MagnaValve.
3. Apply the Analog Input Signal (0-10 Vdc) to the Analog Input (orange wire). This sets the Setpoint (lb/min). Use the equation below to calculate the Analog Input.

**Note:** The Flow Limit is the maximum flow rate for which the 600 Series MagnaValve has been calibrated. This can be found on the gold label located on the side of the 600 Series MagnaValve, or from the Home tab in the embedded webpage. While the Setpoint Lock is enabled, changing the Analog Input (orange wire) while the 600 Series MagnaValve is enabled will not influence the flow rate. While the Setpoint Lock is enabled, any changes to the Analog Input will take effect in the next peening cycle.

$$\text{Analog Input (Vdc)} = \frac{10 \text{ (Vdc)}}{\text{Flow Limit} \left( \frac{\text{lb}}{\text{min}} \right)} \times \text{Setpoint} \left( \frac{\text{lb}}{\text{min}} \right)$$

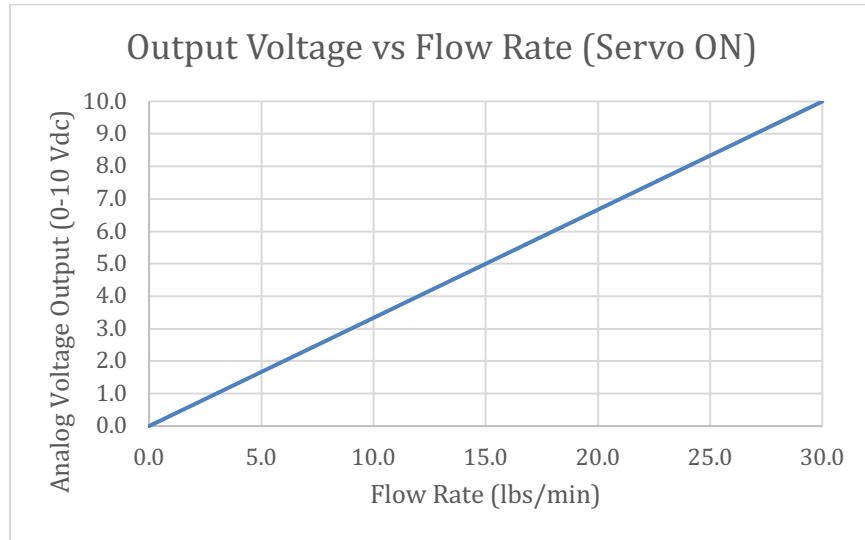


4. Apply 24 Vdc to the Enable Input (blue wire) to start flow and apply 0 Vdc to the Enable Input to stop flow.

**Note:** After changing the Analog Input, allow approximately 2 seconds before applying 24 Vdc to the Enable Input.

5. Monitor the Analog Output Signal (0-10 Vdc) on the Analog Output (white wire). This signal expresses the flow rate measured by the sensor in the 600 Series MagnaValve. Use the equation below to calculate the Flow Rate from the Analog Output.

$$\text{Flow Rate} \left( \frac{\text{lb}}{\text{min}} \right) = \frac{\text{Flow Limit} \left( \frac{\text{lb}}{\text{min}} \right)}{10 \text{ (Vdc)}} \times \text{Analog Output (Vdc)}$$



# The 600 Series MagnaValve® Control Center

The 600 Series MagnaValves have a web browser-based control center that allows users to:

- Review the 600 Series MagnaValve's settings
- Calibrate up to nine tables
- Adjust the 600 Series MagnaValve's settings
- Record results of catch tests
- Verify catch tests results and restore the 600 Series MagnaValve to a previous state

## Accessing the Control Center (Connecting to a PC)

The following is the equipment needed to access the 600 Series MagnaValve's browser-based control center:

- A computer with web browser
- An Ethernet cable
- An Ethernet-to-USB port adapter if the computer does not have an Ethernet port

### Connecting to the control center (direct connect)

1. Plug an Ethernet cable from the Ethernet port on the 600 Series MagnaValve to an Ethernet port on a PC. Use an Ethernet-to-USB adaptor if needed.
2. Apply power to the 600 Series MagnaValve.
3. Wait until the Ethernet Symbol is displayed in the top left corner of the LCD located on the front of the 600 Series MagnaValve. (The connection will take approximately 90 seconds.)
4. Type the 600 Series MagnaValve's IP address in the computer's internet browser search bar and press Enter. The factory default IP address is 169.254.158.24.



Ethernet Symbol

### Connecting to the control center (DHCP router)

1. Plug an Ethernet cable from the Ethernet port on the 600 Series MagnaValve to an Ethernet port on a DHCP router, and another Ethernet cable from the DHCP router to a PC.
2. Apply power to the 600 Series MagnaValve.
3. Wait until the Ethernet Symbol is displayed in the top left corner of the LCD located on the front of the 600 Series MagnaValve.
4. Press and release the RESET button (using a paper clip) in the bottom of the 600 Series MagnaValve.
5. The LCD shows the SYSTEM INFO for 10 seconds, record the IP address.
6. Type the MagnaValve's IP address in the computer's internet browser search bar and press Enter.



Ethernet Symbol



# Home

The Home screen displays reference data from the MagnaValve including the Model Number, Serial Number, the Date of the Factory Calibration, and the Firmware Version. The Home screen also displays the Active Table Settings and the Run Hours.



1-800-832-5653 or 574-256-5001  
<https://www.electronics-inc.com>

## 600 Series MagnaValve® Control Center

MagnaValve Name		MagnaValve	
Model Number	678-24		
Serial Number	211039-19		
Factory Calibration	3/19/21		
Firmware	Rev 1.10 6-9-21		

Active Table Settings	
Active Table	#1 MagnaValve
Media Type	CCW14
Flow Limit	20 lbs/min
Valve Capacity	45.09 lbs/min
Pulse Frequency	20.00 Hz

Run Hours	
Power Cycles	61
Valve On-Time	2.28
Hrs <= 25C	0
25C < Hrs <= 80C	134.7
80C < Hrs <= 95C	0
95C < Hrs	0
<b>Total Hours</b>	<b>134.7</b>

Flow Control	
Local Setpoint Enabled	<input checked="" type="checkbox"/>
Setpoint Value	5 lbs/min

### General Information

**MagnaValve Name** – The name of the MagnaValve. This name can also be used to search for the MagnaValve on the network, i.e., [http://nozzle\\_no2](http://nozzle_no2). This value can be changed. See the **Settings section**.

**Model Number** – The model number of the 600 Series MagnaValve. It is entered at the factory during manufacturing.

**Serial Number** – The serial number of the 600 Series MagnaValve. It is entered at the factory during manufacturing. This number matches the serial number on the gold label located on the side of the 600 Series MagnaValve.

**Factory Calibration** – The day the 600 Series MagnaValve was calibrated at the factory. The Factory Calibration date may be the calibration at the time of purchase or when the 600 Series MagnaValve was sent back to the factory for recalibration.

**Firmware** – The installed version of the Firmware.

### Active Table Settings

**Active Table** – The active table number, followed by the table name. This value can be changed. See the **Calibration section**.

**Media Type** – The media type and size used during the calibration of the Active Table. This value is typically set during calibration. See the **Calibration section**.

**Flow Limit** – Displays the calibration flow rate. In the above example, the output voltage is 10 Vdc when the 600 Series MagnaValve is flowing 20 lb/min. This value can be changed. See the **Calibration section**.

**Valve Capacity** – Displays the maximum flow rate of the 600 Series MagnaValve with the selected shot size. This value is set during the 100% catch test during calibration. See the **Calibration section**.

**Pulse Frequency** – This is the rate at which the valve dispenses shot. The value must be set before calibration. See the **Calibration section**. **Note:** Changing this value affects the 600 Series MagnaValve's calibration.

## Run Hours

**Power Cycles** – Number of times the 600 Series MagnaValve has been powered ON and OFF.

**Valve On-Time** – The amount of time that the 600 Series MagnaValve has been both powered ON and enabled, i.e., the total amount of time the 600 Series MagnaValve has been flowing shot.

**Hrs <= 25C** – The amount of time the 600 Series MagnaValve has been powered ON while below a temperature of 25 °C.

**25C < Hrs <= 80C** – The amount of time the 600 Series MagnaValve has been powered ON while between the temperature of 25 °C and 80 °C.

**80C < Hrs <= 95C** – The amount of time the 600 Series MagnaValve has been powered ON while between the temperature of 80 °C and 95 °C.

**95C < Hrs** – The amount of time the 600 Series MagnaValve has been powered ON while above the temperature of 95 °C.

**Total Hours** – Displays the total time that the 600 Series MagnaValve has been powered ON.

## Flow Control

**Local Setpoint Enabled** – Indicates whether the local setpoint is enabled or not.

**Setpoint Value** – Displays the setpoint value. **Note:** This value is updated only when the page is updated.

## Valve Settings

The Settings screen contains all the settings that affect the whole MagnaValve® and not just one table. For example, it includes network settings and display options.



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### 600 Series MagnaValve® Control Center

HOME
<b>VALVE SETTINGS</b>
CALIBRATION
TABLE SETTINGS
CERTIFICATION

Network Settings (Pwr-cycle after changing settings)	
Active IP Address	192.168.10.4 (DHCP)
MagnaValve Name	MagnaValve
Network Mode	request DHCP
-Static IP Addr	0.0.0.0
-Static NetMask	0.0.0.0
-Static Gateway	0.0.0.0
Save Changes	SAVE CHANGES

Protected Settings (requires Authorization Code to change)	
Model	678-24
Serial Number	211039-19
Factory Cal. Date	3/19/21
Factory Cal. By	MAI
Gauss	407
Authorization Code	
Save Changes	SAVE CHANGES

Valve Settings	
RTS Enable (0-10V table sel)	<input type="checkbox"/>
Units in Kg	<input type="checkbox"/>
Legacy (FC24) Setup	Apply Settings
Display Mode	Bargraph

Setup Analog In/Out	
Sets voltage at Vin to equal 100% Flow	Calibrate Setpoint
Flow Output Mode	0-10V
SP Input Mode	0-10V
DAC 10V Cal <65535 max>	57519
Setpoint 10V Cal <65535 max>	63316

### Network Settings

**Active IP Address** – Displays the 600 Series MagnaValve’s active IP Address. The default IP address is 169.254.158.24

**MagnaValve Name** – Allows the user to enter a desired name for the 600 Series MagnaValve. This name is displayed on the 600 Series MagnaValve’s LCD. This name can also be used in place of the IP address when connecting through a browser. In this example, <http://MagnaValve> was entered. Other possible options are nozzle\_no2, gun2\_, or MagnaValve3. **Note:** Do not use spaces in the 600 Series MagnaValve’s name.

**Network Mode** – The 600 Series MagnaValve can be configured to use DHCP or static IP addressing. Select from the drop-down list.

-Static IP Addr – When static IP addressing is used, it allows the user to enter the desired static IP address.

-Static NetMask – When static IP addressing is used, it allows the user to enter the desired static Netmask.

-Static Gateway – When static IP addressing is used, it allows the user to enter the desired static gateway.

**Save Changes** – Press “Save Changes” after making changes to Network Settings. **Note:** User must cycle power for changes to take effect after saving the changes.

### Valve Settings

**RTS Enable (0-10V table select)** – Checking this option enables RTS mode. When selected, a 0-10V signal applied to the RTS line controls which table is active. When selected, the RTS indicator appears on the MagnaValve’s screen.

**Note:** The RTS option requires a hardware change. If the MagnaValve does not have the RTS option, please contact Electronics Inc. for more information.

**Units in Kg** – Checking this option displays weight in kilograms instead of pounds.

**Legacy (FC24) Setup** – When the 600 Series MagnaValve is used with a FC-24 Controller, selecting this option will automatically make changes to select table settings to ensure proper operation with the FC-24. **Note:** This is a one-way switch—selecting this option makes the changes, but unselecting does not reverse the changes.



**Display Mode** – Selects different MagnaValve screen display options. The different options are Off, Splash (MagnaValve logo), Bargraph (default), Legacy (LEDs), and Bargraph & Splash (cycles between the bargraph and the splash screens).

### **Setup Analog In/Out**

**Sets voltage at Vin to equal 100% Flow** – Calibrates the user’s 10Vdc analog input signal to Full-Scale Flow Rate of the 600 Series MagnaValve. **Note:** This feature only works when SP Input Mode is set to 0-10V. To use this feature, apply 10 Vdc to the Analog Input (Setpoint Input), and then click the “Calibrate Setpoint” button.

**Flow Output Mode** – Allows the user to select between 0-10V or 4-20mA for the Analog Output (Flow Rate Output) signal.

**SP Input Mode** – Allows the user to select between 0-10V or 4-20mA for the Analog Input (Setpoint Input) signal.

**DAC 10V Cal** – Analog Output setting. Default setting is 59410.

**Setpoint 10V Cal** – This value is the result of “Sets voltage at Vin to equal 100% Flow”. **Note:** This value can be overwritten. It is recommended to use the above procedure to set this value.

### **Protected Settings**

All protected settings are entered at the factory and cannot be changed by the end-user.

# Calibration

The Calibration screen is used to change active tables, view current calibration values, and calibrate the MagnaValve with a specific media type, size, and flow rate.

**Note:** Do not forget to press “Save Changes” after making changes on this screen.



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## 600 Series MagnaValve® Control Center

**HOME**

**VALVE SETTINGS**

**CALIBRATION**

**TABLE SETTINGS**

**CERTIFICATION**

**Table Settings**

Table Name: CCW14 22LB 20HZ

Media Type: CCW14

Valve Capacity: 45.09 Lb/min

Max Flow: 20 Lb/min

Pulse Frequency: 20 Hz

Save Settings:

**Calibration Settings**

Active Table: #1

Test Type: Local

Test Duration: 10 sec

**Run Catch Test**

Setpoint: 100%

Begin Test:

Enter Catch:

Sensor Signal:

Calculate and Update Table:

Manually Replace Table values:

Calibration Results		
SetPoint	Lb/min	Sensor Signal
100%	45.090	29131
95%	43.050	27732
85%	29.220	18129
75%	18.000	10497
70%	13.890	7751
65%	10.230	5594
55%	6.570	3488
45%	3.900	2043
40%	2.820	1502
35%	2.010	1069
30%	1.260	686

Setpoint <1~99> 90

### Table Settings

**Table Name** – Enter the desired table name and click “Save Changes.” This table name is displayed on the 600 Series MagnaValve’s LCD.

**Media Type** – Enter the media type and size used during the active table’s calibration and click “Save Changes.” An example of media type and size is S-230 or CCW-14. The media type is displayed on the Home Screen.

**Valve Capacity** – Valve Capacity is the maximum flow rate the 600 Series MagnaValve is capable of with the media type and size used. This value is automatically collected from the 100% Setpoint catch test and equals the 100% catch test flow rate. It is updated each time the 100% Setpoint catch test is completed and saved.

**Max Flow** – Max Flow is the desired maximum flow rate for the active table and is the calibrated flow rate for the Analog Output. If the Servo is turned ON, then when 10 Vdc is applied to the Analog Input (Setpoint Input), the 600 Series MagnaValve flows the Max Flow and the 600 Series MagnaValve outputs 10 Vdc on the Analog Output when flowing the Max Flow value. For example, if the Max Flow is equal to 30 lb/min, then 0 – 10 Vdc is applied to the Analog Input will flow 0 – 30 lb/min (where 0 Vdc flows 0 lb/min and 10 Vdc flows 30 lb/min). While at the same

time, when the 600 Series MagnaValve is flowing 0 lb/min, the Analog Output Signal is 0 Vdc and when the MagnaValve is flowing 30 lb/min, the Analog Output Signal is 10 Vdc.

**Pulse Frequency** This is the rate at which the valve dispenses shot. The value must be set before calibration. See the **Calibration section**. *Note:* Changing this value affects the 600 Series MagnaValve's calibration.

**Save Settings** – Press “Save Settings” after making changes to Table Settings.

## Calibration Settings

The Calibration Settings control which table is active (the desired table to be calibrated must be active), how the catch test is triggered, and the duration of the catch test, if done locally.

**Active Table** – Selects the active table. To change the active table, select the desired table from the drop-down list. The selected table becomes the Active Table. The graph and the Calibration Results table display the saved values for the Active Table.

**Test Type** – Selects whether the catch test is triggered locally (Local) or remotely through the Enable Signal (Remote).

**Test Duration** – If the test type is Local, select the duration of the catch test. Options are 10, 20, 30, 45, 60, 90, 120 seconds. If conducting a Remote test, the catch test duration is equal to the applied Enable signal duration.

## Run Catch Test

This section contains the controls to conduct a catch test.

**Setpoint** – Select the desired Setpoint to conduct a catch test.

**Begin Test** – If Test Type is set to Local, clicking the Start button starts media flow. Media flows for the selected Test Duration. If Test Type is set to Remote, clicking the Start button allows the catch test to start after an Enable signal is received. At that time, the media starts flowing. Media continues to flow until the Enable signal is removed.

**Enter Catch** – At the end of a catch test, enter the total weight caught during the catch test. The system calculates the flow rate automatically based on the catch test's duration and the weight of the media caught.

**Sensor Signal** – This is the measured sensor signal during the catch test.

**Calculate and Update Table** – Press “Save Catch” to enter Catch Test results to the Calibration Results table.

**Manually Replace Table Entries** – Press “Replace” to make changes to the Catch Test results in the Calibration Results table.

## Graph

The graph shows the open-loop Calibration Results. The graph is flow rate vs. Analog Input where 0 – 100% represents 0 – 10 Vdc on the Analog Input.

## Calibration Results

The Calibration Results table shows the flow rate for each Setpoint and its corresponding Sensor Signal. The Sensor Signal was measured during the catch test for the given Setpoint, and the lb/min is the flow rate calculated from the entered catchweight at the end of the catch test.

## Add Setpoint / Del Setpoint

The Add Setpoint and Del (delete) Setpoint buttons at the bottom of the Calibration Results table allow Setpoints to be added or removed from the Calibration Results table.

## Table Settings

The Table Settings screen enables the user to fine-tune the shot peening process, setup data logging, and backup tables.



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### 600 Series MagnaValve® Control Center

The screenshot shows the 'Table Settings' interface with a sidebar on the left containing navigation buttons: HOME, VALVE, SETTINGS, CALIBRATION, TABLE SETTINGS (highlighted), and CERTIFICATION. The main content area is divided into several sections:

- Flow Control:** Active Table (#1), Local Setpoint Enable (checkbox), Local Setpoint Value (5 lbs/min), Manual Flow (Start/Stop buttons).
- Table Settings:** Table Name (CCW14 22LB 20HZ), Valve Capacity (45.09 lbs/min), Max Flow (20 lbs/min), Setpoint Lock (checkbox), Enable Delay (0 seconds), Vout Filter Moving Avg (40).
- Servo Settings:** Servo Enable (checkbox), Servo Filter Moving Avg (4), Servo Gain <1~100> (25), Servo Speed <1~100> (30), Servo Delay (30), Save All Changes (SAVE CHANGES button).
- Neutral Field Settings:** N.F. Value <0~255> (148), Copy N.F. Value to all tables (Copy N.F. Value button), Run Valve at 100% (Start/Stop buttons), Auto Calibrate NF (Fast/Precision buttons, Abort NF Calibration button).
- Backup & Restore (System & ACTIVE table):** Factory Backup (Load button), User Backup (Load/Save buttons), Date Backup was Saved (00/00/00), Calibration Notes <128 char max> (CCW-14 20 LB/MIN 20HZ, 20 SEC CATCH TESTS), Reload this table with default values (Clear Table Data button).
- Copy Table (Copies current table to selected table):** Copy Table To (#1), Copy current table data to selected table (COPY TABLE button).
- Cycle Logging:** Trigger at end/start of cycle (End dropdown), Graph Last Cycle (Show Graph button), Create Textfile (RUNCYCLE.txt button).

### Flow Control

**Active Table** – Selects the active table. To change the active table, select the desired table from the dropdown list. The selected table becomes the Active Table. The graph and the Calibration Results table display the saved values for the Active Table.

**Local Setpoint Enable** – When enabled, the Analog Input is disabled and the Setpoint is controlled by the Local Setpoint Value entered by the user on the Table Setting tab in the embedded webpage.

**Local Setpoint Value** – When the Local Setpoint is enabled, the Local Setpoint Valve sets the flow rate of the 600 Series MagnaValve.

**Manual Flow** – Pressing the Start button will start media flow through the 600 Series MagnaValve. Pressing the Stop button will stop media flow through the 600 Series MagnaValve. *Note:* The Start / Stop buttons will start and stop media flow regardless of the Setpoint mode (local or remote).

### Table Settings

**Table Name** – Enter the desired table name and click “Save Changes.” This table name is displayed on the 600 Series MagnaValve’s LCD and the Home Screen.

**Valve Capacity** – Valve Capacity is the maximum flow rate the 600 Series MagnaValve is capable of with the media type and size used. This value is automatically collected from the 100% Setpoint catch test and equals the 100% catch test flow rate. It is updated each time the 100% Setpoint catch test is completed and saved.

**Max Flow** – Max Flow is the desired maximum flow rate for the active table and is the calibrated flow rate for the Analog Output. If the Servo is turned ON, then when 10 Vdc is applied to the Analog Input (Setpoint Input), the 600

Series MagnaValve flows the Max Flow and the 600 Series MagnaValve outputs 10 Vdc on the Analog Output when flowing the Max Flow value. For example, if Max Flow is equal to 30 lb/min, then 0 – 10 Vdc applied to the Analog Input flows 0 – 30 lb/min (where 0 Vdc flows 0 lb/min and 10 Vdc flows 30 lb/min). While at the same time, when the 600 Series MagnaValve is flowing 0 lb/min, the Analog Output Signal is 0 Vdc and when the 600 Series MagnaValve is flowing 30 lb/min, the Analog Output Signal is 10 Vdc.

**Setpoint Lock** – When the box is checked, the Analog Input (Setpoint Input) gets latched when the Enabled signal is applied. This ensures that the Setpoint remains steady throughout the run cycle.

**Enable Delay (0-5.0 seconds)** – This setting delays the start of media flow for the set time after the enable signal to the 600 Series MagnaValve has been received.

**Vout Filter Moving Avg** – Controls the amount of filtering on the Analog Output signal. This parameter does not affect the servo response. The moving average filter works for averaging the last x number of analog output values together. The sample rate of the Analog Output is equal to the Pulse Frequency. The default value is 4. The range is 1 to 512.

### Servo Settings

**Servo Enable** - Checking this option enables the servo (closed-loop mode). Enabling the servo uses the sensor inside the 600 Series MagnaValve as feedback to maintain a constant flow rate.

**Servo Filter Moving Avg** – Filters the sensor signal before it is used by the servo. This is helpful when the sensor signal is very noisy. The default value is 4. The range is 1 to 32. Increasing this value will slow down the servo's response.

**Servo Gain <1-100>** - The proportional contribution of the PI servo algorithm. The higher the number; the more aggressive the servo response will be. The default value is 25. The range is 1 to 100.

**Servo Speed <1-100>** - The integral contribution of the PI servo algorithm. The higher the number; the quicker the servo will respond. The default value is 30. The range is 1 to 100.

**Servo Delay** – Delays the servo for a set amount of time at the start of a cycle. At the start of a cycle, it takes time for media to reach the sensor and for the flow rate to stabilize. If the servo is active during this stabilization period, the system will start to oscillate. The default value is 30. The range is 1 to 100. The Servo Delay is scaled such that each increment is equal to the Pulse Frequency period.

$$Delay\ time\ (s) = \frac{1}{Pulse\ Frequency\ (Hz)} \times Servo\ Delay\ Value$$

Example: What is the delay when the Pulse Frequency is 20 Hz and the Servo Delay value is 30?

$$\frac{1}{20\ Hz} \times 30 = 1.5\ seconds$$

**Save All Changes** – Press “SAVE CHANGES” after making any changes on this page. **Note:** Pressing “SAVE CHANGES” does not save the cycle logging data.

### Neutral Field Settings

**N.F. Value <0~255>** - This value sets the magnetic field inside the 600 Series MagnaValve to 0 G when flowing media. This value is critical in ensuring that the 600 Series MagnaValve will flow media and the 600 Series MagnaValve will flow the maximum amount physically possible when fully turned on. **Note:** This value is set at the factory and should not need to be changed.

**Copy NF. Value to all tables** – Pressing this button will copy the neutral field (N.F.) valve from the active table to all other tables. In most applications, all tables will have the same N.F. value. Only in special circumstances, such as one

table is calibrated with cast steel and another table is calibrated with stainless conditioned cut wire, then the N.F. values maybe different for those tables. **Note:** Pressing this button will overwrite the N.F. values in all other tables.

**Run Valve at 100%** - Clicking the Start button will turn the 600 Series MagnaValve on 100%; clicking the Stop button will turn off the 600 Series MagnaValve. This option is typically used when setting neutral field (N.F.) using a gauss meter.

**Auto Calibrate NF** – The Auto Calibrate NF is an automatic procedure that turns the 600 Series MagnaValve on 100% and then increases the amount of current through the power coils while monitoring the flow sensor. This procedure finds the amount of current (N.F. Value) needed to get the maximum flow rate when the valve is turned on 100%. The result is stored for the active table only. Pressing the Abort NF Calibration button will abort the procedure. **Note:** The Precision option will flow media for up to two minutes.

## Backup and Restore

**Factory Backup** – Choosing “Load” restores all tables back to factory settings. **Note:** It is recommended that before choosing the Factory Backup option, save all calibrated tables to the User Backup. Doing so allows the user data to be reloaded after the Factory Backup if desired.

**User Backup** – Choosing “Load” restores the active table and table setting to last user backup. Choosing “Save” saves the active table and table settings to the User Backup.

**Date Backup was Saved** – Allows the user to date the backup. The date entered in this field will be displayed at all times even if the “Save” button was never pressed.

**Calibration Notes** – Allows the user to add notes to the backup or to this table. The data entered in this field will be displayed at all times even if the “Save” button was never pressed.

**Reload this table with default values** – Erases the active table and loads all zero values.

## Copy Table

This allows a user to copy the active table to another table. Copy Table can be used to test out different servo settings without risk of affecting the active table.

**Copy Table To** – Selects the table number for the placement of the active table copy.

**Copy current table data to selected table** – Pressing this button will copy the contents and settings of the active table to the selected desired table.

## Cycle Logging

**Trigger at end/start of cycle** – The 600 Series MagnaValve data logs 500 samples of the of the start or end of the peening cycle. The Trigger at end/start of cycle sets whether the first or last 500 samples are logged. Choose from the dropdown list. To see the data, click the “Show Graph” link below.

**Graph Last Cycle** – Clicking the Show Graph link will display a graph showing the first or last 500 samples of the last cycle.

**Create Textfile** – Clicking the RUNCYCLE.txt button will build and download a text file of the first or last 500 samples of the last cycle. The text file is tab delimited and can be imported into Excel or MATLAB for further evaluation.

# Certification

Certification verifies catch tests results. The 600 Series MagnaValve’s Jump-To feature enables users to reduce the length of a catch test.



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## 600 Series MagnaValve® Control Center

HOME

VALVE

SETTINGS

CALIBRATION

TABLE

SETTINGS

CERTIFICATION

**Table Settings**

Table Name CCW14 22LB 20HZ  
 Media Type CCW14  
 Valve Capacity 45.09 Lb/min  
 Max Flow 20 Lb/min  
 Pulse Frequency 20

**Test Settings**

Active Table #1 ▾  
 Test Type Local ▾  
 Test Duration 10 sec ▾

**Run Certification Test**

Setpoint 100% ▾  
 Begin Test   
 Enter Catch  Lb  
 Sensor Signal  
 Calculate and Update Table   
 Manually Replace Table values

**Backup**  
(System & ACTIVE table)

User Backup   
 Date Cert. was Saved 5/24/21  
 Certification Notes <128 char max>:  
 CCW-14 20LB/MIN 20HZ  
 20 SEC CATCH

Create Textfile

[View Enlarged Graph](#)

Certification Results					
SetPoint	Ideal Lb/min	Catch Lb/min	Error Lb/min	% of Pt.	% of FS
100%	20.000	21.750	1.750	8.750	8.750
95%	19.000	20.730	1.730	9.105	8.650
85%	17.000	18.660	1.660	9.765	8.300
75%	15.000	16.530	1.530	10.200	7.650
70%	14.000	15.450	1.450	10.357	7.250
65%	13.000	14.340	1.340	10.308	6.700
55%	11.000	12.210	1.210	11.000	6.050
45%	9.000	9.870	0.870	9.667	4.350
35%	7.000	7.650	0.650	9.286	3.250
25%	5.000	5.520	0.520	10.400	2.600
15%	3.000	3.300	0.300	10.000	1.500

Setpoint <1-99>

### Table Settings

**Table Name** –This table name is displayed on the 600 Series MagnaValve’s LCD and the Home Screen.

**Media Type** – Enter the media type and size used during the active table’s calibration and click “Save Changes.” An example of media type and size is S-230 or CCW-14. The media type is displayed on the Home Screen.

**Valve Capacity** – Valve Capacity is the maximum flow rate the MagnaValve is capable of with the media type and size used. This value is automatically collected from the 100% Setpoint catch test and equals the 100% catch test flow rate. It is updated each time the 100% Setpoint catch test is completed and saved.

**Max Flow** – Max Flow is the desired maximum flow rate for the active table and is the calibrated flow rate for the Analog Output. If the Servo is turned ON, then when 10 Vdc is applied to the Analog Input (Setpoint Input), the 600 Series MagnaValve flows the Max Flow, and the 600 Series MagnaValve outputs 10 Vdc on the Analog Output when flowing the Max Flow value. For example, if Max Flow is equal to 30 lb/min, then 0 – 10 Vdc is applied to the Analog Input will flow 0 – 30 lb/min (where 0 Vdc flows 0 lb/min and 10 Vdc flows 30 lb/min). While at the same time, when the 600 Series MagnaValve is flowing 0 lb/min, the Analog Output Signal is 0 Vdc and when the 600 Series MagnaValve is flowing 30 lb/min, the Analog Output Signal is 10 Vdc.

**Pulse Frequency** – This is the rate at which the valve dispenses shot. The value must be set before calibration. See the **Calibration section**. *Note:* Changing this value affects the 600 Series MagnaValve’s calibration.

### Test Settings

**Active Table** – Selects the active table. To change the active table, select the desired table from the drop-down list. The selected table becomes the Active Table. The graph and the Calibration Results table display the saved values for the Active Table.

**Test Type** – Selects whether the catch test is triggered locally (Local) or remotely through the Enable Signal (Remote).

**Test Duration** – If the test type is Local, select the duration of the catch test. Options are 10, 20, 30, 45, 60, 90, 120 seconds. If conducting a Remote test, the catch test duration is equal to the applied Enable signal duration.

### Run Certification Test

**Setpoint** – Selects the desired Setpoint to conduct a catch test.

**Begin Test** – If Test Type is set to Local, clicking the Start button starts media flow. Media flows for the selected Test Duration. If Test Type is set to Remote, clicking the Start button allows the catch test to start after an Enable signal is received. At that time, the media starts flowing. Media continues to flow until the Enable signal is removed.

**Enter Catch** – At the end of a catch test, enter the total weight caught during the catch test. The system calculates the flow rate automatically based on the catch test’s duration and the weight of the media caught.

**Sensor Signal** – This is the measured sensor signal during the catch test.

**Calculate and Update Table** – Press “Save Catch” to save Catch Test results to the Certification Results table.

**Manually Replace Table values** – Press “Replace” to make changes to Catch Test results in the Certification Results table.

### Backup

**User Backup** – Choosing “Load” restores the active table and table setting to the last user backup. Choosing “Save” saves the active table and table settings to the User Backup.

**Date Cert. was Saved** – Allows the user to date the backup. The date entered in this field is displayed at all times even if the “Save” button was never pressed.

**Calibration Notes** – Allows the user to add notes to the backup or to this table. The data entered in this field is displayed at all times even if the “Save” button was never pressed.

**Create Textfile** – Clicking the TABLE.txt button builds and downloads the text file with all the data (both open-loop and closed-loop tests) from the active table. The textfile is tab-delimited and can be imported into Excel or MATLAB for further evaluation.

### Graph

The graph shows the results of the open-loop test (from the calibration page) and the closed-loop test (the certification results). The graph is flow rate vs. Analog Input where 0 – 100% represents 0 – 10 Vdc on the Analog Input. Green line is open-loop, Blue is closed-loop, and Red is ideal.

### Certification Results

The Certification Results table shows the flow rate for each Setpoint and its corresponding Sensor Signal. The Sensor Signal was measured during the catch test for the given Setpoint, and the lb/min is the flow rate calculated from the entered catchweight at the end of the catch test.

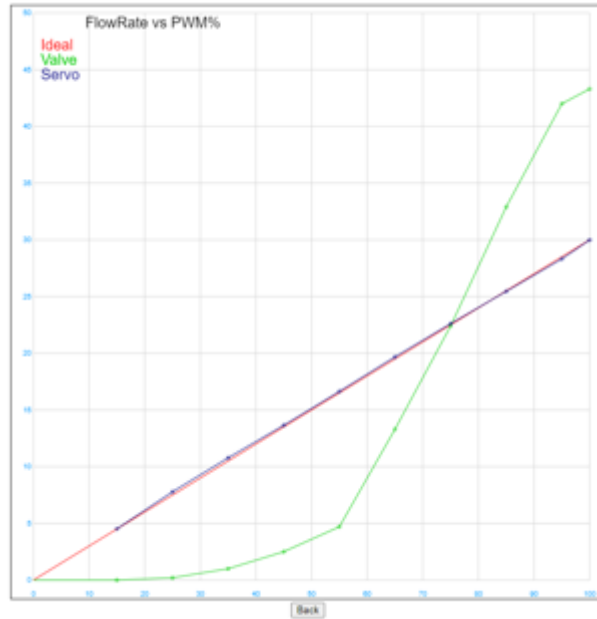
### Add Setpoint / Del Setpoint

The Add Setpoint and Del (delete) Setpoint buttons at the bottom of the Certification Results table allow additional Setpoints to be added or current setpoints removed from the Certification Results table.



## Graph

The graph shows the results of the open-loop test (from the calibration page) and the closed-loop test (the certification results). The graph is flow rate vs. Analog Input where 0 – 100% represents 0 – 10 Vdc on the Analog Input. Green line is open-loop, Blue is closed-loop, and Red is ideal.



# Valve Operation

## Changing Valve Settings

Valve Settings can be found by selecting the VALVE SETTINGS tab on the embedded webpage.



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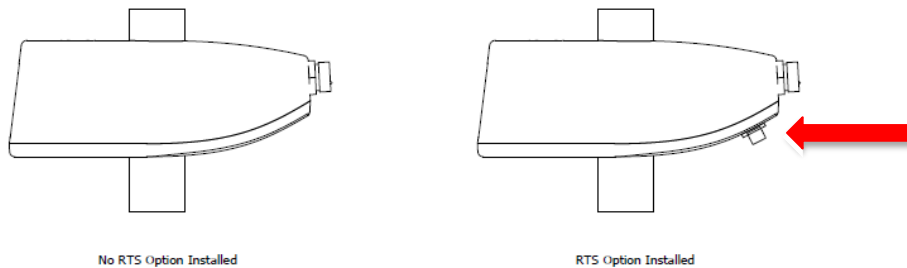
### 600 Series MagnaValve® Control Center

The screenshot shows the web interface for the 600 Series MagnaValve Control Center. On the left is a vertical navigation menu with tabs: HOME, VALVE SETTINGS (highlighted in yellow), CALIBRATION, TABLE SETTINGS, and CERTIFICATION. The main content area is divided into four sections:

- Network Settings** (Pwr-cycle after changing settings):
  - Active IP Address: 192.168.10.4 (DHCP)
  - MagnaValve Name: MagnaValve
  - Network Mode: request DHCP (dropdown)
  - Static IP Addr: 0.0.0.0
  - Static NetMask: 0.0.0.0
  - Static Gateway: 0.0.0.0
  - Save Changes: SAVE CHANGES
- Protected Settings** (requires Authorization Code to change):
  - Model: 678-24
  - Serial Number: 211039-19
  - Factory Cal. Date: 3/19/21
  - Factory Cal. By: MAI
  - Gauss: 407
  - Authorization Code: (empty field)
  - Save Changes: SAVE CHANGES
- Valve Settings**:
  - RTS Enable (0-10V table sel):
  - Units in Kg:
  - Legacy (FC24) Setup: Apply Settings
  - Display Mode: Bargraph (dropdown)
- Setup Analog In/Out**:
  - Sets voltage at Vin to equal 100% Flow: Calibrate Setpoint
  - Flow Output Mode: 0-10V (dropdown)
  - SP Input Mode: 0-10V (dropdown)
  - DAC 10V Cal <65535 max>: 57519
  - Setpoint 10V Cal <65535 max>: 63316

### How to Enable / Disable RTS (Remote Table Select) if installed

If the RTS option is installed on the MagnaValve, the RTS Enable should be selected. If the RTS option is NOT installed on the MagnaValve and this option is selected, unintentional table changes may occur.



To Enable or Disable RTS mode:

1. Left click the Valve Settings tab.
2. Under Valve Settings,
3. Check the box next to **RTS Enable** to enable the RTS mode.
4. Uncheck the box next to **RTS Enable** to disable the RTS mode.

### ***How to change weight units (lb or kg)***

The weight values in the calibration tables can be displayed in either kilograms or pounds.

**Note:** Ensure the correct units are chosen before entering catch weights into a table. The value entered is assumed to be in the units selected under Valve Settings.

To change the weight units:

1. Left click on the Valve Settings tab.
2. Under Valve Settings,
3. Check the box next to **The Units in Kg** to display the weight units in kilograms.
4. Uncheck the box next to **The Units in Kg** to display the units in pounds.

### ***How to set the 600 Series MagnaValve to work with a FC-24 Controller***

To quickly configure the 600 Series MagnaValve to be operated from a FC-24 Controller:

1. Left click the Valve Settings tab.
2. Under Valve Settings,
3. Left click the “Apply Settings” button next to **Legacy (FC24) Setup**.

**Note:** Clicking the “Apply Settings” button makes the following changes:

- Turn off the Servo for all tables
- Turn off Setpoint lock
- Change the display mode of the LCD to Bargraph no Servo

**Note:** To revert to the previous state after clicking the “Apply Settings” button next to **Legacy (FC24) Setup**, all settings must be changed back manually.

### ***How to change the Display Mode***

The 600 Series MagnaValve has five screen display options. The different options are Off, Splash, Bargraph, Legacy, and Bargraph & Splash. The different options are shown below (off is not shown).

**Off** – When “Off” is chosen, the LCD remains blank after power on.

**Bargraph** – When “Bargraph” is chosen, the LCD displays the most information of all the screens. This option shows the setpoint, flow rate, and servo output in both a bar graph view and digital readout. It displays the 600 Series MagnaValve’s name, table number, and table name. It also displays the status of the Enable, Setpoint Lock, and Servo. When the servo is turned OFF, the display will show all the same information; however, the Setpoint bar graph and read out will not be displayed.

**Legacy** – When “Legacy” is chosen, the LCD mimics the four LEDs on the front of the 5xx -24 MagnaValves.

**Bargraph & Splash** – When “Bargraph & Splash” is chosen, the LCD will toggle between the Bargraph and Splash screens at a fixed interval entered into the Change Time number box.

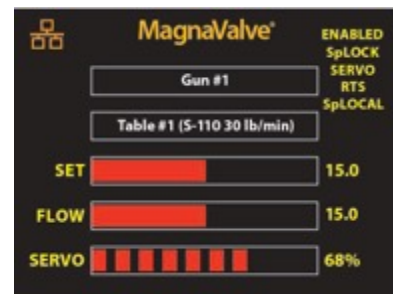
To change the Display Mode:

1. Left click the Valve Setting tab.
2. Under Valve Settings,
3. Select the desired Display Mode from the drop-down next to **Display Mode**.
4. If Bargraph and Splash are chosen for the Display Mode, then enter the switching duration in the number box next to **Change Time**.

The default valve for the Display Mode is Bargraph.



*Splash Screen*



*Bargraph Screen*



*Legacy Screen*

# Setup Analog In/Out

Setup Analog In/Out can be found by selecting the SETTINGS tab on the embedded webpage.



1-800-832-5653 or 574-256-5001  
<https://www.electronics-inc.com>

## 600 Series MagnaValve® Control Center

The screenshot shows the web interface for the 600 Series MagnaValve Control Center. On the left is a navigation menu with buttons for HOME, VALVE SETTINGS (highlighted with a red box), CALIBRATION, TABLE SETTINGS, and CERTIFICATION. The main content area is divided into three panels: Network Settings, Protected Settings, and Valve Settings. The 'Setup Analog In/Out' panel is highlighted with a red box and contains the following fields:

Setup Analog In/Out	
Sets voltage at Vin to equal 100% Flow	Calibrate Setpoint
Flow Output Mode	0-10V
SP Input Mode	0-10V
DAC 10V Cal <65535 max>	57519
Setpoint 10V Cal <65535 max>	63316

### How to change the Setpoint Input to Voltage or Current Input

The Analog Input can be configured to either 0 – 10 V output or 4 – 20 mA input.

To change the Analog Input mode (SP Input Mode):

1. Left click the Valve Settings tab.
2. Under Setup Analog In/Out,
3. Left-click the drop-down next to **SP Input Mode** and choose either 0 – 10 V or 4 – 20 mA.

**Note:** If “Off” is chosen for the “SP Input Mode,” then the Analog Input is disabled.

## ***How to adjust the Analog Voltage Input***

To ensure that the 10 Vdc applied to the Analog Input of the 600 Series MagnaValve® causes the MagnaValve to flow the maximum calibrated flow rate, the Calibrate Setpoint can be run. When this procedure is run, the 600 Series MagnaValve reads the applied voltage signal on the Analog Input and rescales the input to that applied voltage signal.

To adjust the Analog Voltage Input:

1. Left click the Valve Settings tab.
2. Set the PLC, FM-24, or FC-24 to output 10Vdc.
3. Under Setup Analog In/Out,
4. Left click the “Calibrate Setpoint” button.
5. The **Setpoint 10V Cal** number box updates with the new value.

**Note:** This value can be overwritten. It is recommended to use the above procedure to set this value. However, if an adjustment is still needed after running the above procedure, then type in a new value and press Enter on the keyboard. Alternatively, left click the increment or decrement arrows inside the text box.

**Note:** This procedure is only available when the Setpoint Input is set to 0 – 10V.

## ***How to change Analog Output to either Voltage or Current Output***

The Analog Output can be configured to either 0 – 10 V output or 4 – 20 mA output.

To change the Analog Output mode (Flow Output Mode):

1. Left click the Valve Settings tab.
2. Under Setup Analog In/Out,
3. Left-click the drop-down next to **Flow Output Mode** and choose either 0 – 10 V or 4 – 20 mA.

**Note:** If “Off” is chosen for the “Flow Output Mode,” then the Analog Output is disabled.

## ***How to adjust the Analog Output***

The analog output of the 600 Series MagnaValve® can be adjusted to ensure that the attached receiver receives the proper analog output, i.e., the analog output signal and the receiver matches the flow rate displayed on the LCD on the 600 Series MagnaValve.

**Note:** 168  $\mu$ Vdc / count. The default setting is 59410.

To check the Analog Output:

1. Ensure the Analog Output is attached to a receiver, such as a PLC input.
2. Ensure the Analog Output Mode matches the receiver input type (0 – 10 V or 4 – 20 mA).

3. Start flow through the 600 Series MagnaValve or insert a ferrous metal rod into the sensor of the 600 Series MagnaValve, ensure the sensor signal is less than full flow.
4. Record the Analog Output value, voltage or current.
5. Record the flow rate reading on the LCD, located on the front of the 600 Series MagnaValve.
6. Use the following equations to calculate the Correcting Count.

$$\text{Desired Analog Output} = \frac{10 \text{ V or } 20 \text{ mA}}{\text{Full Scale Flow Rate}} \times \text{Flow Rate Reading on LCD}$$

$$\text{Correcting Count} = \frac{\text{Desired Analog Output} - \text{Recorded Analog Output}}{168 \mu\text{V/count}}$$

$$\text{Correcting Count} = \frac{\text{Desired Analog Output} - \text{Recorded Analog Output}}{24 \mu\text{A / count}}$$

To adjust the Analog Output:

1. Left click the Valve Settings tab.
2. Under Setup Analog In/Out,
3. Add the Correcting Counts to the number in the number box next to **DAC 10V Cal**.
4. In the number box next to **DAC 10V Cal**, type the new value and press Enter on the keyboard.
5. Alternatively, left click the increment or decrement arrows inside the text box.

# Adjusting Neutral Field



1-800-832-5653 or 574-256-5001  
<https://www.electronics-inc.com>

## 600 Series MagnaValve® Control Center

**HOME**

**VALVE**

**SETTINGS**

**CALIBRATION**

**TABLE SETTINGS**

**CERTIFICATION**

**Flow Control**

Active Table #1

Local Setpoint Enable

Local Setpoint Value 5 lbs/min

Manual Flow Start Stop

**Table Settings**

Table Name CCW14 22LB 20HZ

Valve Capacity 45.09 lbs/min

Max Flow 20 lbs/min

Setpoint Lock

Enable Delay (0-5.0 seconds) 0

Vout Filter Moving Avg 40

**Servo Settings**

Servo Enable

Servo Filter Moving Avg 4

Servo Gain <1~100> 25

Servo Speed <1~100> 30

Servo Delay 30

Save All Changes SAVE CHANGES

**Backup & Restore**  
(System & ACTIVE table)

Factory Backup Load

User Backup Load Save

Date Backup was Saved 00/00/00

Calibration Notes <128 char max>:  
CCW-14 20 LB/MIN 20HZ  
20 SEC CATCH TESTS

Reload this table with default values Clear Table Data

**Copy Table**  
(Copies current table to selected table)

Copy Table To #1

Copy current table data to selected table COPY TABLE

**Neutral Field Settings**

N.F. Value <0~255> -- 148 ++

Copy N.F. Value to all tables: Copy N.F. Value

Run Valve at 100%: Start Stop

Auto Calibrate NF Fast Precision

Abort NF Calibration

**Cycle Logging**

Trigger at end/start of cycle End

Graph Last Cycle Show Graph

Create Textfile RUNCYCLE.txt

## How to Set the Neutral Field Current

The 600 Series MagnaValve is a normally off valve by using a permanent magnet. When media flow is required, power coils disrupt the permanent magnet's path to the ferrous media, allowing media to flow.

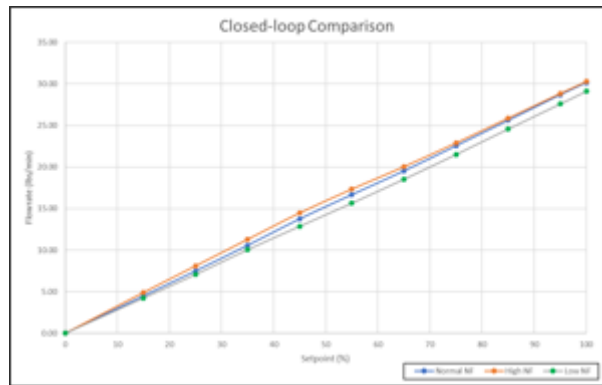
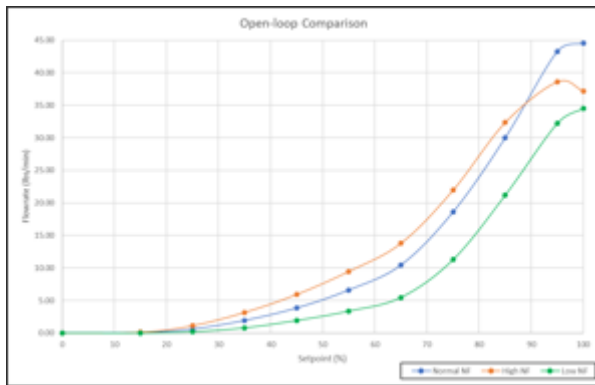
The N.F. or Neutral Field current is the current through the power coils when the 600 Series MagnaValve is on and flowing media. This value is set to provide the best performance and maximum flow rate of ferrous peening media through the 600 Series MagnaValve. There are three methods to set the Neutral Field current in the 600 Series MagnaValve. The N.F. Value can be set using a gauss meter, a Cliff-O-Meter (a ferrous metal strip), or the Auto Calibrate N.F. Procedure built into the 600 Series MagnaValve.

**Note:** If the N.F. Current is too high or too low, the maximum flow rate through the 600 Series MagnaValve reduces, and the open-loop performance changes. See the graphs below. Changing the N.F. Current affects the calibration of the 600 Series MagnaValve, causing inaccurate flow rates, instability of the flow rate, or no media flow may occur if the N.F. Current is too far off.

**Note:** When stainless steel conditioned cut wire shot is used, it can become magnetized. The magnetized shot requires a different N.F. Value. Each table can have its own N.F. Value.

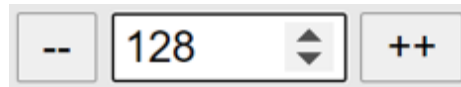
**Note:** Each table can have a separate N.F. Value.



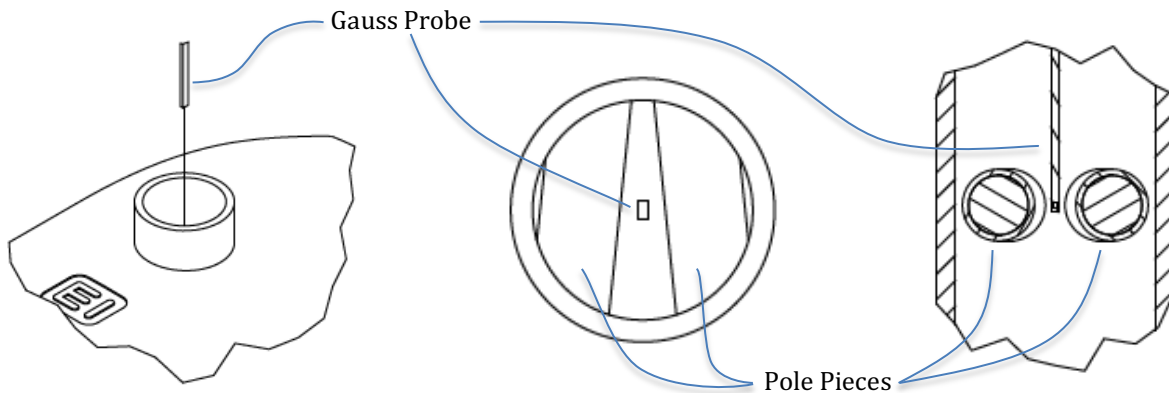


### How to Set the Neutral Field Current Using a Gauss Probe

1. Ensure the desired table is active. See **How to change tables**.
2. Left click the Table Settings tab.
3. Under Neutral Field Settings,
4. Left click the "Start" button next to **Run Valve at 100%**.
5. Insert a gauss probe into the top of the 600 Series MagnaValve, ensure that probe is centered between the pole pieces (front to back and left to right) and the measurement location is centered in the middle of the pole pieces (up and down). See images below.
6. Left click the ++ or -- buttons next to **N.F. Value <0~255>** or left click the increment or decrement arrows inside the text box until the gauss meter reads 0.0 G ±5 G.

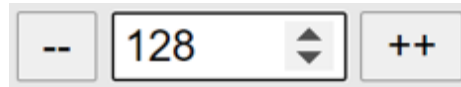


7. Remove the gauss probe.
8. Left click the "Stop" button next to **Run Valve at 100%**.

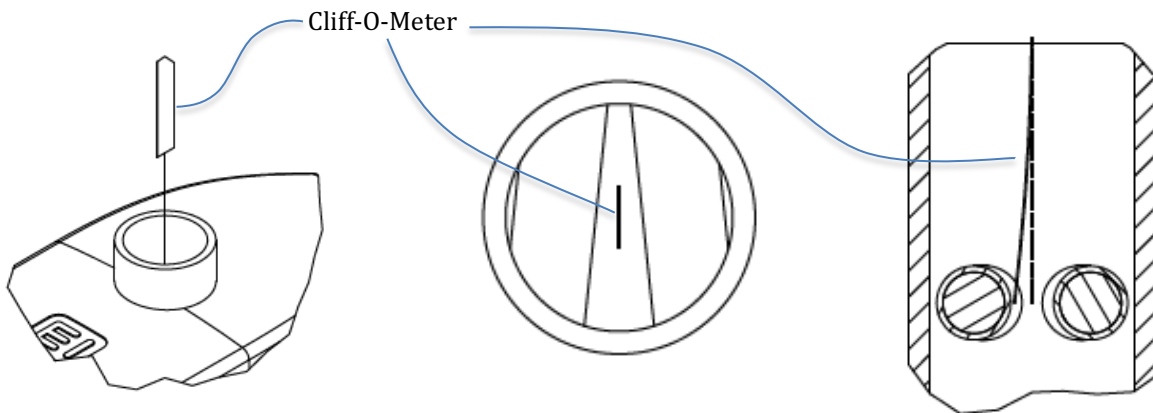


## How to Set the Neutral Field Current Using a Cliff-O-Meter

1. Ensure the desired table is active. See **How to change tables**.
2. Left click the Table Settings tab.
3. Under Neutral Field Settings,
4. Left click the "Start" button next to **Run Valve at 100%**.
5. Insert a Cliff-O-Meter or thin ferrous metal strip into the top of the 600 Series MagnaValve, ensure that probe is centered between the pole pieces (front to back and left to right) and in the middle of the pole pieces (up and down). See images below.
6. The Cliff-O-Meter or thin ferrous metal strip should not be attracted to the pole pieces or very weakly attracted to the pole pieces.
7. Left click the + + or - - buttons next to **N.F. Value <0~255>** or left-click the increment or decrement arrows inside the text box until the Cliff-O-Meter or thin ferrous metal strip is no longer attracted or weakly attracted to the pole pieces.

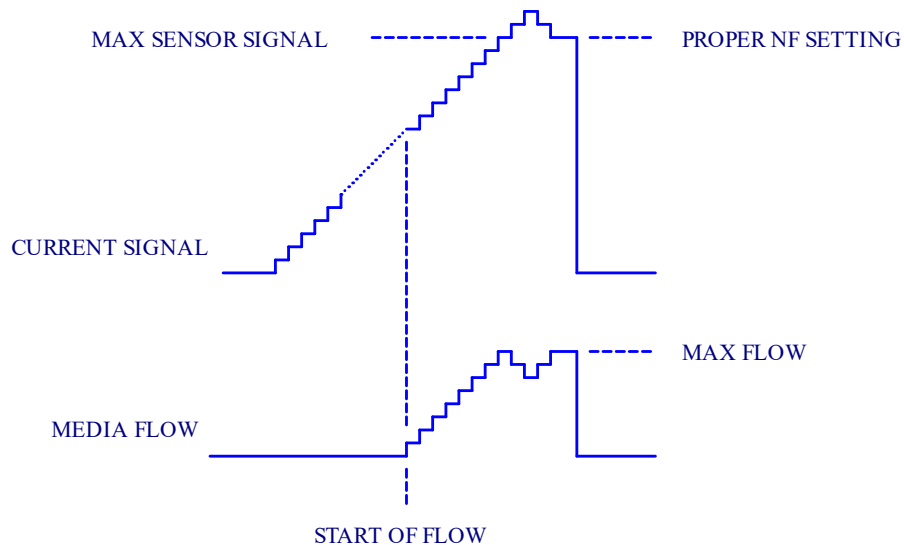


8. Remove the Cliff-O-Meter or thin ferrous metal strip.
9. Left click the "Stop" button next to **Run Valve at 100%**.



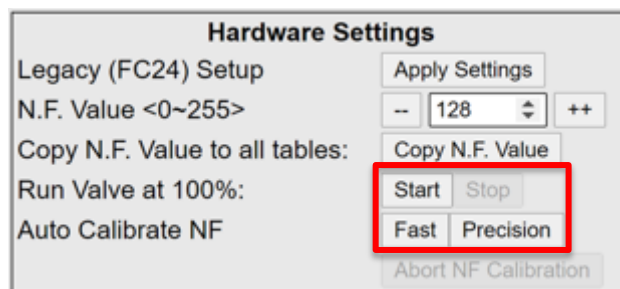
## How to Set the Neutral Field Current Using the Auto Calibrate N.F. Procedure

The procedure increases the current through the MagnaValve while monitoring the sensor signal. The procedure continues to increase the current through the MagnaValve until media starts to flow and the maximum sensor signal is detected. See the figure below.

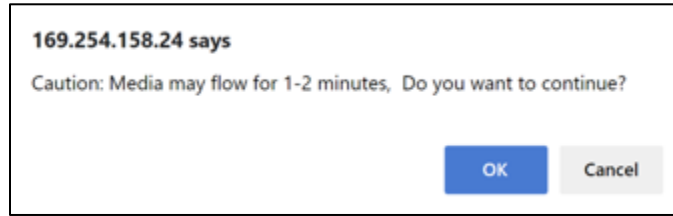


To set the neutral field current using the Auto Calibrate N.F. Procedure:

1. Ensure the desired table is active. See **How to change tables**.
2. Left click the Table Settings tab.
3. Under Neutral Field Settings,
4. Left click either the Fast or Precision button next to **Auto Calibrate NF**.
  - a. Fast – runs the procedure quicker. This is helpful when the media level is low.
  - b. Precision – takes longer but is more precise. The precision option is recommended.



5. Left click the “OK” button on the pop-up box to continue.



6. After the procedure is complete, the number box next to **N.F. Value <0~255>** will update.
7. Pressing the “Abort NF Calibration” button during the procedure stops media flow and exits the procedure.

### ***How to copy a Neutral Field Value from one table to all other tables***

1. Left click the Table Settings tab.
2. Under Neutral Field Settings,
3. Left click the “Copy N.F. Value” button next to **Copy N.F. Value to all tables**.

**Note:** In most applications, cast steel shot and conditioned cut wire shot uses the same N.F. Value. Copying the N.F. Value from the active table into all other tables ensures each table has a good N.F. Value applied.

**Note:** After N.F. is set for Table #1, that value is copied to the other tables at the factory.

## Controlling the Flow Rate

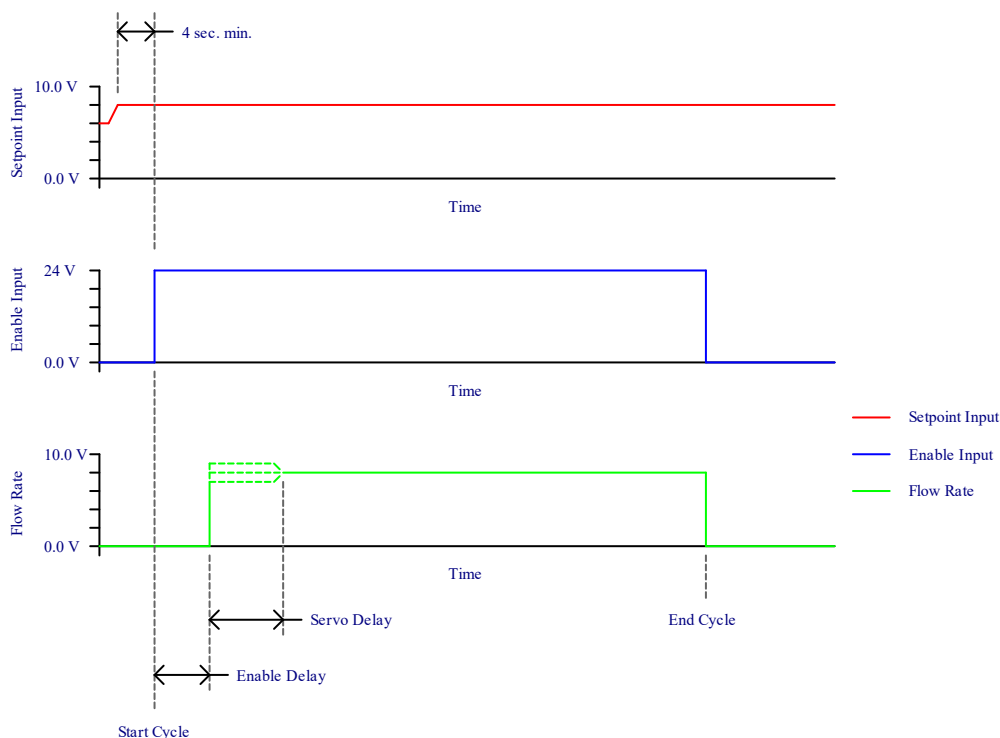
### How to start and stop media flow using Analog I/O

Use the following steps to start and stop media flow.

1. Apply the Setpoint to the Analog Input (0 – 10 Vdc or 4 – 20 mA) the orange wire. To calculate the Analog Input signal, see **How to change the flow rate, servo On** and **How to change the flow rate, servo Off**.
2. Apply 24 Vdc to the Enable Input (blue wire) to start the flow and apply 0 Vdc to the Enable Input to stop the flow.
3. Media flow starts after the application of the Enable Input and the Enable Delay times out. See **How to change the Enable Delay**.

**Note:** After changing the Analog Input, allow approximately two seconds before applying 24 Vdc to the Enable Input.

**Note:** If the Setpoint Lock is enabled, changing the Analog Input (orange wire) while the MagnaValve is enabled (flowing media) does not influence the flow rate. While the Setpoint Lock is enabled, any changes to the Analog Input will take effect the next peening cycle.



## How to start and stop media flow using Local Setpoint

Use the following steps to start media flow when Local Setpoint is enabled.

1. Left click the Table Settings tab.
2. Under Flow Control,
3. Left click the **Start** button.

Use the following steps to stop media flow when Local Setpoint is enabled.

1. Left click the Table Settings tab.
2. Under Flow Control,
3. Left click the **Stop** button.

## How to change the flow rate, Servo On

The 600 Series MagnaValve has two methods of controlling the flow rate: Analog I/O or Local Setpoint. The 600 Series MagnaValve also has two methods of controlling the flow rate: Servo ON (Closed-Loop Mode) and Servo OFF (Open-Loop Mode). When the Internal Servo is ON, the Analog Input or Local Setpoint serves as the Setpoint control where the Analog Input or Local Setpoint controls the flow rate through the 600 Series MagnaValve in a linear response from No Flow to Maximum Calibrated Flow Rate.

The 0 – 10 Vdc or 4 – 20 mA Analog Input represents the flow rate from 0 lb/min (or kg/min) to the Full-Scale Value. For example, if a 600 Series MagnaValve is calibrated and set to 30 lb/min, then 10 Vdc or 20 mA applied to the Analog Input sets the Setpoint to 30 lb/min.

**Note:** The Maximum Calibrated Flow Rate can be found on the gold label located on the side of the MagnaValve, or from the Home tab in the embedded webpage.

To control the flow rate using the Analog I/O.

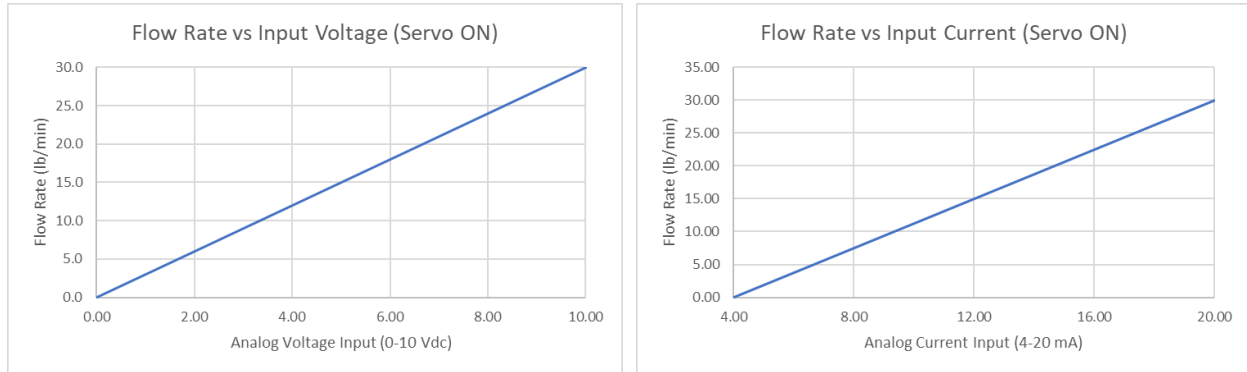
1. Left click the Table Settings tab.
2. Under Flow Control,
3. Ensure the check box next to **Local Setpoint Enabled** is un-checked.
4. Left click on the **SAVE CHANGES** button if changes were made.

To calculate the Setpoint from the Analog Input signal, use the following equations.

$$\text{Setpoint} \left( \frac{\text{lb}}{\text{min}} \text{ or } \frac{\text{kg}}{\text{min}} \right) = \frac{\text{Max Calibrated Flow Rate} \left( \frac{\text{lb}}{\text{min}} \text{ or } \frac{\text{kg}}{\text{min}} \right)}{10 \text{ Vdc}} \times \text{Analog Input (Vdc)}$$

$$\text{Setpoint} \left( \frac{\text{lb}}{\text{min}} \text{ or } \frac{\text{kg}}{\text{min}} \right) = \frac{\text{Max Calibrated Flow Rate} \left( \frac{\text{lb}}{\text{min}} \text{ or } \frac{\text{kg}}{\text{min}} \right)}{16 \text{ mA}} \times (\text{Analog Input (mA)} - 4 \text{ mA})$$

### Example Only



To control the flow rate using the Local Setpoint.

1. Left click the Table Settings tab.
2. Under Flow Control,
3. Ensure the check box next to **Local Setpoint Enabled** is checked.
4. Left click on the **SAVE CHANGES** button if changes were made.
5. Enter the desired flow rate in the number box next to **Local Setpoint Value**.
6. Left click on the **SAVE CHANGES** button if changes were made.

### ***How to change the flow rate, Servo Off***

The 600 Series MagnaValve has two methods of controlling the flow rate, Analog I/O or Local Setpoint. The 600 Series MagnaValve also has two methods of controlling the flow rate: Servo ON (Closed-Loop Mode) and Servo OFF (Open-Loop Mode). When the Servo is OFF, the Analog Input or Local Setpoint controls the PWM directly. The 0 – 10 Vdc or 4 – 20 mA Analog Input represents 0 – 100% PWM. However, when entering a value for the Local Setpoint, the PWM is equal to the percentage of the entered value to the Max Flow value (see equation below).

$$PWM \% = \frac{\text{Setpoint} \left( \frac{lb}{min} \text{ or } \frac{kg}{min} \right)}{\text{Max Calibrated Flow Rate} \left( \frac{lb}{min} \text{ or } \frac{kg}{min} \right)}$$

With the Servo disabled, the internal sensor still measures the media flow rate and updates the Analog Output. However, the flow rate is not adjusted to maintain the desired flow rate.

**Note:** In this mode, the Analog Input could be controlled by a FC-24 that has a built-in servo, or could be controlled by a PLC, with or without a servo.

**Note:** In this mode, the flow rate vs. Analog Input is a non-linear response. See the graphs below.

To calculate the PWM (%) from the Analog Input signal, use the following equations.

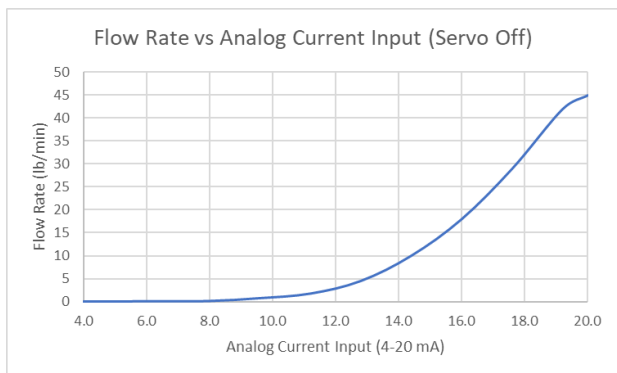
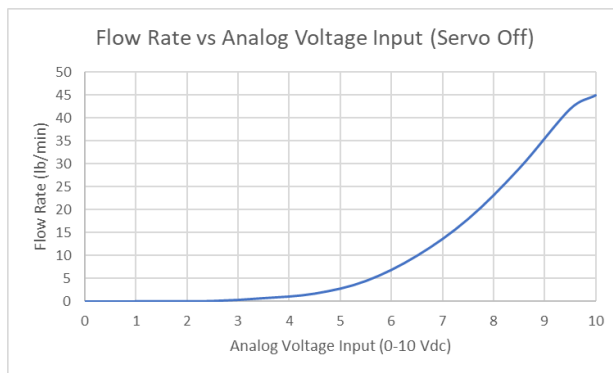
$$PWM (\%) = \frac{100 \%}{10 Vdc} \times Analog\ Input\ (Vdc)$$

$$PWM (\%) = \frac{100 \%}{16\ mA} \times (Analog\ Input\ (mA) - 4\ mA)$$

**Note:** These graphs are an example only. The actual Flow Rate vs. Analog Input is affected by:

- Pulse Frequency
- Shot type
- Shot size
- Pressure differential across the valve

### Example Only



### **How to change active tables (RTS)**

If the 600 Series MagnaValve® is equipped with the RTS (Remote Table Select) option, then the active table is controlled through the RTS cable located on the bottom of the MagnaValve. See the [Electrical section on page 17](#) for more information.

Using a single 0 – 10 Vdc Analog Input (Pin 4, Red/Yellow), located on the RTS connector, one of nine tables can be selected. The table below shows the analog voltage that selects the table.

**Note:** To use the RTS option, it must be enabled. See **How to Enable / Disable RTS (Remote Table Select)**.

### **RTS Voltage Ranges**

<b>Voltage Range</b>	<b>Table #</b>
<b>0 Vdc – 1.5 Vdc</b>	Table 1
<b>1.5 Vdc – 2.5 Vdc</b>	Table 2
<b>2.5 Vdc – 3.5 Vdc</b>	Table 3
<b>3.5 Vdc – 4.5 Vdc</b>	Table 4
<b>4.5 Vdc – 5.5 Vdc</b>	Table 5
<b>5.5 Vdc – 6.5 Vdc</b>	Table 6
<b>6.5 Vdc – 7.5 Vdc</b>	Table 7
<b>7.5 Vdc – 8.5 Vdc</b>	Table 8
<b>8.5 Vdc – 10 Vdc</b>	Table 9



## ***How to change active tables (Non RTS)***

The active table is changed from one of three locations on the embedded webpage: the Calibration, Table Settings, or Certification tab.

Use the following steps to change the table from the embedded webpage:

1. Left click the Calibration tab.
2. Under Calibration Settings,
3. Left click the drop-down next to **Active Table** and choose the desired table number.

Or

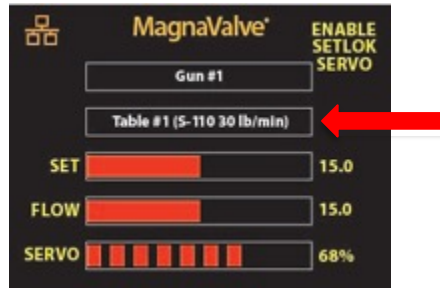
1. Left click the Table Settings tab.
2. Under Flow Control,
3. Left click the drop-down next to **Active Table** and choose the desired table number.

Or

1. Left click the Certification tab.
2. Under Test Settings,
3. Left click the drop-down next to **Active Table** and choose the desired table number.

## How to change the Table Name

The table name is displayed on the LCD located on the front of the 600 Series MagnaValve®. See the image below. The table name is used to provide information about the active table to the user.



Use the following steps to change the Table Name:

1. Left click on the Calibration tab.
2. Ensure the desired Active Table is selected.
3. Under Table Settings,
4. Enter the new table name in the text box next to **Table Name**.
5. Click the “Save Changes” button next to **Save Settings**.

Or

1. Left click on the Table Settings tab.
2. Ensure the desired Active Table is selected.
3. Under Table Settings,
4. Enter the new table name in the text box next to **Table Name**.
5. Click the “Save Changes” button next to **Save Settings**.

## ***How to change the Media Type***

The Media Type is displayed on the Home tab. See the image below. The Media Type is used to provide information about the media type used during the calibration of the active table to the user.

<b>Active Table Settings</b>	
Active Table	#1
	MagnaValve
Media Type	CCW-14
Flow Limit	30 lbs/min
Valve Capacity	44.1022 lbs/min
Pulse Frequency	30.00 Hz

Use the following steps to change the Media Type:

1. Left click on the Calibration tab.
2. Under Table Settings,
3. Ensure the desired Active Table is selected.
4. Enter the new media type in the text box next to **Media Type**.
5. Click the “Save Changes” button next to **Save Settings**.

## ***How to change the maximum flow rate***

Use the following steps to change the maximum flow rate:

1. Left click on the Calibration tab.
2. Ensure the desired Active Table is selected.
3. Under Table Settings,
4. Change the value in the number box next to **Max Flow**.
5. Click the “Save Changes” button next to **Save Settings**.

Or

1. Left click on the Table Settings tab.
2. Ensure the desired Active Table is selected.
3. Under Table Settings,
4. Change the value in the number box next to **Max Flow**.
5. Click the “Save Changes” button next to **Save Settings**.

## How to change the pulse frequency

The pulse frequency is the rate at which the valve dispenses shot. This value must be set before the 600 Series MagnaValve® is calibrated. See **Principle of Operation** for more information.

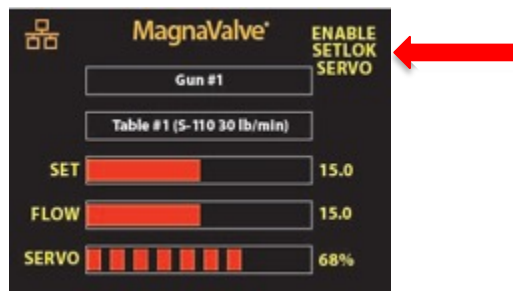
**Note:** Changing this value after calibration affects the MagnaValve’s calibration. The range is 6 to 50 Hz.

Use the following steps to change the Pulse Frequency:

1. Left click on the Calibration tab.
2. Ensure the desired Active Table is selected.
3. Under Table Settings,
4. Enter the new pulse frequency in the number box next to **Pulse Frequency**.
5. Click the “Save Changes” button next to **Save Settings**.

## How to turn the Setpoint Lock On or Off

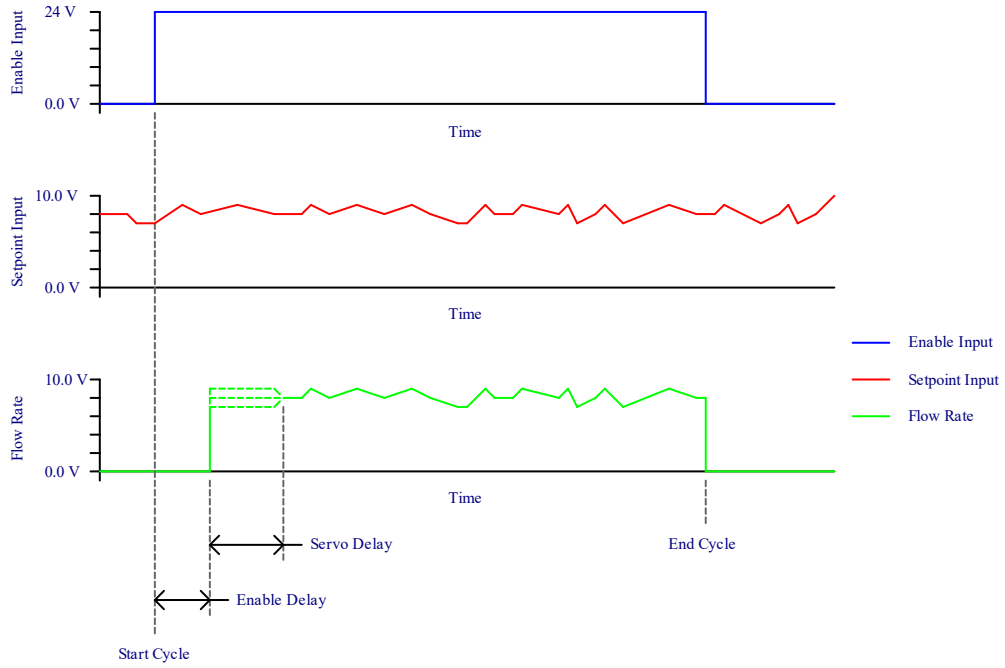
The Setpoint Lock latches the Analog Input (Setpoint Input) when the Enable signal is applied. This ensures that the Setpoint remains steady throughout the run cycle. This is typically used in noisy environments. When Setpoint Lock is enabled, an indicator is shown in the top-right corner of the LCD located on the front of the 600 Series MagnaValve®. See the image below.



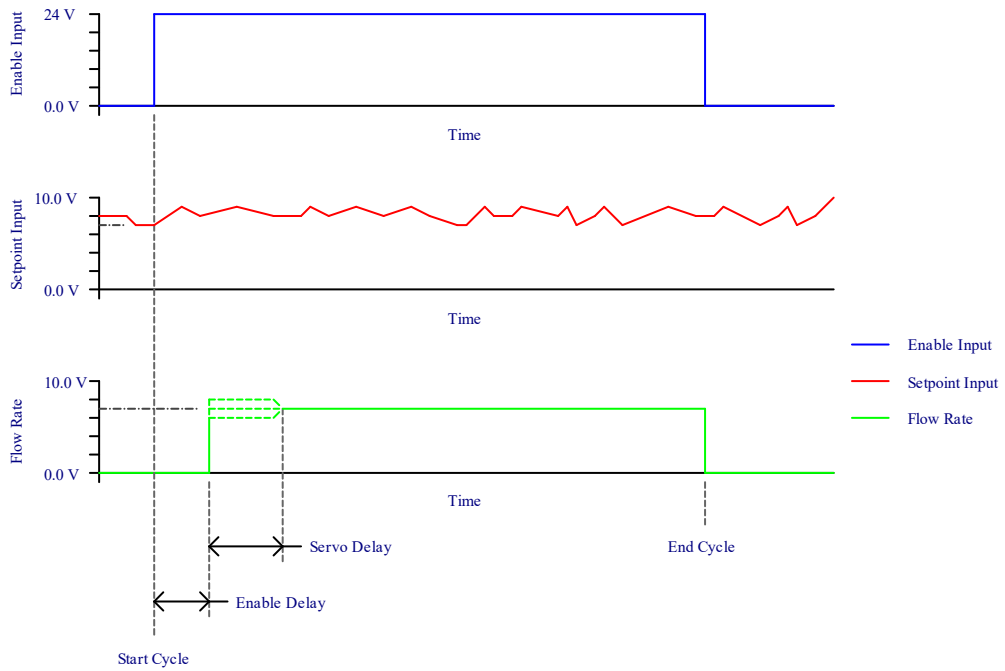
Use the following steps to turn the Setpoint Lock On or Off:

1. Left click on the Table Settings tab.
2. Ensure the desired Active Table is selected.
3. Under Table Settings,
4. Check the box next to **Setpoint Lock**, to enable the Setpoint Lock.
5. Uncheck the box next to **Setpoint Lock**, to disable the Setpoint Lock.
6. Click the “Save Changes” button next to **Save Settings**.

### Setpoint Lock Disabled



### Setpoint Lock Enabled



## How to change the Enable Delay

The Enable Delay delays the start of media flow for a set amount of time after the enable signal to the MagnaValve has been received. The top graph in the figure below shows the applied Setpoint. The middle graph in the figure below shows an applied Enable Signal, where the enable signal equals the duration of the peening cycle, plus the Enable Delay. The bottom graph shows the start of media flow after the Enable Delay times out.

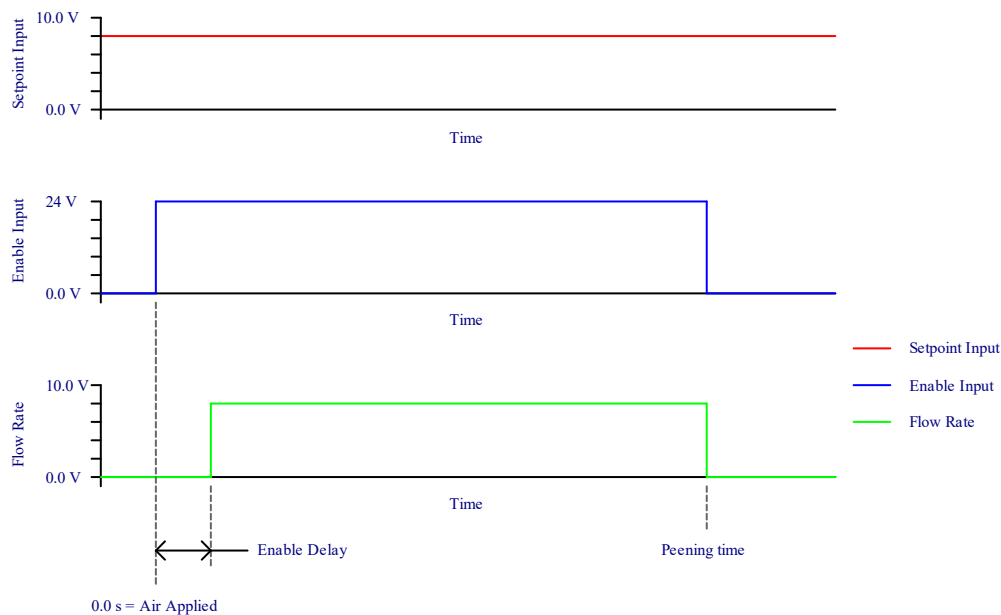
**Note:** The media flow stops at the same time the Enable Signal is removed.

To change the Enable Delay:

1. Left click the Table Settings tab.
2. Under Table Settings,
3. Change the value in the number box next to **Enable Delay**.
4. Click the “Save Changes” button next to **Save Settings**.

The default value for the Enable Delay is 0 seconds.

The range of values for the Enable Delay is 0 – 5.0 seconds.



## How to change the filter for the Analog Output

The Analog Output Filter is a moving average filter that works by averaging the last x number of analog output values. The Analog Output Filter controls the filtering on the Analog Output signal and does not affect the servo response. The sample rate of the Analog Output is equal to the Pulse Frequency.

The default value is 4. The range is 1 to 512.

Use the following steps to change the Pulse Frequency:

1. Left click on the Table Settings tab.
2. Ensure the desired Active Table is selected.
3. Under Table Settings,
4. Enter the new filter value in the number box next to **Vout Filter Moving Avg.**
5. Click the “Save Changes” button next to **Save Settings.**

### ***How to turn the Servo On or Off***

Use the following steps to turn the Servo On or Off:

1. Left click on the Table Settings tab.
2. Ensure the desired Active Table is selected.
3. Under Servo Settings,
4. Check the box next to **Servo Enable**, to enable the servo.
5. Uncheck the box next to **Servo**, to disable the servo.
6. Click the “Save Changes” button next to **Save Settings.**

### ***How to change Servo settings***

**Servo Enable** – Checking this option enables the servo (closed-loop mode). Enabling the servo uses the sensor inside the MagnaValve as feedback to maintain a constant flow rate. The default is Servo Enabled.

**Servo Filter Moving Avg** – Filters the sensor signal before it is used by the servo. This is helpful when the sensor signal is very noisy. The default value is 4. The range is 1 to 32. Increasing this value slows down the servo’s response.

**Servo Gain <1-100>** – The proportional contribution of the PI servo algorithm. The higher the number, the more aggressive the servo response. The default value is 25. The range is 1 to 100.

**Servo Speed <1-100>** – The integral contribution of the PI servo algorithm. The higher the number, the quicker the servo responds. The default value is 30. The range is 1 to 100.

**Servo Delay** – Delays the servo for a set amount of time at the start of a cycle. At the start of a cycle, it takes time for media to reach the sensor and for the flow rate to stabilize. If the servo is active during this stabilization period, the system may start to oscillate. The default value is 30. The range is 1 to 100. The Servo Delay is scaled such that each increment is equal to the Pulse Frequency period.

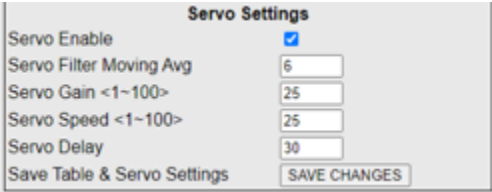
$$Delay\ time\ (s) = \frac{1}{Pulse\ Frequency\ (Hz)} \times Servo\ Delay\ Value$$

Example: What is the delay when the Pulse Frequency is 20 Hz, and the Servo Delay value is 30?

$$\frac{1}{20\ Hz} \times 30 = 1.5\ seconds$$

Use the following steps to change the Servo setting:

1. Left click on the Table Settings tab.
2. Under Flow Control,
3. Ensure the desired Active Table is selected.
4. Then under Servo Settings, change the desired values for:
  - a. Servo Filter Moving Avg
  - b. Servo Gain <1~100>
  - c. Servo Speed <1~100>
  - d. Servo Delay
5. Click the “Save Changes” button next to **Save Table & Servo Settings**.



Servo Settings	
Servo Enable	<input checked="" type="checkbox"/>
Servo Filter Moving Avg	<input type="text" value="6"/>
Servo Gain <1~100>	<input type="text" value="25"/>
Servo Speed <1~100>	<input type="text" value="25"/>
Servo Delay	<input type="text" value="30"/>
Save Table & Servo Settings	<input type="button" value="SAVE CHANGES"/>

### ***How to backup a table***

**Factory Backup** – This is the backup of all calibrated tables completed at the factory. The user can load the Factory Backup but not edit the Factory Backup.

**User Backup** – This is a backup completed by the user after making changes to the active table. The user can save to or restore from the User Backup. Each table has its own User Backup.

**Date Backup was Saved** – Allows the user to date the backup. The data entered in this field is displayed even if the “Save” button was never pressed.

**Calibration Notes** – Allows the user to add notes to the backup or to the active table. The data entered in this field is displayed even if the “Save” button was never pressed.

Use the following steps to save the active table to **User Backup**:

1. Left click on the Table Settings tab.
2. Under Flow Control,
3. Ensure the desired Active Table is selected.
4. Then under Backup & Restore,
5. Enter the “Date” in the number box next to **Date Backup was Saved**.
6. Enter any “Calibration Note” in the text box below **Calibration Notes**.
7. Click the “Save” button next to **User Backup**.

Or

Use the following steps to save the active table to **User Backup**:

1. Left click on the Certification tab.
2. Under Test Settings,
3. Ensure the desired Active Table is selected.
4. Then under Backup,
5. Enter the “Date” in the number box next to **Date Backup was Saved**.
6. Enter any “Calibration Note” in the text box below **Calibration Notes**.
7. Click the “Save” button next to **User Backup**.



## How to restore a table

**Factory Backup** – This is the backup of all calibrated tables completed that the factory. The user can load the Factory Backup but not edit the Factory Backup.

**User Backup** – This is a backup completed by the user after making changes to the active table. The user can save to or restore from the User Backup. Each table has its own User Backup.

**Reload this table with default values** – Erases the active table, loads all zero values into the active table, and sets all Table Settings and Servo Settings to default values.

Use the following steps to restore the active table from **Factory Backup**:

1. Left click on the Table Settings tab.
2. Under Flow Control,
3. Ensure the desired Active Table is selected.
4. Then under Backup & Restore,
5. Click the “Load” button next to **Factory Backup**.

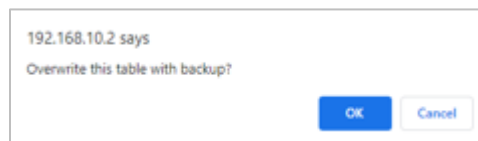


6. Click “OK” in the pop-up box.

Or

Use the following steps to restore the active table from **User Backup**:

1. Left click on the Table Settings tab.
2. Under Flow Control,
3. Ensure the desired Active Table is selected.
4. Then under Backup & Restore,
5. Click the “Load” button next to **User Backup**.



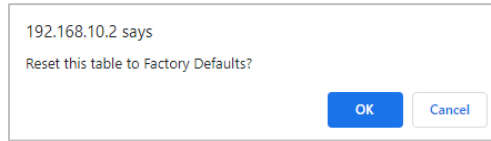
6. Click “OK” in the pop-up box.

Or

Use the following steps to restore the active table to **Default Values**:

1. Left click on the Table Settings tab.

2. Under Flow Control,
3. Ensure the desired Active Table is selected.
4. Then under Backup & Restore,
5. Click the “Clear Table Data” button next to **Reload this table with default values.**



6. Click “OK” in the pop-up box.

### ***How to export a table***

A text file can be created and downloaded containing all the data (both open-loop and closed-loop tests) from the active table. The text file is tab-delimited and can be imported into Excel or MatLAB for further evaluation.

Use the following steps to create and export a text file of the active table:

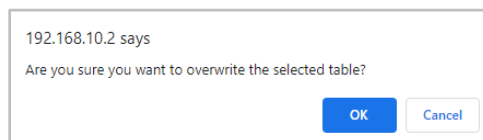
1. Left click on the Certification tab.
2. Under Flow Control,
3. Ensure the desired Active Table is selected.
4. Then under Backup,
5. Click the “TABLE.txt” button next to **Create Textfile.**

### ***How to copy one table to another table***

The Copy Table function copies all the Calibration Results, Certification Results, Table Settings, and Servo Settings from the active table to the selected table.

Use the following steps to copy one table to another table:

1. Left click on the Table Settings tab.
2. Under Flow Control,
3. Ensure the table to be copied (Active Table) is selected.
4. Then under Copy Table,
5. Left click the drop-down next to **Copy Table to** and choose the desired table to copy the active table to.
6. Click the “Copy Table” button next to **Copy current table data to selected table.**

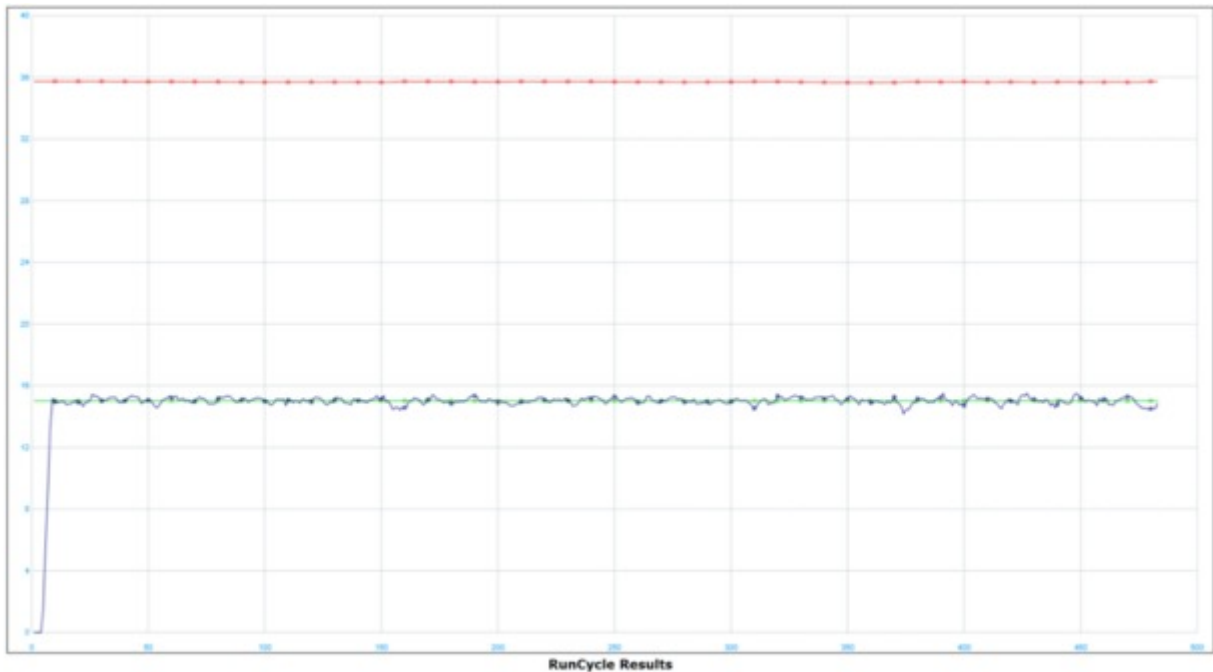


7. Click “OK” in the pop-up box.

## How to log the start / end of a peening cycle

Use the following steps to Data Log the start of a peening cycle:

1. Left click on the Table Settings tab.
2. Under Cycle Logging,
3. Left click the drop-down next to **Trigger at end/start of cycle** and select either Start or End.
4. Run a peening cycle.
5. Then click the "Show Graph" link next to **Graph Last Cycle**.
6. To download a text file of the data, click the "RUNCYCLE.txt" button next to **Create Textfile**.



Key: PWM Setpoint Flow

Legend:

- Red – PWM (Duty Cycle percentage of Pulse Frequency, see **Principle of Operation**)
- Green – Setpoint (Analog Input)
- Blue – Flow (Sensor Signal / Analog Output)

Scaling notes:

- Sample markers are every 10 samples (i.e., there are nine samples plotted between two round markers).
- The sample interval is the Pulse Frequency time base (i.e.,  $1/20 \text{ Hz} = 50 \text{ ms}$ ).
- The PWM amplitude value is the PWM on-time in milliseconds (i.e., 40% Duty Cycle of 20 Hz = 20 ms).
- Flow and Setpoint amplitude values are in user-selected units in kg/min or lb/min.

# Calibration of 600 Series MagnaValve®

An annual calibration of the 600 Series MagnaValve® is recommended. The annual calibration should be based on the first date of use, not the factory date of calibration.

## Preparing for Calibration



### Equipment Needed

- 600 Series MagnaValve
- A peening/blasting machine or test stand (shown above)
- Scale capable of weighing total weight caught during a catch test
- Computer with web browser (not shown)
- Container to catch the media
- 6-pin cable (shipped with MagnaValve)
- CAT5 Ethernet cable
- Peening / Blasting media
- Timer with normally open contacts (optional)

## ***Setting Up the Workstation***

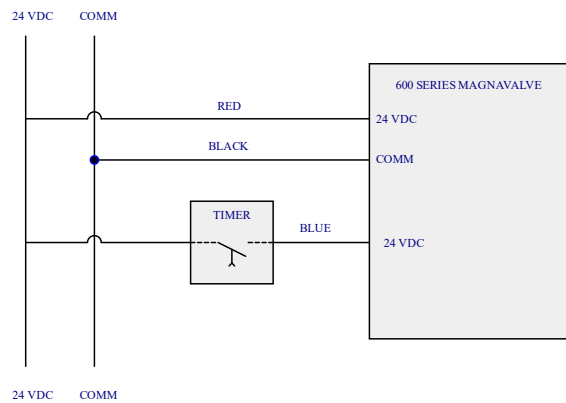


Mount the MagnaValve to the peening / blasting machine or to the test stand. See the **Installation section** for more information about installing the 600 Series MagnaValve on a peening / blasting machine. Shown above is a test stand with a platform scale with a digital readout and a control timer for conducting a timed catch test (optional).



Wire and connect the 6-pin cable to the 600 Series MagnaValve. (See the **Electrical section** for more information about wiring the 600 Series MagnaValve.) Connect the computer to the 600 Series MagnaValve by using a CAT5 Ethernet cable. If using a laptop without an Ethernet port, an Ethernet to USB converter may be used.

**Note:** The 600 Series MagnaValve has a built-in timer for conducting timed catch tests during calibration. However, if timed catch tests or installation on a simple peening / blasting machine without a PLC, an external timer may be used. The wiring diagram below shows how an external timer is wired to the 600 Series MagnaValve.

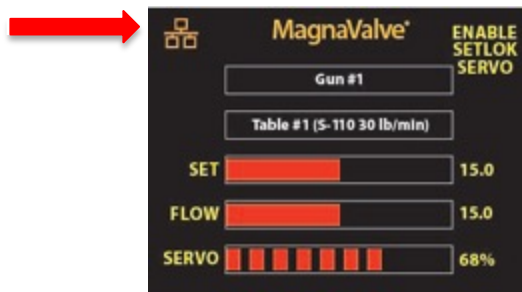




Apply power to the 600 Series MagnaValve. During power up, the splash screen will be displayed on the LCD for five seconds and then switch to the selected display mode. Bargraph is the selected display mode in the above photograph.



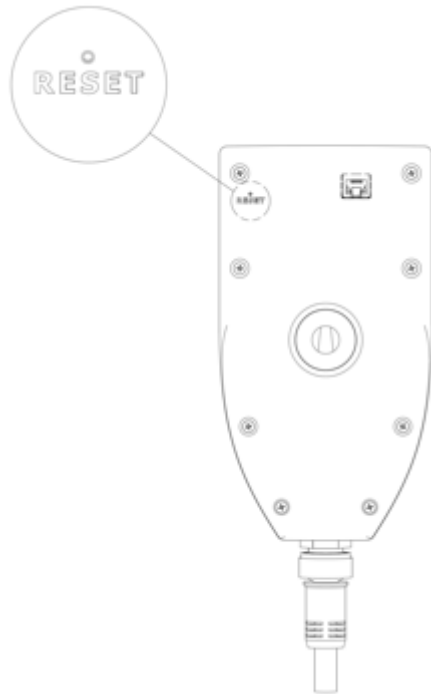
Fill hopper with the shot type / size desired for calibration. **Note:** A small amount of media may fall through the 600 Series MagnaValve when filling the hopper. Place a catch container below the 600 Series MagnaValve and tare the scale.



After powering on the 600 Series MagnaValve, it will take approximately 90 seconds to establish Ethernet communication. Once the 600 Series MagnaValve is communicating with the computer, the network indicator will be displayed in the top left corner of the LCD located on the front of the 600 Series MagnaValve.

Open a web browser and enter the IP address of the 600 Series MagnaValve. The default IP address is:  
<http://169.254.158.24>.





```

----- SYSTEM INFO -----
Valvedriver rev: 1.06 3-22-21
JSON rev      : 1.01 1-8-21
MAC Address   : XXXXXX:XXXXXX:XXXX
IP Address    : 169.254.158.24 <auto>
BT Address    : <no addr>

----- RESET button actions -----
* Press & Hold <1-sec> for CPU Reset.

* Press & Hold <5-sec> to reset system
  settings to FACTORY DEFAULTS.

-----
<timeout in 10 seconds>
  
```

**Note:** If a DHCP server is used or the IP address has been changed and is unknown, use a paper clip and press the RESET button on the bottom of the 600 Series MagnaValve. An information screen will be displayed for 10 seconds that will show the IP address of the 600 Series MagnaValve.



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### 600 Series MagnaValve® Control Center

<b>HOME</b>	<table border="1"> <tr> <th>MagnaValve Name</th> <th>MagnaValve</th> </tr> <tr> <td>Model Number</td> <td>678-24</td> </tr> <tr> <td>Serial Number</td> <td>211039-19</td> </tr> <tr> <td>Factory Calibration</td> <td>3/19/21</td> </tr> <tr> <td>Firmware</td> <td>Rev 1.09 5-20-21</td> </tr> </table>	MagnaValve Name	MagnaValve	Model Number	678-24	Serial Number	211039-19	Factory Calibration	3/19/21	Firmware	Rev 1.09 5-20-21	<table border="1"> <tr> <th colspan="2">Run Hours</th> </tr> <tr> <td>Power Cycles</td> <td>52</td> </tr> <tr> <td>Valve On-Time</td> <td>1.45</td> </tr> <tr> <td>Hrs &lt;= 25C</td> <td>0</td> </tr> <tr> <td>25C &lt; Hrs &lt;= 80C</td> <td>83.4</td> </tr> <tr> <td>80C &lt; Hrs &lt;= 95C</td> <td>0</td> </tr> <tr> <td>95C &lt; Hrs</td> <td>0</td> </tr> <tr> <td><b>Total Hours</b></td> <td><b>83.4</b></td> </tr> </table>	Run Hours		Power Cycles	52	Valve On-Time	1.45	Hrs <= 25C	0	25C < Hrs <= 80C	83.4	80C < Hrs <= 95C	0	95C < Hrs	0	<b>Total Hours</b>	<b>83.4</b>
MagnaValve Name	MagnaValve																											
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<b>VALVE SETTINGS</b>																												
<b>CALIBRATION</b>																												
<b>TABLE SETTINGS</b>	<table border="1"> <tr> <th colspan="2">Active Table Settings</th> </tr> <tr> <td>Active Table</td> <td>#1</td> </tr> <tr> <td>Media Type</td> <td>CCW14</td> </tr> <tr> <td>Flow Limit</td> <td>22 lbs/min</td> </tr> <tr> <td>Valve Capacity</td> <td>45.09 lbs/min</td> </tr> <tr> <td>Pulse Frequency</td> <td>20.00 Hz</td> </tr> </table>	Active Table Settings		Active Table	#1	Media Type	CCW14	Flow Limit	22 lbs/min	Valve Capacity	45.09 lbs/min	Pulse Frequency	20.00 Hz	<table border="1"> <tr> <th colspan="2">Flow Control</th> </tr> <tr> <td>Local Setpoint Enabled</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Setpoint Value</td> <td>10 lbs/min</td> </tr> </table>	Flow Control		Local Setpoint Enabled	<input type="checkbox"/>	Setpoint Value	10 lbs/min								
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Flow Control																												
Local Setpoint Enabled	<input type="checkbox"/>																											
Setpoint Value	10 lbs/min																											
<b>CERTIFICATION</b>																												

Once connected and logged into the 600 Series MagnaValve, the Home Screen will be displayed in the web browser. The Home Screen displays information about the MagnaValve's setup.

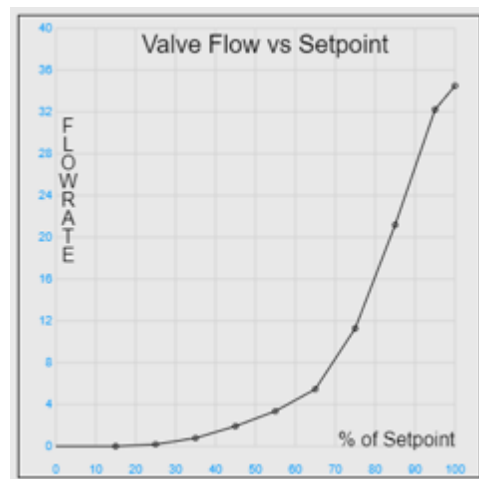
## Conducting a Calibration

The process of calibrating a 600 Series MagnaValve is simply filling in a look-up table with measured sensor signals for known flow rates across the operating range of the MagnaValve. Typically, from the factory, the 600 Series MagnaValve has 10 calibration points in a table. These calibration points are spaced across the operating range of the MagnaValve and referred to as Setpoint percent. Because the media flow through the 600 Series MagnaValve is controlled by PWM (pulse width modulation), the open-loop response (servo turn OFF) is non-linear (see table and graph below). The flow rate of media at each Setpoint in the table is affected by several parameters, such as:

- Media type (cast steel, cut wire, conditioned stainless cut wire, etc.)
- Media size
- Pulse frequency
- Pressure differential (difference in pressure between the pressure pot and mixing tee)

Therefore, it is necessary to re-calibrate the 600 Series MagnaValve if any of these parameters are changed.

Calibration Results		
SetPoint	Lb/min	Sensor Signal
100%	34.500	22327
95%	32.220	20666
85%	21.180	13087
75%	11.280	6397
65%	5.460	2941
55%	3.360	1793
45%	1.920	1029
35%	0.780	488
25%	0.180	133
15%	0.000	0



To calibrate the 600 Series MagnaValve, a timed catch test is conducted at each Setpoint in the table. During the catch test, the sensor signal is measured and then user enters the media weight caught during the duration of the catch test. This information is then loaded into the table. After a catch test has been conducted for each Setpoint, the calibration is complete. However, it is recommended that the calibration be certified by conducting another set of closed-loop (servo ON) catch tests across the calibrated range of the 600 Series MagnaValve. When the servo is turned ON, the 600 Series MagnaValve utilizes the look-up table to ensure the actual flow rate matches the requested flow rate. The certification will confirm that it does.

## Setting Up the Open-Loop Test

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600 Series MagnaValve® Control Center

HOME  
**VALVE SETTINGS**  
 CALIBRATION  
 TABLE SETTINGS  
 CERTIFICATION

**Network Settings**  
 (Per cycle after changing settings)  
 Active IP Address 192.168.10.4 (DHCP)  
 MagnaValve Name MagnaValve  
 Network Mode request DHCP  
 -Static IP Addr 0.0.0.0  
 -Static NetMask 0.0.0.0  
 -Static Gateway 0.0.0.0  
 Save Changes

**Protected Settings**  
 (requires Authorization Code to change)  
 Model 678-24  
 Serial Number 211039-19  
 Factory Cal. Date 3/19/21  
 Factory Cal. By MW  
 Gauss 457  
 Authorization Code  
 Save Changes

**Valve Settings**  
 RTS Enable (3-12V table set)   
 Units in Kg    
 Legacy (FC24) Setup   
 Display Mode Emergency  
 Upload Custom Logo Choose File No file chosen  
 Use Custom Logo

**Setup Analog In/Out**  
 Set voltage at Vin to equal 100% Flow Calibrate Setpoint  
 Flow Output Mode 0-12V  
 SP Input Mode 0-12V  
 DAC 12V Cal -05535 max- 57519  
 Setpoint 12V Cal -05535 max- 63609

Before starting calibration, left click on the Valve Settings tab. In the Valve Settings section, confirm the proper Units are selected: lb/min or kg/min. **Note:** All weights entered during calibration must be entered in the Units selected.

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600 Series MagnaValve® Control Center

HOME  
 VALVE SETTINGS  
**CALIBRATION**  
 TABLE SETTINGS  
 CERTIFICATION

**Table Settings**  
 Table Name COW14 30L8 29HZ  
 Media Type COW14  
 Valve Capacity 34.5 Lb/min  
 Max Flow 30 Lb/min  
 Pulse Frequency 20 Hz  
 Save Settings Save Changes

**Calibration Settings**  
 Active Table #2  
 Test Type Local  
 Test Duration 10 sec

**Run Catch Test**  
 Setpoint 100%  
 Begin Test \$START  
 Enter Catch  Lb  
 Sensor Signal   
 Calculate and Update Table Save Catch  
 Manually Replace Table values Replace

**Valve Flow vs Setpoint**

**Calibration Results**

SetPoint	Lb/min	Sensor Signal
100%	34.500	22327
95%	32.250	26566
90%	31.180	13087
78%	11.280	8397
68%	6.480	2941
58%	3.380	1793
48%	1.920	1029
38%	0.780	488
28%	0.180	133
18%	0.000	0

Setpoint <1-99> [0] Add Setpoint Del Setpoint

1. Left click on the Calibration Tab on the left side of the webpage.

**Calibration Settings**  
 Active Table #1  
 Test Type Local  
 Test Duration 10 sec

2. Under Calibration Settings, select the table to be calibrated from the drop-down next to **Active Table**.

Choose the Test Type, Local or Remote from the drop-down next to Test Type.

- Remote – the flow duration during a catch test is controlled by the Enable Signal.
  - Local – the flow duration is chosen from the Test Duration drop-down and controlled by a timer built-in the 600 Series MagnaValve.
3. If using Local as the Test Type, then choose the desired Test Duration from the drop-down next to **Test Duration**.

Table Settings	
Table Name	CCW14 22LB 20HZ
Media Type	CCW14
Valve Capacity	45.09 Lb/min
Max Flow	22 Lb/min
Pulse Frequency	20 Hz
Save Settings	SAVE CHANGES

4. Under Table Settings enter the Table Name, Media Type, Max Flow, and Pulse Frequency into their respected fields.

**Note:** Ensure the Pulse Frequency is set to the desired value. Changing the Pulse Frequency after calibration will affect flow rate accuracy. Then Click “Save Changes”.

## Conducting the Open-Loop Catch Test

1. Ensure a catch container is below the 600 Series MagnaValve and the scale has been tared.

**Run Catch Test**

Setpoint 100% ▾

Begin Test START

Enter Catch  Lb

Sensor Signal

Calculate and Update Table SAVE CATCH

Manually Replace Table values REPLACE

2. Under Run Catch Test select the desired Setpoint from the drop-down next to **Setpoint**.
3. Left click on the START button next to **Begin Test**.

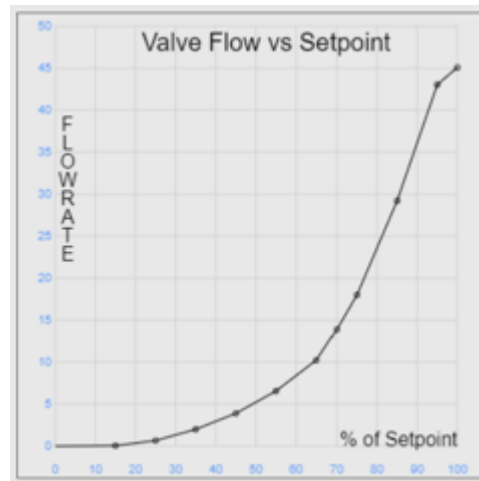
**Note:** The autozero limit is calculated from the 100% catch test values.

**Note:** Notice that after pressing the START button, it changes to an ABORT button. Pressing the ABORT button will cancel the test.

4. After the catch test stops, enter the weight caught during the test in the number box next to **Enter Catch** and left click the SAVE CATCH button.
5. The results of the catch test will be added to the Calibration Results table and displayed in the graph above the table.
6. After the SAVE CATCH button has been pressed, the Setpoint will automatically decrement to the next Setpoint. Repeat steps 1 and 4 until all Setpoint valves have been tested.

Calibration Results		
SetPoint	Lb/min	Sensor Signal
100%	45.090	29131
95%	43.050	27732
85%	29.220	18129
75%	18.000	10497
70%	13.890	7751
65%	10.230	5594
55%	6.570	3488
45%	3.900	2043
35%	2.010	1069
25%	0.660	399
15%	0.060	47

Setpoint <1~99> 90    Add Setpoint    Del Setpoint

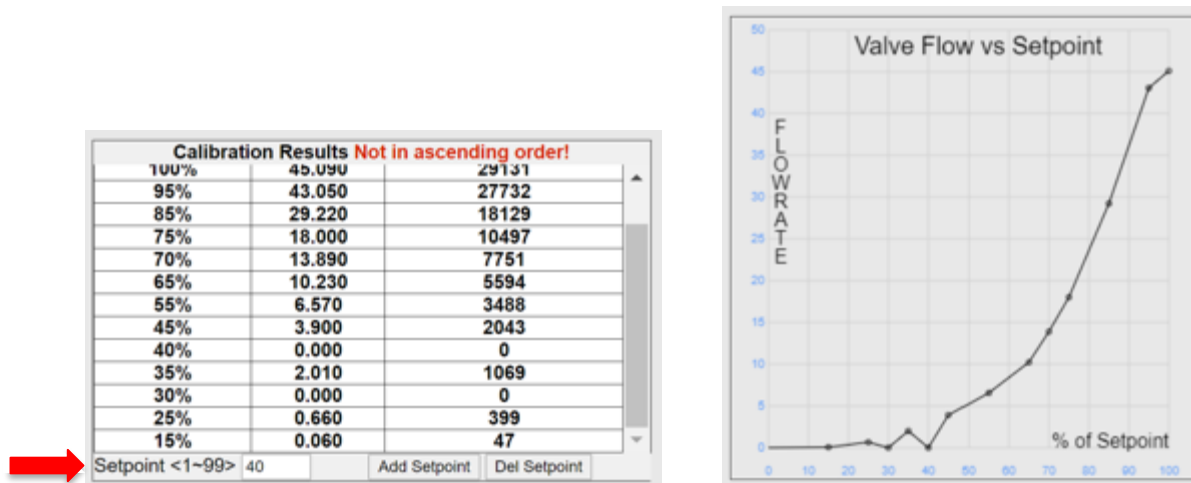


**Note:** If a mistake was made entering data into the table, the entry can be changed by:

- A. Select the Setpoint to be edited.
- B. Enter the correct information in both the Enter Catch box and Sensor Signal box.
- C. Left click the Replace Button next to **Manually Replace Table values**.

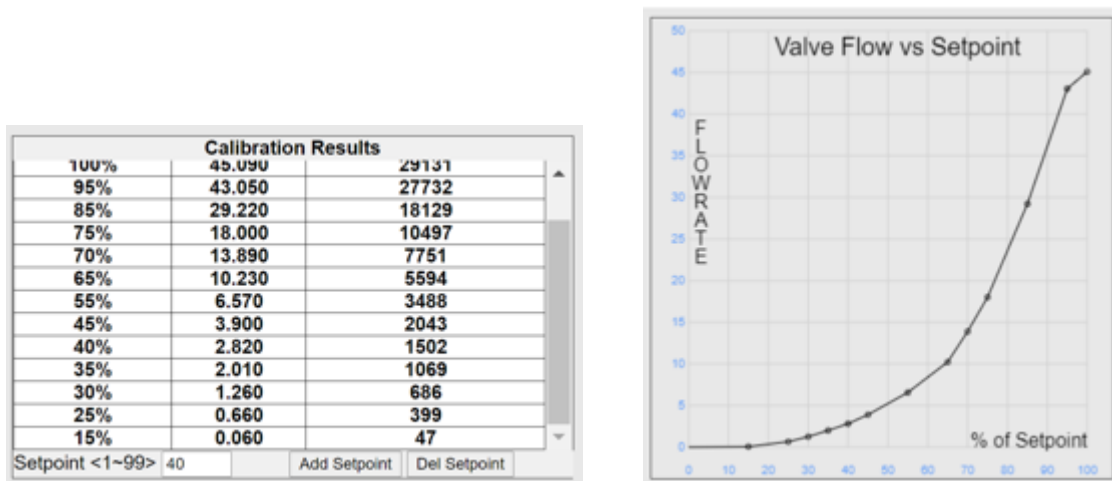
**Note:** Ensure that both the Enter Catch and Sensor Signal boxes have data. If left blank, a zero will be entered into the table for that information.

7. If it is desired to add additional setpoints, enter the setpoint valve to be added and left click the Add Setpoint button located below the **Calibration Results table**.



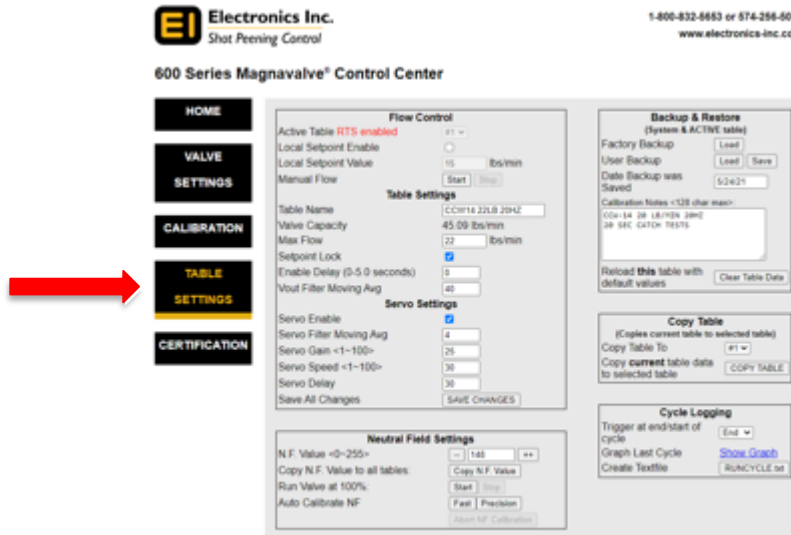
**Note:** 10 additional setpoint can be added to each table for a total of 20 setpoints per table.

8. If any setpoints were added to the table, be sure to conduct a catch test on those setpoint by following steps 1 through 4. The table and graph below show Setpoints 30% and 40% added.



## Confirming the Calibration

Confirming the calibration follows the same procedure as the calibration. The main difference is that the servo is ON. When the servo is turned ON, the 600 Series MagnaValve utilizes the look-up table to ensure the actual flow rate matches the requested flow rate. The certification will confirm that it does.



Left click on Table Settings. Table Setting and Servo Settings and be changed here. For more detail on any single function, please refer to the 600 Series MagnaValve Control Center section or the Valve Operation section.

600 Series Magnavalve® Control Center

**Table Settings**

Table Name: CCW14 22LB 20HZ  
Media Type: CCW14  
Valve Capacity: 45.09 Lb/min  
Max Flow: 22 Lb/min  
Pulse Frequency: 20

**Test Settings**

Active Table: #1  
Test Type: Local  
Test Duration: 10 sec

**Run Certification Test**

Setpoint: 100%  
Begin Test: START  
Enter Catch: Lb  
Sensor Signal:   
Calculate and Update Table:   
Manually Replace Table values:

**Backup (System & ACTIVE table)**

User Backup:   
Date Cert. was: 5/24/21  
Saved:  
Certification Notes: <128 char max>  
CCW-14 22LB-M25 20HZ  
20 SEC CATCH  
Create Textfile:

**Valve Flow vs Setpoint**

Graph showing Ideal, Valve, and Servo flow vs % of Setpoint.

**Certification Results**

SetPoint	Ideal Lb/min	Catch Lb/min	Error Lb/min	% of PL	% of FS
100%	22.000	21.750	-0.250	-1.136	-1.136
95%	20.900	20.720	-0.170	-0.813	-0.773
85%	18.700	18.660	-0.040	-0.214	-0.182
75%	16.500	16.520	0.020	0.182	0.156
70%	15.400	15.450	0.050	0.328	0.227
65%	14.300	14.340	0.040	0.280	0.182
55%	12.100	12.210	0.110	0.909	0.800
48%	9.800	9.870	-0.020	-0.203	-0.156
25%	7.750	7.650	-0.090	-0.949	-0.227
25%	5.550	5.520	0.020	0.364	0.091
15%	3.300	3.200	0.000	0.000	0.000

Setpoint <1-99> | 90

After making changes, left click on the Certification tab.

**Test Settings**

Active Table: #1  
Test Type: Local  
Test Duration: 10 sec

In the Test Setting section, enter the desired settings for the Active Table (should be the same as calibrated table), Test Type, and Test Duration (if doing Local Test Type).



## Conducting the Closed-Loop Catch Test

1. Ensure a catch container is below the 600 Series MagnaValve and the scale has been tared.

**Run Certification Test**

Setpoint 100% ▾

Begin Test START

Enter Catch  Lb

Sensor Signal

Calculate and Update Table SAVE CATCH

Manually Replace Table values REPLACE

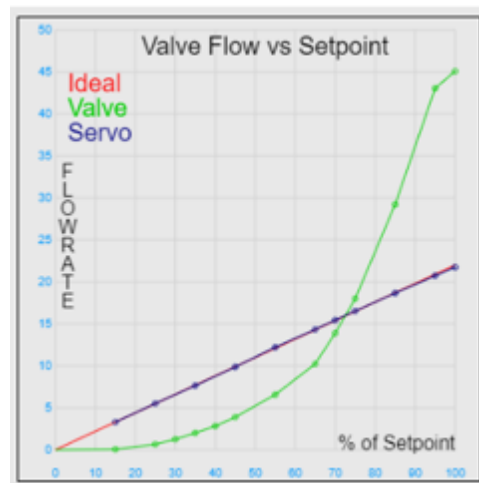
2. Under Run Certification Test, select the desired Setpoint from the drop-down next to Setpoint.
3. Left click on the START button next to Begin Test.

**Note:** Notice that after pressing the START button, it changes to an ABORT button. Pressing the ABORT button will cancel the test.

4. After the catch test stops, enter the weight caught during the test in the number box next to Enter Catch and left click the SAVE CATCH button.
5. The results of the catch test will be added to the Certification Results table and displayed in the graph above the table.
6. After the SAVE CATCH button has been pressed, the Setpoint will automatically decrement to the next Setpoint. Repeat steps 1 and 4 until all Setpoint valves have been tested.

Certification Results					
SetPoint	Ideal Lb/min	Catch Lb/min	Error Lb/min	% of Pt.	% of FS
100%	22.000	30.160	8.160	37.091	37.091
95%	20.900	28.700	7.800	37.321	35.455
85%	18.700	25.620	6.920	37.005	31.455
75%	16.500	22.560	6.060	36.727	27.545
65%	14.300	19.540	5.240	36.643	23.818
55%	12.100	16.559	4.459	36.851	20.268
45%	9.900	13.620	3.720	37.576	16.909
35%	7.700	10.580	2.880	37.403	13.091
25%	5.500	7.500	2.000	36.364	9.091
15%	3.300	4.500	1.200	36.364	5.455

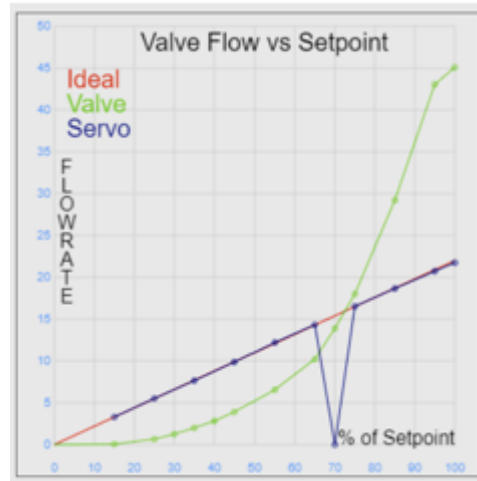
Setpoint <1-99> 90 Add Setpoint Del Setpoint



1. If it is desired to add additional setpoints, enter the setpoint value to be added and left click the Add Setpoint button located below the Calibration Results table.

Certification Results					
SetPoint	Ideal Lb/min	Catch Lb/min	Error Lb/min	% of Pt.	% of FS
100%	22.000	21.750	-0.250	-1.136	-1.136
95%	20.900	20.730	-0.170	-0.813	-0.773
85%	18.700	18.660	-0.040	-0.214	-0.182
75%	16.500	16.530	0.030	0.182	0.136
70%	15.400	0.000	-15.400	-100.000	-70.000
65%	14.300	14.340	0.040	0.280	0.182
55%	12.100	12.210	0.110	0.909	0.500
45%	9.900	9.870	-0.030	-0.303	-0.136
35%	7.700	7.650	-0.050	-0.649	-0.227
25%	5.500	5.520	0.020	0.364	0.091
15%	3.300	3.300	0.000	0.000	0.000

Setpoint <1-99> 70    Add Setpoint    Del Setpoint

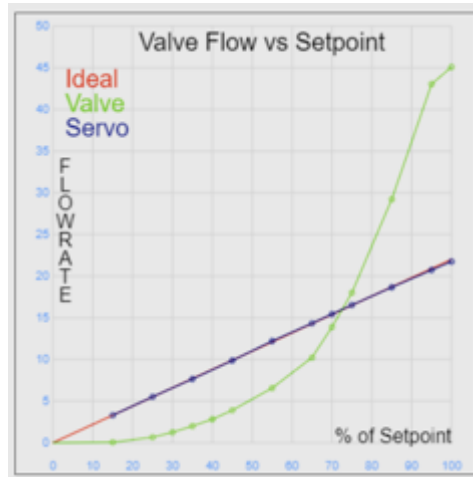


**Note:** 10 additional setpoint can be added to each table for a total of 20 setpoints per table.

2. If any setpoints were added to the table, be sure to conduct a catch test on those setpoint by following steps 1 through 4. The table and graph below show Setpoint 70% added.

Certification Results					
SetPoint	Ideal Lb/min	Catch Lb/min	Error Lb/min	% of Pt.	% of FS
100%	22.000	21.750	-0.250	-1.136	-1.136
95%	20.900	20.730	-0.170	-0.813	-0.773
85%	18.700	18.660	-0.040	-0.214	-0.182
75%	16.500	16.530	0.030	0.182	0.136
70%	15.400	15.450	0.050	0.325	0.227
65%	14.300	14.340	0.040	0.280	0.182
55%	12.100	12.210	0.110	0.909	0.500
45%	9.900	9.870	-0.030	-0.303	-0.136
35%	7.700	7.650	-0.050	-0.649	-0.227
25%	5.500	5.520	0.020	0.364	0.091
15%	3.300	3.300	0.000	0.000	0.000

Setpoint <1-99> 70    Add Setpoint    Del Setpoint



## Calculating Percentage Error

The percentage error is the total percentage of all errors in taking a measurement. This error contains the uncertainties in the MagnaValve, the uncertainties in the scale used to measure the flow rate, and the uncertainties in the timer used to control the flow while measuring the flow rate.

The percentage error can be calculated two main ways: Percentage error of full scale and percentage error of point. This percentage error can then be used to validate the peening process.

**Note:** The Certification Results table located on the Certification page shows both percentage error of point and of full scale.

The Certification Results table located on the Certification page shows for each Setpoint, the Ideal catch weight, the Actual catch weight, the error between the Ideal and Actual, percentage error of point, and percentage error of full scale (see image below).

Certification Results					
SetPoint	Ideal Lb/min	Catch Lb/min	Error Lb/min	% of Pt.	% of FS
100%	22.000	21.750	-0.250	-1.136	-1.136
95%	20.900	20.730	-0.170	-0.813	-0.773
85%	18.700	18.660	-0.040	-0.214	-0.182
75%	16.500	16.530	0.030	0.182	0.136
70%	15.400	15.450	0.050	0.325	0.227
65%	14.300	14.340	0.040	0.280	0.182
55%	12.100	12.210	0.110	0.909	0.500
45%	9.900	9.870	-0.030	-0.303	-0.136
35%	7.700	7.650	-0.050	-0.649	-0.227
25%	5.500	5.520	0.020	0.364	0.091
15%	3.300	3.300	0.000	0.000	0.000

Setpoint <1~99> 70      Add Setpoint      Del Setpoint

## Percentage Error of Full Scale

Percentage Error of full scale can be described as the possible constant error band across the complete operating range. The tolerance band is calculated at the full-scale value (100% Setpoint) and that percentage is used at all points along the operating range. In the example below, the MagnaValve was calibrated for 10 lb/min. The tolerance for the valve is +/-5% of full scale, the tolerance band would be:

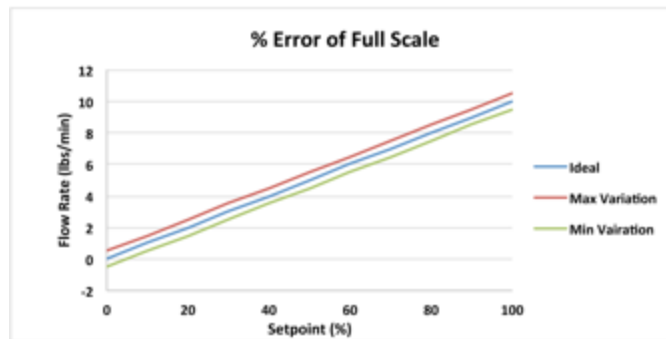
$$\pm \text{tolerance band} = \text{Full Scale Flow Rate} \times 5\%$$

$$\pm 0.5 \text{ lb/min} = 10 \text{ lb/min} \times 5\%$$

The actual % error of full scale at a specific Setpoint can be calculated by:

$$\text{Error (\% FS)} = \frac{\text{Measure Flow Rate} - \text{Ideal Flow Rate}}{\text{Full Scale Range}} \times 100\%$$

This tolerance band for percentage error of full scale is shown in the graph below.



The following table shows this same +/- 5% of full-scale tolerance band for the MagnaValve in this example.

Setpoint (%)	Tolerance Variation (lbs/min)	Max Flow Rate (lbs/min)	Ideal Flow Rate (lbs/min)	Min Flow Rate (lbs/min)
100	0.50	10.50	10.00	9.50
90	0.50	9.50	9.00	8.50
80	0.50	8.50	8.00	7.50
70	0.50	7.50	7.00	6.50
60	0.50	6.50	6.00	5.50
50	0.50	5.50	5.00	4.50
40	0.50	4.50	4.00	3.50
30	0.50	3.50	3.00	2.50
20	0.50	2.50	2.00	1.50
10	0.50	1.50	1.00	0.50
0	0.50	0.00	0.00	0.00

**Red:** Amount of variation for given Setpoint

**Blue:** Maximum and minimum flow rate based on the variation for given Setpoint

**Green:** Ideal flow rate for given Setpoint

## Percentage Error of Point

Percentage Error of point can be described as the possible amount of variation at any specific Setpoint where the amount of variation is calculated using that specific Setpoint. In the example below, the MagnaValve was calibrated for 10 lb/min, the tolerance for the valve is +/-5% of point, then the tolerance band would be calculated by:

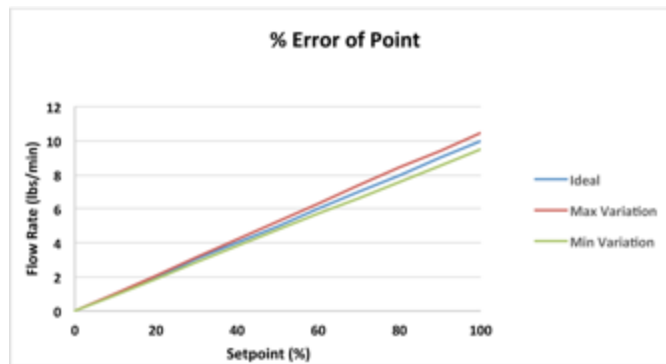
$$\pm \text{tolerance for given Setpoint} = \text{Ideal Setpoint Flow Rate} \times 5\%$$

$$\pm 0.35 \text{ lbs/min} = 7 \text{ lb/min (70\% Setpoint)} \times 5\%$$

The percentage error of point at a specific Setpoint can be calculated by:

$$\text{Error (\%)} = \frac{\text{Measure Flow Rate} - \text{Ideal Flow Rate}}{\text{Ideal Flow Rate}} \times 100\%$$

This tolerance band for percentage error of point is shown in the graph below.



The following table shows this same +/- 5% of full-scale tolerance band for the MagnaValve in this example.

Setpoint (%)	Tolerance Variation (lbs/min)	Max Flow Rate (lbs/min)	Ideal Flow Rate (lbs/min)	Min Flow Rate (lbs/min)
100	0.50	10.50	10.00	9.50
90	0.45	9.45	9.00	8.55
80	0.40	8.40	8.00	7.60
70	0.35	7.35	7.00	6.65
60	0.30	6.30	6.00	5.70
50	0.25	5.25	5.00	4.75
40	0.20	4.20	4.00	3.80
30	0.15	3.15	3.00	2.85
20	0.10	2.10	2.00	1.90
10	0.05	1.05	1.00	0.95
0	0.00	0.00	0.00	0.00

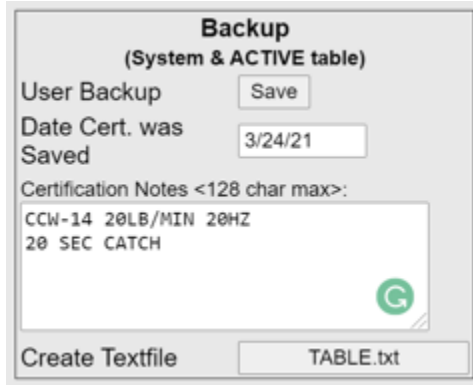
**Red:** Amount of variation for given Setpoint

**Blue:** Maximum and minimum flow rate based on the variation for given Setpoint

**Green:** Ideal flow rate for given Setpoint

## Backing up a Table

1. While still on the Certification page, ensure the desired table is selected under the Test Settings section.
2. Under the Backup section, enter the Date and any Certification Notes.
3. Left click the Save button next to User Backup.



The screenshot shows a dialog box titled "Backup (System & ACTIVE table)". It contains the following fields and buttons:

- User Backup** with a **Save** button.
- Date Cert. was Saved** with a text input field containing "3/24/21".
- Certification Notes <128 char max>** with a text area containing "CCW-14 20LB/MIN 20HZ" and "20 SEC CATCH". A green circular icon with a white 'G' is in the bottom right corner of the text area.
- Create Textfile** with a button labeled **TABLE.txt**.

4. To export the table data to a text file, left click the TABLE.txt button next to Create Textfile.
5. Once the text file finishes downloading, open the text file with MS Excel or similar program.

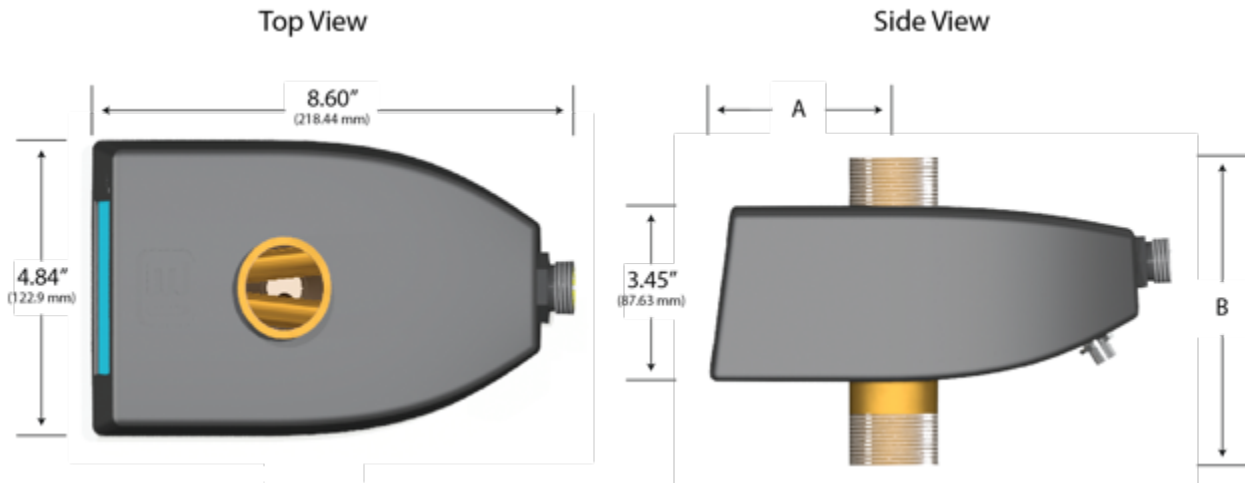
## Specifications

Power	+24Vdc +/-2Vdc @ 2A
Maximum Pressure	100 PSI
Maximum Differential Pressure	5 PSI
Mode	Normally Closed
Media	Steel Shot
Temperature Range	32°F - 131°F (0°C - 55°C)
Flow Enable Input	+24 Vdc ±2 Vdc into 20 KΩ
Setpoint Input	0 - 10 Vdc / 4 - 20 mA
Flow Sensor Output	0 - 10 Vdc, max output 11.5 Vdc 4 - 20 mA, max output 15 Vdc
Ethernet	10/100 Mbps

## 600 Series MagnaValve® Selector Guide Based on Flow Rate

Maximum Flow Rate (pounds per minute/kilograms per minute)												
Shot	676-24		677-24		678-24		679-24		680-24		690-24	
Size	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
S-70	2	1	10	5	30	15	100	45	200	90	300	150
S-110	2	1	10	5	30	15	100	45	200	90	300	150
S-170	2	1	10	5	30	15	100	45	200	90	300	150
S-230	2	1	10	5	30	15	100	45	200	90	300	150
S-280	-	-	10	5	28	13	100	45	200	90	300	135
S-330	-	-	-	-	26	12	100	45	200	90	300	135
S-390	-	-	-	-	25	11	100	45	200	90	250	125
S-460	-	-	-	-	25	11	85	38	200	90	250	125
S-550	-	-	-	-	-	-	70	32	200	90	250	110
S-660	-	-	-	-	-	-	70	32	200	90	240	105
S-930	-	-	-	-	-	-	45	20	200	90	225	100
CCW-14	2	1	10	5	30	15	100	45	200	90	300	150
CCW-23	2	1	10	5	30	15	100	45	200	90	300	150
CCW-28	2	1	10	5	30	15	100	45	200	90	300	150
CCW-32	-	-	10	5	30	13.5	100	45	200	90	300	135
CCW-35	-	-	-	-	26	12	88	40	200	90	300	135

# Product Dimensions



Model Number	Pipe Size	"A"	"B"
676-24	1" NPT	3.4" (87 mm)	6.0" (152.4 mm)
677-24	1" NPT	3.4" (87 mm)	6.0" (152.4 mm)
678-24	1.25" NPT	3.4" (87 mm)	6.0" (152.4 mm)
679-24	1.25" NPT	3.4" (87 mm)	8.0" (203.2 mm)
680-24	2" NPT	3.5" (89.5 mm)	8.0" (203.2 mm)
690-24	2" NPT	3.5" (89.5 mm)	8.0" (203.2 mm)



# Troubleshooting Guide

To expedite a solution, please send images of your valve installation, the valve's Calibration Label and/or a video of the controller and valve driver during operation.

Telephone: (574) 256-5001 or 1-800-832-5653 (USA and Canada) Fax: (574) 256-5222

## 600 Series MagnaValve Replacement Parts

There are no user serviceable parts.

## Maintenance

An annual calibration is recommended for the 600 Series Ferrous MagnaValve.

## Contacting Electronics Inc.

Mailing and Shipping Address:

Electronics Inc.

56790 Magnetic Drive

Mishawaka, IN 46545 USA

Telephone: 1-800-832-5653 (Toll-free in USA and Canada) or (574) 256-5001

Fax: (574) 256-5222

Email: [sales@electronics-inc.com](mailto:sales@electronics-inc.com)

Website: [www.electronics-inc.com](http://www.electronics-inc.com)

# Limited Warranty

## 600 Series MagnaValve®

The warranty obligations of Electronics Inc. for this product are limited to the terms set forth below.

### Length of Warranty Period

This limited warranty lasts one (1) year from the shipping date of this product.

### What is Covered

This limited warranty covers defects in materials and workmanship in this product.

### What is Not Covered

This limited warranty does not cover any damage, deterioration or malfunction resulting from any alteration, modification, improper or unreasonable use or maintenance or use of a media for which the MagnaValve was not calibrated, misuse, abuse, accident, neglect, exposure to excess moisture, fire, improper packing and shipping (such claims must be presented to the carrier), lightning, power surges, or other acts of nature. This limited warranty does not cover any damage, deterioration or malfunction resulting from the installation or removal of this product from any installation, any unauthorized tampering with this product, any repairs attempted by anyone unauthorized by Electronics Inc. to make such repairs, or any other cause which does not relate directly to a defect in materials and/or workmanship of this product. This limited warranty does not cover equipment enclosures, cables or accessories used in conjunction with this product.

### How to Obtain a Remedy Under this Limited Warranty

To obtain a remedy under this limited warranty, contact Electronics Incorporated by letter, email, fax or telephone with the following information:

- Product name and model
- Product serial number
- Original shipping date (see label on product)
- Company name and location
- Name of contact person for description of symptoms
- Return shipping address and any special instructions

If it is determined that the product must be returned under this limited warranty, a Returned Goods (RG) number, obtained from Electronics Inc., will be required. This product should be properly packed to prevent damage in transit. Cartons not bearing a RG number will require additional processing time and repair service may be delayed.

### What Electronics Inc. Will Do Under This Limited Warranty

Electronics Inc. will, at its sole discretion, provide one of the following remedies to whatever extent it shall deem necessary to satisfy a proper claim under this limited warranty:

1. Elect to repair or facilitate the repair of any defective parts within a reasonable period of time, free of any charge for the necessary parts and labor to complete the repair and restore this product to its proper operating condition. Electronics Inc. will pay the shipping costs necessary to return this product once the repair is complete.

2. If the defective product cannot be repaired, it will be replaced with a new unit and the original warranty period will be extended by six (6) months. Electronics Inc. will pay the shipping costs necessary to replace this product.

If this product is returned to Electronics Inc., the product must be insured during shipment, with the insurance and shipping charges prepaid. If this product is returned uninsured, Electronics Inc. does not assume any risk of loss or damage during shipment. Electronics Inc. will not be responsible for any costs related to the removal or re-installation of this product.

#### **Out-of-Warranty Product**

Product that is out-of-warranty will be repaired at customer's request and the cost of repair will be disclosed prior to proceeding with the repair. A purchase order must be received prior to repair. If the product cannot be repaired, Electronics Inc. will provide one of the following remedies:

- 1) New unit at current pricing with a one (1) year Limited Warranty from the shipping date of product.
- 2) Refurbished unit (if available) at a discounted price with a six (6) month Limited Warranty from the shipping date of product.

#### **Limitation on Liability**

The maximum liability of Electronics Inc. under this limited warranty shall not exceed the actual purchase price paid for the product. Electronics Inc. is not responsible for direct, special, incidental or consequential damages resulting from any breach of warranty or condition, or under any other legal theory to the maximum extent permitted by law.

#### **Exclusive Remedy**

To the maximum extent permitted by law, this limited warranty and the remedies set forth above are exclusive and in lieu of all other warranties, remedies and conditions, whether oral or written, express or implied. To the maximum extent permitted by law, Electronics Inc. specifically disclaims any and all implied warranties, including, without limitation, warranties of merchantability and fitness for a particular purpose. If Electronics Inc. cannot lawfully disclaim or exclude implied warranties under applicable law, then all implied warranties covering this product, including warranties of merchantability and fitness for a particular purpose, shall apply to this product as provided under applicable law.

#### **Rights Under State Law**

This warranty defines specific legal rights relative to these products provided by Electronics Inc. Legal rights may also vary from state to state.