

Flow Control *and* Fluid Separation *in one* **Valve**



A New Simple, Sanitary, & Efficient Solution

Resolution Air
A CONTROL VALVE REVOLUTION

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INTRODUCTION

A Simple New Approach that is Sanitary, Efficient, and Cost Effective

Achieving both sanitary fluid separation and flow control is easier than ever with a new, patented technology that offers a variety of design advantages to developers of OEM products for industries including:

- *Biotechnology*
- *Chemical Processing*
- *Dispensing, Filling, & Mixing*
- *Process Equipment*
- *Bioreactors*
- *Medical Devices*
- *Pharmaceuticals*
- *Life Sciences*

Combining the characteristics of pinch valve fluid separation and proportional valve control, the Miniature Proportional Pinch Valve (MPPV) introduces a whole new level of performance and efficiency to sanitary applications requiring cleanliness and sterility, as well as highly accurate incremental flow regulation. Eliminating the need for multiple-valve, high-maintenance assemblies, this single valve offers a compact, efficient solution.



The purpose of this eBook is to introduce readers to this new Miniature Proportional Pinch Valve technology and the advantages it offers.

Topics include:

- **Development of the Patented Technology**
- **Control Requirements**
- **Meeting Sanitary Requirements**
- **Improving Process Efficiency**
- **Simplifying Maintenance and Reducing Costs**
- **Applying the Benefits to Your Design**

Our overview of the MPPV begins with a look at the patented design behind this innovative valve.



DEVELOPMENT OF THE PATENTED TECHNOLOGY

Accuracy, Flow, and Separation

Preserving the integrity of a fluid passing through a non-contact system is essential in a variety of sanitary applications. Ever-increasing levels of sophistication in new technologies have led to more stringent performance demands, and processes need to be regulated with greater speed and accuracy. Needle valves have excellent fluid metering characteristics but poor fluid separation characteristics. Conversely, pinch valves have superior fluid separation characteristics but inadequate fluid metering ability. In order to meet application requirements, these two types of valves would typically be used in tandem.

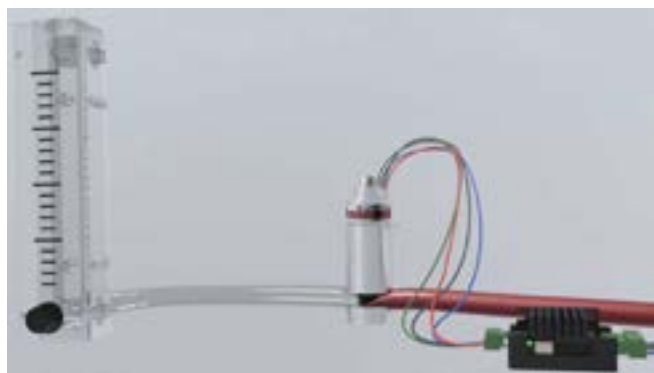


On 10-31-2017, Resolution Air, Ltd. was issued U.S. Patent No. 9,803,754 by the U.S. Patent and Trademark Office.

Recognizing the need for a better approach, Resolution Air, Ltd. Founder and Senior Design Engineer, Brad Thompson set about developing a hybrid valve combining the fluid metering characteristics of the needle valve with the fluid separation of the pinch valve. This hybrid valve, the Miniature Proportional Pinch Valve (MPPV), was developed to deliver tight specifications for high-resolution flow control. The MPPV series can be integrated into portable and handheld equipment in a variety of key industries, including life sciences and medical devices, food and beverage, and healthcare.

The MPPV pinches a fluid-filled, low durometer tube effectively varying the orifice size to regulate the flow of the fluid (liquid or gas) through the tube. The design incorporates a stepper linear actuator (stepper motor and lead screw) and a custom piston in a miniature aluminum valve body.

Using stepper motor linear actuator technology, the MPPV achieves .0005"/step linear travel, high sealing force, low power consumption, and a non-backdrivable lead screw.



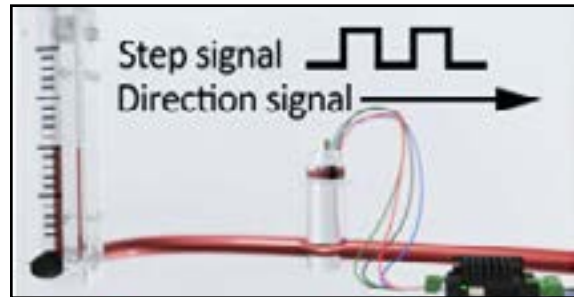
Click the video clip above to see the MPPV pinching action.

NOTE: To see the video clip, you will need to view this eBook in [Acrobat Reader](#). You can also view the [full video at ResolutionAir.com](#).

Control Requirements

The bi-polar stepper motors used in the Miniature Proportional Pinch Valve require two input control signals, a step signal and a directional signal.

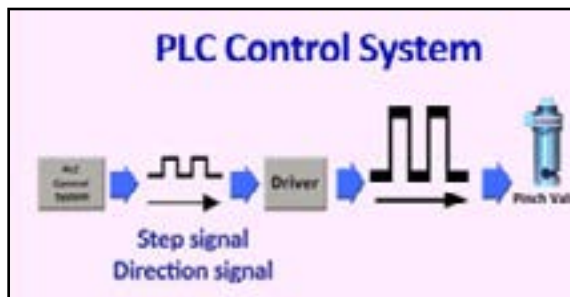
Step Signal - A Pulse Width Modulated (PWM) signal, Each pulse generates a single step. For the MPPV-series, a single step equates to 7.5 degrees of motor rotation. Since the motor shaft is coupled to an integral leadscrew, this rotation translates into .0005"/step of linear motion.



Direction Signal

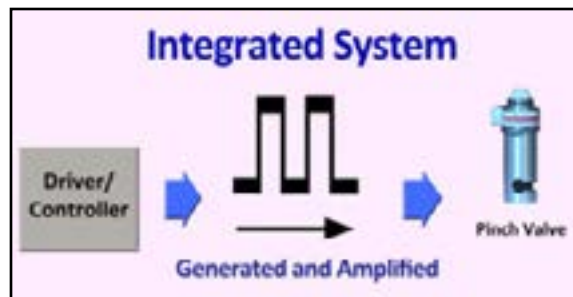
A digital binary signal which determines the clockwise /anti clockwise motor rotation.

There are two primary methods for generating and amplifying step and directional control signals.



PLC Based Control System

Signals generated by a Programmable Logic Controller (PLC) are amplified by a Bi-Polar Chopper Driver (DRV-1) to the level required to drive the motor.



Bi-Polar Driver/Controller System

The step and direction signals are generated and amplified by a single control device known as a Bi-Polar Driver/Controller.

The lightweight, compact MPPV series features an anodized 6061 aluminum body standard, with custom body materials available. Designed for low energy consumption, the MPPV series controls gasses or liquids with comparable linearity.

The design of the proportional pinch valve is groundbreaking, in part due to the ease and simplicity it brings to applications involving the transfer of highly pure liquids. Our next section considers the sanitary requirements met by the MPPV.

MEETING SANITARY REQUIREMENTS

Ideally Suited For Rigorous Standards

In life science, biotechnology, and pharmaceutical applications, tubing for transferring ultra-pure liquids, air, or other gases in manufacturing processes have demanding certification and testing requirements. The type of tube used in a given application is often dependent upon specific industry standards and certification requirements such as:

- Biomedical Grade Elastomer Test Standard United States
- Pharmacopeia (USP) Class VI for Plastics
- European Pharmacopoeia Monograph 3.1.9.
- FDA 21 CFR 210/211 cGMPs for Pharmaceuticals

The MPPV hybrid valve technology is ideally suited for use in industries with rigorous standards because the design of the valve prevents the metered fluid from coming in contact with the valve.

Tubing Selection

In addition to certification, system pressure and chemical compatibility must be considered in the tube selection process. A resilient tube, such as platinum cured silicone, serves as a good launching point for many applications, with a range of 50-65 Durometer, Shore A. A knowledgeable and experienced tubing supplier can offer users guidance in selecting the appropriate tubing for an application.



Biotech and Life Sciences

Biotechnology and the life sciences are two areas that have greatly benefited from this hybrid valve technology. Biotechnology has applications in four major industrial areas:

Healthcare / Medical / Pharmaceutical

Crop Production / Agriculture

Industrial / Non-Food Crops & Products - Biodegradable Plastics, Vegetable Oil, Biofuels

Environmental Uses

The life sciences are rapidly-advancing fields of study that include:

- *Anatomy*
- *Animal Biology*
- *Bacteriology*
- *Biochemistry*
- *Cell Biology*
- *Ecology*
- *Evolutionary Biology*
- *Genetics*
- *Molecular Biology*
- *Plant Biology*
- *Physiology*
- *Virology*

The miniature size of the device creates an excellent opportunity for integration into portable equipment.



Meeting the rigorous requirements of these fields is just the beginning. The MPPV design inherently streamlines the process of flow control and fluid metering. Next, we will look at how the proportional pinch valve improves efficiency.

IMPROVING PROCESS EFFICIENCY

Better by Design

The MPPV offers a more efficient approach to fluid separation and flow control by design. The valve pinches a fluid-filled tube to regulate the flow of the liquid or gas, which never touches the actual valve. This means that switching to an entirely different process media can be done with a quick change of tubing, without the need for time-consuming cleaning or costly filter changes.

Miniature Proportional Pinch Valve Advantages

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- Automated control
 - No physical contact with process fluid
 - High resolution flow control
 - Maintains position with power loss
 - Durable construction
 - Tested performance
 - High repeatability
 - Low power consumption
 - No leakage
 - Long performance life
 - Light weight, low profile design
 - Superior corrosion resistance
 - Valve body material option: Stainless Steel
 - Home switch provides digital output for full open position

Efficiency in Control

The DRV-1 Stepmotor drive is a cost-effective, high performance bi-polar chopper drive. The design is based on advanced digital current control technology, and features high torque, low noise and low vibration. Running current, micro-step resolution, and other parameters are switch selectable so software configuration is not required.

DRV-1 Stepper Motor Features

- Power Supply - Operates from a 12 to 40 volt DC power supply
- Inputs - 3 optically isolated digital inputs, 5 to 24 volts
- Speed Range - up to 3000 rpm
- Current Control – Customized current settings-switch selectable
- Idle Current - Switch selectable for reduction to 50% or 90% of running current 1 second after the motor stops
- Self-Test - Performs a 2rev, 1rps, CW/CCW move test, switch selectable: ON or OFF
- Control Mode - Step & Direction mode, CW/CCW mode
- Microstep Resolution - 4 piano Switch selectable, 16 settings: 200, 400, 800, 1600, 3200, 6400, 12800, 25600, 1000, 2000, 4000, 5000, 6000, 8000, 10000, 20000 steps/rev



The Internet of Things (IoT)

The Internet of Things IoT refers to a huge cloud-based cache of data collected and maintained through an IoT network of intelligent computers and devices. The IoT is shaping a new generation of technology for virtually any industry that involves communication and the exchange of data.



The innovative design of the MPPV and its control system integrate processes with the cloud-based IoT. This connectivity allows the MPPV to be controlled remotely, offering unprecedented capability and efficiency.

SIMPLIFYING MAINTENANCE & REDUCING COSTS

One Longer Lasting Valve Replaces Two

Not only does the MPPV do the job that once required two individual valves, by nature of its design, the miniature proportional pinch valve offers a longer service life than conventional proportional valves. Examples of this include applications involving harsh or abrasive fluid, which degrade the valve body over time. Heated liquid applications also see an advantage, since the fluid is thermally isolated from the valve, the valve is not subjected to overheating.



The benefits of the new miniature proportional pinch valve technology are clear. The next step is determining how this innovative design will benefit your application.

APPLYING THE BENEFITS TO YOUR DESIGN

Great Opportunity for Improvement

Does your application require sanitary fluid separation and flow control? The MPPV provides the opportunity to greatly improve process efficiency, productivity, and bottom-line. The innovative design of the MPPV enables you to:

- ✓ Meet sanitary requirements
- ✓ Improve process efficiency
- ✓ Simplify maintenance
- ✓ Reduce costs
- ✓ Remotely control your process
- ✓ Keep your design lightweight

Resolution Air is the Patented Original Miniature Proportional Pinch Valve

When it comes to this technology, there are imitations out there. Buying from Resolution Air gives you clear advantages that you just won't get from the imitators.

The Best Price

The MPPV was designed to be affordable to help product engineers keep their OEM products profitable. Resolution Air developed this technology specifically to make it accessible, enabling product engineers to improve their designs and experience tangible benefits such as improved efficiency and longer service life.

Streamlined, Efficient Design

Some copy-cat models have been loaded with extra features that are simply not necessary for most applications. We have discovered that most product designers are looking for a light-weight, easy-to-use, affordable valve, so that is what we deliver.

Expert Application Assistance and Support

Resolution Air's MPPV is not just a product-line add-on, it is a solution. Buying from us means you will have comprehensive support and assistance from the company that invented this technology.

Application Evaluation Demo with 10 Minute Set-Up

Only Resolution Air offers the Miniature Proportional Pinch Valve Demonstration Kit (MPPV-DK), a comprehensive tool for demonstrating the function and operation of the MPPV valve series.

In the MPPV-DK, the control is simplified with the use of an Allmotion StepperStickdriver/controller which simplifies wiring and power supply requirements. The programming necessary for evaluation is also straightforward and uncomplicated.



The StepperStick connects to the stepper motor mounted on the MPPV and can then be plugged into the USB port of a computer. This connectivity provides control through the device's digital interface. Since the computer can supply the power necessary for both the controller and the stepper motor, there is no need for an external power supply to drive the valve specifications.



Have Questions? Ready to Discuss Your Project?

Resolution Air is committed to helping develop your custom application!

Please visit www.resolutionair.com to learn more or call (513) 318-4600 to tell us about your process and goals.

