

The PneuWave DUO Pump

Offering bi-directional fluid control and measurement within a single channel!



Two-Channel PneuWave DUO with Remote Flow Sensors

The PneuWave DUO is a pneumatic pump that delivers fluids using both negative and positive pressure within a single channel. It can be operated in either closed-loop pressure or closed-loop flow control mode with programmable flow profiles. The DUO offers unprecedented fluid manipulation capability by imperceptibly switching between vacuum and positive pressure delivery.

Integrated Components for Each Fluid Channel

- On-board microprocessor for fast pressure and flow rate regulation
- Pressure sensor
- Flow rate sensor (optional)

Control

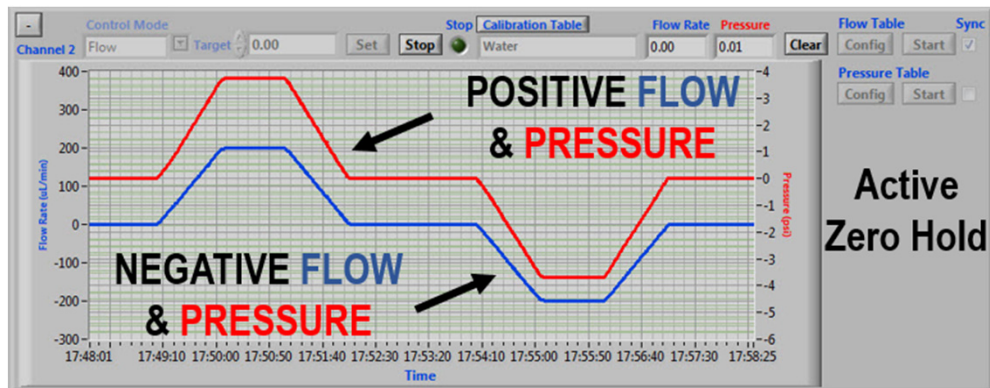
- When in Flow Rate Mode, the rate of fluid passing through the flow sensor is communicated with the microprocessor. As needed, the microprocessor adjusts the pressure, which adjusts the flow rate.
- When in Pressure Mode, the regulation system is set to output the desired pressure profile which can range from standard vacuum to +1 bar within a single channel.

Data Logging

- Both pressure and flow rate are logged
- Optional RS-232

Communication

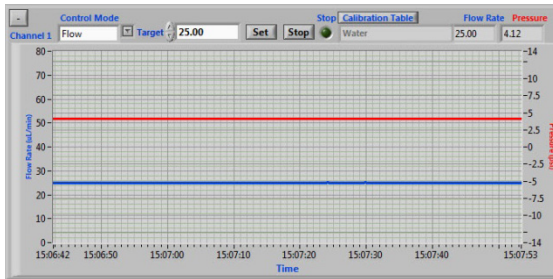
- PC Software can synchronize 2 to 8 independently controlled fluid channels.
- Fully programmable fluid delivery by either flow rate or pressure.
- LabVIEW VI
- Optional RS-232 module



Software Screen Capture demonstrating that flow (blue) and pressure (red) can indiscernibly switch between positive and negative modes. Fluids can be easily manipulated in either direction, or even oscillated back and forth, within the same channel. Furthermore a zero flow rate can be actively held for stop flow experiments.

The PneuWave DUO Pump

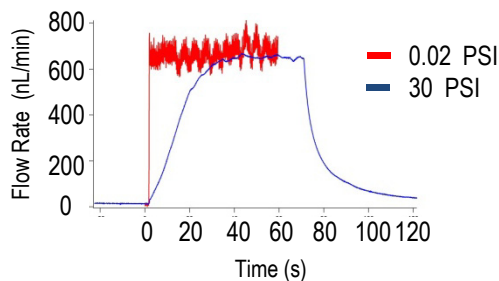
The PneuWave DUO connects to an external vacuum and gas pressure source. Each fluid channel in the pump has two pressurized vessels. With this system, fluids can be readily manipulated in either direction or even oscillated back and forth, as the pump is able to imperceptibly switch between negative and positive pressure delivery modes. PC software allows for programmable fluid delivery in either flow rate control mode or pressure control mode. This user-friendly, intuitive software also allows for fluid delivery profiles of up to eight fluid channels to be synchronized. Thus the PneuWave DUO offers unprecedented fluid control.



Software Screen Capture demonstrating exceptional flow (blue) and pressure (red) stability.

Syringe Pumps Compromise Performance

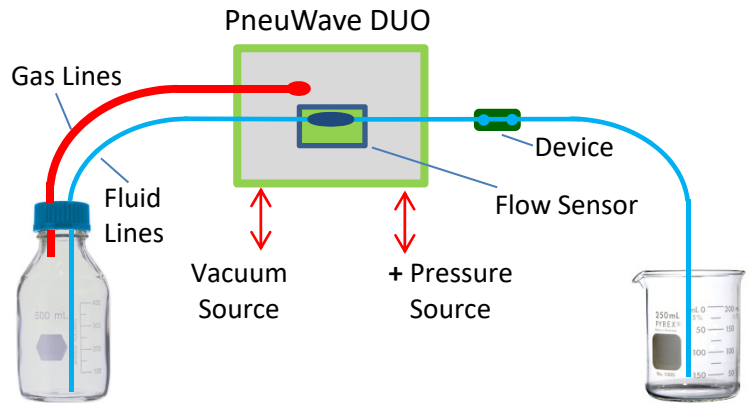
Syringe pumps are the most widely used means of fluid delivery for microfluidics. However these pumps suffer from drawbacks that severely compromise performance which can negatively impact your microfluidic application. These drawbacks include: pulsation, slow response time, refilling of syringes is required, increased chance of air bubble introduction during syringe refill, and backpressure variations significantly effect performance.



Fluid delivery using a syringe pump is undesirable. If backpressure is increased, the pulsation is reduced, but then the response time increases.

PneuWave DUO Advantages

- Offers bi-directional fluid delivery within a single channel
- Precise, accurate fluid control
- Nanoliter and millibar resolution
- Pulse-free
- Fast response
- Accommodates small to large pressurized fluid vessels
- Programmable fluid delivery via flow rate or pressure with user-friendly PC software
- Can operate in either flow rate or pressure control mode
- Active control of a zero flow rate
- Configurable with 1 to 8 channels that can be controlled independently or synchronized with a PC
- Low dead-volume fluid path
- Optional RS-232



Schematic of the PneuWave DUO

Included with the PneuWave DUO

- Pressure Sensors
- On-board microprocessor
- PC Software
- LabVIEW VI
- Ability to store multiple calibrations on-board

Options for the PneuWave DUO

- Flow Sensors
- Various pressure caps
- Pressure chamber
- Tubing / Adapters / Unions / Luers / Barbs
- Liquid isolation valve with integrated drive electronics
- I/O module for analog outputs, triggering and alarms
- Software to generate calibrations for different liquid types

The PneuWave DUO Pump Pressure Caps

A variety of pressure caps for fluid vessels are available.



Glass Bottle Cap



Falcon Tube Cap



Nalgene Bottle Cap



Eppendorf Tube Cap



Universal Chamber

The PneuWave DUO Pump Configurations

Channel Number

- 2 Channels
- 4 Channels
- 6 Channels
- 8 Channels

Pressure Model

- Standard Vacuum to +1 Bar

Flow Model*

- Nano ±70 to ±7000 nL/min
- Micro ± 1 to ±80 µL/min
- Milli ±30 to ±1000 µL/min
- Milli+5 ±0.2 to ±5.0 mL/min

*Models can operate outside the calibrated ranges provided. However flow rate measurement will be most accurate when operated within the corresponding ranges for each model.

Flow Specifications¹

Flow Model	Nano	Micro	Milli	Milli+5
Flow Rate Range	0 to ±7000 nL/min	0 to ±80 µL/min	0 to ±1000 µL/min	0 to ±5.0 mL/min
Standard Calibrated Flow Rate Range	±70 to ±7000 nL/min	±1 to ±80 µL/min	±30 to ±1000 µL/min	±0.2 to ±5.0 mL/min
Accuracy Below Full Scale (% full scale)	0.3%	0.15%	0.2%	0.2%
Repeatability below full scale (% full scale)	0.05%	0.01%	0.02%	0.02%
Flow Detection Response Time	40 msec			
Flow Rate Stability	Down to 0.1% CV*			
Operating Temperature	10 to 50°C			
Fluid Connector Type	6-40 taper		UNF ¼-28 Flat Bottom	
Flow Sensor Materials	Quartz Glass, PEEK™, Teflon®, Tefzel®		Borosilicate Glass, PEEK™, Teflon®, Tefzel®	
Flow Sensor Inner Diameter	150 µm	430 µm	1.0 mm	1.8 mm
Flow Sensor Internal Volume	1.5 µL	5.1 µL	< 30 µL	< 90 µL

*Relative to fluid type, tubing and system set-up.

Pressure Specifications¹

Mode	Range
Negative Pressure ²	Standard Vacuum to 0 Bar
Positive Pressure ³	0 to +1 Bar

¹Specifications subject to change

²Vacuum source must be provided.

³Positive pressure gas source must be provided that is clean, dry, non-corrosive, non-explosive and oil-free.



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