



ULTRA  
WIDE FLOW  
RANGE



# SD Series

Single Use Back Pressure Regulators  
FOR BIOPHARMACEUTICAL INDUSTRIES



# The Equilibar Difference

## Our performance.

Equilibar Single Use back pressure regulators outperform pinch valves, particularly in applications with filtration pressure control, wide flow ranges, and precise pump delivery requirements.

## Our people.

Every inquiry gets focused attention from our engineering team to determine the best possible product for your needs. Every back pressure regulator is manufactured and tested to meet our stringent quality standards and all applicable industry standards.

## Our priorities.

Our goal is to exceed your expectations. All products are prepared in an ISO Class 7 clean room and delivered ready for sterilization up to 50 kGy, with required certifications.

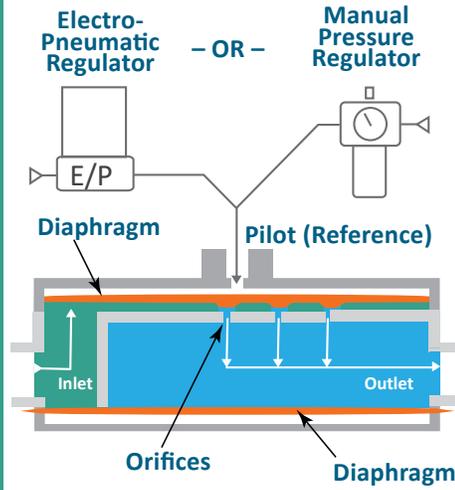
Traditional pressure regulators in the single use market use a tube pinching action or on/off control. These designs deliver choppy, crude control which introduces fluctuations in a system. The Equilibar back pressure regulator uses a thin, supple diaphragm as the only moving part. This allows frictionless operation without cracking pressure or hysteresis. The accuracy of the Equilibar back pressure regulator is determined by the accuracy of the pilot setpoint.



# How It Works

Simply load the Equilbar back pressure regulator with a pilot pressure equal to the desired back pressure and the Equilbar SDO does the rest. This pilot pressure forces the flexible diaphragm down onto a plate of orifices. A rise in inlet pressure lifts the diaphragm up to allow excess pressure to be relieved through the outlet orifices. Similarly, a loss of pressure at the inlet causes the diaphragm to be pushed closer to the orifices, restricting flow and rebuilding pressure upstream.

For *flow control*, connect an electronic pilot regulator and flow meter in an *inverse* PID loop with an Equilbar valve and it will adjust to control flow.

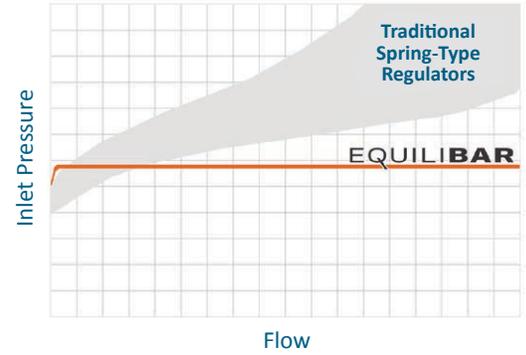


Pilot operate the Equilbar SDO back pressure regulator with an electronic pressure regulator for precision automated control.



Or set the pilot pressure with a precision pressure reducing regulator for manual control.

## Performance Comparison



Inlet Pressure

Flow

## BACK PRESSURE REGULATORS VS PRESSURE REDUCING REGULATORS

Pressure reducing regulators reduce a higher supply pressure at the inlet down to a regulated lower pressure at the outlet (downstream). Back pressure regulators work the opposite way. They regulate the inlet (upstream) pressure by opening up only as much as necessary to hold back the desired pressure at the inlet (upstream).

TYPE	PRESSURE REDUCING REGULATOR	BACK PRESSURE REGULATOR
SCHEMATIC		
CONTROLS PRESSURE	Downstream	Upstream
OPENS TO	Increase downstream pressure	Decrease upstream pressure
CLOSES TO	Decrease downstream pressure	Increase upstream pressure

## FOR SINGLE USE AND HYBRID BIOPROCESSING SYSTEMS

The patent pending Equilibar® SD series valve is manufactured using USP Class VI polymers and 316 stainless steel. The polymer body and welded diaphragms are disposable and are housed in a reusable 316 stainless steel cradle with wing nut closure for quick and easy assembly.

The Equilibar SDO is a revolutionary design in single use pressure control as the industry's first single use back pressure regulator. It features Equilibar's unique dome-loaded multiple orifice technology delivering instantaneous control and superior precision. The stainless steel housing is designed as a permanent part of the process and connects to a dome pilot pressure supply. Universal mounting pattern allows for the housing to be interchanged in the system to accommodate different sizes. The disposable body is sold as non-sterile, is prepared in an ISO Class 7 clean room and comes ready for sterilization up to 50 kGy.

## Key Features

### PRECISE CONTROL, WIDE FLOW RANGE

The combination of multiple orifices and supple diaphragm allows accurate control over a wide range of flows. The SD valve has negligible hysteresis and provides excellent stability. The graph at the right shows performance of the SDO6 3/4" valve with water. It keeps precision control across a range of Cv 1000:1.

### SMOOTH COMPUTER AUTOMATION

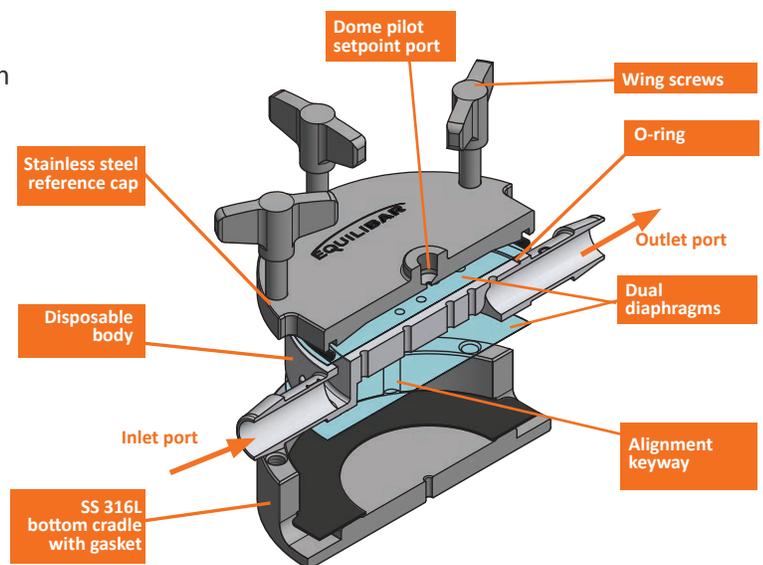
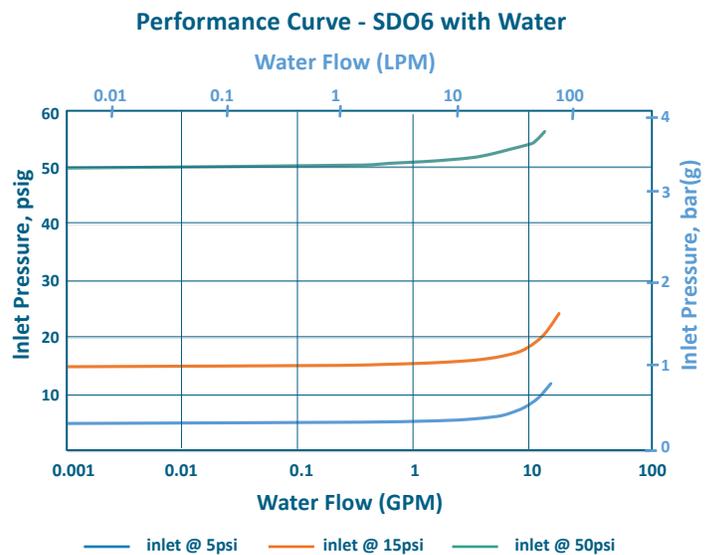
Equilibar regulators respond instantaneously to variations in flow or changes in setpoint to maintain the desired inlet pressure. Because of its speedy response time, the SD Series is a perfect match for computer automated control. Paired with an electronic pilot regulator, the SD valve can be connected to the process control system for easy automation.

### VERSATILITY

The Equilibar SDO can be set up in closed loop flow control in addition to back pressure control.

### OTHER FEATURES

- Injection molded
- Thermally welded diaphragms
- ISO Class 7 clean room assembly
- Ready for sterilization up to 50 kGy<sup>1</sup>
- Gamma indicator on product label<sup>2</sup>
- All product 100% leak tested
- Simple compact design
- Wing screw closure for easy assembly
- Keyway system for disposable insert alignment ensures proper installation
- Multi-day use
- Documentation & traceability



SDO exploded cut view

<sup>1</sup>SDO not sold as sterile device    <sup>2</sup>10 KGy Min

PATENTS [equilibar.com/support/patents/](http://equilibar.com/support/patents/)

# Tangential Flow Filtration

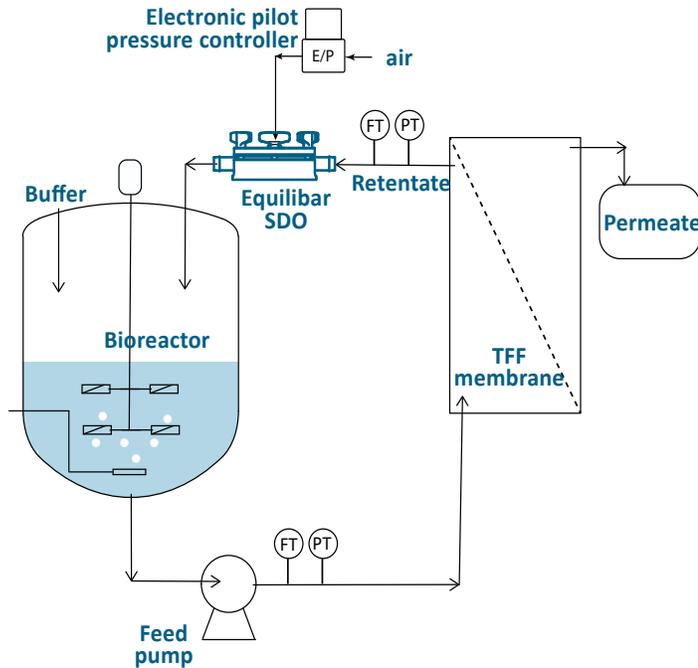
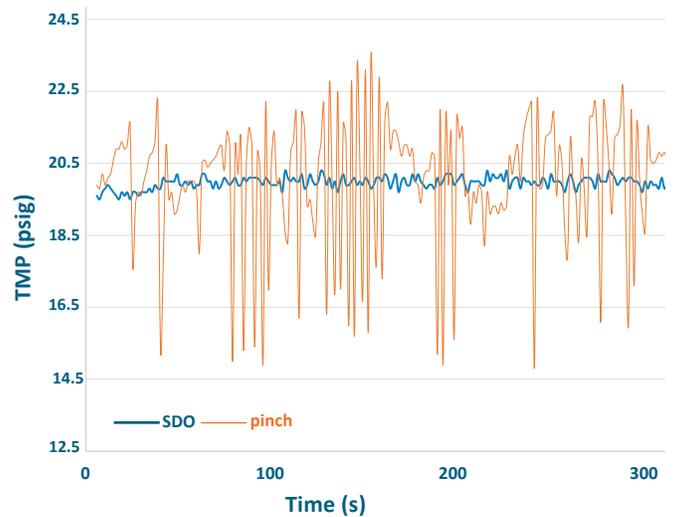


Fig. 1 Membrane pressure control in TFF process

SDO vs Pinch Valve in TMP Control



The graph above shows a direct comparison between the Equilibrar SDO BPR and an industry standard automated pinch valve used in TMP control in a representative system shown in the schematic (left). The SDO improves control by an order of magnitude, increasing TFF process precision, reducing filter fouling, and potentially increasing product yield due to the reduction target molecule degradation.

## Preventing Pump Push-Through Flow

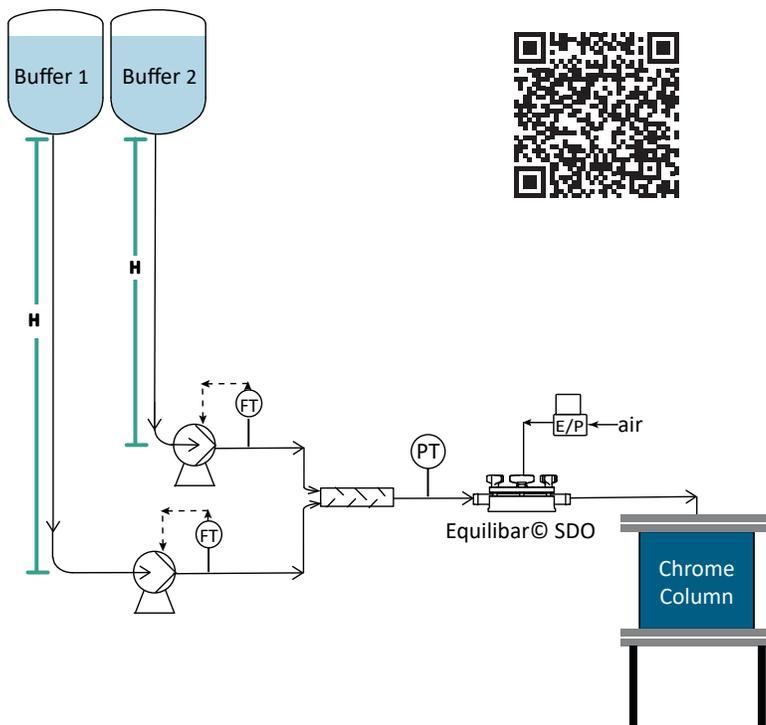


Fig. 2 Minimize flow-through effects of elevated NPSH by controlling diaphragm pump outlet pressure

Some buffer tanks are stored at elevated heights above the feed pump to a chromatography skid or filtration skid to save space. The height of these buffers creates hydraulic pressure, often called “elevation pressure,” or Net Positive Suction Head (NPSH). If NPSH is too high, it may result in unwanted flow-through of buffer fluids, causing inaccurate concentrations.

Placing an Equilibrar SDO single use back pressure regulator after the buffer delivery pumps and inline mixer, controls differential pressure in the diaphragm pumps with the following benefits.

- Prevents NPSH Push-Through Flow
- Stops Flow When Pump is Off
- Improves Accuracy of Pump Delivery at Low Flows

# Pressure Control Points in Chromatography

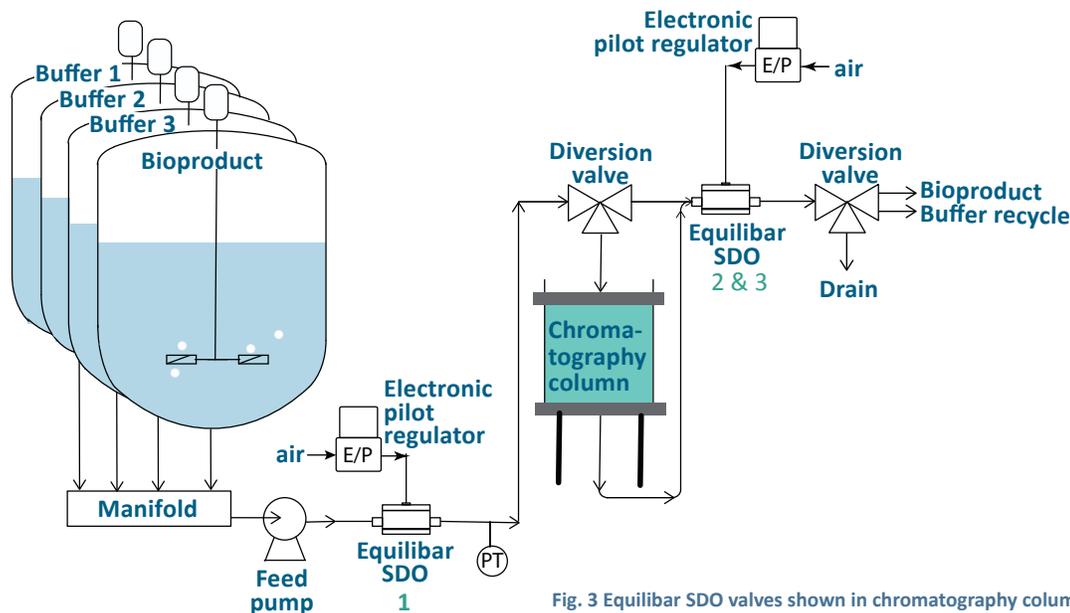


Fig. 3 Equilibrar SDO valves shown in chromatography column application

## Ways Equilibrar SDO helps in the chromatography process:

**1. Chromatography is vulnerable to pulsations** which can cause channelling in the packed bed and damage sensitive cells. **Placing an SDO valve after the feed pump can stabilize flow.** The upper diaphragm responds to slugs of fluid moving through the valve, keeping upstream pressure constant. Downstream pulsation is mitigated through the lower diaphragm, which act to dampen pulsations and absorb downstream pulsations.

**2. An SDO helps maintain column pressure during column bypass steps.** Column bypass is used at system start-up to

pre-tune the supply pump before column installation. An SDO placed at the outlet of the column and the outlet of the diversion valve maintains process pressure when switching to or diverting from the chromatography column.

**3. An SDO valve at the outlet of the column also prevents a siphon.** If the system is designed with a drain line lower than the column outlet, it is possible for a siphon to occur. A siphon would result in pulling fluid back through the column, affecting residence time and column velocity. The unique design of the SDO allows it to operate despite downstream pressure changes; it acts as an isolator to downstream pressures, preventing siphoning.

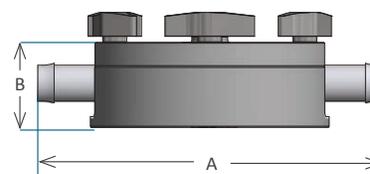
## OTHER APPLICATIONS

Read about other applications such as [disk stack centrifuge pressure control](#) on our website [equilibrar.com](http://equilibrar.com)

## Specifications

MODEL	INLET / OUTLET PORT	CV RANGE (PRECISION)		DIMENSION IN (MM)		INTERNAL VOLUME ML / IN <sup>3</sup>
		MIN	MAX	A	B	
SDO1	1/8" (3.2mm)	1E-04	0.06	2.3 (58)	1.0 (25)	1.8 / 0.1
SDO2	1/4" (6.4mm)	1E-04	0.4	3.6 (91)	1.2 (30)	7.0 / 0.4
SDO3	3/8" (9.5mm)	1E-04	0.9	4.2 (107)	1.4 (36)	13.8 / 0.8
SDO4	1/2" (12.5mm)	1E-03	1.6	5.5 (140)	1.6 (41)	38 / 2.3
SDO6	3/4" (19mm)	1E-03	4.0	7.2 (183)	1.8 (46)	109 / 6.6
SDO8	1" (25.4mm)	1E-03	7.0	9.6 (244)	2.6 (66)	245 / 14.9

- Pilot reference port size 1/8" NPT
- Max pressure 60 psig / 4 bar(g)
- Single use body & diaphragm material is USP Class VI HDPE - BPE and TSE free
- Cradle material is 316L stainless steel
- Wing nuts standard/ Hex head bolts optional



SDO Dimensions

# Pilot Control Options

## ELECTRONIC PILOT OPERATION

For precise electronic control, using an Equilibar EPC or QPV Series electronic pilot regulator is recommended. The pilot regulator can be mounted near the process control system for easy process integration or mounted closer to the dome of the SD regulator<sup>1</sup>.

REGULATOR	DESCRIPTION	KEY FEATURES
QPV	 <p>Precision Low Pressure Regulator Controls up to 150 psi (10 bar)</p> <p>4-20 mA or 0-10 VDC</p>	<ul style="list-style-type: none"> <li>• Dual proportional valve control with analog electronic control circuit</li> <li>• Closed loop control</li> <li>• 4-20mA or 0-10V command</li> <li>• Gauge, vacuum, and absolute pressure models</li> <li>• Bleed orifice for static applications or dynamic applications needing max stability</li> <li>• IP65 enclosure</li> <li>• CE models available</li> </ul>
EPR	 <p>High Resolution Electronic Pressure Regulator Controls up to 500 psi (200 bar)</p> <p>4-20 mA or 0-5 VDC Analog RS232 or RS485 Digital</p>	<ul style="list-style-type: none"> <li>• Models control to 150 psig (10 bar); or 500 psig (34 bar);</li> <li>• Available in gauge, absolute</li> <li>• Proportional inlet &amp; outlet valves for maximum stability</li> <li>• No gas wasted at steady state</li> <li>• Factory set for your pressure</li> <li>• Digital or analog communication</li> <li>• Direct control from the keypad</li> <li>• IP40 enclosure</li> </ul>

<sup>1</sup> For best stability, the tubing between the outlet of the electronic regulator and the dome of the SDO requires a minimum volume of 2 cubic inches / 35cc.

## MANUAL PILOT OPERATION

REGULATOR	DESCRIPTION	KEY FEATURES
MODEL 10	 <p>The Model 10 is a pressure reducing regulator designed for applications that require high capacity and accurate process control.</p>	<ul style="list-style-type: none"> <li>• More rugged construction than others in its class</li> <li>• Model output ranges from 0 – 2 psig / 0.1 bar(g) up to 5 – 400 psig / 0.35 – 27.5 bar(g)</li> <li>• Max supply pressure 500 psig / 35 bar(g)</li> <li>• Temperature range -40°F to +200°F (-40°C to 93.3°C)</li> <li>• Pipe size 1/4" NPT</li> <li>• Acceptable for use in Zones 1 and 2 for gas atmosphere; Groups IIA and IIB and Zones 21 and 22 for dust atmospheres</li> </ul>

Contact an Equilibar application engineer for assistance or visit [equilibar.com](http://equilibar.com) for additional details.

## Consumable Part Number Information

### EXAMPLE CONSUMABLE PART NUMBER: SDO3NZA2 - 12345

Equilibar SDO consumable part numbers have two components. The first component (SDO3NZA2) describes the size and model. The second part (12345) is a unique number created for our customer's specific application to ensure traceability. When ordering parts or communicating with application engineers about any questions you may have, please refer to both components of the part number.

### CERTIFICATIONS only apply to the diaphragms and valve bodies (wetted parts), not the actuator.

- USP Bacterial Endotoxins Test, USP <85>
- USP Biological Reactivity Test in vitro, USP <87>
- USP Biological Reactivity Tests in vivo for Class VI, USP <88>
- USP Particulate Matter in Injections, USP <788>
- For Additional Certifications scan the QR code

Contact Equilibar if you have any questions



# About Equilibar

Equilibar provides innovative and robust pressure control technology for researchers and engineers worldwide. We are proud to design, manufacture and test our patented back pressure regulators in our factory overlooking the Blue Ridge Mountains near Asheville, NC, and we are equally proud to work with clients around the world each and every day.

## APPLICATION ENGINEERING – WHAT SETS US APART

Unlike mass-market regulator distributors, we focus on working with you, the scientist or engineer with a complex pressure control scenario.

Our application engineers work collaboratively with clients to identify the optimal model, trim, and diaphragm for each application's unique challenges. No matter where you are on the globe, you can stay in close contact with your engineer by email, telephone, videoconferencing or fax.

After installation, your application engineer will support you with start-up information and fine-tuning as needed.



Single Use Technology Division

Equilibar, LLC  
320 Rutledge Rd.  
Fletcher, North Carolina 28732  
United States  
Tel: +1-828-650-6590  
Fax: +1-801-504-4439  
Monday - Friday  
8:00 AM - 5:00 PM EST  
12:00 - 21:00 GMT  
[singleuseteam@equilibar.com](mailto:singleuseteam@equilibar.com)



Made in the  
**USA**

Equilibar's quality system is  
**ISO 9001:2015** certified.



Each application is reviewed by our engineering team to ensure quality performance of our products.



Our engineers offer custom designed solutions for the most difficult pressure control challenges. Feel free to contact us to discuss your situation.