PRESSURE CONTROL SOLUTIONS

EQ-DA SERIES™

Stable, fast, and controllable pilot pressure

EQ-DA CORE | EQ-DA PRO | EQ-DA ULTRA™

Digital Electro-Pneumatic Pilot Pressure Control
for dome-loaded control valves

EQ-DA Series | Enabling Innovative Solutions

- Unique **electro-pneumatic actuation** for piloting dome-loaded control valves
- **Ultra-precise digital control** of pressure, flow, level, Δ,P vacuum and more
- **Robust, versatile & ultra-fast**, even under changing process conditions and wide ranges
- Well-suited for **open-loop simplicity** as well as **closed-loop integration**
- Pilot-side actuation isolates control hardware from process media
- **User-friendly** configuration via USB-C and **real-time visibility** via web-based GUI

Working Principle

The EQ-DA Series is an **electro-pneumatic digital controller for Equilibar® dome-loaded valves**. It regulates the pilot (dome) pressure: The loading pressure that sets the valve operating point in a direct 1:1 relationship with the controlled process pressure.

Inside the EQ-DA, fast proportional valves, an internal pressure sensor, and a digital control loop continuously adjust pilot pressure to match the setpoint.

In **open-loop mode**, EQ-DA acts as a precise electronic pilot regulator. In **closed-loop mode**, it uses external feedback (such as pressure, flow, ΔP, level, or vacuum) to automatically compute the required pilot pressure, eliminating the need for a PLC control loop.

Because only clean pilot gas enters the actuator, the proportional valve remains isolated from the process medium, ensuring **reliability** and **chemical compatibility**.

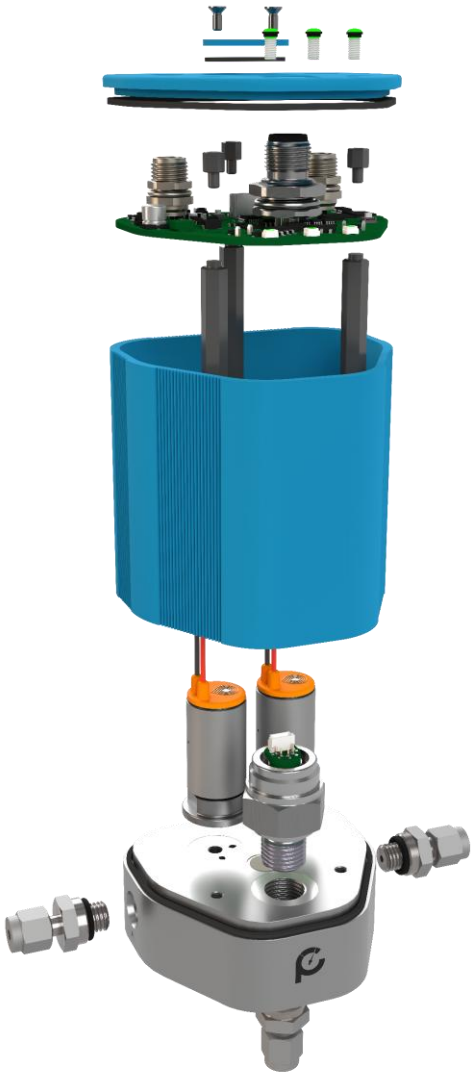
EQ-DA Key Specifications

- Pressure ranges **from vacuum to 200 barg**
- **Fast and stable control** with minimal internal volume
- **Precision 0.005% F.S.** and **accuracy up to 0.05% F.S.** (temperature compensated)
- Very **low consumption** of reference gas
  (< 0.2 mln/min, open-loop steady state/< 5 mln/min, closed-loop steady state)
- Multiple **flexible control modes** (open/closed-loop) and **external sensor support**, enabling control of pressure, flow, ΔP, forward/back pressure, level, vacuum, and more
- **High-Speed control core**: < 0.2 ms PID loop on a 500 MHz processor
- **Analog I/O**: 2× high-precision (24-bit ADC) analog inputs standard, optional 3rd input
- **Robust design for industry use**: SS316 body, robust aluminum housing, IP65-rated seals
- **Connections**: Swagelok® OD compression type fittings, different sizes to choose
- Interface: **USB-C connectivity with web-based GUI** for setup and monitoring

Smart Actuator for Dome-Loaded Control Valves

The EQ-DA is a high-performance pneumatic actuator module designed by PCS in cooperation with Equilibar to automate dome-loaded, pilot-operated control valves.

It regulates the valve's pilot (dome) pressure - the loading pressure applied to the top port - enabling highly stable and accurate control of pressure, flow, differential pressure (ΔP), level, and vacuum in demanding processes.
Inside the EQ-DA, 2 fast proportional valves, a high-speed internal pilot pressure sensor, and a powerful digital PID loop continuously adjust pilot (dome) pressure to match the commanded setpoint. The EQ-DA can operate in open-loop mode (precise electronic pilot regulator) or in closed-loop mode, where it uses an external feedback signal (e.g., upstream pressure, downstream pressure, flow, ΔP, level, or vacuum) to automatically compute the required pilot (dome) pressure, eliminating the need for a PLC control loop for the primary control function.



Why combine EQ-DA & Equilibar

Equilibar valves are known for their **multi-orifice diaphragm technology** and wide rangeability, making them a strong choice for severe-service conditions:

- Very high or ultra-low temperatures, ranging from **-253°C to 600°C**
- Pressure ranges from **vacuum up to 1380 bar**.
- Also available for **extremely low flows** with a Cv down to 1.0E-10, and enormous turndown ratio
- Suitable to handle **two-phase** or mixed-phase flow, **high viscosity**
- Uniquely **responsive** to process disturbances
- **FDA & USP Class VI** certifications available for use in food and pharma
- Broad **compatibility with aggressive media**: SS316 is default and material options include Hastelloy 276, Monel, Zirconium, Inconel 625, PTFE and more

EQ-DA Series adds a precise digital actuation layer on top: Fast pilot (dome) pressure control, tunable response, monitoring, and closed-loop control capability turning difficult processes into stable, repeatable, automated control systems.

PRESSURE CONTROL SOLUTIONS

EQ-DA Series | Product Line Overview

The EQ-DA family delivers exceptional control, precision, and repeatability across three variants – Core, Pro, and Ultra – to match different integration needs and performance targets. All models support configurable analog interfacing for both setpoint and analog input(s) and include Modbus RTU digital communication via both M12 (RS485) and a dedicated USB-C connector.

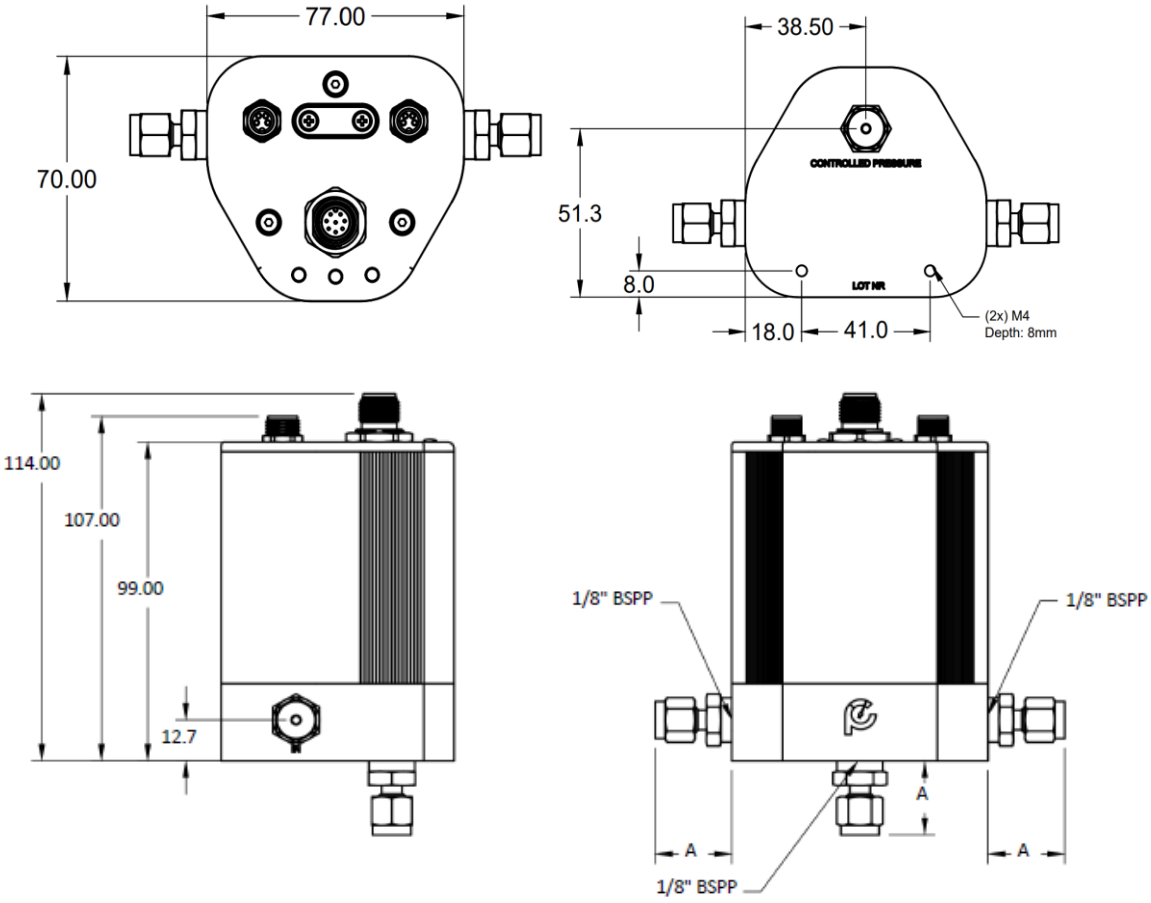
EQ-DA Product Lines | Core, Pro & Ultra

- EQ-DA Core: Premium essentials, optimized for larger quantities
- EQ-DA Pro: Main high-performance series
- EQ-DA Ultra: Range-specific flagship option for maximum accuracy
- All versions: IP65, −20 to +50 °C, 24 VDC

Further comparison in the table below

	EQ-DA Core (starting Q3 2026)	EQ-DA Pro	EQ-DA Ultra (starting Q3 2026)
Positioning | Primary focus	Premium essentials for **high-volume** customers and **cost-optimized** without sacrificing control quality	Main high-performance series Best **all-round controller** with full options and high performance	Flagship option **for absolute best accuracy** and max achievable accuracy & stability for a specified range
Pressure ranges	Sensor selected for customer requirement	3 base models: **10 - 70 - 200 bar** Full-scale can be adapted later	Customer specific pressure range
Control precision and repeatability	**±0.02% of selected range** 40 bar → ±8 mbar 6 bar → ± 1.2 mbar	**±0.005% of *full* range** 10 bar FS ±0.5 mbar | ±0,007 psi 70 bar FS ±3.5 mbar | ±0,051 psi 200 bar FS ±10 mbar | ±0,145 psi	**±0.005% of *selected* range** 16 bar FS ±0.8 mbar | ±0,012 psi 1 bar FS ±0.05 mbar | ±7.3E-04 psi
Sensor	**Keller® 20D Series** Matching customer requirement	**Keller® 20SXiiC Series** 10 - 64 - 200 bar	Keller® 20SXiiC | Range to match customer requirement
Sensor accuracy	**0.5% FS of *selected* range**	**0.05% FS of *default* range**	**0.05% FS of *selected* range**
Calibration certificate	Available upon request	Yes, supplier certificate included	
External analog inputs	**1×** external analog input; when **single cascade** control is required ModBus RTU setpoint mode only	**3×** external analog inputs; preferred choice when **2 or more external analog inputs** are required	
Sample rate	All versions: 24-bit, 0.5 ms sample rate		
External sensor wiring convenience	External analog input routed via M12 connector; no dedicated M8 connectors, no external-sensor cable	In addition to M12 connector, 2 dedicated M8 connectors for external signals enable separate cabling and easier external sensor integration	
Analog interfacing	All versions: Configurable analog setpoint + analog input(s): 4–20 mA, 0–20 mA, 0–5 V, 0–10 V		
Digital communication	All versions: Modbus RTU via M12 (RS485) and via dedicated USB-C connector		
Digital fieldbus options	Available upon request	Upcoming: PROFINET, EtherCAT, Ethernet, Modbus TCP/IP	
Operating voltage	All versions: +24 VDC		
Power consumption	Typically, 200 mA for devices <70 bar | max 450 mA Typically, 450 mA for devices >70 bar | max 900 mA		
IP rating	All versions: IP65		
Operating temperature	All versions: −20 °C to +50 °C		
Min order quantity	**20**	No minimum order quantity	
Lead time	**1 – 2 weeks** Based on master agreement	**1 – 2 weeks** Available from stock	**8 – 10 weeks** Based on sensor lead time

Product drawings



EQ-DA HOOKUP DIAGRAM

17/03/2026

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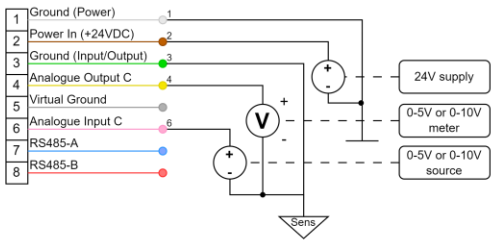
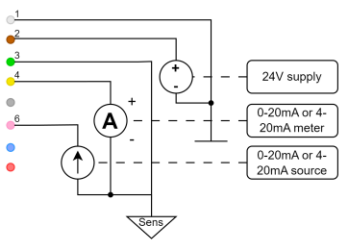
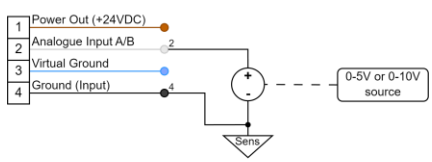
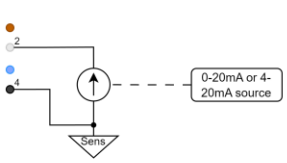
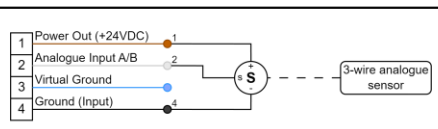
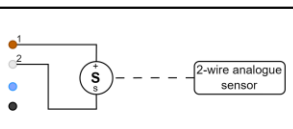
EQ-DA connector front view	Functionality	Analogue operated at 0-5V or 0-10V	Analogue operated at 0-20mA or 4-20mA	Cable connector front view
M12 male connector C 	Supply, Analogue Output & Analogue Input			M12 female connector 
M8 female connector A/B 	Analogue Input			M8 male connector 
	Analogue Sensor	3-wire analogue sensor 	2-wire analogue sensor 	

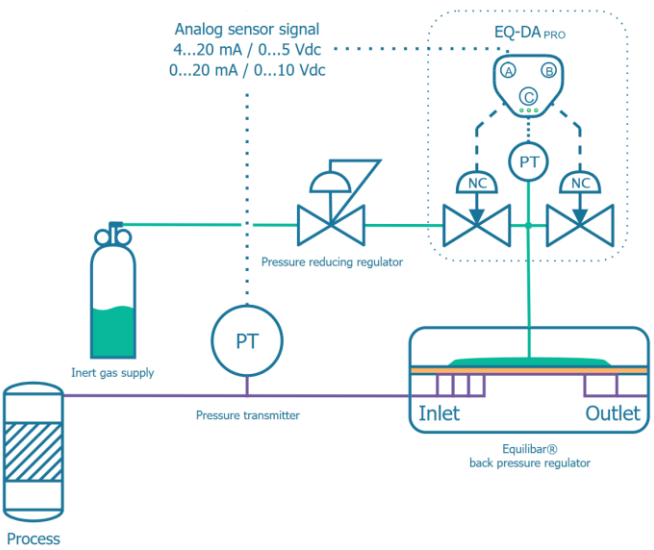
Back Pressure Control | Open- & Closed-Loop

Back pressure control is often expected to be “simple,” though real systems rarely behave ideally in practice. Rapid flow changes, variable downstream conditions, two-phase flow effects, and wide turndown can introduce pressure offset, overshoot, or oscillation. Especially when the process must remain stable from very low to high flow. With an Equilibar dome-loaded valve actuated by an EQ-DA controller, the controlled variable is achieved by modulating pilot (dome) pressure.

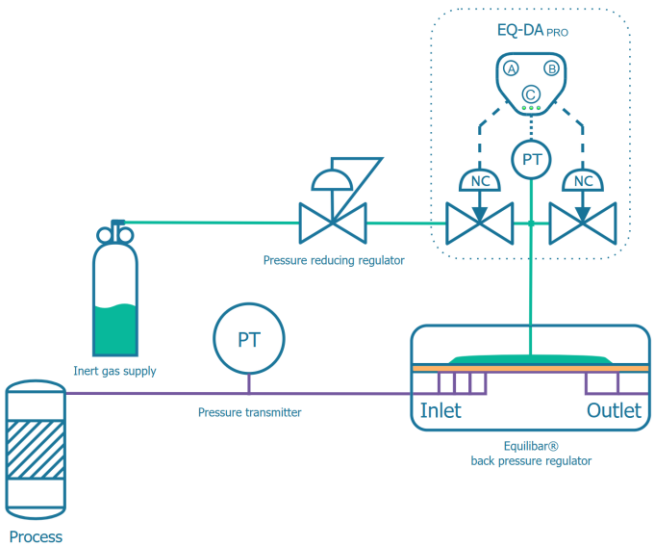
In open-loop, the EQ-DA generates a precise pilot (dome) pressure setpoint; the valve then maintains upstream pressure with a near 1:1 relationship to that pilot pressure. This is best suited when the pressure drop across the valve is small or relatively constant. In closed-loop, the EQ-DA reads the actual upstream pressure (process feedback) and continuously adjusts pilot (dome) pressure to eliminate offset and compensate for changing flow, density, or downstream conditions. This delivers tight control across the full operating envelope.

Because only clean pilot gas enters the actuator, the proportional valve remains isolated from the process medium—improving reliability and chemical compatibility.

Closed-loop back pressure control



Open-loop back pressure control



Unique solutions for complex applications

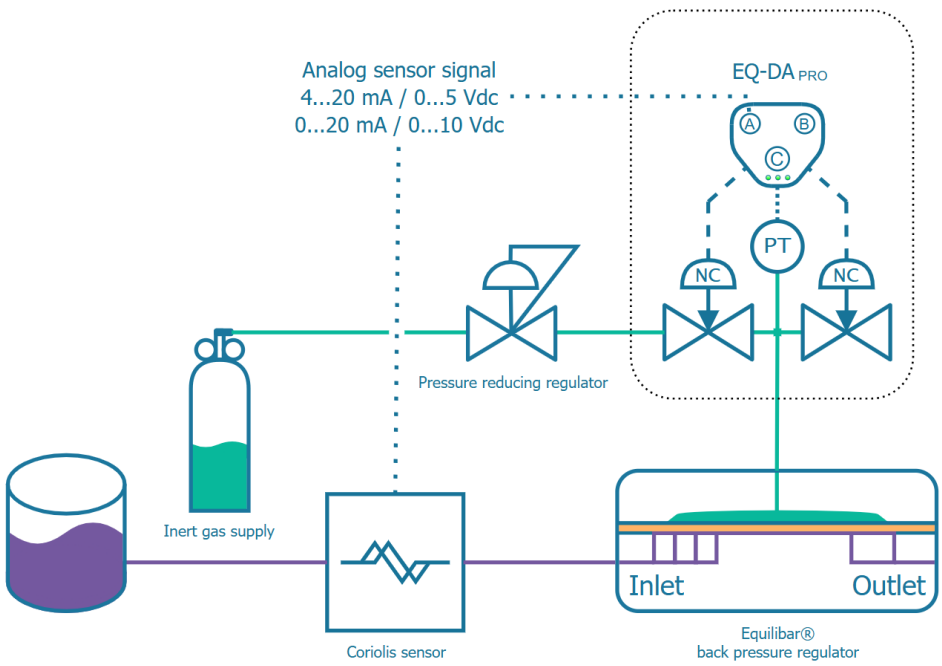
- Tight upstream pressure control across wide turndown and dynamic flow conditions
- Open-loop simplicity or closed-loop accuracy; no PLC control loop required
- Adjustable response – damping, ramps, limits – to prevent overshoot or undershoot
- Compensates for pressure drop changes and process disturbances automatically
- Full diagnostics: Upstream pressure, pilot (dome) pressure, output and alarms
- Dome-loaded valve customizable for broad range of severe process conditions

Flow Control | Closed-Loop

Flow control is often where *conventional control valves* show their limits: Low-flow instability, non-linear behavior across turndown, sensitivity to upstream pressure variations, and poor performance with flashing or variable viscous media. In high-value processes, flow overshoot or oscillation can directly impact product quality, yield, and process integrity.

EQ-DA enables closed-loop flow control with external sensor feedback – by linking an external flow signal to the actuator. The EQ-DA compares the measured flow to the setpoint and adjusts pilot (dome) pressure to modulate the Equilibar valve until the requested flow is achieved. Because the Equilibar valve offers wide rangeability and stable behavior under difficult flow regimes, the combination can maintain controllability across operating points where traditional valves would require complex multi-valve architectures. Coriolis sensors often offer a measurement range much wider than the control valve. The combination of EQ-DA and an Equilibar dome-loaded control valve eliminates that limitation, offering >1:1000 Cv/Kv rangeability and thus allowing the highly accurate, media-independent measuring technology to reach its full potential. Even if properties such as viscosity or density change, an Equilibar dome-loaded valve actuated by EQ-DA will compensate for the pressure drop over the sensor, allowing the user to control over a wider range.

This is especially effective for “non-invasive” or contamination-sensitive measurement setups, such as ultrasonic flow sensors, requiring reliable automated control without adding wetted complexity.



Unique solutions for complex applications

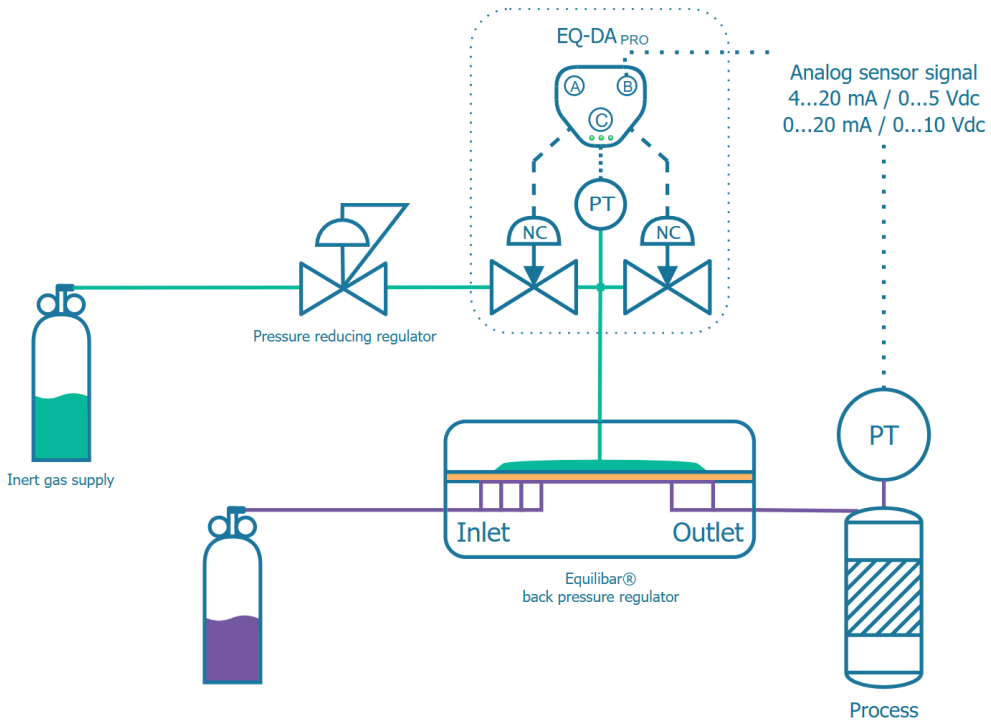
- Precise flow control across wide turndown and rapidly changing conditions
- Closed-loop flow regulation inside EQ-DA; no PLC control loop required
- Works with a wide range of external flow sensors and signal types
- Adjustable response for stable control due to the cascade control loop
- Diagnostics: flow feedback, pilot (dome) pressure, output, and control status
- Dome-loaded valve customizable for broad range of severe process conditions

Forward Pressure Control | Closed-Loop

Pressure reducing applications become challenging when conditions move beyond “clean gas at steady flow.” 2-phase flow, flashing, condensables, aggressive chemistries, large turndown requirements, and rapid demand changes can cause conventional pressure-reducing regulators to droop, drift, stick, or become unstable, leading to inconsistent downstream pressure and frequent operator intervention.

Combined with EQ-DA, a dome-loaded Equilibar valve turns into a high-performance pressure-reducing control element. By closing the loop on downstream pressure feedback, the EQ-DA continuously adjusts pilot (dome) pressure to modulate valve opening until the downstream pressure reaches and holds the setpoint. This enables you to tune control behavior (response speed, damping, ramping) and eliminate natural effects known with traditional spring-loaded pressure-reducing regulators.

EQ-DA control algorithms include protective strategies, such as pressure output limiting, to reduce wear and avoid aggressive diaphragm loading during abnormal conditions. Because the proportional valve only handles clean pilot gas, the actuation hardware remains isolated from the process medium, making it useful for corrosive or contamination-sensitive services. Since the dome-loaded Equilibar control valve can be made from any machinable material, the combination of a dome-loaded valve and the EQ-DA can be built for the most aggressive media.



Unique solutions for complex applications

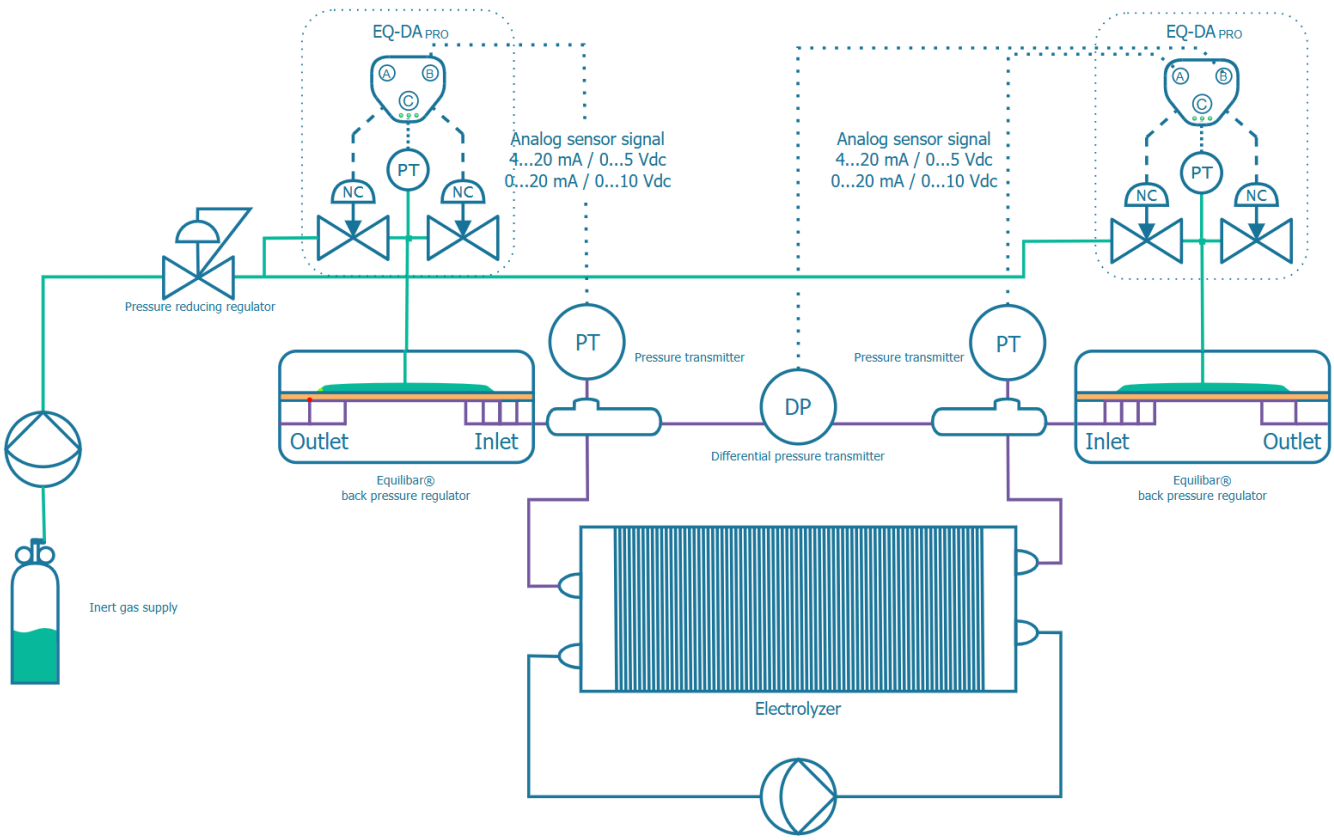
- Stable downstream pressure control in demanding, non-ideal process conditions
- Closed-loop pressure reducing without requiring a PLC control loop
- Tunable dynamics (ramps, damping, limits) for smooth setpoint changes
- Better control across a wide turndown than many conventional PR regulators
- Monitoring of downstream pressure, pilot (dome) pressure, and valve output for troubleshooting
- Dome-loaded valve customizable for broad range of severe process conditions

ΔP Differential Pressure Control |Closed Loop

Many critical unit operations depend on maintaining a controlled differential pressure across a component: membranes in electrolysers, filters, heat exchangers, packed beds, separators, and seals. ΔP is rarely constant. Viscosity, fouling, gas fraction, temperature, and flow changes can shift ΔP quickly, making manual tuning or simple fixed-valve approaches unreliable.

With EQ-DA, the control loop is built around ΔP directly. A differential pressure transmitter (or two pressure signals with internal ΔP calculation) is used as the feedback signal. EQ-DA then adjusts pilot (dome) pressure to modulate the Equilibar valve and holds ΔP at setpoint. This delivers a predictable, repeatable ΔP even during disturbances such as flow step changes, phase changes, or gradual fouling.

Optional features include absolute pressure limits and controlled ramp profiles, allowing ΔP “clamp” strategies that protect sensitive equipment while still enabling fast process transitions.



Unique solutions for complex applications

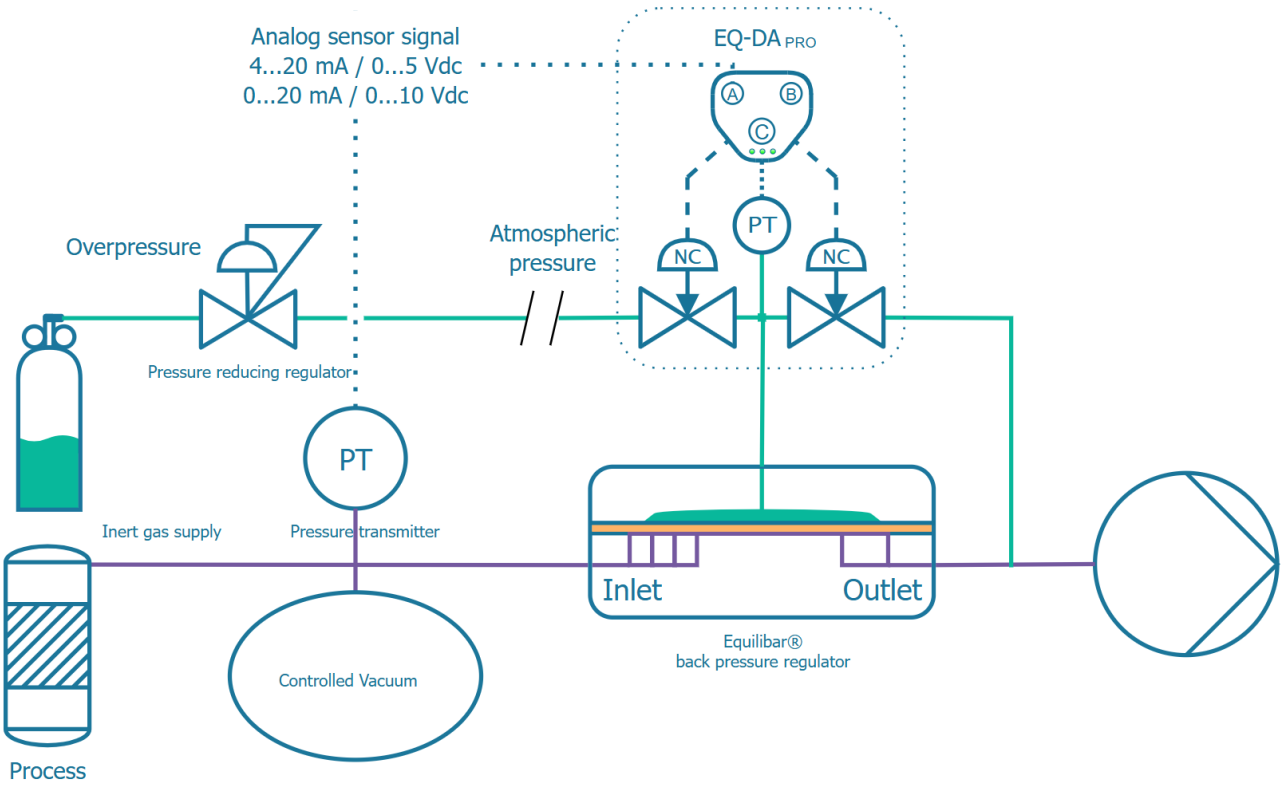
- Direct ΔP control to protect membranes, filters and sensitive stacks
- High stability during flow/viscosity changes, two-phase effects, or fouling drift
- No PLC control loop required; closed-loop handled inside EQ-DA
- Adjustable control behavior for smooth, non-oscillatory ΔP regulation
- Clear diagnostics: ΔP feedback + pilot (dome) pressure + valve output monitoring
- Dome-loaded valve customizable for broad range of severe process conditions

Vacuum Control | Closed-Loop

Vacuum processes are often sensitive to leaks, pump behavior, condensables, and rapidly changing loads. Maintaining a stable vacuum setpoint can be difficult when flow varies from near-zero holding conditions to high pumping rates during evacuation.

With an Equilibar valve actuated by EQ-DA, vacuum can be controlled by modulating pilot (dome) pressure to throttle the vacuum flow path. In closed loop, the EQ-DA reads the vacuum pressure signal and continuously adjusts the pilot (dome) pressure so the valve opening changes just enough to maintain the set vacuum. In open-loop, the EQ-DA can generate a fixed pilot (dome) pressure for stable, repeatable vacuum “bias” settings when tight feedback control is not required.

When controlling vacuum, gas densities drop rapidly, requiring a wide Cv/Kv range. Equilibar valves offer a >1:1000 rangeability, extended by the EQ-DA compensator, which compensates for pressure drops along the process lines and the regulators themselves. Because only clean pilot gas enters the actuator, the proportional valve remains isolated from the process stream, which is ideal for aggressive vapors or contamination-sensitive systems.



Unique solutions for complex applications

- Stable vacuum control across wide operating ranges (high turndown)
- Closed-loop control with direct vacuum feedback (no PLC loop required)
- Adjustable response (damping, ramping) to prevent over- or undershoot
- Handles challenging conditions: leaks, pump ripple, condensables, intermittent load changes
- Monitoring of setpoint, vacuum feedback, and pilot (dome) pressure for diagnostics
- Dome-loaded valve customizable for broad range of severe process conditions

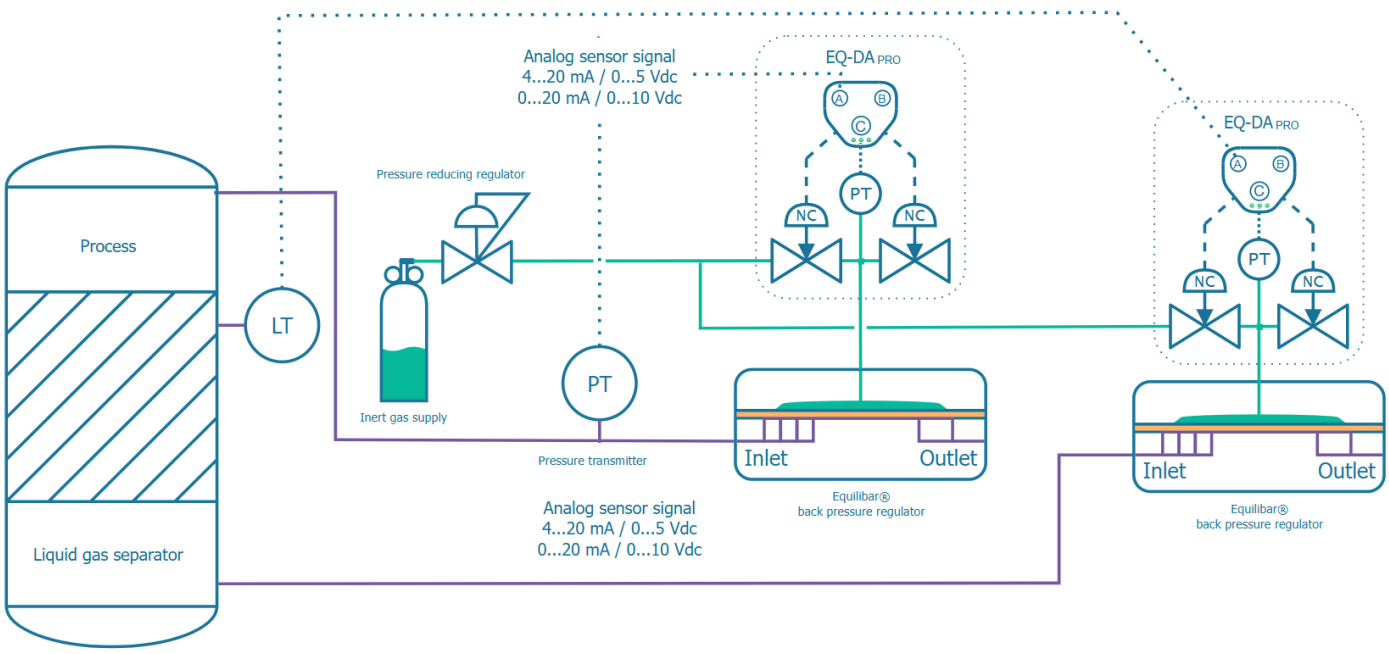
Level Control | Closed-Loop

Level control becomes difficult when the process is non-linear or “messy”: Flashing liquids, entrained gas, foam, slugs, and varying densities. In high-pressure separators, Liquid gas separators, knockout drums, condensate pots, and batch vessels, level stability often determines downstream quality.

By using EQ-DA with an Equilibar valve, level is controlled by closing the loop on a level signal (like a ΔP-based level transmitter, radar, or other analog measurement). The EQ-DA converts the level deviation into an adjustment of pilot (dome) pressure, thereby modulating the valve opening to control outlet flow (or a related pressure/flow condition) and maintain the desired level.

Because the Equilibar valve offers wide rangeability and strong stability under variable flow regimes, the system can remain controllable even during intermittent inflow, two-phase conditions, or sudden load changes.

Level control can also be combined with protective logic such as ramped transitions, output limits, and (if desired) overriding constraints to avoid extreme operating conditions.



Unique solutions for complex applications

- Stable level control in challenging, non-linear, two-phase environments
- Closed-loop control with level/ΔP feedback (no PLC loop required)
- Wide controllable range for both low and high outflow conditions
- Tunable dynamics to prevent hunting during slugs and intermittent inflow
- Monitoring of level signal, pilot (dome) pressure and valve output for troubleshooting
- Dome-loaded valve customizable for broad range of severe process conditions

Want to know more?

This brochure was published with the launch of the EQ-DA Series early 2026. Based on continuous improvement and planned expansion of the EQ-DA product family, we will regularly update this brochure. Check www.pressurecontrolsolutions,com/eq-da/ for updates and more information – such as:

- Application notes
- Product manuals
- 2D & 3D files
- Demo videos

Contact us

If you want to know more about our EQ-DA Series, about Equilibar control valves or PCS in general, please contact us – contact data below in the footer and on our website.
We look forward to meeting you!

About PCS

We are Pressure Control Solutions. Originally founded in 2016 to distribute Equilibar ® back pressure regulators in Northwest Europe. Now well-known and respected way beyond and for a much broader product portfolio.

PCS specializes in the selection, assembly, integration, and manufacturing of high-precision process control components. As the authorized distributor for Equilibar® in Northwest Europe, we combine innovative valve technology with advanced instrumentation to deliver tailor-made solutions for the most demanding applications. From laboratory setups to pilot plants and industrial processes, we support customers with expertise, flexibility, and reliable high-value solutions. With a focus on customer satisfaction and quality, we proudly maintain an ISO 9001 & 14001 certified management system.

PCS stands for high-precision process control solutions. Often customized, always high quality.