



Proportional Ratio Assembly High Pressure Controller

About Equilibar PRA

The PRA Proportional Ratio Assembly provides a solution for applications requiring inert gas pressure control greater than 1000 psig (up to 6000 psig) using electro pneumatic controls. Electro-pneumatic pressure control applications for pressures less than 1000 psig can make use of other <u>Equilibar electronic pressure controllers</u>.

The PRA assembly has a limited flow coefficient (Cv) of 0.05 and is typically used for dead-headed or low-flow applications. The most common application for the PRA is pilot operating a high pressure dome-loaded regulator such as an Equilibar® back pressure regulator.

The PRA assembly consists of 3 basic components:

- 1. A pilot operated ratio regulator to control the high pressure gas outlet.
- 2. A low pressure <u>QB2 electro-pneumatic regulator</u> with closed-loop control to pilot operate the high pressure ratio regulator.

3. A DS downstream pressure transducer to sense the high pressure outlet and provide feedback to the QB2 regulator's closed loop controller.

The PRA Proportional Ratio Assembly is available in two ratios: A 15:1 outlet to pilot pressure ratio for low pressures and A 45:1 outlet to pilot pressure ratio for higher pressures.

The **15:1** ratio regulators have an accuracy of roughly $\pm 1.5\%$ of full scale. The **45:1** ratio regulators have an accuracy of roughly $\pm 2.5\%$ of full scale.

All PRA assemblies come pre-assembled and calibrated, ready for use. Additional details regarding each of these components individually are available in the latter pages of this information packet.

*Not intended for hazardous/explosive environments. Meant for use with air or inert gases only.



Figure 1: The PRA Proportional Ratio assembly, labeled corresponding to the components list above.

How to use the PRA

It is important to note that this PRA assembly does not generate high pressures but regulates a higher source pressure to a lower more useful pressure. The advantage of this assembly is that it is able to use a more economical low pressure electro-pneumatic regulator and avoids the high cost of high pressure gas controls.

The PRA Proportional Ratio Assembly requires two gas supplies—a low pressure supply for the QB2 regulator (2) and a high pressure supply for the ratio regulator (1). The schematic below details this configuration.

For best results, provide a supply pressure of 110% of the maximum control range for each device.

Example: A 2500 psig unit with a 45:1 ratio requires a 2500*110% = 2750 psig supply for the ratio regulator and a 2500/45*110% = 61 psig supply for the QB2 regulator.

There are some limitations with the PRA assembly users should understand. The ratio regulator uses sliding seals and springs which can cause hysteresis and other forms of inaccuracy (i.e. friction). The assembly responds to changes instantly but may sometimes require extra time (on the order of a few seconds) to reach its final stable pressure.



Figure 2: A schematic detailing the configuration and use of the PRA Proportional Ratio Assembly. Many applications will have the controlled outlet going to the reference port of an Equilibar[®] Back Pressure Regulator.

PRA-15-1500-E Performance



PRA-15-1500-E COMMAND VS OUTPUT

COMMAND (PSIG)



COMMAND (PSIG)



PRA-45-2500-E COMMAND VS OUTPUT

PRA-45-2500-E



OUTPUT (PSIG)

EQUILIBAR 5

PRA Ordering Information

EXAMPLE PART NUMBER	PRA	-	45	-	1500	-	E
Your Part Number:	PRA						
			1		2		3

1 PRESSURE RATIO

- 15 15:1 Pressure Ratio*
- 45 45:1 Pressure Ratio

2 MAX PRESSURE (PSIG)*

Between 1000 - 6000 psig

3 COMMAND / MONITOR SIGNAL

- E 0 to 10 Vdc
- I 4 to 20 mA

*15:1 Pressure Ratio Units can only be used up to 1500 psig Max Pressure

ALL UNITS REQUIRE A POWER CORD POWER CORD PART NUMBER: QBT-C-X WHERE X IS LENGTH OF POWER CORD IN FEET



PRE-ASSEMBLED QBT POWER CORD Part Number: QBT-C- Length in feet*

*6 ft is typical. Other lengths are available [from 1 to 25 feet (8 meters), 1 foot increments]

THE PAGES TO FOLLOW CONTAIN RELEVANT TECHNICAL INFORMATION FOR EACH COMPONENT IN THE PRA PROPORTIONAL RATIO ASSEMBLY

RECOMMENDED ACCESSORIES

QBT-C-6 6 ft. Power Cable

Pilot Operated Ratio Regulator

The model RG1262 is a reducing regulator wherein outlet pressure is controlled by lower pressure control air applied to the control port. Outlet or regulated pressure will be 45 times or 15 times (depending on the version) the control pressure used. This permits using shop air or other low pressure source to provide an accurately controlled high pressure regulator. By using air rather than a spring to set pressure, the regulator can be controlled remotely and pressure changes can be made much more rapidly.

OPERATION

Outlet pressure can be adjusted by varying control pressure at the control port. The outlet pressure will be 15 or 45 times the control pressure, depending on the unit.

SPECIFICATIONS			
MAX INLET PRESSURE	6000 psig		
OUTLET PRESSURE RANGE	0 TO 5000 PSIG (45:1 RATIO) 0 TO 1500 PSIG (15:1 RATIO)		
FLOW COEFFICIENT	0.05		
ACCURACY	0.5% F.S.		
SUPPLY PRESSURE DEPENDENCY	Outlet rises 50 psi with 1000 psi drop in supply		
PORT FITTINGS GAUGE FITTINGS	1/4" FNPT		

MATERIALS OF CONSTRUCTION			
BODY AND CAP	ALUMINUM		
INTERNALS	BRASS, ALUMINUM		
SEALS	DELRIN, BUNA N, VITON		

INSTALLATION

Use a suitable pipe thread sealant, preferably liquid instead of Teflon tape on the 1/4'' inlet and 1/4'' outlet connections. Connect the inlet to the source gas such as a high pressure storage tank. An outlet gauge and relief valve set slightly higher than the desired outlet pressure should be connected to the outlet. If the inlet pressure can exceed 6000 psi a relief valve should also be installed at the inlet to prevent exceeding 6000 psi. Avoid over torque of pipe threads. Normal torque with a 6 or 8 inch wrench is ample. The regulator is NOT shipped oxygen clean and should NOT be used for oxygen service as provided. Consult the factory for details. Mounting can be done by clamping to inlet and outlet piping or by providing threaded mount holes in the bottom of the body. Avoid intercepting the body ports. The regulator can be mounted in any position. The vent port can be oriented in any position by rotating the cylinder.



Figure 3: Model RG1262 reducing regulator dimensions



Pilot Operated Ratio Regulator

INSTALLATION

- Use a suitable pipe thread sealant, preferably liquid instead of Teflon tape on the 1/4" inlet and outlet connections.
- Connect the inlet to the source gas such as a high pressure storage tank. See image below for location of inlet ports.
- Note: If the inlet pressure can exceed 6000 psi, a relief valve should also be installed at the inlet to prevent exceeding 6000 psi.
- An outlet gauge and relief valve set slightly higher than the desired outlet pressure should be connected to the outlet. See image below for location of outlet port.

- Avoid over torque of pipe threads. Normal torque with a 6 or 8 inch wrench is ample.
- The regulator is NOT shipped oxygen clean and should NOT be used for oxygen service as provided.
 <u>Consult the factory for details.</u>
- Mounting can be done by clamping to inlet and outlet piping or by providing threaded mount holes in the bottom of the body.
- Avoid intercepting the body ports.
- The regulator can be mounted in any position.
- The vent port can be oriented in any position by rotating the cylinder.



Two Inlet ports are positioned to the right of the DS pressure transducer.



DS Pressure Transducer is installed in one outlet port. Another outlet port is positioned to the left of the DS.

QB2 Electropneumatic Pressure Regulator

THEORY OF OPERATION

The QB2 is a nested loop model consisting of valves, manifold, internal pressure transducer, and electronic controls. Output pressure is proportional to an electrical signal input. Pressure is controlled by two solenoid valves. One valve functions as the inlet control, the other as exhaust. The pressure output is measured by a pressure transducer internal to the QB2 and provides a feedback signal to the electronic controls. This feedback signal is compared against the command signal input. A difference between the two signals causes one of the solenoid valves to open allowing flow in or out of the system. Accurate pressure is maintained by controlling these two valves.

In addition to the internal pressure transducer, the QB2 also receives a feedback signal from an external sensing device. The external signal functions as the primary feedback signal which is compared against the command signal input. This outer loop comparison is then used to provide a command to the inner loop. A difference between the two comparisons causes one of the solenoid valves to open allowing flow in or out of the system.

COMMAND SIGNAL

Command inputs come in a choice of either 0 to 10 Vdc, 4 to 20mA.

MONITOR SIGNAL

All QB2's come with a 0-10 volt or an optional 4-20mA monitor signal for output to a panel meter or controller for data acquisition or quality assurance needs. The monitor signal represents the signal from the external sensor that is monitoring the output downstream.The vent port can be oriented in any position by rotating the cylinder.

SPECIFICATIONS

PHYSICAL			
WETTED PARTS	Fluorocarbon, Brass, Nickel-Plated Brass, Silicon and Aluminum, Stainless Steel		
OPERATING TEMP	32°F to 158°F		
PROTECTION	NEMA 4/IP65		
WEIGHT	1 lbs. 1.4 lbs. (SS)		
ELECTRICAL CONNECTOR	6-pin Hirschman		

ELECTRICAL			
SUPPLY VOLTAGE	15 to 24 VDC		
SUPPLY CURRENT	250 mADC		
COMMAND VDC	0 to 10 VDC		
COMMAND (CURRENT option)	4 to 20 mADC Differential		
	0 to 10 VDC		
MONITOR (CLIPPENT option)	4 to 20 mADC		
	4 10 20 MADC		
COMMAND SIGNAL IMPEDANCE	Voltage=10 KΩ Current=100 Ω		

PNEUMATIC			
INLET PRESSURE	125 psig		
FILTRATION REQUIRED	40 Micron		
PORT SIZE	1/8" NPT Female		
CRITICAL VOLUME	1 in ³		

For more information, see the full QB2 brochure.

QB2 Dimensional Drawing & Accessories



WARRANTY

Equilibar products are warranted to the original purchaser only against defects in material or workmanship for one (1) year from the date of manufacture. The extent of Equilibar's liability under this warranty is limited to repair or replacement of the defective unit at Equilibar's option. Equilibar, LLC shall have no liability under this warranty where improper installation or filtration occurred.

All specifications are subject to change without notice. THIS WARRANTY IS GIVEN IN LIEU OF, AND BUYER HEREBY EXPRESSLY WAIVES, WARRANTIES OR LIABILITIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION ANY OBLIGATION OF Equilibar, LLC WITH REGARD TO CONSEQUENTIAL DAMAGES, WARRANTIES OF MERCHANTABILITY, DESCRIPTION, AND FITNESS FOR A PARTICULAR PURPOSE.

WARNING: Installation and use of this product should be under the supervision and control of properly qualified personnel in order to avoid the risk of injury or death.

OPERATION

DS series pressure transducers accurately measure pressure of gases or fluids. The output is an electrical signal based on the pressure measurement.

Conditioning of the electrical signal from the strain gauge sensor gives a 0-10 VDC output. The electrical output is a linear ratio of the pressure sensed. DS series transducers are enclosed in a rugged aluminum housing. A strain relief protects the wiring from damage caused by excessive pulling force.

The stainless steel version (DST) utilizes the same silicon etched device mounted on a stainless steel diaphragm. On these units, no elastomers or O-rings contact the pressurized media.

All media wetted parts are ANSI type 316L stainless steel.

SPECIFICATIONS

PHYSICAL			
WETTED PARTS	Stainless Steel		
OPERATING TEMP	32°F to 158°F		
PROTECTION	ALUMINUM HOUSING		

ELECTRICAL			
SUPPLY VOLTAGE	15 to 24 VDC		
SUPPLY CURRENT	35 to 50 mADC		

PNEUMATIC		
PRESSURE RANGE	Full Vac to 7,000 psig	
RESPONSE TIME	100 Microseconds	
REPEATABILITY	+/- 0.25%	
ACCURACY	+/- 0.5% (DST)	
OPERATION TEMP	32°F to 158°F (0°C to 70°C)	
CALIBRATION TEMP EFFECT		
Zero & Span adjustable <1% over specified temp. range (0-50°C, 122°F)		







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.

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.

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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.



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