250E

PRESSURE/FLOW CONTROL MODULE

The 250E is a self-contained PID control module designed to provide optimized control of the total pressure or flow of a gas (or gases) in a dynamic closed-loop system.

With the 250E, input can be supplied by a Baratron® Capacitance Manometer or other compatible vacuum gauge for closed-loop pressure control, or flow input can be measured by a mass flow transducer for closed-loop flow control. Its power supply has sufficient output to power most capacitance manometers and flow transducers.

Process control can be manually adjusted through a front panel potentiometer or remotely programmed with a 0-5 VDC analog signal for profile generating. With the multi-set point option, a simple ground closure will select one of four preset set points. The basic 250E provides a simple analog error meter to show deviation of actual versus desired set point. It is also available with an optional 4½ digit LED display which provides a readout of the input transducer signal and eliminates the need for a separate display instrument. A Process Limit Option provides logic level and relay closure when actual pressure or flow exceeds a preset percentage of desired set point. These limits are adjustable from 0.5% to 100% of set point.

Features & Benefits

- Provides fast response control of pressure or flow of single gas
- Gain and phase lead adjustment capability for optimized closed-loop control
- Supports internal (front panel) set point control or external set point voltage
- Operates with a wide variety of pressure/flow transducers and control valves
- Standard analog or optional 4½ place digital display
- Offers rack-mountable design
- Powers and displays Baratron Capacitance Manometer with digital meter option

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Application Schematics

A pressure/flow control system consists of three basic parts: 1) a process sensor, 2) a PID controller, and 3) a control element. In the simplest single-gas control system (Figure 1), a pressure transducer or mass flow meter measures the process pressure or gas inlet flow rate. The 250E PID controller compares the measured pressure or flow to the desired set point and adjusts the gas flow control valve as necessary to achieve set point.

For pressure control with multiple gases, the 250E can be used as the master controller to several mass flow controllers (Figure 2). In this configuration, multiple MFCs are slaved to the output of the 250E, which adjusts the total flow to achieve the desired pressure, while the flow electronics maintains the desired gas ratio/mixture.

Many processes require a constant total flow, as well as ratio of the inlet gases, yet still require a constant pressure. In this case (Figure 3), the inlet gases are controlled independently of the pressure control. The 250E is used to operate a valve located in the gas ballast line located between the process chamber and pump. With the upstream gas inlet flow rate (total and ratio) held constant by the MFCs and the electronics, the 250E adjusts the gas ballast flow to achieve the desired pressure set point.

Compatible Control Valves

MKS control valves are solenoid-actuated proportioning control valves designed for precise control of gaseous flows in the range from 0.1 sccm to 200 slm. The 250E control module is compatible with 148, 154 and 248 control valves.

The 148 valve is a metal-sealed design for high purity applications and for the delivery of hazardous gases where minute leakage to atmosphere cannot be tolerated. It controls flows in the range of 10 to 30,000 sccm.

The 154 valve is designed for flow rates from 20 to 200 slm and uses a patented balanced-forces control valve. Unlike pilot valves and other magnetically-actuated solenoid valves, the 154 enables fast response to set point changes without oscillations over a wide range of inlet pressures. Because the 154 requires higher drive current, the 250E must be modified for this. Use with the 154 should be noted when placing orders.

The 248 is an elastomer sealed, general purpose valve for applications from 10 sccm to 10,000 sccm.

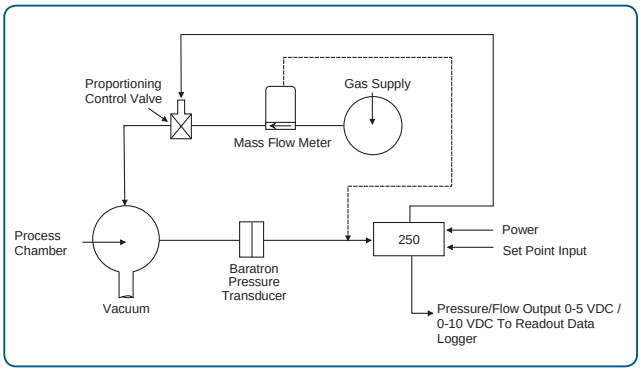

Figure 1 —

Upstream pressure or flow control system

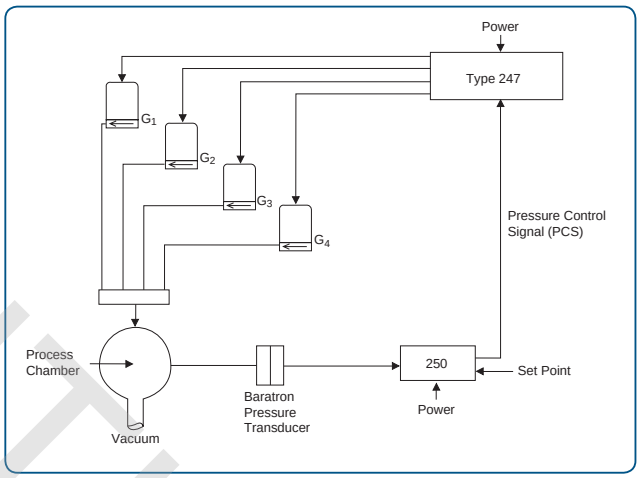

Figure 2 —

Upstream pressure control system with four-gas ratio

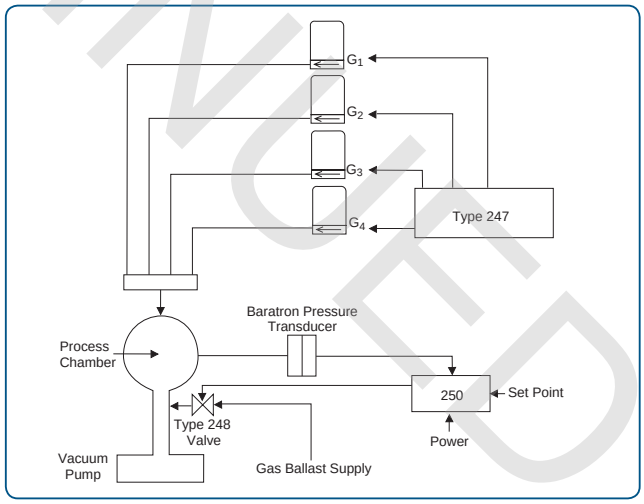

Figure 3 —

Downstream pressure control with up to four independent gases using a gas ballast technique

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Specifications

Control Accuracy	0.25% of Full Scale 0.1, 1 or 10 VDC selectable on front panel
Control Loop Tuning	
Phase lead	0.05 sec to 10 sec
Gain	0.2% to 100%
Compatible Control Valves	
Proportioning	148J, 248D, and 154B Valves (A special version of the 250E is required to drive the 154 control valve. Contact Applications Engineering.)
Power Input	115/230 VAC, 50-60 Hz, 50 Watts
Power Output	±15 VDC @ 250 mA (to power input transducers)
Signal Input (from transducer)	0 to ±0.1, 1 or 10 VDC
Input Impedance	>200K W
Display	
Standard	analog error meter
Optional	4½ digit LED input signal display
Signal Outputs	
Input transducer signal	0-5, 10 VDC into >10K Ω load
Pressure control signal	0-10 VDC
Remote Control	
Analog set point input	0 to 5 VDC into 40K Ω load
Multi-set point select (option)	ground closure to select (one or four set points)
Valve close or auto operation	ground closure to select
Process limits (option)	logic level and relay closure adjustable 0.5 to 100% of set point
Operating Temperature Range	0°C to 40°C
Size	
Millimeters	241W x 89H x 229D
Inches	9.5”W x 3.5”H x 9.0”D
Mounting	bench-top or rack-mount

Compatible Control Valves	**154B (elastomer)**	**248D (elastomer)***	**148J (metal)**
Full Scale Flow Range	20 to 200 slm	10 to 10,000 sccm	10 to 30,000 sccm
Minimum Controllable Flow	0.1% of F.S.	0.2% F.S. (<100 sccm) 0.1% F.S. (100 to 10,000 sccm) <2% F.S. (>10,000 sccm)	<2% F.S.
Closed Conductance Leakage (15 psid to atm)	<0.1% of F.S.	<1 × 10^{-5} scc/sec He (up to 10,000 sccm) <1% F.S. (>10,000 sccm)	<1% F.S.
Wetted Materials			
Standard	316 S.S., Nickel, Viton®	316 S.S., Viton	316 S.S., Nickel, Teflon®
Optional	Buna-N, Kalrez®, Neoprene®	Buna-N, Kalrez, Neoprene	
Fittings			
Standard	½” Swagelok®	¼” Swagelok	4 VCR® male
Optional	8 VCR or 8 VCO® male	4 VCR or 4 VCO male	
Operating Temperature Range	-10°C to +60°C	-10°C to +60°	15°C to +50°C (bakeable to 150°C)

** 248D and 154D only does not apply to 148JA*

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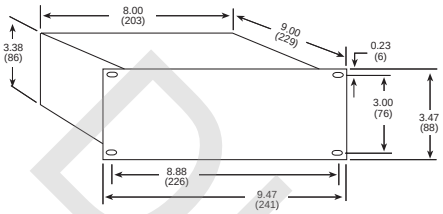
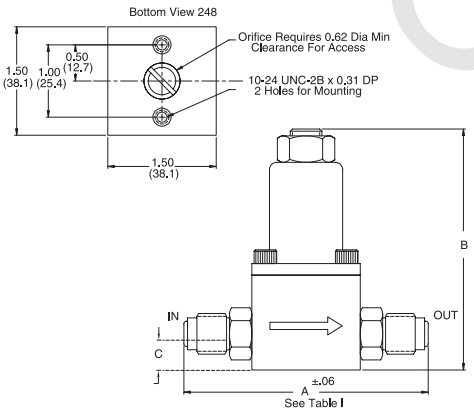
Ordering Information



Note: Allow 2.5" (63 mm) clearance behind rear panel for connectors/cables.

Dimensional Drawing —

Note: Unless otherwise specified, dimensions are nominal values in inches (mm referenced).



Valve Dimensions	Dimensions (nominal)							
	A		B		C		Width	
Valve Type	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)
148J								
4 VCR	3.36	85.3	4.04	102.6	0.5	12.7	1.5	38.1
248D								
4 VCR	3.37	85.6	3.38	85.9	0.5	12.7	1.5	38.1
4 VCO	3.05	77.5						
1/4" Swagelok	2.76	70.1						
154B								
8 VCR	4.62	117.3	4.5	114.3	0.75	19.1	1.53	38.9
8 VCO	4.31	109.5						
1/2" Swagelok	4.25	108.0						

Dimensional Drawing —

Note: Unless otherwise specified, dimensions are nominal values in inches (mm referenced).

Ordering Code Example: 250E1APLO	Code	Configuration
250E Pressure/Flow Control Module	250E	250E
Number of Set Points		
Standard: one set point	1	1
Optional: four set points	4	
Display Options		
Standard: Analog Error Meter	A	A
Optional: 4½ Place Digital Display	D	
PLO Process Limit	PLO	

Note: Use with the 154 should be noted when placing orders.

Ordering Code Example: 148JA11CR1M	Code	Configuration
148JA Control Valve	148JA	148JA
Full Scale Range		
10 sccm	11C	11C
20 sccm	21C	
50 sccm	51C	
100 sccm	12C	
200 sccm	22C	
500 sccm	52C	
1000 sccm	13C	
2000 sccm	23C	
5000 sccm	53C	
10,000 sccm	14C	
20,000 sccm	24C	
30,000 sccm	34C	
Fittings		
Swagelok 4 VCR	R	R
Valve		
Normally closed	1	1
Valve Seal Material		
Metal	M	M

Ordering Code Example: 0248D00050SV	Code	Configuration
154 & 248 Elastomer-Sealed Control Valves		
0154	0154B	0248D
0248	0248D	
Full Scale Range (sccm of N_2)		
10 sccm	00010 (248 only)	00050
20 sccm	00020	
50 sccm	00050	
100 sccm	00100	
200 sccm	00200	
500 sccm	00500	
1000 sccm	01000	
2000 sccm	02000	
5000 sccm	05000	
10,000 sccm	10000	
20,000 sccm	20000	
50,000 sccm	50000	
200 slm	200L (154 only)	
Fittings		
½" Swagelok	S (154 only)	S
8 VCR male	R (154 only)	
8 VCO male	G (154 only)	
¼" Swagelok	S (248 only)	
4 VCR male	R (248 only)	
4 VCO male	G (248 only)	
Seals		
Viton	V (standard)	V
Buna-N	B (optional)	
Kalrez	K (optional)	
Neoprene	N (optional)	

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