

π PC - PC99

Integrated Pressure Controller with Mass Flow Meter



The π PC with Integral MFM (PC99) provides pressure measurement and control while monitoring mass flow rates for critical process applications such as backside wafer pressure control and process gas panel pressure balancing. This is accomplished in a compact package that saves critical space when compared to the previous multi-component systems necessary to accomplish the task.

The PC99 utilizes MKS Instruments' leading Baratron capacitance manometer technology for pressure measurement and patented thermal flow meter to monitor gas mass flow. Both are integrated along with a proportioning control valve and the latest in control electronics providing fast and accurate pressure control with critical flow monitoring as a system diagnostic. The PC99 can be configured to be

capable of controlling pressures as low as 20 torr; critical to backside wafer pressure control or as high as 100 psia for process gas pressure control. The valve and flow meter can be configured for Full Scale flow rates from 10 sccm to 30 slm depending on process conditions.

The PC99 is available with either digital (DeviceNet or RS-485) or analog I/O allowing for straightforward integration into new or retrofit applications. In-situ tuning and component diagnostics are enhanced through the device's standard Ethernet user interface accessible via virtually any PC with a web browser. The PC99's bright, 4 digit display provides easy viewing of the device's IP address as well as process pressure, flow, and temperature.

Product Features

- Backside wafer cooling
- Integral Baratron® Capacitance Manometer technology provides accuracy, reliability, and wide range
- Patented mass flow sensor* provides exceptional long-term accuracy and zero stability
- Two alarm trip points for process limit control (Analog only)
- 4-digit display for easy viewing of P99A IP address, pressure, flow, and temperature (DeviceNet only)
- Four status indicator LEDs, functions dependent on interface type

**Protected under the following U.S. patents: No. 5,461,913, No. 6,810,308, No. 7,000,465, or International Patents and Patents pending.*



Key Benefits

- Metal-sealed, cleanroom manufactured for critical high purity application needs
- 1-1/8" wide body for semiconductor applications
- Fast response to set point with minimal overshoot
- Integral pressure measurement and control with flow metering in a single package requires less space and reduces system cost

Performance	
Pressure Type	Absolute
Pressure Full Scale Ranges	1000 Torr, 2000 Torr, 100 psia
Transducer Overpressure Limit	2x Full Scale for all ranges
Maximum Differential Pressure	45 psid
Burst Pressure	1500 psig
Flow/Orifice Full Scale Ranges ¹	50, 200, 1000, 5000, 10000, 20000, 30000 (scm)
Control Modes	Downstream
Pressure Measurement Accuracy ²	±1.0% of Reading
Temperature Coefficients	Zero Span <ul style="list-style-type: none"> • ±0.02% of Full Scale /°C • ±0.04% of Reading /°C
Pressure Readout Units	(For all Torr Full Scale ranges) Torr, kPa; (For psi Full Scale Range) psi, kPa
Pressure Resolution	0.1 Torr for 0 to 100 Torr, 1 Torr for >1000 Torr, 0.1 psi for 0 to 100 Psi
Pressure Control Accuracy ²	±0.2% of Full Scale (<10% Full Scale); ±1.0% of Reading (≥10% Full Scale)
Control Range	>2 to 100% of Full Scale
Typical Response Time ³	<1.0 second
Flow Reading	Measurement Range Accuracy <ul style="list-style-type: none"> • 2% to 100% of Full Scale • ±1.0% of Reading >10% of Full Scale (including non-linearity, hysteresis, and non-repeatability referenced to 760 mmHg and 0°C)
	Repeatability Resolution <ul style="list-style-type: none"> • ±0.2% of Full Scale • 0.1% of Full Scale
	Temperature Coefficients <ul style="list-style-type: none"> • Zero: <0.05% of Full Scale/°C; Span: <0.08% of Reading/°C
Temperature Display Range	0 to 100°C
Temperature Readout Units	°C
Temperature Accuracy	±2°C
Temperature Resolution	0.1°C
Operating Temperature Range	10° to 50°C (50° to 122°F)
Storage Temperature Range	-20° to 80°C (-4° to 176°F)
Storage Humidity Range	0 to 95% Relative Humidity, non-condensing
Mechanical	
Fittings	Swagelok 4 VCR Male, 1-1/8" surface mount (C-seal, W-seal)
Valve Options	Type <ul style="list-style-type: none"> • Normally Closed or Normally Open
	Seat Material <ul style="list-style-type: none"> • PTFE (Teflon) or Sapphire (Metal)
Display	4 digits for value, 4 characters for unit (DeviceNet only)
Leak Integrity	External (scc/sec He) Through closed valve <ul style="list-style-type: none"> • <1 x 10⁻¹⁰ • <1.0% of orifice Full Scale (Nitrogen at 25 psig on inlet to atmosphere)
Wetted Materials	Standard <ul style="list-style-type: none"> • 316L S.S. VAR (equivalent to 316 S.S. SCQ for semiconductor quality), 316 S.S., Elgiloy, KM-45, Inconel® 718, 825 Incoloy®
	Optional (Valve Seat) <ul style="list-style-type: none"> • PTFE (Teflon) or Sapphire (Metal)
Surface Finish	5 μinches, average Ra
Weight	<3 lbs (1.36 kg)
Electrical Analog I/O	
Input Power Required	+15 to +24 VDC (@ < 4 watts)
Pressure Set Point	0 to 10 VDC (Default), 0 to 5 VDC (User Switchable)
Command/Output Signal	0 to 10 VDC (Default), 0 to 5 VDC (User Switchable)
Flow Output Signal	0 to 5 VDC
Trip Points	Rated Current State Hysteresis Status LEDs <ul style="list-style-type: none"> • Two open collector transistors, adjustable from 0 to 100% of Full Scale • 30VDC / 250mA • On, above, or below trip point • 3% of Full Scale (factory set) • Red when the transistor is on
Output Impedance	<1 Ω
Connector	15-pin Type "D" Male

Digital I/O	DeviceNet	RS485 w/Analog Pressure Out
Input Power Required	+11 to +25 VDC per DeviceNet specification (@ <3.5 watts)	+15 to +24 VDC (@ < 4 watts)
Connector	5 pin microconnector (DeviceNet)	9 pin Type D male
Data Rate Switch	4 positions: 125, 250, 500K (Default), PGM (programmable over the network)	3 positions: 9.6, 19.2, 38.4K (Default)
Data Rate/Network Length	<ul style="list-style-type: none"> Data rate (user selectable) 125 Kbps, 500 meters (1,640 feet) 250 Kbps, 250 meters (820 feet) 500 Kbps, 100 meters (328 feet) 	<ul style="list-style-type: none"> Data rate (user selectable) 9.6 Kbps, 1200 meters (4,000 feet) 19.2 Kbps, 1200 meters (4,000 feet) 38.4 Kbps, 1200 meters (4,000 feet)
Mac ID Switches	2 switches, 10 positions; 0,0 to 6,3 are hardware ID numbers; 7,0 to 9,9 are software ID numbers; (6,4 to 6,9 are unused and, if selected will default to hardware ID number 6,3)	2 switches, 10 positions; 0,0 to 9,9. Available MAC ID's are 3,2 to 9,9.
Network Size	Up to 64 nodes	Up to 32 nodes
Network Topology	Linear (trunkline/dropline) power and signal on same network cable	Master/slave
Visual Communication Indicators	<ul style="list-style-type: none"> LED network status (green/red) LED module status (green/red) Scrolling LED displays (nPC Type, Pressure Full Scale, Flow Full Scale, Gas Type, IP address, Instance Number (1 to 31)) Push Button Display toggles between (Pressure in Torr & kPa or psi & kPa, Flow, Temperature and Scrolling display) 	<ul style="list-style-type: none"> LED network status (green/red) LED module status (green/red)

¹ Orifice Full Scale ranges are nominal Full Scale flow rates for Nitrogen with 15 Psig on the inlet and atmosphere on the outlet side.

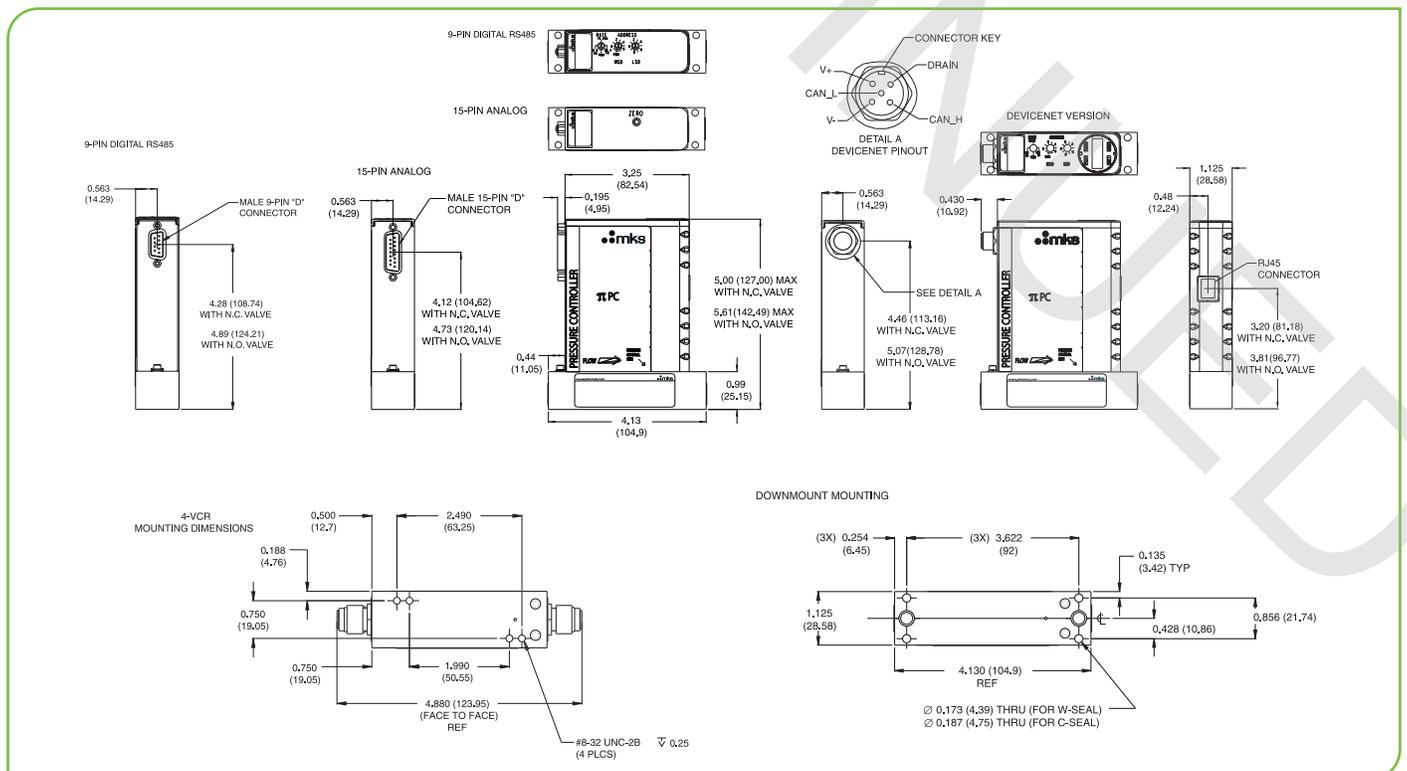
² Accuracy includes linearity, hysteresis, and repeatability.

³ Typical response time is excluding system time constant.

Notes:

The PC99 Series controllers require flow to operate, but will not control pressure in "dead-ended" (zero flow) applications.

The PC99 Control Valves should not be used for positive shutoff. Where positive shutoff is required, a separate valve should be installed. When selecting the location of an external shutoff valve, consideration should be given to the maximum pressure rating of the internal transducer and to the possibility that leakage across the internal valve over time can build up and result in a sudden surge of gas.



Dimensional Drawing – Unless otherwise specified, dimensions are nominal values in inches (mm referenced).

Ordering Code Example: P99A13TFHB3T	Code	Configuration
Model		
PC99 π Pressure Controller	P99A	P99A
Pressure Range Full Scale		
1000 Torr (mmHg) 2000 Torr (mmHg) 100 psi	13T 23T 12P	13T
Flow Rate (N₂ Equivalent)		
A (10 sccm) B (20 sccm) C (50 sccm) D (100 sccm) E (200 sccm) F (500 sccm) G (1000 sccm) H (2000 sccm) J (5000 sccm) K (10,000 sccm) L (20,000 sccm) M (30,000 sccm)	A B C D E F G H J K L M	F
Fittings (compatible with)		
Swagelok 4 VCR male C-Seal W-Seal (1.125")	R C H	H
Electrical Connector		
DeviceNet RS-485 (9 pin D) (No Display) 15 Pin D (Analog I/O) (No Display)	6 5 B	B
Valve Orifice # (See Note)		
A (50 sccm) #1 (200 sccm) #2 (1000 sccm) #3 (5000 sccm) #4 (10000 sccm) #5 (20000 sccm) #6 (30000 sccm)	A 1 2 3 4 5 6	3
Valve Seal Material/Operation		
Metal/NC (\leq 5000 sccm orifice only) Teflon/NC Teflon/NO	M T P	T
Firmware DeviceNet Version Only		
Unless otherwise specified, MKS will ship firmware revision current to date	20	20

NOTE: To determine appropriate valve orifice, see MKS Application Note #01/06: Pressure Controller-Valve Orifice Selection Guide available at www.mksinst.com.

Analog 15-Pin D Male Pinouts	
Pin Number	Signal Description
Pin 1	Valve Test Point
Pin 2	Pressure Signal Output
Pin 3	Valve Close
Pin 4	Valve Open
Pin 5	Power Supply Common Ground
Pin 6	No Connection
Pin 7	+15 to +24 VDC
Pin 8	Set Point Input
Pin 9	Flow Signal Output
Pin 10	Optional Input
Pin 11	Signal Common
Pin 12	Signal Common
Pin 13	Trip Point A
Pin 14	Trip Point B

RS-485 9-Pin D Male Pinouts	
Pin Number	Signal Description
Pin 1	Pressure Signal Output
Pin 2	Signal Common
Pin 3	+15 to +24 VDC
Pin 4	Power Supply Common Ground
Pin 5	No Connection
Pin 6	RS-485 Return
Pin 7	RS-485 +
Pin 8	RS-485 -