

Series 946

Vacuum System Controller



The Series 946 is a versatile half-rack vacuum gauge measurement and control system. The Series 946 provides power and simultaneous readout for up to six different vacuum gauges and/or mass flow controllers, with options for controlling pressure.

This highly flexible vacuum system controller supports a wide range of sensor technologies, including Baratron® capacitance manometers, cold cathode, hot cathode, standard Pirani and convection Pirani sensors for a measurement range from ultra-high vacuum to above atmospheric pressure. In addition, the Series 946 Controller will also monitor and control MKS mass

flow controller Series G, I, or P and legacy mass flow controllers along with MKS pressure control valves.

Internal communication between sensor cards, provides a combined output across as many as three sensors for one continuous pressure reading. The internal control feature provides automatic control of ion gauges, protecting them from accidental power on at high pressures. The Series 946 also provides set point relays for external signals and control and may be configured to provide upstream or downstream system pressure control. Serial communications and individual analog outputs are also furnished as standard features.

Product Features

- Simultaneous control and readout for up to six vacuum gauges and/or six mass flow controllers for ultimate versatility
- Pressure readings from 10,000 Torr down to 10^{-11} Torr, eliminating the need for individual electronics for each sensor
- Flow ratio control using multiple mass flow controllers
- Intelligent communication between gauges enables a reference sensor to span or zero another gauge allowing for accurate and continuous measurement over wide pressure ranges



Key Benefits

- Closed-loop pressure control option for use with MKS valves eliminates the need for separate pressure control electronics
- RS232/485 computer control standard in all configurations for ease of system interfacing
- Twelve set point relays are included in the base unit for system control flexibility

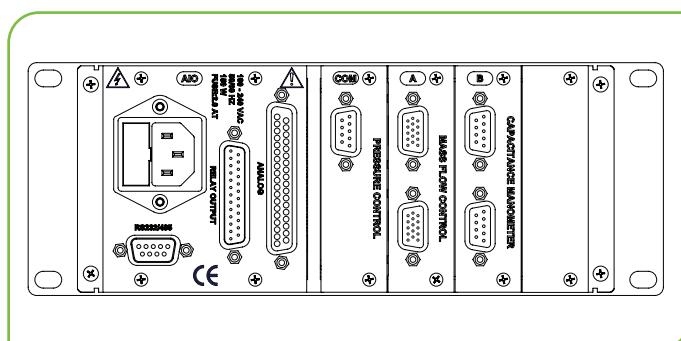
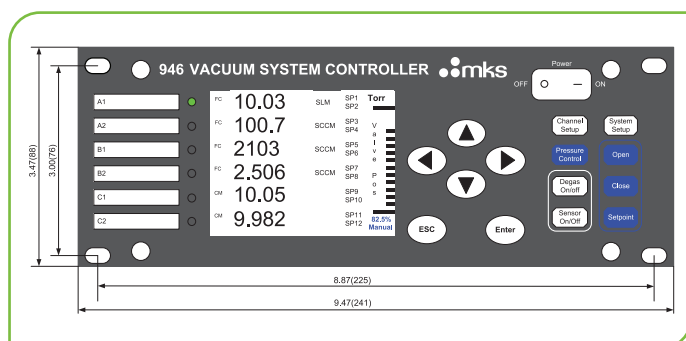
The Series 946 provides twelve user programmable set point relays with adjustable hysteresis, four assigned to each of the three card slots. The analog outputs can be programmed as linearly scaled, logarithmically scaled, or as set points, and can be assigned to any of the six sensor channels. With the installation of a valve drive card, fast and accurate closed-loop digital PID pressure control is achieved with an MKS gas proportioning valve or exhaust throttle valve. Additionally, upstream

pressure control can be accomplished with a mass flow controller and an MFC card operating in ratio mode. Commands are activated through the front panel or via an RS232/485 interface, and all entry parameters are stored in nonvolatile memory in case of power loss. The Series 946 has the versatility to be reconfigured as your needs change. With the reassignment of channels and the addition of cards, the Series 946 affords the flexibility needed for future upgrades.

Specifications	
Display	<ul style="list-style-type: none"> • 320 x 240 color QVGA TFT LCD with back lighting. Up to 6 pressure or flow displays. • Display indicators for unit of measure, calibration functions, user calibration, set points, PID control status and valve position.
Compatible Sensors/Transducers	<ul style="list-style-type: none"> • MKS Baratron Capacitance Manometers providing 0 to 10 VDC output* • MKS Differential Baratron Capacitance Manometer, 226A • MKS Convectron®/Convection Series 275/317 • MKS Cold Cathode Ionization Sensors - Series 423, 431 and 422 • MKS Hot Cathode Ionization Sensors (Nude)
Compatible Mass Flow Controllers	MKS Mass Flow Controller: G, I, P Series and legacy products**
Compatible Pressure Control Valves	MKS 248A, 148J, 154A (Solenoid Control Valve), 153D and T2BA (Exhaust Throttle Valve)
Pressure Measurement Range	10,000 Torr to 10 ⁻¹¹ Torr (Dependent upon sensor type)
Measurement Range	<ul style="list-style-type: none"> • 1.0 x 10⁻¹¹ to 10,000 Torr • 1.0 x 10⁻¹¹ to 2.7 x 10⁻⁴ mbar • 1.0 x 10⁻⁹ to 2.7 x 10⁻⁶ Pascal • 1.0 x 10⁻⁸ to 2.0 x 10⁻⁷ microns
Pressure Units	Torr, mbar, Pascal
Flow Units	sccm and slm
Operating Temperature	5° to 40° C (41° to 104°F)
Storage Temperature	10° to 55°C (50° to 131°F)
Relative Humidity	80% max for temperatures less than 31°C, decreasing linearly to 50% maximum at 40°C
Size	½ rack, 2U High, 13" Deep
Power Requirement and Consumption	150 watts maximum 100 - 240 VAC 50/60 Hz
Set Point Relays	Twelve pressure dependent set points (4 per card slot); SPST relays, contact rating 2 amps @ 30 VAC
Output	Buffered, log linear and linear output for each channel and log linear for combined channels
Front Panel Controls	Power on-off switch, setup and operational commands can be accessed via the keypad
Insulation Coordination	Over voltage Category II, Pollution Degree 2
Dimensions	Half 19" Rack, 2U, 3.47" x 9.47" x 13.00"
Controller Weight	8 lbs. (3.6 kg)
Compliance	CE

* Limited to power requirements of ≤1 amp, cable connections and Full Scale ranges.

** Any MFC requiring ±15 VDC or +15 to +24 VDC, 0 - 5 VDC set point and standard 15 pin or 9 pin D-sub cable connection.



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

Series 946 Back Panel

Base Controller	Country Code	Base Gauge Slot "A"	Gauge Choice Slot "B"	Gauge Choice Slot "C"	Communication Port
946	US	CC/CL	CC/CL	CC/CL	NA
	EU	Cold Cathode	Cold Cathode	Cold Cathode	Blank
	UK	CT	CT	CT	PC
	JP	Dual	Dual	Dual	Pressure
	CA (Canada)	Convection Pirani/ Standard Pirani	Convection Pirani/ Standard Pirani	Convection Pirani/ Standard Pirani	Control
		CM	CM	CM	
		Dual Baratron/ Piezo	Dual Baratron/ Piezo	Dual Baratron/ Piezo	
		HC	HC	HC	
		Hot Cathode Nude	Hot Cathode Nude	Hot Cathode Nude	
		FC	FC	FC	
		Dual Mass Flow Controller	Dual Mass Flow Controller	Dual Mass Flow Controller	
		NA	NA	NA	
		Blank	Blank	Blank	

The 946 with Dual Capacitance Manometer and Dual Mass Flow Controller gauge cards and Pressure Control card in the comm port.
Standard controller includes power cord for country selected and accessory connectors. Sample part number: 946-US-CMFCNA-PC

Cables

275 Convector® Cables

100016980	10 ft cable to connect 946 to 275 Convector
100016981	25 ft cable to connect 946 to 275 Convector

317 Convection Pirani Cables

100016217	10 ft cable to connect 431 cold cathode
100016218	25 ft cable to connect 431 cold cathode
100016295	10 ft cable to connect 423 I-Mag cold cathode
100016296	25 ft cable to connect 423 I-Mag cold cathode

Baratron® Capacitance Manometer Cables

100007555	10 ft cable to connect 946 to 626 and 627 Baratron manometers with 15 pin connector
100007556	25 ft cable to connect 946 to 626 and 627 Baratron manometers with 15 pin connector
100016951	10 ft cable to connect 946 to 722 and 226A Baratron manometers with 9 pin connector
100016952	25 ft cable to connect 946 to 722 and 226A Baratron manometers with 9 pin connector

Cold Cathode Cables

100016217	10 ft cable to connect 431 cold cathode
100016218	25 ft cable to connect 431 cold cathode
100016295	10 ft cable to connect 423 I-Mag cold cathode
100016296	25 ft cable to connect 423 I-Mag cold cathode

Hot Cathode Cables

100010909	10 ft cable to connect Nude Tube Hot Cathode Sensor
100010910	25 ft cable to connect Nude Tube Hot Cathode Sensor

Mass Flow Controller Cables

100016744	10 ft cable to connect MKS MFC, with $\pm 15V$ or $\pm 15-24V$ and 15 pin std D-sub
100016745	25 ft cable to connect MKS MFC, with $\pm 15V$ or $\pm 15-24V$ and 15 pin std D-sub
100016746	50 ft cable to connect MKS MFC, with $\pm 15V$ or $\pm 15-24V$ and 15 pin std D-sub
100019087	10 ft cable to connect MKS MFC, with $\pm 15V$ or $\pm 15-24V$ and 9 pin std D-sub
100019088	25 ft cable to connect MKS MFC, with $\pm 15V$ or $\pm 15-24V$ and 9 pin std D-sub
100019089	50 ft cable to connect MKS MFC, with $\pm 15V$ or $\pm 15-24V$ and 9 pin std D-sub

Pressure Control Valve Cables

100018192	10 ft cable to connect 148/248/154 Pressure Control Valve
100018191	10 ft cable to connect 153 Throttle Valve <i>For T2BA cabling, please contact MKS Applications Engineering.</i>

Plug-In Controller Modules and Accessories

20057714-001	Plug-in Controller Board for Dual Capacitance Manometer/Piezo (CM)
20057715-001	Plug-in Controller Board for Dual Convection Pirani Sensor (CT)
20057716-001	Plug-in Controller Board for Cold Cathode Sensor (CC)
20057717-001	Plug-in Controller Board for Cold Cathode Sensor, TTL (CL)
20057718-001	Plug-in Controller Board for Hot Cathode (Nude) (HC)
20057720-001	Plug-in Controller Board for Dual Mass Flow Controllers (FC)
20057721-001	Plug-in Controller Board for Pressure Control (PC)
RM-13	946 Half-Rack Controller Installation Kit
100007700	Full Rack Mounting Kit (2 Controllers)

For any additional cabling, please contact MKS Applications Engineering.