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

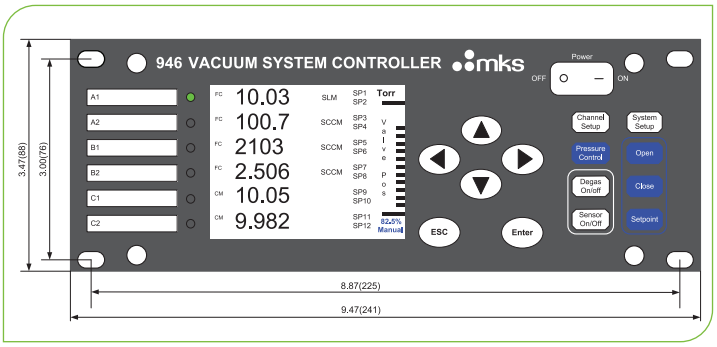
- Closed-loop pressure control option for use with MKS valves eliminates the need for separate pressure control electronics
- RS232/485 computer control standard in all configurations for ease of system interfacing
- Twelve set point relays are included in the base unit for system control flexibility

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.

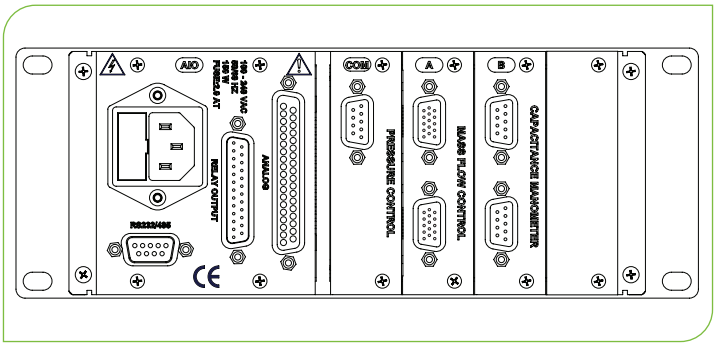
Commands are activated through the front panel or via an RS232/485 interface, and all entry parameters are stored in nonvolatile memory in case of power loss.

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.



Dimensional Drawing

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



Series 946 Back Panel

Specifications

Display	320x240 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	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 and Mini-Ion gauge types)
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 T3Bi (Exhaust Throttle Valves)
Pressure Measurement Range	10,000 Torr to 10^{-11} Torr (Dependent upon sensor type)
Measurement Range	1.0×10^{-11} to 10,000 Torr 1.0×10^{-11} to $2.7 \times 10^{+4}$ mbar 1.0×10^{-9} to $2.7 \times 10^{+6}$ Pascal 1.0×10^{-8} to $2.0 \times 10^{+7}$ 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.

Ordering Information

Base Controller	Country Code	Card Slot "A"	Card Slot "B"	Card Slot "C"	Comm/Pressure Control Slot
Part Code	Part Code	Part Code	Part Code	Part Code	Part Code
946	US EU JP UK CA (Canada)	CC/CL Cold Cathode CT Dual Convection Pirani/ Standard Pirani CM Dual Baratron®/Piezo HC Hot Cathode LPN/ Mini-Ion Gauge FC Dual Mass Flow Controller NA Blank	CC/CL Cold Cathode CT Dual Convection Pirani/ Standard Pirani CM Dual Baratron®/Piezo HC Hot Cathode LPN/ Mini-Ion Gauge FC Dual Mass Flow Controller NA Blank	CC/CL Cold Cathode CT Dual Convection Pirani/ Standard Pirani CM Dual Baratron®/Piezo HC Hot Cathode LPN/ Mini-Ion Gauge FC Dual Mass Flow Controller NA Blank	NA Blank PC Pressure Control

Sample Part Number: 946-US-CMFCNA-PC
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.

Plug-in Controller Modules and Accessories

100015267	Plug-in Controller Board for Dual Capacitance Manometer/Piezo (CM)
100015132	Plug-in Controller Board for Dual Convection Pirani Sensor (CT)
100018446	Plug-in Controller Board for Cold Cathode Sensor (CC)
100018448	Plug-in Controller Board for Cold Cathode Sensor, TTL (CL)
100015641	Plug-in Controller Board for Hot Cathode (Nude/Mini-Ion Gauge) (HG)
20000712	Plug-in Controller Board for Dual Mass Flow Controllers (FC)
100016609	Plug-in Controller Board for Pressure Control (PC)
RM-13	946 Half-Rack Controller Installation Kit
100007700	Full Rack Mounting Kit (2 Controllers)

317 Convection Pirani Cables

103170006SH	10 ft cable to connect 317/345
103170007SH	25 ft cable to connect 317/345

275 Convectron® Cables

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

MKS Baratron® Capacitance Manometer Cables

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

MKS 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

MKS 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
100011106	10 ft cable to connect Mini-Ion Gauge Sensor
100011107	25 ft cable to connect Mini-Ion Gauge Sensor

MKS Mass Flow Controller Cables

100016744	10 ft cable to connect MKS MFC, with ±15V or +15-24V and 15 pin std D-sub
100016745	25 ft cable to connect MKS MFC, with ±15V or +15-24V and 15 pin std D-sub

MKS 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

For T3Bi cabling, please contact MKS Applications Engineering.

For any additional cabling, please contact MKS Applications Engineering.

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+1-978-645-5500 | +1-800-227-8766

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