Series 835

Quick Start Guide for the Granville-Phillips® Series 835 Vacuum Quality Monitor™ (VQM®)

Quick Start Guide p/n 835001-Rev. J

NOTICE

More detailed instructions regarding installation, operation, and service of the Series 835 Vacuum Quality Monitor are provided in the Instruction Manual, p/n 835000 which can be downloaded from the MKS website. Go to: *www.mksinst.com and search for "835000".*

Figure 1: Series 835 Vacuum Quality Monitor and Mass Spectrometer Gauge

Catalog Numbers for the VQM Controller and Gauge covered in this Quick Start Guide and Instruction Manual 835000

VQM Controller:

- 835500-U#-#

VQM Mass Spectrometer Gauge:

- 835835100-YG-#X

Micro-Ion Total Pressure Measurement Gauge (Optional):

- 390802-2-YG-T

Figure 2: Optional Micro-Ion Total Pressure Measurement Gauge

General Description

The Series 835 Vacuum Quality Monitor™ (VQM®) provides gas compositional analysis with full data collection and data logging at 85 msec capture rates over the full 1-to-145 amu measurement range. Optionally, the VQM can monitor a full 1-to-300 amu at 120 msec rates. Partial scans can be selected to allow even faster scanning.

Benefits of the design include:

- Instant information of the 10 most prevalent gases in normalized, percentage and absolute values, total and partial pressure trend graphs.
- Accurate hydrogen and helium measurements (no zero blast).
- Data logging at all sample rates.
- Power requirement of only 24 Vdc, 75 W max.
- Easy single-gas calibration using a gas already in the vacuum chamber.

Intended Use

The 835 VQM is typically used for any manufacturing or experimentation process that occurs in a vacuum (glass coating, semiconductor manufacturing, beam line gas analysis, etc.). Primary usage includes system baselining, post chamber PM verification, leak detection, contamination monitoring, process monitoring, and checking the quality of the vacuum in the system.

Improper Use

- Removal of any factory installed components
- Modifying any factory installed components
- Removal of any labeling or warranty seals
- Operation of this device in any condensing vapor or liquid environment.

Safety Notices

These safety precautions must be observed during all phases of installation, operation, and service of this product. Failure to comply with these precautions or with specific warnings elsewhere in this instruction guide violates safety standards of design, manufacture, and intended use of the instrument. MKS Instruments, Inc./ Granville-Phillips disclaims all liability for the customer's failure to comply with these requirements.

These instructions do not and cannot provide for every contingency that may arise in connection with the installation, operation, or maintenance of this product. If you require further assistance, contact MKS, Granville-Phillips Division at the address given on this instruction guide.

Safety Notices / Warnings

Caution, Warning, or Danger indicating a possible hazardous situation which could result in personal injury or death.

Figure 3: Safety Symbol on the VQM Gauge and the Optional Micro-Ion Total Pressure Measurement Module

CAUTION

General Safety Notices

Do not use this instrument to measure the pressure of flammable or explosive gases. Using the VQM Gauge to measure the pressure of flammable or explosive gases can cause a fire or explosion resulting in severe property damage or personal injury.

Exposing the product to moisture can cause fire or electrical shock resulting in severe property damage or personal injury. To avoid exposing the product to moisture, install it in an indoor environment. Do not install the product in any outdoor environment.

High Voltage

WARNING

Electrical Shock or Personal Injury

The service and repair information in this instruction guide is for the use of Qualified Service Personnel. To avoid possible electrical shock or personal injury, do not perform any procedures in this manual or perform any servicing on this product unless you are qualified to do so.

System Grounding

WARNING

High Voltage and Proper Grounding

All components of a vacuum system used with this or any similar high voltage product must be maintained at Earth ground for safe operation.

Be aware that grounding this product does not guarantee that other components of the vacuum system are maintained at Earth ground.

Verify that the vacuum port to which the product is mounted is electrically grounded. It is essential for personnel safety as well as proper operation that the envelope of the VQM Gauge be connected to a facility ground.

Connect power cords only to properly grounded outlets or sources.

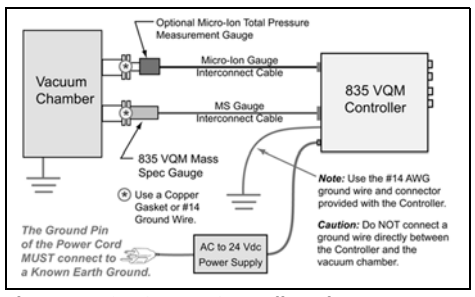

Figure 4: VQM System Grounding Diagram

Components of the VQM System

Figure 5: Standard Components of the 835 VQM System

Figure 6: Optional Components of the 835 VQM System

Computer Requirements for the VQM System

Processor/Memory: Minimum: Intel® CoreTM 2 Duo T7250@2Ghz with 2.56 GB of Ram or equivalent

Screen Resolution: Minimum: 1366 x 768 pixels, larger to take advantage of resizing

OS: Windows® 7 (32 or 64 bit)/ Windows XP (32 bit) SP2

.NET 3.5 Framework SP1 (provided)

Disk space: Minimum 1.6 GB. (More needed for large log files.)

Note: *Minimum requirements are for one PC connected to one VQM Controller. Four or Eight core systems are recommended when driving multiple Controllers.*

Installation of the VQM Mass Spectrometer Gauge on the Vacuum Chamber

Initial installation and setup requires mounting the VQM Mass Spectrometer Gauge (MS Gauge) and the optional Micro-Ion Total Pressure Measurement Gauge to the vacuum chamber and making the necessary interconnections to the bench-top mounted VQM Controller.

- Do not operate the MS Gauge in a corrosive gas environment. Corrosive gases will limit gauge lifetime and degrade both filament and electron multiplier detector performance.
- Do not operate the MS Gauge in the presence of strong magnetic fields.
- The operating pressure range for the MS Gauge is between Ultra High Vacuum (UHV) and $1x10^{-5}$ Torr.
- The VQM System provides optimal performance at $2x10^{-7}$ Torr or lower.
- The maximum safe operating pressure for the MS Gauge is 10^{-5} Torr.
- The MS Gauge can be mounted in any orientation.
- The MS Gauge must be located in a position close to where the partial pressures are to be measured.
- The MS Gauge must be distanced or shielded from all other instruments that could potentially affect the mass spectrometry readings.
- The MS Gauge must be protected from evaporation sources that could provide line of sight contamination into the gauge.
- Allow enough clearance for the MS Gauge/Controller interconnect cable connector.
- The location of the MS Gauge relative to the VQM Controller must be compatible with the available interconnect cable length.
- To obtain accurate total and ratiometric partial pressure measurements from a common gas environment, connect the MS Gauge and the ionization gauge responsible for simultaneous total pressure readings in close proximity to each other and without vacuum conductance restrictions between them.

See Chapter 3, "Hardware Installation" in the Instruction Manual 835000 for more detailed information regarding installation procedures.

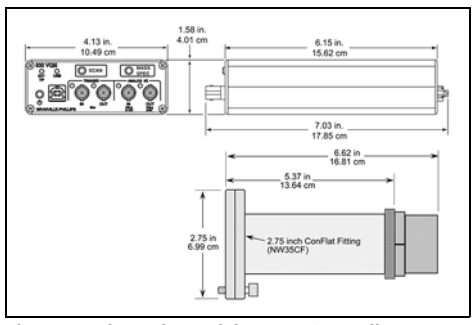

Figure 7: Dimensions of the VQM Controller

Mounting Location of the VQM MS Gauge

- Locate the VQM MS Gauge where it can be easily accessed.
- For greatest accuracy and repeatability, locate the MS Gauge in a stable, room-temperature environment. Ambient temperature should never exceed 40 °C (104 °F) operating, non-condensing, or 85 °C (185 °F) non-operating.
- Locate the MS Gauge away from internal and external heat sources and in an area where ambient temperature remains reasonably constant. Do not mount the gauge above other equipment that generates excessive heat.
- Do not locate the MS Gauge directly below the chamber which may allow sputtering particles or other contamination to fall into the gauge.
- Do not locate the MS Gauge near the pump, where gauge pressure might be lower than system vacuum pressure.
- Do not locate the MS Gauge near a gas inlet or other source of contamination.
- Do not locate the MS Gauge where it will be exposed to corrosive gases such as mercury vapor or fluorine.
- Do not locate the MS Gauge in an area of high vibration.

Attach the VQM MS Gauge to the Vacuum Chamber

- Install the VQM MS Gauge and the Total Pressure Measurement Gauge on the vacuum chamber. Use new copper gaskets and ensure all metal seals are fully compressed to Ultra High Vacuum standards.
- Pump down the vacuum chamber to $1x10^{-5}$ Torr or lower. See the Initial Operation Procedure in Section 8.3 of the Instruction Manual (835000) for the factory recommended Initial Pumpdown procedure.

Attach the Micro-Ion Total Pressure Measurement Gauge to the Vacuum Chamber

For systems including an optional Micro-Ion Gauge, connect the MS Gauge and the Micro-Ion Gauge in close proximity to each other and without conductance restrictions between them. Ideally, the MS Gauge and the Micro-Ion Gauge must be exposed to identical vacuum conditions.

- An optional T-Flange is available which allows connection of the Micro-Ion Gauge to the same port as the MS Gauge.
- Any mounting orientation may be used.
- Allow enough clearance for the interconnect cable connector.

Additional installation and operation procedures for the Micro-Ion Gauge are provided in the Instruction Manual, p/n 390001 which can be downloaded from the MKS website, *www.mksinst.com*.

VQM Controller, MS Gauge, and Micro-Ion Gauge Connections

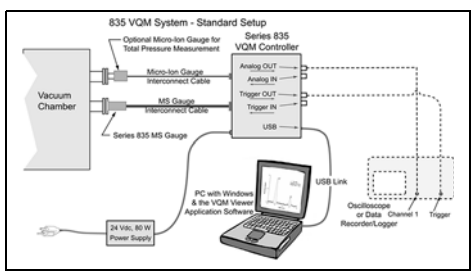

Figure 8: Typical VQM System Connection Diagram

The VQM Controller is designed for benchtop mount operation. The Controller connects to the Mass Spectrometer Gauge (MS Gauge) and the Micro-Ion Gauge using two individual interconnect cables.

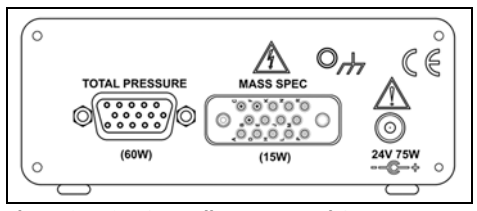

Figure 9: VQM Controller Rear Panel Connectors

1. Connect the MS Gauge to the VQM Controller

- Connect and secure the VQM Controller to the MS Gauge using the MS Gauge interconnect cable. Insert the gauge connection plug into the metal guard located on the receptacle of the MS Gauge. Use the alignment pin inside the metal guard of the receptacle on the MS Gauge and the matching slot on the plug to assure proper orientation of the connector sockets relative to the feedthrough pins before pushing the plug into the metal receptacle. Lock (rotate) the connector collar with the integral pin guard.
- Connect the other end of the MS Gauge interconnect cable to the VQM Controller. Insert the cable plug into the VQM Controller's back panel connector labeled MASS SPEC. The thumb screws of the plug are Male and Female to match with the connector on the VQM Controller. Tighten the thumb screws. The pins will not be visible once the thumb screws are tightened.

2. Connect the Micro-Ion Gauge to the VQM Controller

- Connect the Micro-Ion Gauge to the VQM Controller using the interconnect cable. DC power and communications with the Micro-Ion Gauge are provided through the 15-pin connector labeled TOTAL PRESSURE on the rear panel of the VQM Controller. Connect and secure the interconnect cable between the VQM Controller and the Micro-Ion Gauge.

3. Connect the 24 Vdc power supply to the VQM Controller

- It is recommended that a factory-provided DC power supply be used to provide power to the VQM System.
- Be sure that the DC power to the VQM Controller is 24 Vdc, >75 Watts when using the optional Micro-Ion Gauge.
- Do not apply power to the Controller until instructed later in this quick start guide.

Connect the VQM Controller to your Computer

- Install the VQM Viewer Software: See Chapter 4 of the 835 VQM Instruction Manual (835000) or simply run the 835 System Software Suite.exe application on the Installation CD. Follow the on-screen prompts.
- Connect the Controller to the computer via the provided USB cable.

Initial Startup/Setup of the VQM System

Both Filament Outgassing and Electron Multiplier Preconditioning are recommended before the Mass Spectrometer Gauge is activated.

Note*: The following is an abbreviated version of Section 8.3, Initial Operation Procedure, of the VQM Instruction Manual (p/n 835000).*

CAUTION: The MS Gauge filament may be damaged at system pressures higher than $1x10^{-5}$ Torr.

A. Pump down the vacuum chamber to $1x10^{-5}$ Torr or lower before turning ON the VQM Controller.

B. Press the Power button on the front of the VQM Controller to turn ON power to the Controller. The power button LED will illuminate to solid Green indicating that the power is ON. Do Not turn ON the MS Gauge at this time.

C. Open the 835 VQM Viewer Application by clicking on the 835 VQM.exe icon on the computer. ***See the illustration on the following page to match each of the steps below to the appropriate location on the Viewer Application screen***.

1. Click the Connect icon on the Viewer Application display screen to activate the connection between the computer and the 835 VQM System.
2. Change the gauge mode to Standby. This places the MS Gauge in Standby mode with the default emission current but with a reduced electron multiplier bias voltage (-500 V). The purpose of this is to outgas the MS Gauge filament.
   Allow the system to run under this condition for 2 hours.
3. Open the Settings screen and select the Total Pressure Source (usually the 390802 RS-485).
4. Open the Tune Screen to continue the setup procedure.
5. Click on the Display Mode button just above the words "Controller Settings" and select Raw (nA).
6. Change the Scan function from Standby to Off.
7. Set the EM Bias to (minus) -750 Volts. Drag the cursor across the current voltage setting and type -750.
8. Click the Autoscale X button to set the display of the mass spectra.
9. Set the Y Axis to 30. (Drag the cursor across the existing number and type 30.)
10. Set the Averaging Mode to Running, and the Avgs to Collect to 25.
11. Change the Scan function from Off to Scan. This turns On MS Gauge scanning to precondition the Electron Multiplier.
12. Click to the right of the 10s digit of the EM Bias setting, then use the Down arrow to Decrease the voltage by 10 volts every 30 seconds until the EM Bias equals -900 Volts.
    Allow the system to operate under these conditions for 2 hours.
13. Click Auto Tune icon to allow the auto tune function to run. Select Complete Auto Tune and Standard. Auto Tune is a procedure that automatically sets some of the MS Gauge parameters for optimum performance and stores the settings in volatile memory in the VQM Controller.
    If conditions do not allow Auto Tune to succeed, contact Customer Support at 1-303-652-4400 to get the optimal gauge settings for each VQM MS Gauge. Instructions will be provided for easy loading of the settings into the Viewer Application software.
14. Select a known Mass Peak to calibrate. Any gas in the system can be used, but water (amu 18) is usually used for calibration of the system.
15. Calibrate the Mass Axis display. Use the Left and Right Calibrate Arrows (i.e. Top of Tuning Spectrum) to mass-shift the peak until the location value indicates the correct amu (18.01 for water). This provides single gas mass-axis calibration for the 835 VQM System.
16. Click Store User to save the settings of this setup procedure. This stores the settings in non-volatile Flash memory and turns OFF power to the MS

Gauge. To begin scanning again, set the Scan function from OFF to Scan.

17. The 835 VQM System is now ready to operate. See Section 8.4 in the Instruction Manual.

NOTE: To assure maximum gauge lifetime, turn the MS Gauge Off or to Standby when not in use.

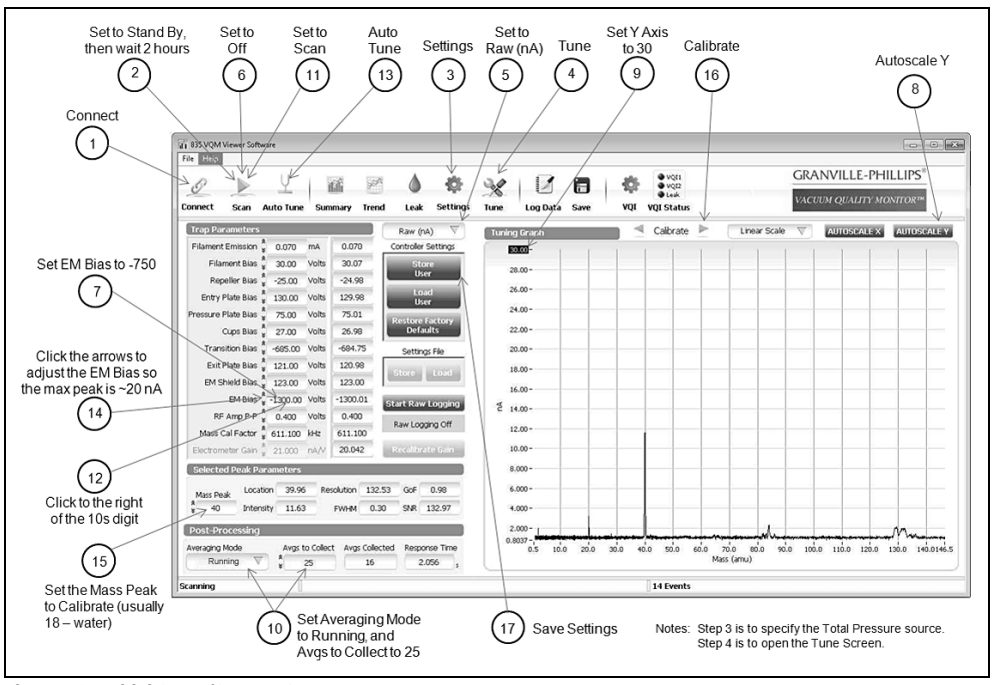

Figure 10: Initial Setup/Startup Sequence

1. Connect to the VQM System
2. Change (set) to Standby, then wait 2 hours
3. Open the Settings screen and select the Total Pressure source (usually the 390 TPMK)
4. Open the Tune screen (displayed above)
5. Set to Raw (nA)
6. Change from Standby to Off
7. Set the EM Bias to -750 Volts
8. Click the Autoscale X button
9. Set the Y Axis to 30
10. Set the Averaging Mode to Running, and the Avgs to Collect to 25
11. Change from Off to Scan
12. Click to the right of the 10s digit, then use the Down arrow to Decrease the voltage by 10 Volts every 30 seconds to -900 Volts
13. Click the Auto Tune icon to run the Auto Tune operation.
14. Select a Mass Peak to Calibrate (usually water; 18 amu)
15. Calibrate the Mass Axis display (18.01 for water)
16. Save these settings

Chapter 8 of Instruction Manual 835000 provides in-depth operational instructions.

Chinese Hazardous Substances Concentration Table

Document # 145746
Revision A

有毒有害物质或元素名称及含量标识格式

(Chinese Hazardous Substances Table)

部件名称 (Part Name)	有毒有害物质或元素 (Hazardous Substances)					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板组件 (Printed Circuit Board Assembly)	X	O	O	O	O	O
电子器件外壳 (Electronics Enclosure)	O	O	O	O	O	O
真空传感器 (Vacuum Sensor)	O	O	O	O	O	O
电缆 (Cable Assembly)	X	O	O	O	O	O

O: 表示该有毒有害物质在该部件所有均匀材料中的含量均在GB/T 26572规定的限量要求以下
(Indicates that said hazardous substances contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.)

X: 表示该有毒有害物质至少在该部件的某一均匀材料中的含量超出GB/T 26572规定的限量要求。
(Indicates that said hazardous substances contained in at least one of the homogeneous materials used for the part is above the limit requirement of GB/T 26572.)

MKS Instruments, Inc.
Granville-Phillips Div.
6450 Dry Creek Parkway
Longmont, CO. 80503-9501 USA

Product Specifications

Parameter	Specification
VQM Controller Specifications	
Mass Range/Scan Time	1 - 145 amu in 85 ms, or 1 - 300 amu in 120 msec
Scan RF Frequency	2.65 MHz to ~147 kHz
Inputs and Outputs 1. Trigger In (BNC) 2. Trigger Out (BNC) 3. Analog In (BNC) 4. Analog Out (BNC) 5. USB (Type B) 6. MS Gauge 7. Ext TP Gauge	Analog I/O, Trigger I/O, USB, Mass Spec Gauge, External Total Pressure Gauge 1. 50 Ω, positive TTL, 1 msec, minimum pulse width 2. 50 Ω, Active High, TTL frame pulse, or VQI output 3. 10K Ω, 0-10 V, 12 bit resolution 4. 0 V to +5 V with 30 KHz 3 db bandwidth 5. 2.0, full speed, 12 Mb/sec ** 6. 14-Pin connector for the Mass Spectrometer Gauge 7. 15-Pin "D" connector for the optional Total Pressure Measurement Kit (390802 with RS-485)
LEDs on front panel	EXT TP, USB, Trigger IN, Trigger OUT, Analog IN, Analog OUT
Buttons on front panel	Power, Scan, Mass Spec
Input Power - Controller and MS Gauge Only	24 Vdc, 15 Watts required, 8 Watts typical *NOTE: The System MUST be properly grounded.*
Input power when using the optional Series 390802 Micro-Ion ATM Gauge	24 Vdc, 75 Watts maximum *NOTE: The System MUST be properly grounded.*
Input Power Plug	DC power jack, 5.5 mm OD x 2.5 mm ID x 11 mm long
Operating Temperature	0 ºC to 40 ºC (32 ºF to 104 ºF)
Non-operating Temperature	0 ºC to 80 ºC (32 ºF to 176 ºF)
Relative Humidity	< 90%, non-condensing
Physical Dimensions	17.85 cm long x 10.49 cm wide x 4.01 cm. high (7.03 x 4.13 x 1.58 inches)
Weight	720 grams (25 ounces)
CE Compliance	EMC: EN61326-1 Safety: EN61010-1
Environmental	RoHS and CE compliant
IP rating	IP20
VQM Mass Spectrometer Gauge Specifications	
Measurement Range	Partial Pressure: 1 x 10^{-5} Torr to UHV Total Pressure with the optional Micro-Ion Total Pressure Measurement Gauge: ATM to 1 x 10^{-9} Torr. For total pressure measurement below 1 x 10^{-9} Torr, use a Granville-Phillips Series 370 Vacuum Gauge Controller.
Mass Range	1 to 145 amu, or 1 to 300 amu (Relative Partial Pressure or Partial Pressure)
Mass Separator Type	Autoresonant Ion Trap
Resolution (m/Δm)	150 typical, 100 minimum *
Dynamic Range	2 decades for single scan, >3 decades with averaging
Response Time	~125 msec for 1-300 amu at default VQM Controller settings
Filament	Single Yttria coated Iridium, field replaceable
Operating Temperature	0 ºC to 50 ºC (32 ºF to 122 ºF), non-condensing
Detector Type	Continuous Dynode Electron Multiplier, field replaceable
Bakeout Temperature	200 ºC maximum, non-operating, with the cable disconnected, degas not required
Mounting Flange	NW35CF 2.75 inch ConFlat type
Interconnect cable	1, 3, 20, or 50 meters long
Physical Dimensions	See Figure 2-5
Weight	420 grams (14.8 ounces)
Materials exposed to process environment	304L Stainless Steel, 316L Stainless Steel, Alumina Ceramic, Al2O3 98% Min., Nickel, Molybdenum, Ag/Cu eutectic braze, Gold, Iridium, Yttria, Y2O3 99.95%, Lead Glass (multiplier body), Chromium
VQM Viewer Software Specifications	
Top Ten Gases Display Table	Automatic listing by species or amu. The Viewer Application software has a library of 10 gases; Hydrogen, Helium, Nitrogen, Oxygen, Water, Carbon Monoxide, Argon, Carbon Dioxide, Krypton, and Neon. Up to 20 additional gases can be added using the Gas Library Editor.
Gas Recipe Fit	Correlation fit against expected gas spectrum
Total Pressure Trend Graph	Range: ATM to 10^{-9} Torr (Requires Micro-Ion ATM Gauge Total Pressure Gauge or analog input from another pressure source, such as a Granville-Phillips Series 370 Stabil-Ion Gauge Controller.)
Pressure Trend of User Selected Gases or Masses	User selection in display table. Maximum of 10 displayed.
Sensor Spectrum	Displayed, 1-145 or 1- 300 amu
Capture, Display Information	1-300 amu scan, total pressure, timestamp
Logging, VQM Data	Binary Exportable comma separated variable (csv) (MS Excel Compatible) 1-300 amu scan, total pressure, timestamp, status per scan
VQM Controller Configuration	Mass Spec Mode: ON / OFF Acquisition: via application control or external trigger control Mass Spectrometer Calibration: single gas/ mass, manual
Leak Detection	User assigned leak gas detection, audible tone
Software interface	API, LabVIEW VIs
Host/PC Requirements	
Processor/Memory	Intel Core 2 Duo T7250@2Ghz with 2.56G of Ram or equivalent
Display Resolution	Minimum: 1024 x 768 pixels, larger to take advantage of resizing
Operating System	Windows 7 (32 or 64 bit)/ Windows XP (32 bit) SP2, .NET 3.5 Framework SP1 (provided)
Disk Space	Minimum: 1.6 GB. (More will be needed for large log files.)
Optional Development Environment	LabVIEW 2013 SP1 required to use LabVIEW VIs. .NET development platform required to use API. (tested with Visual Studio 2010.)
Minimum requirements are for one PC connected to one VQM Controller. Four or Eight core systems are recommended when driving multiple Controllers.	

Specifications and dimensions are subject to change without notice.

Service / Maintenance

If the product requires service, contact the MKS, Granville-Phillips Technical Support Department at 1-303-652-4400 for troubleshooting help.

If the product must be returned to the factory for service, request a Return Material Authorization (RMA) from Granville-Phillips. Do not return products without first obtaining an RMA. In some cases a hazardous materials document may be required. The MKS/Granville-Phillips Customer Service Representative will advise you if the hazardous materials document is required.

When returning a product to Granville-Phillips, be sure to package the product to prevent shipping damage. Circuit boards and modules separated from the gauge assembly must be handled using proper anti-static protection methods and must be packaged in anti-static packaging. Shipping damage on returned products as a result of inadequate packaging is the Buyer's responsibility.

Service / Maintenance Procedures

Troubleshooting and gauge replacement instructions are given in the Instruction Manual, p/n 835000, which can be downloaded at: www.mksinst.com.

Customer Service / Technical Support

MKS Pressure and Vacuum Measurement Solutions
MKS Instruments, Inc., Granville-Phillips® Division
6450 Dry Creek Parkway
Longmont, Colorado 80503 USA
Tel: 303-652-4400
Fax: 303-652-2844
Email: mks@mksinst.com

MKS Corporate Headquarters
MKS Instruments, Inc.
2 Tech Drive, Suite 201
Andover, MA 01810 USA
Tel: 978-645-5500
Fax: 978-557-5100
Email: mks@mksinst.com

Notice

More detailed instructions regarding installation, operation, and service of the Vacuum Quality Monitor are provided in the Instruction Manual, p/n 835000 available online at www.mksinst.com.

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