

Series 835

Granville-Phillips® Series 835 VQM®
Differential Pump System



Instruction Manual

Instruction manual part number 835007
Revision E - August 2015



Series 835

Granville-Phillips® Series 835 VQM® Differential Pump System

This Instruction Manual is for use with all Series 835 VQM® Differential Pump Systems with Edwards vacuum pumps. A list of applicable catalog numbers is provided on the following page.

This product is RoHS compliant.



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Instruction Manual

Catalog numbers for Series 835 VQM® Differential Pump Systems

835 VQM Differential Pump System

Product/Description..... Catalog Number

Differential Pump System, MS Gauge, Total Pressure Gauge, Cross Fitting, 835901- DPS -(a) # # - #(b)
 Roughing Pump, Turbo Pump, Orifice, Power Supply & Cord

Pressure Range: 90 mTorr to 3000 mTorr	Orifice Size 1	
Pressure Range: 9 mTorr to 350 mTorr	Orifice Size 2	
Pressure Range: 1 mTorr to 45 mTorr	Orifice Size 3	
Pressure Range: .05 mTorr to 2.2 mTorr	Orifice Size 4	
Pressure Range: .02 mTorr to 1 mTorr	Orifice Size 5	
No Bypass Valve	N	
Manual Valve	M	
Pneumatic Valve (24 Vdc)	P	
Mass Range AMU 1-145	1	
Mass Range AMU 1-300	3	
Power Cord (b) (see below)	#	

(a) = Size of Orifice (1 through 5) - see above.

(b) = Power Cord: -1 = North American 115 VAC & Japan 100 VAC, -2 = North American 240 VAC,
 -3 = Universal European 220 VAC, -4 = United Kingdom 240 VAC

835 VQM Controller and Software

NOTE: The following items are required for system operation, but are not included with the Differential Pump System catalog number listed above.

Controller, Single Gauge, Benchtop Mount, USB 2.0, Power Supply & Cord 835500-U#- #

Mass Range AMU 1-145	1	
Mass Range AMU 1-300	3	
Power Cord for VQM Controller (b) (see above)	#	

Cable - VQM Controller to VQM Gauge. 835300-##M

1 meter (3.28 ft) long	01	
3 meters (9.84 ft) long	03	

Cable - VQM Controller to 390 Micro-Ion ATM Module. 802301-##M

1 meter (3.28 ft) long	01	
3 meters (9.84 ft) long	03	
10 meters (32.8 ft) long	10	

CD- 835 VQM Software Suite (Viewer Application Software, LabVIEW VI). 835400

835 VQM Differential Pumping Options / Replacements

KF40 Adapter Kit 801210-K

Isolation Valve Kit 801700-#-K

Manual Valve	M	
Pneumatic Valve	P	

Orifice Valve Hardware Kit 801701-#-K

Manual Valve	M	
Pneumatic Valve	P	

Hardware/Bolt Kit - includes 6 flange bolts & washers, 3 plate nuts, & 1 copper gasket ... 801274-1

Bolt Kit for Orifice when no Gate Valve is used 801207-K

Field Replaceable Filament Assembly Kit 830105-Y-K

Field Replaceable Electron Multiplier Kit 835110-K

Orifice for Gate Valve 801211-#(a)

Orifice for when no Gate Valve is used 801212-#(a)

#(a) = Size of Orifice (1 through 5) - see above.

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Chapter 1

Safety Instructions

1.1 Safety Introduction

BEGIN BY READING THESE IMPORTANT SAFETY INSTRUCTIONS AND NOTES collected here for your convenience and repeated with additional information at appropriate points throughout this instruction manual.

These safety alert symbols in this manual or on the Product mean caution - personal safety, property damage or danger from electric shock. Read these instructions carefully.

 DANGER	Danger indicates a hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	Caution indicates a hazardous situation or unsafe practice which, if not avoided, may result in minor or moderate personal injury.
NOTICE	Indicates a situation or unsafe practice which, if not avoided, may result in equipment damage.

Notice 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 further assistance is needed, contact MKS/Granville-Phillips. See Section 1.9 or Section 6.1 of this instruction manual.

This product was designed and tested to offer reasonably safe service provided it is installed, operated, and serviced in strict accordance with these safety instructions.

	 WARNING
	Safety Precautions Failure to comply with these instructions may result in serious personal injury, including death, or property damage. Always observe and follow all safety notices that are provided throughout this instruction manual and on the product.

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

- *Read Instructions* – Read all safety and operating instructions before operating the product.
- *Retain Instructions* – Retain the Safety and Operating Instructions for future reference.
- *Heed Warnings* – Adhere to all warnings on the product and in the operating instructions.
- *Follow Instructions* – Follow all operating and maintenance instructions.
- *Accessories* – *Do not* use accessories not recommended in this manual as they may be hazardous.

	WARNING High Voltage Be aware that when high voltage is present in any vacuum system, a life threatening electrical shock hazard may exist unless all exposed conductors are maintained at Earth ground. This hazard is not unique to this product.
	WARNING High Voltage Be aware that an electrical discharge through a gas may couple dangerous high voltage directly to an ungrounded conductor almost as effectively as would a copper wire connection. A person may be seriously injured or even killed by merely touching an exposed ungrounded conductor at high potential. This hazard is not unique to this product.
	WARNING High Voltage To reduce the risk of fire or electric shock, do not expose this product to rain or moisture.

	WARNING Replacement Parts Do not substitute parts or modify the instrument. If replacement parts are required, be certain to use the replacement parts that are specified by Granville-Phillips or that have the same characteristics as the original parts. Unauthorized substitutions may result in fire, electric shock or other hazards. Return the product to a service facility designated by Granville-Phillips for service and repair to ensure that safety features are maintained. Do not use this product if it has unauthorized modifications.
	WARNING Objects and Liquid Entry Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short out parts that could result in a fire or electric shock. Be careful not to spill liquid of any kind onto the products
	CAUTION Finite Lifetime After ten years of normal use or even non-use, the electrical insulation in this product may become less effective at preventing electrical shock. Under certain environmental conditions which are beyond the manufacturer's control, some insulation material may deteriorate sooner. Therefore, periodically inspect all electrical insulation for cracks, chafing, or other signs of deterioration. Do not use if the electrical insulation has become unsafe.
	CAUTION Safety Check Upon completion of any service or repairs to this product, ask the Qualified Service Person to perform safety checks to determine that the product is in safe operating order.

	 WARNING
	User's Responsibility It is the user's responsibility to ensure that the automatic signals provided by the product are always used in a safe manner. Carefully check the system programming before switching to automatic operation.

1.2 Equipment Grounding

All components of the Vacuum System **MUST** be properly grounded. See Section 3.4 and Figure 3-6 in the Hardware Installation chapter of this instruction manual.

	 WARNING
	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. The power cord of this product MUST be connected only to a properly grounded outlet. Be aware, however, that grounding this product does not guarantee that other components of the vacuum system are maintained at Earth ground. Have a licensed electrician check the entire system to assure proper and safe grounding of all electrical components. Complying with the usual warning to connect the power cable only to a properly grounded outlet is necessary but not sufficient for safe operation of a vacuum system with this or any similar high voltage producing product. Verify that the vacuum port to which the MS Gauge and all vacuum gauges are mounted are electrically grounded. It is essential for personnel safety as well as proper operation that the envelope of the gauge be connected to a facility ground. Use a ground lug on a flange bolt if necessary.

1.3 Implosion / Explosion

	 WARNING
	Implosion / Explosion Do not use the Product in an environment of explosive or combustible gases or gas mixtures. Operation of any electrical instrument in such an environment constitutes a definite safety hazard. Do not use the product to measure the pressure of explosive gases or gas mixtures. Install suitable devices that will limit the pressure to the level that the vacuum system can safely withstand. In addition, install suitable pressure relief valves or rupture disks that will release pressure at a level considerably below the pressure that the system can safely withstand.

Danger of injury to personnel and damage to equipment exists on all vacuum systems that incorporate gas sources or involve processes capable of pressurizing the system above the limits it can safely withstand.

For example, danger of explosion in a vacuum system exists during backfilling from pressurized gas cylinders because many vacuum devices such as ionization gauge tubes, glass windows, glass bell jars, etc., are not designed to be pressurized.

Install suitable devices that will limit the pressure from external gas sources to the level that the vacuum system can safely withstand. In addition, install suitable pressure relief valves or rupture disks that will release pressure at a level considerably below that pressure which the system can safely withstand.

Suppliers of pressure relief valves and pressure relief disks can be located via an online search, and are listed on ThomasNet.com under "Relief Valves" and "Rupture Discs. **Confirm that these safety devices are properly installed before installing the product.** In addition, check that:

- a. The proper gas cylinders are installed,
- b. Gas cylinder valve positions are correct on manual systems, and
- c. The automation is correct on automated gas delivery systems.

It is the installer's responsibility to ensure that the automatic signals provided by the product are always used in a safe manner. Carefully check manual operation of the system and the set point programming before switching to automatic operation.

Where an equipment malfunction could cause a hazardous situation, always provide for fail-safe operation. As an example, in an automatic backfill operation where a malfunction might cause high internal pressures, provide an appropriate pressure relief device.

1.4 Hot Surfaces

	CAUTION
	Hot Surface Equipment surfaces become hot, up to approximately 200 °C during bakeout of the MS Gauge. Do not touch hot surfaces of the system. Touching a hot surface may result in serious personal injury, including burning of skin or flesh.

	CAUTION
	Hot Surface Do not touch hot surfaces of the system. Touching a hot surface may result in serious personal injury, including burning of skin or flesh.

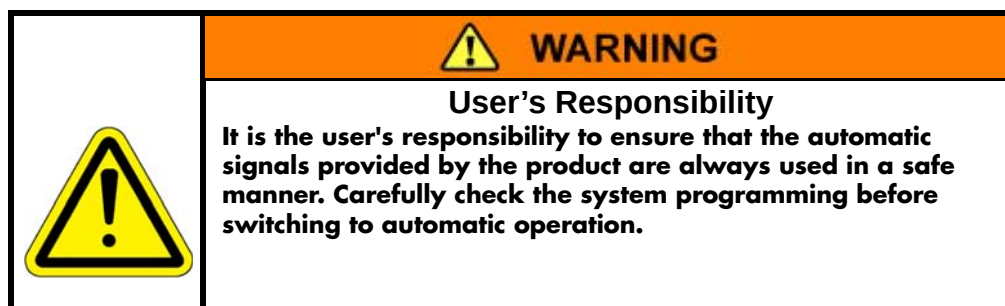
1.5 Mounting

The pressure reduction vacuum system requires support to be mounted to a port on a main chamber. A mounting bracket is provided to aid in supporting the pressure reduction system. Failure to use the provided bracket may damage the port or the vacuum system to which it is attached.

1.6 Pneumatic Valve Safety

The pneumatic valve, if used on the pressure reduction system, must be powered and pressurized properly to the manufacturer's specifications. The input voltage is 24 Vdc, and the supply air for actuation of the gate is 70 psi. The valve is a normally-closed valve, single action. In the event of either power loss or air pressure loss, the valve will return to a closed state. Prior to any maintenance or removal from the system, the valve must be de-energized and de-pressurized to prevent potential pinching danger.

1.7 User's Responsibility



It is the responsibility of the Customer to comply with all local, state, and federal ordinances, regulations, and laws applicable to the installation, operation and service of this equipment.

It is the responsibility of the end user to provide sufficient lighting at work to meet local regulations.

Operation and Service of this equipment in strict accordance with the methods and procedures supplied by MKS/Granville-Phillips is the responsibility of the Customer.

MKS/Granville-Phillips assumes no liability, whatsoever, for any personal injuries or damages resulting from the operation or service of this equipment in any manner inconsistent or contrary to the methods supplied in Granville-Phillips literature including, but not limited to, manuals, instructions, bulletins, communications, and recommendations.

For emergencies and for product safety related matters, contact the MKS /Granville-Phillips Customer Service Department. See Section 1.9 or Section 6.1 for detailed information regarding how to contact MKS /Granville-Phillips Customer Service Representatives.

1.8 Damage Requiring Service

Disconnect the product from all power sources and refer servicing to Qualified Service Personnel under the following conditions:

- a. When any cable or plug is damaged.
- b. If any liquid has been spilled onto, or objects have fallen into the product.
- c. If the product has been exposed to rain or water.
- d. If the product does not operate normally even if you follow the operating instructions. Adjust only those controls that are covered by the operation instructions. Improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
- e. If the product has been dropped or the enclosure has been damaged.
- f. If the product exhibits a distinct change in performance, service may be required.

1.9 Service Guidelines

If the product requires service, contact the MKS/Granville-Phillips Customer Service Department at 1-303-652-4400 for troubleshooting help over the phone or email gp-csr@mksinst.com.

If the product must be returned to the factory for service, request a Return Material Authorization (RMA) from MKS/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 products to Granville-Phillips, be sure to package the products 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.

Granville-Phillips will supply return packaging materials at no charge upon request. Shipping damage on returned products as a result of inadequate packaging is the Buyer's responsibility.

For Customer Service / Technical Support:

MKS, Granville-Phillips Division
6450 Dry Creek Parkway
Longmont, CO 80503 USA
Phone: 1-303-652-4400 or 1-800-776-6543
FAX: 1-303-652-2844
Email: gp-csr@mksinst.com

1.10 FCC Verification

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

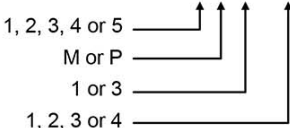
Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

1.11 Warranty Information

MKS Instruments, Inc. warrants that new 835 Series VQM Products shall be free of defects in material and workmanship for a period of 12 months (excluding consumables) from the date of shipment from the manufacturer or from an MKS Instruments, Inc. regional office or supply center. The gauge filament and electron multiplier are consumables and are not warranted against wear due to use, accelerated failures in harsh environments, or misuse through improper handling or configuration.

1.12 Declaration of Incorporation

	Declaration of Incorporation of Partly Completed Machinery For the European Union	Document #: 189213 Rev.: C
Description: <i>Series 835 VQM[®] Differential Pumping System</i> Function: <i>Differential Pumping System</i> Part Number: 835901-DP, or DPS - # # # - #  Serial Number: 835DP # # # # or 835DPS # # # # (5 consecutive numbers) (5 consecutive numbers) Business name and full address of the manufacturer of the partly completed machinery: MKS Instruments, Inc., 6450 Dry Creek Pkwy, Longmont, Colorado 80503 USA Name and address of the person, established in the Community, authorized to compile the relevant technical documentation: Ole Wenzel, MKS Instruments ApS, Ndr. Strandvej 119G, DK-3150 Hellebaek, Denmark The manufacturer declares: • That the following essential requirements of Machinery Directive 2006/42/EC are applied and fulfilled and that the relevant technical documentation is compiled in accordance with part B of Annex VII: ○ 1.1.2, 1.1.3, 1.1.5, 1.1.6, 1.2.1, 1.2.2, 1.2.3, 1.2.4, 1.2.5, 1.2.6, 1.3.1, 1.3.4, 1.3.7, 1.2.4.1, 1.5.1, 1.5.2, 1.5.3, 1.5.5, 1.5.6, 1.5.8, 1.5.9, 1.5.10, 1.5.11, 1.6.1, 1.6.3, 1.7.1 ○ EN60204-1: Machinery Safety – electrical equipment • That this partly completed machinery conforms with the provisions of Electromagnetic Compatibility Directive 2004/108/EC. ○ EN61326-1:2006 - Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements. • We will transmit, in response to a reasoned request by a national authority, relevant information on the partly completed machinery, on paper or in electronic form, without prejudice to our intellectual property rights. The partly completed machinery must not be put into service until the final machinery into which it is incorporated has been declared in conformity with the provisions of Directive 2006/42/EC.		
Form: QMS100362 Rev D		

Notes:

Chapter 2

Introduction & Specifications

2.1 General Description

The 835 VQM (Vacuum Quality Monitor) Differential Pump System by Granville-Phillips is a bolt-on vacuum system that allows sampling from a high pressure process chamber into a lower pressure sampling chamber suitable for operation of the 835 VQM by using a small orifice and a compact pumping system.

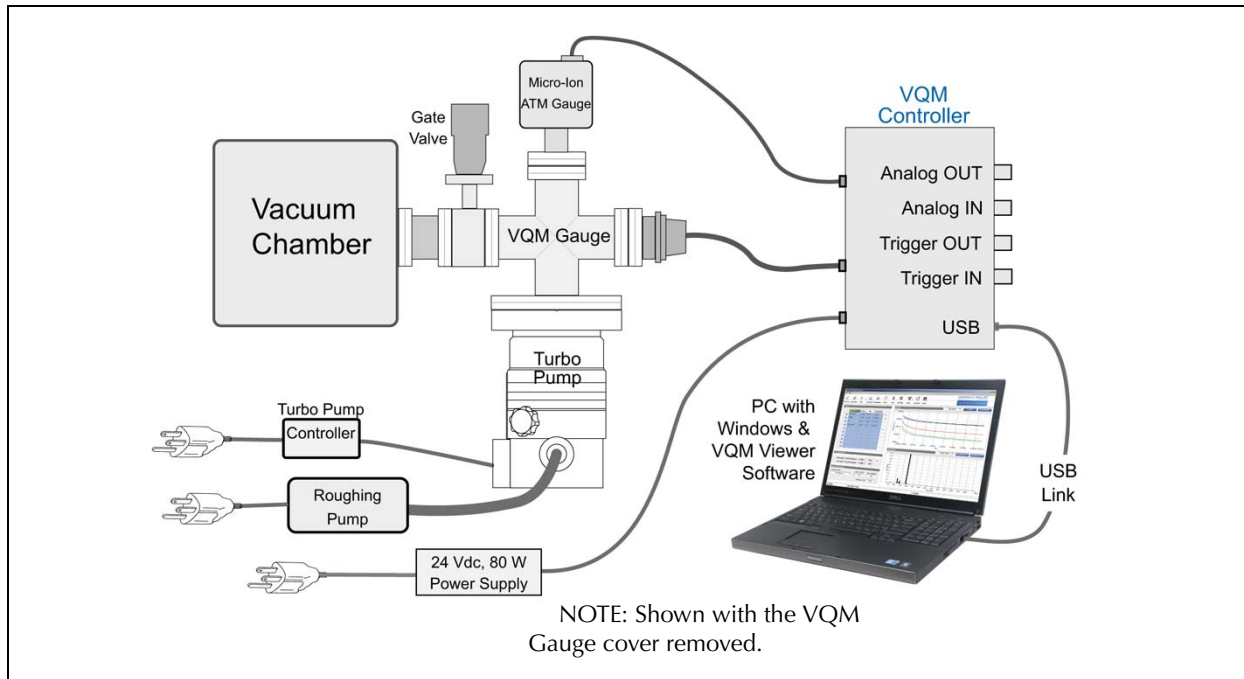


Figure 2-1 835 VQM Differential Pump System

The system includes a 70Lit/sec turbomolecular pump, and an oil-free rough pump that provides the necessary vacuum to operate the 835 series ion trap mass spectrometer at a lower pressure than the process vacuum chamber. The included Series 390 Micro-Ion total pressure measurement gauge protects the VQM MS Gauge from accidental overpressure that may damage the mass spectrometer. The pressure reduction is produced by having a small orifice between the process chamber and the differential pump system. The orifice is installed in either a gate valve that can be opened for $<10^{-5}$ Torr operation or as a fixed orifice in a double-sided conflat-type flange.

2.1.1 Intended Use

The intended use of this system is to sample and analyze gases in a vacuum process chamber.

2.1.2 Proper Use

- CE conformity: The manufacturer's declaration becomes invalid if the operator modifies the original product or installs additional components. Following installation, and before commissioning, the operator must check the entire system for compliance with the valid EU directives and reassert it accordingly.
- This device is to be used only in accordance with the instructions in this operation manual.

2.1.3 Improper Use

- Removal of any factory installed components
- Modifying factory installed components
- Pumping any corrosive or explosive media
- Pumping any condensing vapors or liquids
- Operation of this device in radioactive areas
- Pumping any media containing particulates
- Removal of any labeling or warranty seals
- Using this vacuum system to generate pressure
- Using any of the individual components outside of the differentially pumping system
- Using any modified or non-factory approved orifices
- Exceeding the manufacturer's specifications on any individual component

2.1.4 Transportation

- Reuse the original shipping container. The main chamber and rough pump should be shipped only in the original shipping containers. Contact Granville-Phillips for a replacement if the original containers are no longer available.
- The mass of the main differential pumping chamber is 25-35lbs (10-14Kgs) depending on the options installed. Use the supplied lifting handle to carry the chamber.
- Replace all dust caps on open vacuum housings prior to shipping.
- Bag the system in suitable material and seal it as best as possible.

2.1.5 Storage

- Close the bypass valve (if manual), replace all protective covers on open vacuum ports (turbo pump rough, and main 2.75 CF connection).
- Store the system indoors between -25C and 55C.
- If the system is in a high dust environment, store it in a sealed or shrink-wrapped bag with desiccant.
- All system components should be bagged and boxed together along with the instructions for future reference.

2.1.6 Rough Vacuum Pump

The rough vacuum pump provided is a diaphragm based oil-free roughing pump. The pump is operated by plugging in the line cord and using the built in power switch.



For pump operation and maintenance instructions, refer to the manufacturer's instruction manual.

2.1.7 Turbomolecular Pump

The turbomolecular pump used in this instrument is a 70lit/sec molecular drag pump. Refer to the manufacturer's instruction manual for specific operation instructions for the turbo pump.

2.1.8 Pressure Reduction and Isolation Valves

Depending on which version of the instrument purchased, it will have a manual or pneumatic valve. The system performance is the same. Refer to the operation manual provided by the manufacturer. This is very important for operation of the pneumatic type valve.

2.1.9 Series 390 Total Pressure Measurement Gauge

The operation of the 390 Micro-Ion total pressure measurement gauge is described in the instruction manual (390001) which can be downloaded from the MKS website, www.mksinst.com.

For this application, make sure the supplied gray cable is connected firmly to both the 390 Micro-Ion Module and the 835 VQM Controller.

2.1.10 Series 835 Vacuum Quality Monitor (VQM)

The operation and service of the 835 VQM (a small, low-power ion trap mass spectrometer) is explained in detail in the 835000 Instruction Manual which can be downloaded from the MKS website, www.mksinst.com. Refer to this instruction manual before operating the Differential Pump System.

2.2 Receiving Inspection

Inspect all received materials for shipping damage. Confirm that your shipment includes all the materials and options that were ordered. If materials are missing or damaged, the carrier that made the delivery must be notified within 15 days of delivery in accordance with Interstate Commerce regulations to file a valid claim with the carrier. Any damaged material, including all containers and packaging, should be held for carrier inspection.

If your shipment is not correct for reasons other than shipping damage, contact Granville-Phillips Customer Service Department, 6450 Dry Creek Parkway, Longmont, Colorado 80503, phone +1-303-652-4400, email gp-csr@mksinst.com.



Figure 2-2 Components of the VQM Differential Pump System

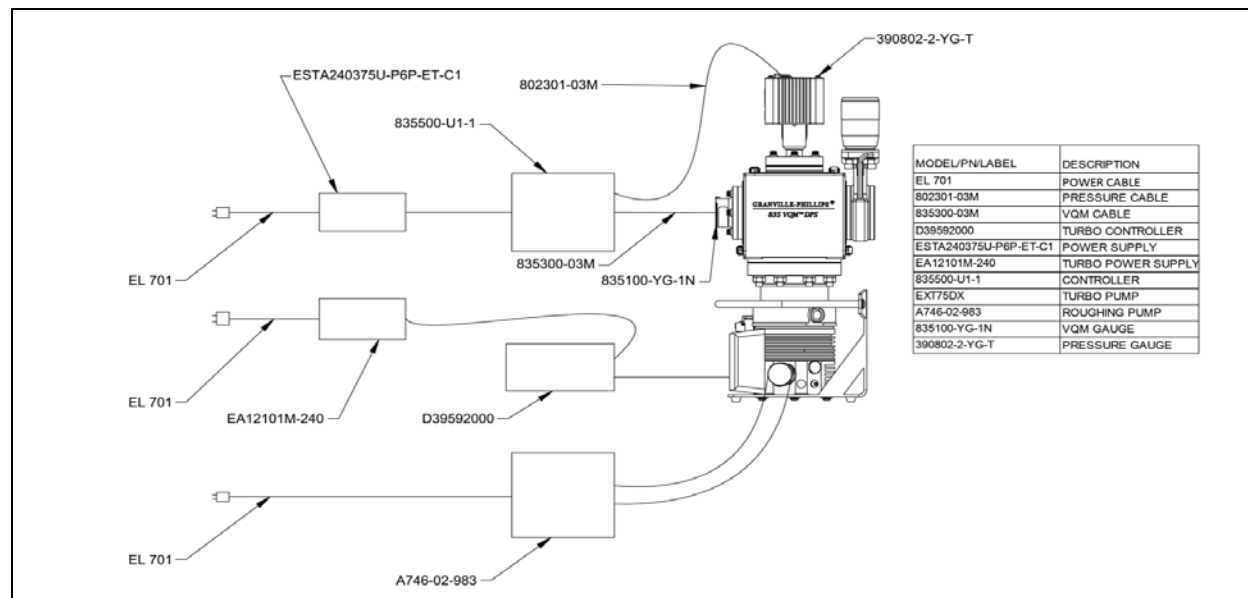


Figure 2-3 Electrical Diagram of the VQM Differential Pump System

2.3 Compliance & Specifications

2.3.1 Compliance

All components of the Vacuum Quality Measurement System are compliant with the following:

- EMC EN61326-1
- Safety EN61010-1
- Environmental RoHS compliant
- IP Rating IP20

* Granville-Phillips recommends the use of interconnect cables of 3 meters or less in length for connection to the VQM Controller. The attachment of any cable greater than 3 meters in length will result in failure of the system to meet CE Compliance specifications; more specifically, the ability to meet the Conducted RF Immunity standard IEC 61000-4-6. The test for this standard couples RF into I/O cables over the same RF frequency range that is injected into the Ion Trap, directly affecting the signal. This includes all generic cables such as USB and BNC cables that are connected to the VQM Controller. Use of cables longer than 3 meters should not affect the performance of the system, but the system will not be CE Compliant.

2.3.2 Dimensional Illustration

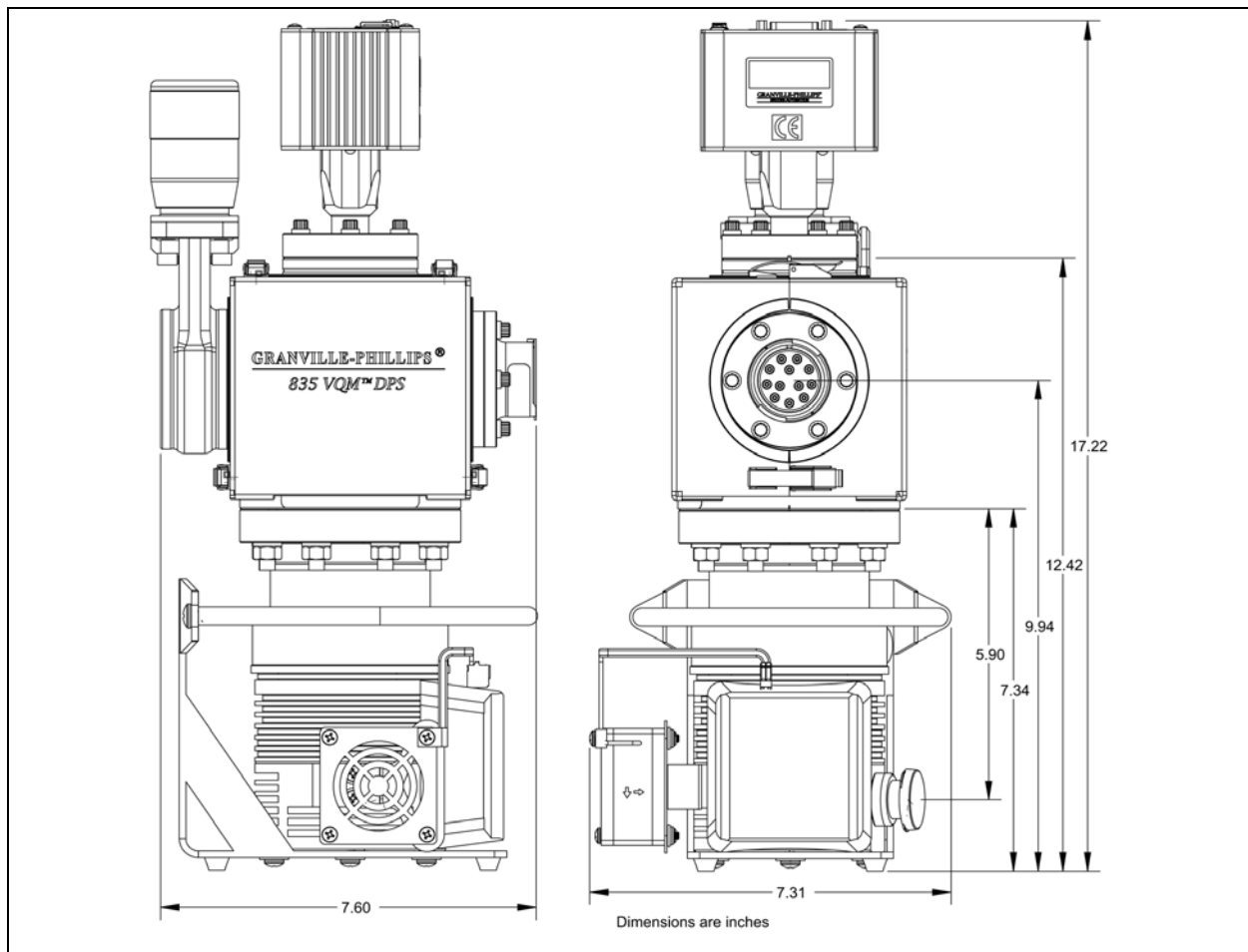


Figure 2-4 Differential Pump System Dimensions (Shown with the Manual Gate Valve)

2.3.3 VQM Differential Pump System Specifications

Table 2-1 System Specifications

Parameter	Specification
Operating Range	3 Torr to 10^{-5} Torr through orifice, or 10^{-5} Torr and below through bypass gate valve
Mass Range	1 - 145 amu or 1 - 300 amu
Resolution (m/ Δ m)	120 Full Width Half Maximum (FWHM), 180 resolution for the 300 amu system
Dynamic Range	2 decades for single scan, 3 or more with averaging
Response Time	85 ms (1-145 amu) or 120 ms (1-300 amu)
Mounting Flange	NW35CF 2.75 inch ConFlat type
Physical Dimensions	43.52 cm high (17.13 inches) (see Figure 2-4)
Weight	10.88 Kg (24 pounds) plus the weight of the gate valve and the Rough Pump (6.5 kg)
Power Requirements	
Rough Pump	120 W
Turbo Pump	110 W
VQM Controller	75 W
Operating Temperature Range	5 °C to 40 °C (41 °F to 104 °F), non-condensing
MS Gauge Bakeout Temperature	200 °C maximum, non-operating, with the cable disconnected, degas not required
Materials exposed to vacuum	304 L Stainless Steel, 316 L Stainless Steel, Alumina Ceramic, Al ₂ O ₃ 98% Min., Nickel, Molybdenum, Ag/Cu eutectic braze, Gold, Iridium, Yttria, Y ₂ O ₃ 99.95%, Lead Glass (multiplier body), Chromium, Viton, Copper
IP Rating	IP20

Specifications and dimensions are subject to change without notice.

2.3.4 Host/PC Requirements

A Host/PC is required (1) to use the VQM Viewer Application Software, (2) to control the VQM Controller from a remote location, or (3) to program additional control functions that provide process automation or input/output data.

Table 2-2 Host/PC Requirements

Parameter	Recommended *
Processor/Memory	Intel Core 2 Duo T7250@2Ghz with 2.56G of Ram or equivalent
Display Resolution	Minimum: 1366 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 is needed for large log files.)
Optional Development Environment	LabVIEW 2011 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.	

**The Recommended platform is required for high-speed operation.*

Chapter 3

Hardware Installation

3.1 Introduction

The 835 VQM Differential Pump System (DPS) is shipped in four containers.

1. The diaphragm rough pump
2. The main pressure reduction chamber assembly
3. 835 VQM Controller and Viewer Application Software CD
4. Accessories (cables, power supplies, mounting hardware)

3.2 Unpacking the Components

3.2.1 Before Opening the Boxes

Adhere to good high vacuum practices throughout the system installation procedure.

3.2.1.1 Accessory Equipment

See Figure 2-2.

- 835 Cable: VQM Controller to Mass Spectrometer Gauge
- 390 Cable: VQM Controller to 390802 Micro-Ion Total Pressure Measurement Gauge
- Rough pump vacuum hose
- Rough pump connection kit
- System hardware connection kit (*use ONLY the included .75" long bolts*)
- Power cords (3x)
- USB 2.0 Cable
- 835 VQM power supply
- Turbo pump power supply & controller

3.3 Install the Differential Pressure System



3.3.1 Preparing for Installation

- Carefully unpack the Differential Pump System (DPS) assembly from its shipping container and inspect the equipment for shipping damage. Any notable damage should immediately be reported to the shipper.
- Do not lift the unit by using the Micro-Ion Gauge at the top of the chamber. Use ONLY the attached handle to lift the chamber from the container. (Note: this handle may be removed if necessary for installation clearance.)

- The DPS weighs up to 15.9 kg (35 pounds), depending on the attached gate valve and accessories. Use two people to remove the unit from the shipping container and to connect it to the vacuum chamber.
- Use only the supplied hardware kits for connections; use of longer bolts will lead to the blind tapped holes being stripped or broken bolts in the tapped holes. Orient the included mounting bracket so that additional support can be provided to hold the DPS securely to the chamber.
- It is highly recommended that an isolation valve be installed between the DPS and the process vacuum chamber in case the chamber needs to be vented or to service the DPS.
- Operating the DPS with the orifice at atmosphere will cause the system to shut down and not restart without a power cycle. This is to protect the sensors and the pumps from permanent damage.

	 WARNING
	Safety Precautions Do not apply power or pressure to the pneumatic valve (if your system has an optional valve) prior to installation. A potential pinching hazard is present if the valve is opened by applying air pressure and 24 Vdc to the valve (which opens the valve) and then having an accidental loss of either, causing the valve to close.

3.3.2 Vacuum Connections

1. Connect the DPS assembly to the vacuum chamber following good vacuum practices. Use the included copper gasket and bolt kit (see Figure 2-2).

	 CAUTION
	Safety Check Use ONLY the supplied bolts to connect the main chamber to your vacuum system. Using other bolts can damage the blind-tapped threads in the valve.

2. Remove the cap-plug from the inlet of the rough pump.
3. Connect the rough pump hose to the NW16 fitting on the bottom of the turbo pump using the O-ring and clamp provided. Connect the other end of the hose to the rough pump using similar hardware. Be sure the rough pump is set to the proper AC line voltage prior to plugging it into the power source. See Figure 3-1. Permanent damage to the pump motor may occur if the line voltage is not set correctly.

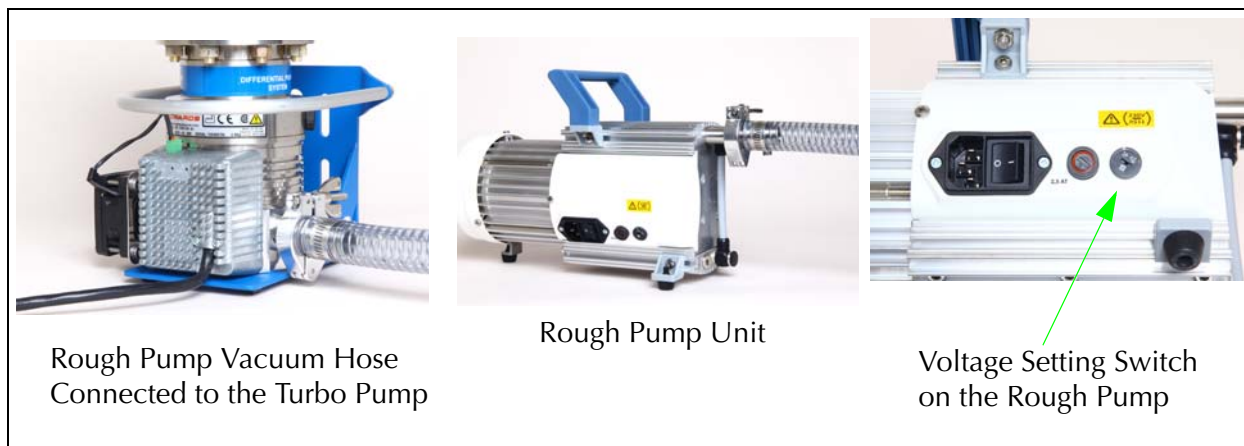


Figure 3-1 Rough Pump Vacuum line Connections

3.3.3 Electrical Connections

1. Check the line voltages for each component of the system to be sure the supplied voltages and currents match the requirements listed on the components.
2. Connect the turbo pump power supply to the turbo pump controller. See Figure 3-2.
3. Connect the turbo pump cable 15 pin connector to the turbo pump controller.



Figure 3-2 Cable Connections - DPS Controller and Turbo Pump

4. Connect and secure the VQM Controller-to-Mass Spectrometer (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 connector labeled MASS SPEC on the rear panel of the VQM Controller. 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.

More detailed information is provided in Section 3.6.3 of the VQM Instruction manual, 835000. The manual is available for download from the MKS website, www.mksinst.com.



Figure 3-3 Cable Connections - MS Gauge to VQM Controller

5. 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. Tighten the connector screws.

More detailed information is provided in Section 3.6.4 of the VQM Instruction manual, catalog #835000.

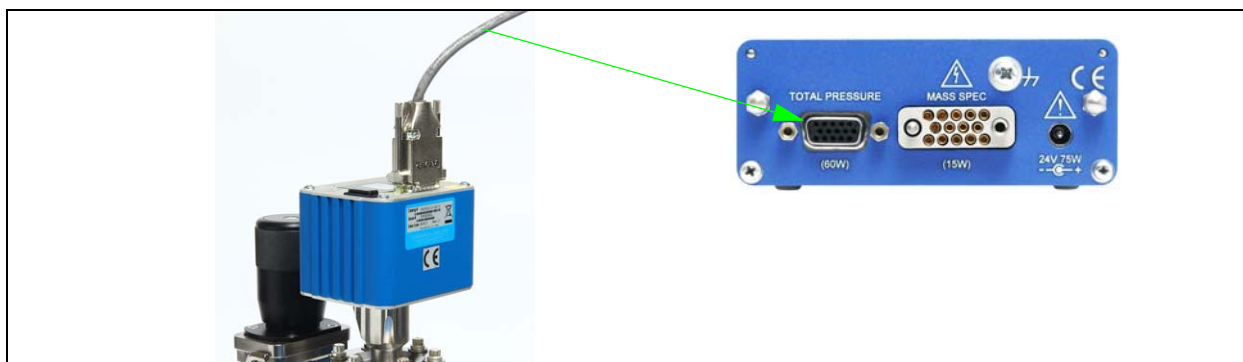


Figure 3-4 Cable Connections- Micro-Ion Gauge to VQM Controller

6. Connect the AC power cords to the Turbo Pump, Rough Pump, and VQM Controller. Detailed instructions to connect power to the VQM Controller are provided in Section 3.7 of the VQM Instruction Manual, catalog #835000.

NOTE: Do not apply power to the Differential Pump System until specifically directed in the Initial Operation Procedure in Section 3.7 of this DPS Instruction Manual.

3.4 System Grounding Requirements



Verify that all electrical connections on the vacuum system are properly grounded. It is essential for personnel safety as well as proper operation that the system is properly connected to an Earth ground.



WARNING

High Voltage

Verify that all electrical connections on the vacuum system are properly grounded. It is essential for personnel safety as well as proper operation that the system is properly connected to a facility Earth ground.

A strict ground protocol is required due to the electronic circuits within the VQM System and the process by which data is gathered and output. The emission current, ion trap voltage gradient, and detector are all precision signals relative to the Mass Spectrometer Gauge/vacuum system ground. The proper system electrical grounding procedure must be adhered to for proper VQM System operation, data integrity and personnel safety.



WARNING

High Voltage

- Improper grounding can cause product damage or personal injury.
- Follow the ground network requirements for the facility.
- Maintain all exposed conductors at Earth ground.
- Connect all power cords to a properly grounded outlet.
- Make sure the vacuum port to which the gauge is mounted is properly grounded.



WARNING

High Voltage

Be aware that an electrical discharge through a gas may couple dangerous high voltage directly to an ungrounded conductor almost as effectively as would a copper wire connection. A person may be seriously injured or even killed by merely touching an exposed ungrounded conductor at high potential.

This hazard is not unique to this product.

	! WARNING High Voltage Provide a connection to ground for each ungrounded metal component in, on, or around the vacuum system, including the gauge envelopes, which personnel may touch and which can potentially be exposed to high voltage electrical discharges within the vacuum system.
	! WARNING High Voltage Compliance with the usual warning to connect the power cable only to a properly grounded outlet is necessary but not sufficient for safe operation of a vacuum system with this or any similar high voltage producing product. Grounding this product does not and cannot guarantee that other components of the vacuum system are all maintained at Earth ground.
	! WARNING High Voltage All conductors in, on, or around the vacuum system that are exposed to potential high voltage electrical discharges must either be shielded at all times to protect personnel or must be connected to Earth ground at all times.

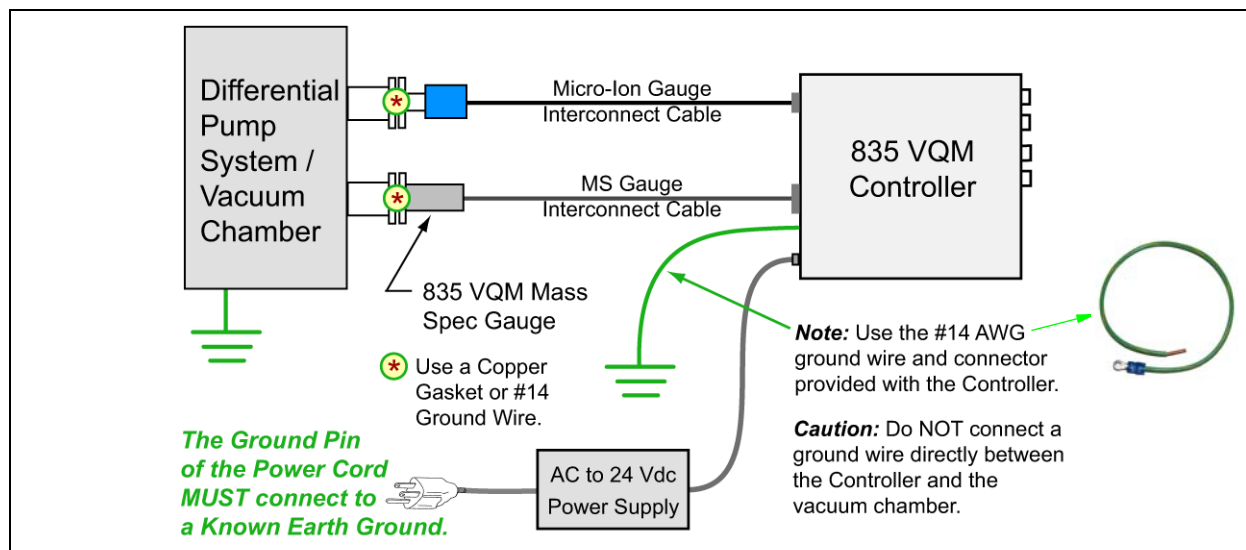


Figure 3-5 VQM System Grounding Diagram

3.4.1 System Ground Test Procedure

Use the following procedure to test vacuum systems that incorporate a VQM System:

NOTE: *This procedure uses a digital multimeter (DMM) and a 10 Ohm, 10 Watt resistor.*

1. Examine the grounding of both the VQM Controller and the vacuum chamber. Make sure there is a heavy duty ground connection to all exposed conductors on the chamber.
2. With the VQM Controller turned OFF, test for both DC and AC voltages between the metal parts of the vacuum chamber and the VQM Controller chassis.
3. If no voltages exist, measure the resistance. The resistance should not exceed 2 Ohms. A resistance of 2 Ohms or less implies commonality of these grounds that should prevent a plasma from creating a dangerous voltage between them. This test does not prove that either connection is at Earth ground, only that they are the same. If more than 2 Ohms is indicated, have a licensed electrician check the system.
4. If AC or DC voltages exist and are less than 10 volts, shunt the meter with a 10 Ohm/10 Watt resistor. Repeat the voltage measurement. With the shunt in place across the meter, if the voltage remains at 83% or more of the un-shunted value, commonality of the grounds is implied. Repeat the measurements several times to be sure that the voltage ratio is not changing with time. This should prevent a plasma from creating a dangerous voltage between these grounds. Make sure that no more than 10 volts exists between grounds.

$$\frac{\text{VOLTAGE (SHUNTED)}}{\text{VOLTAGE (UNSHUNTED)}} = 0.83 \text{ OR MORE}$$

If the voltage change in step 3 is greater than 17% due to the placement of the shunt, it complicates the measurement. The commonality of the grounds may be satisfactory and the coupling poor, or the commonality could be poor. Be sure to check the electrical continuity between these two ground systems.

3.5 Pneumatic Valve Connections

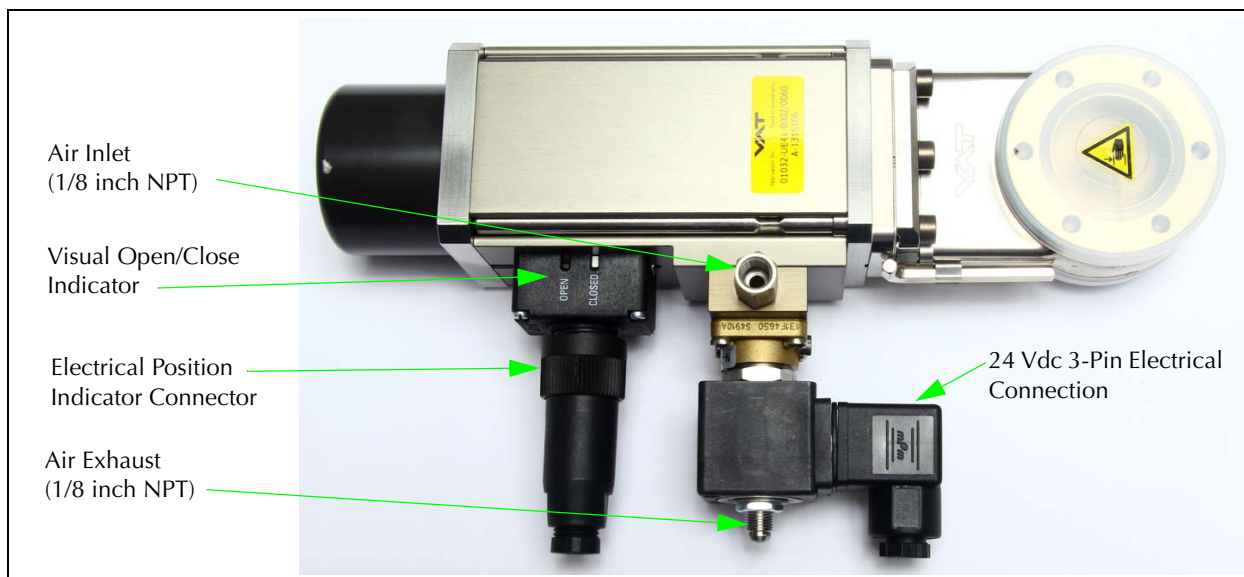


Figure 3-6 **Pneumatic Gate Valve**

	CAUTION
	Hot Surface The 24 Vdc solenoid may be hot when power is applied.

	WARNING
	General Hazard Connect compressed air ONLY if the valve is installed on the vacuum chamber and any moving parts cannot be touched. Use ONLY clean, dry, compressed air.

	DANGER
	Electrical Shock Hazard Do not touch any electrically charged parts.

Table 3-1 Utilities Requirements

Utility	Minimum	Maximum
Supply Air	72.5 psig (5.0 bar)	100 psig (7.0 bar)
Supply Power	22 Vdc	26 Vdc

24 Vdc Connector

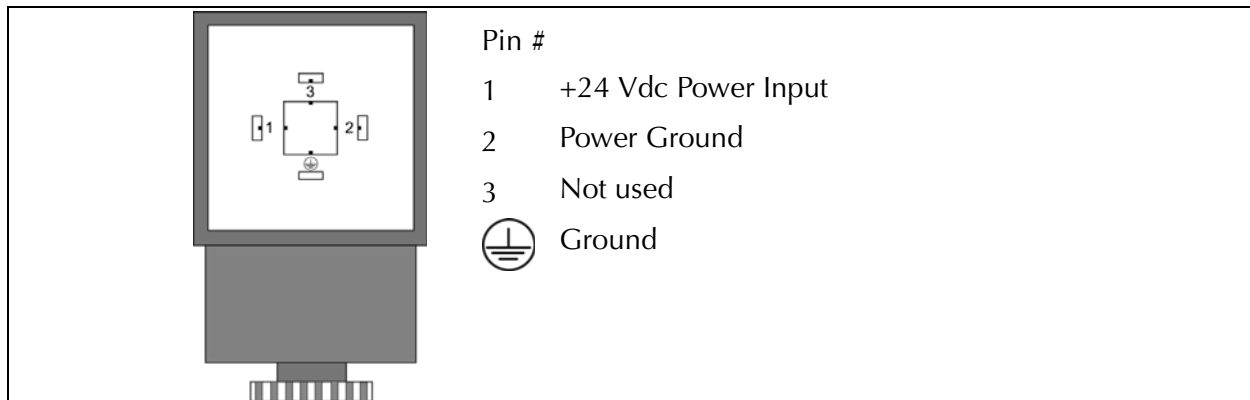


Figure 3-7 24 VDC 3-Pin Connector

Visual Open/Closed Indicator



Figure 3-8 Gate Open/Closed Visual Position Indicator

3.6 Install the VQM Viewer Application Software

See Chapter 4 to Install the Viewer Application software.

3.7 Initial Power-up Procedure

1. Check to be sure all power cords and vacuum connections are properly connected and secured.
2. Verify the line voltage to each connection to be sure they correctly match the power requirements listed on each component.
3. Turn ON the VQM Controller (this supplies power to the Series 390 Micro-Ion ATM Gauge).
4. Turn ON power to the rough pump and allow 2-3 minutes for the pressure to drop below 5 Torr on the Micro-Ion Gauge.
5. Turn ON the turbo pump. Press the Start/Stop button on the left side on the Turbo Pump Controller. See Figure 3-9. The top left portion of the percentage sign will flash, indicating that the turbo is accelerating. When the turbo pump reaches >80%, the percent sign stops flashing. The display should read 100% when the pump reaches full speed.

The display will indicate the percent of full rotation speed of the pump

6. Refer to Chapter 8 of the 835 VQM Instruction Manual (835000) or the Quick Start Guide (835001) for detailed instructions to setup and operate the 835 VQM System.

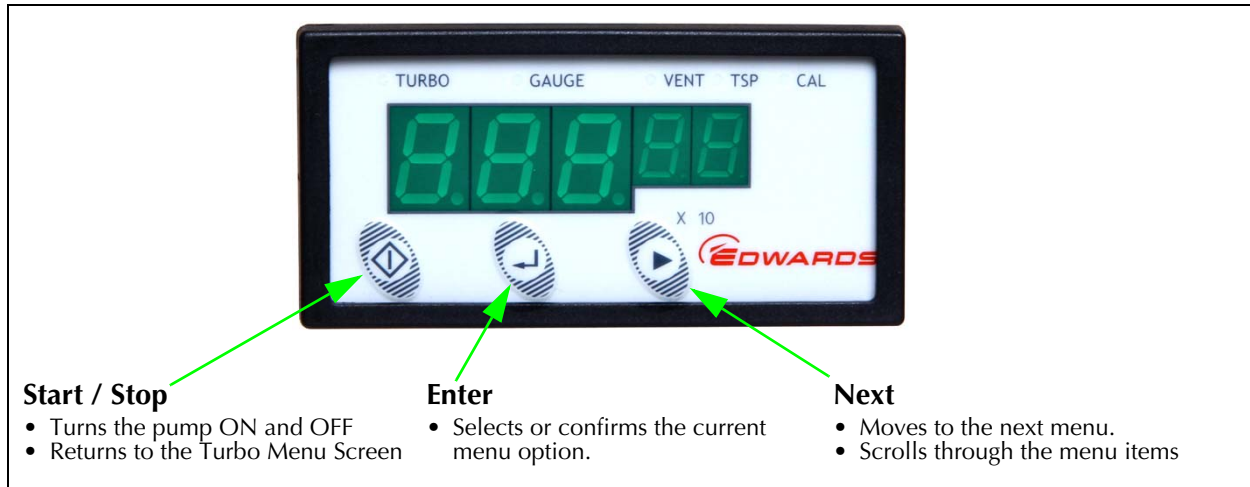


Figure 3-9 Turbo Pump Controller

3.8 Power-down Procedure

1. Close the isolation valve to the process chamber and/or the orifice gate valve to isolate the DPS from the main vacuum chamber.
2. Press the Start/Stop button on the Turbo Pump Controller to turn OFF the pump. The controller will display STOP. Press the Enter key within three seconds to stop the pump. While the pump is decelerating, the bottom right portion of the percent sign will flash until the turbo pump has stopped rotating.
3. After the turbo pump has completely stopped, turn OFF the roughing pump. Press the power switch on the side of the pump to turn it OFF.

Chapter 4

Software Installation

4.1 Introduction to the Software Installation

The VQM® Viewer Software is a Windows software package that communicates with the VQM Controller through a USB 2.0, Full Speed, 12.5 Mb/sec interface, allowing data acquisition and full Mass Spectrometer Gauge control. Advanced users can also access the full functionality of the VQM Controller using the VQM Command Set (see Chapter 9), a USB link, a Host/PC, and custom designed software packages and GUIs.

Some PCs, particularly laptops, provide USB 3.0 ports which are backwards compatible with USB 2.0, but some are not fully USB 2.0 compatible. If problems occur when using the VQM system while connected to a USB 3.0 port, see Section 8.5.7 for additional information.

Due to the User Access Control in Windows 7, the USB Driver for communication between the VQM Controller and the Host/PC may not automatically install during the Viewer software installation procedure. See Section 4.3 if the USB Driver does not install during the software installation. The person installing the Viewer Software must have Administrator access.

If complications are experienced while installing the Viewer Software, check the Windows firewall and anti-virus settings on the PC.

The service part of the VQM software needs to run as a system level service and some anti-virus policies prevent general installation of system level services. In windows XP SP2, the user that launches the installation must have been granted the impersonate client after authentication privilege in the Local Security Policy in the User Rights Assignment section.

4.1.1 Installation Issues

If complications are experienced while installing the Viewer Software, check the Windows firewall and anti-virus setting on the PC. The service part of the VQM software needs to run as a system level service and some anti-virus policies prevent general installation of system level services. The user that launches the installation must also have been granted the impersonate client after authentication privilege in the Local Security Policy in the User Rights Assignment section. (See https://flexeracomunity.force.com/customer/articles/en_US/PROBLEM/Q111303 for more information).

If the above criteria are met and the person installing the software has admin rights, but the installation still fails, it may be possible to install the suite components individually. First, remove what has been installed via the Control Panel and to remove any registry entries for the GP VQM. Then using the Windows Explorer open the Disk1 folder on the CD. Instead of clicking on the 835 VQM Software Sutie.exe, open the individual folders and click on the setup.exe or msi.

4.2 Install the Viewer Application Software

Recommended computer requirements are given in Section 2.3.3.

When the software installation is complete, an icon for the Viewer Application is placed on the desktop of your computer.



Figure 4-1 Desktop Icon for the VQM Viewer Application

NOTE: When updating an existing version of the software, the new applications do not over-write the existing ones. The existing applications will still be available for use, and a new application icon will be placed on the desktop of the computer.

The InstallShield Wizard installs the Viewer Application software in a logical and easy-to-follow procedure.

1. Disconnect the USB cable from the VQM Controller before installing or upgrading the Viewer Application software.
2. Insert the CD labeled VQM Software Suite into your computer.
3. Use Windows Explorer to open the CD.
4. Double click "835 System Software Suite.exe" to open the installer.

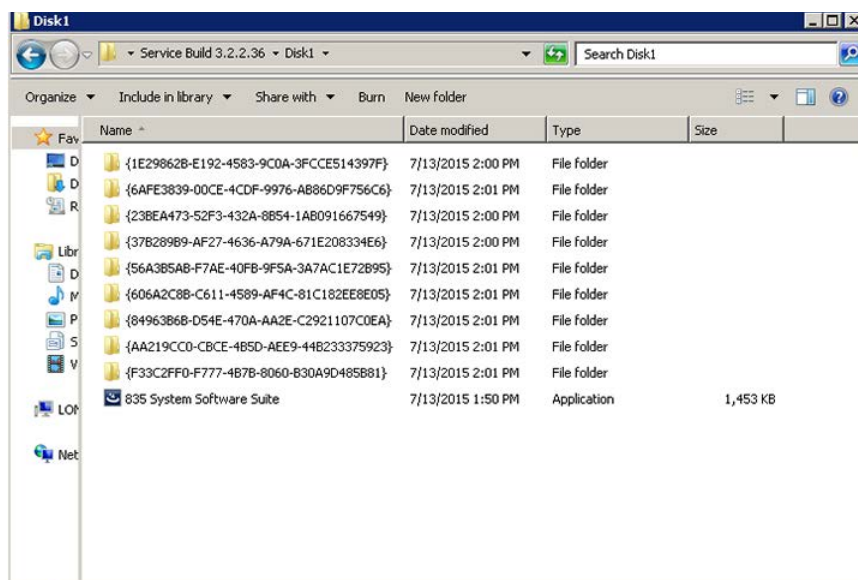


Figure 4-2 Files on the Installation CD

5. The InstallShield Wizard will open. Click "Next" to begin the installation.



Figure 4-3 Install Wizard for VQM Software

6. Read the license agreement, select "I accept the terms in the license agreement", and click "Next".

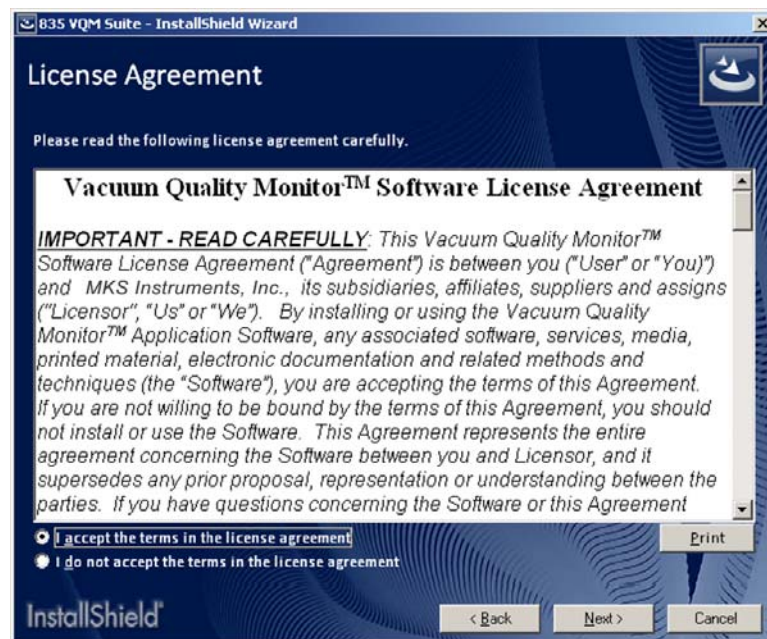


Figure 4-4 User Software License Agreement

- Click the preferred setup type for installation of the VQM software. "Complete" installs all of the features of the software. Use the "API Files" option only when the software will be used in a development environment requiring the use of the programming interface.

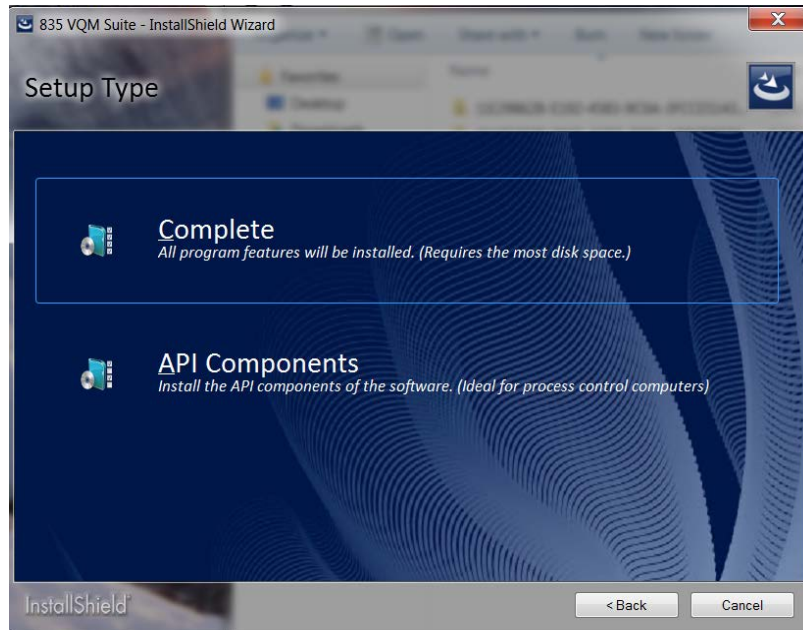


Figure 4-5 Select Setup Type

- Click "Install" to begin installation of the software. The InstallShield Wizard will install the necessary Windows drivers, LabVIEW, and the Viewer Application software for the "Complete" setup.

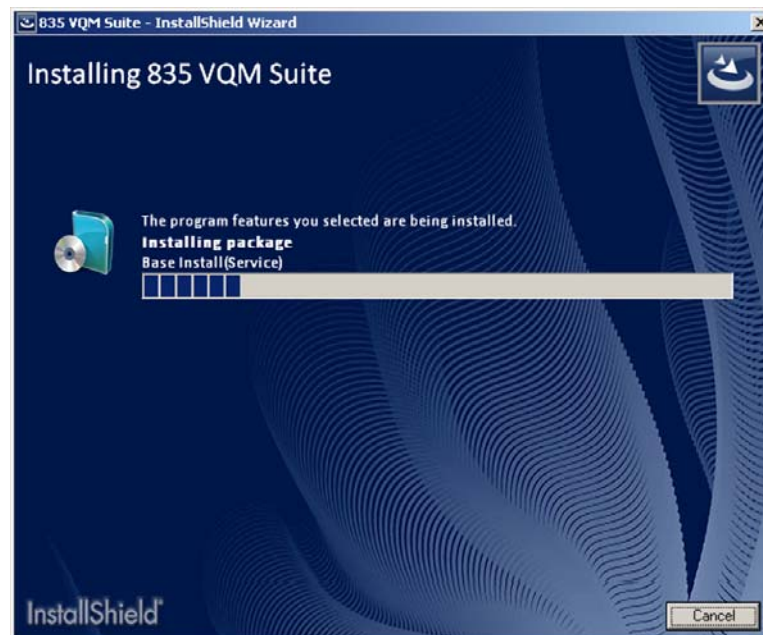


Figure 4-6 Installing the VQM Suite Software

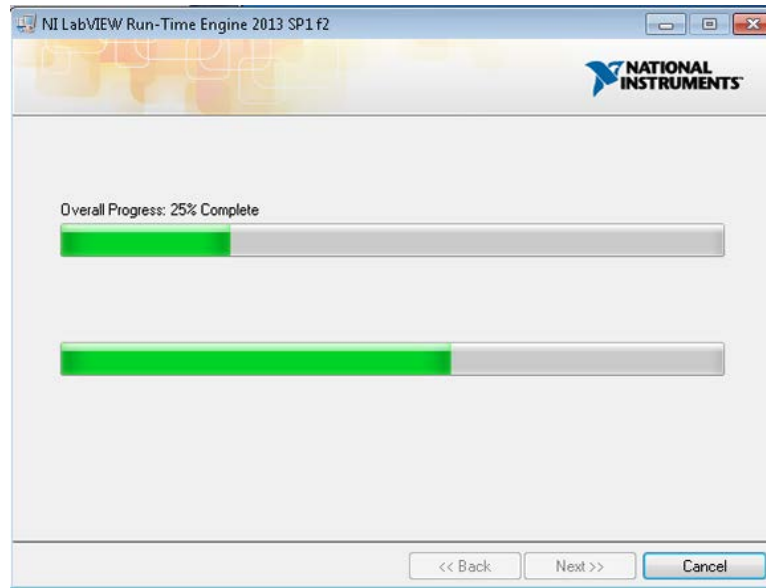


Figure 4-7 Installing the LabVIEW Software

9. Click "Install" to install the driver for the 835 VQM system.

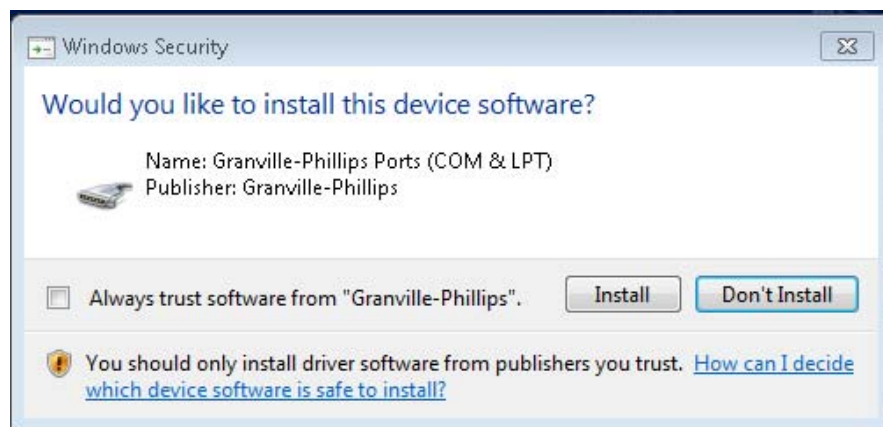


Figure 4-8 Installing the VQM Driver

10. Click "Finish" to complete the installation of the VQM Viewer Application Software.



Figure 4-9 Installation Complete

11. When the installation is complete, the Registration screen will appear in your browser. Registration is strongly recommended to receive important information, product updates, and access to helpful utilities and documentation. The link to the VQM software registration page is: www.mksinst.com/contact/gp-835vqmswregistration.aspx

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PRESSURE/VACUUM MEASUREMENT

- Baratron® Direct (Gas Independent) Pressure/Vacuum Capacitance Manometers (0.01-155,000 Torr)
- Granville-Phillips® Indirect Vacuum Gauges
- Pressure/Vacuum Switches

Solutions in Manufacturing & Industry

VQM SOFTWARE REGISTRATION FORM

Please register your VQM Software to receive important information and product update notices.

* Indicates a required field
* Zip Codes are required for the United States

First Name*
Last Name*
Title
Company*
Country* Select
State/Province
City
Address 1
Address 2
Zip/Postal Code*
Telephone: country/area code
telephone number
extension
FAX: country/area code

Figure 4-10 VQM Viewer Application Software Registration

12. The Viewer Application is now installed and ready to use. See the Quick Start Guide for initial startup and setup procedures.

4.3 Install the USB Driver

A specific driver is required for a USB communication link with the VQM Controller. If you have installed the Viewer Application software, the proper driver was installed during that procedure. In some cases, a Windows operating system may block the installation of the driver. This will become evident when you open the Viewer software and try to connect to an VQM Mass Spectrometer Gauge. If you cannot connect to an MS Gauge, the USB driver will have to be activated.

The 835 VQM driver was installed in <install directory> as part of the base install. Go to that directory to find the driver and install it.

NOTE: On 64 bit PCs, the install directory is *C:\Program Files x86\GP\VQM*.
On 32 bit PCs, the install directory is *C:\Program Files\GP\VQM*.

To communicate with the VQM Controller without using the Viewer software, the GP Device Driver must be installed.

4.3.1 Installing the 835 Driver from the CD

1. Insert the CD labeled VQM Software Suite into your computer.
2. Use Windows Explorer to open the CD.
3. Install the Viewer Application software as outlined in Section 4.2.
4. Use Windows Explorer to access "*C:\Program Files\GP\Device Driver*" or "*C:\Program Files(x86)\GP\Device Driver*".
5. Double click the appropriate driver "*GP Device Driver(64 bit).msi*" or "*GP Device Driver.msi*" to install the driver.
6. Simply follow the prompts to install the driver. The InstallShield Wizard will install the necessary Windows driver.

4.3.2 Installing the GP Device Driver after a Software Installation

1. Use Windows Explorer to access "*C:\Program Files\GP\Device Driver*" (for a 32-bit host) or "*C:\Program Files(x86)\GP\Device Driver*" (for a 64-bit host).
2. Click the appropriate driver, "*GP Device Driver(64 bit).msi*" or "*GP Device Driver.msi*", to install the driver.
3. Accept the agreement and follow the prompts to install the GP Device driver. The Install Shield Wizard will install the necessary Windows driver.

4.4 Troubleshooting

4.4.1 Installation Does Not Complete

If a previous version of the 835 VQM software was installed (or partially installed), remove all components of the older version using the following process:

1. Use the Windows Control Panel => Add/remove or Uninstall tool to remove the 835 suite.
2. Refresh the control panel list with CTRL-F5.
3. Sort the list by publisher.
4. Remove any remaining Brooks or Brooks Automation components, and any Granville-Phillips components that are for a different application or gauge.
5. Delete the *C:\Program Files\Brooks\VQM\835* folder and contents - this will be *C:\Program Files (x86)* on 64-bit Windows 7 hosts.

Notes:

Chapter 5

System Operation

5.1 Introduction

The 835 VQM (Vacuum Quality Monitor) Differential Pump System by Granville-Phillips is a bolt-on vacuum system that allows sampling from a high pressure process chamber into a lower pressure sampling chamber suitable for operation of the 835 VQM by using a small orifice and a compact pumping system.

5.2 Theory of Operation

The principle of differential pumping has been used in vacuum systems for decades. It uses standard conductance formulae for a thin aperture to calculate the conductance and hence the flow in the system. The pressure reduction for a single orifice is fixed and constant over the entire applicable pressure range. Each orifice is designed to work over a range that keeps the VQM at a pressure between 5×10^{-8} Torr and 3×10^{-6} Torr when sampling through the orifice. Operation below 5×10^{-8} Torr will mean that a larger fraction of the gas measured in the system is background gas from the DPS. Operation above 3×10^{-6} Torr at the MS Gauge will lead to performance degradation as the pack of ions stored in the ion trap will be dephased and exit as unresolved baseline. With a 24-hour pump down, the DPS system routinely pumps into the upper 10^{-9} Torr range, such that in normal operation, the gases sampled should be 90% or greater of the total gas analyzed.

Due to slight variations in manufacturing processes, an adjustment to the suggested orifice size may be required if the device is being operated at the ends of the pressure reduction range. For most cases, changing to a one size smaller or larger orifice will provide the appropriate solution to operate in the middle of the pressure range for a given orifice. Also, the system is specified for use with nitrogen gas. Gas compositions low in nitrogen, and other gases with different (higher) ionization potentials may require different orifice sizes than those shown for nitrogen. See Section 5.3 or contact Customer Support for orifice selection guidelines based on the process being used. See page 3 or the back cover of this instruction manual for contact information.

5.3 Selecting the Required Orifice Size

See Figure 5-1 to determine the best orifice size for proper pressure indication in the pressure range of the manufacturing process. If possible, select an orifice size that will provide pressure indication in the middle of the range of the orifice. For example, if the process pressure is 9 to 10 mTorr, use orifice #3; if the process pressure is 100 to 110 mTorr, use orifice #2.

However, if the process pressure is near one end of the range for a particular orifice, select the orifice size larger or smaller that will provide the widest range pressure indication. For example, if the process pressure is 2 mTorr, using orifice #4 will provide greater sensitivity since less of the sampled gas will be DPS background gas. Using orifice #3 will allow operation at higher pressures if necessary.

See Section 5.5 for orifice replacement instructions.

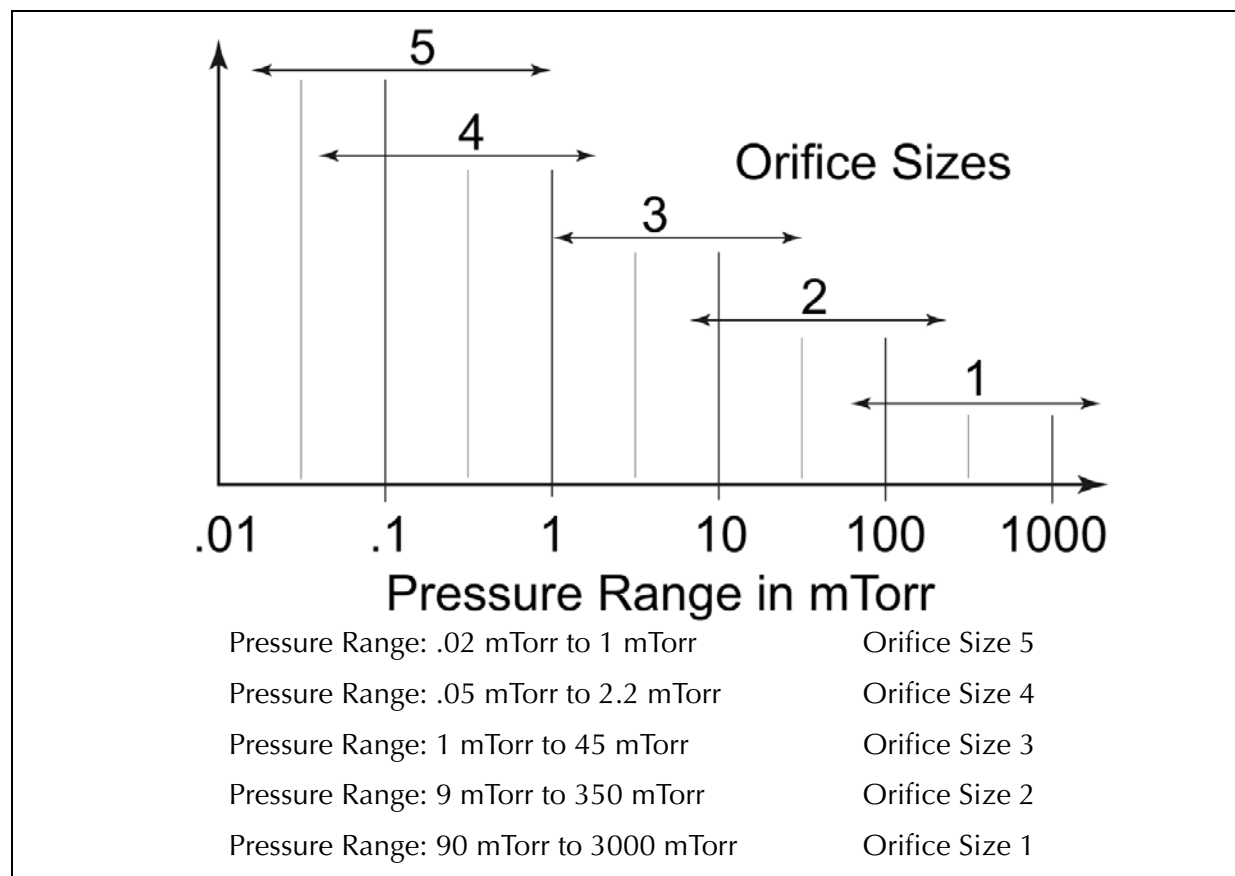


Figure 5-1 Orifice Pressure Ranges and Sizes

5.4 Operation Procedures

5.4.1 Startup Procedure

1. Check to be sure all power cords and vacuum connections are properly connected and secured.
2. Verify the line voltage to each connection to be sure they correctly match the power requirements listed on each component.
3. Turn ON the VQM Controller (this supplies power to the 390 Micro-Ion ATM Gauge).

4. Turn ON power to the rough pump and allow 2-3 minutes for the pressure to drop below 5 Torr on the Micro-Ion Gauge.
5. Turn ON the turbo pump. Press the Start/Stop button on the left side on the Turbo Pump Controller. See Figure 5-2. The top left portion of the percentage sign will flash, indicating that the turbo is accelerating. When the turbo pump reaches >80%, the percent sign stops flashing. The display should read 100% when the pump reaches full speed.

The display will indicate the percent of full rotation speed of the pump

6. Refer to Chapter 8 of the 835 VQM Instruction Manual (835000) or the Quick Start Guide (835001) for detailed instructions to setup and operate the 835 VQM System.

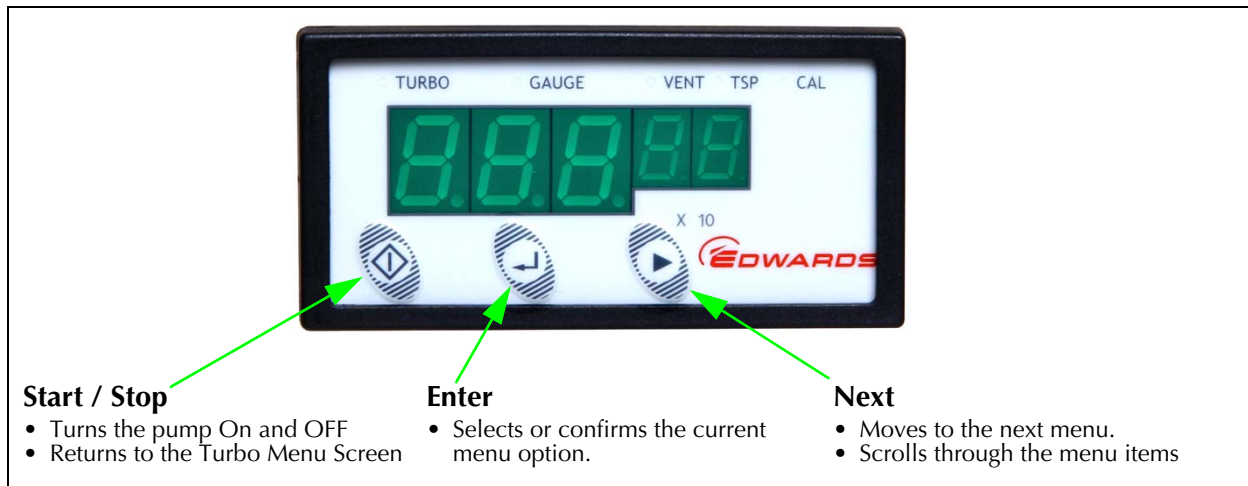


Figure 5-2 Turbo Pump Controller

5.4.2 Power-down Procedure

1. Close the isolation valve to the process chamber and/or the orifice gate valve to isolate the DPS from the main vacuum chamber.
2. Press the Start/Stop button on the Turbo Pump Controller to turn OFF the pump. The controller will display STOP. Press the Enter key within three seconds to stop the pump. When the pump is decelerating, the bottom right portion of the percent sign will flash until the turbo pump has stopped rotating.
3. After the turbo pump has completely stopped, turn OFF the roughing pump. Press the power switch on the side of the pump to turn it OFF.

5.5 Changing the Orifice in the Gate Valve

The orifice on the DPS is easily changed with tools included with each system. To change the orifice, isolate the DPS from any other vacuum sources. Turn OFF the VQM Controller, the turbo pump, and the roughing pump. Wait until the turbo pump has stopped rotating as indicated by the LEDs on the pump controller going OFF.

NOTE: *Be sure to follow good vacuum practices when changing an orifice in the DPS.*

	NOTICE
	Disconnect power and air to the gate valve before performing this procedure. If power/air is still applied to the gate valve, the valve could close, causing a pinch point if a finger or tool is in the valve.

1. Using two persons, unbolt the entire DPS unit from the main chamber by removing the six 1/4-28 x 3/4 inch, silver plated bolts from the pressure chamber side of the gate valve, leaving the gate valve attached to the DPS.
2. With the gate valve closed, use the included spanner wrench to turn the mounting ring counter clockwise to loosen the seal. See Figure 5-3.
3. Remove the mounting ring and the orifice disk noting the sealing O-ring. Closely inspect the O-ring for debris or damage prior to installing the replacement orifice.
4. Gently place the replacement orifice onto the O-ring seal and tighten the sealing ring.
5. Use two persons to re-attach the DPS and its mounting bracket to the main process vacuum chamber. Use a new copper gasket and the same six 3/4-inch long bolts that were removed in Step 1.



Figure 5-3 Orifice Disk Replacement (valve shown removed from the system)

5.6 Bakeout Procedure

A bakeout of the VQM Differential Pump System may provide performance enhancements or help clean the system if it is exposed to contaminants that can be removed with a vacuum bakeout procedure. Do not allow bakeout temperatures to exceed 200 °C; permanent damage to the VQM device or pumps may occur. Using bakeout temperatures above 200 °C will void the 835 VQM Differential Pump System warranty. Do not operate the VQM Gauge during bakeout.

	CAUTION
	Hot Surface Hot surfaces during bakeout.

	CAUTION
	Hot Surface Maximum bakeout temperature is 200 °C.

	NOTICE
	Use only conductive surface rated heat tape.

	NOTICE
	Use suitably rated temperature sensors and heater controller.

1. Turn ON power to the roughing pump and turbo pump. See Section 5.4.1.
1. Turn OFF power and disconnect the black power cord from the VQM Controller.
2. Remove the blue cover over the VQM Gauge; open the 4 mounting latches and remove the covers to expose the 4 way cross that is attached to the VQM gauge, the Micro-Ion Gauge, and the turbomolecular pump. See Figure 5-4.
3. Disconnect the cable from the VQM Gauge.
4. Apply a suitable heating source with a temperature sensor on the cross flange which houses the VQM Gauge. Place the temperature sensors to monitor and ensure the surface and flange temperatures do not exceed 200 °C.
5. Heat the system until the water and contaminants are pumped out of the system.

6. Allow the system to cool and remove the heater element and sensors.
7. Attach the VQM Gauge cable.
8. Install the blue cover over the VQM Gauge.
9. Connect the power cable to the VQM Controller.
10. Turn ON the VQM Controller and check the system for proper operation.

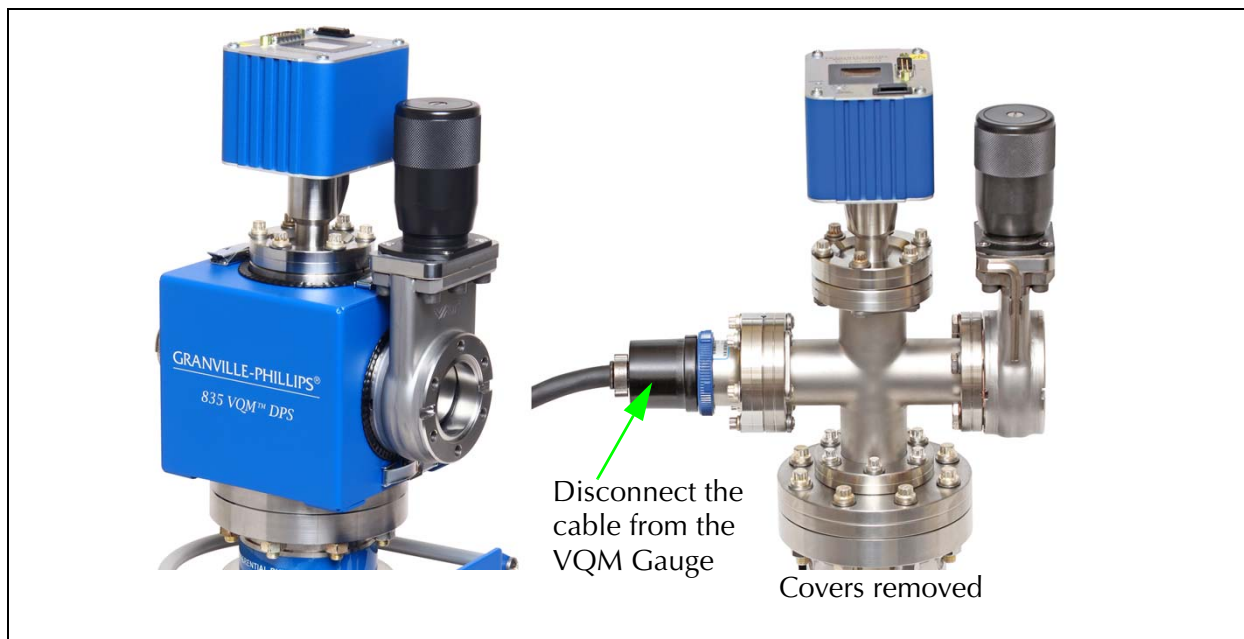


Figure 5-4 **Differential Pump System With & Without Covers**

Chapter 6

Service & Maintenance

6.1 Service Guidelines

If the product requires service, contact the MKS/Granville-Phillips Customer Service Department at 1-303-652-4400 for troubleshooting help over the phone or email gp-csr@mksinst.com.

If the product must be returned to the factory for service, request a Return Material Authorization (RMA) from MKS/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 products to Granville-Phillips, be sure to package the products 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. Granville-Phillips will supply return packaging materials at no charge upon request. Shipping damage on returned products as a result of inadequate packaging is the Buyer's responsibility.

For Customer Service / Technical Support:

MKS, Granville-Phillips Division
6450 Dry Creek Parkway
Longmont, CO 80503 USA
Phone: 1-303-652-4400 or 1-800-776-6543
FAX: 1-303-652-2844
Email: gp-csr@mksinst.com

6.2 Damage Requiring Service

Disconnect the product from the power source and refer servicing to Qualified Service Personnel if any the following conditions exist:

- The gauge cable, power-supply cord, or connector is damaged.
- Liquid has been spilled onto, or objects have fallen into, the product.
- The product does not operate normally even if you have followed the Operation Instructions. Adjust only those controls that are covered in this instruction manual.
- The product has been dropped or the enclosure has been damaged.

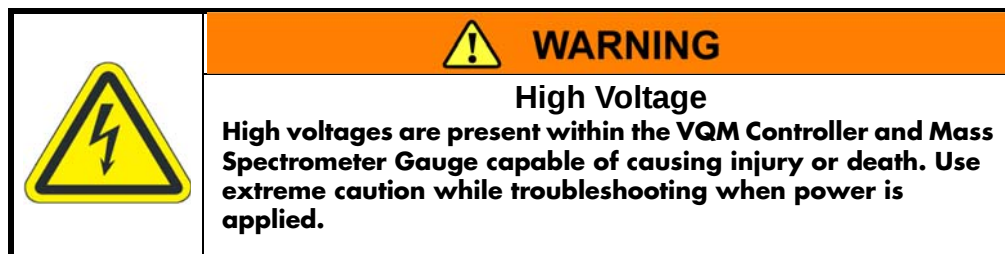
6.3 General Repair Guidelines

	 CAUTION Replacement Parts When replacement parts are required, be certain to use the replacement parts that are specified by Granville-Phillips, or that have the same characteristics as the original parts. Unauthorized substitutions may result in fire, electric shock or other hazards.
	 CAUTION Safety Check Upon completion of any service or repairs to this product, ask the Qualified Service Person to perform safety checks to assure that the product is in safe operating order.
	 WARNING High Voltage The service and repair information in this manual is for the use of Qualified Service Personnel. To avoid shock, do not perform any procedures in this manual or perform any servicing on this product unless you are qualified to do so.
	 DANGER Hazards Do not substitute parts or modify the product. Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to a service facility designated by Granville-Phillips for service and repair to ensure that safety features are maintained. Do not use this product if it has unauthorized modifications.

Because the VQM System contains static-sensitive electronic parts, the following precautions must be followed when troubleshooting:

- Use a grounded, conductive work surface. Wear a high impedance ground strap for personal protection.
- Use conductive or static dissipative envelopes to store or ship static sensitive devices or printed circuit boards.
- Do not operate the product with static sensitive devices or other components removed from the product.

- Do not handle static sensitive devices more than absolutely necessary, and only when wearing a ground strap.
- Do not use an ohmmeter for troubleshooting MOS circuits. Rely on voltage measurements.
- Use a grounded, electrostatic discharge safe soldering iron.



6.4 MS Gauge Repair

The filament assembly and the electron multiplier components of the MS Gauge can be replaced by service technicians.

Filament replacement and electron multiplier replacement instructions are provided in the 835000 VQM Instruction Manual, which can be downloaded from the MKS website at www.mksinst.com. Filament assembly replacement instructions are given in Section 7.5.2, and electron multiplier replacement instructions are given in Section 7.6.10. The bakeout procedure is given in Section 7.3.

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Series 835

Granville-Phillips® Series 835 VQM® Differential Pump System



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Instruction Manual

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