Series 342/343

Mini-Ion™ Vacuum Gauge Modules with Analog Output

Instruction Manual

Instruction manual part number 342030
Revision C - March 2020

Series 342/343

Mini-Ion™ Vacuum Gauge Modules with Analog Output

This instruction manual is for use with Series 342 & 343 Vacuum Gauges. A list of applicable catalog numbers is provided on the following page.

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Instruction Manual

Series 342 & 343 Mini-Ion Vacuum Modules with Analog Output

Catalog numbers for Series 342 & 343 Mini-Ion Vacuum Gauges

20342034	20343021	20343037	342006	343004
20342047	20343024	20343041	342006-EU	343005-EU
20342048	20343027	20343046	342011	343005
20342049	20343028	342002	342011-EU	343005-EU
20342054	20343029	342020	342040	343014
20342056	20343030	342002-EU	342040-EU	343014-EU

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Chapter 1

General Information

1.1 Receiving Inspection

On receipt of the equipment, inspect all material for damage. Confirm that the shipment includes all items ordered. If items are missing or damaged, submit a claim as stated below for a domestic or international shipment, whichever is applicable.

If materials are missing or damaged, the carrier that made the delivery must be notified within 15 days of delivery, or in accordance with Interstate Commerce regulations for the filing of a claim. Any damaged material including all containers and packaging should be held for carrier inspection. Contact MKS Instruments, Inc. Customer Support for assistance if your shipment is not correct for reasons other than shipping damage.

1.2 International Shipment

Inspect all materials received for shipping damage and confirm that the shipment includes all items ordered. If items are missing or damaged, the airfreight forwarder or airline making delivery to the customs broker must be notified within 15 days of delivery. The following illustrates to whom the claim is to be directed.

- If an airfreight forwarder handles the shipment and their agent delivers the shipment to customs, the claim must be filed with the airfreight forwarder.
- If an airfreight forwarder delivers the shipment to a specific airline and the airline delivers the shipment to customs, the claim must be filed with the airline.

Any damaged material including all containers and packaging should be held for carrier inspection. Contact MKS Customer Support for assistance if your shipment is not correct for reasons other than shipping damage.

1.3 Warranty

MKS Instruments, Inc. provides an eighteen (18) month warranty from the date of shipment for new MKS products. The MKS Instruments, Inc. General Terms and Conditions of Sale provides the complete and exclusive warranty for MKS products. This document is located on our web site at www.mksinst.com, or may be obtained by contacting an MKS Customer Service Representative.

1.4 Certification

MKS Instruments, Inc. certifies that this product met its published specifications at the time of shipment from the factory.

1.5 Service Guidelines

Some minor problems are readily corrected on site. If the product requires service, contact the MKS Technical Support Department at +1-833-986-1686. If the product must be returned to the factory for service, request a Return Material Authorization (RMA) from MKS. Do not return products without first obtaining an RMA. In some cases a hazardous materials disclosure form may be required. The MKS Customer Service Representative will advise you if the hazardous materials document is required.

When returning products to MKS, be sure to package the products to prevent shipping damage. Shipping damage on returned products as a result of inadequate packaging is the Buyer's responsibility.

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Chapter 2
Safety

2.1 Safety Introduction

START 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 you require further assistance, contact MKS at the address on the title page 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 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

Electrical Shock or Personal Injury

The service and repair information in this manual 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.

WARNING

Electrical Shock or Fire

To reduce the risk of fire or electric shock, do not expose this product to rain or moisture.

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.

2.2 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 is the responsibility of the Customer.

MKS 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 MKS literature including, but not limited to, manuals, instructions, bulletins, communications, and recommendations.

For emergencies and for product safety related matters, contact the MKS Customer Service Department. See Section 1.5 or Section 6.9 for detailed information regarding how to contact MKS Customer Service Representatives.

2.3 Grounding Requirements

See Grounding, Section 4.2 in the Installation chapter for more detailed requirements regarding gauge and system grounding.

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.

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 Series 342/343 Mini-Ion Gauge Module is mounted is 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. See Section for detailed grounding instructions.

Connect power cords only to properly grounded outlets or sources.

Grounding is very important! Be certain that ground circuits are correctly used on your ion gauge power supplies, gauges, and vacuum chambers, regardless of their manufacturer. Safe operation of vacuum equipment requires grounding of all exposed conductors of the gauges, the controller and the vacuum system. LETHAL VOLTAGES may be established under some operating conditions unless correct grounding is provided.

Ion producing equipment, such as ionization gauges, mass spectrometers, sputtering systems, etc., from many manufacturers may, under some conditions, provide sufficient electrical conduction via a plasma to couple a high voltage electrode potential to the vacuum chamber. If exposed conductive parts of the gauge, controller, and chamber are not properly grounded, they may attain a potential near that of the high voltage electrode during this coupling. Potential fatal electrical shock could then occur because of the high voltage between these exposed conductors and ground.

2.4 High Voltage

High Voltage is present in the unit when electrical power is applied to the electronics enclosure. Hazardous voltages may still be present for some time after disconnecting power to the electronics enclosure. Refer to the Installation and Service chapters for more information.

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

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.

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.

2.5 Over Pressure Conditions

WARNING

Explosive Environment

Do not use the Series 342/343 Mini-Ion Gauge 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.

WARNING

Potential Automatic Operation

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 the system programming before switching to automatic operation.

WARNING

Vacuum Chamber High Pressures

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.

Danger of injury to personnel and damage to equipment exists on all vacuum systems that incorporate gas sources or involve processes capable of pressuring 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 belljars, 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. ***Confirm that these safety devices are properly installed before installing and operating the product.***

Ensure the following precautions are complied with at all times:

(1) the proper gas cylinders are installed,

(2) the gas cylinder valve positions are correct on manual systems,

(3) and the automation is correct on automated gas delivery systems.

CAUTION

Vacuum gauges with compression fittings may be forcefully ejected if the vacuum system is pressurized.

2.6 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.** When the product exhibits a distinct change in performance. This indicates a need for service.

Notice

Do not substitute parts or modify the instrument.

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 MKS for service and repair to ensure that safety features are maintained. Do not use this product if it has unauthorized modifications.

Notice

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.

See Service Guidelines, Section 1.5 for detailed information regarding how to contact MKS Customer Service Representatives.

Chapter 3

Specifications

3.1 General Description

The Series 342 Mini-Ion vacuum gauges are a modular instrument consisting an ionization gauge and electronics enclosure capable of measuring vacuum pressures from less than 1 x 10^{-6} Torr to 5 x 10^{-2} Torr, air or equivalent using a miniature triode style ionization gauge.

The Series 343 Mini-Ion vacuum gauges are a modular instrument consisting an ionization gauge and electronics enclosure capable of measuring vacuum pressures from less than 5 x 10^{-8} Torr to 5 x 10^{-3} Torr, air or equivalent using a miniature B-A style ionization gauge.

3.2 Intended Use

Both series are intended for computer control only, with no external controls or adjustments. Pressure readout is via a logarithmic analog output on the I/O connector on all models, and digital readout on models with the digital display option.

These instruments are to be used only in accordance with the instructions in this operation manual.

3.2.1 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, or explosive environment.

3.3 Transportation

- Reuse the original shipping container.
- Replace all of the dust caps on all ports prior to shipping.

3.4 Storage

- Store the Mini-Ion gauge assembly indoors between -40 ^{o}C to +70 ^{o}C (-40 ^{0}F to 158 ^{0}F).
- Bag the assembly in a sealed or shrink wrapped bag with desiccant.
- All of the components should be bagged and boxed together along with the instructions for future reference.

3.5 Specifications

Table 3-1 Specifications for the Series 342 & 343 Mini-Ion Gauges

Parameter	Specification
Performance	
Measurement Range for N_2 / Air	*See notes 1 and 2, below*
Series 342 with a Triode style gauge	$<1x10^{-6}$ to $5x10^{-2}$ Torr
Series 343 with a B-A style gauge	$<5x10^{-8}$ to $5x10^{-3}$ Torr
Accuracy	
Series 342	+/- 15% (typical)
Series 343	+30%, - 15% (typical)
Emission Current	2 ranges: 0.1 mA, 2 mA
Analog Output	Logarithmic, 1 Vdc/decade
Overpressure Protection	
Series 342	Triode gauge turns OFF if pressure rises above $5x10^{-2}$ Torr
Series 343	B-A gauge turns OFF if pressure rises above $5x10^{-3}$ Torr
Operating Power	+24 Vdc ±15%, 12 W max
Degas	Electron bombardment, approximately 3 W with 2 minute timer
Physical	
Vacuum Connection	NW16KF flange or 1-5/16 inch Conflat type
Electrical Connection	9 pin sub-miniature “D” type
Case Material	Aluminum extrusion
Weight	13 oz.
Electrical Safety	Metal enclosure houses up to 180 V, requires assured ground to system
Compliance EMC Directive Low Voltage Directive	 2004/108/EC; EN61326-1 2006/95/EC; EN61010-1
IP Rating	IP 20
Operating Temperature	0 °C to +40 °C (32 °F to 104 °F) ambient, indoor use only, ordinary protection from moisture
Operation humidity	0 to 90%
Non-operating temperature	-40 °C to +70 °C (-40 °F to 158 °F)
Gauge Design	Triode or B-A style design with thoria-coated iridium cathode
Gauge bake out temperature with electronics removed	250 °C maximum (482 °F)
Gauge Replacement	Field replaceable using only a Phillips type screwdriver
Mounting Orientation	Any. However, avoid mounting the gauge directly below the chamber to prevent sputtered material or other debris falling into the gauge.
Specifications and dimensions are subject to change without notice.	

1. Measurements will change with different gases and mixtures. Correction parameters must be used for gases other than N2 or Air.

2. Do NOT use Mini-Ion Gauges with flammable or explosive gases.

3.5.1 Dimensions

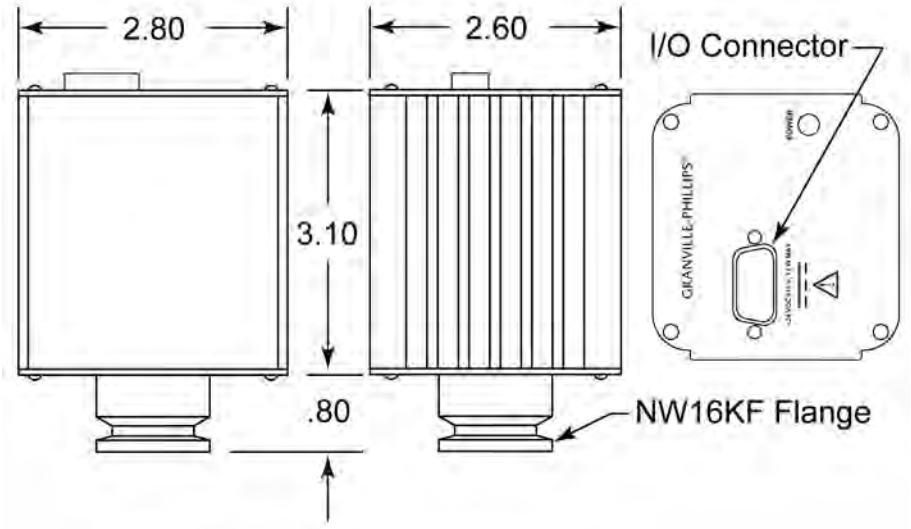

Figure 3-1: Series 342 & 343 Mini-Ion Gauge Dimensions

Notes:

Chapter 4

Installation

4.1 Introduction

This section provides the information required to install a Series 342 or 343 Mini-Ion Gauge on a vacuum system and prepare the product for use.

4.2 Vacuum Gauge Connection (mechanical)

Use the following procedure to install the Mini-Ion Gauge Module on the vacuum system.

Notice

Install the gauge on the vacuum chamber where it is protected from physical damage and high heat.

See Section 2.5, Over Pressure Conditions, for important safety information before mounting the gauge.

4.2.1 Mounting Location and Orientation

The Series 342 or 343 Mini-Ion Gauge Module can be mechanically mounted anywhere on the vacuum system in any attitude. It should be mounted in a location with free air flow and ambient temperature less than 40 ^{0}C (104 ^{0}F). The gauge is mounted to the vacuum system by the flange only. Be sure to use common vacuum practices when mounting the gauge on the vacuum system.

- Locate the Mini-Ion Gauge where it can be easily accessed.
- For greatest accuracy and repeatability, locate the Mini-Ion Gauge in a stable, room-temperature environment. Ambient temperature should never exceed 40 °C (104 °F) operating, non-condensing, or 70 °C (158 °F) non-operating. Bake out temperature with the electronics enclosure removed from the gauge is 250 °C (482 °F).
- Locate the Mini-Ion Gauge away from internal and external heat sources and in an area where ambient temperature remains reasonably constant.
- Do not locate the Mini-Ion Gauge near the pump, where gauge pressure might be lower than normal vacuum pressure.
- Do not locate the Mini-Ion Gauge near a gas inlet or other source of contamination.
- Do not locate the Mini-Ion Gauge where it will be exposed to corrosive gases such as mercury vapor or fluorine.
- Do not locate the Mini-Ion Gauge directly below the vacuum chamber which may allow sputtering particles or other contamination to fall into the gauge.

4.2.2 Dimensions

- See Figure 3-1 in the Specifications Chapter.

4.2.3 Attach the Gauge to the Vacuum Chamber

Connect the Mini-Ion Gauge to the vacuum system flange using the appropriate gasket and mounting hardware.

For an NW16KF flange:

1. The NW16KF style flange requires a self-centering O-ring between mating flanges. Use a metal clamp and tighten the clamp to compress the mating flanges together. Do Not use a plastic clamp. See Grounding in Section 4.4.
2. Attach the Mini-Ion Gauge to the mating NW-style connector on the vacuum chamber. Use a new seal and the appropriate tools to tighten the metal clamp.

4.3 Power and Input/Output Cable Connections

A 9-pin connector is used to operate and communicate with the Mini-Ion Gauge. See Figure 4-1 for pinout assignments of the connectors.

Use the supplied connector on the customer supplied Input/Output cables according to the pin assignments in Figure 4-1. The cable is user-supplied; MKS does not supply the interconnect cable.

- Use a shielded cable and connect its designated conductors to the pins of a Female subminiature "D" connector that will directly mate with the designated pins of the Mini-Ion Gauge Module Electronics Male subminiature "D" connector, shown in Figure 4-1.
- To prevent ground loops, connect the cable's shield to the outer shell of the Female "D" connector on the Mini-Ion Gauge. "Do not" connect the shield to the receiver side, the side that receives the Mini-Ion Gauge signal outputs.
- CE Mark compliance requires metal connector housings and cable with a shield.

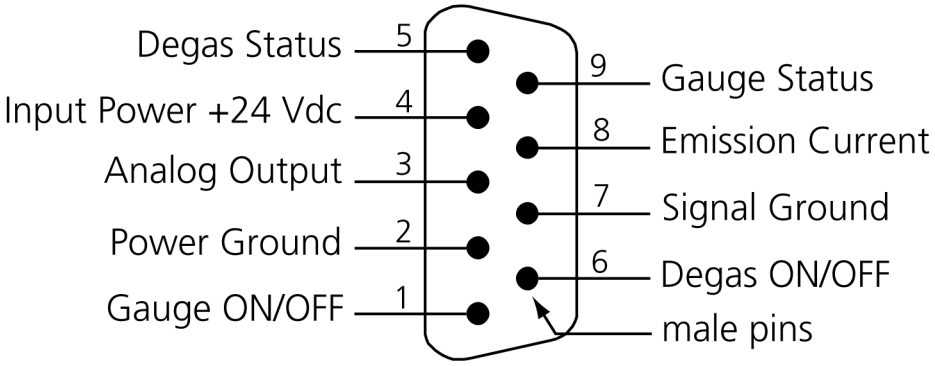

Figure 4-1: 9-pin Connector Pin Assignments

Table 4-1: 9-pin Power & Communications Connector Pin Assignments

Pin #	Function
1	Gauge ON/OFF. A continuous ground is required for an ON condition. Removal of the ground turns the gauge OFF.
2	Power Ground. Use for input power return, Ion-gauge ON/OFF, Degas ON/OFF, and Status Outputs.
3	Analog Output
4	Input Power. +24 Vdc ±15%, 12 W max. Protected against reversal and over-voltage.
5	Degas Status. Open collector transistor (grounded emitter) rated at 40 V max VCE, 50 mA max. Transistor OFF = Degas OFF, transistor ON = Degas ON.
6	Degas ON/OFF. Same as Gauge ON/OFF
7	Signal Ground. For use with Analog Output, only.
8	Emission Current. Application of a ground increases emission current from 100 microamps to 2 milliamps.
9	Gauge Status. Same as Degas Status.

4.4 Grounding the Gauge to the Vacuum Chamber

⚠ WARNING

Proper Grounding

Improper grounding could cause product failure or personal injury.

- Follow ground network requirements for the facility.
- Maintain all exposed conductors at Earth ground.
- Ground the gauge to the vacuum chamber as illustrated below.
- Make sure the vacuum port to which the gauge is mounted is properly grounded.
- See the grounding cautions in Section 2.3.

The Mini-Ion Gauge converts the input power to +180 Vdc for the grid supply. For safety, the outer housing of the Mini-Ion Gauge must be grounded to the vacuum chamber. This is accomplished by the use of a metal flange clamp for the NW16KF type flanges. Due to the O-ring seal, grounding cannot be assumed through the fitting. The groove in the KF flange of the Mini-Ion Gauge is designed to prevent the use of a non-metallic type of flange clamp. Do not alter either the groove or a non-metallic flange clamp to attempt usage. See Section 2.3, Grounding Requirements in the Safety chapter.

Check continuity between the gauge and the vacuum chamber. If necessary, to assure a ground connection, add a 3.31 mm^2 (12 AWG) or larger copper wire between the ground tab on the electronics enclosure and the vacuum chamber.

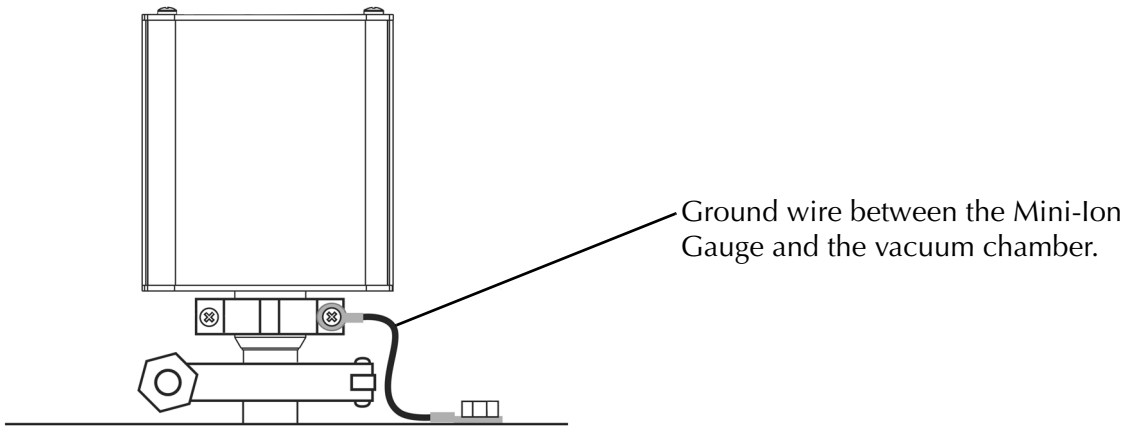

Figure 4-2: Grounding the Mini-Ion Gauge to the Vacuum Chamber

Chapter 5

Operation

5.1 Basic Theory of Operation

The functional parts of a typical ionization gauge are the filament (cathode), grid (anode) and ion collector, which are shown schematically in Fig. 1.2. These electrodes are maintained by the gauge controller at +30, +180, and 0 volts, relative to ground, respectively.

The filament is heated to such a temperature that electrons are emitted, and accelerated toward the grid by the potential difference between the grid and filament. Most of the electrons eventually collide with the grid, but many first traverse the region inside the grid one or more times.

When an energetic electron collides with a gas molecule an electron may be dislodged from the molecule leaving it with a positive charge. Most ions are then accelerated to the collector. The rate at which electron collisions with molecules occur is proportional to the density of gas molecules, and hence the ion current is proportional to the gas density (or pressure, at constant temperature).

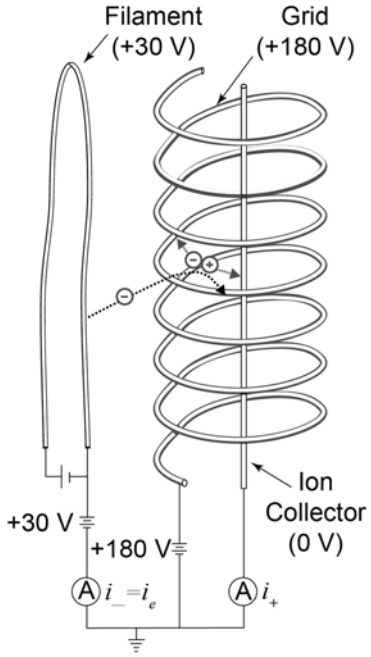

Figure 5-1: Typical Ion Gauge Schematic

The amount of ion current for a given emission current and pressure depends on the ion gauge design. This gives rise to the definition of ion gauge "sensitivity", frequently denoted by "K":

K = ion current/(emission current x pressure)

The Series 342 triode type gauge typically has a sensitivity of 6.2/Torr when used with nitrogen or atmosphere. (The design of the triode gauge is different than the illustration in Figure 5-1, but the operational characteristics are the same.)

The Series 343 B-A type gauge has a sensitivity of 5.2/Torr. Sensitivity ratios for some other gases are given in Table 5-1.

The ion gauge electronics (controller) varies the heating current to the filament to maintain a constant electron emission, and measures the ion current to the collector. The pressure is then calculated from these data.

Ion gauge degas is accomplished by increasing the emission current to 10 mA resulting in an increased temperature of the grid to drive off contaminants.

5.2 Emission Current

There are two ranges of emission current available: 100 microamps or 2 milliamps as determined by the status of pin 8 of the I/O connector. While either range can be used continuously, the following guidelines are suggested. For operation in the higher pressure ranges with a clean system, 100 microamperes emission is satisfactory. This will give a theoretical longer filament life and allows

usage to where the gauge pressure reading overlaps with other type transducers such as the Convectron® Gauge or Capacitance Manometer. For operation in the lower pressure ranges, the 2 milliampere range can be used to give a more accurate pressure reading. Internal circuitry corrects the analog output voltage to pressure relationship curve for the emission current selected.

There is a common issue with ion gauges when used in systems which have the potential for diffusion pump oil vapor to enter the gauge tube. This oil vapor deposits on the grid forming an insulator and preventing emission resulting in higher and higher filament power being required and ultimate inability to control emission. In this situation the 2 milliamp position is recommended.

Table 5-1: Ion Gauge Gas Sensitivity Ratios

Gas	N_2	He	Ne	Ar	Kr	Xe	H_2
r	1	0.15	0.24	1.19	1.86	2.73	0.46

Ion gauge sensitivity ratios, r, derived from data obtained by S. Dushman and A. H. Young, Phys, Rev. 68 278 (1945).

5.3 Analog Output

This signal is proportional to the logarithm of the pressure with 0 volts at 1×10^{-9} Torr. When the IG is turned OFF the output will switch to slightly over +10 Vdc. See Fig. 5.2 for complete details.

5.4 Gas Sensitivity Correction

The 342 Mini-Ion Gauge is calibrated to read pressure for nitrogen or air. If used with gases other than this it will be required that the analog output voltage to pressure reading be corrected for the gas in use. Table 1.1 gives some typical sensitivity ratios. To correct the analog output to pressure curve reading, divide the indicated pressure reading by the sensitivity ratio.

5.4.1 Example

The analog output voltage is measured and found to be 4.69 Vdc which, for air or nitrogen, indicates a pressure of 5×10^{-5} Torr. If the gas type in the system is known to be neon, then:

$$\frac{5 \times 10^{-5}\ Torr}{0.24} = 2.08 \times 10^{-4}\ Torr\ of\ neon$$

5.5 Overpressure Shutdown

The Series 342 (triode style gauge) is preset by fixed component values to shut down the ion gauge should pressure rise above 5×10^{-2} Torr of nitrogen. The Series 343 (B-A style gauge) is preset for a shutdown at 5×10^{-3} Torr of nitrogen.

5.6 Gauge ON/OFF

To turn the gauge ON, it is required that pin 1 be grounded to pin 2 of the I/O connector. To turn the gauge OFF, remove the ground. Note that the application of the ground will only try to turn the gauge ON once. If, for any reason, this is not successful, it will be required that the input be recycled back to OFF and then ON again.

Possible reasons for this to happen include:
1.Initial application of power to the unit.
2.Attempt made to turn ON the gauge at a pressure where emission could not be established.
3.An overpressure shutdown where system pressure exceeded the overpressure shutdown level.

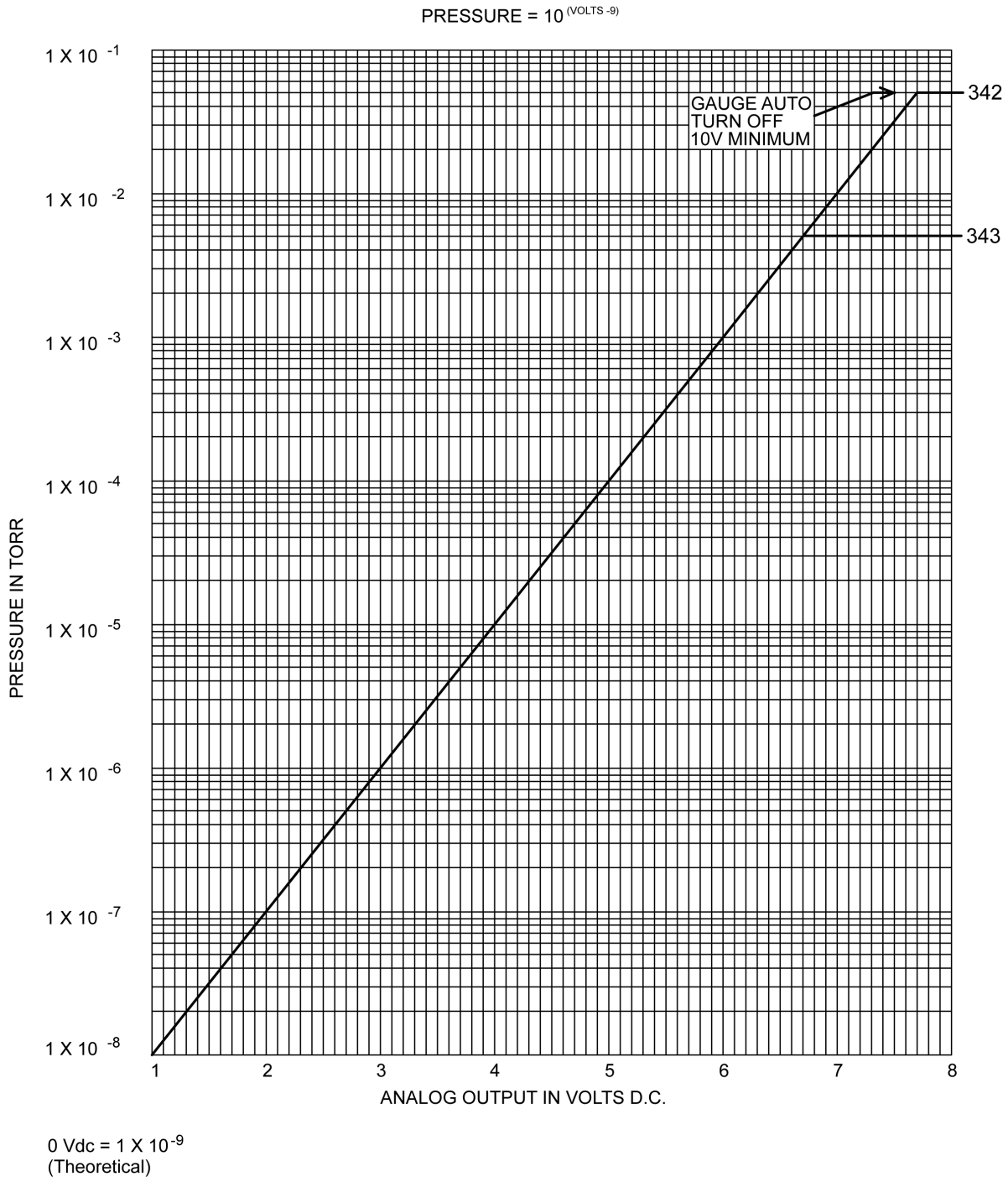

Figure 5-2: Analog Output in Volts dc

5.7 Degas

Degassing of the gauge tube is accomplished by Electron Bombardment heating of the grid. Pressure reading during degas is allowable. To activate the degas circuit, the IG ON circuit must be first activated. This assures that there is a vacuum in the system prior to degas. The degas circuit will turn OFF if the IG ON circuit is turned OFF.

Degassing is of limited value in the pressure range covered by this gauge, and due to the small size of the gauge, power during degas is approximately 3 watts above operating power and is turned OFF automatically after a two minute period.

Chapter 6

Service & Maintenance

6.1 Introduction

The procedures in this section provide instructions for normal service issues that may be required during use of the Series 342 or 343 Mini-Ion Gauge/Module.

6.2 Service Guidelines

Some minor difficulties are readily corrected in the field.

Because the Mini-Ion Module 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 personnel 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.

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

WARNING

High Voltage

High voltages present within the electronics enclosure are capable of causing injury or death. To avoid electric shock, wait 3 minutes after power is removed before touching any component within the electronics enclosure.

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.

CAUTION

Product Modifications

Do not substitute parts or modify the instrument.

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 MKS for service and repair to ensure that safety features are maintained. Do not use this product if it has unauthorized modifications.

6.3 Damage Requiring Service

Disconnect this product from all power sources, and refer servicing to Qualified Service Personnel if any the following conditions exist:

- The gauge cable, power-supply cord, or plug is damaged.
- Liquid has been spilled onto, or objects have fallen into, the product.
- The product has been exposed to rain or water.
- The product does not operate normally even if you have followed the Operation Instructions. Adjust only those controls that are covered in the instruction manual. Improper adjustment of other controls may result in damage and require extensive work by a qualified technician to restore the product to its normal operation.
- The product has been dropped or the enclosure has been damaged.
- The product exhibits a distinct change in performance. This may indicate a need for service.

CAUTION

Replacement Parts

When replacement parts are required, be certain to use the replacement parts that are specified by MKS, 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 determine that the product is in safe operating order.

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, crazing, or other signs of deterioration. Do not use if the electrical insulation has become unsafe.

6.4 Gauge Bake-out Procedure

Baking the Series 342/342 Mini-Ion Gauge helps reduce residual background gases and can help if contamination has occurred.

WARNING

Hot Surface

Do not touch the gauge or the immediate surrounding area of the vacuum chamber during the bake out process. Wait until the bake out process has finished and the area has cooled.

Maximum gauge bake out temperature with the electronics enclosure removed is 250 ºC.

To bake the Mini-Ion Gauge:

1. Turn OFF Power to the Mini-Ion electronics module.
2. Disconnect the I/O cable from the electronics module.
3. Remove the four screws (see Fig 6-1).
4. Remove the electronics enclosure from the ionization gauge, leaving the gauge attached to the vacuum chamber.
5. Bake the Mini-Ion gauge to a maximum of 250 ºC.

Notice

Be careful when installing the electronics enclosure onto the ion gauge to be sure the pins on the ion gauge are properly aligned with the sockets on the PC Board and do not get bent or distorted.

6. Reinstall the electronics enclosure onto the ion gauge. Note the alignment notches illustrated in Figure 6-1.
7. Install the four screws and connect the I/O cable.

6.5 Troubleshooting

Table 6-1 General Symptoms/Possible Causes

Symptom	Possible Causes
Power indicator does not illuminate.	Power supply disconnected, OFF, or inadequate for load. A switching supply may shut down from the current surge upon power-up. If a switching power supply is used, size the current limit to two times the working load. Assure that the power supplied to the module is +24 Vdc ±15%, 12 W max. The connector may be wired incorrectly. See Section 4.3. Blown fuse. This could be caused by incorrect wiring. Replace the fuse. See Section 6.7.
Ion gauge will not stay ON.	Overpressure condition. See Section 5.5 and Section 5.6. Emission control failure. Causes include gauge failure due to broken filament, contamination, or pressure over 1 Torr. High voltage power to gauge failure. Causes include gauge failure due to mechanical damage or leakage due to contamination.
Inaccurate pressure reading.	Organic seals. If the ion gauge connection to the vacuum system is sealed with an organic O-ring, the gauge will not read accurately below 1e-7 Torr. Use a metal seal. Contamination. Pump oil and other organic compounds, or metal coating from a sputtering process can cause electrical current leakage between ion gauge elements. Degas the Mini-Ion gauge by connecting Pin 6 (Degas ON/OFF) on the I/O connector to Pin 2 (Power Ground) (see Section 4.3 and Section 5.7). Degas will operate for up to two minutes. Disconnect Pin 6 from Pin 2 to allow another degas cycle.

6.6 Ion Gauge Continuity Test

WARNING

High Voltage

To prevent electrical shock, turn OFF electrical power before servicing the Module. Do not touch any gauge pins while the gauge tube is under vacuum.

This test should only be performed while the ion gauge is exposed to atmospheric pressure and the Mini-Ion Vacuum Gauge Module electronics is removed from the gauge. If a problem with pressure measurement is traced to the Mini-Ion Vacuum Gauge Module, the gauge may be tested with an ohm meter. This test can detect open filaments or shorts between gauge elements. This test may not detect inaccurate pressure measurement due to gauge contamination or vacuum leaks.

1. Turn OFF power to the module.
2. Remove the I/O connector from the module.
3. Remove the Mini-Ion Module from the vacuum system.
4. Remove the four Phillips head screws from the gauge collar plate as shown in Figure 6-1.

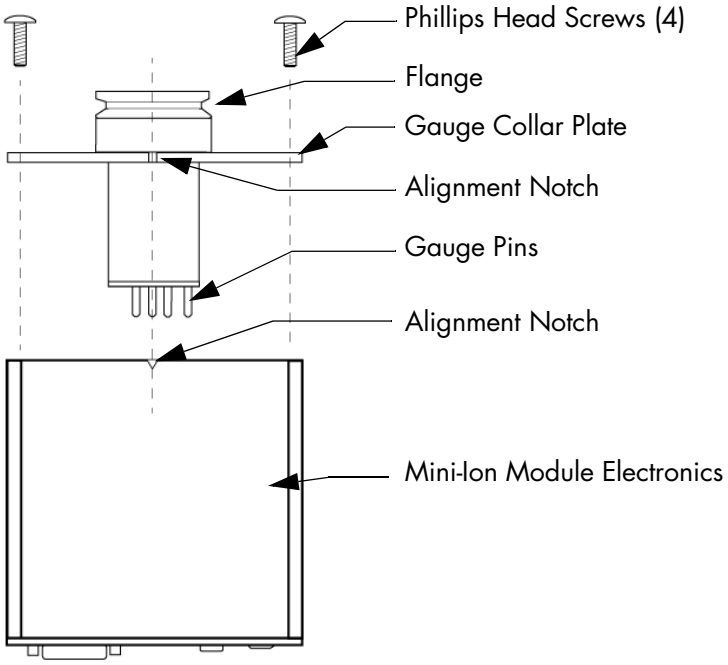

Figure 6-1 Mini-Ion Gauge Removal.

5. While holding the flange, *gently* pull the Mini-Ion Vacuum Gauge Module away from the gauge collar plate as shown in Figure 6-1. The gauge tube and plate will disconnect from the module.
6. Use a digital multimeter to measure the resistance of the left and right filament pins as illustrated in Figure 6-2. The reading should be approximately 0.2 Ohm.

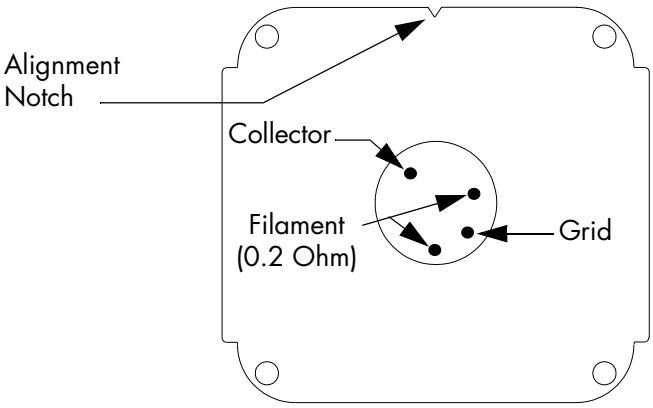

Figure 6-2 Mini-Ion Gauge Pin Identification.

7. Measure the resistance of filament pins to any other pin or gauge case as shown in Figure 6-2. The reading should be infinity.

8. Measure the resistance of Grid pin to any other pin or gauge case as shown in Figure 6-2. The reading should be infinity.

9. Measure the resistance of Collector pin to any other pin or gauge case as shown in Figure 6-2. The reading should be infinity.

NOTE: If the readings obtained during this procedure are not within the values specified, the gauge should be replaced. Contact an MKS Customer Service Representative to order a replacement gauge.

10. Once the replacement Mini-Ion Gauge is received, refer to Section 6.8 to install the gauge.

6.7 Fuse Replacement

Use the following procedure to replace the fuse in the Mini-Ion module.

WARNING

High Voltage

To prevent electrical shock, turn OFF electrical power before servicing the Mini-Ion Module. Do not touch any gauge pins while the gauge tube is under vacuum.

1. Turn OFF power to the Mini-Ion Module.

2. Disconnect the I/O cable from the connector.

3. Remove the I/O cable connector jack posts from the connector.

4. Remove the four screws from the Mini-Ion Module. See Figure 6-1.

5. Locate the defective fuse as shown in Figure 6-3 and replace it with a new 1 amp, slow blow fuse.

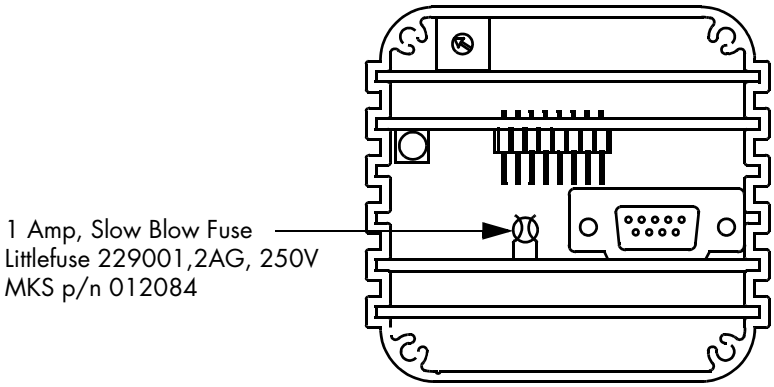

Figure 6-3 Position of 1 Amp, Slow Blow Fuse.

6. Install the Micro-Ion Module top cover with the previously removed four screws.

7. Install the I/O cable connector jack posts on the connector.

8. Connect the I/O cable to the connector.

9. Turn ON power to the Mini-Ion Module. It is now ready to be used.

6.8 Gauge Replacement

The Mini-Ion replacement gauge is double-packaged at the factory for cleanroom compatibility. Handle the gauge carefully to avoid damaging the vacuum port screen after the cap plug is removed. To reduce the chance of contamination, do not remove a Mini-Ion replacement gauge from its inner bag until moments before it is to be connected to the module and vacuum system.

Avoid contaminating the Mini-Ion replacement gauge. Do not touch the vacuum connection port. Follow good vacuum practice. To minimize the possibility of leaks, do not scratch the vacuum connection seal surfaces.

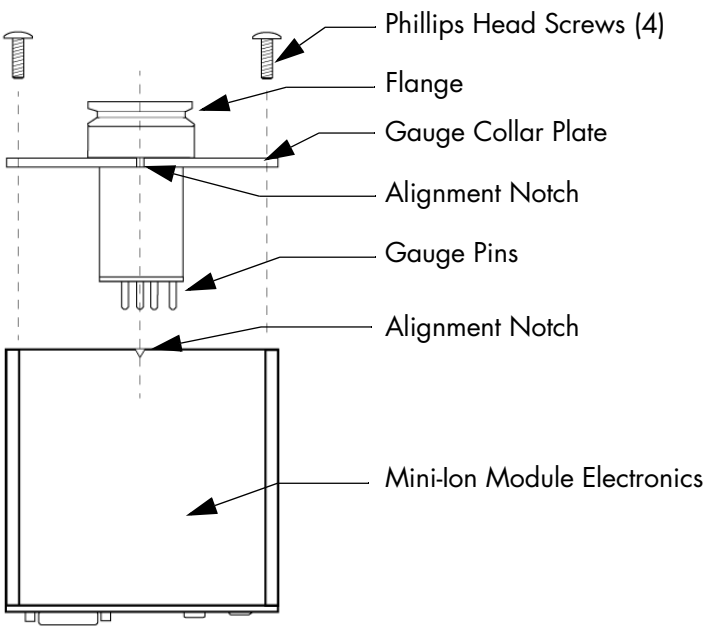

Figure 6-4 Mini-Ion Gauge Removal.

Use the following step-by-step procedure to replace the Mini-Ion Module gauge:

1. Turn OFF power to the Mini-Ion Module and unplug the electrical connector.
2. Remove the Mini-Ion Module from the vacuum system.
3. Remove the four Phillips head screws from the plate that attaches the gauge to the module.
4. Gently pull (unplug) the gauge from the module.
5. Insert the replacement gauge in the module by aligning the notch on the replacement gauge plate with the notch in the module body. Gently insert the gauge by engaging the pins into the socket on the module circuit board.

Notice

Be careful when installing the gauge into the electronics enclosure to be sure the pins on the ion gauge are properly aligned with the sockets on the PC Board and do not get bent or distorted.

6. Replace the four Phillips head screws and tighten.
7. Reinstall the Mini-Ion Module on the vacuum system.
8. Plug in the electrical connector and restore power to the module.

6.9 Service Guidelines

Some minor problems are readily corrected on site. If the product requires service, contact the MKS Technical Support Department at +1-833-986-1686. If the product must be returned to the factory for service, request a Return Material Authorization (RMA) from MKS. Do not return products without first obtaining an RMA. In some cases a hazardous materials disclosure form may be required. The MKS Customer Service Representative will advise you if the hazardous materials document is required.

When returning products to MKS, be sure to package the products to prevent shipping damage. Shipping damage on returned products as a result of inadequate packaging is the Buyer's responsibility.

For Customer Service / Technical Support:
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Andover MA, 01810 USA
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Email: insidesales@mksinst.com

Visit our website at: www.mksinst.com

Series 342/343

Mini-Ion™ Vacuum Gauge Modules with Analog Output

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