

**Instruction Manual  
For  
Penning Vacuum Gauge  
GPH-325**



## STANDARD WARRANTY

The following warranty will apply only upon condition that Buyer has utilized or operated the goods in strict conformance with operating instructions and manuals appropriate for the goods and any other instructions provided by Seller.

Seller warrants that all goods will be as specified on this order and will be free from defects. No warranty as to fitness, nor suitability to the Buyer's process, nor any other warranty, except of title, shall be implied. Minor deviations from specifications, which do not affect performance of the products covered hereby, shall not be deemed to constitute defects of materials or workmanship or a failure to comply with the specifications referred to herein.

Notice of any claim that the products are in any way defective shall be given the Seller immediately on discovery and the Seller shall thereupon correct the defects by repair or replacement without charge F.O.B. Shipping Point. The liability of the Seller arising out of the supplying of said products, whether based on warranty or otherwise, shall in no case exceed the cost of the parts or products, and all liability shall terminate within one year after shipment from the Seller's plant. The foregoing warranty does not apply to vacuum tubes, diodes, transistors, batteries, lamps or other items which are expendable by nature. No warranty whatever is made with respect to these items and Seller does not agree to repair or replace them. All vacuum gauge sensing elements, such as, thermocouple tubes, Pirani tubes, Philips tubes, etc., are warranted against defects in manufacture in normal use, as determined by Seller's inspection, for a period of 90 days from date of shipment, provided the defective gauge tube is returned to Seller at Kittanning, Pennsylvania for inspection.

## STANDARD ACCEPTANCE

The products covered by the order shall be deemed finally inspected and accepted within ten (10) days after delivery thereof, unless notice of rejection or notice of any claim, express or implied, is given in writing to the Seller within said period. Acceptances as aforesaid shall be deemed full performance of the Seller's obligations hereunder save for its obligation under the above warranty.

All correspondence concerning warranty repairs should be addressed to MYERS VACUUM REPAIR, 1155 Myers Lane, Kittanning, PA 16201 Attention Order Services.

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## INSTALLATION, OPERATING, AND MAINTENANCE INSTRUCTIONS FOR THE PENNING GAUGE, TYPE GPH-325

### 1.0 INTRODUCTION

#### 1.1 Operating Principle

The Penning vacuum gauge (named after its inventor, F. M. Penning) measures pressure as a function of the ion current flowing in a cold cathode pressure sensing tube which operates at high voltage and with a magnetic field. The gauge circuit responds to the sensing tube and displays in units of pressure.

#### 1.2 Specifications

AC Power Input:	115 volts, 60 Hz, 18 watts max.
Pressure Range:	$1 \times 10^{-7}$ torr to $10 \times 10^{-4}$ torr
Sensing Tube:	One GPH-001A (See Figure 2).
Tube Cord Length:	10 feet is standard. (Other lengths available).
Response Time:	~300 milliseconds
Recorder Terminal Volts:	Log scale (2-7 VDC)
Cabinet:	3U (5-1/4) Half 19"-rack style for bench or rack mounting
Cabinet Dimensions:	GPH-325: 5-1/4 inches high, 9-1/2 inches wide, ~9.5 inches deep (allow 3" inches for connections).
Relay Controlled Output:	SPDT 5 Amp 250 VAC Max.
Trip Point:	Adjustable the range of the gauge.

## 2.0 INSTALLATION

### 2.1 Unpacking

Inspect the shipping carton and its contents for damage or shortages. Equipment is normally shipped FOB Kittanning, PA. Any damage in transit is the normal responsibility of the transportation company should be reported to them. The shipping carton contains the items listed below:

2.1.1 The control unit

2.1.2 GPH-001A Gauge Tube (if ordered). The open tubulation of the tube is plugged with a plastic stopper to prevent foreign particles from entering the tube. Do not remove this plug until you are ready to install the tube in the vacuum system. The magnet in the tube may attract and hold small steel chips, etc.

2.1.3 Power Cord

2.1.4 Axillary Connector

2.1.5 Gauge/Tube Connection Cable (if ordered)

2.1.3 An instruction manual.

### 2.2 Installing the Control Unit

2.2.1 Position the gauge control unit for convenience in operation and good visibility. A clean location is highly desirable as dust and moisture entering the gauge can result in electrical failure of the circuitry.

2.2.2 The control units can be installed in a standard 19-inch rack cabinet as a half rack space or bench top mounted.

### 2.3 Installing the Gauge Tube

Install the sensing tube(s) in the vacuum system where the pressure is to be measured. Avoid locations where heavy back streaming of pump fluid vapors will occur as this will necessitate frequent cleaning of the tube. For convenient installation and quick removal we offer several types of tube of tube connector fittings.

KF 25 to 1" Tube connector (Female) P/N 500234-0025  
KF 40 to 1" Tube connector (Female) P/N 500234-0040  
KF 50 to 1" Tube connector (Female) P/N 500234-0050  
CF 35 (2 3/4" Conflat) to 1" Tube connector (Female) P/N 500235

NOTE: Wherever possible, use the large 1-inch tube connection to minimize errors caused by pumping and/or outgassing of the system if possible, to minimize the effects of outgassing of the sealing O-rings. Rubber tubing is not recommended as a connecting sleeve.

### 2.4 Electrical Connections

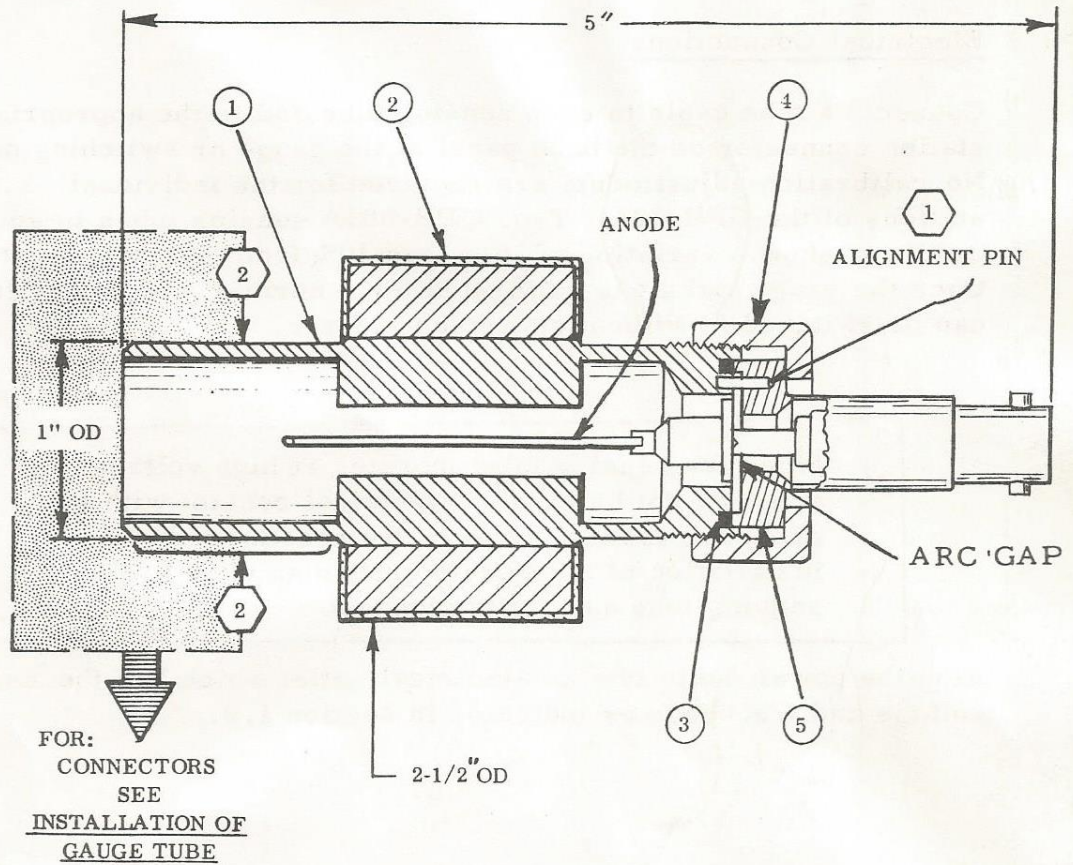
Connect the gauge/tube cable to the sensing tube and to the connector on the back panel of the gauge. No calibration adjustments are required the type GPH-001 sensing tubes in good condition show a variation of less than 10% from normal sensitivity. Once the gauge circuit is calibrated for a normal tube, others tubes can be switched in without appreciable error.

Plug the power cord into an electrical outlet which has the correct voltage and frequency as indicated in section 1.2.

Make connections as needed prior to connecting the auxiliary connector.

#### **CAUTION:**

**Since the sensing tube operates at high voltage and may not be in good electrical contact with a grounded vacuum system, we recommend installation of a separate grounding wire to the sensing tube as a safety backup.**



**CAUTION :**  
 (1) ENGAGE ALIGNMENT PIN BEFORE TIGHTENING CAP NUT ITEM NO. (4)  
 (2) PROTECT SEAL SURFACE

ITEM NO.	IDENTIFICATION	PART NO.
(1)	CASING ASSEMBLY	61351
(2)	MAGNET	66267
(3)	GASKET	264091-5
(4)	CAP NUT	60053
(5)	ANODE ASSEMBLY	282395

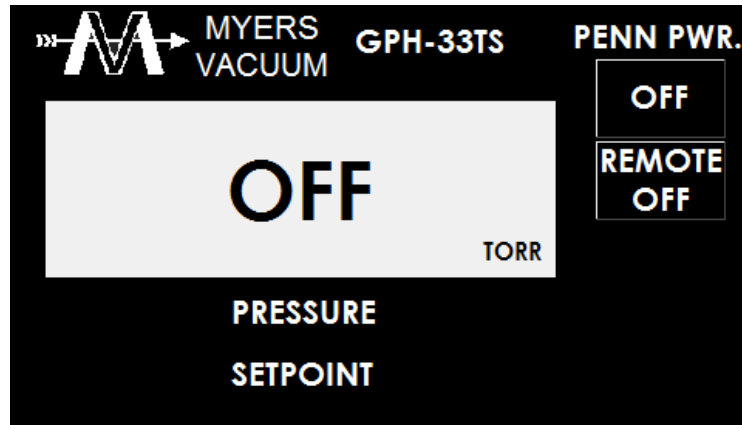
FIG. 2 DISCHARGE GAUGE TUBE TYPE GPH-001A

### 3.0 OPERATION

After the sensing tube has been installed and the electrical connections made, the gauge is ready for operation. A dependable reading on the gauge cannot be obtained until the sensing tube has been outgassed. An outgassing period of a few minutes to an hour or longer may be required for a very contaminated tube. In general, a dependable reading can be obtained if the tube is first allowed to reach equilibrium. If only a general indication of the pressure is required, this warm-up period is unimportant.

Although the gauge will not be damaged by operation of the sensing tube at higher pressure, the penn. power should not be turned on when the system pressure is above the operating range of the gauge this will prevent rapid contamination of the sensing tube. There is a built in protect that will turn the penn power off if this occurs.

To turn on the gauge, move the manual switch up (on). To turn on penning power touch the screen in the area below PENN PWR. To use remote a remote switch to turn on penning power make the necessary connections to auxiliary jack pin “A” and “B”, connect to your switch or relay and touch the screen in that area of REMOTE to enable the remote penning power to function. Once enabled the remote area will turn green and change from REMOTE OFF to REMOTE ON.



### 3.1 Sensitivity of the Gauge for Common Gases

If a Penning gauge is calibrated for air, the true pressure for a gas other than air is found by dividing the gauge reading by factor f. The value of f is fairly constant for most gases over the greater part of the operating range.

GAS	f
Helium	0.21
Hydrogen	0.4
Carbon Monoxide	0.95
Nitrogen	1.0
Air (Dry)	1.0
Oxygen	1.23
Carbon Dioxide	1.23
Argon	1.39

### 3.2 Use of a Recorder

A DC voltage signal (2-7 VDC), which is a log function of the pressure in the sensing tube, is available at the auxiliary connector on the back panel at pins “C” + and “D” -.

The equation is as follows to convert the voltage to a pressure reading:

$$\text{Pressure Torr} = (10^{\text{volt}}) / 1000000000$$

Example if voltage is 6.12

$$\text{Pressure Torr} = (10^{6.12}) / 1000000000$$

$$\text{Pressure Torr} = 1318256.7385564071020473747423042 / 1000000000$$

$$\text{Pressure Torr} = 0.00131 = 1.31 \times 10^{-3}$$

Example if voltage is 2.67

$$\text{Pressure Torr} = (10^{2.67}) / 1000000000$$

$$\text{Pressure Torr} = 467.73514128719819358209039209393 / 1000000000$$

$$\text{Pressure Torr} = 4.7 \times 10^{-7}$$

## 4.0 MAINTENANCE

### 4.1 Cleaning the GPH-001 Sensing Tube

The type GPH-001 sensing tube will in time become contaminated with residue from the vacuum system. It may be cleaned as follows:

- 4.1.1 Unplug the control circuit power cord and disconnect the tube cord from the tube.
- 4.1.2 Remove the tube from the vacuum system. Although the tube magnet is protected by a blue coating, you should take ordinary precautions to avoid the possibility of demagnetizing.
- 4.1.3 Unscrew the knurled cap-nut and withdraw the anode assembly from the tube casing. Remove or protect the gasket. Protect the gasket sealing surfaces.
- 4.1.4 Remove all carbon and residue from inside the tube casing. If suitable equipment is available, vapor blast (liquid honing) is an excellent method. Otherwise, remove deposits using a wire brush, scrapper, or fine abrasive cloth.

Soaking for 5 minutes in a strong sodium hydroxide solution will help to soften tenacious deposits.

**CAUTION: Sodium hydroxide will burn skin, eyes and clothing. This solution will also damage the magnet coating. Confine the solution to the inside of the tube casing. If necessary, the magnet may be removed by pressing off with an arbor press. Use non-magnetic tools to avoid altering magnet strength.**

- 4.1.5 Loosen the set screw and remove the anode loop from the rod extending from the center of the high-voltage insulator. Examine the interior of the insulator. If it is

dirty, clean it with the vapor blast method or a chemical cleaning solution. Also clean deposits from the anode loop assembly.

- 4.1.6 Wash the parts in clean water and isopropyl alcohol, and dry them under mild heat. Be sure to flush any particulate matter from inside the anode insulator and dry thoroughly.
- 4.1.7 Reassemble the anode loop assembly to the center rod. Maintain an arc gap of 0.010-0.015 inches between the projection of the anode support bushing and the grounded mounting ring. (See Figure 2). Make sure the set screw is seated squarely against the support rod so the anode loop is perpendicular to the magnetic field and centered between the pole pieces. Check the anode alignment visually after installing it in the casing.
- 4.1.8 Clean the vacuum sealing surfaces and lightly coat the O-ring gasket with high quality vacuum grease.
- 4.1.9 Reassemble the anode assembly to the casing.

## 4.2 Servicing Control Unit

**CAUTION: High voltages are present in the circuit. Use adequately insulated test equipment. Avoid sharp points which would cause corona discharge or field emission discharge when making or repairing solder connections.**

**Servicing should be done by qualified personnel only.**

The only attention likely to be needed by the GPH-325 is an occasional cleaning of the switch contacts and screen. If the wiring board becomes heavily coated with dust, clean it with alcohol or a good electronic cleaning solvent.

### 4.2.1 Cleaning the touch screen

Resistive touchscreen surface material is PET (polyethylene terephthalate, also called polyester). Capacitive touchscreen surface material is tempered glass. Both surfaces can be cleaned with the following method.

Using a cleaning solution of 75% alcohol or 1:100 diluted bleach, spray the solution on a dry cloth. Gently wipe the HMI's screen.

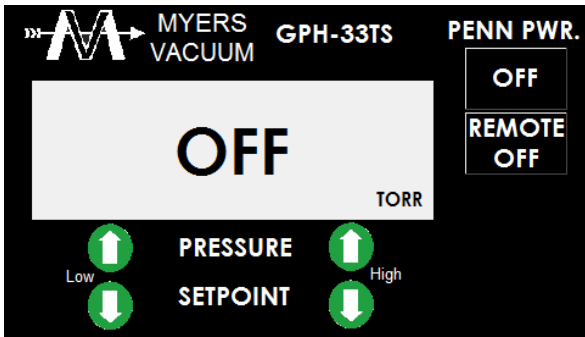
**Note:** Avoid spraying the solution directly onto the HMI.

### 4.3 Calibration

In normal use the gauge should not require recalibration. Errors in pressure indication caused by dirty sensing tubes should be corrected by cleaning as described in Section 4.1. After long use, or if circuit components have been changed, it may be desirable to recalibrate. Recalibration requires reference gauges of known accuracy and a clean vacuum system with provisions for connecting the reference gauge tube and the tube under calibration. A throttling type high-vacuum valve and a precision-metering air inlet valve are needed to control the pressure. The system is normally operated in a near static condition with the high-vacuum valve nearly closed and a small flow through the air inlet valve. Gas flow should be well diffused throughout the test chamber by suitable baffles.

**CAUTION: HIGH VOLTAGES ARE PRESENT IN THE PENNING GAUGE CIRCUIT. SERVICING SHOULD BE DONE BY QUALIFIED PERSONNEL ONLY.**

#### 4.3.1 Calibration using a Calibration Vacuum System



1. Pump the calibration system down to its base pressure which should be at least one decade below the lowest pressure calibration point. Operate the reference and test gauges for 30 minutes or more.
2. Adjust the pressure and stabilize it at  $1 \times 10^{-7}$  torr. Press the word Pressure on the screen, a pop up will appear, then use the arrows on the low to adjust pressure readings.
3. Adjust the pressure to  $9 \times 10^{-4}$  torr and use the arrows on the high to adjust pressure reading for the  $10^{-4}$  reading.
4. Press the word pressure on the screen to remove the adjustment screen popup.

#### 4.3.2 Calibration by Resistor Substitution

If a calibration system is not available, the gauge circuit can be calibrated by disconnecting a sensing tube and substituting the following fixed resistors which simulate the resistance of the sensing tube at the indicated pressures. Then adjust as in 4.3.1.

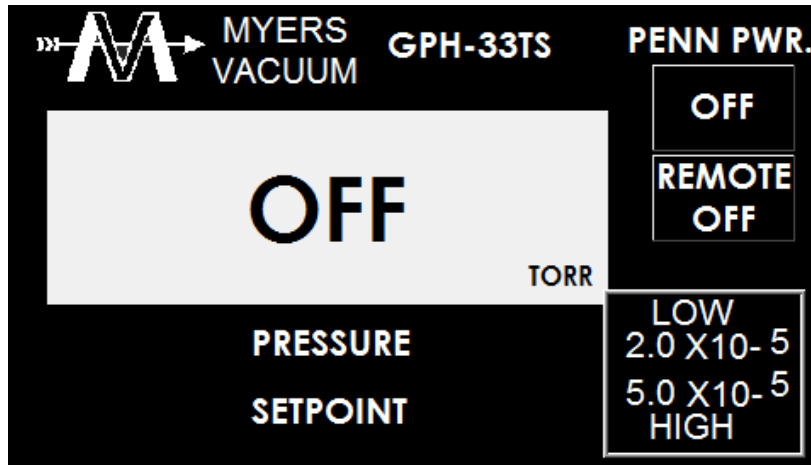
<u>Pressure</u>	<u>Resistance</u>	<u>Voltage</u>	<u>Current</u>
$1 \times 10^{-3}$ torr	456 K ohms	800	1750 uA
$1 \times 10^{-4}$ torr	3.85 megohms	2400	623 uA
$1 \times 10^{-5}$ torr	55 megohms	3200	58 uA

**Note** the operating voltage and use appropriate high-voltage resistors, or connect a sufficient number of standard resistors in series to withstand the voltage.

## 5.0 RELAY SETPOINT CONTROL

### 5.1 Description

The trip points can be adjusted to cover the pressure range. Both normally open (pin “G”) and normally closed (pin “F”) contacts are brought to the auxiliary connector on the rear panel of the gauge. The common relay connection is pin “E”. A mating connector is provided.



To adjust the trip in and trip out points for the relay, touch the screen in the area labeled SETPOINT and a pop up screen will appear. Press the screen in the area of needed change and a numerical keyboard will appear and necessary changes can be made.

If the setpoints are set to the same pressure or if the high is set higher than the low, the relay trip point is disabled.

In normal operation when the pressure is less than the low setpoint, the circuit is enabled and will disable once the pressure is above the high setpoint. The word setpoint on the screen will also indicate the function of the circuit by changing from white when not enabled to green when enabled.

## 6.0 REPLACEMENT PARTS LIST

MINIMUM ORDER BILLING OF \$75.00 PER ORDER. PLEASE INCLUDE PART NUMBER AND DESCRIPTION OF EACH PART ORDERED.

<u>Description</u>	<u>Part No.</u>
Power Cord Assembly, 8 ft.	5506544-9
Discharge Tube GPH-001A	282396
Anode Assembly	282395
Gasket	264091-5
Magnet	66267

### 6.1 Accessories

10' Cable Assembly, Discharge Tube	282394-1
15' Cable Assembly, Discharge Tube	282394-2
25' Cable Assembly, Discharge Tube	282394-3
50' Cable Assembly, Discharge Tube	282394-4
100' Cable Assembly, Discharge Tube	282394-5
Panel Mounting Kit	

### 6.2 Drawing List

502440	GPH-325 Assembly Drawing (various dash numbers)
502443	Schematic Electrical (proprietary)

## 7.0 ASSISTANCE FROM MYERS VACUUM

Myers offers the customer services listed below. Rates for these services are available from your Myers Vacuum Field Sales Office.

### Equipment Field Service

1. Emergency Service takes top priority. If your system does not operate, contact your Myers Vacuum Field Sales Office to arrange for a service call as soon as possible.
2. Scheduled Service is useful when your equipment requires check-out after installation, cleaning, repairing, rebuilding, modernizing, or moving to a new location.
3. Field Instruction can be given on the customer's equipment when desired.
4. Information includes the latest techniques and suggestions for more efficient operation.

**NOTE: Equipment Field Service does not include process assistance or service connections such as electrical or water service.**

### Myers Vacuum In-Plant Service

1. Instruction on system operation, technique, and equipment maintenance can be provided for customer personnel at the Myers plant in Kittanning, PA.
2. Scheduling of this instruction can be arranged through your Myers Vacuum Field Sales Office.
3. Warranty Repair Service: Products falling within the conditions of the Myers Standard Warranty will be repaired or replaced without cost other than transportation charges.
4. Factory Repair or Recalibration Service: Myers products may be shipped prepaid to our factory in Kittanning, PA for repair or recalibration. Cost estimates will be furnished when requested. On many standard products we can offer a fixed charge repair service which includes all necessary repairs, calibration where applicable, and upgrading of the product to include, as far as possible, all engineering changes to date.