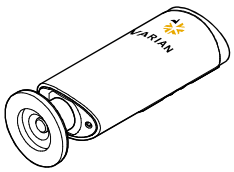
VARIAN
vacuum technologies

Pirani Standard Gauge

PVG-500
PVG-502

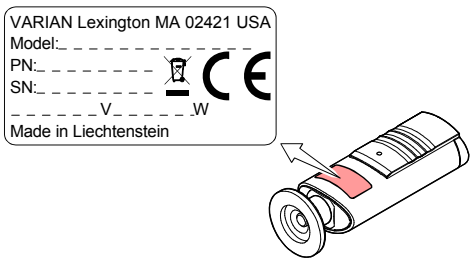


Instruction Manual
Incl. EC Declaration of Conformity

tqna44e1 (2010-05)

Product Identification

In all communications with VARIAN, please specify the information on the product nameplate. For convenient reference copy that information into the space provided below.



Validity

This document applies to products with the following part numbers:

W filament

PVG500KV16	(DN 16 ISO-KF, w/o switching functions)
PVG500KV16S	(DN 16 ISO-KF, with switching functions)

Ni filament

PVG502KV16S	(DN 16 ISO-KF, with switching functions)

The part number (PN) can be taken from the product nameplate.

We reserve the right to make technical changes without prior notice.

All dimensions in mm.

Intended Use

The Pirani Standard Gauges PVG-500 and PVG-502 have been designed for vacuum measurement of gases in the pressure range of 5×10^{-4} … 1000 mbar.

They must not be used for measuring flammable or combustible gases in mixtures containing oxidants (e.g. atmospheric oxygen) within the explosion range.

They can be operated in connection with an VARIAN controller or with another controller.

Safety

Symbols Used

DANGER

Information on preventing any kind of physical injury.

WARNING

Information on preventing extensive equipment and environmental damage.

Caution

Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.

Personnel Qualifications

Skilled personnel

All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the end-user of the product.

General Safety Instructions

- Adhere to the applicable regulations and take the necessary precautions for the process media used.
  Consider possible reactions between the materials and the process media.
  Consider possible reactions (e.g. explosion) of the process media due to the heat generated by the product.
- Adhere to the applicable regulations and take the necessary precautions for all work you are going to do and consider the safety instructions in this document.
- Before beginning to work, find out whether any vacuum components are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Communicate the safety instructions to all other users.

Liability and Warranty

VARIAN assumes no liability and the warranty becomes null and void if the end-user or third parties

- disregard the information in this document
- use the product in a non-conforming manner
- make any kind of interventions (modifications, alterations etc.) on the product
- use the product with accessories not listed in the product documentation.

The end-user assumes the responsibility in conjunction with the process media used.

Gauge failures due to contamination or wear and tear, as well as expendable parts (filament), are not covered by the warranty.

Technical Data

Measurement principle		thermal conductance according to Pirani
Measurement range (air, O_2, CO, N_2)		5×10^{-4} … 1000 mbar
Accuracy (N_2)		
1×10^{-3} … 100 mbar		±15% of reading
5×10^{-4} … 1×10^{-3} mbar		±50% of reading
100 … 1000 mbar		±50% of reading
Resolution		1% of reading
Repeatability		
1×10^{-3} … 100 mbar		2% of reading
Output signal (measurement signal)		
Voltage range	VDC	0 … +10.3
Measurement range	VDC	+1.9 … +10.0
Voltage vs. pressure		logarithmic 1.286 V/decade
Error signal	V	0 … +0.5
Filament rupture	V	+0.1
Output impedance	Ω	2×4.7
Minimum loaded impedance	kΩ	10, short-circuit proof
Response time	ms	80
Gauge identification		27.0 kΩ, referenced to supply common (voltage at pin 4 ≤5 V)
Adjustment		one tactile switch for ATM and HV adjustment
Switching functions		SP1, SP2
Threshold value indication and setting		one tactile switch at measurement value output. Press briefly for threshold indication. Keep pressing or press repeatedly for threshold setting.
Setting range		2×10^{-3} … 500 mbar
Hysteresis		10% above lower threshold
Relay contact		30 V, 0.5 ADC, floating
closed		at low pressure (LED is lit)
open		at high pressure, error, missing supply

Supply

DANGER

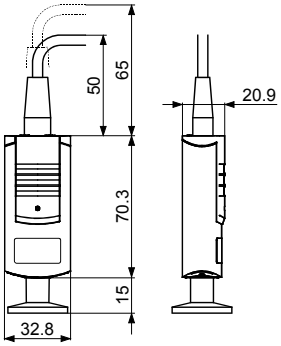
The gauge may only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded extra-low voltage (SELV). The connection to the gauge has to be fused [1].

Supply voltage		
At gauge	VDC	+14 … +30
Ripple	V_{pp}	≤1
Current consumption	mA	<500 (max. starting current)
Power consumption	W	≤1
Fuse required [1]	AT (slow)	1
Electrical connection		FCC 68 / RJ45 appliance connector, 8 poles, male
Sensor cable		8 poles plus shielding
Cable length		≤100 m (8×0.14 mm^2)
Grounding concept		→ "Power Connection"
Vacuum connection to signal common		connected via 1 MΩ (voltage difference <15 V)
Supply common to signal common		conducted separately, for differential measurement
Materials exposed to vacuum		DIN 1.4301, DIN 1.4305, DIN 1.4435, glass, Ni, NiFe
Filament		
PVG-500		W
PVG-502		Ni
Internal volume	cm^3	≈1.5
Admissible pressure	bar (abs.)	10, limited to inert gases

[1] VARIAN controllers fulfill these requirements.

Admissible temperatures		
Operation	°C	+5 … +60
Vacuum connection	°C	80
Filament	°C	110
Storage	°C	–20 … +65
Relative humidity	%	≤80 at temperatures up to ≤+31 °C, decreasing to 50 at +40 °C
Use		indoors only, altitude up to 2000 m NN
Mounting orientation		any
Degree of protection		IP40

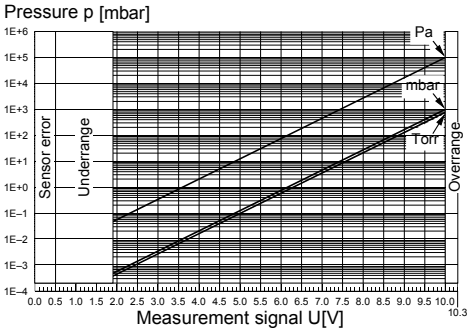
Dimensions mm



Weight		
DN 16 ISO-KF	g	80
DN 16 CF-R	g	100

Measurement Signal vs. Pressure

Pressure p [mbar]



$p = 10^{((U-c)/1.286)}$ ⇔ $U = c + 1.286 \times \log_{10} p$

valid in the range 5×10^{-4} mbar <p< 1000 mbar
3.75×10^{-4} Torr <p< 750 Torr
5×10^{-2} Pa <p< 1×10^{5} Pa

U	p	c
[V]	[mbar]	6.143
[V]	[µbar]	2.287
[V]	[Torr]	6.304
[V]	[mTorr]	2.448

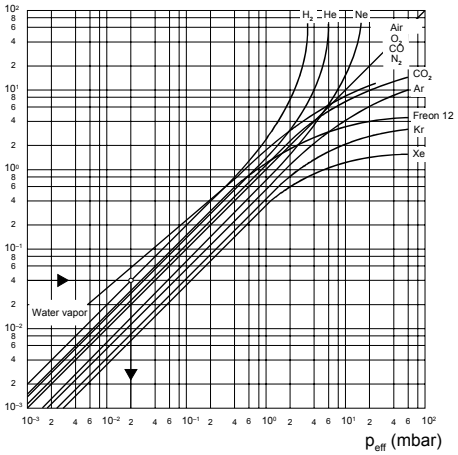
U	p	c
[V]	[micron]	2.448
[V]	[Pa]	3.572
[V]	[kPa]	7.429

where p pressure
U measurement signal
c constant (depending on pressure unit)

Gas Type Dependence

Pressure reading (gauge adjusted for air)

p (mbar)



Calibration factors for the pressure range below 1 mbar

$p_{eff} = C \times$ pressure reading

Gas type	Calibration factor C	Gas type	Calibration factor C
He	0.8	H_2	0.5
Ne	1.4	air, O_2, CO, N_2	1.0
Ar	1.7	CO_2	0.9
Kr	2.4	water vapor	0.5
Xe	3.0	freon 12	0.7

Installation

Vacuum Connection

DANGER

DANGER: overpressure in the vacuum system >1 bar

Injury caused by released parts and harm caused by escaping process gases can result if clamps are opened while the vacuum system is pressurized.

Do not open any clamps while the vacuum system is pressurized. Use the type of clamps which are suited to overpressure.

DANGER

DANGER: overpressure in the vacuum system >2.5 bar

KF connections with elastomer seals (e.g. O-rings) cannot withstand such pressures. Process media can thus leak and possibly damage your health.

Use O-rings provided with an outer centering ring.

DANGER

DANGER: protective ground

Incorrectly grounded products can be extremely hazardous in the event of a fault.

The gauge must be electrically connected to the grounded vacuum chamber. This connection must conform to the requirements of a protective connection according to EN 61010:

- CF connections fulfill this requirement.
- For gauges with a KF connection, use a conductive metallic clamping ring.

Caution

Caution: vacuum component

Dirt and damages impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.

Caution

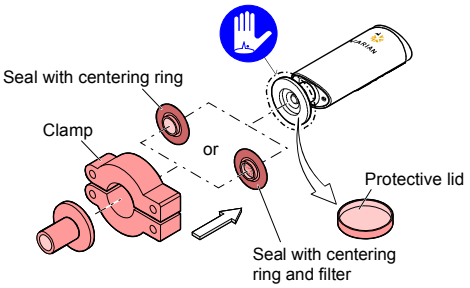
Caution: dirt sensitive area

Touching the product or parts thereof with bare hands increases the desorption rate.

Always wear clean, lint-free gloves and use clean tools when working in this area.

The gauge may be mounted in any orientation. To keep condensates and particles from getting into the measuring chamber preferably choose a horizontal to upright position and possibly use a seal with a centering ring and filter. If adjustment should be possible after the gauge has been installed, be sure to install it so that the button can be accessed with a pin (→ "Adjusting the Gauge").

Remove the protective lid and install the product to the vacuum system.

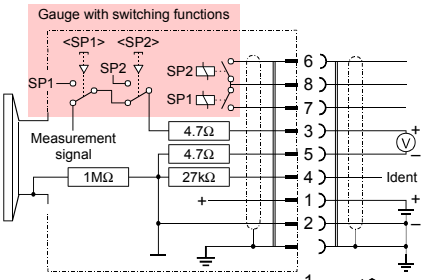


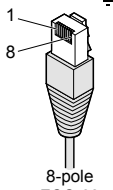
Keep the protective lid.

Power Connection

Make sure the vacuum connection is properly made (→ "Vacuum Connection").

1. If no sensor cable is available, make one according to the following diagram.





8-pole FCC-68 connector

Electrical connection

Pin 1	Supply
Pin 2	Supply common, GND
Pin 3	Measurement signal or thresholds SP1/2
Pin 4	Gauge identification
Pin 5	Signal common
Pin 6, 8	Relay SP2, closing contact
Pin 7, 8	Relay SP1, closing contact

2. Connect the sensor cable to the gauge and the controller.

Operation

When the supply voltage is applied, the measurement signal is available between pins 3 and 5 (relationship between measurement signal and pressure → "Technical Data").

Allow a stabilization period of at least 10 minutes. It is advisable to operate the gauge continuously, irrespective of the pressure.

Gas Type Dependence

The measurement value is gas dependent. The pressure reading applies to dry air, O_2, CO and N_2. For other gases, it has to be corrected (→ "Technical Data").

If the gauge is operated with an VARIAN controller, a calibration factor for correction of the actual reading can be applied (→ 🕮 of the corresponding controller).

Adjusting the Gauge

The gauge is factory calibrated. Due to long time operation or contamination, a zero drift could occur. Periodically check the zero and adjust it if necessary.

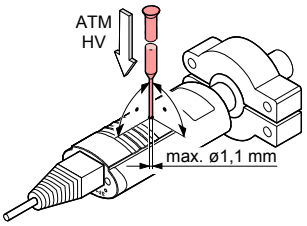
For adjusting the zero, operate the gauge under the same ambient conditions and in the same mounting orientation as normally.

The gauge is adjusted to default values. However, it can also be adjusted to other pressure values, if the exact pressure value is known (reference measurement).

1. If you are using a seal with centering ring and filter, check that they are clean or replace them if necessary (→ "Deinstallation").

2. Activate the gauge and operate it at atmospheric pressure for at least 10 minutes.

3. Press the button with a pin (max. ø1.1 mm) and the ATM adjustment is carried out: The gauge is adjusted to 1000 mbar (10 VDC) by default. By pressing the button >5 s the pressure value is increased towards 1200 mbar (or, by pressing it again, decreased towards 500 mbar) until the button is released or the limit is reached.

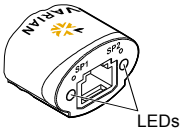


4. Evacuate to p ≪ 10^{-4} mbar (recommended) or to a pressure in the range of 10^{-4} … 10^{-2} mbar and wait at least 2 minutes.

5. Press the button with a pin and the HV adjustment is carried out: The gauge is adjusted to 1.2×10^{-4} mbar (1.1 VDC) by default. By pressing the button >5 s the pressure value is increased toward 1×10^{-2} mbar until the button is released or the limit is reached.

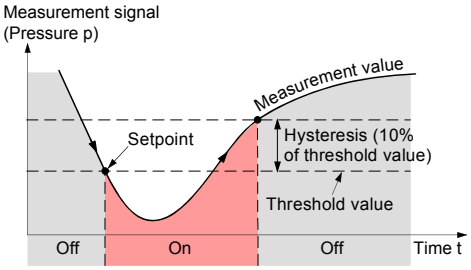
Switching Functions

The setpoints are adjustable within a pressure range of 2×10^{-3} … 500 mbar (voltage range of 2.67 … 9.61 VDC). Each switching function provides a floating relay contact (→ "Electrical Connection").



The status of the switching function is indicated by a LED.

Status	LED	Relay
off	off	deenergized



Adjusting the Setpoints

DANGER

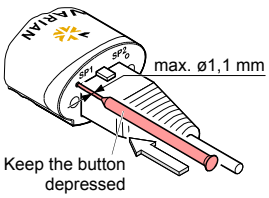
DANGER: malfunction

If processes are controlled via the signal output, keep in mind that by pressing a button <SP> the measurement signal is suppressed and that the corresponding threshold value is output instead. This can cause malfunctions.

Press a button <SP> only if you are sure that no damages can arise from a malfunction.

The status of the relay and LED is not affected by pressing the button.

1. Press the button <SP1> with a pin (max. ø1.1 mm):
The gauge changes to the switching function mode and outputs the current lower threshold value at the measurement value output for about 5 s. When the button is kept depressed for more than 5 s, the threshold setting is modified until the button is released or until the limit of the setting range is reached.



The upper threshold is 10% above the lower one (hysteresis).

2. When the button is pressed again within 5 s the threshold setting is adjusted in the reverse direction.

3. Release the button. The gauge resumes operation after 5 s and the connected controller displays the current measurement value.

The adjustment procedure for <SP2> is the same as described for <SP1>.

Deinstallation

DANGER

DANGER: contaminated parts

Contaminated parts can be detrimental to health and environment.

Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Caution

Caution: vacuum component

Dirt and damages impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.

Caution

Caution: dirt sensitive area

Touching the product or parts thereof with bare hands increases the desorption rate.

Always wear clean, lint-free gloves and use clean tools when working in this area.

1. Vent the vacuum system.

2. Put the gauge out of operation.

3. Unplug the sensor cable.

4. Remove the gauge from the vacuum system and install the protective lid.

Maintenance, Repair

In case of severe contamination or a malfunction, the sensor can be replaced.

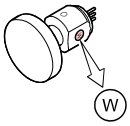
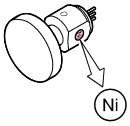
Gauge failures due to contamination or wear and tear, as well as expendable parts (filament), are not covered by the warranty.

VARIAN assumes no liability and the warranty becomes null and void if any repair work is carried out by the end-user or third parties.

Spare Parts

When ordering spare parts, always indicate:

- all information on the product nameplate
- description and ordering number according to the spare parts list

Sensor	for gauge	Ordering number
	PVG500KF16, PVG500KF16S	PVG500KF16RS
	PVG502KF16S	PVG502KF16RS

Returning the Product

WARNING

WARNING: forwarding contaminated products

Contaminated products (e.g. radioactive, toxic, caustic or microbiological hazard) can be detrimental to health and environment.

Products returned to VARIAN should preferably be free of harmful substances. Adhere to the forwarding regulations of all involved countries and forwarding companies and enclose a duly completed declaration of contamination.

Products that are not clearly declared as "free of harmful substances" are decontaminated at the expense of the customer.

Products not accompanied by a duly completed declaration of contamination are returned to the sender at his own expense.

Disposal

DANGER

DANGER: contaminated parts

Contaminated parts can be detrimental to health and environment.

Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

WARNING

WARNING: substances detrimental to the environment

Products or parts thereof (mechanical and electric components, operating fluids etc.) can be detrimental to the environment.

Dispose of such substances in accordance with the relevant local regulations.

Separating the components

After disassembling the product, separate its components according to the following criteria:

- Contaminated components

  Contaminated components (radioactive, toxic, caustic, or biological hazard etc.) must be decontaminated in accordance with the relevant national regulations, separated according to their materials, and disposed of.
- Other components

  Such components must be separated according to their materials and recycled.

EC Declaration of Conformity

We, VARIAN, hereby declare that the equipment mentioned below complies with the provisions of the Directive relating to electromagnetic compatibility 2004/108/EC.

Products

Pirani Standard Gauge

PVG-500
PVG-502

Standards

Harmonized and international/national standards and specifications:

- EN 61000-6-2:2005 (EMC: generic immunity standard)
- EN 61000-6-3:2007 (EMC: generic emission standard)
- EN 61010-1:2001 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326-1:2006 (EMC requirements for electrical equipment for measurement, control and laboratory use)

Manufacturer / Signature

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19 May 2010

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