

Agilent Cold Cathode Pirani Gauge FRG-705, FRG-707

## User Manual



# Notices

## Manual Part Number

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## Safety Notices

### CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

### WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

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# 1 Instructions for Use

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## About this manual

### Validity

This manual lists the instructions for the users of the FRG-705 and FRG-707, with particular reference to the notions relating to safety, operation and first level maintenance, limited to maintenance operations for which the user is responsible.

The maintenance operations, illustrated in the specific sections, with specific provisions relating to the higher level of maintenance (personnel specifically trained for maintenance operations) must not be carried out by the user.

For a correct installation and start/stop, please refer to "Installation" chapter.

For more detailed technical use, please refer to "Operations" chapter.

#### NOTE

- 1 This manual contains useful information so that all personnel using the FRG-705 and FRG-707 can operate it safely and guarantee perfect efficiency, for its entire life span.
  - 2 Keep this manual, together with all the related publications, in an accessible place known to all operators/maintenance personnel.
-

## Definitions and terminology

### Definition of Caution, Warning and Note

Some important references of this manual are highlighted and framed in contrasting color.

---

**CAUTION**

Caution messages are displayed before procedures which, if not observed, could cause damage to the equipment.

---

**WARNING**

Warning messages draw the operator's attention to a specific procedure or practice which, if not performed correctly, could result in serious personal injury.

---

**NOTE**

Notes are intended to call attention to important information and provide more detail regarding specific steps.




---

## Warning Symbols

The following is a list of symbols that appear in conjunction with warnings on the FRG-705 and FRG-707. The hazard they describe is also shown. A triangular symbol indicates a warning. The meanings of the symbols that may appear alongside warnings in the documentation are as follows.

The following symbol may be used on warning labels attached to the instrument. When you see this symbol, refer to the relevant operation or service manual for the correct procedure referred to by that warning label.



	Generic hazard
	CE certification
	Waste Electrical and Electronic Equipment

# Safety

This section contains the information, prescribed by the Low Voltage Directive 2014/35/EU, which is essential for the compliance and observance of the safety regulations both generally and in relation to the specific use of the product.

Failure to comply with these instructions and the other instructions contained in this manual may render the safety conditions envisaged in the design phase inefficient and cause accidents to those operating the product.

Agilent Technologies declines all responsibility for damage to the product or for the physical safety of the operator or third parties deriving from the non-observance of the safety rules indicated in the technical documentation.

## Proper use

This manual contains important warnings and safety instructions to be observed in order for the unit to work safely.

The product described in this manual is intended exclusively for the area of application specified in the instructions. The manual also provides indications regarding the essential requirements for the application and operation of the product as well as the safety measures that can be adopted to guarantee regular operation. Agilent Technologies does not provide any guarantee or assume any responsibility for applications other than those described in this manual or in which the essential requirements and safety measures are not respected.

The product must only be used by qualified personnel who are able to take the necessary safety measures under conditions that do not cause damage or injury. Any accessories and equipment used with the product must be supplied or approved by Agilent Technologies. Any adjustment or maintenance operation must be performed by a professional technician informed about the risks.

Repairs on the product must be carried out exclusively by Agilent authorized personnel.

## Instructions for Use

### Improper use

Agilent Technologies declines all responsibility, deriving from the improper use of the FRG-705 and FRG-707.

Agilent 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 corresponding 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 (e.g. ionization chamber, ignition aid, Pirani filament) are not covered by the warranty.

## Instructions for Use

### Safety guideline for FRG-705 and FRG-707

- 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 (Pirani filament 120° C).
- 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.
- The device must not be connected to the internet.

Communicate the safety instructions to all other users.

#### 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

##### **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.**

---

## Disposal

### Meaning of the "WEEE" logo found in labels.

The following symbol is applied in accordance with the EC WEEE (Waste Electrical and Electronic Equipment) Directive.

This symbol (valid only in countries of the European Community) indicates that the product it applies to must NOT be disposed of together with ordinary domestic or industrial waste but must be sent to a differentiated waste collection system. The end user is therefore invited to contact the supplier of the device, whether the Parent Company or a retailer, to initiate the collection and disposal process after checking the contractual terms and conditions of sale.



**Figure 1** Logo "WEEE"

For more information refer to:

<http://www.agilent.com/environment/product/index.shtml>

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.

## Service

Should a customer need support, please contact local distributor or directly e-mail to:

[vpt-customer@agilent.com](mailto:vpt-customer@agilent.com)

[vpl-customer@agilent.com](mailto:vpl-customer@agilent.com)

Completion of the "Request for Return" form is required to return your product to Agilent for service (provided at the end of this manual).

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## Product Description

The Cold Cathode Gauges FRG-705 and FRG-707 have been designed for vacuum measurement of gases in the pressure range of  $1 \times 10^{-9}$  ... 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.

Gauges with gauge identification can be operated in connection with an Agilent gauge controller AGC-100, AGD-100, XGS-600 and Turbo AG controllers.

Over the whole measuring range, the measuring signal is output as a logarithm of the pressure. The gauge consists of two separate measurement systems (Pirani and cold cathode system according to the inverted magnetron principle).

They are combined in such a way that for the user, they behave like one measuring system. The Pirani measurement circuit is always on.

This document applies to products with part numbers:

Description	Part Number
FRG-705 Pirani/inverted magnetron combination full range gauge, Low Current, NW25KF flange.	<b>FRG705KF25</b>
FRG-705 Pirani/inverted magnetron combination full range gauge, Low Current, DN 40 (2.75in) ConFlat flange.	<b>FRG705CF35</b>
FRG-705 Pirani/inverted magnetron combination full range gauge, Low Current, with RS485, NW25KF flange.	<b>FRG705KF25SI</b>
FRG-705 Pirani/inverted magnetron combination full range gauge, Low Current, with RS485, DN 40 (2.75in) ConFlat flange.	<b>FRG705CF35SI</b>
FRG-707 Pirani/inverted magnetron combination full range gauge, High Current, NW25KF flange.	<b>FRG707KF25</b>
FRG-707 Pirani/inverted magnetron combination full range gauge, High Current, DN 40 (2.75in) ConFlat flange.	<b>FRG707CF35</b>
FRG-707 Pirani/inverted magnetron combination full range gauge, High Current, with RS485, NW25KF flange.	<b>FRG707KF25SI</b>
FRG-707 Pirani/inverted magnetron combination full range gauge, High Current, with RS485, DN 40 (2.75in) ConFlat flange.	<b>FRG707CF35SI</b>

## Technical Information

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

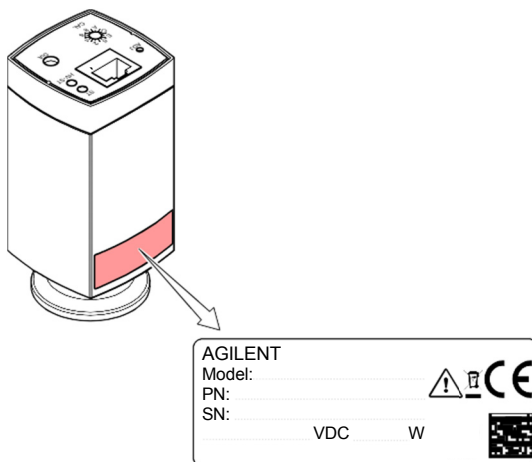


Figure 2

## Technical Specifications

**Table 1** Technical Specifications

FRG-705, FRG-707 Specifications	Value
Measuring range (air, N <sub>2</sub> )	1×10 <sup>-9</sup> ... 1000 mbar
Accuracy (N <sub>2</sub> )	
1×10 <sup>-8</sup> ...100 mbar	30% of reading
100 ...1000 mbar	50% of reading
Repeatability (N <sub>2</sub> )	
1×10 <sup>-8</sup> ...100 mbar	5% of reading
Gas type dependence	See page 22
Voltage range (analog output)	0 ... +10.5 V
Measuring range	+1.398 ... +8.6 V (dc)
Voltage vs. pressure	logarithmic, 0.6 V / decade
Status signal	14.5 ... 30 V (ignited)
Error signal	+9.5 ... +10.5 V
Output impedance	2 x 4.7 Ω, short-circuit proof
Load impedance	≥ 10 kΩ, short-circuit proof
Step response time (pressure dependent)	
>1 x 10 <sup>-6</sup> mbar	<100 ms
1 x 10 <sup>-6</sup> ... 1 x 10 <sup>-8</sup> mbar	≈1 s
Gauge identification	85 kΩ referenced to supply common
Status signal (digital output)	
FCC receptacle	
Current rating	100 mA
High voltage is ON	+14.5 ... +30 V (dc) (depending on supply voltage)
High voltage is OFF	0 V (dc)
High voltage cut-in, low active (digital input)	
High voltage ON	<2.5V (dc)
High voltage OFF	>4.0V (dc)
High voltage cut-in, high active (digital input)	
High voltage ON	>11.0V (dc)
High voltage OFF	>5.0V (dc)

## Technical Information

Table 1 Technical Specifications (continued)

**WARNING**



The gauge may only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded extra-low voltage (PELV) and limited power source (LPS), Class 2. The connection to the gauge has to be fused <sup>1)</sup>.

Supply voltage at the gauge <sup>2)</sup>	+14.5 ... +30 V (dc)
Ripple	≤1 V <sub>pp</sub>
Power consumption with fieldbus interface	≤2.5 W
Fuse to be connected <sup>1)</sup>	≤1 AT
High voltage in the measuring chamber	
Ignition voltage	≤4.5 kV
Operating voltage	≤3.3 kV
Current in the measuring chamber	
FRG-707	high current
FRG-705	low current
Electrical connection	
FRG-705/FRG-707	FCC 68, 8-pin
FRG-70xxxxSI	D-sub HD, 15 pin
Sensor cable	
FCC connector	8-pin, shielded
D-sub connector	9-pin, shielded
Cable length (FCC only)	≤50 m (0.14 mm <sup>2</sup> /conductor)
Grounding concept	"Power Connection"
Vacuum connection – signal common	connected via 10 kΩ (potential difference ≤16 V)
Supply common – signal common	conducted separately; differential measurement is recommended
Materials exposed to vacuum	
Vacuum connection	stainless steel (1.4435)
Measuring chamber	stainless steel (1.4435)
Pirani filament	W
Feedthrough	
Isolation	glass, ceramic (Al <sub>2</sub> O <sub>3</sub> )
Ring	stainless steel (1.4435)
Anode	molybdenum
Pin	Ni alloy

<sup>1)</sup> Agilent controller fulfill these requirements.

<sup>2)</sup> The minimum voltage of the power supply unit must be increased proportionally to the length of the sensor cable.

## Technical Information

**Table 1 Technical Specifications (continued)**

FRG-705, FRG-707 Specifications	Value
Feedthrough Anode	ceramic coated molybdenum
Ionization chamber	stainless steel (1.4301, 1.4016) Ti
Ignition aid	stainless steel (1.4310)
Internal volume DN 25 ISO-KF DN 40 CF-F	≈19.9 cm <sup>3</sup> ≈25.2 cm <sup>3</sup>
Permissible pressure (absolute)	10 bar, limited to inert gases <55 °C
Bursting pressure (absolute)	>13 bar
Permissible temperatures Operation Pirani filament Bakeout Storage	+5 °C ... +55 °C 120 °C ≤150 °C <sup>3)</sup> -40 °C ... +70 °C
Relative humidity, year's mean during 30 days a year 1×10 <sup>-8</sup> ... 1×10 <sup>-2</sup> mbar 1×10 <sup>-8</sup> ... 1×10 <sup>-2</sup> mbar	≤70% (non-condensing) ≤95% (non-condensing)
Mounting orientation	any
Use	indoors only, altitude up to 6000 m NN
Pollution degree	2
Degree of protection	IP 40
Weight DN 25 ISO-KF DN 40 CF-F	≤280 g ≤570 g

<sup>3)</sup> Without electronics unit

## FRG-705 and FRG-707 Outline

Dimensions [mm]

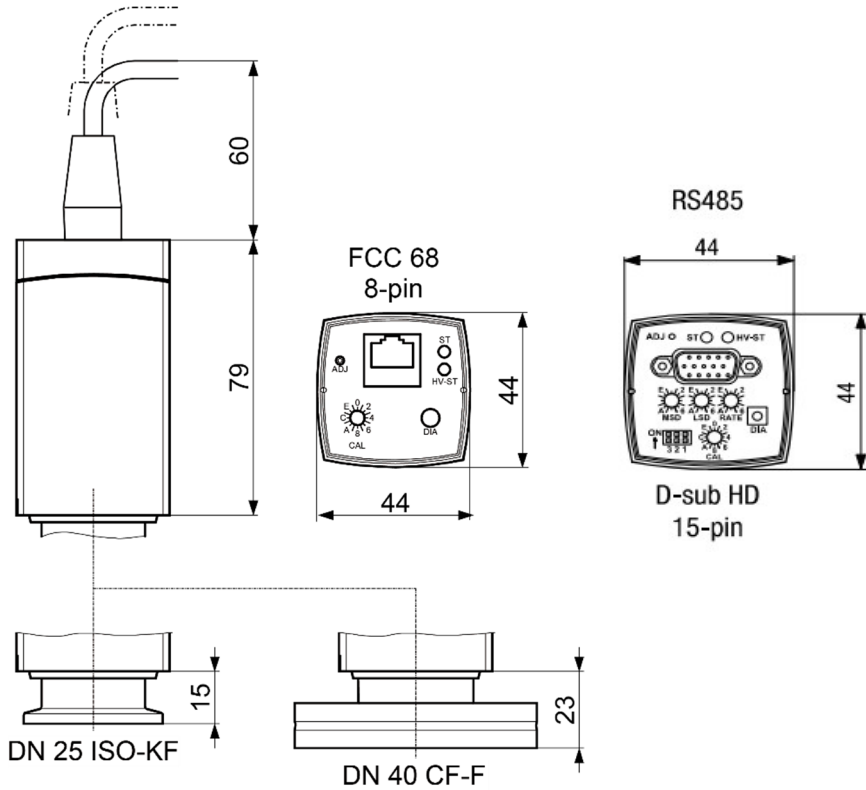
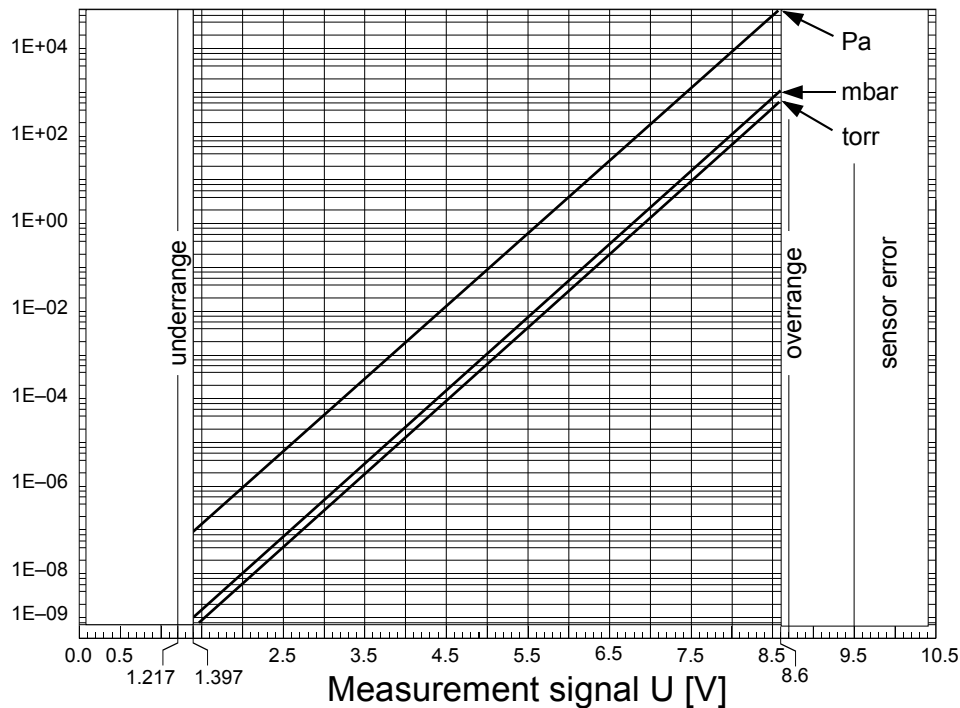


Figure 3 FRG-705 and FRG-707 Outline

## Technical Information

### Measurement range 1.398 ... 8.6 V

#### Pressure p



$$p = 10^{1.667U-d} \Leftrightarrow U = c + 0.6 \log p$$

valid in the range  $1 \times 10^{-9}$  mbar  $< p < 1000$  mbar  
 $7.5 \times 10^{-10}$  Torr  $< p < 750$  Torr  
 $1 \times 10^{-7}$  Pa  $< p < 1 \times 10^5$  Pa

	mbar	Pa	Torr
c	6.798	5.598	6.873
d	11.33	9.333	11.46

where p pressure  
 U measurement signal  
 c, d constant (pressure unit dependent)

Figure 4

## Technical Information

### Gas Type Dependence

Indication range from  $10^2 \dots 10^{-2}$  mbar (Pirani-only operation)

Indicated pressure (gauge calibrated for air)

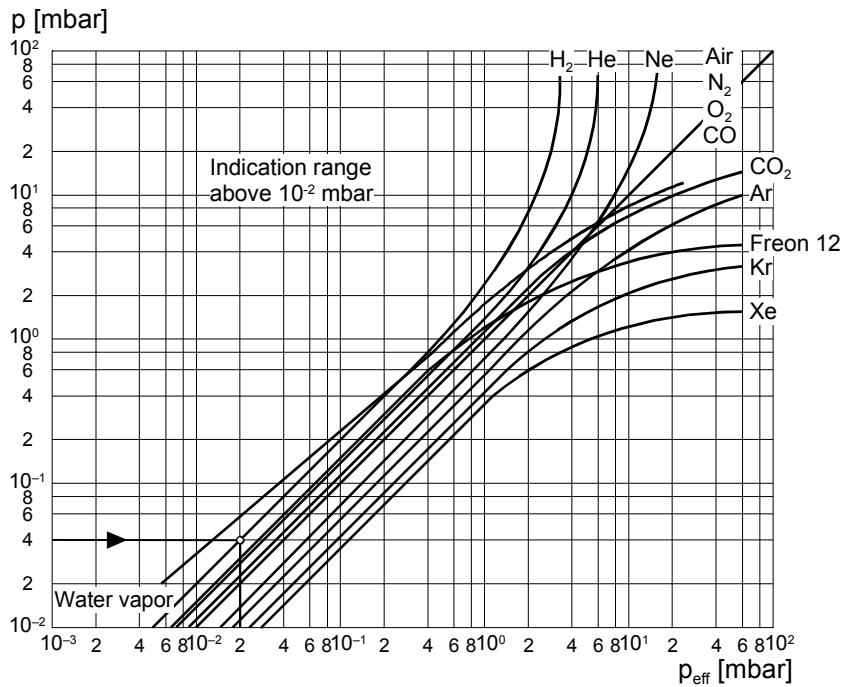
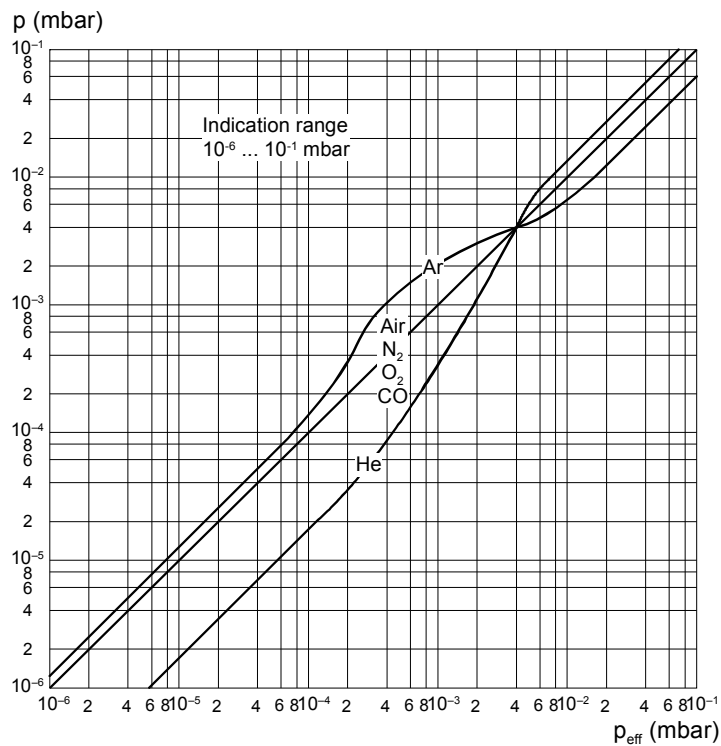


Figure 5

## Technical Information

### Indication range $10^{-6}$ ... 0.1 mbar

Indicated pressure (gauge calibrated for air)



### Indication range below $10^{-5}$ mbar

In the range below  $10^{-5}$  the pressure indication is linear. For gases other than air, the pressure can be determined by means of a simple conversion formula:

$$p_{\text{eff}} = K \times \text{indicated pressure}$$

Figure 6

## Technical Information

In the range below  $10^{-5}$  mbar, the pressure indication is linear. For gases other than air, the pressure can be determined by means of a simple conversion formula:

$$p_{\text{eff}} = K \times \text{pressure indicated}$$

where	gas type	K
	air (O <sub>2</sub> , CO, N <sub>2</sub> )	1.0
	Xe	0.4
	Kr	0.5
	Ar	0.8
	H <sub>2</sub>	2.4
	Ne	4.1
	He	5.9

These conversion factors are average values.

### NOTE

A mixture of gases and vapors is often involved. In this case, accurate determination is only possible with a partial pressure measurement instrument, e.g. a quadrupole mass spectrometer.

---

## Installation

### Vacuum Connection

**WARNING**

**Leaking process media**



High-intensity mechanical, chemical or thermal impacts can cause leaks in the measuring sensor. Process media can thus leak and possibly cause hazards, if overpressure is in the vacuum system.

- Avoid high-intensity mechanical, chemical or thermal impacts and overpressure in the vacuum system.
  - Take appropriate measures (e.g. shut off gas supply, extraction, leak test) to avoid hazards or damage due to leaking process media.
- 

**WARNING**

**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.

---

**WARNING**

**DANGER: overpressure in the vacuum system >2.5 bar.**



KF flange 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.

---

**WARNING**

**DANGER: protective ground**



Products that are not professionally connected to ground can be extremely hazardous in the event of a fault.

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

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

## Technical Information

### 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.

---

## Technical Information

### NOTE

Mount the gauge so that no vibrations occur. Vibrations at the gauge cause a deviation of the measured values. 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. For potentially contaminating applications and to protect the measurement system against contamination, installation of the optional seal with centering ring and filter is recommended.

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

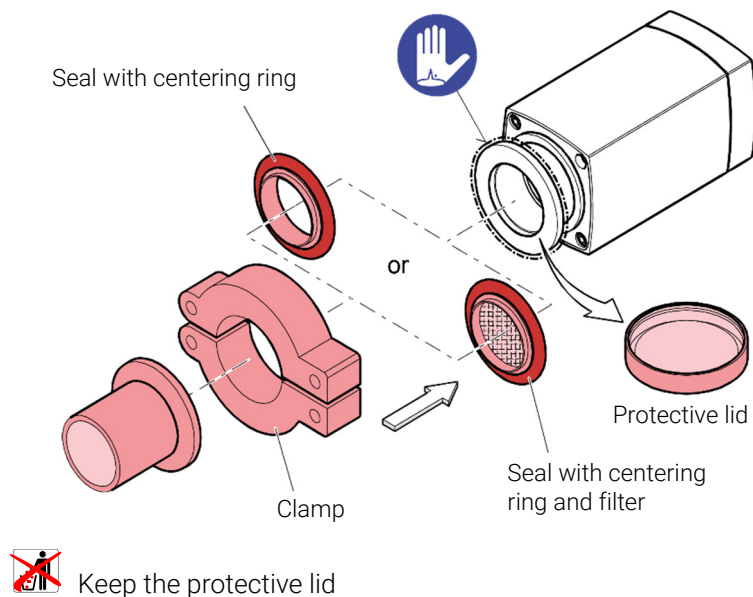
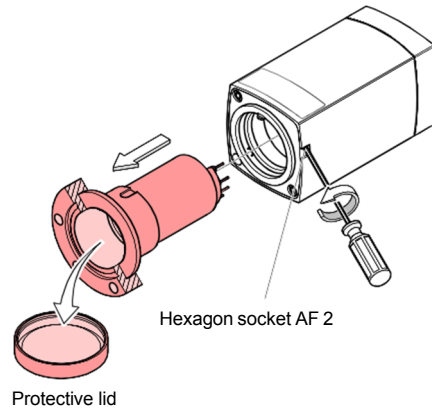


Figure 7

## Technical Information

### NOTE

When making a CF flange connection, it may be advantageous to temporarily remove the electronics unit.



Keep the protective lid

Figure 8

## Power Connection

NOTE

Make sure the vacuum connection is properly made.

---

WARNING



The gauge may only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded protective extra-low voltage (PELV) and limited power source (LPS), Class 2. The connection to the gauge has to be fused. <sup>4)</sup>

---

NOTE

Ground loops, differences of potential, or EMC problems may affect the measurement signal. For optimum signal quality, please do observe the following notes:

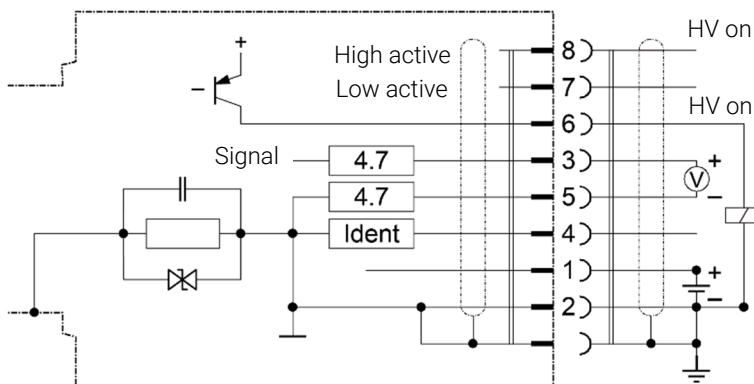
- Use an overall metal braided shielded cable. The connector must have a metal case.
  - Connect the supply common with protective ground directly at the power.
  - Use differential measurement input (signal common and supply common conducted separately).
  - Potential difference between supply common and housing  $\leq 6$  V (overvoltage protection).
- 

<sup>4)</sup> Agilent controllers fulfill these requirements.

## Technical Information

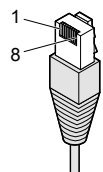
### FCC 68, 8-pin Connector

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



### Electrical connection

Pin 1	Supply (14.5 ...30 Vdc)
Pin 2	Supply common GND
Pin 3	Signal output (measuring signal)
Pin 4	Gauge identification
Pin 5	Signal common
Pin 6	Status signal
Pin 7 *)	
Pin 8 *)	



FCC 68  
8-pin

\*) Pin 7 and 8 are not assigned

Figure 9

## Technical Information

### Status Indication

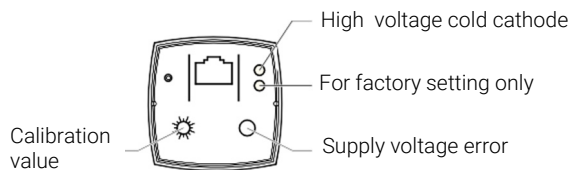


Figure 10

Table 2

LED		Meaning
<ST>	<HV-ST>	
OFF	OFF	No supply voltage
Lit solid green	OFF	Supply voltage = ok, Pirani active, no high voltage in the measuring chamber
Lit solid green	Blinking green	Supply voltage = ok, pressure in the cold cathode range, cold cathode has not ignited
Lit solid green	Lit solid green	Cold cathode has ignited.
Lit solid green	OFF	Measurement system error
Blinking red	OFF	EEPROM error

# Operation

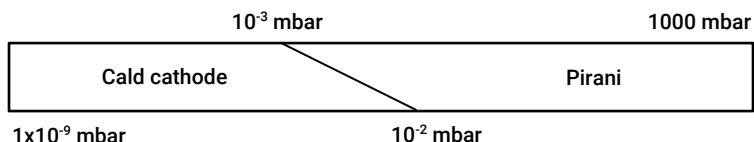
When the supply voltage is applied, the measuring signal is available at the signal output.

Allow for a stabilizing time of approx. 10 min. Therefore it is advisable to operate the gauge continuously, irrespective of the pressure.

## Measurement Principle, Measuring Behavior

The gauge consists of two separate measuring systems: Pirani and cold cathode system according to the inverted magnetron principle. They are combined in such a way that for the user, they behave like one measuring system.

The optimum measuring configuration for the particular pressure range, in which measurement is performed, is used.



- The Pirani measuring circuit is always on
- The cold cathode measuring circuit is controlled by the Pirani circuit and is activated only at pressures  $< 1 \times 10^{-2}$  mbar

As long as the cold cathode measuring circuit has not ignited, the measuring value of the Pirani is output as measuring signal.

## Technical Information

### Gas Type Dependence

The measurement value is gas dependent. The pressure reading applies to dry air, O<sub>2</sub>, CO and N<sub>2</sub>. For other gases, it has to be corrected:

- FRG-705/FRG-707 on page 22

If the gauge is operated with an Agilent controller, a calibration factor for correction of the actual reading can be applied.

### Ignition Delay

An ignition delay occurs when cold cathode gauges are switched on. The delay time increases at low pressures and for clean, degassed gauges it is typically:

$1 \times 10^{-5} \dots 1 \times 10^{-2}$ mbar	< 1	second
$1 \times 10^{-7} \dots 1 \times 10^{-5}$ mbar	< 20	seconds
$5 \times 10^{-9} \dots 1 \times 10^{-7}$ mbar	< 2	minutes
$< 5 \times 10^{-9}$ mbar	< 20	minutes

The ignition is a statistical process. Already a small amount of depositions on the inner surfaces can have a strong influence on it

As long as the cold cathode measuring circuit has not yet ignited, the measured value of the Pirani is output as measuring signal. The status output (= 0 V) indicates the Pirani-only mode.

#### NOTE

If the gauge is activated at a pressure  $p < 3 \times 10^{-9}$ , the gauge cannot recognize whether the cold cathode system has ignited.

#### NOTE

Once flanged on, permanently leave the gauge in the operating mode irrespective of the pressure range. Like this, the ignition delay of the cold cathode measuring circuit is always negligible (<1 s), and thermal stabilizing effects are minimized.

### Contamination

#### NOTE

Gauge failures due to contamination or wear and tear as well as expendable parts (e.g. ionization chamber, ignition aid, Pirani filament) are not covered by the warranty.

Gauge contamination is influenced by the process media used as well as by any existing or new contaminants and their respective partial pressures. Continuous operation in the range of  $10^{-4}$  mbar ...  $10^{-2}$  mbar can cause severe contamination as well as reduced up-time.

Contamination of the gauge generally causes a deviation of the measured values:

- In the high pressure range ( $1 < 10^{-3}$  mbar ... 0.1 mbar), the pressure reading is too high (as a consequence of the contamination of the Pirani element). Readjustment of the Pirani.
- In the low pressure range ( $p < 1 \times 10^{-3}$  mbar), the pressure reading is usually too low (as a consequence of the contamination of the cold cathode system). In case of severe contamination, instabilities can occur (layers of the measuring chamber peel off). Contamination due to insulation layers can even lead to a complete failure of the discharge.

Contamination can to a certain extent be reduced by:

- geometric protection measures (e.g. screenings, elbows) for particles that spread rectilinearly.
- mounting the flange of the gauge at a place where the partial pressure of the pollutants is particularly low.

Special precautions are required for vapors deposited under plasma (of the cold cathode measuring system).

While vapors occur it may even be necessary:

- to temporarily switch off the gauge
- to temporarily seal off the gauge from the vacuum chamber using a valve.

# Adjusting the Gauge

The cold cathode measuring circuit, which is dominant for low pressures ( $<1 \times 10^{-3}$  mbar), is factory-calibrated and cannot be adjusted.

The gauge is factory-calibrated and requires no maintenance. In the event of a defect

- only replace the ionization chamber and ignition aid, or
- replace the measuring chamber cpl. (spare sensor).

The HV adjustment of the Pirani measuring circuit is carried out automatically by the gauge itself at pressures  $<1 \times 10^{-5}$  mbar.

The new zero point is saved non-volatile every 15 minutes. Any adjustment has a negligible effect on the pressure range between approx.  $10^{-2}$  mbar and  $10^2$  mbar.

If used under different climatic conditions, through extreme temperatures, aging or contamination the characteristic curve can be offset and a manually readjustment or a maintenance may become necessary.

An adjustment via the <ADJ> button can become necessary, if pressure values  $<10^{-2}$  mbar are no longer output.

## Technical Information

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

The zero can be adjusted via

- the <ADJ> button on the gauge,
- the diagnostic port
- the 485C interface.

- 1 If you are using a seal with centering ring and filter, check that they are clean or replace them if necessary.
- 2 Put the gauge into operation and operate it at atmospheric pressure for at least 10 minutes.
- 3 Briefly press the <ADJ> button with a pin (max.  $\varnothing 1.1$  mm) and the ATM adjustment is carried out, or ...

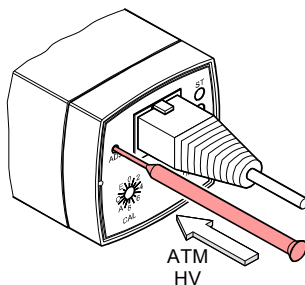


Figure 11

... perform the adjustment via the diagnostic port or via the serial interface.

The Pirani sensor is adjusted to 1000 mbar (duration  $\approx 5$  s).

## Technical Information

### NOTE

If the pressure value 1000 mbar is output at the measurement value output, the adjustment has been successful. Otherwise, repeat the adjustment procedure.

---

- 4 Evacuate the vacuum system to  $p < 10^{-5}$  mbar and wait at least 2 minutes.
- 5 Press the <ADJ> button with a pin and the HV adjustment is carried out (duration  $\approx 5$  s).

### NOTE

If the pressure value  $1 \times 10^{-5}$  mbar is output at the measurement value output, the adjustment has been successful. Otherwise, repeat the adjustment procedure.

---

## Deinstallation

**WARNING**



**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**

**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**

**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.

### Procedure

- 1 Vent the vacuum system.
- 2 Put the gauge out of operation and disconnect the sensor cable.
- 3 Remove the gauge from the vacuum system and install the protective lid.

**NOTE**

When deinstalling the CF flange connection, it may be advantageous to temporarily remove the magnet unit.

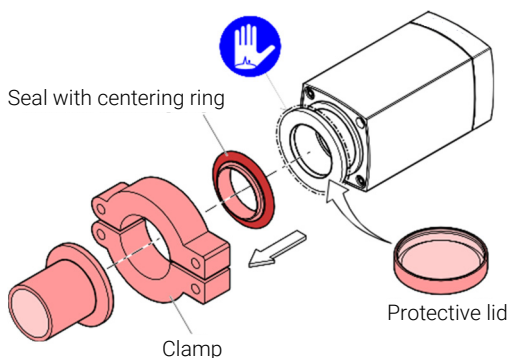


Figure 12

## Technical Information

### Cleaning the Gauge/Replacing Parts

#### NOTE

In case of severe contamination or defective (e.g. Pirani filament rupture), replace the complete measuring chamber.

---

#### WARNING



#### 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

#### 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

#### 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

---

#### WARNING



#### Cleaning agents

Cleaning agents can be detrimental to health and environment. Adhere to the relevant regulations and take the necessary precautions when handling and disposing of cleaning agents. Consider possible reactions with the product materials

---

#### Precondition

Gauge deinstalled.

## Troubleshooting

In case of an error, it may be helpful to just turn off the mains supply and turn it on again after 5 s.

**Table 3 Troubleshooting Table**

Problem	LED <ST>	LED <HV-ST>	Status Signal	Possible Cause	Correction
No voltage at signal output.	OFF	OFF	0	No supply voltage.	Turn on power supply.
Measuring signal unstable.	lid solid green	lid solid green	0	Gauge contaminated.	Replace ionization chamber or measuring chamber cpl.
Voltage at signal output does not drop under <4.82 V.	lid solid green	blinking red	0	Gas discharge has not ignited.	Wait, until the gas discharge has ignited (≈5 minutes at a pressure of $10^{-9}$ mbar).
Voltage at signal output continually > 5.6 V.	lid solid green	OFF	0	Pirani zero point shift.	Perform a HV adjustment via button.
Voltage at signal output continually > 9.5 V.	lid solid green	OFF	0	Pirani defective.	Replace the measuring chamber cpl.
	blinking red	OFF	0	EEPROM error.	Switch the gauge off and on again after 5 s. Replace the gauge.
Signal continually at approx. $5 \times 10^{-4}$ mbar.	lid solid green	lid solid green	14.5 ... 30 V	Measuring chamber severely contaminated.	Replace the measuring chamber cpl.

## Technical Information

### Troubleshooting (measuring chamber)

If the cause of the fault is suspected to be in the measuring chamber, the following checks can be made with an ohmmeter.

#### Tools / material required

- Allen wrench AF 2
- Pliers for retaining ring
- Ohmmeter

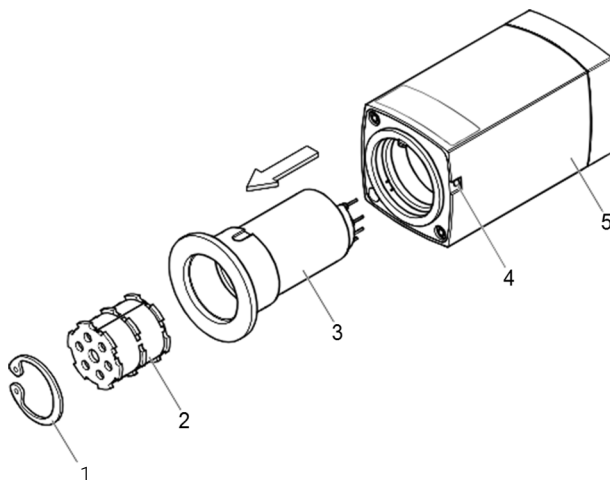




Figure 13

- 1** Unfasten the hexagon socket set screw (4) and remove the complete measuring chamber (3) from the electronics unit (5).
- 2** Remove the retaining ring (1) as well as the ionization chamber (2) from the measuring chamber (3).
- 3** Check the ionization chamber and the measuring chamber for contamination:
  - Ionization chamber is contaminated only: Replace ionization chamber.
  - Measuring chamber is severely contaminated: Replace complete measuring chamber.

## Technical Information

- 4 Using an ohmmeter, make following measurements on the contact pins.

Table 4

Measurement between pins			Possible cause
1 + 4	39.5 ... 40.5 $\Omega$ (at 20 °C)	Values outside of the range	Pirani filament rupture
1 + 2	1000 ... 1100 $\Omega$ (at 20 °C)	Values outside of the range	Pirani temperature sensor rupture
5 + measuring chamber	$\infty$	$\ll \infty$	Contamination, short circuit cold cathode

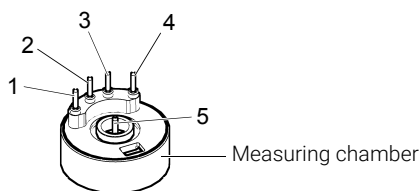


Figure 14

All of these faults can only be remedied by replacing the complete measuring chamber.

- 5 We recommend to perform a leak test (leak rate  $<1 \times 10^{-9}$  mbar l/s).

## Replacing Ionization Chamber and Ignition Aid

### Precondition

Troubleshooting (measuring chamber) performed

## Technical Information

- 1 Due to contamination remove the ignition aid with the removing tool.

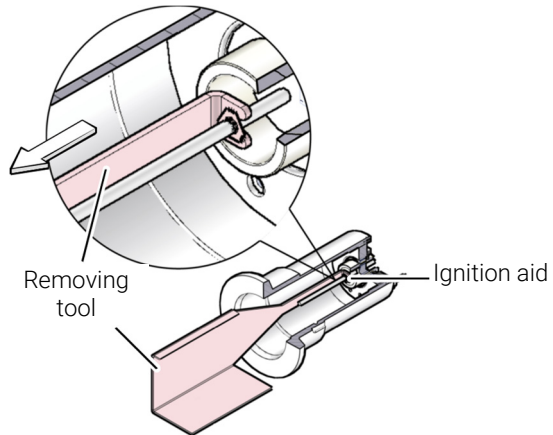


Figure 15

- 2 Insert e.g. a Scotch-Brite into the mounting tool.

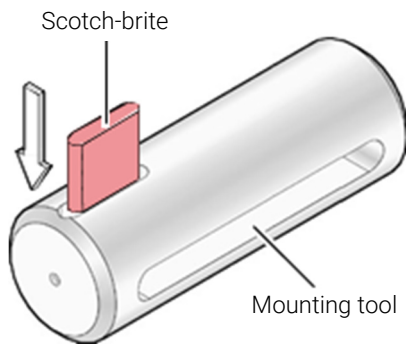
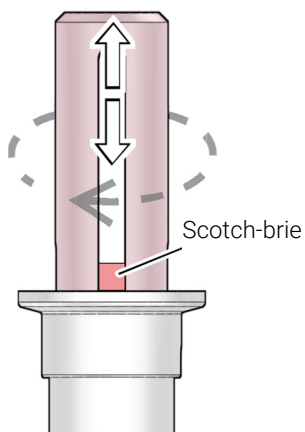


Figure 16

## Technical Information

... and carefully rub the anode to a bright finish.



**WARNING**



Do not bend the anode.

Figure 17

**3** Insert e.g. a Scotch-Brite into the mounting tool ...

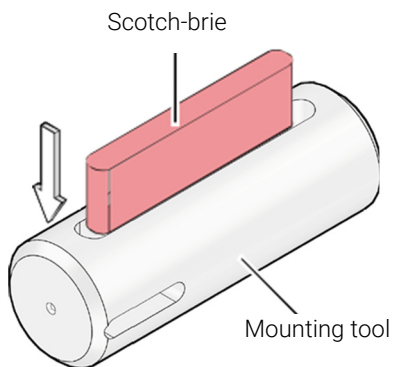
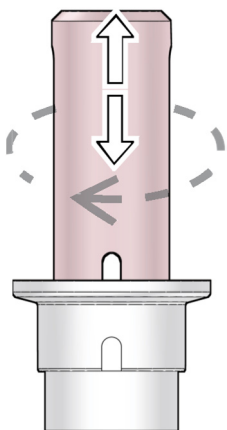


Figure 18

## Technical Information



### WARNING



Do not bend the anode.

---

Figure 19

- 4 We recommend to rub the inside walls of the measuring chamber up to the groove for the retaining ring to a bright finish using a polishing cloth.

### WARNING



- The sealing surfaces must only be worked concentrically.
  - Do not bend the anode.
- 

- 5 Rinse the measuring chamber with alcohol and allow it to dry.

## Technical Information

Insert the new ignition aid into the mounting tool with the flat side upwards ...

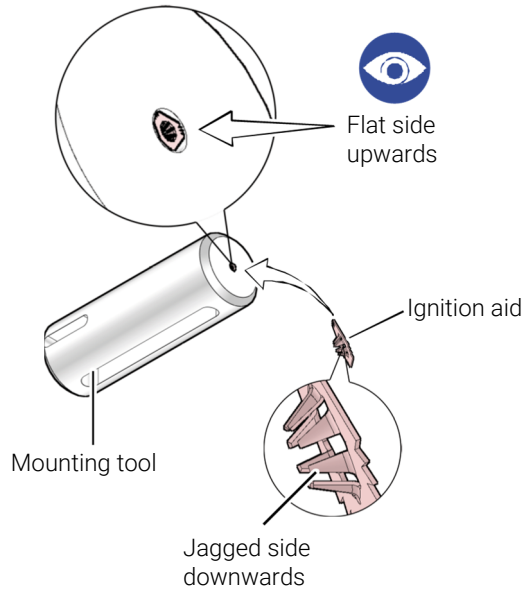


Figure 20

... and carefully slide it onto the anode until the stop position is reached.

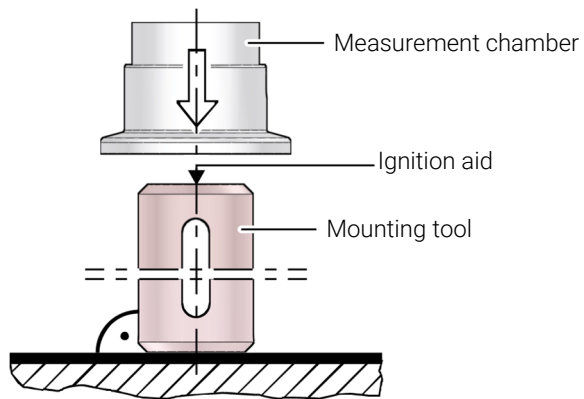


Figure 21

## Technical Information

- 6 Remove particles in the measuring chamber by blowing with dry nitrogen (while the vacuum flange of the measuring chamber is pointing downward).
- 7 Slide a new ionization chamber (2) into the measuring chamber (3) until the mechanical stop is reached and mount the retaining ring (1).

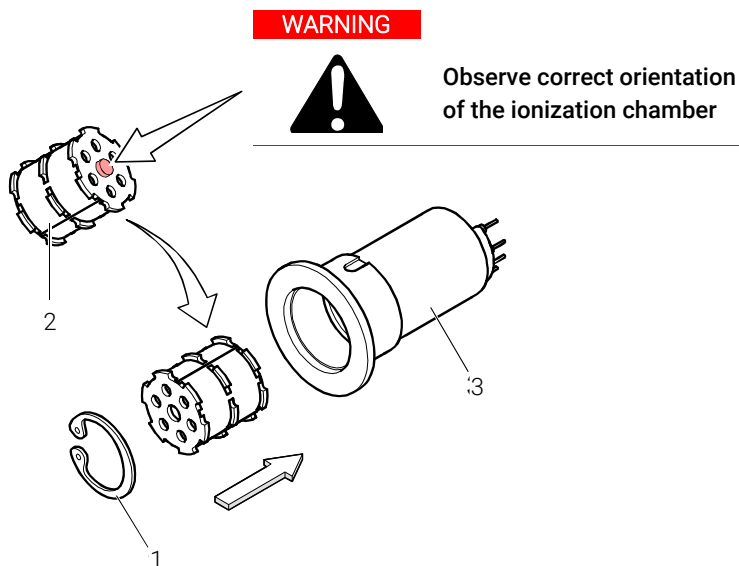


Figure 22

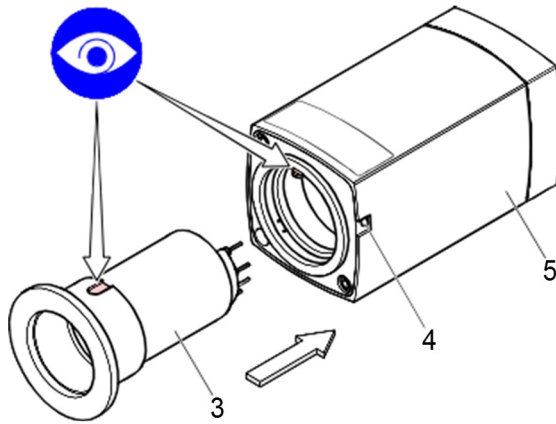
**We recommend to perform a leak test (leak rate  $<1 \times 10^{-9}$  mbar l/s)**

- 8 Carefully slide the measuring chamber cpl. (3) (clean or new) into the electronics unit (5) until the mechanical stop is reached ...



Figure 23

## Technical Information



... and fasten it by means of the hexagon socket set screw (4)

Figure 24

## Technical Information

### Replacing Measuring Chamber

#### Precondition

Troubleshooting (measuring chamber) performed.

- 1 Set the calibration value of the spare sensor with the <CAL> switch on the electronics unit (5).

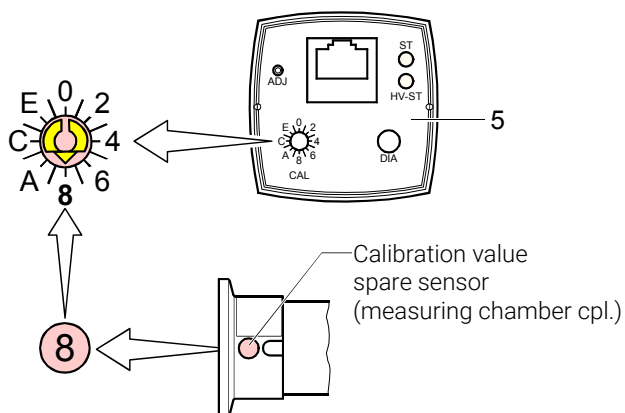
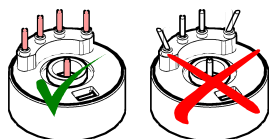


Figure 25

## Technical Information

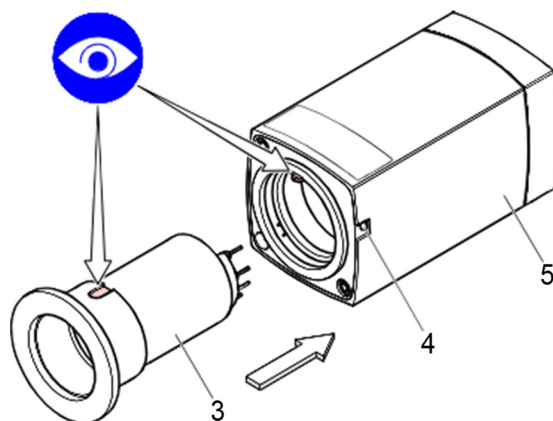
- Carefully slide the measuring chamber cpl. (3) into the electronics unit (5) until the mechanical stop is reached.



**WARNING**



**Pins aligned straight.**



- Fasten the measuring chamber (3) by means of the hexagon socket set screw (4).
- Perform an ATM and HV adjustment of the Pirani measuring circuit via the <ADJ> button.

### NOTE

A recalibration of the gauge is not necessary.

## Accessories and Spare Parts

When ordering spare parts, always mention:

- all information on the product nameplate
- description and ordering number.

**Table 5 Accessories and Spare Parts for FRG-705 and FRG-707**

Description		Ordering number
<b>Accessories</b>		
FRG-700 Ignition Aid		FRG700IGN
FRG705/707 Mounting / Removing Tool for Ignition Aid		FRG705IGNT
Cable to AGD-100 and AGC-100 controller	3 meter	AGCCBL103
	5 meter	AGCCBL105
	10 meter	AGCCBL110
Cable to XGS-600 controller	3 ft	R35893003
	10 ft	R35893010
	25 ft	R35893025
	50 ft	R35893050
Cable to Rack / Remote AG controllers	3 meter	9699960
	5 meter	9699961
<b>Spare Parts</b>		
FRG705/707 Replacement sensor, NW25KF Flange, SS		FRG705KF25RS
FRG705/707 Replacement sensor, 2.75 inches Conflat Flange (DN35), SS		FRG705CF35RS
FRG705/707 Spare ion chamber, SS		FRG705IC

## Vacuum Products Division Instructions for returning products

Dear Customer,

Please follow these instructions whenever one of our products needs to be returned.

Complete the attached **Request for Return form** and send it to Agilent Technologies (see below), taking particular care to include the completed **Health and Safety** declaration Section. No work can be started on your unit until we receive a completed copy of this form.

After evaluating the information, Agilent Technologies will provide you with a **Return Authorization (RA) number** via email or fax, as requested. Note: Depending on the type of return, a Purchase Order may be required at the time **the Request for Return is submitted**. We will quote any necessary services (evaluation, repair, special cleaning, eg).

### Product preparation

- Remove all accessories from the core product (e.g. inlet screens, vent valves).
- Prior to shipment and if applicable for your product, drain any oils or other liquids, purge or flush all gasses, and wipe off any excess residue.
- If ordering an Advance Exchange product, please use the packaging from the Advance Exchange to return the defective product.
- Seal the product in a plastic bag, and package product carefully to avoid damage in transit. You are responsible for loss or damage in transit.
- Include a copy of the Health and Safety Declaration in the shipping documentation on the outside of the shipping box of your returning product.
- Clearly label package with RA number. Using the shipping label provided will ensure the proper address and RA number are on the package. Packages shipped to Agilent without a RA clearly written on the outside cannot be accepted and will be returned.
- Return only products for which the RA was issued.

### Shipping

- Ship to the location specified on the printable label, which will be sent, along with the RA number, as soon as we have received all of the required information. Customer is responsible for freight charges on returning product.
- Return shipments must comply with all applicable Shipping Regulations (IATA, DOT, ADR, etc.) and carrier requirements.

RETURN THE COMPLETED **REQUEST FOR RETURN** FORM TO YOUR NEAREST LOCATION:

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Toll Free: 00 800 234 234 00

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### TERMS AND CONDITIONS

Please read the terms and conditions below as they apply to all returns and are in addition to the Agilent Technologies Vacuum Product Division – Products and Services Terms of Sale.

- Unless otherwise pre-negotiated, customer is responsible for the freight charges for the returning product. Return shipments must comply with all applicable **Shipping Regulations** (IATA, DOT, etc.) and carrier requirements.
- Agilent Technologies is not responsible for returning customer provided packaging or containers.
- Customers receiving an Advance Exchange product agree to return the defective, rebuildable part to Agilent Technologies **within 15 business days**. Failure to do so, or returning a non-rebuildable part (crashed), will result in an invoice for the non-returned/non-rebuildable part.
- Returns for credit toward the purchase of new or refurbished Products are subject to prior Agilent approval and may incur a restocking fee. Please reference the original purchase order number.
- Units returned for evaluation will be evaluated, and a quote for repair will be issued. If you choose to have the unit repaired, the cost of the evaluation will be deducted from the final repair pricing. A Purchase Order for the final repair price should be issued within 3 weeks of quotation date. Units without a Purchase Order for repair will be returned to the customer, and the evaluation fee will be invoiced.
- Products returned that have not been drained from oil will be disposed.
- A Special Cleaning fee will apply to all exposed products
- If requesting a calibration service, units must be functionally capable of being calibrated.



Vacuum Products Division
Request for Return Form

Customer information
Company :
Address:
Contact Name:
Tel:
Fax:
Email:

Equipment
Product description
Agilent PartNo
Agilent Serial No
Original Purchasing Reference
Failure description
Type of process (for which the equipment was used)

Type of return
Non Billable
Billable
Exchange
Repair
Upgrade
Demo
Calibration
Evaluation
Return for Credit
New PO # (hard copy must be submitted with this form):

Health and safety
Substances (please refer to MSDS forms)
The product has been exposed to the following substances:
Toxic
Harmful
Corrosive
Reactive
Flammable
Explosive (\*)
Radioactive (\*)
Biological (\*)
Oxidizing
Sensitizer
Other dangerous substances
Trade name
Chemical name
Chemical Symbol
CAS Number

Goods preparation
If you have replied YES to one of the above questions. Has the product been purged?
If yes, which cleaning agent/method:
Has the product been drained from oil?
I confirm to place this declaration on the outside of the shipping box.

I declare that the above information is true and complete to the best of my knowledge and belief.
I understand and agree to the terms and conditions on page 2 of this document.

Name:
Position:
Date:
Authorized Signature:

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## In This Book

The manual describes the following:

- Instruction for Use
- Technical information

This information is subject to change without notice.

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