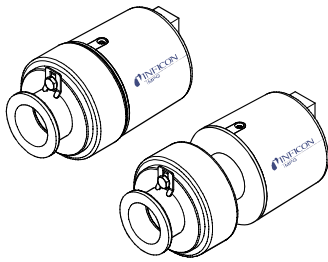


Inverted Magnetron Pirani Gauge

MPG400
MPG401

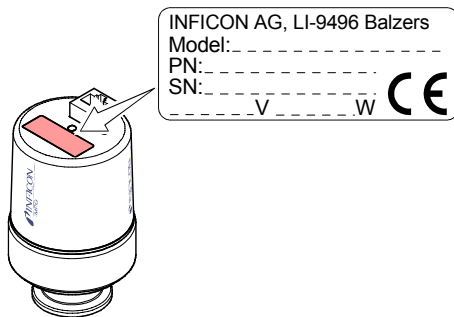


Instruction Sheet
Incl. Declaration of Conformity

tima48e1 (2005-06)

Product Identification

In all communications with INFICON, 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:

MPG400 (FPM sealed)	MPG401 (all-metal)
351-010 (DN 25 ISO-KF)	351-020 (DN 25 ISO-KF)
351-011 (DN 40 ISO-KF)	351-021 (DN 40 ISO-KF)
351-012 (DN 40 CF-F)	351-022 (DN 40 CF-F)

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

If not indicated otherwise in the legends, the illustrations in this document correspond to the product with part number 351-010. They apply to the other products by analogy.

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

All dimensions in mm.

Intended Use

The Inverted Magnetron Pirani Gauges MPG400 and MPG401 have been designed for vacuum measurement in the pressure range of 5×10^{-9} ... 1000 mbar.

The Inverted Magnetron Pirani Gauges must not be used for measuring flammable or combustible gases which react in air.

The gauges can be operated in connection with an INFICON Single-Channel Controller VGC401, Two-Channel Controller VGC402 and Three-Channel Controller VGC402, or with another controller.

Functional Principle

The gauges consist of two separate measurement systems (Pirani and cold cathode system) the signals of which are combined in such a way that one measurement signal is output. The Pirani measurement circuit is always on.

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

INFICON 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, as well as expendable parts (filament), are not covered by the warranty.

Technical Data

Measurement range (air, N ₂)	5×10^{-9} ... 1000 mbar
Accuracy (N ₂)	$\approx \pm 30\%$ (in the range 1×10^{-8} ... 100 mbar)
Repeatability	$\approx \pm 5\%$ (in the range 1×10^{-8} ... 100 mbar)

Output signal (measuring signal)	
Voltage range	0 ... +10.5 V
Measurement range	1.82 ... 8.6 V
Voltage vs. pressure	logarithmic, 0.6 V/decade
Error signal	<0.5 V no supply >9.5 V Pirani sensor defective (filament rupture)

Output impedance	$2 \times 10 \Omega$
Minimum loaded impedance	10 k Ω , short-circuit proof
Response time	(pressure dependent)
$p > 10^{-6}$ mbar	<10 ms
$p = 10^{-8}$ mbar	≈ 1000 ms

Identification gauge	85 k Ω , referenced to supply common
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Status	pin 6
$p > 10^{-2}$ mbar Pirani-only mode	Low = 0 V
$p < 10^{-2}$ mbar Cold cathode not ignited Pirani-only mode	Low = 0 V
$p < 10^{-2}$ mbar Cold cathode ignited Combined Pirani / cold cathode mode	High = 15 ... 30 VDC
LED	High voltage on (LED on)

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-E according to EN 61010). The connection to the gauge has to be fused ¹⁾.

Voltage at the gauge	15 ... 30 VDC (ripple ≤ 1 V _{pp})
Power consumption	≤ 2 W
Fuse ¹⁾	≤ 1 AT
Voltage at the supply unit with maximum cable length	16 ... 30 VDC (ripple ≤ 1 V _{pp}) ²⁾

Adjustment	
Potentiometer <HV>	adjustment under 10^{-4} mbar
Potentiometer <ATM>	adjustment at atmospheric pressure

Electrical connection	FCC68 socket, 8 poles
Sensor cable	8 poles, shielded
Line length	≤ 50 m (8 \times 0.14 mm ²)

Operating voltage	≤ 3.3 kV
Operating current	≤ 500 μ A

Grounding concept	→ "Electrical Connection"
Vacuum connection – measuring common	connected via 10 k Ω (max. voltage differential with respect to safety ± 50 V accuracy ± 10 V)

Supply common – signal common	conducted separately
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Materials exposed to vacuum	
Vacuum connection	stainless steel
Measurement chamber	stainless steel
Feedthrough isolation	ceramic
Internal seal	
MPG400	FPM 75
MPG401	Ag, Cu, soft solder (Sn, Ag)
Anode	Mo
Ignition aid	stainless steel
Pirani measurement tube	Ni, Au
Pirani filament	W

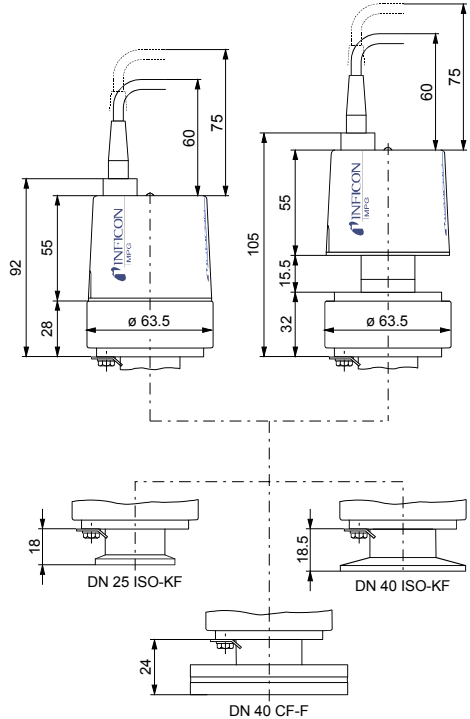
Mounting orientation	any
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¹⁾ INFICON controllers fulfill these requirements.

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

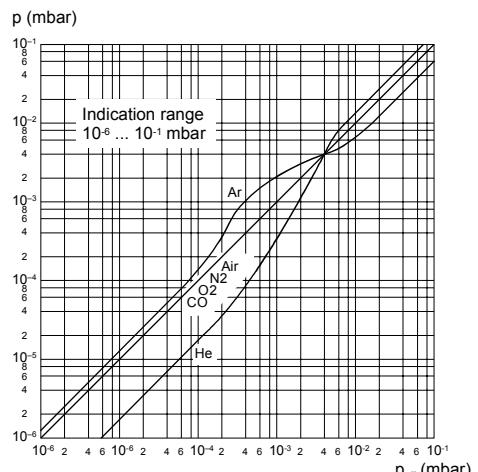
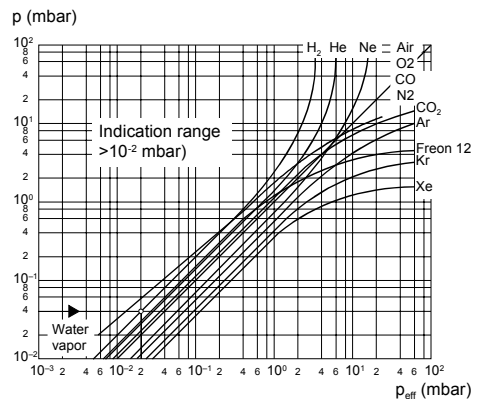
Internal volume	≈20 cm ³
Pressure	≤10 bar (absolute), limited to inert gases
Temperatures	
Operation ³⁾	+5...+55 °C
Bakeout	150 °C (without electronics and magnetic shielding)
Pirani filament	120 °C
Storage	-40...+65 °C
Relative humidity	
	≤80% at temperatures ≤+31 °C decreasing to 50% at +40 °C
Use	
	indoors only altitude up to 2000 m
Type of protection	
	IP 40

Dimensions [mm]



Weight	351-010	≈700 g	351-020	≈730 g
	351-011	≈720 g	351-021	≈750 g
	351-012	≈980 g	351-022	≈1010 g

Gas Type Dependence

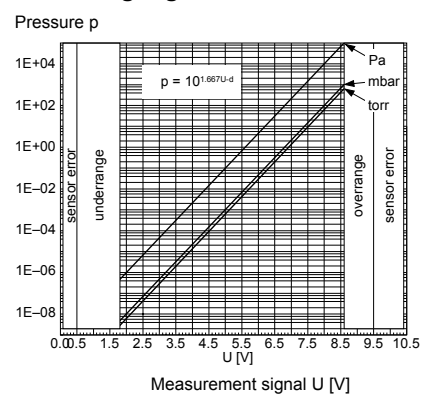


In the range below 10^{-5} mbar, the pressure indication is linear.
For gases other than air, the pressure can be determined by means of a simple conversion formula:

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

Gas type	Air (O ₂ , CO, N ₂)	Xe	Kr	Ar	H ₂	Ne	He
C (mean values)	1.0	0.4	0.5	0.8	2.4	4.1	5.9

Measuring Signal vs. Pressure



$$p = 10^{1.667 \times U - d} \iff U = c + 0.6 \log_{10} p$$

	mbar	Pa	Torr
d	11.33	9.33	11.46
c	6.8	5.6	6.875

valid in the range 5×10^{-9} mbar $< p < 1000$ mbar
 3.8×10^{-9} Torr $< p < 750$ Torr
 5×10^{-7} Pa $< p < 1 \times 10^5$ Pa

Installation

Vacuum Connection

DANGER

Caution: 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

Caution: 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.

DANGER

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 flange, 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

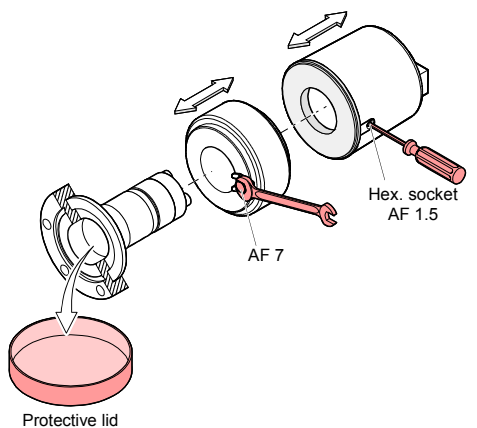
Touching the product or parts thereof with one's bare hands increases the desorption rate.

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.

When making a CF flange connection, it can be advantageous to temporarily remove the electronics and the magnet unit (→ Operating Manual tina48e1).

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



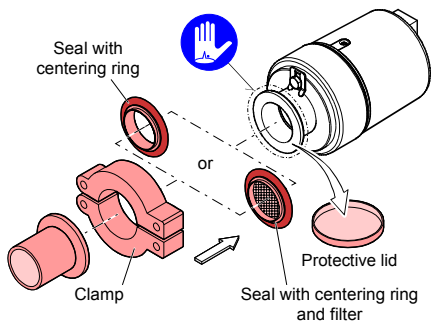
Protective lid

Keep the protective lid.



(2005-06)

³⁾ MPG401: Up to 150 °C at the flange if mounted horizontally; without magnetic shielding



Keep the protective lid.

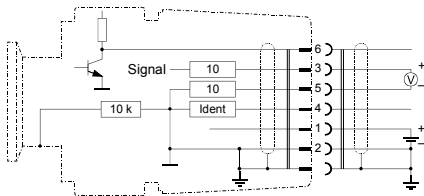
If adjustment should be possible after the gauge has been installed, be sure to install it so that potentiometers <HV> and <ATM> can be accessed with a screwdriver (→ "Adjusting the Gauge").

Electrical Connection



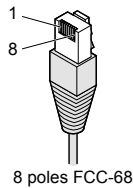
Make sure the vacuum connection is properly made (→ "Vacuum Connection").

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



Electrical connection

Pin 1	Supply (15 ... 30 VDC)
Pin 2	Supply common
Pin 3	Signal output (measuring signal)
Pin 4	Identification
Pin 5	Signal common
Pin 6	Status
Pin 7, 8	n.c.



8 poles FCC-68

- Connect the gauge to the controller using the sensor cable.

Operation

When the supply voltage is applied, the measuring signal is available between pins 3 and 5. Over the whole measurement range, the measuring signal is output as a logarithm of the pressure (measuring signal vs. pressure → "Technical Data").

Allow for a stabilizing time of ≈10 minutes. Once the gauge has been switched on, permanently leave it on irrespective of the pressure.

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

Gas Type Dependence

The measurement value depends on the type of gas being measured. The value displayed is accurate for dry air, O_2 , CO and N_2 . It can be mathematically converted for other gases (→ "Technical Data").

If the gauge is operated in connection with an INFICON vacuum gauge controller, a calibration factor can be entered for correction of the reading.

Ignition Delay

When cold cathode measurement systems are activated upon switching the gauge on, an ignition delay occurs, which is typically:

10^{-5} mbar	≈ 1 second
10^{-7} mbar	≈ 20 seconds
5×10^{-9} mbar	≈ 2 minutes

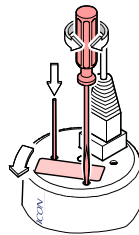
As long as the cold cathode measurement circuit has not yet ignited, the measurement value of the Pirani is output as measuring signal ("Pirani underrange" is displayed for pressures $<5 \times 10^{-4}$ mbar).

Adjusting the Gauge

The gauge is factory-calibrated. If used under different climatic conditions, through extreme temperatures, aging or contamination, and after exchanging the sensor, the characteristic curve can be offset and readjustment may become necessary.

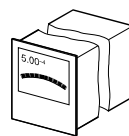
The cold cathode measurement circuit, which is dominant for low pressures ($<1 \times 10^{-3}$ mbar), is factory-calibrated. By way of contrast, the Pirani measurement circuit can be adjusted. Any adjustment has a negligible effect on the pressure range between approx. 10^{-2} mbar and 10^2 mbar.

- If you are using a seal with centering ring and filter, check that they are clean or replace them if necessary (→ "Deinstallation").
- Activate the gauge.
- Evacuate it to $p \ll 10^{-4}$ mbar and wait at least 10 minutes.
- Turn the nameplate counter-clockwise until the mechanical stop is reached.



While depressing the tactile switch with a cylindrical pin ($\varnothing \approx 3$ mm), adjust the <HV> potentiometer by means of a 1.5 mm screwdriver ...

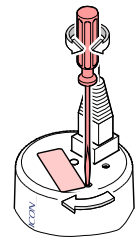
... to 4.20 V or ... to 5×10^{-4} mbar



After that, turn the potentiometer counter-clockwise by 1/3 of a turn.

- Vent the gauge with air or nitrogen to atmospheric pressure, and wait at least 10 minutes.
- Turn the nameplate clockwise until the mechanical stop is reached.

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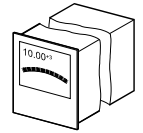


Using the 1.5 mm screwdriver, adjust the <ATM> potentiometer ...

... to 8.60 V

or

... to 1×10^3 mbar



- Turn the nameplate back to its original position (it catches).

Deinstallation

STOP DANGER



Caution: 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 one's bare hands increases the desorption rate.

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

- Vent the vacuum system.
- Put the gauge out of operation and unplug the sensor cable.
- Remove the gauge from the vacuum system and place the protective lid.



When deinstalling a CF flange connection, it can be advantageous to temporarily remove the electronics and the magnet unit (→ "Installation").

