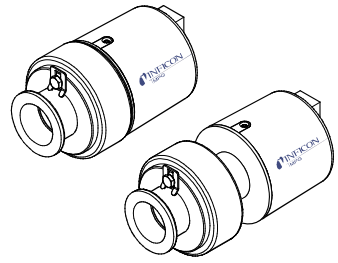


# Inverted Magnetron Pirani Gauge

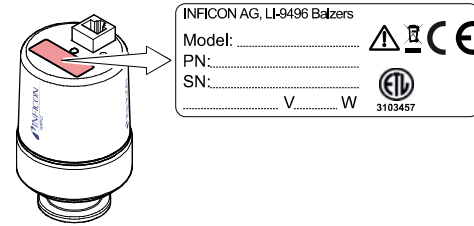
## MPG400 MPG401



Instruction Sheet  
Incl. EU Declaration of Conformity  
tima48e1-b (2017-07)

### 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  $5 \times 10^{-9}$  ... 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 Vacuum Gauge Controller of the VGC40x / VGC50x series, 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

**STOP 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.

**STOP DANGER**  
DANGER: magnetic fields  
Strong magnetic fields can disturb electronic devices like heart pacemakers or impair their function.  
Maintain a safety distance of =10 cm between the magnet and the heart pacemaker or prevent the influence of strong magnetic fields by anti-magnetic shielding.

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 <sub>2</sub> )	$5 \times 10^{-9}$ ... 1000 mbar
Accuracy (N <sub>2</sub> )	$\pm 30\%$ (in the range $1 \times 10^{-8}$ ... 100 mbar)
Repeatability	$\pm 5\%$ (in the range $1 \times 10^{-8}$ ... 100 mbar)

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

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

Identification gauge	85 k $\Omega$ , 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 V (dc)
LED	High voltage on (LED on)

**STOP 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 (PELV). The connection to the gauge has to be fused <sup>1)</sup>.

Voltage at the gauge	15 ... 30 V (dc) (ripple $\leq 1 V_{pp}$ )
Power consumption	$\leq 2$ W
Fuse <sup>1)</sup>	$\leq 1$ AT

Voltage at the supply unit with maximum cable length	16 ... 30 V (dc) (ripple $\leq 1 V_{pp}$ ) <sup>2)</sup>
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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	$\leq 50$ m (8 $\times$ 0.14 mm <sup>2</sup> )

Operating voltage	$\leq 3.3$ kV
Operating current	$\leq 500 \mu A$

Grounding concept	→ "Electrical Connection"
Vacuum connection – measuring common	connected via 10 k $\Omega$ (max. voltage differential with respect to safety $\pm 50$ V accuracy $\pm 10$ 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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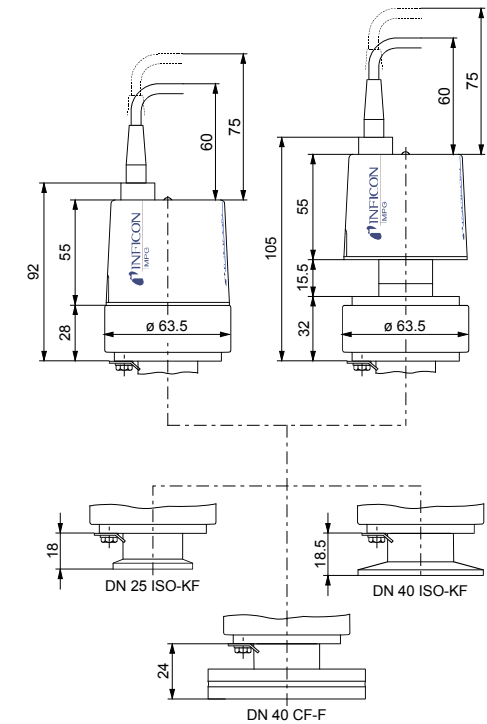
Internal volume	$\approx 20$ cm <sup>3</sup>
Pressure	$\leq 10$ bar (absolute), limited to inert gases

Temperatures	
Operation <sup>2)</sup>	+5 ... +55 °C
Bakeout	150 °C (without electronics and magnetic shielding)
Pirani filament Storage	120 °C
	-40 ... +65 °C

Relative humidity	$\leq 80\%$ at temperatures $\leq +31$ °C decreasing to 50% at +40 °C
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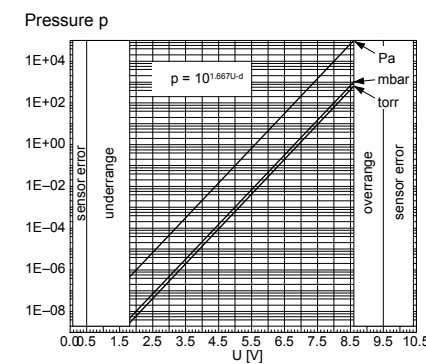
Use	indoors only altitude up to 2000 m
Type of protection	IP 40

#### Dimensions [mm]



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

### Measuring Signal vs. Pressure

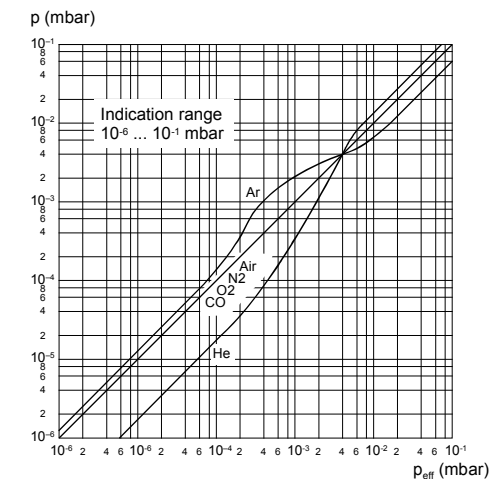
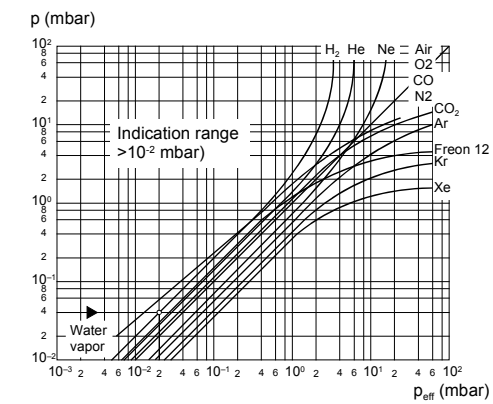


$$p = 10^{1.667 \times U - d} \Leftrightarrow U = c + 0.6 \log_{10} p$$

	mbar	Pa	Torr
d	11.33	9.33	11.46
c	6.8	5.6	6.875

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

### 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:

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

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

### Installation

#### Vacuum Connection

**STOP 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.

**STOP DANGER**  
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.

**STOP 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.

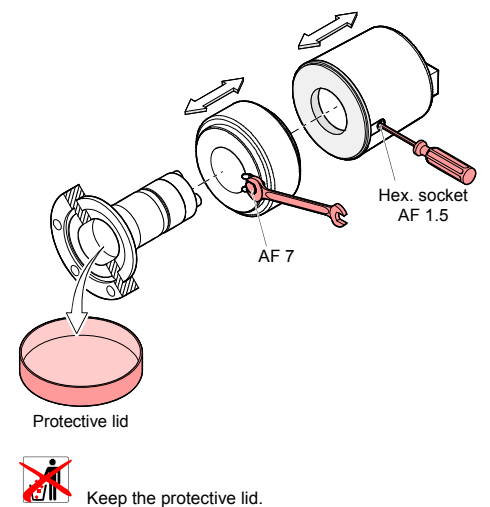
**Caution**  
Caution: dirt sensitive area  
Touching the product or parts thereof with one's bare hands increases the desorption rate. Always wear clean, lint-free gloves and use clean tools when working in this area.

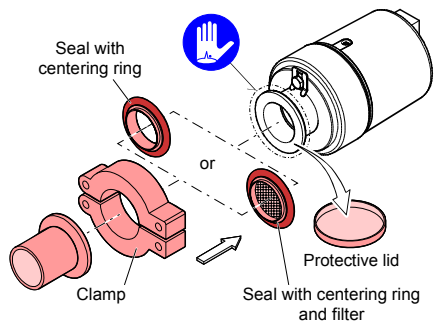
**WARNING**  
WARNING: electric arcing  
Helium may cause electric arcing with detrimental effects on the electronics of the product.  
Before performing any tightness tests put the product out of operation and remove the electronics unit.

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.





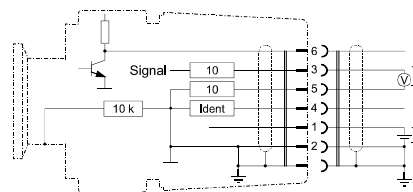
Keep the protective lid.

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").

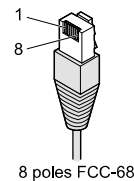
## Electrical Connection

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

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



Electrical connection  
 Pin 1 Supply (15 ... 30 V (dc))  
 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.



**2** 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 <math><1 \times 10^{-2}</math> mbar.

## Gas Type Dependence

The measurement value depends on the type of gas being measured. The value displayed is accurate for dry air, O<sub>2</sub>, CO and N<sub>2</sub>. 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  
 $5 \times 10^{-9}$  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 <math><5 \times 10^{-4}</math> 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 (<math><1 \times 10^{-3}</math> 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.

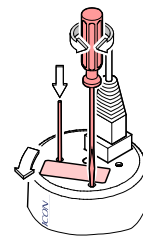
**1** If you are using a seal with centering ring and filter, check that they are clean or replace them if necessary (→ "Deinstallation").

**2** Activate the gauge.

**3** Evacuate it to  $p < 10^{-4}$  mbar and wait at least 10 minutes.

**4** Turn the nameplate counter-clockwise until the mechanical stop is reached.

**5**



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

... to 4.20 V or ... to  $5 \times 10^{-4}$  mbar

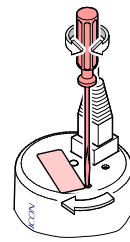


After that, turn the potentiometer counter-clockwise by 1/3 of a turn.

**6** Vent the gauge with air or nitrogen to atmospheric pressure, and wait at least 10 minutes.

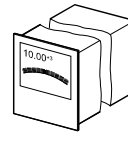
**7** Turn the nameplate clockwise until the mechanical stop is reached.

**8**



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

... to 8.60 V or ... to  $1 \times 10^3$  mbar



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

## Deinstallation

**STOP 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 one's 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 and unplug the sensor cable.

**3** 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").

## Maintenance, Troubleshooting

→ Operating Manual tina48e1



If operated at high pressures or under dirty conditions, the gauge must be regularly cleaned.

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

## 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 INFICON 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 (Form under [www.inficon.com](http://www.inficon.com)).

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

**STOP 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.

## ETL Certification



RECOGNIZED COMPONENT

ETL LISTED

The products MPG400 and MPG401  
 • conform to the UL Standard UL 61010-1 (EMC Directive; Directive relating to electromagnetic compatibility)  
 • are certified to the CAN/CSA Standard C22.2 No. 61010-1

Intertek

3103457

## EU Declaration of Conformity



We, INFICON, hereby declare that the equipment mentioned below comply with the provisions of the following Directives:

- 2014/30/EU, OJ L 96/79, 29.3.2014 (EMC Directive; Directive relating to electromagnetic compatibility)
- 2011/65/EU, OJ L 174/88, 1.7.2011 (RoHS Directive; Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment)

## Inverted Magnetron Pirani Gauge MPG400 MPG401

### Part numbers

351-010 351-020  
 351-011 351-021  
 351-012 351-022

### Standards

Harmonized and international/national standards and specifications:

- EN 61000-6-2:2005 (EMC: generic immunity standard)
- EN 61000-6-3:2007 + A1:2011 (EMC: generic emission standard)
- EN 61010-1:2010 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326-1:2013; Group 1, Class B (EMC requirements for electrical equipment for measurement, control and laboratory use)

### Manufacturer / Signatures

INFICON AG, Alte Landstraße 6, LI-9496 Balzers

17 July 2017

17 July 2017

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