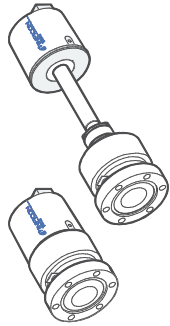


Compact Cold Cathode Gauge MAG470



Instruction Sheet
Incl. EU Declaration of Conformity
timb57e1 (2020-07)

Validity

This document applies to products with ordering numbers 399-360 (DN 40 CF-F flange short type) and 399-361 (DN 40 CF-F flange long type). We reserve the right to make engineering changes without prior notice.



About this document

This document describes the installation and operation of the products listed above. For further information please refer to the Operating Manual which is separately available [1].

Intended use

The above Compact Cold Cathode Gauges have been designed for vacuum measurement of gases in a pressure range of 5×10^{-11} ... 1×10^{-7} mbar.

Functional Principle

The Compact Cold Cathode Gauge MAG470 functions with a cold cathode ionization element circuit (according to the inverted magnetron principle). Over the whole measurement range, the measuring signal is output as logarithm of the pressure.

Safety

Symbols Used



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.



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.



Note

General Safety Information

- Adhere to the applicable regulations and take the necessary precautions for the process media used.
- Consider possible reactions between the materials (→ Technical Data) and the process media.
- 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.



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.

Responsibility 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 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. seals), are not covered by the warranty.

Installation

Vacuum Connection



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.



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-flanges fulfil this requirement.

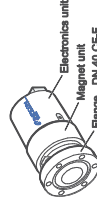


WARNING

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 electric risk unit.

The gauge may be mounted in any orientation. A horizontal mounting is preferred, to keep condensates and particles from getting in.

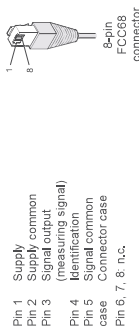
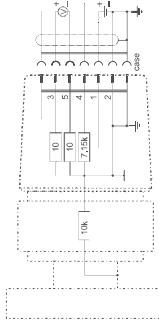
When making CF-flange connections, it can be advantageous to temporarily remove the magnet (→ [1]).



The space necessary can be gathered from the diagram (→ Technical Data).

Power Connection

Make sure that the gauge is correctly flanged (see above). If no sensor cable is available, make one according to the diagram.



Operation

When voltage is being supplied to the gauge, the measuring signal is available between pins 3 and 5 (→ Technical Data for the relationship between the measuring signal and the pressure).

- The green lamp on the gauge indicates the operating state.
- No supply voltage.

Caution
Turn on the gauge only at pressures $< 10^{-7}$ mbar to prevent excessive contamination.
If you are using an INFICON measurement unit with at least the gauge connections, the cold cathode gauge can be controlled, for example, by a Pirani gauge.

Gas Type Dependence

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

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

- 10^{-7} mbar \approx 0.1 minute
- 10^{-8} mbar \approx 1 minute
- 10^{-9} mbar \approx 20 minutes
- 5×10^{-11} mbar \approx 30 minutes

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

Adjusting the Gauge

The gauge is factory calibrated and ready for use. It cannot be readjusted.

Technical Data

Measurement principle
Cold cathode ionization measurement circuit (according to the inverted magnetron principle)

Measurement range (air, N_2)
 5×10^{-11} ... 1×10^{-7} mbar

Accuracy
 $\approx \pm 30 \%$

Repeatability
 1×10^{-7} ... 1×10^{-9} mbar $\approx \pm 5 \%$

Voltage range (analog output)
 ≈ 0 V ... $\approx +10.5$ V

Measurement range
1.95 V ... 8.6 V

Measurement signal vs. pressure
Logarithmic, 0.8 V / decade

Error signal
 < 0.5 V (to supply)

Output impedance
 $2 \times 10^3 \Omega$

Minimum load
10 k Ω , short-circuit proof

Response time
pressure dependent
 < 10 ms

p
 $p = 10^{-7}$ mbar ≈ 1 s

Gauge identification
7.15 k Ω resistance referenced to supply common

STOP DANGER
The gauge may only be connected to supply or measurement units that conform to the requirements of a grounded protective extra-low voltage and limited power source (LPS), Class 2. The connection to the gauge has to be tested.

Voltage at the gauge
Class 2 / LPS
14.5 ... 30.0 V (ripple max. 1 V_{pp})

Power consumption
 ≤ 2 W

Fuse
1 AT

Electrical connection
FCC68, 8-pin, female
5-pin plus screen

Cable
50 m (0.14 mm² conductor)

Operating voltage (in the measuring chamber)
 ≤ 3.3 kV

Operating current (in the measuring chamber)
 ≤ 100 μ A

Grounding concept
Vacuum flange - measuring common
→ Power Connection
connected via 10 k Ω (max. voltage differential with resp. to safety ≤ 50 V with resp. to accuracy ± 10 V)

Supply common - signal common
conducted separately, for external magnetron (if no external measuring is recommended)

Materials on the vacuum side

Feedthrough isolation
ceramic (Al₂O₃)

Internal seal
Ag
stainless steel (1.4306 / AISI 304L)

Flange
Mo
stainless steel (1.4310 / AISI 301)

Anode
stainless steel (1.4310 / AISI 301)

Ignition aid
 ≈ 20 cm²

Internal volume
 ≤ 10 bar (absolute), limited to inert gases and temperatures < 100 °C

Pressure max.

Admissible temperatures
Storage
- 40 °C ... +65 °C

Operation
of all types
+ 5 °C ... +55 °C
250 °C ^{b)} in bakeout area, see dimension drawing

Bakeout short-types
250 °C ^{b)} (without electronics unit)

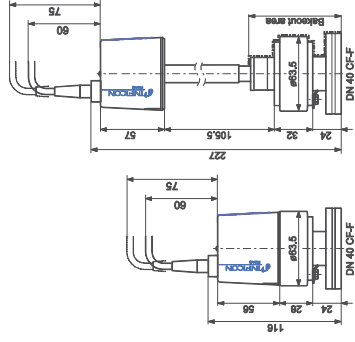
long types
250 °C ^{b)} in bakeout area, see dimension drawing

Relative humidity
max. 80% up to +31 °C
decreasing to 50 % at +40 °C
for indoor use only
altitude up to 3000 m

Application
IP 40

Degree of protection
1) Any magnetic shielding (accessory) must be removed.

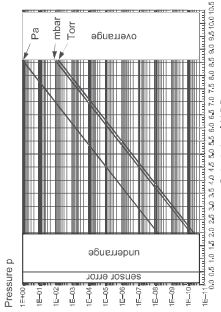
Dimensions [mm]



Weight
960 g (DN 40 CF-F flange short type)
1100 g (DN 40 CF-F flange long type)



Relationship Output Signal vs. Pressure



Output signal U [V]

U	p	c	d
[V]	[mbar]	10,2	12,75
[V]	[ubar]	7,8	9,75
[V]	[Torr]	10,3	12,875
[V]	[mTorr]	7,9	9,875

U	p	c	d
[V]	[micron]	7,9	9,875
[V]	[Pa]	8,6	10,75
[V]	[kPa]	11,0	13,75

where:

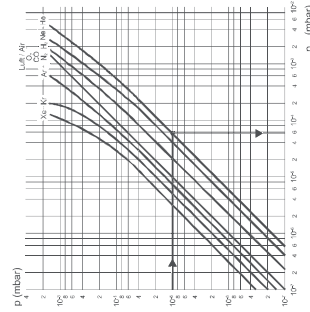
- U: output signal
- p: pressure
- c, d: constants

valid in the range:

- 5×10^{-11} mbar < p < 10^{10} mbar
- $< 1 \times 10^{-10}$ Torr
- $3,75 \times 10^{-11}$ Torr < p < $< 7,5 \times 10^{-3}$ Torr
- 5×10^7 Pa < p < < 1 Pa

Gas Type Dependence

Indicated pressure (Gauge calibrated for air)



Indication range below 10^{-6} mbar

In the range below 10^{-6} mbar the pressure indication is linear. For gases other than air the pressure can be determined by means of a simple conversion formula:

$$p_{ind} = K \cdot p_{actual}$$

where:

gas type	K
air (N ₂ , O ₂ , CO)	1,0
Xe	0,4
Kr	0,5
Ar	0,8
H ₂	2,4
Ne	4,1
He	5,9

Maintenance, Troubleshooting

If the gauge is operated under high pressures or under dirty conditions, it must be regularly cleaned. Gauge failures due to contamination or wear and tear, as well as expendable parts (e.g. seals), are not covered by the warranty.

Returning the Product

WARNING

Forwarding contaminated products

Products returned to INFICON for service or repair should preferably be free of harmful substances (e.g. radioactive, toxic, caustic or microbiological).

Adhere to the forwarding regulations of all the relevant countries and regions. Please contact and enclose a completed declaration of contamination.

Form under www.inficon.com

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

When returning a product for service, put it in a tight and impact resistant package.

Disposal

WARNING

Substances detrimental to the environment

Products, operating materials etc. may require disposal in accordance with special regulations. Dispose of environmentally detrimental substances according to local regulations.

DANGER

Contaminated parts

Contaminated parts can be detrimental to your health.

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

- Separating the parts**
- After disassembly of the product, separate the parts into the following categories for disposal:
- Components with exposure to process gases
 - Components which have been exposed to radioactive, toxic, caustic, or microbiological process gases must be disposed of in accordance with the relevant national regulations.
 - Components which have been exposed to other process gases must be separated according to their materials and recycled.
 - Components without exposure to process gases
- Such components must be separated according to their materials and recycled.

EU Declaration of Conformity

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

- 2014/30/EU, O.J.L 96/75, 29.3.2014 (EMC Directive; Directive relating to electromagnetic compatibility)
- 2011/65/EU, O.J.L. 174/68, 1.7.2011 (RoHS Directive; Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment)

Product

Compact Cold Cathode Gauge

MAG470

Standards

Harmonized and international 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

30 July 2020

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Conversion Table

	mbar	bar	Pa	hPa	kPa	Torr	mm HG
mbar	1	1×10^{-3}	100	1	0,1	0,75	
bar	1×10^5	1	1×10^5	1×10^3	100	750	
Pa	0,01	1×10^{-5}	1	0,01	1×10^{-3}	$7,5 \times 10^{-3}$	
hPa	1	1×10^{-3}	100	1	0,1	0,75	
kPa	10	0,01	1×10^3	10	1	7,5	
Torr	1,332	$1,332 \times 10^{-3}$	133,32	1,332	0,1332	1	
mm HG	1,332	$1,332 \times 10^{-3}$	133,32	1,332	0,1332	1	

1 Pa = 1 N/m²

Further Information

□ [1] Operating Manual MAG470
im657d1 (German)
im657e1 (English)