

Plug-In Boards for Total Pressure Gauge Controller TPG300


CP300C9,
IF300P



About this Document



About this document

This document describes the plug-in boards for the total pressure gauge controller TPG300, intended as a supplement to the documentation of the basic unit TPG300 (→  [1]).

Validity

This document applies to plug-in boards listed below

Type	Description	Part number
CP300C9	Pirani / cold cathode measurement board	IO441000
IF300P	Interface and relay Board (Profibus)	IO441395

The part number (No) can be taken from the product nameplate.

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1 Safety

1.1 General Safety Information

- a) Take the necessary precautions when doing installation work.
It may be necessary implement additional protective measures in the system.
- b) Before connecting any external elements, check that they are compatible with the technical data in this document.
- c) Take the necessary precautions when doing maintenance or repair work.

1.2 Symbols Used



Danger:

Information on preventing any kind of personal injury or extensive equipment damage.



Caution:

Special information on damage prevention.



Note:

Special information on cost-effective use.



Skilled Personnel:

This work may only be carried out by persons with suitable technical training and the necessary experience.



Waiting time, reaction time, duration of test

< ... >

Marking



See page ...



See document ...

1.3 General Stipulations

Since the individual components are delicate, appropriate measures must be taken to protect them from static electricity. Store modules in antistatic bags or containers.

Damage resulting from incorrect handling may lead to a revocation of the guarantee.

INFICON accepts no responsibility nor warranty if the user or third parties

- utilize the product not according to the defined use
- make any kind of changes (modifications, alterations, etc.) to the product.

2 Description

2.1 Pirani / Cold Cathode Measurement Board CP300C9

The CP300C9 board is a combined board containing one Pirani and one cold cathode measurement circuit.

Pirani measurement circuit

The Pirani measurement circuit has one gauge cable connector, two trimmer potentiometers and one analog signal output. When the control unit is on, the Pirani measurement circuit is in continuous operation. The analog signal is constantly available, independent of what is shown on the pressure display.

Cold cathode measurement circuit

The cold cathode measurement circuit for the measurement of high and ultra high vacuum has one gauge cable connector and one analog signal output. When the gauge is turned on, the analog signals are constantly available, independent of what is shown on the pressure display.

This measurement board contains special electronics to limit the measurement current to 100 μA , a feature that considerably extends the lifetime of the gauge.

2.2 Interface and Relay Board IF300P

The IF300P board contains a RS232C interface and a Profibus-DP interface. The board has five relays with one floating changeover contact each.

2.3 Pirani Measurement

Within certain limits the thermal conductivity of gases is a function of the pressure. Pirani thermal conductivity vacuum gauges exploit this phenomenon for pressure measurements.

The measurement element consists of a thin filament with a high temperature coefficient. The resistance of the wire and consequently its temperature are maintained at a constant value by means of a suitable control circuit. The electrical power supplied to the filament is, therefore, a measure of the thermal conductivity and consequently the gas pressure.

2.4 Cold Cathode Measurement

The current flowing in a self-sustained gas discharge with a cold cathode (inverted magnetron) depends on the applied voltage, the gas composition, and the pressure. A magnetic field that penetrates the measurement chamber has the effect that the electrons move along a spiral trajectory from the cathode to the anode and thereby cause even at low gas densities a sufficient number of ionizing impacts for maintaining the discharge. If (with a known gas type) the anode voltage and magnetic field are kept constant, the discharge current is a measure of the pressure.

3 Technical Data



3.1 Pirani / Cold Cathode Measurement Board CP300C9

Number of measurement circuits		1 each
Gauges		TPR018, IKR085 (both ITER)
Display range (signal output) ¹⁾		
Pirani	mbar	$5 \times 10^{-4} \dots 1000$
Cold cathode	mbar	$5 \times 10^{-9} \dots 1 \times 10^{-2}$
Measurement range ¹⁾		
Pirani	mbar	$1 \times 10^{-2} \dots 100$
Cold cathode	mbar	$1 \times 10^{-8} \dots 5 \times 10^{-3}$
Cable length		
Pirani, max.	m	100
Cold cathode, max.	m	$60^{2)} \dots 100$
Power supply cold cathode gauges		
Operating voltage	kV	3.3
Measurement current	μ A	≤ 600
Signal output		
Measured value, analog	V	0 ... +10
Error message	V	>11.5
Current, max.	mA	2
Output resistance	Ω	400
Reaction time (10 \Rightarrow 90%) for sudden pressure step		
Pirani		
$<10^{-3} \Rightarrow 10^3$ mbar	ms	<50
Cold cathode		
$10^{-9} \Leftrightarrow 10^{-6}$ mbar	ms	<100
Connection, equipment side		
Pirani gauge	female	Amphenol C91E, 6-pin
Cold cathode gauge	female	SHV coaxial
Signal output	female	$\varnothing 2$ mm
Weight	kg	≈ 0.21

¹⁾ N₂-equivalent

²⁾ when using the lower measurement range limit (\rightarrow  9)

3.2 Interface and Relay Board IF300P

Relay Number	5
Contact type	1 change over contact each floating max. 50 V (ac) relative to other contacts and ground
Characteristic data (ac) Switching voltage, max. Switching current, max. Switching power, max.	30 V (dc), 50 V (ac) 1.5 A 45 W, 75 VA
Characteristic data (dc) Switching current, max.	switching voltages >50 V (dc) are inadmissible for safety reasons 0.6 A at 50 V (dc) 0.8 A at 40 V (dc) 1.5 A at 30 V (dc)
Connection, equipment side Type Transition resistance with socket	D-sub connector, 15-pin, male 125 mΩ
Interface Type Baud rates Data format Connection, equipment side Cable length, max.	Profibus-DP <12Mbaud Profibus-DP interface →  [2] D-sub connector, 9 pin, male →  [2]
Weight	≈0.16 kg




Before connecting any external elements, check that they conform to the above technical data and the controller is switched off for at least 15 seconds.

4 Installation

General



Use screened cables only (connect screen to barrel of connector). If both ends of the screen are connected to ground, compensating currents must be prevented (e.g. by connecting all involved units to a common power distributor).

In a Profibus-DP installation (IF300P board), use the recommended special cable only (→  [2]).

4.1 Installing / Removing the Plug-In Boards



For safety reasons, vacant slots should always be covered with blank panels.

Disconnect all cables from the unit before installing / removing any plug-in modules.



Modules should only be handled on an ESD protected bench.

Procedure

- Switch off the unit and wait one minute
- Remove all cables (power cable last)
- Unscrew the blind plate / plug-in module
- Insert / remove plug-in module
- Screw on the plug-in module / blind plate
- Connect the cables (mains cable first)
- Switch on the unit again



To ensure correct operation, check that the screws of the plug-in modules are tightened.

4.2 Connecting the Pirani Gauge



Additional protective measures must be taken if certain processes in the vacuum system (e.g. flashovers) can cause hazardous voltages on the gauge terminals.



Although the gauge cables are screened, they should not be routed in parallel to lines producing strong electrical noise.

Connect the gauge to the <TPR> connector on the rear panel. The connectors are locked so that they cannot be separated accidentally.

4.3 Connecting the Cold Cathode Gauge

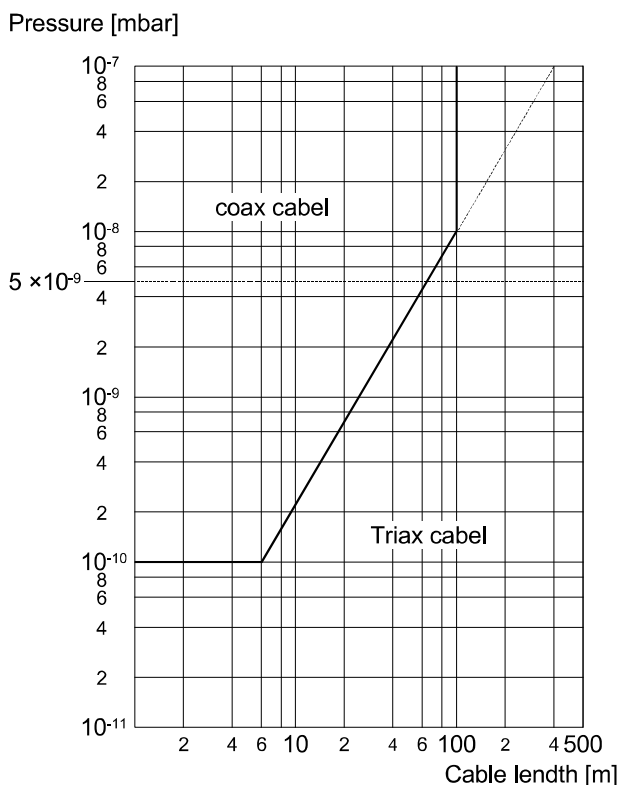


Additional protective measures must be taken if certain processes in the vacuum system (e.g. flashovers) can cause hazardous voltages on the gauge terminals.



Although the gauge cables are screened, they should not be routed in parallel to lines producing strong electrical noise.

Connect the gauge to the <IKR> connector. Coaxial cables normally suffice. The following diagram indicates the conditions under which a triaxial cable is required.

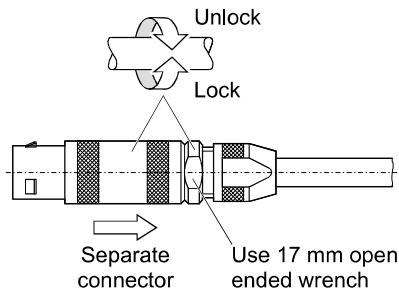


The maximum length of 100 m for coaxial cables is specified by EN 61010. Greater lengths are not admissible without additional protective measures.

If the gauge is not grounded via the vacuum chamber, it must be grounded separately.

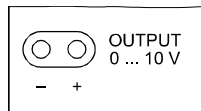


If the cable length is >100 m (only admissible with triaxial cable), the connectors must be protected against unintentional separation and contact of the center conductor. The cable must only be plugged in or detached while the unit is switched off for at least 15 seconds.



Protection against unintentional separation of the triaxial connector.

4.4 Connecting the <OUTPUT> Analog Signal

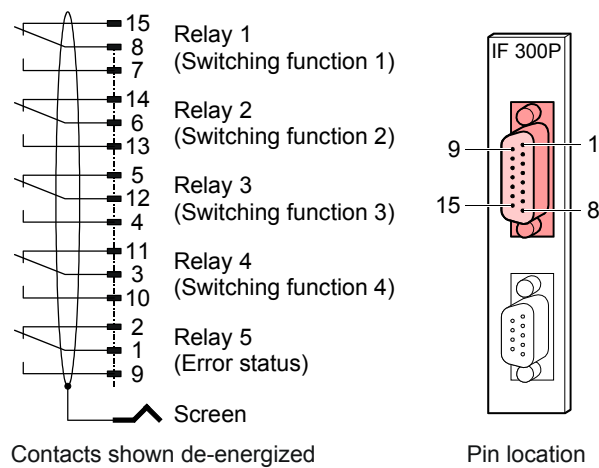


Each measurement circuit is equipped with an analog signal output. Matching connectors are included with each measurement board.

4.5 Connecting the Relays of the IF300P

Pin Assignment

The relay connector on the rear of the IF300P has the following pin assignment:



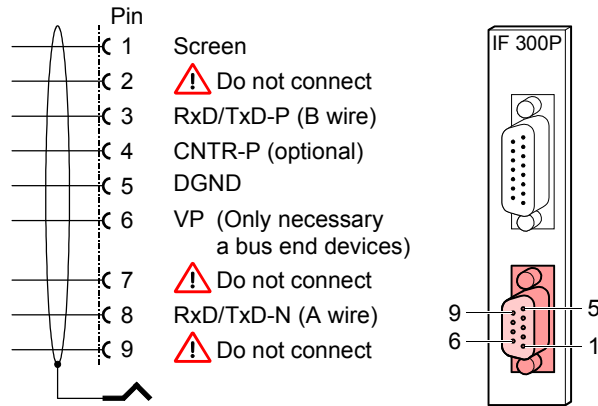
4.6 Connecting the Profibus-DP Interface to the IF300P



In a Profibus-DP installation, use the recommended special cable only (→ [2]).

Pin Assignment

The interface connector on the rear of the IF300P has the following pin assignment:

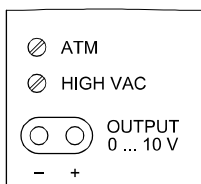


5 Adjustment

Pirani measurement circuits are factory-adjusted to the standard gauge. Due to manufacturing tolerances, contamination of the gauges, and different cable lengths, deviations are inevitable.

Cold cathode measurement circuits are factory-adjusted and require no readjustment.

5.1 Adjusting the Pirani Measurement Circuit




Two trimmer potentiometers are available for compensating the gauge tolerances, gauge contamination, or different cable lengths, within certain limits.



The adjustment should only be performed after the equipment has attained operating temperature (≈ 10 minutes).


Adjustment at High Vacuum

- With gauge connected, lower the vacuum chamber pressure to $<1 \times 10^{-4}$ hPa
- Select the measurement circuit to be adjusted (»sensor« mode)
- With the <HIGH VAC> potentiometer adjust the display to 8.0×10^{-4} hPa
- Turn the potentiometer clockwise by 90°
- «ur 10^{-4} » should now be displayed (\rightarrow  [1]).






Adjustment at Atmospheric Pressure

- Expose the gauge to atmospheric pressure (vent the vacuum chamber)
- Turn the <ATM> potentiometer to obtain a reading of 1.0×10^3 hPa
- Decrease the pressure to $<1 \times 10^{-4}$ hPa
- Check the high vacuum reading and readjust, if necessary.






6 Troubleshooting

In addition to the guidelines below, take the documentation of the other system components into account (→ Literature  21).


6.1 Operating and Adjustment Problems

Problem	Possible cause	Correction
Pirani reading too high	Pirani gauge contaminated	Adjust Pirani measurement circuit (→  12)
		Clean gauge (→  [3])
		Replace gauge
Cold cathode reading too high	Connector insulation contaminated or moist	Clean insulation or replace connector
	Air humidity (⇒ leakage current)	Keep the air humidity low
Cold cathode reading too low	Cold cathode gauge contaminated	Clean gauge (→  [4])
		Replace ionization chamber
Pirani can not be adjusted	Incorrect combination measurement board – gauge – cable	Select correct combination (→  8)
	Gauge severely contaminated	Clean or replace gauge (→  [3])


6.2 Defects

Problem	Possible cause	Correction
Cold cathode constantly indicates «  » (overrange), (even though the pressure is within the measuring range)	Short circuit in the cold cathode cable / gauge	Replace or repair the cable / gauge
	Cold cathode measurement board defective	Replace the cold cathode measurement board (→  8)
Cold cathode indicates «  » (underrange), even though the pressure is within the measuring range	No IKR gauge connected	Connect the gauge
	Interruption in cold cathode cable	Replace or repair the cable
	Cold cathode gauge defective	Replace the gauge (→  [4])
	Cold cathode measurement board defective	Replace the cold cathode measurement board (→  8)

6.3 Problems with the RS232C Interface

Problem	Possible cause	Correction
No communication	Pin 2 and 3 of the interface cable not crossed	Use the correct cable
	Incorrect Baud rate	Match Baud rate
	Incorrect data format	Adhere to the format specified for the TPG300 (→  [1])

6.4 Problems with the Profibus-DP Interface

Problem	Possible cause	Correction
No communication	Incorrect Baud rate ¹⁾	Set Baud rate to 19200 Baud
	Incorrect data format	Adhere to the standardized Profibus-DP data format (→  [2])
Cycle time >100 ms	Incorrect firmware	Firmware TPG300: 302-654 Firmware Profibus: V1.5
	Incorrect Baud rate ¹⁾	Set Baud rate to 19200 Baud

¹⁾ At the controller TPG300, firmware 302-654 or higher

7 Accessories

7.1 Gauges

Gauge	Compatible to measurement board:	Vacuum connection	Ordering number
TPR018 → [3]	CP300C9	DN 16 ISO-KF DN 40 CF-F	IO G15 020 IO G15 024
IKR085 → [4]	CP300C9	DN 40 ISO-KF DN 40 CF-F	PT R18 772 PT R18 773

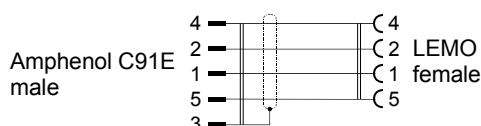
7.2 Measurement Cables and Cable Connectors

Pirani Measurement cables

With Amphenol C91 and Lemo (standard plugs on each side).

Length [m]	80 °C Pirani Measurement cables for TPR018	250 °C Measurement cables, high temperature version for TPR018 ¹⁾
3	ITC548308	ITC548414
5	–	ITC548465
10	ITC548456	ITC448047
15	ITC548457	ITC448043
20	ITC548458	ITC448044
25	ITC548459	ITC120025
30	ITC548460	ITC120030
35	ITC548461	ITC120035
40	ITC548462	ITC120040
45	ITC548463	ITC120045
50	ITC548464	ITC120050

¹⁾ Pirani measurement cable for TPR018:



Pirani cable connectors
controller side

Connectors controller side	Ordering Number
Amphenol C91	IT4722125
Crimp contact C91 plug connector	IT4722841

Pirani cable connectors
gauge head side

Connectors gauge head side	Ordering Number
Lemo 4.3 – 5.2 mm	IT4722062
Lemo 5.3 – 6.2 mm	IT4722063

Cold Cathode Measurement Cables

With SHV and Triax Lemo (standard plugs on each side).

(Test voltage: 6 kV (dc))

Length [m]	80 °C Pirani Measurement cables for IKR085	250 °C Measurement cables, high temperature version for IKR085 ¹⁾
3	ITC220003	ITC230003
5	ITC220005	ITC230005
10	ITC220010	ITC230010
15	ITC220015	ITC230015
20	ITC220020	ITC230020
25	ITC220025	ITC230025
30	ITC220030	ITC230030
35	ITC220035	ITC230035
40	ITC220040	ITC230040
45	ITC220045	ITC230045
50	ITC220050	ITC230050

Cold cathode cable connectors controller side

Connectors controller side	Ordering Number
SHV-50-Peek	IT4726605
SHV-50-Capton	IT4728606

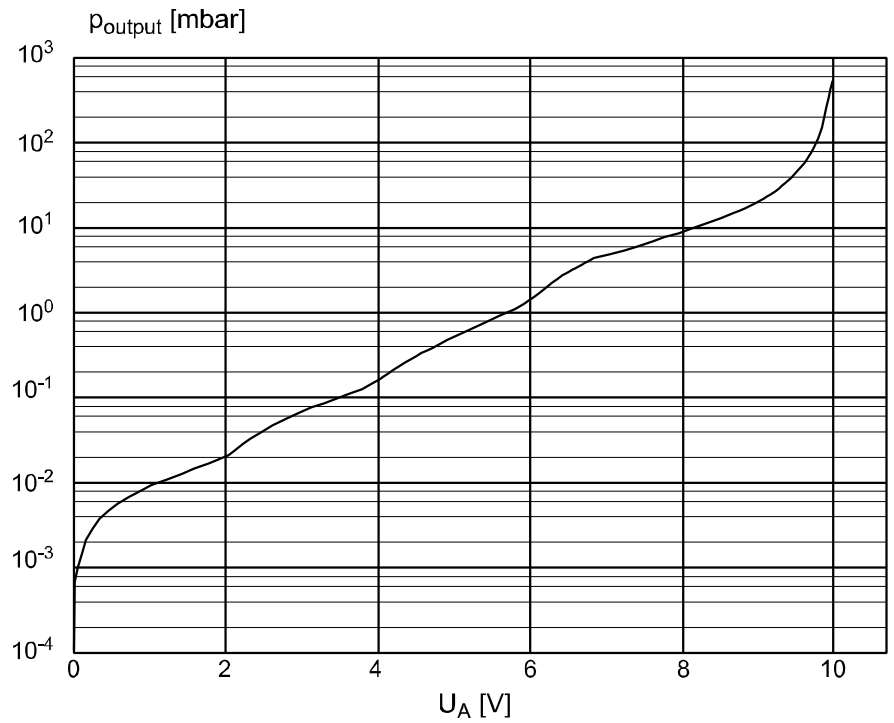
Cold cathode cable connectors gauge head side

Connectors gauge head side	Ordering Number
Triax	IT1001030
Coax	IT100103116

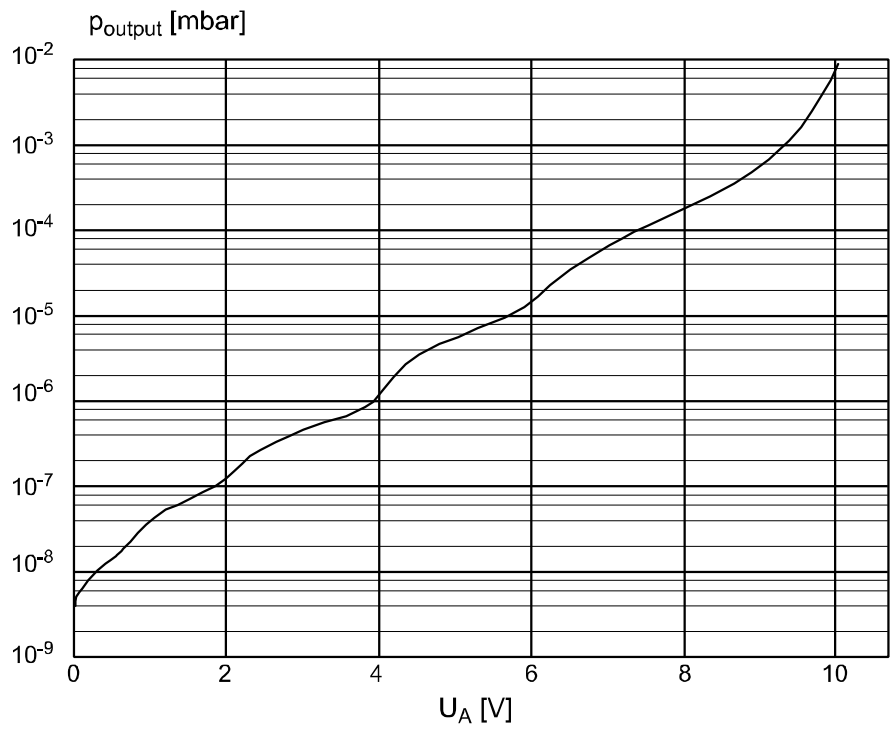
Appendix

A: Output Signals of the Measurement Boards

Pirani Gauge
TPR018 with CP300C9



Cold Cathode Gauge
IKR085 with CP300C9

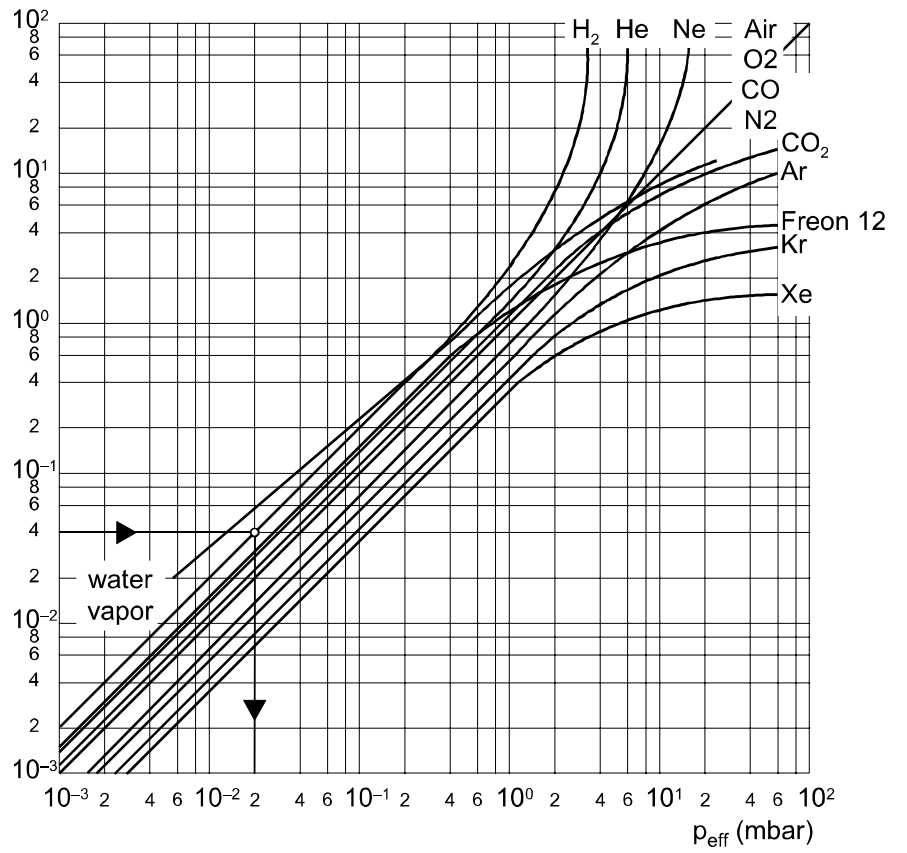


B: Gas Type Dependence

Pirani Gauge TPR018

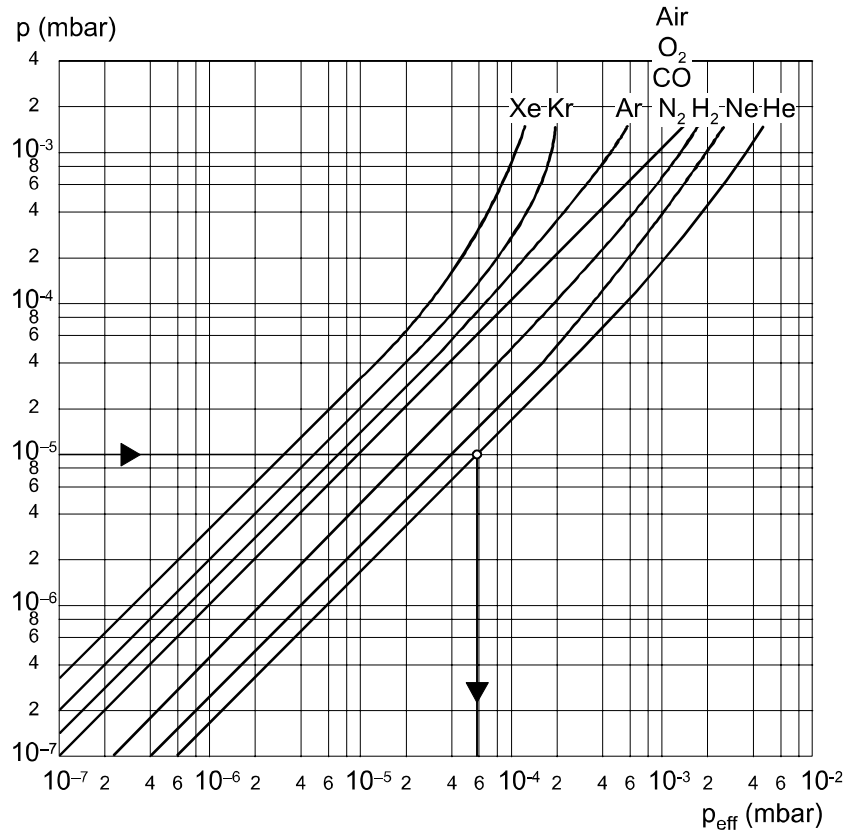
Indicated pressure (instrument calibrated for air)

p (mbar)



Cold Cathode Gauge IKR085

Indicated pressure (Instrument calibrated for air)



(Mean values, deviations possible depending on degree of contamination).
Reference gauge: Hot cathode ionization gauge

C: Literature

- [1]
 - www.inficon.com
 - Operating Manual
 - Total Pressure Gauge Controller TPG300
 - IG9970BEN
 - INFICON AG, LI-9496 Balzers, Liechtenstein
- [2]
 - www.inficon.com
 - Communication Protocol
 - Profibus-DP Interface Board IF300P
 - IG9973BEN
 - INFICON AG, LI-9496 Balzers, Liechtenstein
- [3]
 - www.inficon.com
 - Operating Manual
 - Pirani Gauge TPR018
 - BG9976BEN
 - INFICON AG, LI-9496 Balzers, Liechtenstein
- [4]
 - www.inficon.com
 - Operating Manual
 - Cold Cathode Gauge IKR085
 - IG9048BEN
 - INFICON AG, LI-9496 Balzers, Liechtenstein

Original: English



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