

Plug-In Boards for Total Pressure Gauge Controller TPG300 and TPG500

CP300C9
CP300T11
CP300T11L
IF300A
IF300P
IF301P



About this Document



About this document

This document describes the plug-in boards for the total pressure gauge controller TPG300 and TPG500, intended as a supplement to the documentation of the basic unit TPG300 (→  [1]), TPG500 (→  [2]).

Validity

This document applies to plug-in boards listed below

Type	Description	Part number
CP300C9	Pirani / cold cathode measurement board	IO441000
CP300T11	Pirani / cold cathode measurement board	IO441080
CP300T11L	Pirani / cold cathode measurement board	IO441120
IF300A	Interface and relay board (RS232C)	IO441130
IF300P	Interface and relay Board with mechanical relays (Profibus)	IO441395
IF301P	Interface and relay Board with PhotoMOS relays (Profibus)	IO441396

The part number can be taken from the product nameplate.

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For cross-references within this document, the symbol (→  XY) is used; for cross-references to further documents listed under 'Literature', use is made of the symbol (→  [Z]).

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.



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.

1.2 Symbols Used



Note



Waiting time, reaction time, duration of test

<...>

Marking

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 CP300xxx

Pirani measurement circuit

The CP300xxx board is a combined board containing one Pirani and one cold cathode 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 mechanical relays with one floating changeover contact each.

2.3 Interface and Relay Board IF301P

The IF301P board contains a RS232C interface and a Profibus-DP interface. The board has five PhotoMOS relays with one floating changeover contact each.

2.4 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.

2.5 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 Boards CP300xxx

		CP300C9	CP300T11	CP300T11L
Number of measurement circuits		1 each	1 each	
Gauges		TPR018, IKR084 ... 086		TPR018, IKR086
Display range (signal output) ¹⁾				
Pirani	mbar	8×10 ⁻⁴ ... 1000		8×10 ⁻⁴ ... 1000
Cold cathode	mbar	5×10 ⁻⁹ ... 5×10 ⁻³		1×10 ⁻¹¹ ... 5×10 ⁻³
Cable length				
Pirani, max.	m	100	100	500
Cold cathode, max.	m	60 ²⁾ ... 100	500	500
Power supply cold cathode gauges				
Operating voltage	kV	3.3	3.3	
Measurement current	µA	≤600	≤100	
Signal output				
Measured value, analog	V	0 ... +10	0 ... +10	
Error message	V	>11.5	>11.5	
Current, max.	mA	2	2	
Output resistance	Ω	400	400	
Reaction time (10 ⇒ 90%) for sudden pressure step				
Pirani				
<10 ⁻³ ⇔ 10 ³ mbar	ms	<50	<50	
10 ³ ⇔ 10 ⁻³ mbar	ms	<600	<600	
Cold cathode				
10 ⁻⁹ ⇔ 10 ³ mbar	ms	<10	<50	
Connection, equipment side				
Pirani gauge	female	Amphenol C91E, 6-pin		Amphenol C91E, 6-pin
Cold cathode gauge	female	SHV coaxial		triaxial
Signal output	female	ø2 mm		ø2 mm
Weight	kg	≈0.21	≈0.25	

¹⁾ N₂-equivalent

²⁾ when using the lower measurement range limit (→ 10)

3.2 Interface and Relay Board IF300A

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.	50 V (ac)
Switching current, max.	1.5 A
Switching power, max.	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	D-sub connector, 15-pin, male
Transition resistance with socket	125 mΩ
Interface Type	RS232C, asynchronous
Baud rates	300, 1200, 2400, 4800, 9600
Data format	ASCII 1 start bit, 8 data bits, 1 stop bit, no parity bit
Connection, equipment side Cable length, max.	D-sub connector, 9 pin, male 30 m
Weight	≈0.14 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.

3.3 Interface and Relay Board IF300P

Relay	
Number	5
Contact type	mechanical relay 1 change over contact each floating max. 50 V (ac) relative to other contacts and ground
Characteristic data (ac)	
Switching voltage, max.	50 V (ac)
Switching current, max.	1.5 A
Switching power, max.	75 VA
Characteristic data (dc)	
Switching voltage, max.	30 V (dc) switching voltages >50 V (dc) are inadmissible for safety reasons
Switching current, max.	1.5 A 0.6 A at 50 V (dc) 0.8 A at 40 V (dc) 1.5 A at 30 V (dc)
Switching power, max.	45 VA
Connection, equipment side	
Type	D-sub connector, 15-pin, male
Transition resistance with socket	125 mΩ
Interface	
Type	Profibus-DP
Baud rates	<12Mbaud
Data format	Profibus-DP interface →  [3]
Connection, equipment side	D-sub connector, 9-pin, male
Cable length, max.	→  [3]
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.

3.4 Interface and Relay Board IF301P

Relay Number	5
Contact type	PhotoMOS relay 1 change over contact each floating max. 50 V (ac) relative to other contacts and ground
Characteristic data (ac) Switching voltage, max.	50 V (ac)
Switching current, max.	0.5 A
Switching power, max.	25 VA
Characteristic data (dc) Switching voltage, max.	30 V (dc) switching voltages >50 V (dc) are inadmissible for safety reasons
Switching current, max.	0.5 A
Switching power, max.	15 W
Connection, equipment side Type	D-sub connector, 15-pin, male
Transition resistance with socket	2.5 Ω
Interface Type	Profibus-DP
Baud rates	<12Mbaud
Data format	Profibus-DP interface →  [3]
Connection, equipment side	D-sub connector, 9-pin, male
Cable length, max.	→  [3]
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, IF301P board), use the recommended special cable only (→ [3]).

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.



Bevorzugen Sie bei Kabellängen <100 m die Messkarte für kurze Kabel, da sonst der Abgleich schwieriger ist. Bei Messröhrenkabeln >100 m ist die Version für lange Kabel zu verwenden.

4.3 Connecting the Cold Cathode Gauge

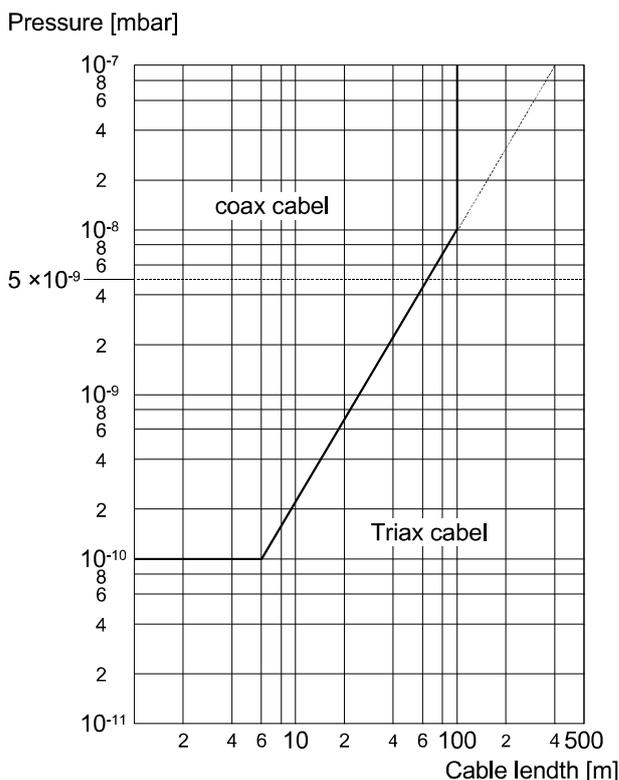


Additional protective measures must be taken if certain processes in the vacuum system (e.g. flashovers) can cause hazardous voltages on the gauge terminals.



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.

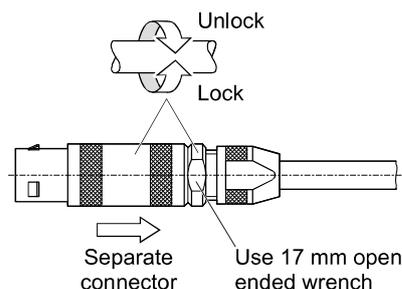


The maximum length of 100 m for coaxial cables is specified by EN 61010. Greater lengths are not admissible without additional protective measures.

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

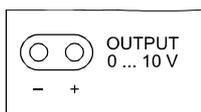


If the cable length is >100 m (only admissible with triaxial cable), the connectors must be protected against unintentional separation and contact of the center conductor. The cable must only be plugged in or detached while the unit is switched off for at least 15 seconds.



Protection against unintentional separation of the triaxial connector.

4.4 Connecting the <OUTPUT> Analog Signal

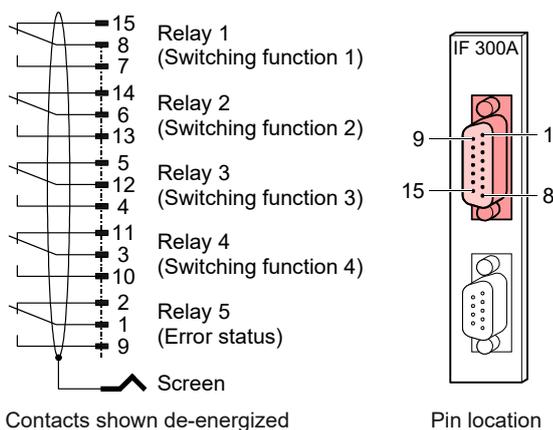


Each measurement circuit is equipped with an analog signal output. Matching connectors are included with each measurement board.

4.5 Connecting the Relays of the IF300A

Pin Assignment

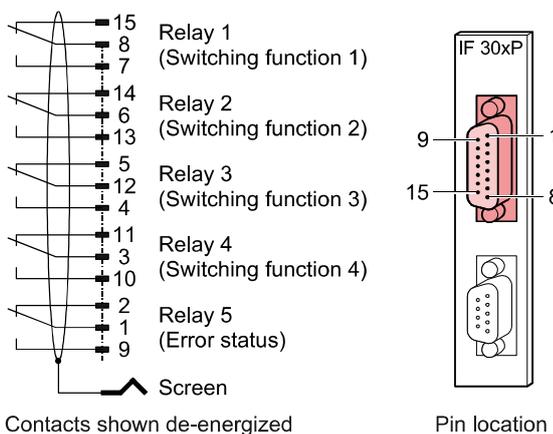
The relay connector on the rear of the IF300A has the following pin assignment:



4.6 Connecting the Relays of the IF30xP

Pin Assignment

The relay connector on the rear of the IF30xP has the following pin assignment:



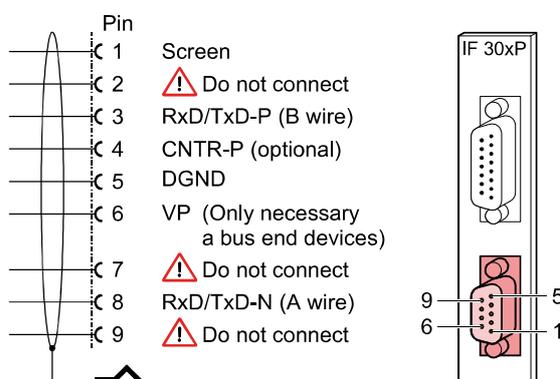
4.7 Connecting the Profibus-DP Interface to the IF30xP

Pin Assignment



In a Profibus-DP installation, use the recommended special cable only (→ [3]).

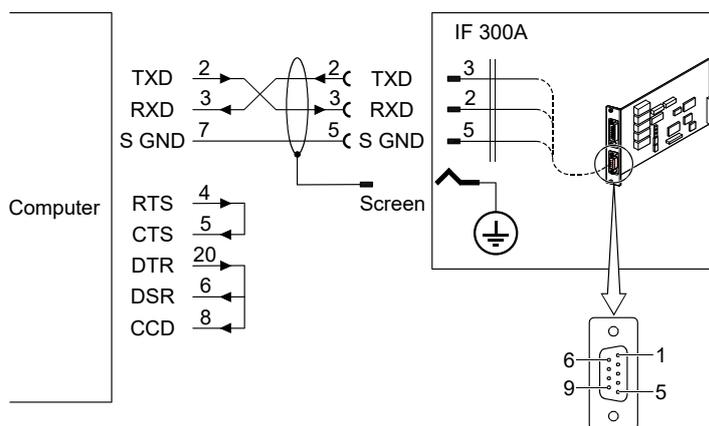
The interface connector on the rear of the IF30xP has the following pin assignment:



4.8 Connecting the RS232C Interface to the IF300A

Pin Assignment

The interface connector on the rear of the IF 300A has the following pin assignment:



Pin 3 = Transmit data TXD *)
 Pin 2 = Receive data RXD *)
 Pin 5 = Signal gnd
 Housing = Screen

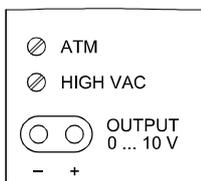
*) Reference point: IF 300A

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  22).

6.1 Operating and Adjustment Problems

Problem	Possible cause	Correction
Pirani reading too high	Pirani gauge contaminated	Adjust Pirani measurement circuit (→  14)
		Clean gauge (→  [4])
		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 (→  [5])
		Replace ionization chamber
Pirani can not be adjusted	Incorrect combination measurement board – gauge – cable	Select correct combination (→  10)
	Gauge severely contaminated	Clean or replace gauge (→  [5])

6.2 Defects

Problem	Possible cause	Correction
Cold cathode constantly indicates « OR » (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 (→  10)
Cold cathode indicates « UR » (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 (→  [5])
	Cold cathode measurement board defective	Replace the cold cathode measurement board (→  10)

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, TPG500 (→  [1], [2])

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 (→  [3])
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 → [4]	CP300C9, T11, T11L	DN 16 ISO-KF DN 40 CF-F	IO G15 020 IO G15 024
IKR084 → [5]	CP300C9	DN 40 ISO-KF DN 40 CF-F	PT R18 770 PT R18 771
IKR085 → [5]	CP300C9	DN 40 ISO-KF DN 40 CF-F	PT R18 772 PT R18 773
IKR086 → [5]	CP300C9, T11, T11L	DN 40 ISO-KF DN 40 CF-F	PT R18 776 PT R18 777

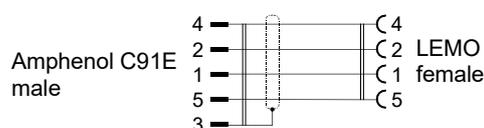
7.2 Measurement Cables and Cable Connectors

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	IC100003	tbd
5	IC100005	tbd
10	IC100010	tbd
15	IC100015	tbd
20	IC100020	tbd
25	IC100025	tbd
30	IC100030	tbd
35	IC100035	tbd
40	IC100040	tbd
45	IC100045	tbd
50	IC100050	tbd

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	IC1250003	tbd
5	IC1250005	tbd
10	IC1250010	tbd
15	IC1250015	tbd
20	IC1250020	tbd
25	IC1250025	tbd
30	IC1250030	tbd
35	IC1250035	tbd
40	IC1250040	tbd
45	IC1250045	tbd
50	IC1250050	tbd

Measurement cables for IKR086 are to be defined.

Cold cathode cable connectors controller side

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

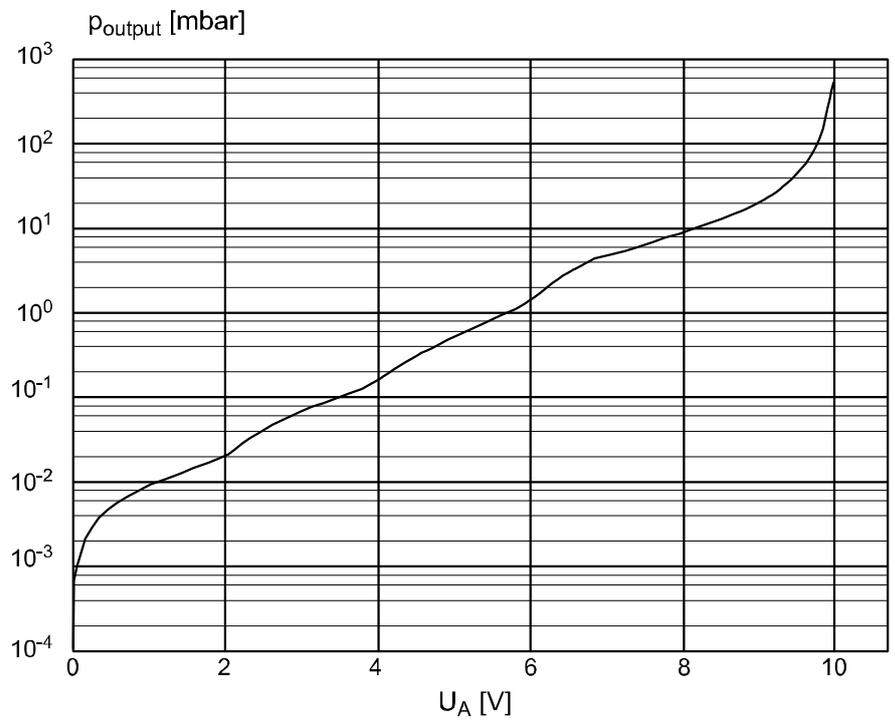
Cold cathode cable connectors gauge head side

Connectors gauge head side	Ordering Number
Triax	IT1001030
Coax	IT100103116

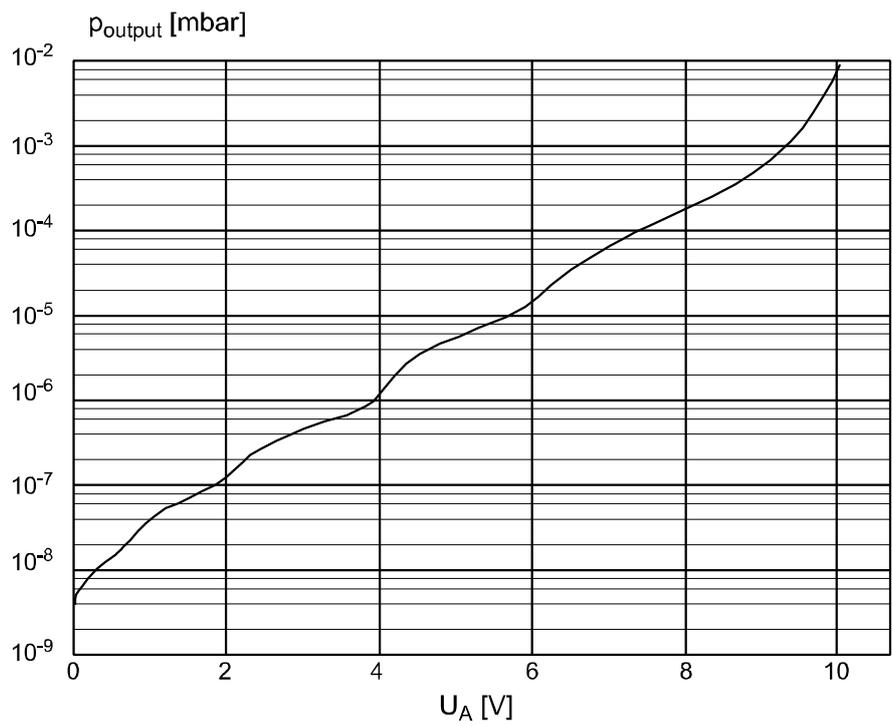
Appendix

A: Output Signals of the Measurement Boards

Pirani Gauge
TPR018 with CP300C9



Cold Cathode Gauge
IKR08x with CP300C9

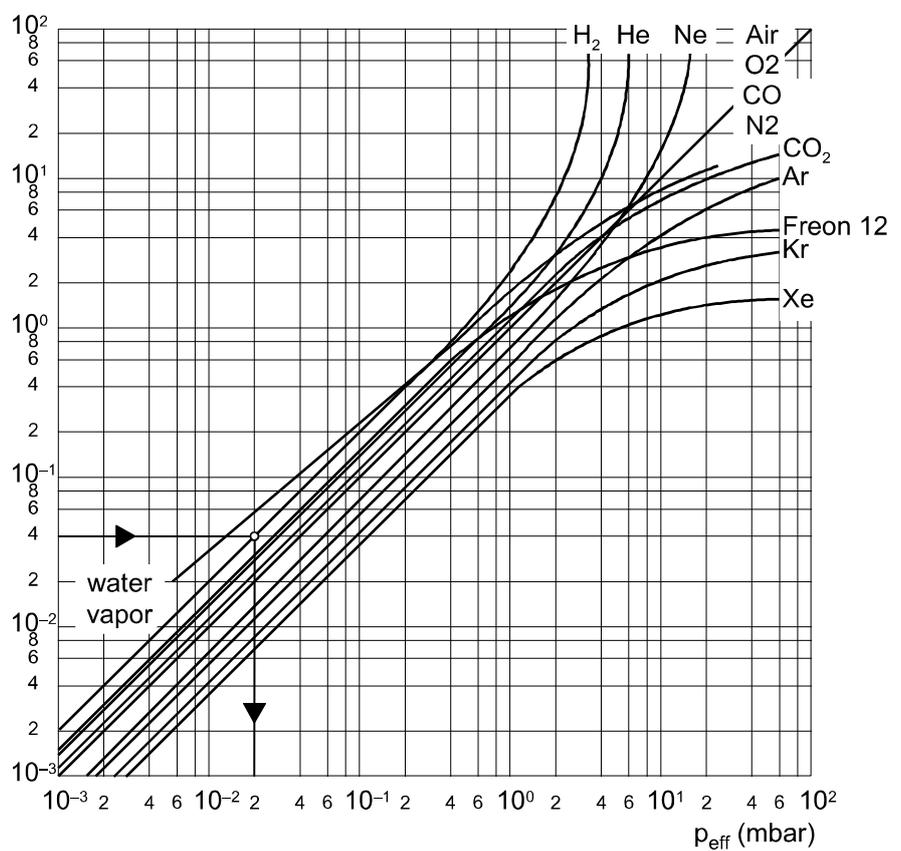


B: Gas Type Dependence

Pirani Gauge TPR018

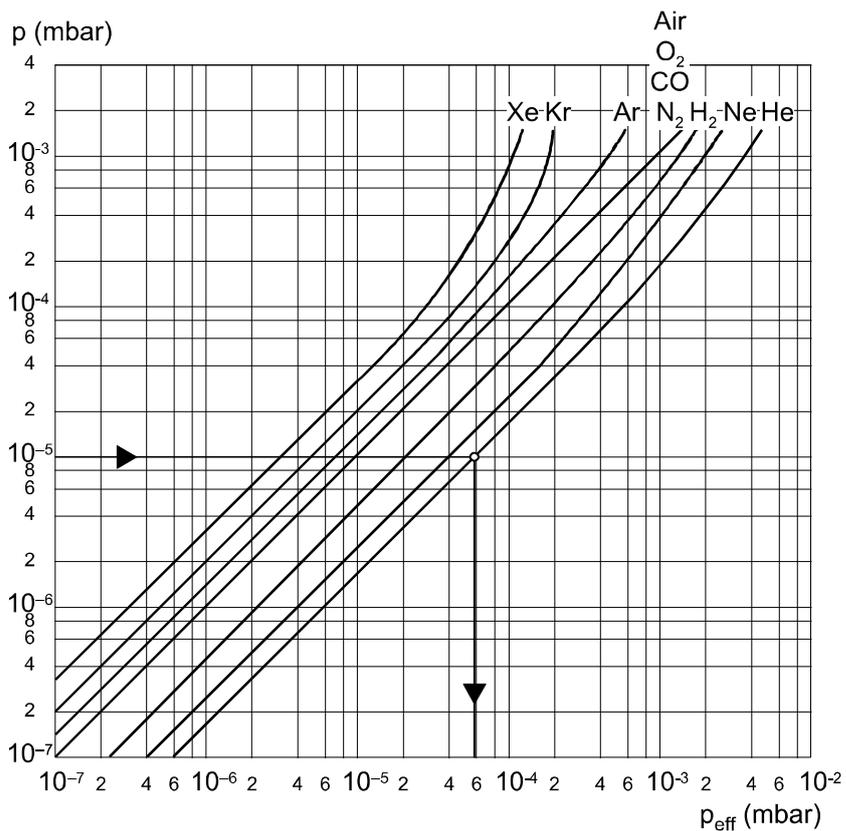
Indicated pressure (instrument calibrated for air)

p (mbar)



Cold Cathode Gauge IKR08x

Indicated pressure (Instrument calibrated for air)



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

C: Literature

-  [1] Operating Manual
 Total Pressure Gauge Controller TPG300
 IG9970BEN
 INFICON AG, LI-9496 Balzers, Liechtenstein
-  [2] Operating Manual
 Total Pressure Gauge Controller TPG500
 IG6008BEN
 INFICON AG, LI-9496 Balzers, Liechtenstein
-  [3] Communication Protocol
 Profibus-DP Interface Board IF300P, IF301P
 IG9973BEN
 INFICON AG, LI-9496 Balzers, Liechtenstein
-  [4] Operating Manual
 Pirani Gauge TPR018
 BG9976BEN
 INFICON AG, LI-9496 Balzers, Liechtenstein
-  [5] Operating Manual
 Cold Cathode Gauge IKR084, IKR085, IKR086
 IG9048BEN
 INFICON AG, LI-9496 Balzers, Liechtenstein

Notes

Original: English



i 95972ber/ a



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