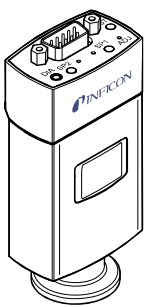
Pirani Capacitance Diaphragm Gauge

PCG550
PCG552
PCG554

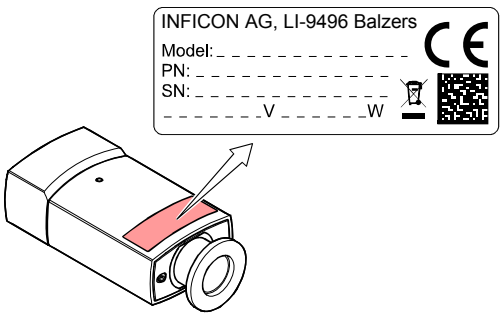


CE

Operating Manual
Incl. EC Declaration of Conformity

Product Identification

In all communications with INFICON, please specify the information given on the product nameplate. For convenient reference copy that information into the space provided below.

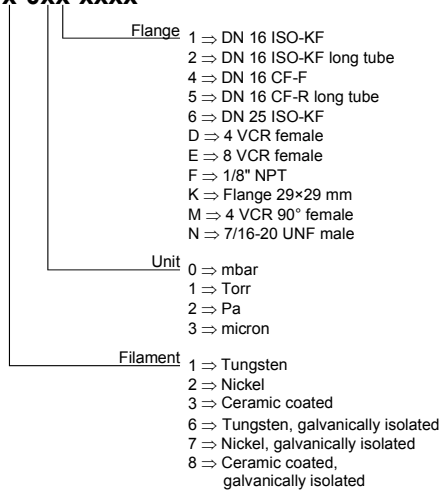


Validity

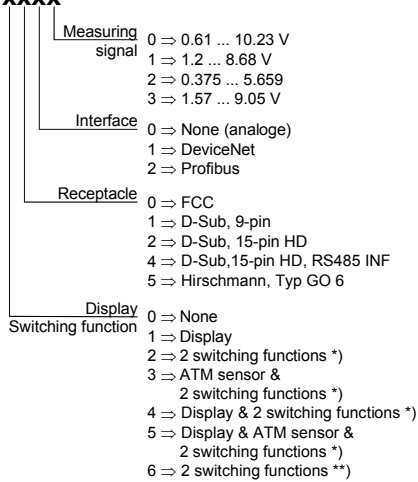
This document applies to products of the PCG55x series.

Part numbers of standard products are indicated below. OEM products have other part numbers and different parameter settings (e.g. factory setting of setpoint) as defined in the corresponding ordering information.

3PCx-0xx-xxxx



3PCx-0xx-xxxx



*) Solid state relays
**) Mechanical relays

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 gauges with the DN 16 ISO-KF vacuum connection and display. They apply to gauges with other vacuum connections by analogy.

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

Intended Use

The Pirani Capacitance Diaphragm Gauge PCG55x has been designed for vacuum measurement of gases in the pressure range of 5×10^{-5} … 1500 mbar.

It must not be used for measuring flammable or combustible gases which react in air.

The gauge is intended for operation in connection with an INFICON Vacuum Gauge Controller VCG401, 402, 403 or with another suitable controller.

Functional Principle

The PCG gauge is a combination gauge consisting of a Pirani sensor and a diaphragm capacitive sensor. Both sensors are constantly active.

At low pressures, only the signal of the Pirani sensor is used for pressure measurement; at high pressures, only the signal of the diaphragm capacitive sensor. To determine the output signal in the intermediate range, both signals are used proportionally to the pressure.

Trademark

VCR® Swagelok Marketing Co.

Patents

EP 0689669 B1, 0689670 B1, 0658755 B1

US Patente 5608168, 4031997, 5583297

Scope of Delivery

1× gauge
1× pin for adjusting settings via buttons
1× Operating Manual English
1× Operating Manual German

Contents

For cross-references within this document, the symbol (→ 🗎 XY) is used, for cross-references to further documents, listed under "Further Information", the symbol (→ 🕮 [Z]).

1 Safety

1.1 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.

Notice

<…> Labeling

1.2 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.

1.3 General Safety Instructions

- Adhere to the applicable regulations and take the necessary precautions for the process media used.

  Consider possible reactions with the product materials.

  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.

1.4 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.

2 Technical Data

For further technical data for gauges with DeviceNet and Profibus interface → 🕮 [3], [4], [5].

Measurement range	5×10^{-5} … 1500 mbar
Measurement principle	
10 [1] mbar … 1500 mbar	diaphragm capacitive sensor
1 … 10 [1] mbar	crossover range
5×10^{-5} … 1 mbar	thermal conductance acc. to Pirani
Accuracy (N_2)	
5×10^{-4} … 1×10^{-3} mbar	±50% of reading
1×10^{-3} … 100 mbar	±15% of reading
100 … 950 mbar	±5% of reading
950 … 1050 mbar	±2.5% of reading
Repeatability (N_2)	
1×10^{-3} … 1100 mbar	±2% of reading

Output signal (measurement signal)

Voltage range	
3PCx-0xx-xxx0	0 … +10.23 V
3PCx-0xx-xxx1	0 … +8.68 V
3PCx-0xx-xxx2	0 … +5.659 V
3PCx-0xx-xxx3	0 … +9.05 V

[1] Crossover range for air, O_2, CO and N_2 10 mbar, 100 mbar in heavy gases.

Measurement range	
3PCx-0xx-xxx0	+0.61 … +10.23 V
3PCx-0xx-xxx1	+1.2 … +8.68 V
3PCx-0xx-xxx2	+0.375 … +5.659 V
3PCx-0xx-xxx3	+1.57 … +9.05 V
Error signal	0 V (default)
Voltage vs. pressure	
3PCx-0xx-xxx0	1.286 V/decade, logarithmic
3PCx-0xx-xxx1	1 V/decade, logarithmic
3PCx-0xx-xxx3	1 V/decade, logarithmic
3PCx-0xx-xxx2	→ 🗎 22
Output impedance	2 × 4.7 Ω, short circuit-proof
Load impedance	>10 kΩ
Response time	<30 ms
Gauge identification	
FCC 68 (+0.61 … +10.23 V)	71.5 kΩ
Hirschmann GO 6	
(+1.2 … +8.68 V)	3.01 kΩ
HV adjustment	at $<10^{-5}$ mbar
ATM adjustment	at >100 mbar

Solid state relays	switching functions SP1, SP2, ATM
Setting range (N_2)	5.0×10^{-5} … 1500 mbar
Hysteresis [2)]	10% of threshold
Switching characteristics [2)]	Low Trip Point
Contact rating	<30 VAC/DC, ≤0.3 A resistive
closed	LED lit solid
open	LED off
Switching time	<30 ms

Mechanical relays	switching functions SP1, SP2, ATM
Setting range (N_2)	5.0×10^{-5} … 1500 mbar
Hysteresis [2)]	10% of threshold
Switching characteristics [2)]	Low Trip Point
Type	1 floating contact (n.o.) per switching function
Contact rating	<30 VAC/DC, ≤1 A resistive
closed	LED lit solid
open	LED off
Switching time	<30 ms

Diagnostic port	Jack connector 2.5 mm, 3-pin

[2)] The hysteresis and the switching characteristics can be programmed via the serial interface or the diagnostic port.

Supply

DANGER

The gauge may only be connected to power supplies, instruments, or control devices that conform to the requirements of a grounded protective extra-low voltage (SELV). The connection to the gauge has to be fused. [3)]

Supply voltage at the gauge	+15 … +30 VDC
Ripple	≤1 V_{pp}
Power consumption	
without fieldbus	≤2.5 W
DeviceNet	≤3 W
Profibus	≤3 W
Fuse to be connected [3)]	1 AT

The voltage for the gauge equipped with the DeviceNet interface is supplied via the DeviceNet cable.

Gauges with DeviceNet interface and part number 3PC1- / 3PC2- / 3PC3-0xx-x1x require an additional, separate power supply via the sensor cable.

Supply voltage at the sensor cable	+15 … +30 VDC
Power consumption	≤3 W

[3)] INFICON controllers fulfill this requirement.

Electrical connection	
3PCx-0xx-x0xx	FCC 68
3PCx-0xx-x1xx	D-Sub 9-pin, male
3PCx-0xx-x2xx	D-Sub 15-pin HD, male
3PCx-0xx-x4xx	D-Sub 15-pin HD, RS485 INF, male
3PCx-0xx-x5xx	Hirschmann GO 6, 6-pin, male
Sensor cable	shielded 0.14 mm^2/conductor
Cable length	≤100 m
RS232C operation	≤30 m
Grounding concept	→ "Power Connection"
Vacuum connection to signal common	connected via 10 kΩ, 10 nF
RS232C / RS485 interface	
Transmission rate	57600 baud (default)
Data format	binary 8 data bits one stop bit no parity bit no handshake → "Power Connection"

For further information on the RS232C / RS485C interface → 🕮 [3].

DeviceNet interface	
Specification, data format, communication protocol	→ 🕮 [7]
Interface, physical	CAN bus
Data rate (adjustable via <RATE> switch)	125 kBaud 250 kBaud 500 kBaud (default) <P> (125 kBaud, 250 kBaud, 500 kBaud programmable via DeviceNet, → 🕮 [4])
Node address (MAC ID) (Adjustable via <ADDRESS>, <MSD>, <LSD> switches)	0 … 63dec (63dec default) <P> (0 … 63 programmable via DeviceNet, → 🕮 [4])
DeviceNet connector	Micro-Style, 5-pin, male
Cable	shielded, special DeviceNet cable, 5 conductors → 🗎 35, → 🕮 [8]
Cable length, system wiring	according to DeviceNet specifications, → 🕮 [7], [8]
For further information on the DeviceNet interface → 🕮 [4]	

Profibus interface	
Specification, data format, communication protocol	→ 🕮 [9]
Interface, physical	RS485
Data rate	≤12 Mbaud (→ 🕮 [5])
Node address	
Local (Adjustable via hexadecimal <ADDRESS>, <MSD>, <LSD> switches)	00 … $7D_{hex}$ (0 … 125_{dec})
Default setting	$0.1C_{hex}$
Via Profibus (hexadecimal <ADDRESS> switches set to >$7D_{hex}$ (>125_{dec})	00 … $7D_{hex}$ (0 … 125_{dec})
Profibus connection	D-Sub, 9-pin, female
Cable	shielded, special Profibus cable, → 🗎 36, → 🕮 [10]
Cable length, system wiring	according to Profibus specifications, → 🕮 [9], [10]
For further information on the Profibus interface → 🕮 [5]	

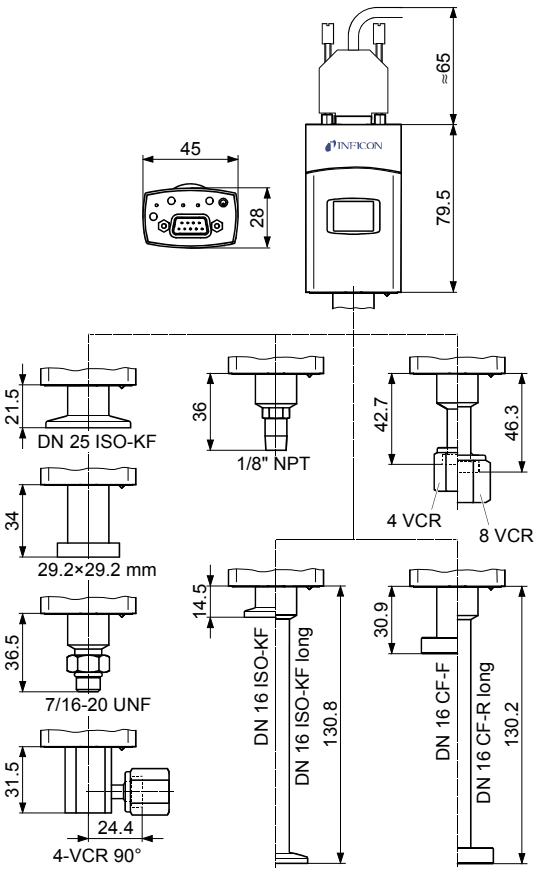
Materials exposed to vacuum	
Vacuum connection	stainless steel 1.4435
Filament	
3PC1 / 6-0xx-xxxx	W
3PC2 / 7-0xx-xxxx	Ni
3PC3 / 8-0xx-xxxx	ceramic coated
Feedthrough	glass
Orifice [4)]	stainless steel
Diaphragm	ceramic
Further materials	Ni, NiFe, stainless steel 1.4301, SnAg

4) Only versions DN 16 ISO-KF and DN 16 CF-F.

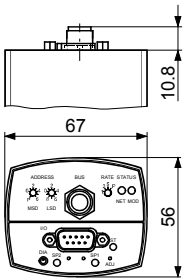
Internal volume	
DN 16 ISO-KF	4.7 cm^3
DN 16 ISO-KF, long tube	14.5 cm^3
DN 16 CF-F	8 cm^3
DN 16 CF-R, long tube	14 cm^3
DN 25 ISO-KF	5.5 cm^3
4 VCR® female	5.5 cm^3
8 VCR® female	7 cm^3
1/8" NPT	5.2 cm^3
Flange 29×29 mm	4.9 cm^3
4 VCR® 90°, female	7.9 cm^3
7/16-20 UNF	5.2 cm^3
Permissible pressure (absolute)	≤5 bar
Bursting pressure (absolute)	10 bar
Permissible temperatures	
Operation	+10 °C … +50 °C
Vacuum connection [5]	≤80 °C
long tube [5]	≤250 °C
Filament	<160 °C
Storage	–20 °C … +65 °C
Relative humidity	
Year's mean	≤65% (no condensation)
During 60 days	≤85% (no condensation)
Mounting orientation	any
Use	indoors only, altitude up to 2000 m NN
Degree of protection	IP 40
Weight	
without fieldbus interface	115 g …130 g
with fieldbus interface	230 g … 250 g

[5] For horizontal mounting orientation only. During bakeout, measurement range, accuracy, and repeatability may deviate from specifications.

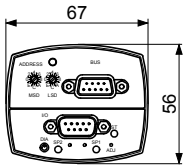
Dimensions [mm]



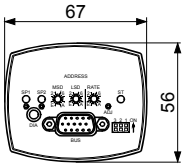
DeviceNet



Profibus

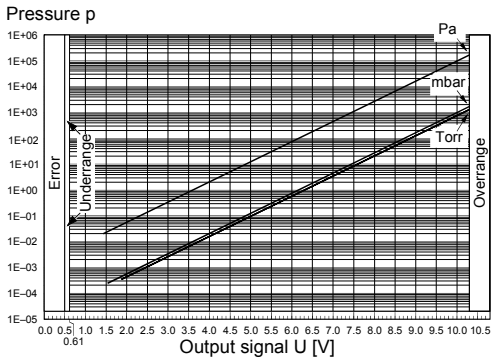


RS485



2.1 Output Signal vs. Pressure

Measurement range 0.61 … 10.23 V



$p = 10^{0.778(U-c)}$ ⇔ $U = c + 1.286 \log_{10} p$

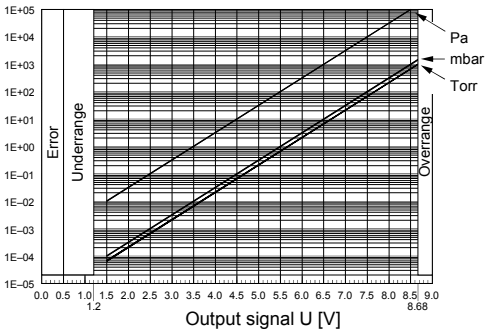
valid in the range 5×10^{-5} mbar <p< 1500 mbar

U	p	c
[V]	[mbar]	6.143
[V]	[µbar]	2.287
[V]	[Torr]	6.304
[V]	[mTorr]	2.448

U	p	c
[V]	[micron]	2.448
[V]	[Pa]	3.572
[V]	[kPa]	7.429

where p pressure
U output signal
c constant (pressure unit dependent)

Measurement range 1.2 … 8.68 V



$p = 10^{(U-c)}$ ⇔ $U = c + \log_{10} p$

valid in the range 5×10^{-5} mbar <p< 1500 mbar

U	p	c	U	p	c
[V]	[mbar]	5.5	[V]	[micron]	2.625
[V]	[µbar]	2.5	[V]	[Pa]	3.5
[V]	[Torr]	5.625	[V]	[kPa]	6.5
[V]	[mTorr]	2.625			

where p pressure
U output signal
c constant (pressure unit dependent)

Measurement range 0.375 … 5.659 V

Signal U	Pressure p		
[V]	[mbar]	[Pa]	[Torr]
0.375	$<5\times10^{-5}$	$<6.65\times10^{-3}$	$<5\times10^{-5}$
0.376	0.000133322	0.013332237	0.0001
0.377	0.000266645	0.026664474	0.0002
0.379	0.000666612	0.066661184	0.0005
0.384	0.001333224	0.133322368	0.0010
0.392	0.002666447	0.266644736	0.0020
0.417	0.006666118	0.66661184	0.0050
0.455	0.013332237	1.33322368	0.0100
0.523	0.026664474	2.66644736	0.0200
0.682	0.066661184	6.6661184	0.0500
0.876	0.133322368	13.3322368	0.1000
1.155	0.266644736	26.6644736	0.2000
1.683	0.66661184	66.661184	0.5000
2.217	1.33322368	133.322368	1.0000
2.842	2.66644736	266.644736	2.0000
3.675	6.6661184	666.61184	5.0000
4.206	13.3322368	1333.22368	10.0000
4.577	26.6644736	2666.44736	20.0000
4.846	66.661184	6666.1184	50.0000
4.945	133.322368	13332.2368	100.0000
5.019	266.644736	26664.4736	200.0000
5.111	399.967104	39996.7104	300.0000
5.224	533.289472	53328.9472	400.0000
5.329	666.61184	66661.184	500.0000
5.419	799.934208	79993.4208	600.0000
5.495	933.256576	93325.6576	700.0000
5.534	1013.249997	101324.9997	760.0000
5.558	1066.578944	106657.8944	800.0000
5.614	1199.901312	119990.1312	900.0000
5.659	1333.22368	133322.368	1000.0000

Valid in the range 0.375 … 2.842 V

$$p = a + bU + cU^2 + dU^3 + eU^4 + fU^5$$

a	–0.02585	c	0.04563	e	–0.04158
b	0.03767	d	0.1151	f	0.008737

where p pressure in Torr a, b, c, d, e, f constant
U output signal

Valid in the range 2.842 … 4.945 V

$$p = \frac{a + cU + eU^2}{1 + bU + dU^2 + fU^3}$$

a	0.1031	c	–0.02322	e	0.07229
b	–0.3986	d	0.07438	f	–0.006866

where p pressure in Torr a, b, c, d, e, f constant
U output signal

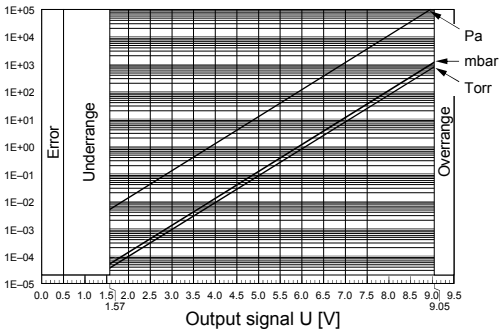
Valid in the range 4.945… 5.659 V

$$p = \frac{a + cU}{1 + bU + dU^2}$$

a	100.624	c	–20.5623
b	–0.37679	d	0.0348656

where p pressure in Torr a, b, c, d constant
U output signal

Measurement range 1.57 … 9.05 V



$$p = 10^{(U-c)} \quad \Leftrightarrow \quad U = c + \log_{10} p$$

valid in the range 5×10^{-5} mbar <p< 1500 mbar

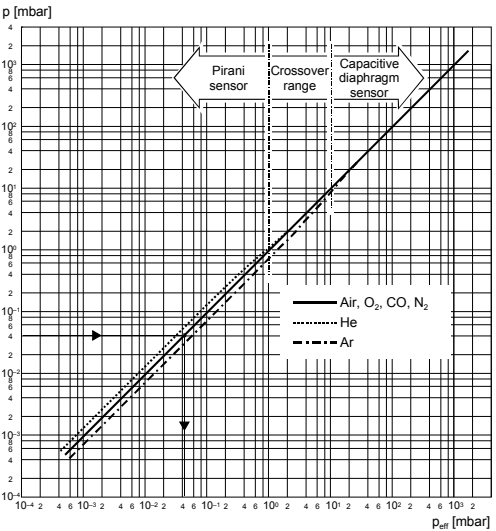
U	p	c
[V]	[mbar]	5.8751
[V]	[µbar]	2.8751
[V]	[Torr]	6
[V]	[mTorr]	3

U	p	c
[V]	[micron]	3
[V]	[Pa]	3.8751
[V]	[kPa]	6.8751

where p pressure
U output signal
c constant (pressure unit dependent)

2.2 Gas Type Dependence

Indicated pressure (gauge calibrated for air)



Calibration factors

valid for Pirani pressure range below 1 mbar

$$p_{eff} = C \times \text{indicated pressure}$$

Gas type	Calibration factor C	Gas type	Calibration factor C
He	0.8	H_2	0.5
Ne	1.4	air, O_2, CO, N_2	1.0
Ar	1.7	CO_2	0.9
Kr	2.4	water vapor	0.5
Xe	3.0	Freon 12	0.7

3 Installation

WARNING

WARNING: fragile components

The ceramic sensor may be damaged by impacts.

Do not drop the product and prevent shocks and impacts.

3.1 Vacuum Connection

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 clamps which are suited to overpressure.

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.

DANGER

DANGER: protective ground

Products that are not correctly connected to ground can be extremely hazardous in the event of a fault.

Electrically connect the gauge to the grounded vacuum chamber. This connection must conform to the requirements of a protective connection according to EN 61010:

- CF, NPT, UNF and VCR flanges fulfill this requirement.
- For gauges with a KF flange, use a conductive metallic clamping ring.
- For gauges with a ½" tube and a 29×29 mm flange, take appropriate measures to fulfill this requirement.

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

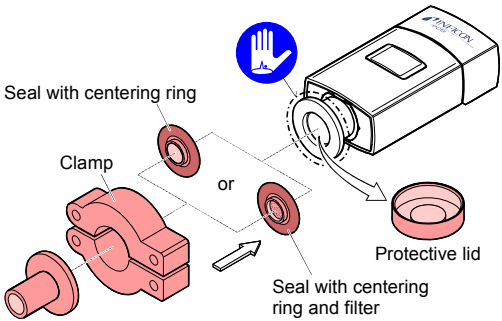
Caution: dirt sensitive area

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

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

Mount the gauge so that no vibrations occur. 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 consider using a seal with centering ring and filter. If adjustment should be possible after the gauge has been installed, be sure to install it so that the buttons can be accessed with a pin.

Remove the protective lid and connect the product to the vacuum system.



Keep the protective lid.

3.2 Power Connection

Make sure the vacuum connection is properly made (→ 🗎 26).

DANGER

The gauge may only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded protective extra-low voltage (SELV). The connection to the gauge has to be fused. [6)]

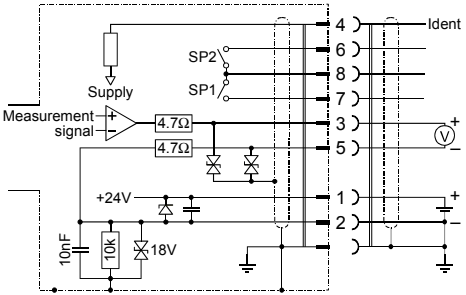
Ground loops, differences of potential, or EMC problems may affect the measurement signal. For optimum signal quality, please do observe the following notes:

- Connect the cable shield to ground on one side via the connector housing. Do not connect the other side of the shield.
- Connect the supply common with protective ground directly at the power supply.
- Use differential measurement input (signal common and supply common conducted separately).
- Potential difference between supply common and housing ≤18 V (overvoltage protection).

6) INFICON controllers fulfill these requirements.

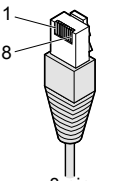
3.2.1 FCC 68, 8-pin Connector

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



Electrical connection

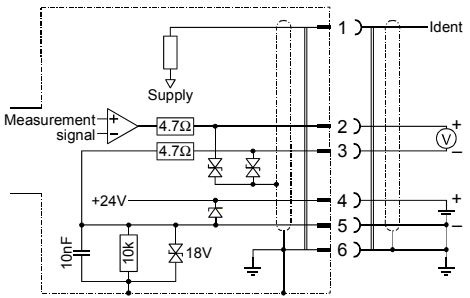
Pin 1	Supply
Pin 2	Supply common, GND
Pin 3	Measurement signal or threshold SP1, SP2
Pin 4	Gauge identification
Pin 5	Signal common
Pin 6, 8	Relay SP2 Common closing contact (com)
Pin 7, 8	Relay SP1 Common closing contact (com)



8-pin FCC-68 connector

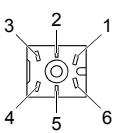
3.2.2 Hirschmann, Type GO 60 Connector

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



Electrical connection

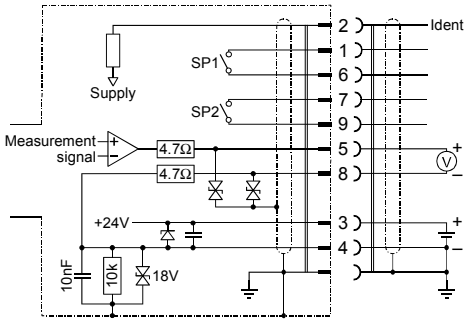
Pin 1 Gauge identification
Pin 2 Measurement signal or threshold SP1, SP2
Pin 3 Signal common
Pin 4 Supply
Pin 5 Supply common (GND)
Pin 6 Shield



Connector soldering side

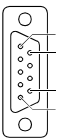
3.2.3 D-Sub, 9-pin Connector

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



Electrical connection

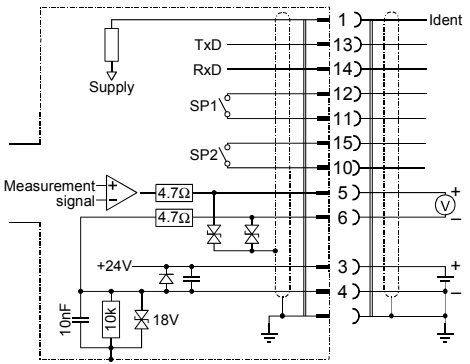
Pin 1 Relay SP1, closing contact
Pin 2 Gauge identification
Pin 3 Supply
Pin 4 Supply common, GND
Pin 5 Measurement signal
or thresholds SP1, SP2
Pin 6 Relay SP1
Common contact (com)
Pin 7 Relay SP2
Common contact (com)
Pin 8 Signal common
Pin 9 Relay SP2, closing contact



D-Sub, 9-pin female soldering side

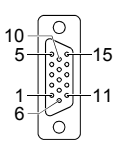
3.2.4 D-Sub, 15-pin HD Connector

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



Electrical connection

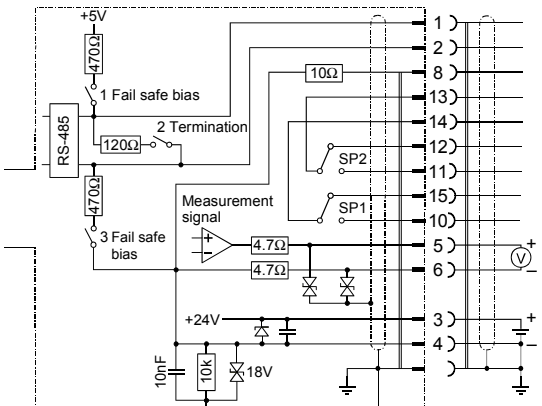
Pin 1,2	Gauge identification
Pin 2	N.C.
Pin 3	Supply
Pin 4	Supply common
Pin 5	Measurement signal
Pin 6	Signal common
Pin 7,8,9	N.C
Pin 10	Relay SP1, N.O.
Pin 11	Relay SP2, N.O.
Pin 12	Relay SP2 Common contact (com)
Pin 13	RS232, TxD
Pin 14	RS232, RxD
Pin 15	Relay SP1 Common contact (com)



D-Sub 15-pin HD female soldering side

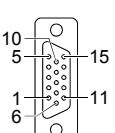
3.2.5 D-Sub, 15-pin HD, RS485 INF Connector

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



Electrical connection

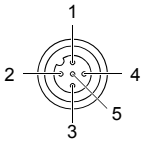
Pin 1	RS485 B+
Pin 2	RS485 A–
Pin 3	Supply
Pin 4	Supply common
Pin 5	Measurement signal
Pin 6	Signal common
Pin 7	Reserved
Pin 8	RS485 GND
Pin 9	Reserved
Pin 10	Relay SP1, N.O.
Pin 11	Relay SP2, N.O.
Pin 12	Relay SP2, common contact (com)
Pin 13	Relay SP2, N.C.
Pin 14	Relay SP1, N.C.
Pin 15	Relay SP1, common contact (com)



D-Sub 15-pin HD female soldering side

3.2.6 DeviceNet Connector

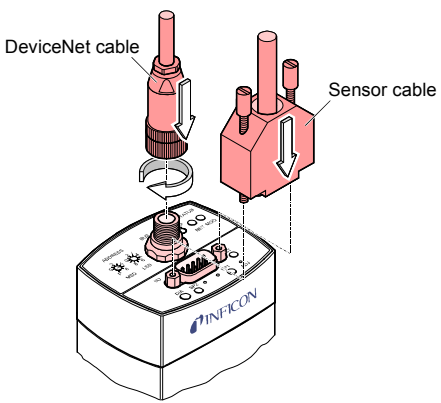
If no DeviceNet cable is available, make one according to the following diagram. Connect the DeviceNet cable.



Micro-Style, 5-pin, (DeviceNet), female, soldering side

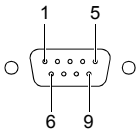
Pin 1	Drain	
Pin 2	Supply	+15 … +30 VDC
Pin 3	Supply common	GND
Pin 4	CAN_H	
Pin 5	CAN_L	

Gauges with DeviceNet interface and part number 3PC1- / 3PC2- / 3PC3-0xx-x1x require an additional, separate power supply via the sensor cable (→ 🕮 13).



3.2.7 Profibus Connector

If no Profibus cable is available, make one according to the following diagram. Connect the Profibus cable.

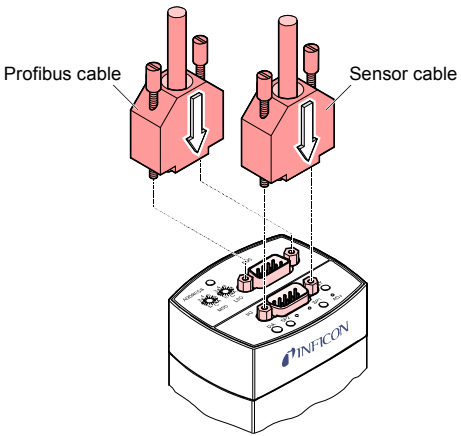


D-Sub, 9-pin, male, soldering side

Pin 1, 2	Do not connect	Pin 6	VP [2]
Pin 3	RxD/TxD-P	Pin 7, 9	Not connected
Pin 4	CNTR-P [1]	Pin 8	RxD/TxD-N
Pin 5	DGND [2]		

[1] Only to be connected if an *optical link* module is used.

[2] Only required as line termination for devices at both ends of bus cable (→ 🕮 [10]).



4 Operation

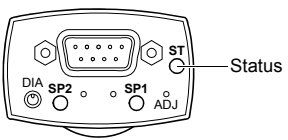
When the supply voltage is applied, the measurement signal is available at the connector (→ "Power Connection").

Allow a stabilization period of at least 10 minutes. It is advisable to operate the gauge continuously, irrespective of the pressure.

The gauge is factory calibrated. Due to long time operation or contamination, a zero drift could occur. Periodically check the zero and adjust it if necessary (adjusting the gauge → 57).

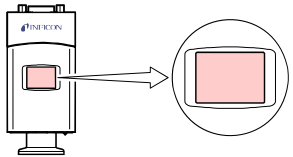
4.1 Status Indication and Displays

Status indication (LED)



LED	State	Meaning
<ST>	off	no supply voltage
	lit green	measurement mode
	lit red	error
<SP1>	lit green	Relay SP 1 closed
	off	Relay SP 1 open
<SP2>	lit green	Relay SP 2 closed
	off	Relay SP 2 open

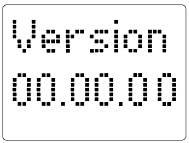
LCD display



State	Meaning
off	no supply voltage
lit green	measurement / parameter mode
lit red	error

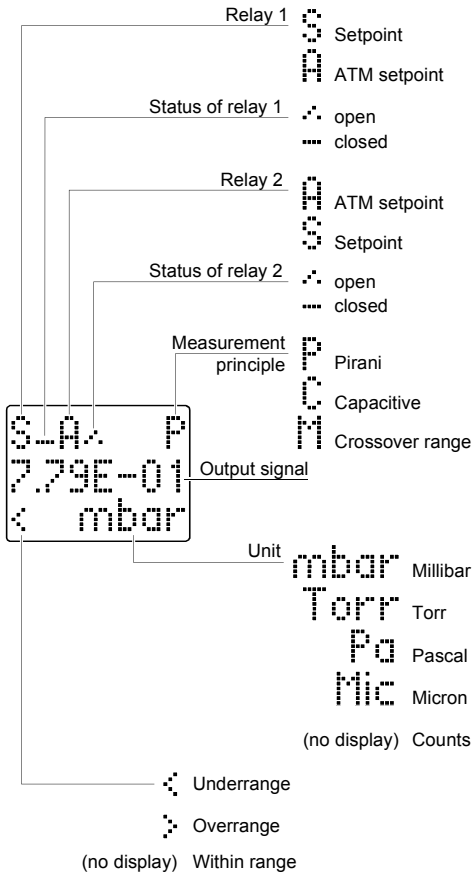
The display can be rotated by 180 ° via the serial interface.

Put the gauge into operation

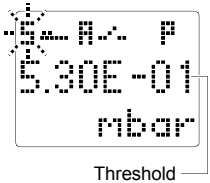


When the supply voltage is applied the software version is briefly displayed.

Measurement mode



Parameter mode

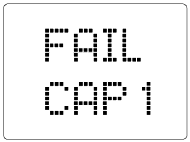


Switching functions <S>

When the <SP1> or <SP2> button is pushed, the corresponding threshold is displayed and the corresponding relay flashes.

Error display (trouble shooting → 🗎 61)

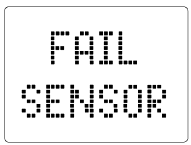
Pirani sensor error



Diaphragm sensor error

Atmosphere pressure sensor error

EEPROM error



Sensor error

4.2 Gas Type Dependence

Pressure range	Measurement principle	Gas type dependence
10 [7] … 1500 mbar	diaphragm capacitive sensor	independent of gas type, no correction required
1 … 10 [7] mbar	diaphragm capacitive sensor and Pirani sensor	crossover range
5×10^{-5} … 1 mbar	Pirani sensor	proportional to pressure [8]

4.3 Switching Functions SP1, SP2

The two switching functions can be set to any pressure within the measurement range of the gauge. A solid state relay is provided for each switching function.

---

[7] Crossover range for air, O_2, CO and N_2 10 mbar, 100 mbar in heavy gases.

[8] The pressure reading applies to dry air, O_2, CO and N_2. For other gases, it has to be converted (calibration factors (→ 🗎 25).

The current threshold setting

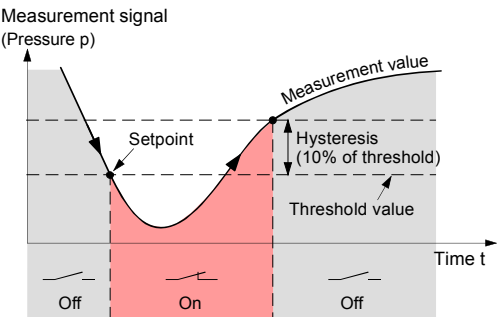
- can be read / written via the diagnostic port
- is output at the measurement signal output instead of the pressure signal, can be measured with a voltmeter, and is displayed on the LCD display after the <SP1> or <SP2> button is pressed
- can be read / written via the serial interface.

Switching characteristics and hysteresis

The switching characteristics and the hysteresis of each set point can be programmed (→ 🗎 45).

Low Trip Point (default)

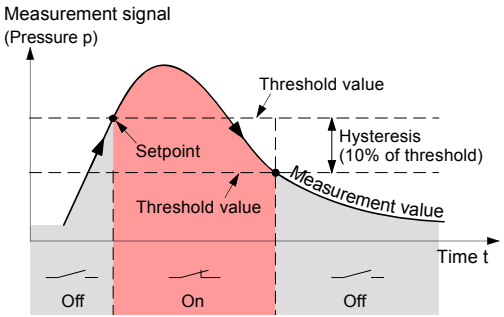
If the pressure in the vacuum system is lower than the setpoint, the corresponding LED (<SP1> or <SP2>) is lit solid and the corresponding relay is closed.



The setpoints SP1 and SP2 are factory set to the lower measurement range limit and therefore do not switch.

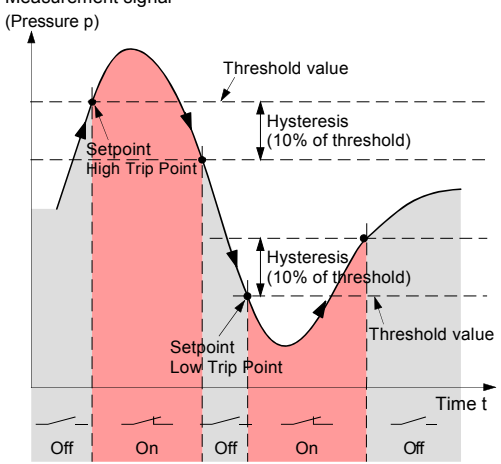
High Trip Point

If the pressure in the vacuum system is higher than the setpoint, the corresponding LED (<SP1> or <SP2>) is lit solid and the corresponding relay is closed.



High & Low Trip Point

Both a High Trip Point and a Low Trip Point are assigned to each setpoint. If the pressure in the vacuum system is higher than the defined High Trip Point threshold, the corresponding LED (<SP1> or <SP2>) is lit and the corresponding relay is closed. If the pressure in the vacuum system is lower than the defined Low Trip Point threshold, the correspoinding LED (<SP1> or <SP2>) is lit and the corresponding relay is closed.



The setpoints can only be programmed via

- the diagnostic port (→ 🕮 [6])
- the serial interface (→ 🕮 [3], [4], [5]).

4.3.1 Adjusting the Setpoints SP1, SP2

The switching characteristics and the hysteresis can only be programmed via

- the diagnostic port (→ 🕮 [6])
- the serial interface (→ 🕮 [3], [4], [5]).

The thresholds of the setpoints can be adjusted via

- the buttons on the gauge
- the diagnostic port (→ 🕮 [6])
- the serial interface (→ 🕮 [3], [4], [5]).

If both a High Trip Point and a Low Trip Point are assigned to a setpoint, Low Trip Point only can be adjusted via the corresponding button on the gauge.

DANGER

DANGER: malfunction

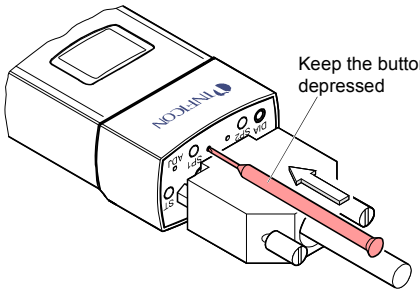
If processes are controlled via the signal output, keep in mind that by pushing an <SP> button the measurement signal is suppressed and the corresponding threshold value is output instead. This can cause malfunctions.

Push the <SP> button only if you are sure that no damages can arise from a malfunction.

Adjusting setpoint SP1 with button on the gauge

1. Push the <SP1> button with a pin (max. ø1.1 mm). The gauge changes to the switching function mode and outputs the current threshold value at the measurement value output or on the LCD display for about 5 s and the corresponding <S> on the display blinks.

The threshold setting is increased towards the upper limit until the button is released or the limit is reached. If the button is briefly released and pushed again, the threshold setting starts changing in the reverse direction.



The factory setting of the upper threshold is 10% above the Low Trip Point and 10% below the High Trip Point (hysteresis).

If after programming of the hysteresis the corresponding button <SP1> or <SP2> is pushed, the factory setting of the corresponding hysteresis (10%) is reactivated.

❷ Release the button. The gauge resumes operation after 5 s and at the current pressure value is available at the measurement signal output.

Programming setpoint SP1

Programmable parameters: (→ 🕮 [3], [4], [5])	Low Trip Point Low Trip Enable Low Trip Point Hysteresis High Trip Point High Trip Enable High Trip Point Hysteresis Setpoint Mode

Adjusting setpoint SP2

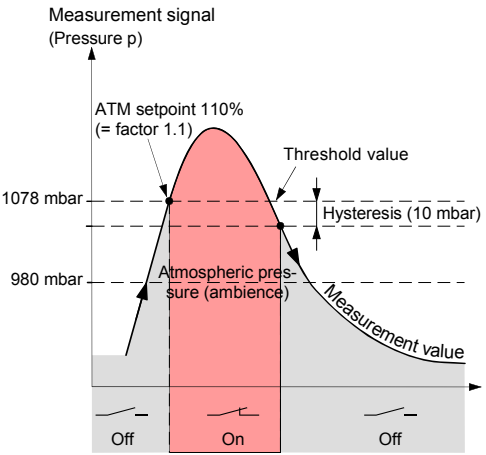
The adjustment procedure is the same as for setpoint SP1.

4.4 ATM Setpoint

The setpoints SP1 and SP2 of gauges with separate atmospheric pressure sensor [9)] can be programmed to atmospheric pressure setpoint (ATM setpoint) via the diagnostic port or serial interface.

The ATM setpoint is defined as a factor of the current atmospheric pressure and can be set to any pressure within the measurement range of the gauge. The relay switches when the pressure in the vacuum system has reached the defined value.

Example: ATM setpoint: 110% of the atmospheric pressure (= factor 1.1)
Switching characteristic: High Trip Point
Hysteresis: 10 mbar



9) The atmospheric pressure sensor measures the atmospheric pressure (pressure outside the vacuum system and can be calibrated against the diaphragm capacitive sensor in the gauge (→ 🗎 59).

The current ATM threshold setting

- can be read / written via the diagnostic port
- is output at the measurement signal output instead of the pressure signal, can be measured with a voltmeter, and is displayed on the LCD display after the <SP1> or <SP2> button is pressed
- can be read / written via the serial interface

DANGER

DANGER: malfunction

If processes are controlled via the signal output, keep in mind that by pushing the <SP> button the measurement signal is suppressed and the corresponding threshold value is output instead. This can cause malfunctions.

Push the <SP> button only if you are sure that no damages can arise from a malfunction.

Programming ATM setpoint

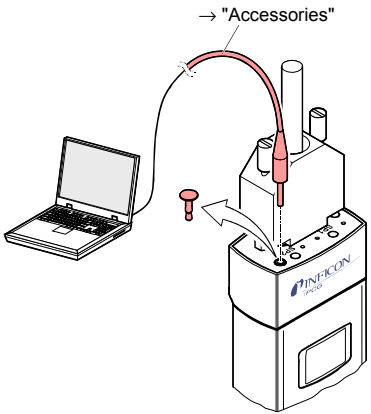
Programmable parameters: (→ 🕮 [3], [4], [5])	Factor of ATM Low Trip Enable Low Trip Point Hysteresis High Trip Enable High Trip Point Hysteresis Setpoint Mode

Switching characteristics of the setpoints → 🗎 42.

Diagnostic port → 🕮 [6].

4.5 Diagnostic Port (RS232C Interface)

The diagnostic port <DIA> permits to output the pressure reading and all status information and to enter all settings at the same time (→ 🕮 [6]).



4.6 DeviceNet Operation

Caution

Caution: data transmission errors

The attempt to operate the DeviceNet gauge with the RS232C interface causes data transmission errors.

This DeviceNet gauge must not be operated with the RS232C interface.

Before the gauge is put into operation, it has to be configured for the DeviceNet. A configuration tool and the device specific EDS (Electronic Data Sheet) file are required for this purpose. This software can be downloaded via internet.

Node Address Setting

Set the node address (0 … 63_{dec}) via the <ADDRESS>, <MSD>, and <LSD> switches (default 63_{dec}). The node address is polled by the firmware when the gauge is switched on. If the setting deviates from the stored value, the new value is taken over into the NVRAM. If a setting higher than 63 is made, the previous node address setting remains valid.

If the <MSD> switch is in the <P> position, the node address is programmable via the DeviceNet (→ 🕮 [4]).

Data Rate Setting

By means of the <RATE> switch, the data rate can be set to 125 (<1>), 250 (<2>) or 500 kBaud (<5>) (default 500 kBaud).

If the switch is in the <P> position, the data rate is programmable via the DeviceNet (→ 🕮 [4]).

Status LED

Two LEDs on the gauge inform on the gauge status and the current DeviceNet status.

<STATUS MOD> (gauge status):

LED	Meaning
off	No supply
blinking green-red	Selftest
lit solid green	Normal operation
lit solid red	Non recoverable error
blinking red	Recoverable error (e.g. missing DeviceNet power supply)

<STATUS NET> (network status):

LED	Meaning
off	Gauge not online: • Selftest not yet concluded • No supply, → "STATUS MOD"
blinking green	Gauge online but no communication: • Selftest concluded but no communication to other nodes established • Gauge not assigned to any master
lit solid green	Gauge online; necessary connections established
blinking red	One or several input / output connections in "time out" status
lit solid red	Communication error. The gauge has detected an error that impedes communication via the network (e.g. two identical node addresses (MAC IC) or "Bus-off")

4.7 Profibus Operation

Caution

Caution: data transmission errors

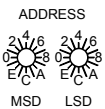
The attempt to operate the gauge with the RS232C interface causes data transmission errors.

This gauge must not be operated with the RS232C interface.

For operating the gauge via Profibus, prior installation of the device specific GSD file is required on the bus master side. This file can be downloaded via internet.

Node Address Setting

For unambiguous identification of the gauge in a Profibus environment, a node address is required. The node address setting is made on the gauge.



The node address (0 … 125_{dec}) is set in hexadecimal form (00 … $7D_{hex}$) via the <ADDRESS>, <MSD>, and <LSD> switches. The node address is polled by the firmware when the gauge is switched on. If the setting deviates from the stored value, the new value is taken over into the NVRAM. If a value >$7D_{hex}$ (>125_{dec}) is entered, the node address setting currently stored in the device remains valid but it can now be defined via Profibus ("Set slave Address", → 🕮 [5]).

Default address setting is $5C_{hex}$.

5 Deinstallation

WARNING

WARNING: fragile components

The ceramic sensor may be damaged by impacts.

Do not drop the product and prevent shocks and impacts.

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.

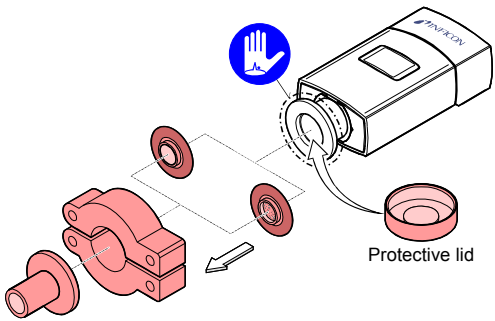
Caution

Caution: dirt sensitive area

Touching the product or parts thereof with 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.
3. Untighten the fastening screw(s) and disconnect the sensor cable.
4. Remove gauge from the vacuum system and install the protective lid.



6 Maintenance, Repair

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

INFICON assumes no liability and the warranty becomes null and void if any repair work is carried out by the end-user or third parties.

6.1 Adjusting the Gauge

The gauge is factory calibrated. Due to long time operation or contamination, a zero drift could occur. Periodically check the zero and adjust it if necessary.

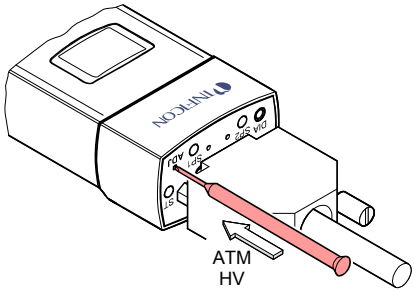
For adjusting the zero, operate the gauge under the same constant ambient conditions and in the same mounting orientation as normally.

The gauge is adjusted to default values. However, it can also be adjusted to other pressure values, if the exact pressure value is known (reference measurement).

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

❷ Put the gauge into operation and operate it at atmospheric pressure for at least 10 minutes.

❸ Press the <ADJ> button with a pin (max. ø1.1 mm) and the ATM adjustment is carried out: The gauge is adjusted to 1000 mbar by default. By pressing the button >5 s the pressure value is increased towards 1200 mbar (or, by pressing it again, decreased towards 500 mbar) until the button is released or the limit is reached.



❹ Evacuate the vacuum system to p << 10^{-5} mbar and wait at least 2 minutes.

❺ Press the <ADJ> button with a pin and the HV adjustment is carried out: The gauge is adjusted to 5×10^{-5} mbar (default).

✓ If the pressure value 4.99×10^{-5} mbar is output at the measurement value output or on the LCD display, the adjustment has been successful. Otherwise, repeat the adjustment procedure.

6.2 Adjusting the Atmospheric Pressure Sensor

The ambient pressure of the gauge is measured by a separate atmospheric pressure sensor built into the electronics unit of the gauge.

The atmospheric pressure sensor can be calibrated against the diaphragm capacitive sensor in the gauge. The gauge electronics compares the output signals of the two sensors and carries out the necessary adjustments to the atmospheric pressure sensor signal.

The adjustment of the atmospheric pressure sensor can only be carried out via

- the diagnostic port (→ 🕮 [6])
- the serial interface (→ 🕮 [3], [4], [5]).

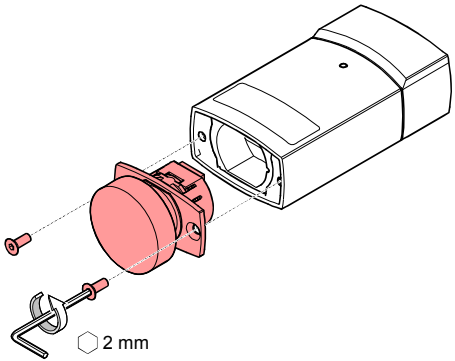
6.3 Replacing the Sensor

In case of severe contamination or a malfunction, the sensor can be replaced.

Precondition

Gauge deinstalled (→ 🗎 55).

❶ Unscrew the hexagon socket screws and remove the sensor without twisting it.



❷ Place the new sensor without twisting it and lock it with the screws.

6.4 Troubleshooting

In case of an error, it may be helpful to just turn off the mains supply and turn it on again after 5 s.

Problem	Possible cause	Correction
Output signal permanently ≈0V	Sensor cable defective or not correctly connected	Check the sensor cable
	No supply voltage	Turn on the power supply
	Error	Remedy the error
	Gauge in an undefined status	Turn the gauge off and on again after 5 s (reset)
FAIL PIR1	Pirani sensor defective	Replace the sensor (→ 🗎 60)
	Electronics unit not correctly mounted on sensor	Check the connections (electronics – sensor)
FAIL CAP1	Diaphragm sensor defective	Replace the sensor (→ 🗎 60)
	Electronics unit not mounted correctly on sensor	Check the connections (electronics – sensor)
FAIL ATM1	Atmospheric pressure sensor defective	Replace the gauge
FAIL EEPROM	EEPROM error	Turn the gauge off and on again after 5 s (reset)
		Replace the gauge
FAIL SENSOR	Electronics unit not compatible with the sensor	Replace the sensor (→ 🗎 60)
		Replace the gauge

7 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.

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.

8 Disposal

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.

9 Accessories

	Ordering No.
Centering ring with fine filter DN 16 ISO-KF	303-333
Communication adapter (2 m) [10)]	303-333

[10)] The diagnostic software (Windows NT, XP) can be downloaded from our website.

10 Spare Parts

When ordering spare parts, always indicate:

- all information on the product nameplate
- description and ordering number

	Sensor for gauge with tungsten (W) filament		Ordering No.
PCG550	3PC1-0x1-xxxx 3PC6-0x1-xxxx	DN 16 ISO-KF	357-925
	3PC1-0x2-xxxx 3PC6-0x2-xxxx	DN 16 ISO-KF, long tube	357-926
	3PC1-0x4-xxxx 3PC6-0x4-xxxx	DN 16 CF-F	357-927
	3PC1-0x5-xxxx 3PC6-0x5-xxxx	DN 16 CF-R, long tube	357-928
	3PC1-0x6-xxxx 3PC6-0x6-xxxx	DN 25 ISO-KF	357-929
	3PC1-0xD-xxxx 3PC6-0xD-xxxx	4 VCR female	357-932
	3PC1-0xE-xxxx 3PC6-0xE-xxxx	8 VCR female	357-931
	3PC1-0xF-xxxx 3PC6-0xF-xxxx	1/8" NPT	357-930
	3PC1-0xK-xxxx 3PC6-0xK-xxxx	29×29 mm	357-934
	3PC1-0xM-xxxx 3PC6-0xM-xxxx	4 VCR 90° female	357-935
	3PC1-0xN-xxxx 3PC6-0xN-xxxx	7/16-20 UNF male	357-933

	Sensor for gauge with nickel (Ni) filament		Ordering No.
PCG552	3PC2-0x1-xxxx 3PC7-0x1-xxxx	DN 16 ISO-KF	357-936
	3PC2-0x2-xxxx 3PC7-0x2-xxxx	DN 16 ISO-KF, long tube	357-937
	3PC2-0x4-xxxx 3PC7-0x4-xxxx	DN 16 CF-F	357-938
	3PC2-0x5-xxxx 3PC7-0x5-xxxx	DN 16 CF-R, long tube	357-939
	3PC2-0x6-xxxx 3PC7-0x6-xxxx	DN 25 ISO-KF	357-940
	3PC2-0xD-xxxx 3PC7-0xD-xxxx	4 VCR female	357-943
	3PC2-0xE-xxxx 3PC7-0xE-xxxx	8 VCR female	357-942
	3PC2-0xF-xxxx 3PC7-0xF-xxxx	1/8" NPT	357-941
	3PC2-0xK-xxxx 3PC7-0xK-xxxx	29×29 mm	357-945
	3PC2-0xM-xxxx 3PC7-0xM-xxxx	4 VCR 90° female	357-946
	3PC2-0xN-xxxx 3PC7-0xN-xxxx	7/16-20 UNF male	357-944

	Sensor for gauge with Al_2O_3 coated filament		Ordering No.
PCG554	3PC3-0x1-xxxx 3PC8-0x1-xxxx	DN 16 ISO-KF	357-947
	3PC3-0x2-xxxx 3PC8-0x2-xxxx	DN 16 ISO-KF, long tube	357-948
	3PC3-0x4-xxxx 3PC8-0x4-xxxx	DN 16 CF-F	357-949
	3PC3-0x5-xxxx 3PC8-0x5-xxxx	DN 16 CF-R long tube	357-950
	3PC3-0x6-xxxx 3PC8-0x6-xxxx	DN 25 ISO-KF	357-951
	3PC3-0xD-xxxx 3PC8-0xD-xxxx	4 VCR female	357-954
	3PC3-0xE-xxxx 3PC8-0xE-xxxx	8 VCR female	357-953
	3PC3-0xF-xxxx 3PC8-0xF-xxxx	1/8" NPT	357-952
	3PC3-0xK-xxxx 3PC8-0xK-xxxx	29×29 mm	357-956
	3PC3-0xM-xxxx 3PC8-0xM-xxxx	4 VCR 90° female	357-957
	3PC3-0xN-xxxx 3PC8-0xN-xxxx	7/16-20 UNF male	357-955

Further Information

[1] www.inficon.com
Operating Manual
Single-Channel Controller VGC401
tinb01d1 German
tinb01e1 English
INFICON AG, LI–9496 Balzers, Liechtenstein

[2] www.inficon.com
Operating Manual
Two and Three Channel Measurement and Control Unit
VGC402, VGC403
tinb07d1 German
tinb07e1 English
INFICON AG, LI–9496 Balzers, Liechtenstein

[3] www.inficon.com
Communication Protocol
Serial Interface RS232C, RS485C
PCG55x, PSG55x
tira59d1 German
tira59e1 English
INFICON AG, LI–9496 Balzers, Liechtenstein

[4] www.inficon.com
Communication Protocol
DeviceNet™ PCG55x, PSG55x
tira58e1 English
INFICON AG, LI–9496 Balzers, Liechtenstein

[5] www.inficon.com
Communication Protocol
Profibus PCG55x, PSG55x
tira56e1 English
INFICON AG, LI–9496 Balzers, Liechtenstein

[6] www.inficon.com
Operating Manual
Diagnostics Software
tina62d1 German
tina62e1 English
INFICON AG, LI–9496 Balzers, Liechtenstein

[7] Common Industrial Protocol (CIP™) Ed. 3.5 and DeviceNet™ Adaption of CIP Ed. 1.6 (Open DeviceNet Vendor Association)

[8] www.odva.org
Open DeviceNet Vendor Association, Inc. DeviceNet™ Specifications

[9] IEC 61158 Type 3 elements: Industrial communication networks – Fieldbus specifications
IEC 61784: Industrial communication networks – Fieldbus profiles

[10] www.profibus.com
Profibus user organization

Declaration of Contamination

The service, repair, and/or disposal of vacuum equipment and components will only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay.

This declaration may only be completed (in block letters) and signed by authorized and qualified staff.

1 Description of product

Type _____

Part number _____

Serial number _____

2 Reason for return

_____

_____

_____

3 Operating fluid(s) used (Must be drained before shipping.)

_____

4 Used in copper process

no ❑ yes ❑ → Seal product in plastic bag and mark it with a corresponding label.

5 Process related contamination of product:

toxic	no ❑ 1)	yes ❑
caustic	no ❑ 1)	yes ❑
biological hazard	no ❑	yes ❑ 2)
explosive	no ❑	yes ❑ 2)
radioactive	no ❑	yes ❑ 2)
other harmful substances	no ❑ 1)	yes ❑

The product is free of any substances which are damaging to health. yes ❑

1) or not containing any amount of hazardous residues that exceed the permissible exposure limits

2) Products thus contaminated will not be accepted without written evidence of decontamination.

6 Harmful substances, gases and/or by-products

Please list all substances, gases, and by-products which the product may have come into contact with:

Trade/product name	Chemical name (or symbol)	Precautions associated with substance	Action if human contact

7 Legally binding declaration:

We hereby declare that the information on this form is complete and accurate and that we will assume any further costs that may arise. The contaminated product will be dispatched in accordance with the applicable regulations.

Organization/company _____

Address _____ Post code, place _____

Phone _____ Fax _____

Email _____

Name _____

Date and legally binding signature _____ Company stamp

This form can be downloaded from our website.

Copies:
Original for addresee - 1 copy for accompanying documents - 1 copy for file of sender

EC Declaration of Conformity

CE

We, INFICON, hereby declare that the equipment mentioned below complies with the provisions of the Directive relating to electromagnetic compatibility 2004/108/EC.

Pirani Capacitance Diaphragm Gauge

PCG550, PCG552, PCG554

Standards

Harmonized and international / national standards and specifications:

- EN 61000-6-2:2005 (EMC: generic immunity standard)
- EN 61000-6-3:2007 (EMC: generic emission standard)
- EN 61010-1:2001 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326-1:2006 (EMC requirements for electrical equipment for measurement, control and laboratory use)

Manufacturer / Signatures

INFICON AG, Alte Landstrasse 6, LI-9496 Balzers

19 February 2010	19 February 2010
Dr. Urs Wälchli	Claudio Christoffel
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Original: German tina56d1 (2010-02)

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