Vacuum Solutions

Application Support

Service

LEYBOLD VAKUUM

GA 09.420/3.02

IONIVAC

ITR 90
ITR 90 P

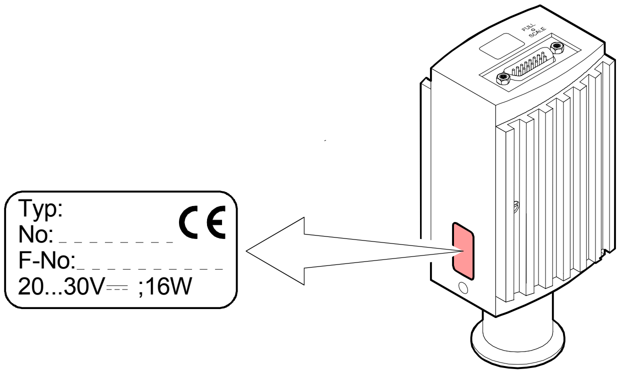
Catalog numbers

120 90
120 91
120 92
120 94
230030
230031

Operating Manual

Product Identification

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



Validity

This document applies to products with the following catalog numbers:

ITR 90 (without display)

120 90 (vacuum connection DN 25 ISO-KF)
120 92 (vacuum connection DN 40 CF-R)

ITR 90 (with display)

120 91 (vacuum connection DN 25 ISO-KF)
120 94 (vacuum connection DN 40 CF-R)

ITR 90 P (with Profibus interface and switching functions)

230030 (vacuum connection DN 25 ISO-KF)
230031 (vacuum connection DN 40 CF-R)

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

If not indicated otherwise in the legends, the illustrations in this document correspond to the KF vacuum connection. They apply to other vacuum connections by analogy.

All ITR 90 versions are shipped with an instruction sheet (→ 📖 [1]). ITR 90 P comes with a supplementary instruction sheet describing the fieldbus interfaces and the switching functions (→ 📖 [2]).

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

All dimensions in mm.

Intended Use

The ITR 90 transmitters have been designed for vacuum measurement of non-flammable gases and gas mixtures in a pressure range of 5×10^{-10} … 1000 mbar. Possible reactions between the exposed materials and the process media have to be considered. Incompatibilities can shorten the transmitters lifetime.

The transmitters can be operated in connection with a Leybold Vakuum controller or with other control devices.

Functional Principle

Over the whole measuring range, the transmitters has a continuous characteristic curve and its measuring signal is output as logarithm of the pressure.

The transmitters functions with a Bayard-Alpert hot cathode ionization measurement system ($p < 2.0\times10^{-2}$ mbar) and a Pirani measurement system ($p > 5.5\times10^{-3}$ mbar). In the overlapping pressure range of 2.0×10^{-2} … 5.5×10^{-3} mbar, a mixed signal of the two measurement systems is output. The hot cathode is switched on by the Pirani measurement system only below the switching threshold of 2.4×10^{-2} mbar (to prevent filament burn-out). It is switched off when the pressure exceeds 3.2×10^{-2} mbar.

Contents

For cross-references within this document, the symbol (→ 🗎 XY) is used, for cross-references to further documents and data sources, the symbol (→ 🕮 [Z]).

1 Safety

1.1 Symbols Used

DANGER

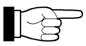
Information on preventing any kind of physical injury.

WARNING

Information on preventing extensive equipment and environmental damage.

Caution

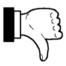
Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.



Notice

Hint, recommendation

The result is O.K.



The result is not as expected

Optical inspection

Waiting time, reaction time

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 between the materials (→ 🗎 9) and the process media.

  Consider possible reactions (e.g. explosion) of the process media due to the heat generated by the product.
- Adhere to the applicable regulations and take the necessary precautions for all work you are going to do and consider the safety instructions in this document.
- Before beginning to work, find out whether any vacuum components are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Communicate the safety instructions to all other users.

1.4 Liability and Warranty

Leybold Vakuum assumes no liability and the warranty becomes null and void if the end-user or third parties

- disregard the information in this document
- use the product in a non-conforming manner
- make any kind of interventions (modifications, alterations etc.) on the product
- use the product with accessories not listed in the corresponding product documentation.

The end-user assumes the responsibility in conjunction with the process media used.

☞ Transmitter failures due to contamination are not covered by the warranty.

2 Technical Data

Measurement

Measuring range (air, O_2, CO, N_2)	5×10^{-10} … 1000 mbar, continuous
Accuracy	15% of reading in the range of 10^{-8} … 10^{-2} mbar (after 5 min stabilization)
Repeatability	5% of reading in the range of 10^{-8} … 10^{-2} mbar (after 5 min stabilization)
Gas type dependence	→ Appendix B

Emission

Switching on threshold	2.4×10^{-2} mbar
Switching off threshold	3.2×10^{-2} mbar
Emission current	
p $\leq 7.2\times10^{-6}$ mbar	5 mA
7.2×10^{-6} mbar <p $<3.2\times10^{-2}$ mbar	25 µA
Emission current switching	
25 µA ⇒ 5 mA	7.2×10^{-6} mbar
5 mA ⇒ 25 µA	3.2×10^{-5} mbar

Degas

Degas emission current (p $<7.2\times10^{-6}$ mbar)	≈16 mA (P_{degas} ≈4 W)
Control input signal	0 V/+24 VDC, active high (control via RS232 → 🗎 27)
Duration	max. 3 min, followed by automatic stop

In degas mode, ITR 90 transmitters keep supplying measurement values, however their tolerances may be higher than during normal operation.

Output signal

Output signal (measuring signal)	0 … +10 V
Measuring range	0.774 V ≙ 5×10^{-10} mbar … +10 V ≙ 1000 mbar
Relationship voltage-pressure	logarithmic, 0.75 V/decade (→ Appendix A)
Error signal	<0.3 V/0.5 V (→ 🗎 36)
Minimum load impedance	10 kΩ

Display (120 91 and 120 94)

Display panel	LCD matrix, 32×16 pixels, with background illumination
Dimensions	16.0 mm × 11.2 mm
Pressure units (pressure p)	mbar (default), Torr, Pa (selecting the pressure unit → 🗎 27)

Power supply

STOP **DANGER**

The transmitter must only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded extra-low voltage (SELV-E according to EN 61010). The connection to the transmitter has to be fused (Leybold Vakuum-controllers fulfill these requirements).

Operating voltage at the IONIVAC ITR 90	+24 VDC (20 … 28 VDC) [1)] ripple max. 2 V_{pp}
Power consumption	
Standard	≤0.5 A
Degas	≤0.8 A
Emission start (<200 ms)	≤1.4 A
Power consumption	
ITR 90	≤16 W
ITR 90 P	≤18 W
Fuse necessary	1.25 AT

Sensor cable

For reasons of compatibility, the expression "sensor cable" is used for all ITR 90 versions in this document, although the pressure reading of the transmitters with fieldbus interface (ITR 90 P) is normally transmitted via the corresponding bus.

Electrical connector	
ITR 90	D-Sub,15 pins, male (→ 🗎 17)
ITR 90 P	D-Sub,15 pins, male (→ 🗎 18)
Cable for ITR 90	
Analog values only Without degas function	4 conductors plus shielding
Analog values With degas function	5 conductors plus shielding
Analog values With degas function And RS232C interface	7 conductors plus shielding
Cable for ITR 90 P	depending on the functions used, max. 15 conductors plus shielding
Max. cable length (supply voltage 24 V[1)])	
Analog operation	≤35 m, conductor cross-section 0.25 mm² ≤50 m, conductor cross-section 0.34 mm² ≤100 m, conductor cross-section 1.0 mm²
RS232C operation	≤30 m
Transmitter identification	42 kΩ resistor between Pin 10 (sensor cable) and GND
Switching functions	
ITR 90	none
ITR 90 P	2 (setpoints A and B)
Adjustment range	1×10^{-9} mbar … 100 mbar Setpoints adjustable via potentiometers (setpoints A and B), one floating, normally open relay contact per setpoint (→ 🗎 18, 31) Adjusting the setpoints via field bus is described in the corresponding bus sections.
Relay contact rating	
Voltage	≤60 V
Current	≤0.5 ADC

[1)] Measured at sensor cable connector (consider the voltage drop as function of the sensor cable length).

RS232C interface

Data rate	9600 Baud
Data format	binary 8 data bits one stop bit no parity bit no handshake
Connections (sensor cable connector)	
TxD (Transmit Data)	Pin 13
RxD (Receive Data)	Pin 14
GND	Pin 5

Function and interface protocol of the RS232C interface → 🗎 27

Profibus interface (ITR 90 P)

Fieldbus name	Profibus
Standard applied	→ 🕮 [5]
Interface protocol data format	→ 🕮 [3], [5]
Interface, physical	RS485
Data rate	≤12 MBaud (→ 🕮 [3])
Node address	
Local (Adjustable via hexadecimal "ADDRESS", "MSD", "LSD" switches)	00 … $7D_{hex}$ (0 … 125_{dec})
Via Profibus (hexadecimal "ADDRESS" switches set to >$7d_{hex}$ (>125_{dec}))	00 … $7D_{hex}$ (0 … 125_{dec})
Profibus connection	D-Sub, 9 pins, female
Cable	Shielded, special Profibus cable (→ 🗎 20 and 🕮 [4])
Cable length, system wiring	According to Profibus specifications (→ 🕮 [4], [5])

Vacuum

Materials exposed to vacuum	
Housing, supports, screens	stainless steel
Feedthroughs	NiFe, nickel plated
Insulator	glass
Cathode	iridium, yttrium oxide (Y_2O_3)
Cathode holder	molybdenum
Pirani element	tungsten, copper
Internal volume	
DN 25 ISO-KF	≤24 cm^3
DN 40 CF-R	≤34 cm^3
Max. Pressure	2 bar (absolute)

Weight

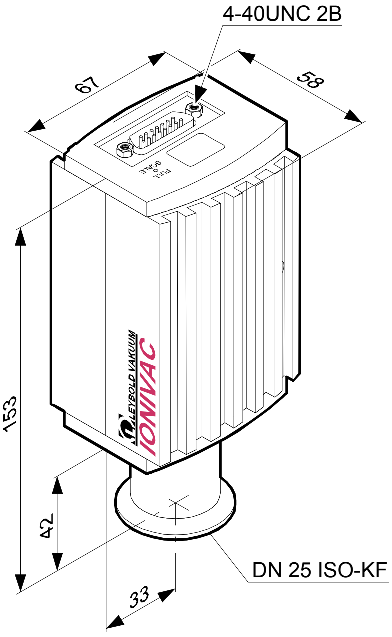
Catalog numbers	
120 90, 120 91	≈290 g
120 92, 120 94	≈550 g
230030	≈430 g
230031	≈695 g

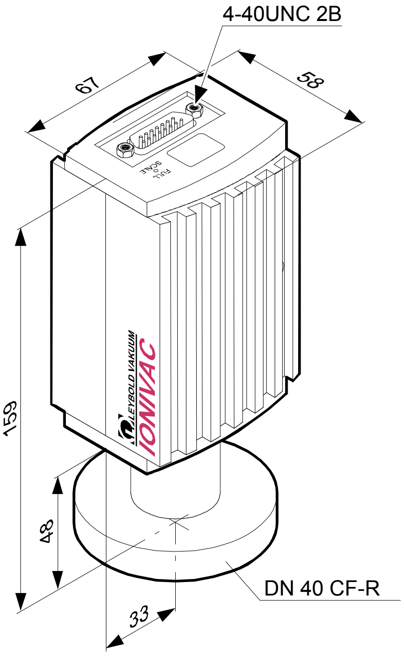
Ambiance

Admissible temperatures	
Storage	-20 … 70 °C
Operation	0 … 50 °C
Bakeout	+150 °C (without electronics unit)
Relative humidity (year's mean / during 60 days)	≤65 / 85% (no condensation)
Use	indoors only altitude up to 2000 m NN
Type of protection	IP 30

Dimensions [mm]

Catalog numbers	Catalog numbers
120 90	120 92
120 91	120 94
230030	230031





3 Installation

3.1 Vacuum Connection

DANGER

Caution: overpressure in the vacuum system >1 bar

Injury caused by released parts and harm caused by escaping process gases can result if clamps are opened while the vacuum system is pressurized.

Do not open any clamps while the vacuum system is pressurized. Use the type of clamps which are suited to overpressure.

DANGER

The transmitter must be electrically connected to the grounded vacuum chamber. This connection must conform to the requirements of a protective connection according to EN 61010:

- CF connections fulfill this requirement
- For transmitters with a KF vacuum connection, use a conductive metallic clamping ring.

Caution

Caution: vacuum component

Dirt and damages impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.

The transmitter may be mounted in any orientation. To keep condensates and particles from getting into the measuring chamber, preferably choose a horizontal to upright position. See dimensional drawing for space requirements (→ 🗎 10).

When installing the transmitter, make sure that the area around the connector is accessible for the tools required for adjustment while the transmitter is mounted (→ 🗎 34).

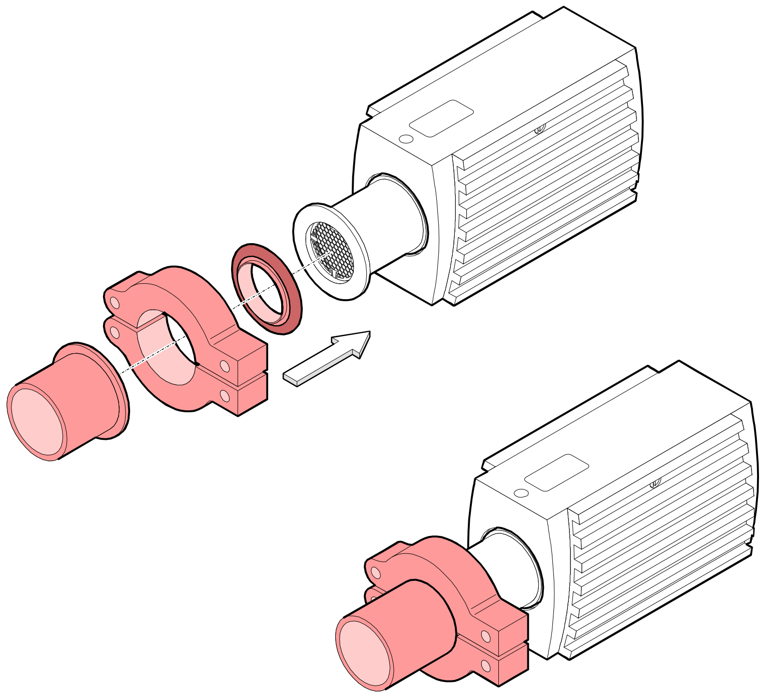
When installing the transmitter, allow for installing/deinstalling the connectors and accommodation of cable loops.

- The transmitter is supplied with a built-in grid. For potentially contaminating applications and to protect the electrodes against light and fast charged particles, installation (→ 🗎 13) of the optional baffle is recommended (→ 🗎 39).
- The sensor can be baked at up to 150 °C. At temperatures exceeding 50 °C, the electronics unit has to be removed (→ 🗎 12) or an extension (Option → 🗎 39) has to be installed.

3.1.1 Making the Flange Connection

Procedure

It is recommended not to apply any vacuum grease.



The protective lid will be needed for maintenance.

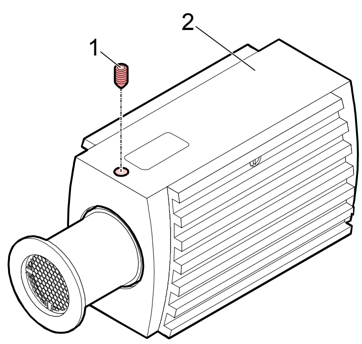
3.1.2 Removing and Installing the Electronics Unit

Required tool

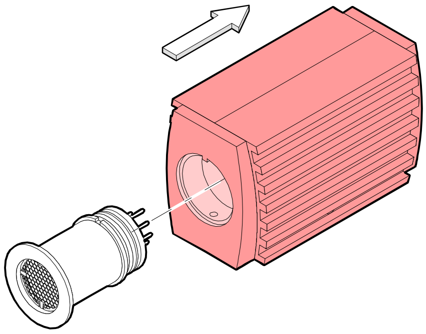
- Allen key, size 2.5 mm

Removing the electronics unit

❶ Unscrew the hexagon socket set screw (1) on the side of the electronics unit (2).



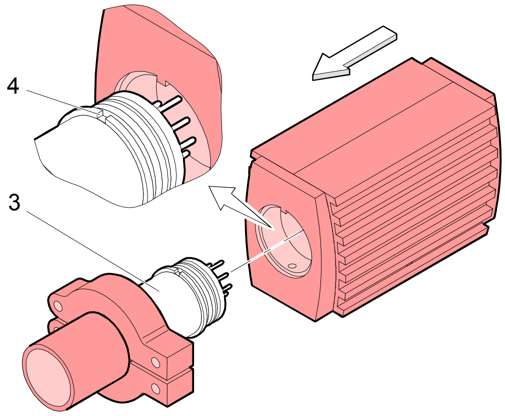
❷ Remove the electronics unit **without twisting it**.



✓ Removal of the electronics unit is completed.

Installing the electronics unit

❶ Place the electronics unit on the sensor (3) (be careful to correctly align the pins and notch (4)).



❷ Slide the electronics unit in to the mechanical stop and lock it with the hexagon socket set screw (1).

✓ The electronics unit is now installed.

3.1.3 Using the Optional Baffle

In severely contaminating processes and to protect measurement electrodes optically against light and fast charged particles, replacement of the built-in grid by the optional baffle (→ 🗎 39) is recommended.

Installing/deinstalling the baffle

The optional baffle will be installed at the sensor opening of the deinstalled transmitter (Deinstallation → 🗎 33).

Caution

Caution: dirt sensitive area

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

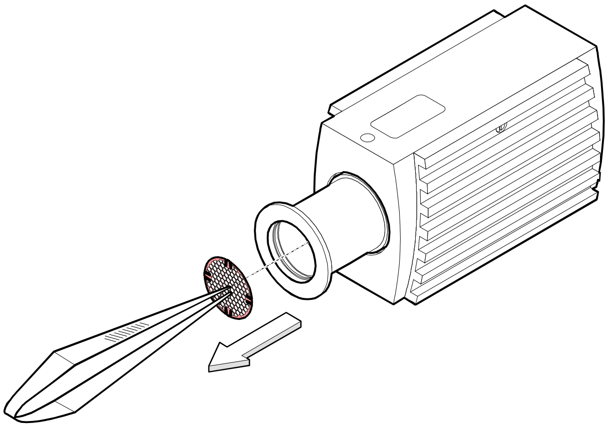
Always wear clean, lint-free gloves and use clean tools when working in this area.

Required tools / material

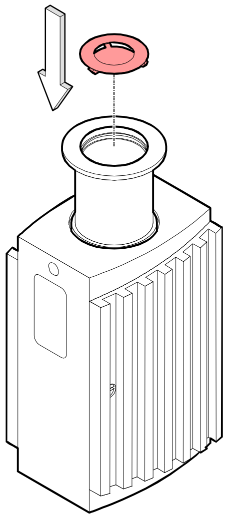
- Baffle (→ 🗎 39)
- Pointed tweezers
- Pin (e.g. pencil)
- Screwdriver No 1

Procedure

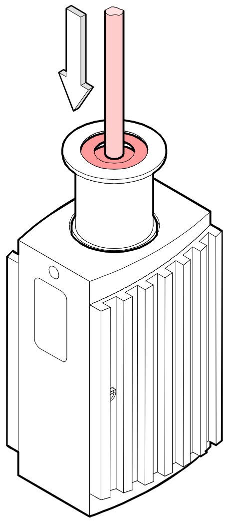
❶ Carefully remove the grid with tweezers.



❷ Carefully place the baffle onto the sensor opening.



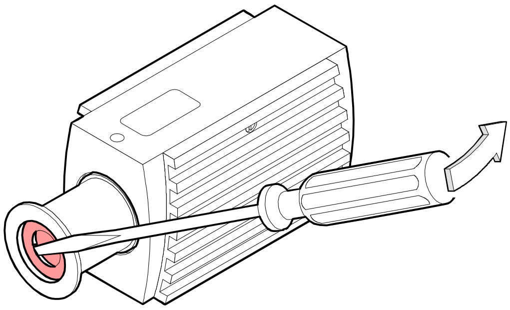
❸ Using a pin, press the baffle down in the center until it catches.



✓ The baffle is now installed (Installation of the transmitter → 🗎 11).

Deinstallation

Carefully remove the baffle with the screwdriver.



✓ The baffle is now deinstalled (Installation of the transmitter → 🗎 11).

3.2 Electrical Connection

3.2.1 Use With Leybold Vakuum Transmitter Controllers

See Leybold Vakuum sales literature and data sources for controllers and our range of sensor cables on our internet home page (→ 🕮 [6]).

Caution

Caution: data transmission errors

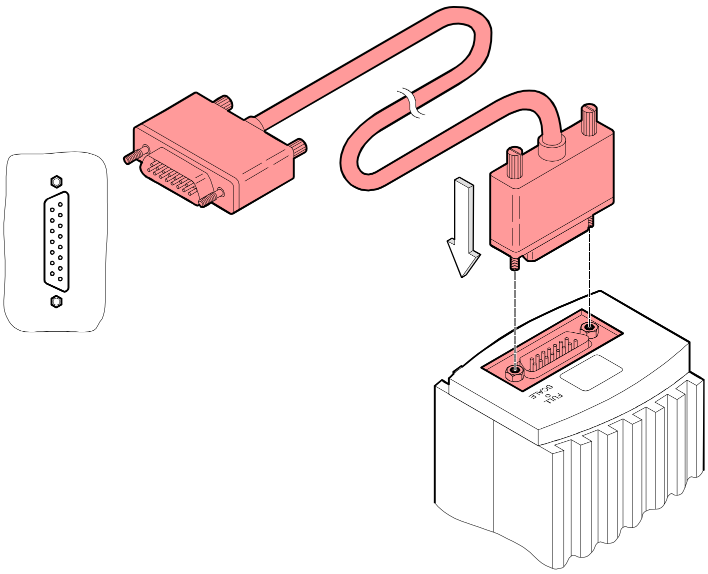
If the transmitter is operated with the RS232C interface and a fieldbus interface at the same time, data transmission errors may occur.

The transmitter must not be operated with the RS232C interface and Profibus at the same time.

Procedure

❶ Plug the sensor connector into the transmitter and secure it with the locking screws.

❷ Connect the other end of the sensor cable to the Leybold Vakuum controller and secure it.



✓ The transmitter can now be operated with the Leybold Vakuum controller.

3.2.2 Use With Other Controllers

The transmitter can also be operated with other controllers.

Especially the fieldbus version ITR 90 P (Profibus) is usually operated as part of a network, controlled by a master or bus controller. In such cases, the control system has to be operated with the appropriate software and interface protocol (→ 🕮 [3]).

3.2.2.1 Making an Individual Sensor Cable

For reasons of compatibility, the expression "sensor cable" is used for all ITR 90 versions in this document, although the pressure reading of the ITR 90 P transmitter with fieldbus interface is normally transmitted via Profibus.

The sensor cable is required for supplying all ITR 90 types with power. In connection with the ITR 90 P transmitter with fieldbus interface it also permits access to the relay contacts of the switching functions (→ 🗎 18).

Cable type

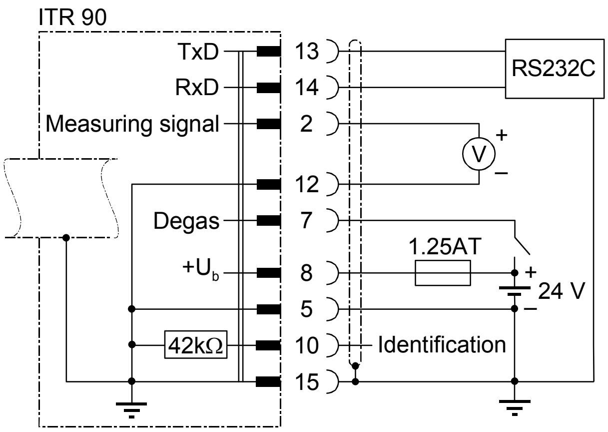
The application and length of the sensor cable have to be considered when determining the number and cross sections of the conductors (→ 🗎 8).

Procedure

❶ Open the cable connector (D-Sub, 15 pins, female).

❷ Prepare the cable and solder/crimp it to the connector as indicated in the diagram of the transmitter used:

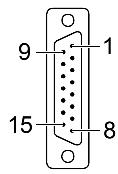
Sensor cable connection ITR 90



Electrical connection

Pin 2	Signal output (measuring signal)	0 … +10 V
Pin 5	Supply common, GND	
Pin 7	Degas on, active high	+24 VDC
Pin 8	Supply	+24 VDC
Pin 10	Transmitter identification	
Pin 12	Signal common, GND	
Pin 13	RS232C, TxD	
Pin 14	RS232C, RxD	
Pin 15	Shielding, housing, GND	

Pins 1, 3, 4, 6, 9 and 11 are not connected internally.



D-Sub, 15 pins female, soldering side

WARNING

The supply common (Pin 5) and the shielding (Pin 15) must be connected at the supply unit with protective ground.

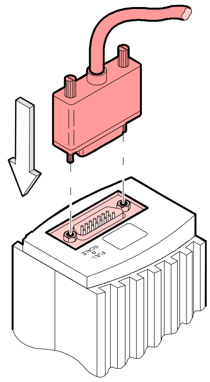
Incorrect connection, incorrect polarity or inadmissible supply voltages can damage the transmitter.

For cable lengths up to 5 m (0.34 mm^2 conductor cross-section) the output signal can be measured directly between the positive signal output (Pin 2) and supply common GND (Pin 5) without loss of accuracy. At greater cable lengths, differential measurement between signal output (Pin 2) and signal common (Pin 12) is recommended.

❸ Reassemble the cable connector.

❹ On the other cable end, terminate the cable according to the requirements of the transmitter controller you are using.

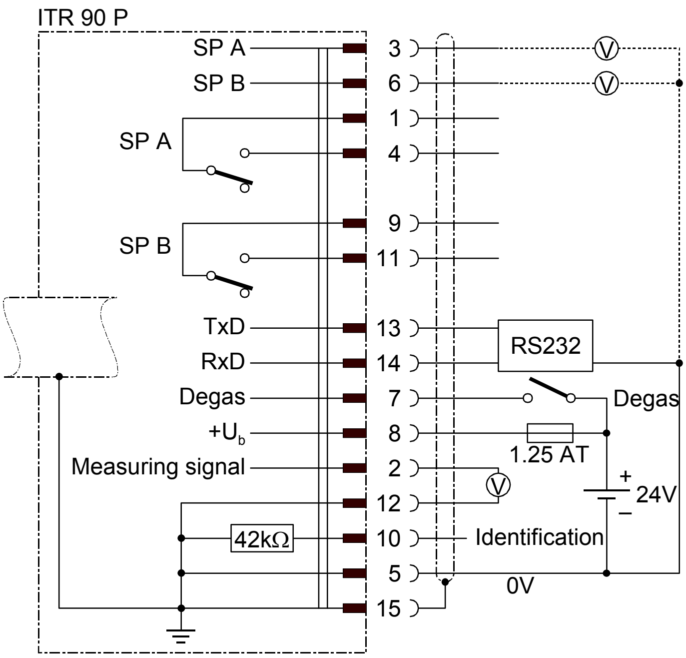
❺ Plug the sensor connector into the transmitter and secure it with the locking screws.



❻ Connect the other end of the sensor cable to the connector of the instrument or transmitter controller you are using.

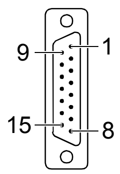
✓ The transmitter can now be operated via analog and RS232C interface.

Sensor cable connection ITR 90 P



Electrical connection

Pin 1	Relay switching function A, COM contact	
Pin 2	Signal output (measuring signal)	0 … +10 V
Pin 3	Threshold (Setpoint) A	0 … +10 V
Pin 4	Relay switching function A, N.O. contact	
Pin 5	Supply common, GND	
Pin 6	Threshold (Setpoint) B	0 … +10 V
Pin 7	Degas on, active high	+24 VDC
Pin 8	Supply	+24 VDC
Pin 9	Relay switching function B, common	
Pin 10	Transmitter identification	
Pin 11	Relay switching function B, N.O. contact	
Pin 12	Signal common, GND	
Pin 13	RS232C, TxD	
Pin 14	RS232C, RxD	
Pin 15	Shielding, housing, GND	



D-Sub, 15 pins female, soldering side

WARNING

The supply common (Pin 5) and the shielding (Pin 15) must be connected at the supply unit with protective ground.

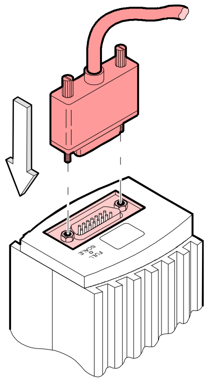
Incorrect connection, incorrect polarity or inadmissible supply voltages can damage the transmitter.

For cable lengths up to 5 m (0.34 mm^2 conductor cross-section) the output signal can be measured directly between the positive signal output (Pin 2) and supply common GND (Pin 5) without loss of accuracy. At greater cable lengths, differential measurement between signal output (Pin 2) and signal common (Pin 12) is recommended.

❸ Reassemble the cable connector.

❹ On the other cable end, terminate the cable according to the requirements of the transmitter controller you are using.

❺ Plug the sensor connector into the transmitter and secure it with the locking screws.



❻ Connect the other end of the sensor cable to the connector of the instrument or transmitter controller you are using.

✓ The transmitter can now be operated via analog and RS232C interface.

3.2.2.2 Making a Profibus Interface Cable
(ITR 90 P)

For operating ITR 90 P via Profibus, an interface cable conforming to the Profibus standard is required.

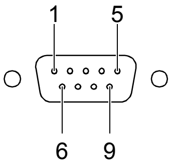
If no such cable is available, make one according to the following indications.

Cable type

Only a cable that is suited to Profibus operation may be used (→ 🕮 [4], [5]).

Procedure

❶ Make the Profibus interface cable according to the following indications:



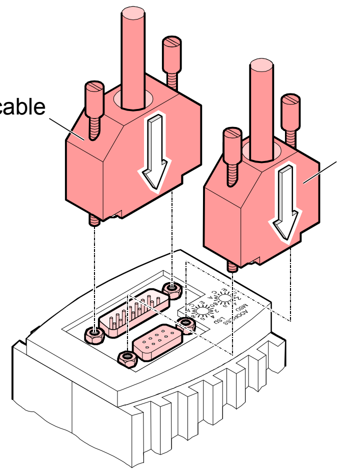
D-Sub, 9 pins
male, soldering side

Pin	Function (BPG400-SP)	
1	Do not connect	
2	Do not connect	
3	RxD/TxD-P	
4	CNTR-P	1)
5	DGND	2)
6	VP	2)
7	Do not connect	
8	RxD/TxD-N	
9	Do not connect	

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 (→ 🕮 [4]).

❷ Plug the Profibus (and sensor) cable connector into the transmitter.



❸ Lock the Profibus (and sensor) cable connector.

✓ The transmitter can now be operated via Profibus interface (→ 🗎 30).

3.2.3 Using the Optional Power Supply (With RS232C Line)

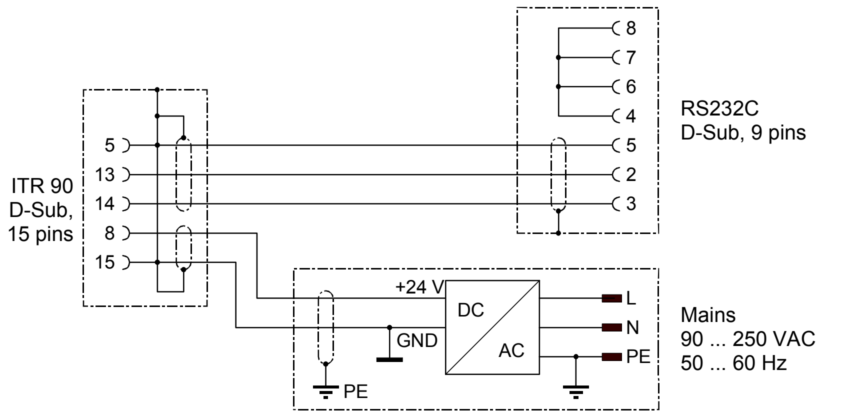
The optional 24 V power supply (→ 🗎 39) allows RS232C operation of the ITR 90 transmitter with any suitable instrument or control device.

The instrument or control device needs to be equipped with a software that supports the RS232C protocol of the transmitter (→ 🗎 27).

Technical data

Mains connection	
Mains voltage	90 … 250 VAC 50 … 60 Hz
Mains cable	1.8 meter (Schuko DIN and U.S. connectors)
Output (operating voltage of transmitter)	
Voltage	21 … 27 VDC, set to 24 VDC
Current	Max. 1.5 A
Transmitter connection	
Connector	D-Sub, 15 pins, female
24 VDC cable	5 m, black
Connection of the instrument or control device	
RS232C connection	D-Sub, 9 pins, female
Cable	5 m, black, 3 conductors, shielded

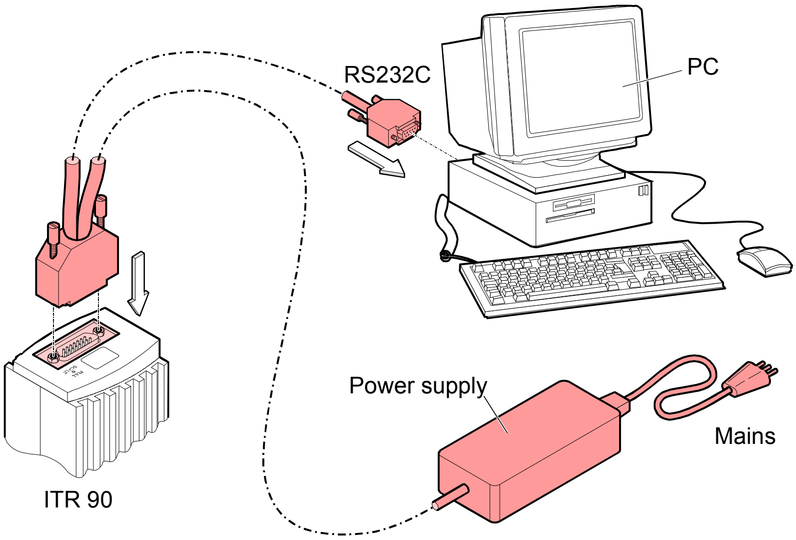
Wiring diagram



Connecting the power supply

❶ Connect the transmitter to the power supply and lock the connector with the screws.

❷ Connect the RS232C line to the instrument or control device and lock the connector with the screws.



❸ Connect the power supply to the mains.

❹ Turn the power supply on.

✓ The transmitter can now be operated via RS232C interface (→ 🗎 27).

4 Operation

4.1 Measuring Principle, Measuring Behavior

The ITR 90 vacuum transmitters consist of two separate measuring systems (hot cathode Bayard-Alpert (BA) and Pirani).

Bayard-Alpert

The BA measuring system uses an electrode system according to Bayard-Alpert which is designed for a low x-ray limit.

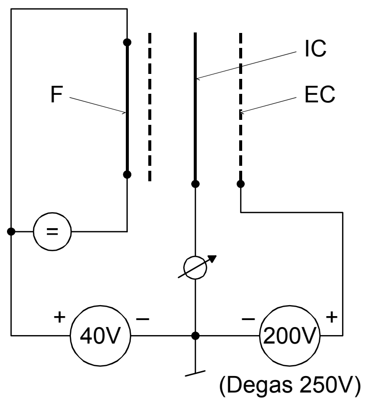
The measuring principle of this measuring system is based on gas ionization. Electrons emitted by the hot cathode (F) ionize a number of molecules proportional to the pressure in the measuring chamber. The ion collector (IC) collects the thus generated ion current I^+ and feeds it to the electrometer amplifier of the measurement instrument. The ion current is dependent upon the emission current I_e, the gas type, and the gas pressure p according to the following relationship:

$$I^+ = I_e \times p \times C$$

Factor C represents the sensitivity of the transmitter head. It is generally specified for N_2.

The lower measurement limit is 5×10^{-10} mbar (transmitter metal sealed).

To usefully cover the whole range of 5×10^{-10} mbar … 10^{-2} mbar, a low emission current is used in the high pressure range (fine vacuum) and a high emission current is used in the low pressure range (high vacuum). The switching of the emission current takes place at decreasing pressure at approx. 7.2×10^{-6} mbar, at increasing pressure at approx. 3.2×10^{-5} mbar. At the switching threshold, the ITR 90 can temporarily (<2 s) deviate from the specified accuracy.



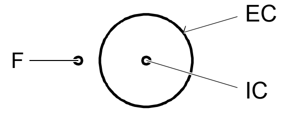
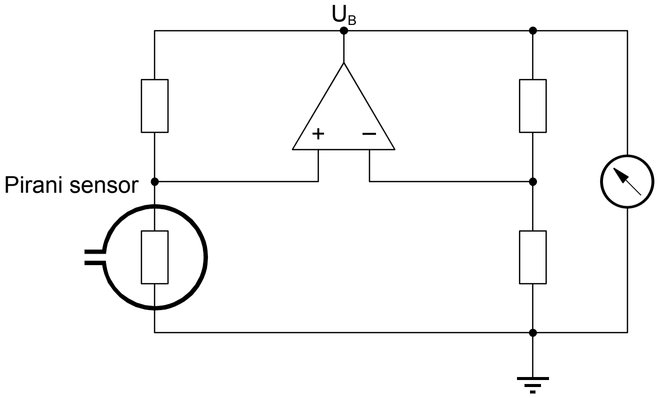


Diagram of the BA measuring system
- F hot cathode (filament)
- IC ion collector
- EC anode (electron collector)

Pirani

Within certain limits, the thermal conductibility of gases is pressure dependent. This physical phenomenon is used for pressure measurement in the thermal conductance vacuum meter according to Pirani. A self-adjusting bridge is used as measuring circuit (→ schematic). A thin tungsten wire forms the sensor element. Wire resistance and thus temperature are kept constant through a suitable control circuit. The electric power supplied to the wire is a measure for the thermal conductance and thus the gas pressure. The basic principle of the self-adjusting bridge circuit is shown in the following schematic.

Schematic



The bridge voltage U_B is a measure for the gas pressure and is further processed electronically (linearization, conversion).

Measuring range

The ITR 90 transmitters continuously cover the measuring range 5×10^{-10} mbar … 1000 mbar.

- The Pirani constantly monitors the pressure.
- The hot cathode (controlled by the Pirani) is activated only at pressures $<2.4\times10^{-2}$ mbar.

If the measured pressure is higher than the switching threshold, the hot cathode is switched off and the Pirani measurement value is output.

If the Pirani measurement drops below the switching threshold ($p = 2.4\times10^{-2}$ mbar), the hot cathode is switched on. After heating up, the measured value of the hot cathode is fed to the output. In the overlapping range of 5.5×10^{-3} … 2.0×10^{-2} mbar, the output signal is generated from both measurements.

Pressure rising over the switching threshold ($p = 3.2\times10^{-2}$ mbar) causes the hot cathode to be switched off. The Pirani measurement value is output.

Gas type dependence

The output signal is gas type dependent. The characteristic curves are accurate for dry air, N_2 and O_2. They can be mathematically converted for other gases (→ Appendix B).

4.2 Operational Principle of the Transmitter

The measuring currents of the Bayard-Alpert and Pirani sensor are converted into a frequency. A micro-controller converts this frequency into a digital value representing the measured total pressure. After further processing this value is available as analog measurement signal (0 … +10 V) at the output (sensor cable connector Pin 2 and Pin 12). The maximum output signal is internally limited to +10 V (≙ atmosphere). The measured value can be read as digital value through the RS232C interface (Pins 13, 14, 15) (→ 🗎 27). transmitters with a display show the value as pressure. The default setting of the displayed pressure unit is mbar. It can be modified via the RS232C interface (→ 🗎 27).

In addition to converting the output signal, the micro controller's functions include monitoring of the emission, calculation of the total pressure based on the measurements of the two sensors, and communication via RS232C interface.

4.3 Putting the Transmitter Into Operation

When the operating voltage is supplied (→ Technical Data), the output signal is available between Pin 2 (+) and Pin 12 (–) of the sensor cable connector (Relationship output signal – pressure → Appendix A).

Allow for a stabilizing time of approx. 10 min. Once the transmitter has been switched on, permanently leave it on irrespective of the pressure.

Communication via the digital interface is described in a separate section.

4.4 Degas

Contamination

☞ Transmitter failures due to contamination are not covered by the warranty.

Deposits on the electrode system of the BA transmitter can lead to unstable measurement readings.

The degas process allows in-situ cleaning of the electrode system by heating the electron collector grid to approx. 700 °C by electron bombardment.

Depending on the application, this function can be activated by the system control via a digital interface. The ITR 90 automatically terminates the degas process after 3 minutes, if it has not been stopped before.

☞ The degas process should be run at pressures below 7.2×10^{-6} mbar (emission current 5 mA).

For a repeated degas process, the control signal first has to change from ON (+24 V) to OFF (0 V), to then start degas again with a new ON (+24 V) command. It is recommended that the degas signal be set to OFF again by the system control after 3 minutes of degassing, to achieve an unambiguous operating status.

4.5 Display

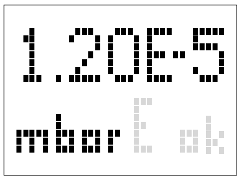
The transmitters with catalog numbers

120 91 and
120 94

have a built-in two-line display with an LCD matrix of 32×16 pixels. The first line shows the pressure, the second line the pressure unit, the function and possible errors. The background illumination is usually green, in the event of an error, it changes to red. The pressure is displayed in mbar (default), Torr or Pa. The pressure unit can be changed via RS232C interface (→ 🗎 27).

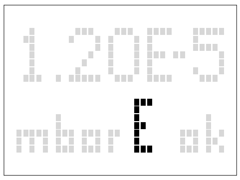
Pressure display

Pressure reading, pressure unit



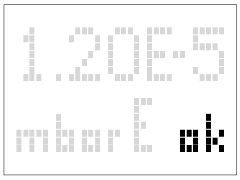
Function display

(none) Pirani operation
E Emission 25 µA
E. Emission 5 mA
D Degas
A 1000 mbar adjustment (Pirani)

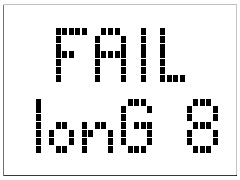


Error display

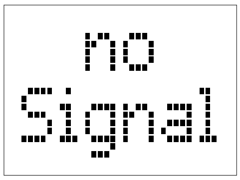
ok no error
(green background illumination)
5 Pirani sensor warning
(red background illumination)
9 Pirani sensor error
(red background illumination)



8 BA sensor error
(red background illumination)



Internal data connection failure
(red background illumination)



What to do in case of problems → 🗎 36.

4.6 RS232C Interface

The built-in RS232C interface allows transmission of digital measurement data and instrument conditions as well as the setting of instrument parameters.

Caution

Caution: data transmission errors

If the transmitter is operated with the RS232C interface and a fieldbus interface at the same time, data transmission errors may occur.

The transmitter must not be operated with the RS232C interface and Profibus at the same time.

4.6.1 Description of the Functions

The interface works in duplex mode. A nine byte string is sent continuously without a request approx. every 20 ms.

Commands are transmitted to the transmitter in a five byte input (receive) string.

Operational parameters

- Data rate 9600 Baud set value, no handshake
- Byte 8 data bits
  1 stop bit

Electrical connections

- TxD Pin 13
- RxD Pin 14
- GND Pin 5

(Sensor cable connector)

4.6.1.1 Output String (Transmit)

The complete output string (frame) is nine bytes (byte 0 … 8). The data string is seven bytes (byte 1 … 7).

Format of the output string

Byte No	Function	Value	Comment
0	Length of data string	7	(Set value)
1	Page number	5	(For ITR 90)
2	Status		→ Status byte
3	Error		→ Error byte
4	Measurement high byte	0 … 255	→ Calculation of pressure value
5	Measurement low byte	0 … 255	→ Calculation of pressure value
6	Software version	0 … 255	→ Software version
7	Sensor type	10	(For ITR 90)
8	Check sum	0 … 255	→ Synchronization

Synchronization

Synchronization of the master is achieved by testing three bytes:

Byte No	Function	Value	Comment
0	Length of data string	7	Set value
1	Page number	5	(For ITR 90)
8	Check sum of bytes No 1 … 7	0 … 255	Low byte of check sum [1)]

[1)] High order bytes are ignored in the check sum.

Status byte

Bit 1	Bit 0	Definition
0	0	Emission off
0	1	Emission 25 µA
1	0	Emission 5 mA
1	1	Degas

Bit 2	Definition
0	1000 mbar adjustment off
1	1000 mbar adjustment on

Bit 3	Definition
0 ⇔ 1	Toggle bit, changes with every string received correctly

Bit 5	Bit 4	Definition
0	0	Current pressure unit mbar
0	1	Current pressure unit Torr
1	0	Current pressure unit Pa

Bit 7	Bit 6	Definition
x	x	Not used

Error byte

Bit 3	Bit 2	Bit 1	Bit 0	Definition
x	x	x	x	Not used

Bit 7	Bit 6	Bit 5	Bit 4	Definition
0	1	0	1	Pirani adjusted poorly
1	0	0	0	BA error
1	0	0	1	Pirani error

Software version

The software version of the transmitter can be calculated from the value of byte 6 of the transmitted string according to the following rule:

$$\text{Version No} = \text{Value}_{\text{Byte 6}} / 20$$

(Example: According to the above formula, $\text{Value}_{\text{Byte 6}}$ of 32 means software version 1.6)

Calculation of the pressure value

The pressure can be calculated from bytes 4 and 5 of the transmitted string. Depending on the currently selected pressure unit (→ byte 2, bits 4 and 5), the appropriate rule must be applied.

As result, the pressure value results in the usual decimal format.

$$p_{\text{mbar}} = 10^{((\text{high byte} \times 256 + \text{low byte}) / 4000 - 12.5)}$$

$$p_{\text{Torr}} = 10^{((\text{high byte} \times 256 + \text{low byte}) / 4000 - 12.625)}$$

$$p_{\text{Pa}} = 10^{((\text{high byte} \times 256 + \text{low byte}) / 4000 - 10.5)}$$

Example

The example is based on the following output string:

Byte No	0	1	2	3	4	5	6	7	8
Value	7	5	0	0	242	48	20	10	69

The instrument or controller (receiver) interprets this string as follows:

Byte No	Function	Value	Comment
0	Length of data string	7	(Set value)
1	Page number	5	ITR 90
2	Status	0	Emission = off Pressure unit = mbar
3	Error	0	No error
	Measurement		
4	High byte	242	Calculation of the pressure:
5	Low byte	48	$p = 10^{((242 \times 256 + 48) / 4000 - 12.5)} = 1000$ mbar
6	Software version	20	Software version = 20 / 20 = 1.0
7	Sensor type	10	ITR 90
8	Check sum	69	5 + 0 + 0 + 242 + 48 + 20 + 10 = $325_{dec} \triangleq 01\ 45_{hex}$ High order byte is ignored ⇒ Check sum = $45_{hex} \triangleq 69_{dec}$

4.6.1.2 Input String (Receive)

For transmission of the commands to the transmitter, a string (frame) of five bytes is sent (without <CR>). Byte 1 to byte 3 form the data string.

Format of the input string

Byte no	Function	Value	Comment
0	Length of data string	3	(Set value)
1	Data		→ admissible input strings
2	Data		→ admissible input strings
3	Data		→ admissible input strings
4	Check sum (from bytes No 1 … 3)	0 … 255	(low byte of sum) [1]

[1] High order bytes are ignored in the check sum.

Admissible input strings

For commands to the transmitter, six defined strings are used:

	Byte No				
Command	0	1	2	3	4 [2]
Set the unit mbar in the display	3	16	62	0	78
Set the unit Torr in the display	3	16	62	1	79
Set the unit Pa in the display	3	16	62	2	80
Power-failure-safe storage of current unit	3	32	62	62	156
Switch degas on (switches itself off after 3 minutes)	3	16	93	148	1
Switch degas off before 3 minutes	3	16	93	105	214

[2] Only low order byte of sum (high order byte is ignored).

4.7 Profibus Interface (ITR 90 P)

This interface allows operation of ITR 90 P with catalog number

230030 and
230031

in connection with other devices that are suited for Profibus operation. The physical interface and interface firmware of ITR 90 P comply with the Profibus standard (→ 🕮 [4], [5]).

Two adjustable switching functions are integrated in the ITR 90 P. The corresponding relay contacts are available at the sensor cable connector (→ 🗎 7, 18, 31).

The basic sensor and sensor electronics of all ITR 90 transmitters are identical.

Caution

Caution: data transmission errors

If the transmitter is operated via RS232C interface and Profibus interface at the same time, data transmission errors may occur.

The transmitter must not be operated via RS232C interface and Profibus interface at the same time.

4.7.1 Description of the Functions

Via this interface, the following and further data are exchanged in the standardized Profibus protocol (→ 🕮 [3]):

- Pressure reading
- Pressure unit (Torr, mbar, Pa)
- Degas function
- Transmitter adjustment
- Status and error messages
- Status of the switching functions

4.7.2 Operating Parameters

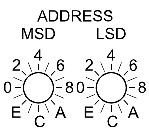
As the Profibus protocol is highly complex, the parameters and programming of ITR 90 P are described in detail in the separate Interface Manual (→ 🕮 [3]).

4.7.2.1 Operating Software

For operating the transmitter via Profibus, prior installation of the ITR 90 specific GSD file is required on the bus master side. This file can be downloaded from the CD ROM, which is enclosed in scope of delivery of the transmitter.

4.7.2.2 Node Address Setting

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



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 transmitter 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", → 🕮 [3]).

Electrical connections

The transmitter is connected to Profibus via the 9-pin Profibus connector (→ 🗎 20).

4.8 Switching Functions (ITR 90 P)

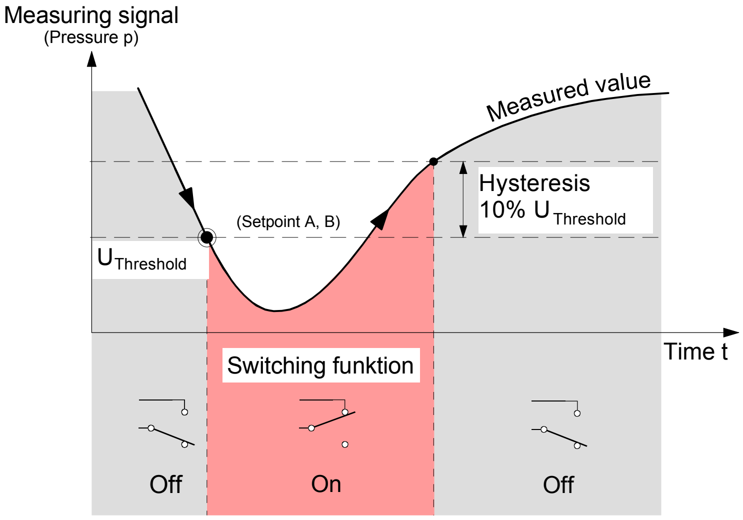
The transmitter ITR 90 P has two independent, manually settable switching functions. Each switching function has a floating normally open relay contact. The relay contacts are accessible at the sensor cable connector (→ 🗎 18).

The threshold values of switching functions A and B can be set within the pressure range 1×10^{-9} mbar … 100 mbar via potentiometers "SETPOINT A" and "SETPOINT B".

Calculating the threshold voltage

$$U_{Threshold} = 0.75 \times (\log p_{Setpoint} - c) + 7.75$$

Constant c is pressure unit dependent (→ Appendix A).



The hysteresis of the switching functions is 10% of the threshold setting.

4.8.1 Setting the Switching Functions

The threshold values of the two switching functions "SETPOINT A" and "SETPOINT B" are set locally on the potentiometers of the transmitter that are accessible via the openings on one side of the transmitter housing.

Required tools

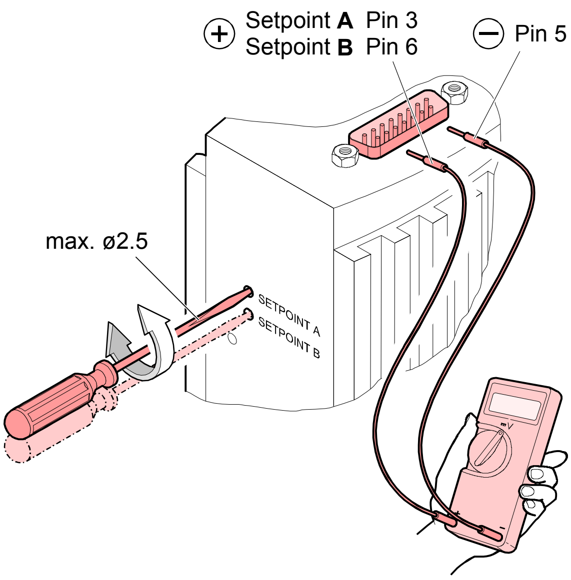
- Voltmeter
- Ohmmeter or continuity checker
- Screwdriver, max. ø2.5 mm

Procedure

The procedure for setting thresholds is identical for both switching functions.

❶ Put the transmitter into operation.

❷ Connect the **+** lead of a voltmeter to the threshold measurement point of the selected switching function ("Setpoint A" Pin 3, "Setpoint B" Pin 6) and its **–** lead to Pin 5.



❸ Using a screwdriver (max. ø2.5 mm), set the voltage of the selected switching function (Setpoint A, B) to the desired value $U_{Threshold}$.

✓ Setting of the switching functions is now concluded.

There is no local visual indication of the statuses of the switching functions. However, a functional check of the switching functions (On/Off) can be made with one of the following methods:

- Reading the status via fieldbus interface → 🕮 [3].
- Measurement of the relay contacts at the sensor cable connector with a ohmmeter/continuity checker (→ 🗎 18).

5 Deinstallation

DANGER

Caution: 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.

Procedure

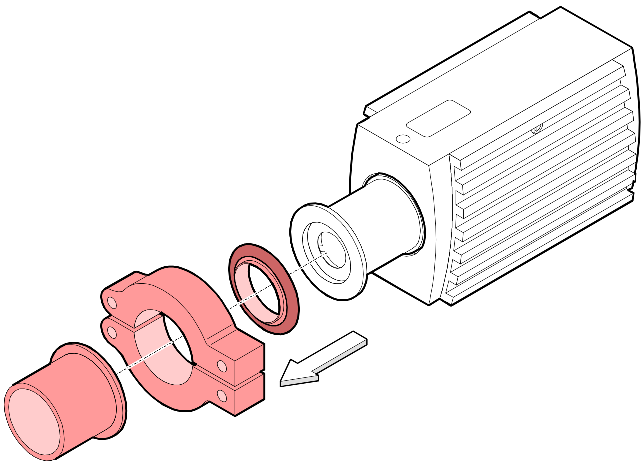
1. Vent the vacuum system.

   Before taking the transmitter out of operation, make sure that this has no adverse effect on the vacuum system.

   Depending on the programming of the superset controller, faults may occur or error messages may be triggered.

   Follow the appropriate shut-down and starting procedures.

2. Take transmitter out of operation.
3. Disconnect all cables from the transmitter.
4. Remove transmitter from the vacuum system and replace the protective lid.



✓ The transmitter is now deinstalled.

6 Maintenance, Repair

6.1 Maintenance

DANGER

Caution: 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.

The product is maintenance-free, If clean operating conditions are met.

6.1.1 Cleaning the Transmitter

Small deposits on the electrode system can be removed by baking the anode (Degas → 🗎 25). In the case of severe contamination, the baffle can be exchanged easily (→ 🗎 13). The sensor itself cannot be cleaned and needs to be replaced in case of severe contamination (→ 🗎 38).

A slightly damp cloth normally suffices for cleaning the outside of the unit. Do not use any aggressive or scouring cleaning agents.

Make sure that no liquid can penetrate the product. Allow the product to dry thoroughly before putting it into operation again.

Transmitter failures due to contamination are not covered by the warranty.

6.2 Adjusting the Transmitter

The transmitter is factory-calibrated. Through the use in different climatic conditions, fitting positions, aging or contamination (→ 🗎 25) and after exchanging the sensor (→ 🗎 38) a shifting of the characteristic curve can occur and readjustment can become necessary. Only the Pirani part can be adjusted.

6.2.1 Adjustment at Atmospheric Pressure

At the push of a button the digital value and thus the analog output are adjusted electronically to 10 V at atmospheric pressure.

Adjustment is necessary if

- at atmospheric pressure, the output signal is <10 V
- the display reads < atmospheric pressure (if the transmitter has a display)
- at atmosphere, the digital value of the RS232C interface is < atmospheric pressure
- at atmosphere, the digital value received by the bus controller of the fieldbus transmitter (Profibus) is < atmospheric pressure
- when the vacuum system is vented, the output voltage reaches 10 V (limited to 10 V by the software) before the measured pressure has reached atmosphere (transmitters with display will show the error "5" at atmospheric pressure (Pirani sensor warning → 🗎 26))
- when the vacuum system is vented, the digital value of the RS232C interface reaches its maximum before the measured pressure has reached atmosphere.
- when the vacuum system is vented, the digital value received by the bus controller of the fieldbus (Profibus) reaches its maximum before the measured pressure has reached atmosphere.

Required tools

- Pin approx. ø1.3 × 50 mm (e.g. a bent open paper clip)

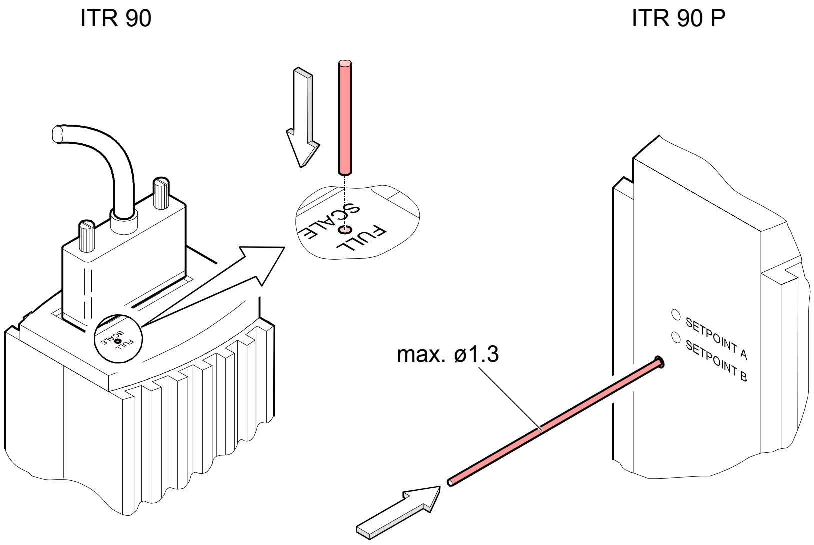
Procedure

The transmitter ITR 90 P is mechanically slightly different from the BPG400. The adjustment opening of ITR 90 P is on one side of the transmitter housing. However, the adjustment procedure is the same for all transmitter versions.

❶ Operate transmitter for approx. 10 minutes at atmospheric pressure.

If the transmitter was operated before in the BA range, a cooling-down time of approx. 30 minutes is to be expected (transmitter temperature = ambient temperature).

❷ Insert the pin through the opening marked <FULL SCALE> and push the button inside for at least 5 s.



transmitters with display will show the reading "1000 mbar" and the function "A" when the button has been pushed for 4 s. Upon completion of the adjustment, the function indication "A" disappears.

The transmitter is automatically adjusted (≈10 s).

The transmitter is now adjusted at atmospheric pressure.

6.2.2 Zero Point Adjustment

A zero point adjustment is recommended

- after the sensor has been exchanged
- as part of the usual maintenance work for quality assurance
- if "FAIL 5" is shown on the display

Required tools

- Pin approx. ø1.3 × 50 mm (e.g. a bent open paper clip)

Procedure

The push button <FULL SCALE> is also used for the zero point adjustment (→ Illustration in "Adjustment at Atmospheric Pressure").

❶ Operate transmitter for approx. 10 minutes at a pressure of 1×10^{-4} mbar.

❷ Insert the pin through the opening marked <FULL SCALE> and push the button inside for 2 s.

The adjustment is done automatically and ends after 2 minutes.

The zero point of the transmitter is now adjusted.

6.3 What to Do in Case of Problems

Required tools / material

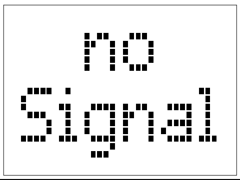
In the event of a fault or a complete failure of the output signal, the transmitter can easily be checked.

- Voltmeter / ohmmeter
- Allen key, size 2.5 mm
- Spare sensor (if the sensor is faulty)

Troubleshooting

The output signal is available at the sensor cable connector (Pin 2 and Pin 12).

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
	transmitter in an undefined status	Turn the transmitter off and on again (reset)
Output signal ≈0.3 V Display: "FAIL 8"	Hot cathode error (sensor faulty)	Replace the sensor (→ 🗎 38)
Output signal ≈0.5 V Display: "FAIL 9"	Pirani error (sensor defective)	Replace the sensor (→ 🗎 38)
	Electronics unit not mounted correctly on sensor	Check the connection the electronics unit - sensor
Display: 	Internal data connection not working	Turn the transmitter off and on again after 5 s Replace the electronics unit
transmitter does not switch over to BA at low pressures	Pirani zero point out of tolerance	Carry out a zero point adjustment (→ 🗎 35)
Output signal ok. Display: "FAIL 5"	Pirani zero point out of tolerance	Carry out a zero point adjustment (→ 🗎 35)

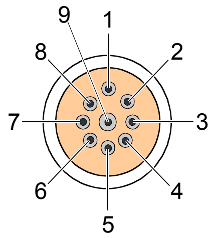
Troubleshooting (sensor)

If the cause of a fault is suspected to be in the sensor, the following checks can be made with an ohmmeter (the vacuum system need not be vented for this purpose).

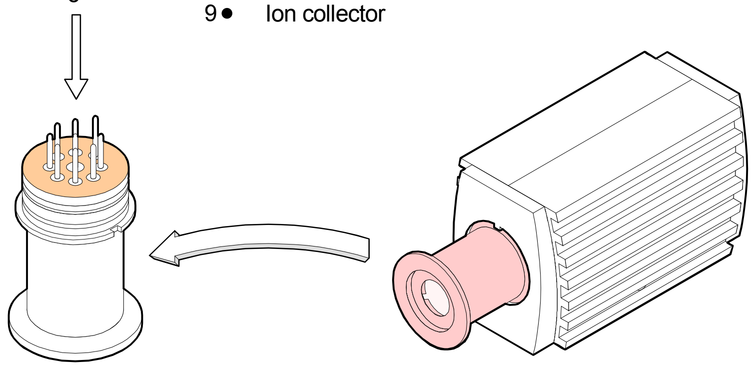
Separate the sensor from the electronics unit (→ 🗎 12). Using an ohmmeter, make the following measurements.

Ohmmeter measurement between pins			Possible cause
2 + 4	≈37 Ω	≫37 Ω	Pirani element 1 broken
4 + 5	≈37 Ω	≫37 Ω	Pirani element 2 broken
6 + 7	≈0.15 Ω	≫0.15 Ω	Filament of hot cathode broken
4 + 1	∞	≪∞	Electrode - short circuit to ground
6 + 1	∞	≪∞	Electrode - short circuit to ground
3 + 1	∞	≪∞	Electrode - short circuit to ground
9 + 1	∞	≪∞	Electrode - short circuit to ground
6 + 3	∞	≪∞	Short circuit between electrodes
9 + 3	∞	≪∞	Short circuit between electrodes

View on sensor pins



6, 7 Hot cathode approx. 0.15 Ohm
8 Not connected
2, 4 Pirani sensor 1 approx. 37 Ohm
4, 5 Pirani sensor 2 approx. 37 Ohm
3 Anode
1 GND (connected to sensor housing)
9 Ion collector



Correction

All of the above faults can only be remedied by replacing the sensor (→ 🗎 38).

Troubleshooting on Fieldbus Transmitters (ITR 90 P)

Error diagnosis of fieldbus transmitters can only be performed as described above for the basic sensor and sensor electronics. Diagnosis of the fieldbus interface can only be done via the superset bus controller (→ 🕮 [3]).

6.4 Replacing the Sensor

Replacement is necessary, when

- the sensor is severely contaminated
- the sensor is mechanically deformed
- the sensor is faulty, e.g. filament of hot cathode broken (→ 🗎 36)
- the sensor is faulty, e.g. Pirani element broken (→ 🗎 36)

Required tools / material

- Allen key, size 2.5 mm
- Spare sensor (→ 🗎 39)

Procedure

➊ Deinstall the transmitter (→ 🗎 33).

➋ Deinstall the electronics unit from the faulty sensor and mount it to the new sensor (→ 🗎 12).

➌ Adjust the transmitter (→ 🗎 34).

✔ The new sensor is now installed.

7 Options

	Catalog number
24 VDC power supply / RS232C line (→ 🗎 21)	121 06
Bake-out extension 100 mm	127 06
Baffle DN 25 ISO-KF / DN 40 CF-R (→ 🗎 13)	121 07

8 Spare Parts

When ordering spare parts, always indicate:

- All information on the product nameplate
- Description and catalog number

	Catalog number
Replacement sensor IE 90, vacuum connection DN 25 ISO-KF (including Allen key)	121 02
Replacement sensor IE 90, vacuum connection DN 40 CF-R (including Allen key)	121 03

9 Storage

Caution

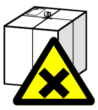
Caution: vacuum component

Inappropriate storage leads to an increase of the desorption rate and/or may result in mechanical damage of the product.

Cover the vacuum ports of the product with protective lids or grease free aluminum foil. Do not exceed the admissible storage temperature range (→ 🗎 10).

10 Returning the Product

WARNING



Caution: forwarding contaminated products

Contaminated products (e.g. radioactive, toxic, caustic or biological hazard) can be detrimental to health and environment.

Products returned to Leybold Vakuum 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 (→ 🗎 45).

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.

11 Disposal

DANGER

Caution: 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

Caution: 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.

Appendix

A: Relationship Output Signal – Pressure

Conversion formulae

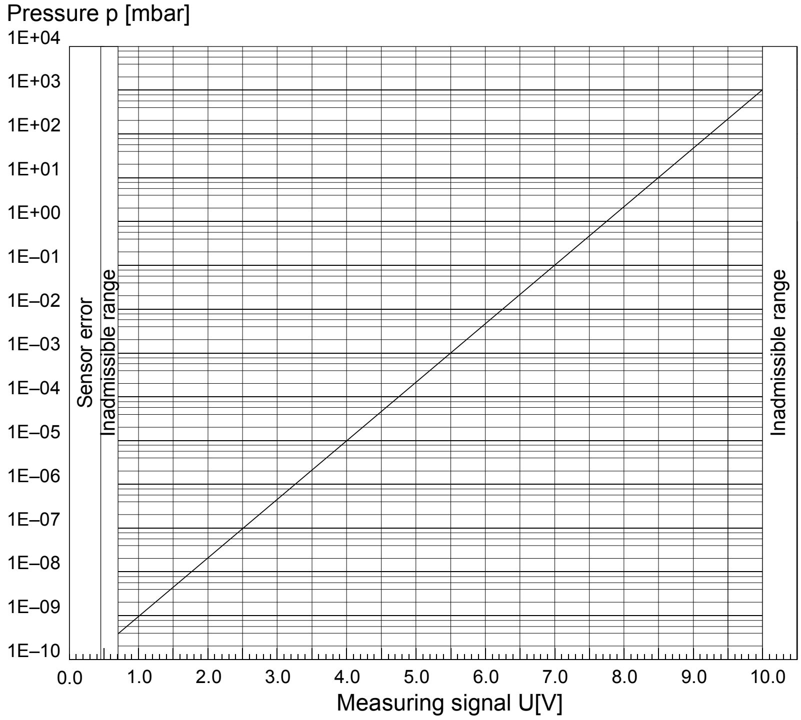
$$p = 10^{(U - 7.75) / 0.75 + c}$$

$$U = 0.75 \times (\log p - c) + 7.75$$

where

U	p	c
[V]	[mbar]	0
[V]	[Pa]	2
[V]	[Torr]	-0.125

Conversion curve



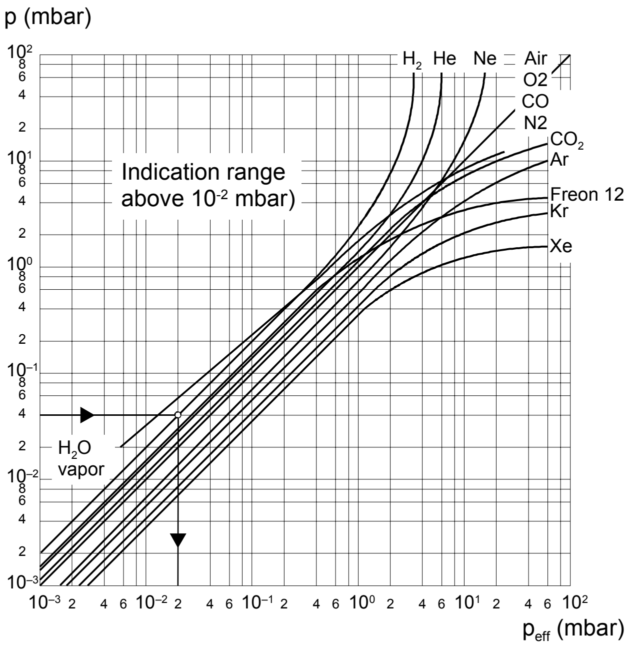
Conversion table

Output signal U	Pressure p		
[V]	[mbar]	[Torr]	[Pa]
0.3 / 0.5	Sensor error (→ 🗎 36)		
0.51 … 0.774	Inadmissible range		
0.774	5×10^{-10}	3.75×10^{-10}	5×10^{-8}
1.00	1×10^{-9}	7.5×10^{-10}	1×10^{-7}
1.75	1×10^{-8}	7.5×10^{-9}	1×10^{-6}
2.5	1×10^{-7}	7.5×10^{-8}	1×10^{-5}
3.25	1×10^{-6}	7.5×10^{-7}	1×10^{-4}
4.00	1×10^{-5}	7.5×10^{-6}	1×10^{-3}
4.75	1×10^{-4}	7.5×10^{-5}	1×10^{-2}
5.50	1×10^{-3}	7.5×10^{-4}	1×10^{-1}
6.25	1×10^{-2}	7.5×10^{-3}	1×10^{0}
7.00	1×10^{-1}	7.5×10^{-2}	1×10^{1}
7.75	1×10^{0}	7.5×10^{-1}	1×10^{2}
8.50	1×10^{1}	7.5×10^{0}	1×10^{3}
9.25	1×10^{2}	7.5×10^{1}	1×10^{4}
10.00	1×10^{3}	7.5×10^{2}	1×10^{5}
>10.00	Inadmissible range		

B: Gas Type Dependence

Indication range above 10^{-2} mbar

Pressure indicated (transmitter adjusted for air, Pirani-only mode)



Calibration in pressure range 10^{-2} … 1 mbar

The gas type dependence in the pressure range 10^{-2} … 1 mbar can be compensated by means of the following formula:

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

where

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

(The above calibration factors are mean values)

Calibration in pressure range $<10^{-3}$ mbar

The gas type dependence in the pressure range $<10^{-3}$ mbar can be compensated by means of the following formula (transmitter adjusted for air):

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

where

Gas type	Calibration factor C
Air, O_2, CO, N2	1.0
N_2	1.0
He	5.9
Ne	4.1
H_2	2.4
Ar	0.8
Kr	0.5
Xe	0.4

(The above calibration factors are mean values)

☞ A mixture of gases and vapors is often involved. In this case, accurate determination is only possible with a partial-pressure measuring instrument.

C: Literature

🕮 [1] www.leyboldvac.de
Instruction Sheet
IONIVAC ITR 90
KA 09.420
Leybold Vakuum GmbH, D–50968 Köln, Deutschland

🕮 [2] www.leyboldvac.de
Instruction Sheet
IONIVAC ITR 90 P
KA 09.421
Leybold Vakuum GmbH, D–50968 Köln, Deutschland

🕮 [3] www. leyboldvac.de
Interface Manual
Profibus ITR 90 P
SB 09.421
Leybold Vakuum GmbH, D–50968 Köln, Deutschland

🕮 [4] www.profibus.com
(Profibus user organization)

🕮 [5] European Standard for Profibus EN 50170

🕮 [6] www.leyboldvac.de
Leybold Vakuum GmbH, D–50968 Köln, Deutschland

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

Notes

Notes

Original: German GA 09.420/3.01 (0406)

ga09. 420/ 3. 02

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