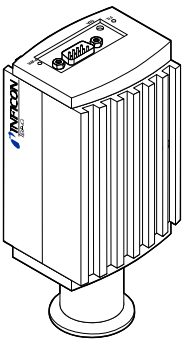
Bayard-Alpert Gauge

BAG402

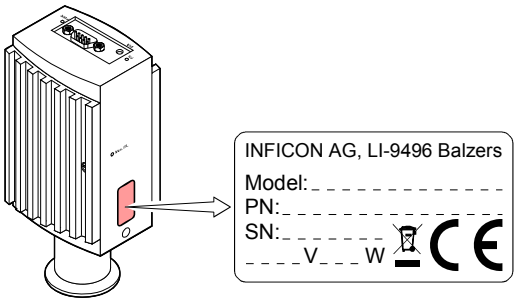


Operating Manual

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 with the following part numbers:

353-600	(DN 25 ISO-KF)
353-601	(DN 40 CF-R)

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 the gauge with vacuum connection DN 25 ISO-KF. They apply to gauges with the other vacuum connection by analogy.

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

Intended Use

The BAG402 gauge has been designed for vacuum measurement of gases and gas mixtures in a pressure range of 5×10^{-10} … 2.7×10^{-2} mbar.

It must not be used for measuring flammable or combustible gases in mixtures containing oxidants (e.g. atmospheric oxygen) within the explosion range.

Funktion

The gauge functions with a Bayard-Alpert hot cathode ionization measurement system.

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

Scope of Delivery

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

Contents

For cross-references within this document, the symbol (→ 🗎 XY) is used.

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 or wear and tear, as well as expendable parts (e.g. filament), are not covered by the warranty.

2 Technical Data

Measurement range (Luft, O_2, CO, N_2)	5×10^{-10} … 2.7×10^{-2} mbar, continuous
Accuracy	
1×10^{-8} … 10^{-2} mbar	15% of reading (after 10 min. stabilization)
Repeatability	
1×10^{-8} … 10^{-2} mbar	5% of reading (after 10 min. stabilization)
Gas type dependence	→ 🗎 14
Emission current	
p ≤7.2×10^{-6} mbar	5 mA
7.2×10^{-6} < p < 3×10^{-5} mbar [1]	25 µA or 5 mA
3×10^{-5} < p < 3.2×10^{-2} mbar	25 µA
Emission current switching	
25 µA ⇒ 5 mA	7.2×10^{-6} mbar
5 mA ⇒ 25 µA	3.0×10^{-5} mbar
Filament	
Number	2
Means of selection (→ 🗎 29)	• controlled by gauge (default) • via the button on gauge • via the diagnostic port
Settling time of measurement signal after filament change	<4 s
Filament status	indicator (→ 🗎 25)
Emission ON	<+6 V (dc), low active
Emission OFF	>+10 V (dc), high active
Automatic emission switch off at p > 3.2×10^{-2} mbar.	

[1] Depending on whether the pass through the pressure range is increasing or decreasing (hysteresis range).

Degas	electro bombardement, may be switched on at $<7.2\times10^{-6}$ mbar
Degas current ($p < 7.2\times10^{-6}$ mbar)	≈20 mA
Degas ON	<+6 V (dc), low active
Degas OFF	>+10 V (dc), high active
Duration	<3 minutes, followed by automatic stop

In degas mode, the gauge keeps supplying pressure readings, the tolerances of which can be higher than during normal operation.

Degas acts only upon the active filament.

Voltage range (analog output)	0 … +10.5 V
Measurement range	+0.57 … +8.31 V
Voltage vs. pressure	1 V/decade, logarithmic
Error signal, emission is switched off	+10.2 V
Minimum load impedance	10 kΩ

Solid state relays	degas status (pin 5) gauge status (pin 9)
Contact rating	<40 V (ac) / (dc), ≤0.1 A resistive
Switching time	<30 ms

Diagnostic port connection	Jack connector. 2.5 m, 3-pin
Cable length	≤2.5 m

Supply

DANGER

The gauge may only be connected to power supplies that conform to the requirements of a grounded protective extra-low voltage (PELV). The connection to the gauge has to be fused.

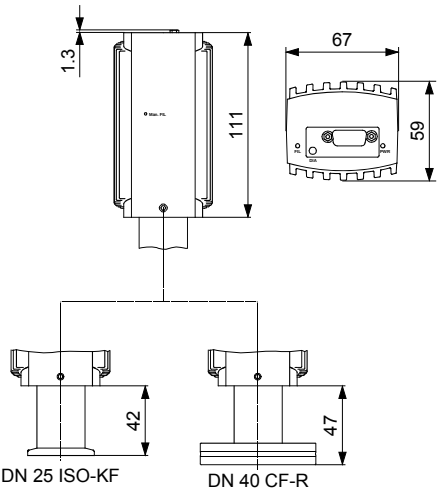
Supply voltage at the gauge [2]	+20 … +28 V (dc)
Ripple	≤2 V_{pp}
Power consumption	
Standard	≤0.5 A
Degas	≤0.8 A
Emission start (<200 ms)	≤1.4 A
Power consumption	≤18 W
Fuse necessary	≤1.25 AT
Power connection	D-Sub, 9-pin, male
Sensor cable	9-pin, shielded
Cable length	≤35 m, 0.25 mm^2/conductor ≤50 m, 0.34 mm^2/conductor ≤100 m, 1.0 mm^2/conductor
Materials exposed to vacuum	
Housing, supports, screens	stainless steel
Feedthroughs	NiFe, nickel plated
Insulator	glass
Cathode	iridium, yttriumoxid (Y_2O_3)
Cathode holder	molybdenum, platinum
Internal volume	
DN 25 ISO-KF	≈24 cm^3
DN 40 CF-R	≈34 cm^3
Permissible pressure	2 bar (absolute)

[2] The minimum voltage of the power supply unit must be increased proportionally to the length of the sensor cable.

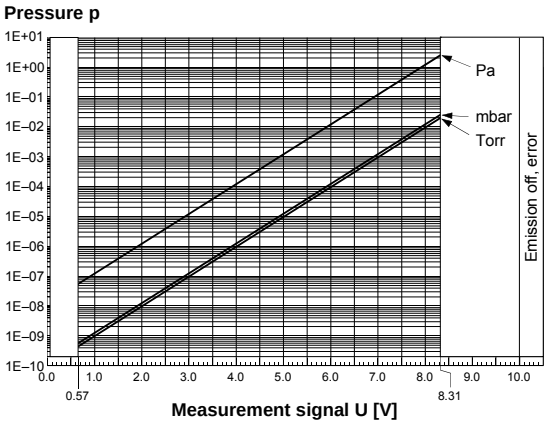
Permissible temperatures	
Operation	0 °C … +50 °C
Bakeout	≤80 °C [3]
Storage	–20 °C … +70 °C
Relative humidity	
Year's mean	≤65% (non-condensing)
During 60 days	≤85% (non-condensing)
Mounting orientation	any
Use	indoors only, altitude up to 2000 m NN
Degree of protection	IP 30
Weight	
353-600,	≈450 g
353-601	≈710 g

[3] Flange temperature, electronics unit removed, horizontally mounted.

Dimensions [mm]



2.1 Measuring Signal vs. Pressure



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

	mbar	Pa	Torr
c	9.875	7.875	10

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

2.2 Gas Type Dependence

The gas type dependence can be compensated by means of the following formula (gauge adjusted for air):

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

where:

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

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.

3 Installation

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: 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 connections fulfill this requirement
- For gauges with a KF flange, 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.

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.

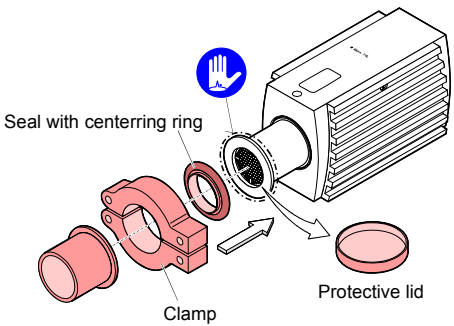
The gauge may be mounted in any orientation. To keep condensates and particles from getting into the measuring chamber, preferably choose a horizontal to upright position.

The gauge is supplied with a built-in grid. For potentially contaminating applications and to protect the electrodes against light and fast charged particles, installation (→ 🗎 46) of the optional baffle is recommended (→ 🗎 19).

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

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

Vacuum connection free of grease.



Keep the protective lid.

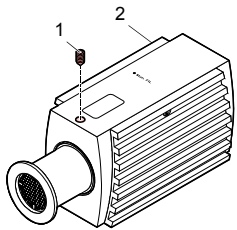
3.1.1 Removing and Installing the Electronics Unit

Required tools / material

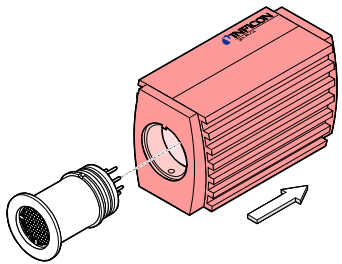
- Allen wrench, AF 2.5

Removing the electronics unit

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

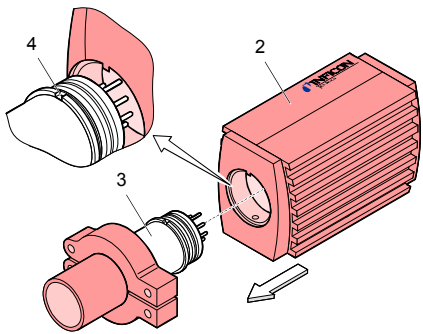


❷ Remove the electronics unit **without twisting it**.



Installing the electronics unit

❸ Place the electronics unit (2) on the sensor (3) (be careful to correctly align the pins and notch (4)).



❹ Slide the electronics unit in to the mechanical stop and lock it with the hexagon socket set screw.

3.1.2 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 (→ 🗎 46) is recommended.

Precondition

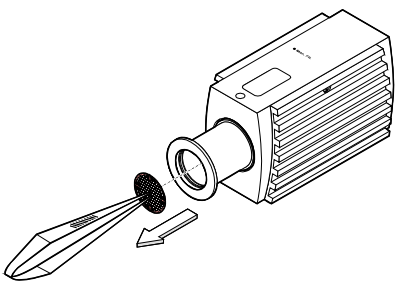
Gauge deinstalled ("Deinstallation" → 🗎 37).

Required tools / material

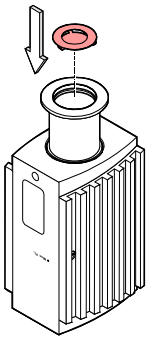
- Baffle (→ 🗎 46)
- Pointed tweezers
- Pin
- Screwdriver

Installation

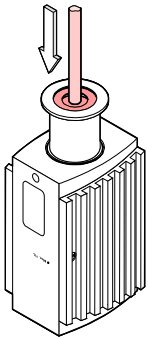
❶ Carefully remove the grid with tweezers.



❷ Carefully place the baffle onto the sensor opening.

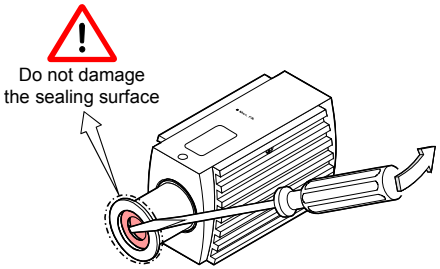


❸ Using a pin, press the baffle down in the center until it catches.



Deinstallation

Carefully remove the baffle with the screwdriver.



3.2 Power Connection

Make sure the vacuum connection is properly made (→ 🗎 15).

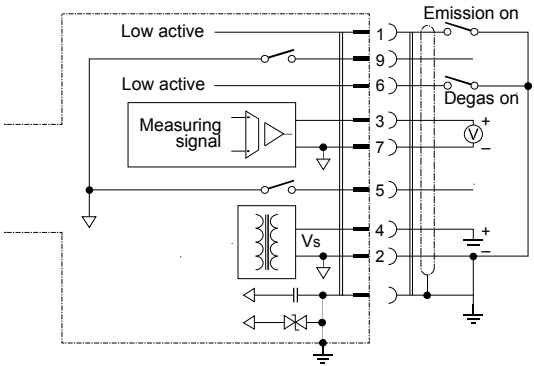
DANGER

The gauge may only be connected to power supplies that conform to the requirements of a grounded protective extra-low voltage (PELV). The connection to the gauge has to be fused.

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

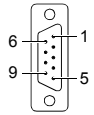
- Use an overall metal braided shielded cable. The connector must have a metal case.
- Connect the supply common with protective ground directly at the power.
- Use differential measurement input (signal common and supply common conducted separately).
- Potential difference between supply common and housing ≤16 V (overvoltage protection).

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



Electrical connection

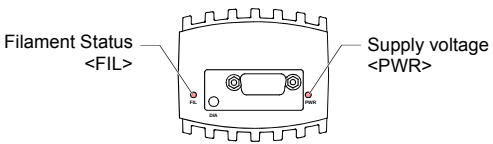
Pin 1	Emission on/off (Low active)
Pin 2	Supply common GND
Pin 3	Signal output (measuring signal)
Pin 4	Supply (V_s)
Pin 5	Degas status
Pin 6	Degas on/off (Low active)
Pin 7	Signal common
Pin 8	n.c.
Pin 9	Gauge status



D-Sub, 9-pin
female
soldering side

4 Operation

4.1 Status Indicator



Supply voltage <PWR>	Indicator
No supply voltage	off
Supply voltage ok	lid solid green

Filament status <FIL>	Emission	Indicator
–	off	off
Both filaments ok	on	lid solid green
One filament broken	on	blinking green
Both filaments broken	on	lid solid red
Emission current not stable	on	blinking red

4.2 Putting the Gauge Into Operation

Caution

Turn on the emission only at pressures $<2.7\times10^{-2}$ mbar to prevent excessive contamination.

When the supply voltage is applied and the emission is switched on via pin 1 (low active), the measuring signal is available at the signal output (stabilizing time approx. 2 s). The solid state relay "Gauge status" (pin-9) is closed.

If pressure rises over the switching threshold ($p = 3.2\times10^{-2}$ mbar), the hot cathode is switched off automatically.

Measuring Principle, Measuring Behavior

The hot cathode 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 operating filament (F1 or F2) ionize a number of molecules proportional to the pressure in the measuring chamber.

The ion collector (IC) collects the produced 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 gauge head. It is generally specified for N_2.

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

To usefully cover the whole range of 5×10^{-10} … 2.7×10^{-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. 3.0×10^{-5} mbar. At the switching threshold, the BAG402 can temporarily (<2 s) deviate from the specified accuracy.

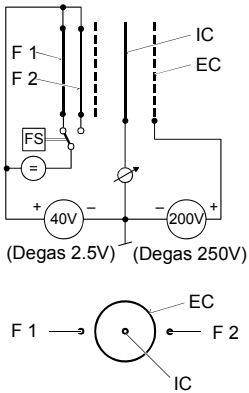


Diagram of the Bayard-Alpert measuring system:

F1 hot cathode (filament 1)
F2 hot cathode (filament 2)
IC ion collector
EC anode (electron collector)
FS filament selector switch

Dual filament feature

BAG402 sensors are equipped with two identical filaments. They are permanently monitored by the gauge electronics. In case of a filament breakage, the gauge will immediately react and switch over to the second (undamaged) filament. During the change over procedure, the last valid pressure value before filament failure will be output. As soon as the second filament is operating and the emission parameters have settled (t <4s), the measuring circuit resumes operation.

A "Hot Cathode Warning" is generated during this switch over cycle. The filament status indicator <FIL> on the gauge will display the incident (blinking green, → 🗎 25). The filament status can also be read via the diagnostic port (→ 🗎 30).

In case of two broken filaments, a "Hot Cathode Error" is generated. The filament status indicator <FIL> lid solid red (→ 🗎 25). In this case, the sensor has to be replaced (→ 🗎 42).

At the beginning of every "Emission ON" cycle, the gauge alternates between filaments in order to age both filaments evenly. However, filament selection can be commanded via the button on the gauge or via the diagnostic port (→ 🗎 30).

We recommend to replace the sensor as soon as the first filament failure has been detected (replacing the sensor → 🗎 42).

4.3 Gas Type Dependence

The measurement value is gas dependent. The pressure reading applies to dry air, O_2, CO and N_2. For other gases, it has to be corrected (→ 🗎 14).

4.4 Contamination (Degas)

Gauge failures due to contamination or wear and tear, as well as expendable parts (e.g. filament), are not covered by the warranty.

Deposits on the electrode system of the Bayard-Alpert gauge 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.

This function can be activated via pin 6 (the solid state relay "Degas status" (pin 5) is closed during the degas process). The gauge automatically terminates the degas process after three 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 (<+6 V) to OFF (>+10 V), to then start degas again with a new ON (+6 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.

A new degas cycle can only be started after a waiting time of thirty minutes.

Degas acts only upon the active filament.

4.5 Filament Selection

4.5.1 Via the Diagnostic Port (RS232C)

In automatic mode (AUTO) (default) the gauge automatically alternates between filaments in order to age both filaments evenly. However, in manual mode (MAN), filament selection can be commanded via the diagnostic port <DIA> (→ 35, "Filament Control Mode").

4.5.2 Via the Button on the Gauge

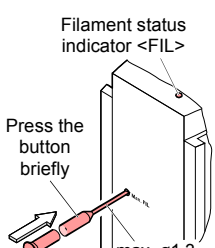
Precondition: Emission is off

Briefly press the button with a pin (max. ø1.3 mm). The gauge changes to the other filament:

The filament status indicator <FIL>

- blinks once: filament 1 is active
- blinks twice: filament 2 is active.

When the button is pressed for the first time, the gauge simultaneously changes to the manual mode (MAN).



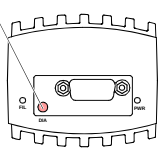
Reset the gauge to the automatic mode (AUTO):

- keep the button depressed for at least five seconds, or
- via the diagnostic port <DIA> (→ 🗎 35, "Filament Control Mode").

4.6 Diagnostic Port (RS232C)

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

Diagnostic port <DIA>



4.6.1 Description of the Functions

D The interface works in duplex mode. A nine byte string is sent continuously without a request approx. every 6 ms.

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

Operational parameters

• Data rate	9600 Baud	(set value)
• Byte	8 data bits 1 stop bit	
• Handshake	no	
• Parity bit	none	

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	hot cathode gauges
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	14	(for BAG402)
8	Check sum	0 … 255	→ Synchroni-zation

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	hot cathode gauges
8	Check sum of bytes No 1 … 7	0 … 255	low byte of check sum [4)]

[4)] 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
x	not used

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

Bit 5	Bit 4	Definition
–	–	not used

Bit 6	Definition
0	filament 1 active
1	filament 2 active

Bit 7	Definition
x	not used

Error byte

Bit 6	Bit 5	Bit 4	Bit 2	Definition
x	x	1	x	hot cathode error [5)]
x	1	x	x	hot cathode warning [6)]
1	x	x	x	electronics error / EEPROM error

[5)] Both filaments broken.

[6)] One filament broken.

Software version

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

$$\text{Versions No} = \text{Wert}_{\text{Byte 6}} / 20$$

(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.

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

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

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

Alternative calculation with the integer value ("press") from bytes 4 and 5):

$$p_{mbar} = 10^{((\text{press}) / 4000 - 12.5)}$$

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	117	48	20	14	204

The instrument or receiver interprets this string as follows:

Byte No	Function	Value	Comment
0	Length of data string	7	set value
1	Page number	5	hot cathode gauge
2	Status	0	emission = off pressure unit = mbar filament 1 active
3	Error	0	no error
4	Measurement High byte	117	calculation of the pressure: $p = 10^{((117 \times 256 + 48) / 4000 - 12.5)} =$
5	Low byte	48	1×10^{-5} mbar
6	Software version	20	Software version = 20 / 20 = 1.0
7	Sensor type	14	BAG402
8	Check sum	204	$5 + 0 + 0 + 117 + 48 + 20 + 14 = 204_{dec} = 00\ CC_{hex}$ High order byte is ignoed $\Rightarrow$ Check sum = $CC_{hex} = 204_{dec}$

4.6.1.2 Input String (Receive)

For transmission of the commands to the gauge, a string (frame) of five bytes is sent (without <CR>). Byte 1 … 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) [7]

Admissible input strings

For commands to the gauge, the following strings are defined (values in decimal notation):

Command	Byte No 0	1	2	3	4 [8]
Switch degas on (switched off automatically after 3 minutes)	3	0x10	0xC4	1	0xD5
Switch degas off (before 3 minutes)	3	0x10	0xC4	0	0xD4
Switch emission on	3	0x40	0x10	1	0x51
Switch emission off	3	0x40	0x10	0	0x50
Set Filament Control Mode to AUTO [9), 10)]	3	0x10	0xD3	0	0xE3

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

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

[9] Defines the Filament Control Mode (→ 🖹 29):
AUTO = Selection of filament automatically controlled by the gauge
MAN = Selection of filament controlled via interface.

Set Filament Control Mode to MAN [9), 10)]	3	0x10	0xD3	0	0xE4
Power-failure-safe storage of the Filament Control Mode [9), 10)]	3	0x20	0x0D	–	0x2D
Select filament 1 [11)]	3	0x10	0xD2	0	0xE2
Select filament 2 [11)]	3	0x10	0xD2	1	0xE3
Power-failure-safe storage of selected filament [11), 10)]	3	0x20	0x0C	–	0x2C
Read filament status	3	0x10	0xD4	–	0xD4
Read software version	3	0x00	0xD1	–	0xD1
Reset	3	0x40	0	0	0x40
Delete sensor history	3	0x40	0xFF	–	0x3F
Safe all EEPROM device parameters	3	0x40	0x40	–	0x80
Safe all EEPROM sensor parameters	3	0x40	0x41	–	0x81

[10)] The parameter is stored non-volatile.

[11)] The "Select filament x" command can be sent any time but is only executed if the gauge is in the "Emission OFF" state.

5 Deinstallation

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.

❶ Vent the vacuum system.

❷ Put the gauge out of operation and disconnect the sensor cable.

❸ Remove gauge from the vacuum system and install the protective lid.

6 Maintenance, Repair

Gauge failures due to contamination and wear and tear, as well as expendable parts (e.g. 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 Cleaning the Gauge

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.

Small deposits on the electrode system can be removed by baking the anode (Degas → 🗎 28). In the case of severe contamination, the baffle can be exchanged easily (→ 🗎 19). The sensor itself cannot be cleaned and needs to be replaced in case of severe contamination (→ 🗎 42).

6.2 What to Do in Case of Problems

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

Required tools / material

- Voltmeter / ohmmeter
- Allen wrench, AF 2.5
- Spare sensor (if the sensor is faulty)

Trouble shooting (Gauge)

The output signal is available at the sensor cable connector (Pin 3).

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 ≈0 V	Sensor cable defective or not correctly connected	Check the sensor cable
	No supply voltage	Turn on the power supply: The power supply indicator lit solid green
	Gauge in an undefined status	Turn the gauge off and on again (reset)
Output signal >10 V	EEPROM error	Turn the gauge off and on again after 5 s Replace the electronics unit
	Hot cathode error (sensor defective) → also 🗎 25, filament status	Replace the sensor (→ 🗎 42)
	Electronics unit not mounted correctly on sensor	Check the connections (electronics – sensor)
	Emission is switched off	Turn on the emission only at pressures $<2.7\times10^{-2}$ mbar
Corrupted or no output signal	Internal data connection not working	Turn the gauge off and on again after 5 s Replace the electronics unit

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).

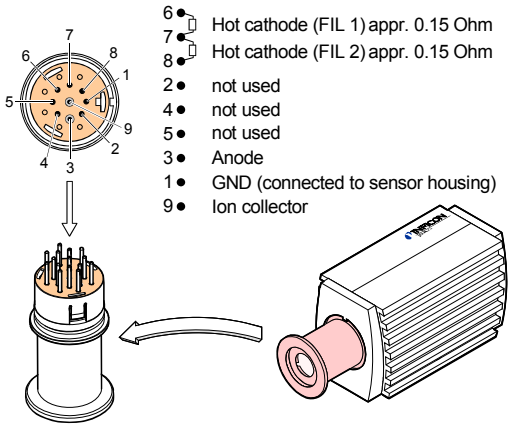
Separate the sensor from the electronics unit (→ 🗎 18). Using an ohmmeter, make the following measurements on the contact pins.

All unmarked pins in the diagram are used by the sensor electronics and cannot be utilized for diagnostic purposes (do not connect an ohmmeter / continuity checker to these pins).

Ohmmeter measurement between pins			Possible cause
6 + 7	≈0.15 Ω	≫0.15 Ω	Filament 1 broken [12)]
7 + 8	≈0.15 Ω	≫0.15 Ω	Filament 2 broken [12)]
6/7/8 + 1	∞	≪ ∞	Electrode - short circuit to ground
3 + 1	∞	≪ ∞	Electrode - short circuit to ground
9 + 1	∞	≪ ∞	Electrode - short circuit to ground
6/7/8 + 3	∞	≪ ∞	Short circuit between electrodes
9 + 3	∞	≪ ∞	Short circuit between electrodes

[12)] → also "Filament Status", 🗎 25.

View on sensor pins



Correction

All of the above faults can only be remedied by replacing the sensor (→ 🗎 42).

6.3 Replacing the Sensor

Replacement is necessary, when

- the sensor is severely contaminated
- the sensor is mechanically deformed
- the sensor is faulty, e.g. one / both filaments of hot cathode broken (→ 🗎 39)

We recommend to replace the sensor as soon as the first filament failure has been detected (→ 🗎 42).

Required tools / material

- Allen wrench, AF 2.5
- Spare sensor (→ 🗎 46)

Procedure

❶ Deinstall the gauge (→ 🗎 37).

❷ Deinstall the electronics unit from the faulty sensor and mount it to the new sensor (→ 🗎 18).

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 (form under www.inficon.com).

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 Options

	Ordering No
Baffle DN 25 ISO-KF / DN 40 CF-R (→ 🗎 19)	353-512

10 Accessories

	Ordering No
Communication adapter for diagnostic port (1.9 m)	303-333

11 Spare Parts

When ordering spare parts, always indicate:

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

	Ordering No
Replacement sensor BAG402, DN 25 ISO-KF (including allen wrench)	354-484
Replacement sensor BAG402, DN 40 CF-R (including allen wrench)	354-485

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 2014/30/EU and the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2011/65/EU.

Bayard-Alpert Gauge

BAG402

Standards

Harmonized and international / national standards and specifications:

- EN 61010-1:2010 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326-1:2013 (EMC requirements for electrical equipment for measurement, control and laboratory use)

Manufacturer / Signatures

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27 October 2014

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