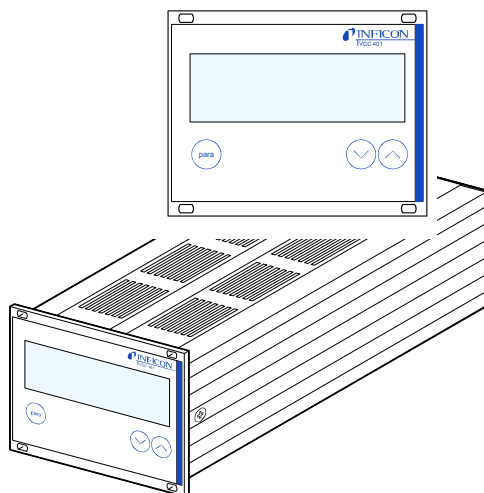




## Single-Channel Controller

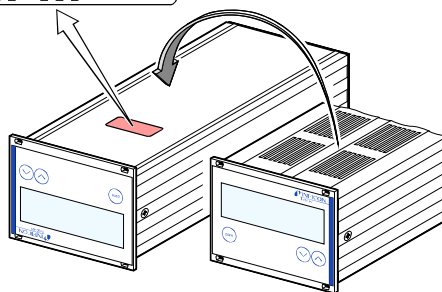
VGC401



## Product Identification

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


INFICON AG, LI-9496 Balzers		 
Model: _____		
PN: _____		
SN: _____		
_____ V	_____ Hz	_____ W



## Validity

This document applies to products with part number 398-010.

The part number (PN) can be taken from the product nameplate.

This document is based on firmware number 302-519-E. If your unit does not work as described in this document, please check that it is equipped with the above firmware version (→  49).

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

All dimensions are indicated in mm.

## **Intended Use**

The VGC401 is used together with INFICON Transmitters (in this document referred to as gauges) for total pressure measurement. All products must be operated in accordance with their respective Operating Manuals.



## **Scope of Delivery**

- 1x Single-Channel Controller
- 1x Power cord
- 1x Rubber bar
- 2x Rubber feet
- 4x Collar screws
- 4x Plastic sleeves
- 1x CD-ROM (Operating Manuals)
- 1x EC Declaration of Conformity
- 1x Installation Manual

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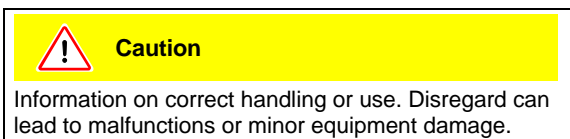
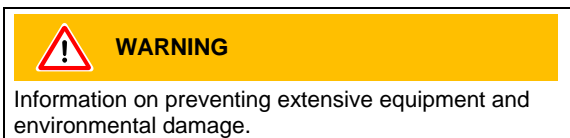
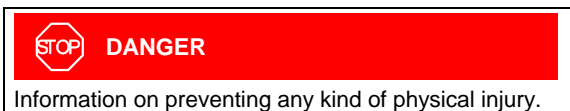
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For cross-references within this document, the symbol (→  XY) is used, for cross-references to further documents listed under "Literature", the symbol (→  [Z]).

# 1 Safety

## 1.1 Symbols Used

Symbols for residual risks



Further symbols



The lamp/display is lit.



The lamp/display flashes.



The lamp/display is dark.

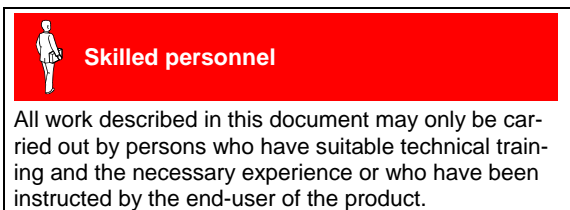


Press the key (example: 'para' key).



Do not press any key

## 1.2 Personnel Qualifications



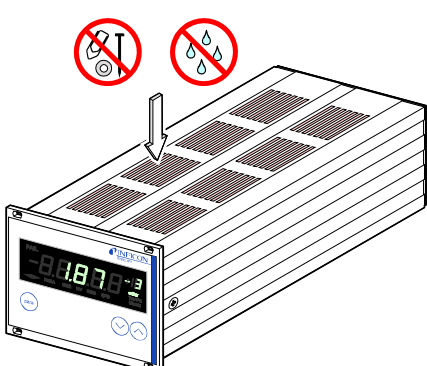
### 1.3 General Safety Instructions

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.

**DANGER**

**DANGER: mains voltage**  
 Contact with live parts is extremely hazardous when any objects are introduced or any liquids penetrate into the unit.

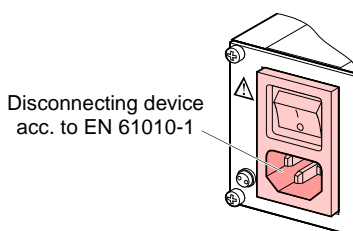
Make sure no objects enter through the louvers and no liquids penetrate into the equipment.



#### Disconnecting device

The disconnecting device must be readily identifiable and easily reached by the user.

To disconnect the controller from mains, you must unplug the mains cable.



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 corresponding documentation.










## 2 Technical Data


Mains specifications	Voltage	90 ... 250 VAC	
	Frequency	50 ... 60 Hz	
	Power consumption	≤30 VA	
	Overvoltage category	II	
	Protection class	1	
	Connection	European appliance connector IEC 320 C14	
Ambiance	Temperature storage	-20 ... +60 °C	
	operation	+ 5 ... +50 °C	
	Relative humidity	≤80% up to +31 °C, decreasing to 50% at +40 °C	
	Use	indoors only max. altitude 2000 m NN	
	Pollution degree	II	
	Protection type	IP30	
Compatible gauges	Number	1	
	Compatible types		
	Pirani	PSG	(PSG400, PSG400-S, PSG100-S, PSG101-S, PSG500, PSG500-S, PSG502-S, PSG510-S, PSG512-S, PSG550, PSG552, PSG554)
	Pirani/Capacitive	PCG	(PCG400, PCG400-S, PCG550, PCG552, PCG554)
	Cold cathode	PEG	(PEG100)
	Cold cathode/Pirani	MPG	(MPG400, MPG401)
	Hot cathode	BAG	(BAG100-S, BAG101-S)
	Hot cathode/Pirani	BPG	(BPG400, BPG402)
		HPG	(HPG400)
	Capacitive	CDG	(CDG025, CDG025D, CDG045, CDG045-H, CDG045D, CDG100, CDG100D, CDG160D)
	TripleGauge™		
	Hot cathode/Pirani/Capacitive	BCG	(BCG450)

Gauge connection	Number	2 (parallel)
		<div>  <b>Caution</b> </div> <p>Do not connect more than one gauge at the same time.</p>
	SENSOR connector	15-pin D-Sub, female RJ45 (FCC68), female (pin assignment → 23)
Operation	Front panel HOST (remote control)	via 3 keys via RS232C interface
Measurement values	Measurement ranges	depending on gauge (→ [1] ... [21])
	Measurement error	
	gain error	≤0.02% FSr
	offset error	≤0.05% FSr
	Measurement rate	
	analog	100 / s
	digital	50 / s (BPG, HPG, BCG, CDGxxx <sup>1)</sup> )
		10 / s (BAG)
	Display rate	10 / s
	Filter time constant	
	slow	750 ms ( $f_g = 0.2$ Hz)
	normal (nor)	150 ms ( $f_g = 1$ Hz)
	fast	20 ms ( $f_g = 8$ Hz)
	Pressure units	mbar, Pa, Torr, Micron
	Zero adjust	for linear gauges
	Correction factor	for logarithmic gauges 0.10 ... 10.00
	A/D converters	resolution >0.001% FSr (The measurement values of BPG, HPG, BCG, BAG and CDGxxx are transmitted digitally.)

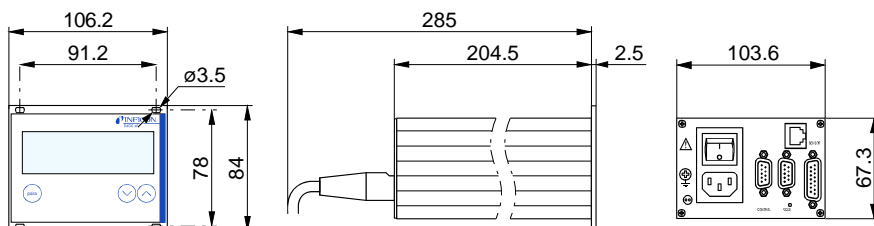
<sup>1)</sup> CDG025D, CDG045D, CDG100D, CDG160D

Gauge supply	Voltage	+24 VDC $\pm 5\%$
	Current	750 mA
	Power consumption	18 W
	Fuse protection	900 mA with PTC element, self-resetting after turning the VGC401 off or disconnecting the gauge
Switching function	Number	1
	Reaction delay	$\leq 10$ ms if switching threshold close to measurement value (for larger differences consider filter time constant).
	Adjustment range	depending on gauge ( $\rightarrow$  [1] ... [21])
	Hysteresis	$\geq 1\%$ FSr for linear gauges $\geq 10\%$ of measurement value for logarithmic gauges
Switching function relay	Contact type	floating changeover contact
	Load max.	60 VDC, 1 A (ohmic) 30 VAC, 2 A (ohmic)
	Service life	
	mechanic	$10^8$ cycles
	electric	$10^5$ cycles (at maximum load)
	Contact positions	$\rightarrow$  24
	CONTROL connector	9-pin D-Sub, male (pin assignment $\rightarrow$  24)
Error signal	Number	1
	Reaction time	$\leq 20$ ms
Error signal relay	Contact type	floating normally open contact
	Load max.	60 VDC, 1 A (ohmic) 30 VAC, 2 A (ohmic)
	Service life	
	mechanic	$10^8$ cycles
	electric	$10^5$ cycles (at maximum load)
	Contact positions	$\rightarrow$  24
	CONTROL connector	9-pin D-Sub, male (pin assignment $\rightarrow$  24)

Analog output	Number	1
	Voltage range	0 ... +10 V
	Internal resistance	660 $\Omega$
	Measurement signal vs. pressure	depending on gauge (→  [1] ... [21])
	CONTROL connector	9-pin D-Sub, male (pin assignment →  24)

Interface	Standard	RS232C
	Protocol	ACK/NAK, ASCII with 3-character mnemonics, bi-directional data flow, 8 data bits, no parity bit, 1 stop bit
	RS232C	only TXD and RXD used
	Transmission rate	9600, 19200, 38400 baud
	RS232 connector	9-pin D-Sub, female (pin assignment →  25)

## Dimensions [mm]



Use	For incorporation into a rack or control panel or as desk-top unit
-----	--

Weight	0.85 kg
--------	---------

## 3 Installation

### 3.1 Personnel



The unit may only be installed by persons who have suitable technical training and the necessary experience.

### 3.2 Installation, Setup

The VGC401 is suited for incorporation into a 19" rack or a control panel or for use as desk-top unit.



**DANGER: damaged product**  
Putting a damaged product into operation can be extremely hazardous.  
In case of visible damages, make sure the product is not put into operation.

#### 3.2.1 Rack Installation

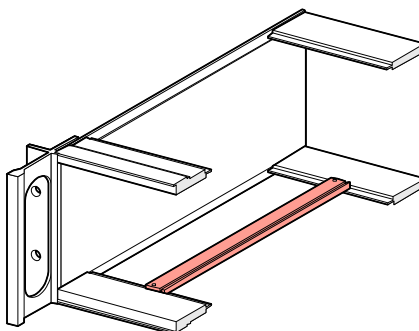
The VGC401 is designed for installation into a 19" rack chassis adapter according to DIN 41 494. For this purpose, four collar screws and plastic sleeves are supplied with it.



**DANGER: protection class of the rack**  
If the product is installed in a rack, it is likely to lower the protection class of the rack (protection against foreign bodies and water) e.g. the EN 60204-1 regulations for switching cabinets.  
Take appropriate measures for the rack to meet the specifications of the protection class.

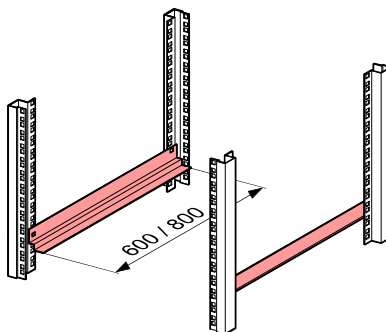
## Guide rail

In order to reduce the mechanical strain on the front panel of the VGC401, preferably equip the rack chassis adapter with a guide rail.

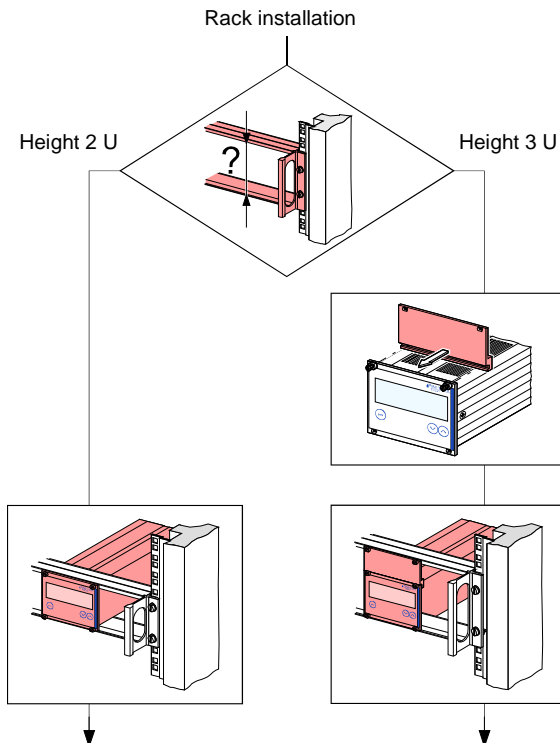


## Slide rails

For safe and easy installation of heavy rack chassis adapters, preferably equip the rack frame with slide rails.



## Mounting height

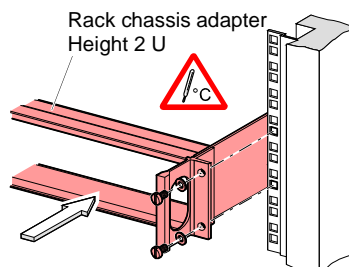


## Height 2 U rack chassis adapter

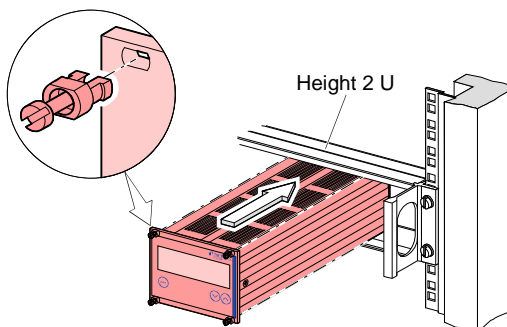
- 1 Secure the rack chassis adapter in the rack frame.



The admissible maximum ambient temperature (→ 9) must not be exceeded neither the air circulation obstructed.



- 2 Slide the VGC401 into the adapter ...



... and fasten the VGC401 to the rack chassis adapter using the screws supplied with it.

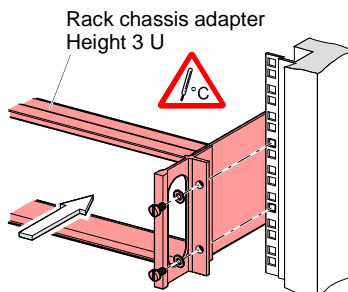
Height 3 U rack chassis adapter

For incorporation into a 19" rack chassis adapter, height 3, an adapter panel (incl. two collar screws and plastic sleeves) is available (→ 79).

- 1 Secure the rack adapter in the rack frame.

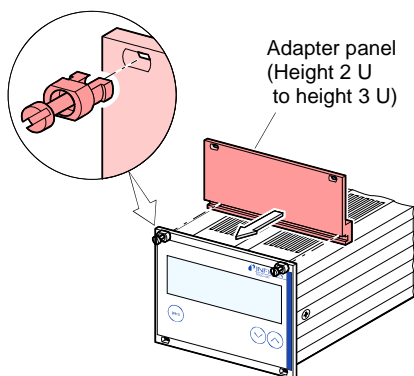


The admissible maximum ambient temperature (→ 9) must not be exceeded neither the air circulation obstructed.

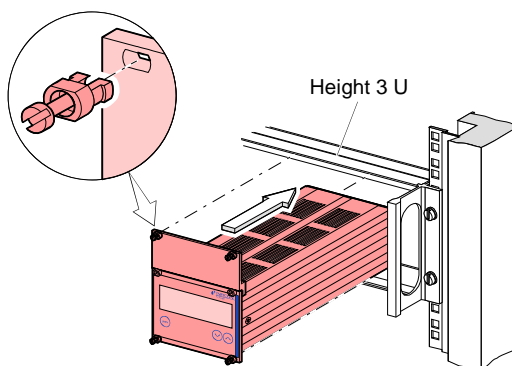




- 2 Mount the adapter panel as upper extension to the front panel of the VGC401 using the screws supplied with the adapter panel.




- 3 Slide the VGC401 into the rack chassis adapter ...



...and fasten the adapter panel to the rack chassis adapter using the screws supplied with the VGC401.

### 3.2.2 Installation in a Control Panel

**DANGER**

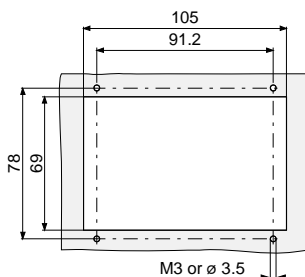


**DANGER:** protection class of the control panel

If the product is installed in a rack, it is likely to lower the protection class of the rack (protection against foreign bodies and water) e.g. according to the EN 60204-1 regulations for switching cabinets.

Take appropriate measures for the control panel to meet the specifications of the protection class.

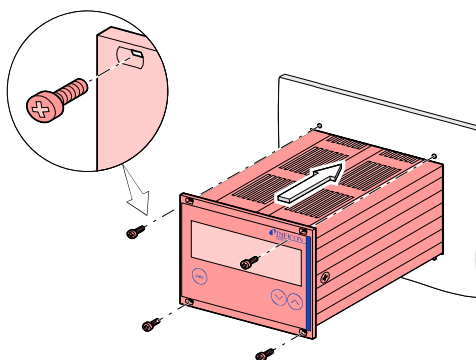
For mounting the VGC401 into a control panel, the following cut-out is required:



The admissible maximum ambient temperature (→ 9) must not be exceeded neither the air circulation obstructed.

For reducing the mechanical strain on the front panel, preferably support the unit.

- 1** Slide the VGC401 into the cut-out of the control panel ...

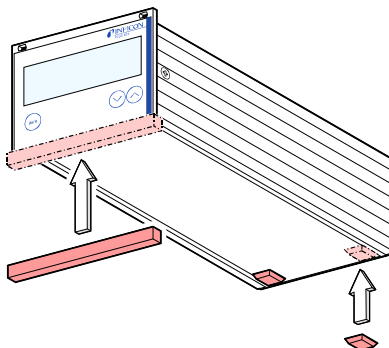


... and secure it with four M3 or equivalent screws.

### 3.2.3 Use as Desk-Top Unit

The VGC401 is also suited for use as desk-top unit. For this purpose, two self-adhesive rubber feet as well as a slip-on rubber bar are supplied with it.

- 1 Stick the two supplied rubber feet to the rear part of the bottom plate ...





... and slip the supplied rubber bar onto the bottom edge of the front panel.



Select a location where the admissible maximum ambient temperature (→ 9) is not exceeded (e.g. due to sun irradiation).

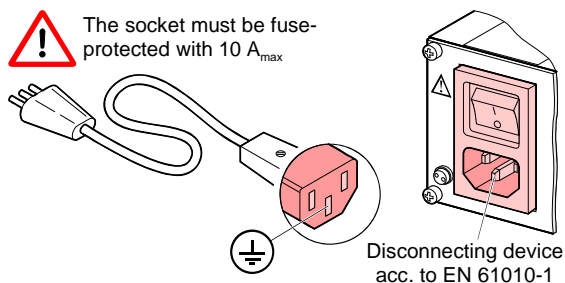
### 3.3 Mains Power Connector


**DANGER**



**DANGER: line voltage**  
 Incorrectly grounded products can be extremely hazardous in the event of a fault.  
 Use only a 3-conductor power cable (3×1.5 mm<sup>2</sup>) with protective ground. The power connector may only be plugged into a socket with a protective ground. The protection must not be nullified by an extension cable without protective ground.

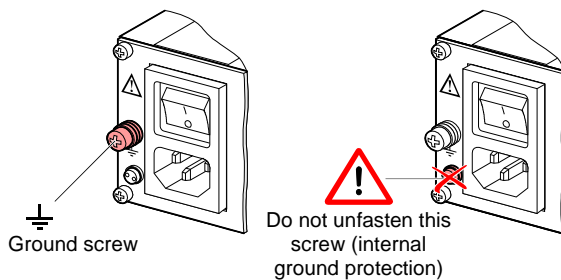
The unit is supplied with a 2.5 m power cord. If the mains cable is not compatible with your system, use your own, suitable cable with protective ground.



If the unit is installed in a switch cabinet, the mains voltage should be supplied and turned on via a central power distributor.


## Grounding


On the rear of the unit, there is a screw which can be used to connect the unit to ground, e.g. using the grounding of the pumping station.



### 3.4 SENSOR Connector

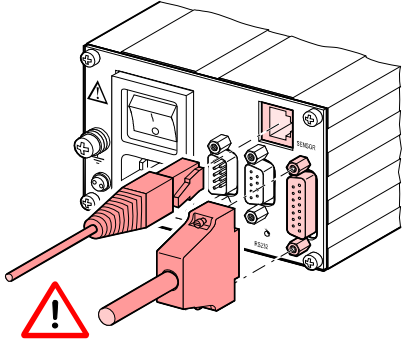
The VGC401 is equipped with two different gauge connectors.


**Caution**



**Caution:** one channel measurement unit


Connecting more than one gauge at the same time may lead to gauge destruction.




**1 only at once**

Make sure that there is never more than one gauge connected to the VGC401 at the same time.

Connect the gauge to one of the two SENSOR connectors on the rear of the unit. Use a screened 1:1 cable (electromagnetic compatibility). Make sure the gauge is compatible (→ 9).


**DANGER**



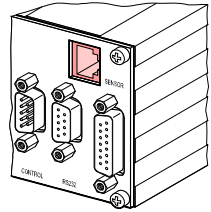
**DANGER:** protective low voltage

According to EN 61010, voltages exceeding 30 VAC or 60 VDC are hazardous.

Only connect a protective low voltage (SELV).

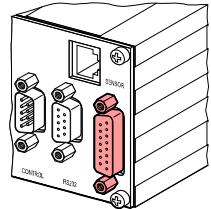
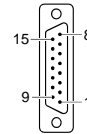
## Pin assignment SENSOR

Pin assignment of  
the 8-pin RJ45  
appliance connector:



Pin	Signal
4	Identification
1	Supply +24 VDC
2	Supply common GND
3	Signal input (Measurement signal+)
5	Signal common (Measurement signal-)
6	Status
7	HV_L
8	HV_H

Pin assignment of  
the female 15-pin  
D-Sub appliance  
connector:



Pin	Signal
10	Identification
8	Supply for BPG, HPG, BCG and BAG
11	Supply for CDG
5	Supply common GND
2	Signal input (Measurement signal+)
12	Signal common (Measurement signal-)
3	Status
1	Emission status
7	Degas
4	HV_H
13	RXD
14	TXD
15	Screening = chassis
6, 9	not connected

## 3.5 CONTROL Connector

This connector allows to read the measurement signal, to evaluate state of the floating switching function and error contacts, and to activate/deactivate the high vacuum measurement circuit (only for PEG cold cathode gauge and BAG ionization vacuum gauge).



Connect the peripheral components to the CONTROL connector on the rear of the unit. Use a screened cable (electromagnetic compatibility).



**DANGER**



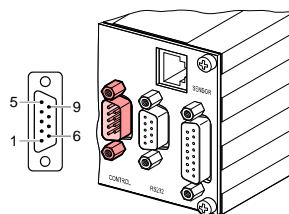
**DANGER:** protective low voltage





According to EN 61010, voltages exceeding 30 VAC or 60 VDC are hazardous.

Only connect a protective low voltage (SELV).

Pin assignment  
Contact positions  
CONTROL

Pin assignment of the male 9-pin D-Sub appliance connector:



Pin	Signal	
1	Analog output 0 ... +10 VDC	
7	Chassis = GND	
5	HV_H on +24 V off 0 V	
The control over this signal is placed superior to the key operation.		
4	 Pressure below threshold	 Pressure above threshold or power supply turned off
3		
2		
Error signal		
9	 No error	 Error or power supply turned off
8		
Supply for relays with higher switching power		
6	Fuse-protected at 300 mA with PTC element, self-resetting after power off or pulling the CONTROL connector. Meets the requirements of a grounded protective extra low voltage (SELV).	
7		



The analog output (pin 1) differ from the displayed value by no more than  $\pm 50$  mV.



### 3.6 RS232 Interface Connector

The RS232C interface allows for operating the VGC401 via a HOST or terminal. It can also be used for updating the firmware (→ 83).



Connect the serial interface to the RS232 connector on the rear of the unit using your own, screened (electromagnetic compatibility) cable.



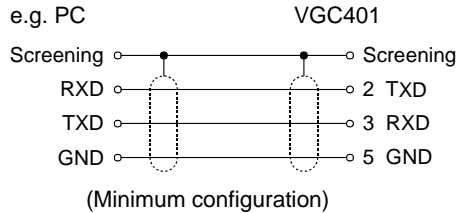
**DANGER**



**DANGER:** protective low voltage

According to EN 61010, voltages exceeding 30 VAC or 60 VDC are hazardous.

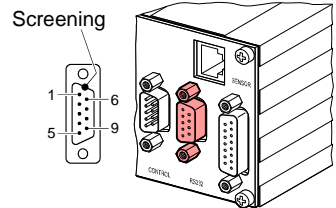
Only connect a protective low voltage (SELV).



Pin assignment  
RS232

Pin assignment  
of the female  
9-pin D-Sub  
appliance con-  
nector:

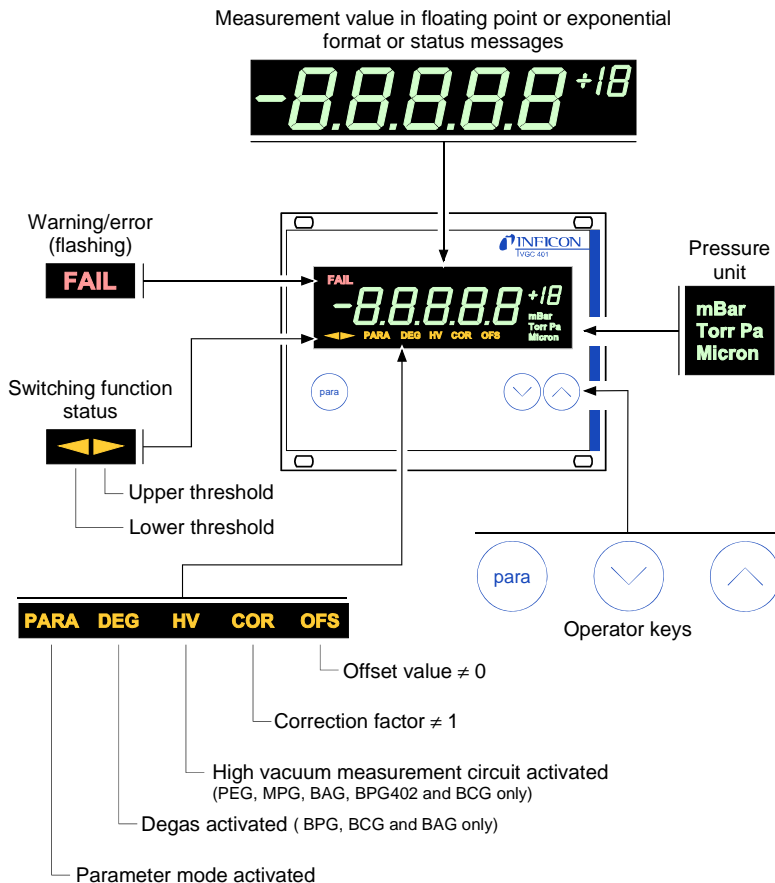
Pin	Signal
2	TXD
3	RXD
5	GND
6	DSR
8	CTS
9	GND



Pin	Signal
1	not connected
4	not connected
7	not connected
Chassis = screening	

## 4 Operation

### 4.1 Front Panel



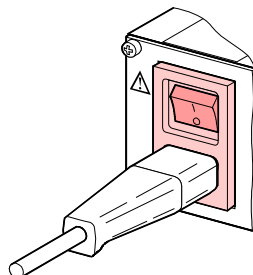
## 4.2 Turning the VGC401 On and Off

Make sure the VGC401 is correctly installed and the specifications in the Technical Data are met.

Turning the VGC401 on

The power switch is on the rear of the unit.

Turn the VGC401 on with the power switch (or centrally, via a switched power distributor, if the unit is incorporated in a rack).



After power on, the VGC401 ...

- automatically performs a self-test
- identifies the connected gauge
- activates the parameters that were in effect before the last power off
- switches to the Measurement mode
- adapts the parameters if required (if another gauge was previously connected).

Turning the VGC401 off

Turn the VGC401 off with the power switch (or centrally, via a switched power distributor, if the unit is incorporated in a rack).



Wait at least 10 s before turning the VGC401 on again in order for it to correctly initialize itself.

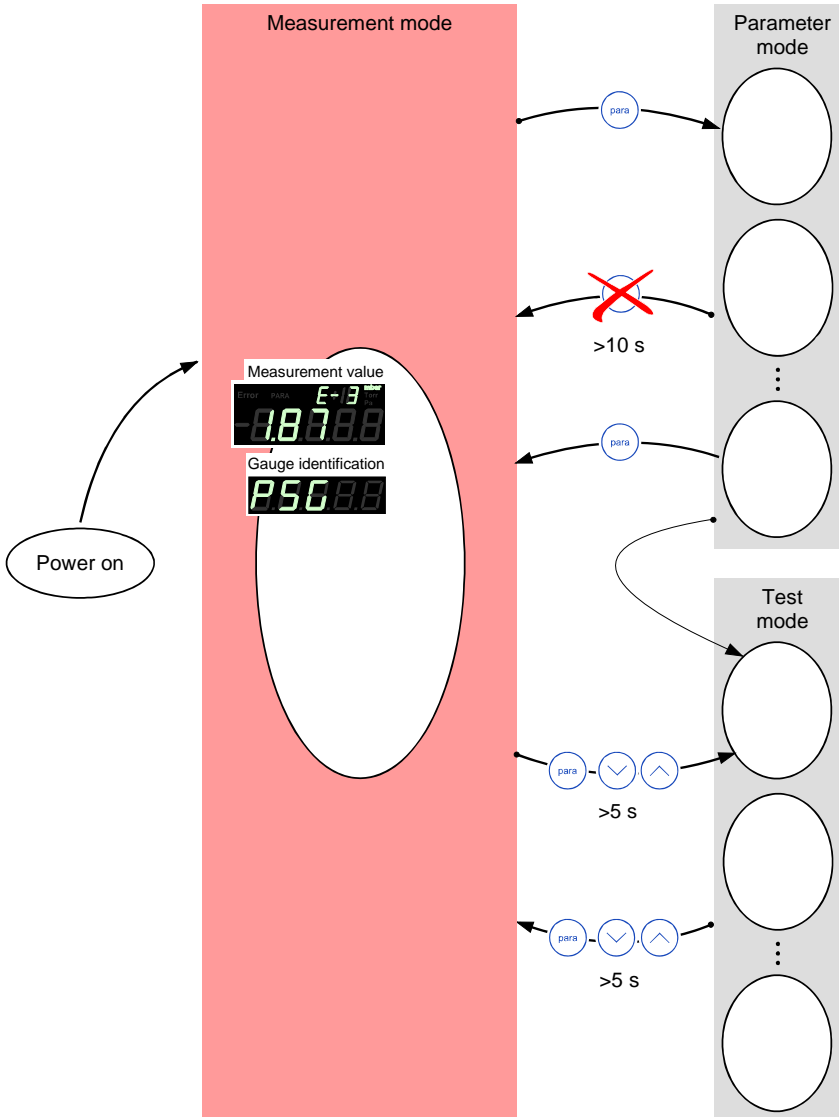
## 4.3 Operating Modes

The VGC401 works in the following operating modes:

- Measurement mode  
for displaying measurement values or status messages (→ [28](#))
- Parameter mode  
for entering or displaying parameters (→ [31](#))
- Test mode  
for running internal test programs (→ [47](#))
- Program transfer mode  
for updating the firmware (→ [83](#))

## 4.4 Measurement Mode

The Measurement mode is the standard operating mode of the VGC401. Measurement values and status messages as well as the gauge identification are displayed in this mode.

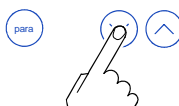


Turning the gauge on and off

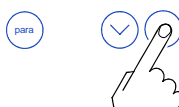
Available for:

- |  |            |
|--|------------|
| <input type="checkbox"/> Pirani                        | (PSG)      |
| <input type="checkbox"/> Pirani/Capacitive             | (PCG)      |
| <input checked="" type="checkbox"/> Cold cathode       | (PEG)      |
| <input type="checkbox"/> Cold cathode/Pirani           | (MPG)      |
| <input checked="" type="checkbox"/> Hot cathode        | (BAG)      |
| <input type="checkbox"/> Hot cathode/Pirani            | (BPG, HPG) |
| <input type="checkbox"/> Capacitive                    | (CDG)      |
| <input type="checkbox"/> Hot cathode/Pirani/Capacitive | (BCG)      |

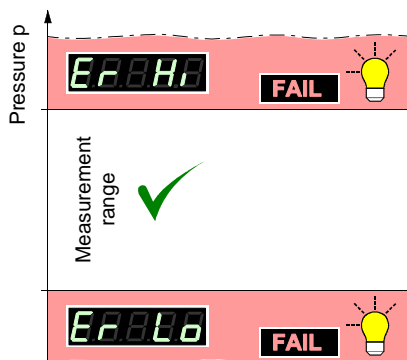
**HV**



⇒ Press key >1 s:  
The gauge is turned off.  
**OFF** is displayed instead of the measurement value.



⇒ Press key >1 s:  
The gauge is turned on. A status message may be displayed instead of the measurement value:



The high vacuum measurement circuit of these gauges can be activated in both, the Measurement and the Parameter mode (→ 43).

## Displaying the gauge identification



⇒ Press keys >0.5 s:  
The type of the connected gauge is automatically identified and displayed for 5 s:

### Pirani gauge

(PSG400, PSG400-S, PSG100-S, PSG101-S, PSG500, PSG500-S, PSG502-S, PSG510-S, PSG512-S, PSG550, PSG552, PSG554)

### Pirani/Capacitive gauge

(PCG400, PCG400-S, PCG550, PCG552, PCG554)

### Cold cathode gauge

(PEG100)

### Cold cathode/Pirani gauge

(MPG400, MPG401)

### Hot cathode gauge

(BAG100-S, BAG101-S)

### Hot cathode/Pirani gauge

(BPG400)

### Hot cathode/Pirani gauge

(BPG402)

### Hot cathode/Pirani gauge

(HPG400)

### Hot cathode/Pirani/Capacitive gauge

(BCG450)

### Linear gauge (capacitive. analog)

(CDG025, CDG045, CDG045-H, CDG100)

### Linear gauge (capacitive. digital)

(CDG025D, CDG045D, CDG100D, CDG160D)

### No gauge connected

(no Sensor)

### Connected gauge cannot be identified

(no Identifier)

## Getting to the Parameter mode



→ 31

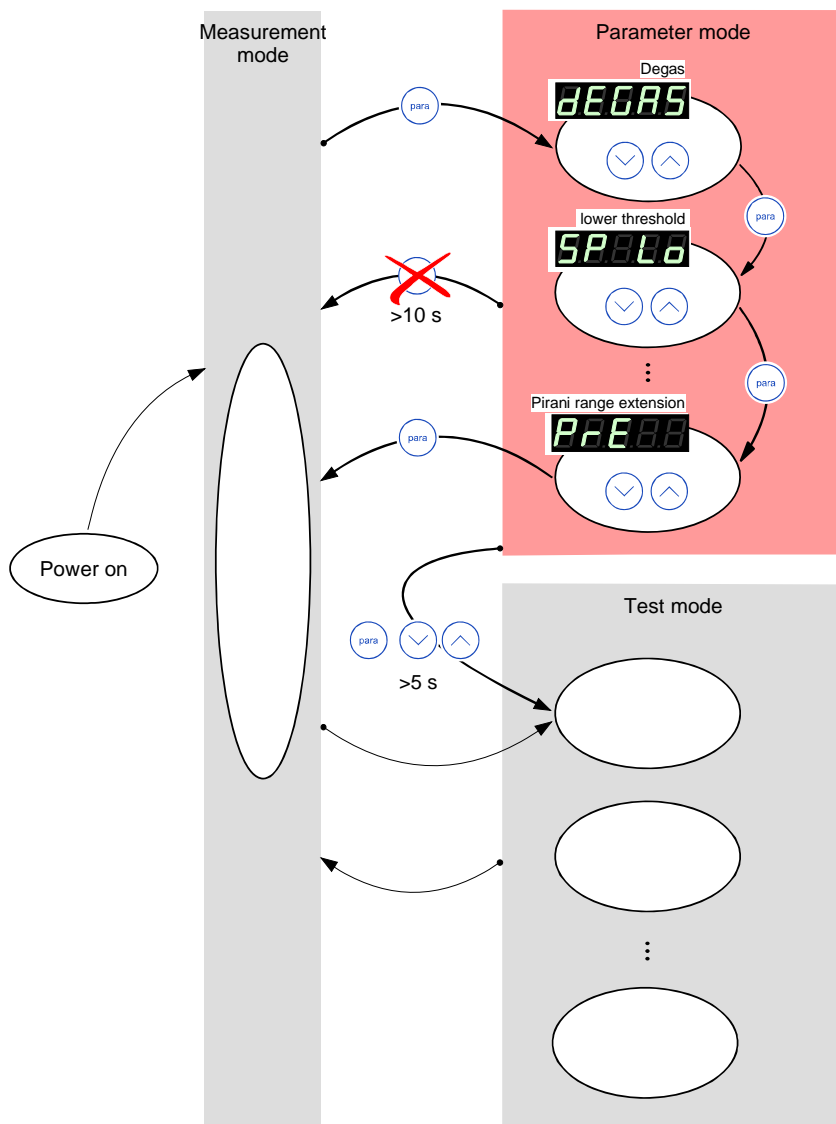
## Getting to the Test mode



Press keys >5 s  
(→ 47)

## 4.5 Parameter Mode

The Parameter mode is used for displaying, editing and entering parameter values.



## Selecting a parameter



⇒ The name of the parameter

e.g.: 

Deqas

is displayed as long as the key is pressed or at least for 2 s.

Afterwards, the currently valid parameter value is displayed.

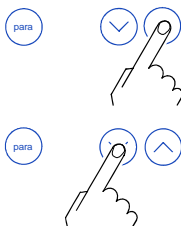
Some parameters are not available for all gauge types.  
They are only displayed if available.

→ 34 34 38 38 41 41 42 43 44 44 45 45 46

Available for	5A93AP	5P4H05	5S2P53	6S5F39	6P1U07	6P2P07	6P7P13	6H9114	7P911P	7P9P19	8P1U03	8P1P13	8P2P08
P5G000	-	✓	-	-	✓	✓	✓	-	✓	✓	-	-	✓
PCG000	-	✓	-	-	✓	✓	✓	-	✓	✓	-	-	✓
PEG000	-	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-
PPG000	-	✓	-	-	✓	✓	✓	-	✓	✓	-	-	-
6PG000	✓	✓	-	-	✓	✓	-	-	✓	✓	-	-	-
6PG020	✓	✓	-	-	✓	✓	-	-	✓	✓	✓	✓	-
HPG000	-	✓	-	-	✓	✓	-	-	✓	✓	-	-	-
6AG000	✓	✓	-	-	✓	✓	-	✓	✓	✓	-	-	-
CGG000	-	✓	✓	✓	✓	-	✓	-	-	✓	-	-	-
CGG000	-	✓	✓	✓	✓	-	✓	-	-	✓	-	-	-
6CG000	✓	✓	-	-	✓	✓	-	-	✓	✓	✓	-	-



## Editing the parameter value

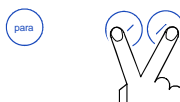


⇒ Press key <1 s:  
The value is increased/  
decreased by 1 increment.

Press key >1 s:  
The value is increased/  
decreased continuously.

Modifications of parameters come into effect immediately and are stored automatically. Exceptions are mentioned under the corresponding parameters.

## Loading the default parameters

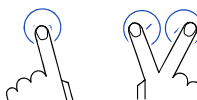


⇒ Press keys >5 s:  
All user-defined parameters  
are restored to their default  
values (→ 82).



Loading of the default parameter settings is irreversible.

## Getting to the Test mode



Press keys >5 s  
(→ 47)

## 4.5.1 Parameters

### Degas







Contamination deposits on the electrode system of Hot cathode gauges may cause instabilities of the measurement values. The Degas function allows to clean the electrode system.



BAG10X and BPG402 gauges: The Degas function acts only upon the active filament.

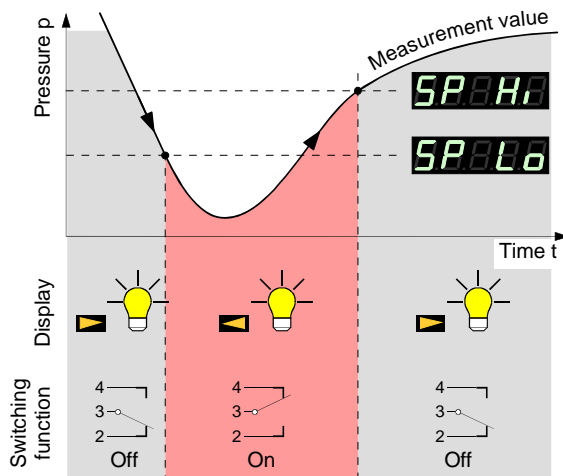
Available for:



- |   |       |
|---|-------|
| <input type="checkbox"/> Pirani                                   | (PSG) |
| <input type="checkbox"/> Pirani/Capacitive                        | (PCG) |
| <input type="checkbox"/> Cold cathode                             | (PEG) |
| <input type="checkbox"/> Cold cathode/Pirani                      | (MPG) |
| <input checked="" type="checkbox"/> Hot cathode                   | (BAG) |
| <input checked="" type="checkbox"/> Hot cathode/Pirani            | (BPG) |
| <input type="checkbox"/> Hot cathode/Pirani                       | (HPG) |
| <input type="checkbox"/> Capacitive                               | (CDG) |
| <input checked="" type="checkbox"/> Hot cathode/Pirani/Capacitive | (BCG) |














	Value
  	<div>  </div> <p>⇒ Normal operation.</p> <p>⇒ Degas: The electron collection grid is heated to <math>\approx 700\text{ }^{\circ}\text{C}</math> by electron bombardment and the electrode system is thus cleaned.</p> <p>Duration of the Degas function: 3 min (can be aborted).</p> <div>    </div>

### Lower/upper switching threshold

The VGC401 has a switching function with two adjustable thresholds. The status of the switching function is displayed on the front panel (→ 26) and can be evaluated via the floating contact at the CONTROL connector (→ 23).



	Value
  e.g.: 	<p>The lower switching threshold (Setpoint low) defines the pressure at which the switching function is activated when the pressure is dropping.</p> <p>⇒ gauge dependent (→ table).</p> <p>If another gauge type is connected, the VGC401 automatically adjusts the switching threshold if required.</p>



	lower threshold limit 	upper threshold limit 
	$2 \times 10^{-3}$ *)	$5 \times 10^2$
	$2 \times 10^{-3}$ *)	$1.5 \times 10^3$
	$1 \times 10^{-9}$	$1 \times 10^{-2}$
	$5 \times 10^{-9}$	$1 \times 10^3$
	$1 \times 10^{-8}$	$1 \times 10^3$
	$1 \times 10^{-8}$	$1 \times 10^3$
	$1 \times 10^{-6}$	$1 \times 10^3$
	$1 \times 10^{-10}$	$1 \times 10^{-1}$
	FSr / 1000	FSr
	FSr / 1000	FSr
	$1 \times 10^{-8}$	$1.5 \times 10^3$














all values in mbar, Cor = 1

\*)  $2 \times 10^{-4}$  mbar, if PrE is activated (→ 46)



The minimum hysteresis between the upper and lower switching threshold is at least 10% of the lower threshold or 1% of the set full scale value. If the value of the minimum hysteresis drops below these values, the upper threshold is automatically adjusted. This prevents unstable states.

	Value
  e.g.: 	<p>The upper switching threshold (Setpoint high) defines the pressure at which the switching function is deactivated when the pressure is rising.</p> <p>⇒ gauge dependent (→ table).</p> <p>If another gauge type is connected, the VGC401 automatically adjusts the threshold if required.</p>

	lower threshold limit 	upper threshold limit 
	+10% lower threshold	$5 \times 10^2$
	+10% lower threshold	$1.5 \times 10^3$
	+10% lower threshold	$1 \times 10^{-2}$
	+10% lower threshold	$1 \times 10^3$
	+10% lower threshold	$1 \times 10^3$
	+10% lower threshold	$1 \times 10^3$
	+10% lower threshold	$1 \times 10^3$
	+10% lower threshold	$1 \times 10^{-1}$
	+1% measurement range (FSr)	FSr
	+1% measurement range (FSr)	FSr
	+10% lower threshold	$1.5 \times 10^3$

all values in mbar, Cor = 1





The minimum hysteresis between the upper and lower switching threshold is at least 10% of the lower threshold or 1% of the set full scale value. This prevents unstable states.


## Measurement range of capacitive gauges

The full scale value of the measurement range (**Full Scale range**) of the linear gauges has to be defined by the user; the full scale value of logarithmic gauges is automatically recognized.

Available for:

- |  |            |
|--|------------|
| <input type="checkbox"/> Pirani                        | (PSG)      |
| <input type="checkbox"/> Pirani/Capacitive             | (PCG)      |
| <input type="checkbox"/> Cold cathode                  | (PEG)      |
| <input type="checkbox"/> Cold cathode/Pirani           | (MPG)      |
| <input type="checkbox"/> Hot cathode                   | (BAG)      |
| <input type="checkbox"/> Hot cathode/Pirani            | (BPG, HPG) |
| <input checked="" type="checkbox"/> Capacitive         | (CDG)      |
| <input type="checkbox"/> Hot cathode/Pirani/Capacitive | (BCG)      |

	Value
	
e.g.: 	⇒ 0.01 mbar 0.01 Torr, 0.02 Torr, 0.05 Torr 0.10 mbar, 0.25 mbar, 0.50 mbar 0.10 Torr, 0.25 Torr, 0.50 Torr 1 mbar, 2 mbar, 5 mbar 1 Torr, 2 Torr, 5 Torr 10 mbar, 20 mbar, 50 mbar 10 Torr, 20 Torr, 50 Torr 100 mbar, 200 mbar, 500 mbar 100 Torr, 200 Torr, 500 Torr 1000 mbar, 1100 mbar 1000 Torr 2 bar, 5 bar, 10 bar, 50 bar

Conversion table → Appendix,  81

## Offset correction of the controller

For displaying the offset correction and zero adjustment of the gauge and adjustment to the currently measured value (in the range -5 ... +110% of the full scale setting).








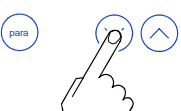
Available for:

- |  |            |
|--|------------|
| <input type="checkbox"/> Pirani                        | (PSG)      |
| <input type="checkbox"/> Pirani/Capacitive             | (PCG)      |
| <input type="checkbox"/> Cold cathode                  | (PEG)      |
| <input type="checkbox"/> Cold cathode/Pirani           | (MPG)      |
| <input type="checkbox"/> Hot cathode                   | (BAG)      |
| <input type="checkbox"/> Hot cathode/Pirani            | (BPG, HPG) |
| <input checked="" type="checkbox"/> Capacitive         | (CDG)      |
| <input type="checkbox"/> Hot cathode/Pirani/Capacitive | (BCG)      |

When the offset correction is activated, the stored offset value is subtracted from the actual measurement value. This allows measuring relative to a reference pressure.

The offset correction affects:

- ☒ the displayed measurement value
- ☐ the displayed threshold value of the switching functions
- ☐ the analog output at the CONTROL connector  
(→ 23)

	Value
	<div style="text-align: right;"><b>OFF</b></div>
	⇒ Offset correction deactivated <div style="text-align: right;"></div>
e.g.: 	⇒ Offset correction activated <div style="text-align: right;"></div>
	⇒ Press briefly: Activate offset correction.
	⇒ Press key >2 s: The offset value is readjusted. The actual measurement value is accepted as new offset value.
	⇒ Press briefly: Deactivate offset correction.

## Zero adjustment of the gauge

Available for:





- |  |            |
|--|------------|
| <input type="checkbox"/> Pirani                        | (PSG)      |
| <input type="checkbox"/> Pirani/Capacitive             | (PCG)      |
| <input type="checkbox"/> Cold cathode                  | (PEG)      |
| <input type="checkbox"/> Cold cathode/Pirani           | (MPG)      |
| <input type="checkbox"/> Hot cathode                   | (BAG)      |
| <input type="checkbox"/> Hot cathode/Pirani            | (BPG, HPG) |
| <input checked="" type="checkbox"/> Capacitive         | (CDG)      |
| <input type="checkbox"/> Hot cathode/Pirani/Capacitive | (BCG)      |

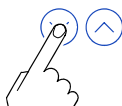


First adjust the gauge and then the controller.



When the zero of the gauge is readjusted, the offset correction must be deactivated.

	Value
	
e.g.: 	⇒ Zero adjustment activated 
	Lit solid after >2 s and as long as key remains pressed




⇒ Press >2 s  
Zero adjustment of the gauge (CDGxxxD only).














After adjusting the zero point, a zero value is displayed. Due to the measuring resolution of the CDG (noise, drift), a zero with plus/minus several digits are displayed.



## Pressure unit


Unit of measured values, thresholds etc. See Appendix (→  81) for conversion.

	Value	
		
	⇒ mbar/bar	
	⇒ Torr (only available if Torr lock is not activated i.e. Torr is not suppressed →  50)	
	⇒ Pascal	
	⇒ Micron (=mTorr)	

A change of the pressure unit influences also the settings of the BPG, HPG and BCG gauges.






When selecting Micron, above 99000 Micron the readout automatically changes over to Torr. When the pressure drops below 90 Torr the instrument automatically switches back to Micron.

## Correction factor

The correction factor allows the measured value to be calibrated for other gases than N<sub>2</sub> (→ respective manual, "Literature"  86).

Available for:

		Only for pressures
<input checked="" type="checkbox"/> Pirani	(PSG)	
<input checked="" type="checkbox"/> Pirani/Capacitive	(PCG)	<10 mbar
<input checked="" type="checkbox"/> Cold cathode	(PEG)	
<input checked="" type="checkbox"/> Cold cathode/Pirani	(MPG)	<1×10 <sup>-2</sup> mbar
<input checked="" type="checkbox"/> Hot cathode	(BAG)	
<input checked="" type="checkbox"/> Hot cathode/Pirani	(BPG)	<1×10 <sup>-2</sup> mbar
<input checked="" type="checkbox"/> Hot cathode/Pirani	(HPG)	
<input type="checkbox"/> Capacitive	(CDG)	
<input checked="" type="checkbox"/> Hot cathode/Pirani/Capacitive	(BCG)	<1 mbar



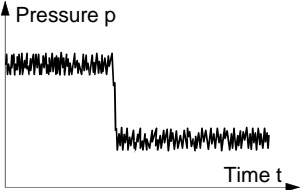
	Value
 e.g.:  e.g.: 	<div> <div><b>COR</b></div> <div>           ⇒ No correction            </div> <div>           ⇒ Measurement value corrected by a factor of 0.10 ... 10.00            </div> </div>

## Measurement value filter

The measurement value filter permits a better evaluation of unstable or disturbed measuring signals.

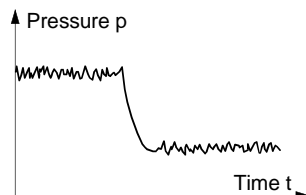
The filter affects:

- ☒ the displayed measurement value
- ☐ the analog output
- ☐ the digitally transmitted measurement value of the Hot cathode gauges BPG, HPG, BCG and BAG

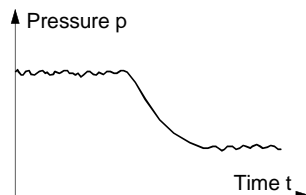
	Value
 	<div>           ⇒ Fast:            The VGC401 responds quickly to fluctuations in measured values. As a result, it will be more sensitive to disturbed measurement signals.         </div> <div>  </div>



⇒ Normal:  
Good relationship between response and sensitivity of the display and the switching functions to changes in the measured values.



⇒ Slow:  
The VGC401 does not respond to small changes in measured values. As a result, it will respond more slowly to changes in the measured values.






Turning the gauge on/off

Activating/deactivating the high vacuum measurement circuit (→ also 29).

Available for:




- |  |            |
|--|------------|
| <input type="checkbox"/> Pirani                        | (PSG)      |
| <input type="checkbox"/> Pirani/Capacitive             | (PCG)      |
| <input checked="" type="checkbox"/> Cold cathode       | (PEG)      |
| <input type="checkbox"/> Cold cathode/Pirani           | (MPG)      |
| <input checked="" type="checkbox"/> Hot cathode        | (BAG)      |
| <input type="checkbox"/> Hot cathode/Pirani            | (BPG, HPG) |
| <input type="checkbox"/> Capacitive                    | (CDG)      |
| <input type="checkbox"/> Hot cathode/Pirani/Capacitive | (BCG)      |

	Value
	
	⇒ High vacuum measurement circuit activated
	⇒ High vacuum measurement circuit deactivated




Display resolution (digits)

Display resolution of measured values.

	Value
	
	⇒ Display
	<ul style="list-style-type: none"> <li>rounded to one decimal digit</li> <li>or two integrals</li> </ul>
	⇒ Display
	<ul style="list-style-type: none"> <li>rounded to two decimal digits</li> <li>or three integrals</li> </ul>








When the PrE (→ 46) is ON and the pressure is in the range  $p < 1.0E-4$  mbar the display resolution of the PSG and PCG Gauges is reduced by one decimal digit.

Transmission rate

Transmission rate of the RS232C interface.




	Value
	
e.g.: 	⇒ 9600 baud
	19200 baud
	38400 baud

## Emission

Switching the emission on and off.

Available for:

- |   |               |
|---|---------------|
| <input type="checkbox"/> Pirani                                   | (PSG)         |
| <input type="checkbox"/> Pirani/Capacitive                        | (PCG)         |
| <input type="checkbox"/> Cold cathode                             | (PEG)         |
| <input type="checkbox"/> Cold cathode/Pirani                      | (MPG)         |
| <input type="checkbox"/> Hot cathode                              | (BAG)         |
| <input checked="" type="checkbox"/> Hot cathode/Pirani            | (BPG402 only) |
| <input type="checkbox"/> Capacitive                               | (CDG)         |
| <input checked="" type="checkbox"/> Hot cathode/Pirani/Capacitive | (BCG)         |





	Value
	
	⇒ the emission is switched on and off automatically by the gauge
	⇒ the emission is switched on and off by the user

## Filament

Means of selection.

Available for:

- |  |               |
|--|---------------|
| <input type="checkbox"/> Pirani                        | (PSG)         |
| <input type="checkbox"/> Pirani/Capacitive             | (PCG)         |
| <input type="checkbox"/> Cold cathode                  | (PEG)         |
| <input type="checkbox"/> Cold cathode/Pirani           | (MPG)         |
| <input type="checkbox"/> Hot cathode                   | (BAG)         |
| <input checked="" type="checkbox"/> Hot cathode/Pirani | (BPG402 only) |
| <input type="checkbox"/> Capacitive                    | (CDG)         |
| <input type="checkbox"/> Hot cathode/Pirani/Capacitive | (BCG)         |




	Value
	
	⇒ the gauge automatically alternates between the filaments
	⇒ filament 1 aktive
	⇒ filament 2 aktive

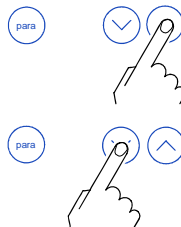
## Pirani range extension

The display and setpoint adjustment range can be extended.

Available for:

		Measurement range
<input checked="" type="checkbox"/>	Pirani Gauge	(PSG) $5 \times 10^{-5} \dots 1000$ mbar
<input checked="" type="checkbox"/>	Pirani Capacitance Gauge	(PCG) $5 \times 10^{-5} \dots 1500$ mbar
<input type="checkbox"/>	Cold Cathode Gauge	(PEG)
<input type="checkbox"/>	Cold cathode/Pirani	(MPG)
<input type="checkbox"/>	Hot cathode	(BAG)
<input type="checkbox"/>	Hot cathode/Pirani	(BPG, HPG)
<input type="checkbox"/>	Capacitive	(CDG)
<input type="checkbox"/>	Hot cathode/Pirani/Capacitive	(BCG)

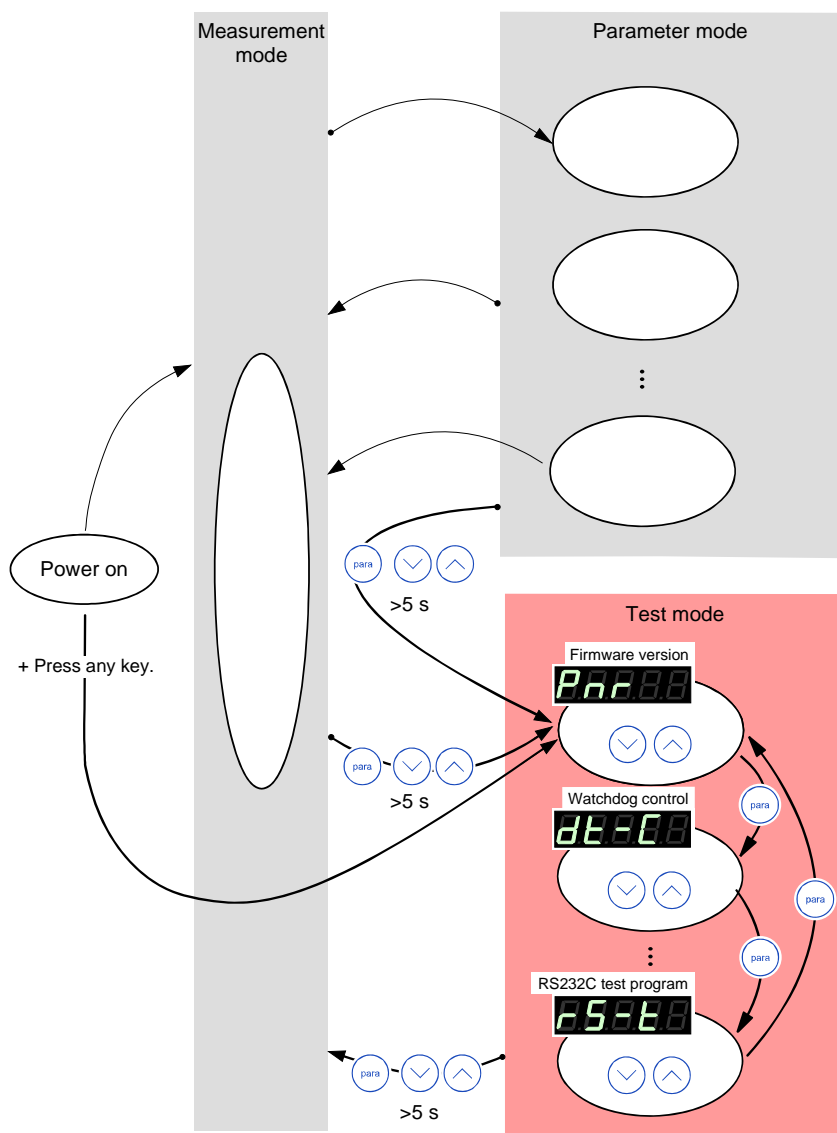
	Value
	
	⇒ Default.
	⇒ Display extended to $5 \times 10^{-5}$ mbar, setpoint adjustment range extended to $2 \times 10^{-4}$ mbar.



⇒ Activate/deactivate the Pirani range extension.

## 4.6 Test Mode

The Test mode is used for displaying, editing and entering special parameter values for testing the VGC401.



## Selecting a parameter



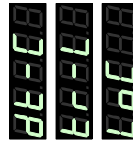
⇒ The name of the parameter

e.g.:   
Firmware version  
is displayed.

→  49



49 50



The name of the parameter is displayed as long as the key is pressed or at least for 2 s.

The firmware version is continuously displayed.

→  50



51



51



52



52



53



53



54



54



The name of the test program is displayed until it is started.

## Modifying a parameter

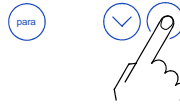


⇒ Increase/decrease the value by the defined increments.



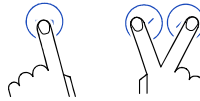


Starting the test program



⇒ Start test program.

Changing to the Measurement mode






Press keys >5 s  
(→ 28)  
or  
turn the unit off, wait for 10 s  
and then turn it on again.

## 4.6.1 Parameters




Firmware version

The firmware version (program version) is displayed.

	Version
	⇒ The two parts of the firmware number are displayed alternately.
	
	
	The last character indicates the modification index (-, A ... Z). Please mention this index when contacting INFICON in the event of a fault.




Watchdog control

Behavior of the system control (watchdog) in the event of an error.

	Setting
	⇒ The system automatically acknowledges error messages of the watchdog after 2 s. ⇒ Error messages of the watchdog have to be acknowledged by the operator.
	
	




## Torr lock

The pressure unit **Torr** can be suppressed in the corresponding parameter setting **00FF** (→ 41).

	Setting
	
	⇒ Pressure unit <b>Torr</b> available.
	⇒ Pressure unit <b>Torr</b> not available.

## Parameter setup lock





This parameter affects the parameter mode. When the lock is activated, the user can inspect but not modify parameter values.

	Setting
	
	⇒ Parameters can be inspected and modified
	⇒ Parameters can be inspected only.

## 4.6.2 Test Programs





### RAM test

Test of the main memory.

	Test sequence
	The test runs automatically one time:
	⇒ Test in process (very briefly).
	⇒ Test finished, no error found.
	⇒ Test finished, error(s) found. The <b>FAIL</b> lamp flashes.





## EPROM test

Test of the program memory.

	Test sequence
	The test runs automatically one time:
	⇒ Test in process
	⇒ Test finished, no error found. After the test, a four-digit checksum (hexadecimal format) is displayed.
	⇒ Test finished, error(s) found. After the test, a four-digit checksum (hexadecimal format) is displayed. The <b>FAIL</b> lamp flashes.


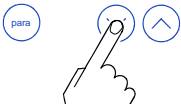
## EEPROM test

Test of the parameter memory.

	Test sequence
	The test runs automatically one time:
	⇒ Test in process (very briefly).
	⇒ Test finished, no error found.
	⇒ Test finished, error(s) found. The <b>FAIL</b> lamp flashes.

## Display test

### Test of the display.



	Test sequence
	<p>The test runs automatically one time <sup>1)</sup>:</p> <p>⇒ First, all display elements are lit at the same time, ...</p> <p>⇒ ... and then, each element is lit individually.</p>
<p>1)</p> 	<p>⇒ Stop the test sequence and activate one element after another by pressing the key once per element.</p>

## A/D converter test 0

Test of channel 0 of the analog/digital converter (with a reference voltage at the signal input of the SENSOR connector (→ 23)).



The measurement value filter affects the applied voltage. If the signal input is open, the VGC401 displays a default value that may easily fluctuate because of the high sensitivity of the open measurement circuit.



	Test sequence
 <p>e.g.: </p>	<p>⇒ Positive portion of the measurement signal in Volt</p>

## A/D converter test 1

Test of channel 1 of the analog/digital converter (with a reference voltage at the signal input of the SENSOR connector (→ 23)).



The measurement value filter affects the applied voltage. If the signal input is open, the VGC401 displays a default value that may easily fluctuate because of the high sensitivity of the open measurement circuit.




	Test sequence
 e.g.: 	⇒ Negative portion of the measurement signal in Volt.

## A/D converter test 2

Test of channel 2 of the analog/digital converter (with a reference voltage at the signal input of the SENSOR connector (→ 23)).





The measurement value filter affects the applied voltage. If the signal input is open, the VGC401 displays a default value that may easily fluctuate because of the high sensitivity of the open measurement circuit.

	Test sequence
 e.g.:  	⇒ Gauge identification voltage ⇒ No gauge connected

## I/O test

Test of the two relays of the VGC401. The program tests their switching function.

 **Caution**










**Caution:** The relays switch irrespective of the pressure

Starting a test program may cause unwanted effects in connected control systems.

Disconnect all sensor cables and control system lines to ensure that no control commands or messages are triggered by mistake.


The relays switch on and off cyclically. The switching operations are indicated optically and can be heard.


The contacts are connected to the CONTROL connector on the rear of the housing (→  23). Check the switching function with an ohmmeter.

	Test sequence
	The test runs automatically one time:
	⇒ both relays deactivated
	⇒ switching function relay
	⇒ switching function relay
	⇒ error relay
	⇒ error relay

## RS232C test

Test of the RS232C interface. The VGC401 repeats each sign transmitted by the communicating HOST.


 The data transferred from/to the VGC401 can be displayed by the computer only (→ Section 5).

	Test sequence
	The test runs automatically.


## 5 Communication (Serial Interface)

### 5.1 RS232C Interface

The serial interface is used for communication between the VGC401 and a computer. A terminal can be connected for test purposes.

When the VGC401 is put into operation, it starts transmitting measured values in intervals of 1 s. As soon as the first character is transferred to the VGC401, the automatic transmission of measured values stops. After the necessary inquiries or parameter modifications have been made, the transmission of measured values can be started again with the **COM** command (→  61).

Connection diagram,  
connection cable

Pin assignment of the 9-pin D-Sub connector and RS232 cable →  25.

#### 5.1.1 Data Transmission

The data transmission is bi-directional, i.e. data and control commands can be transmitted in either direction.

Data format

1 start bit  
8 data bits  
No parity bit  
1 stop bit  
No hardware handshake

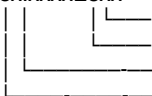
## Definitions

The following abbreviations and symbols are used:

Symbol	Meaning	Dec	Hex
HOST	Computer or terminal		
[...]	Optional elements		
ASCII	American Standard Code for Information Interchange		
<ETX>	END OF TEXT (CTRL C) Reset the interface	3	03
<CR>	CARRIAGE RETURN Go to beginning of the line	13	0D
<LF>	LINE FEED Advance by one line	10	0A
<ENQ>	ENQUIRY Request for data transmission	5	05
<ACK>	ACKNOWLEDGE Positive report signal	6	06
<NAK>	NEGATIVE ACKNOWLEDGE Negative report signal	21	15
"Transmit":	Data transfer from HOST to VGC401		
"Receive":	Data transfer from VGC401 to HOST		

## Format of pressure values

For pressure values, the following format is used:

$sx.xxxxEsxx$   


- Exponent
- Sign exponent
- Mantissa
- Sign mantissa

## Flow Control

After each ASCII string, the HOST must wait for a report signal (<ACK><CR><LF> or <NAK> <CR><LF>).

The input buffer of the HOST must have a capacity of at least 25 bytes.



## 5.1.2 Communication Protocol

### Transmission format

Messages are transmitted to the VGC401 as ASCII strings in the form of mnemonics and parameters. All mnemonics comprise three ASCII characters.

Spaces are ignored. <ETX> (CTRL C) clears the input buffer in the VGC401.

The input is terminated by <CR> or <LF> or <CR><LF> ("end of message"), and evaluation in the VGC401 is subsequently started.

The tables starting on 59 are applicable to the mnemonics and parameters. The maximum number of digits, the data formats and admissible value ranges are also specified there.

### Transmission protocol

HOST	VGC401	Explanation
Mnemonics		
[and parameters]	—————>	Receives message with "end of message"
<CR>[<LF>]	—————>	
<———— <ACK><CR><LF>		Positive acknowledgment of a received message

### Reception format

When requested with a mnemonic instruction, the VGC401 transmits the measurement data or parameters as ASCII strings to the HOST.

<ENQ> must be transmitted to request the transmission of an ASCII string. Additional strings, according to the last selected mnemonic, are read out by repetitive transmission of <ENQ>.

If <ENQ> is received without a valid request, the ERROR word is transmitted.

## Reception protocol

HOST	VGC401	Explanation
Mnemonics [and parameters] —————>		Receives message with "end of message"
<CR>[<LF>] —————>		
<— <ACK><CR><LF>		Positive acknowledgment of a received message
<ENQ> —————>		Requests to transmit
<— Measurement values or parameters		
<— <CR><LF>		Transmits data with "end of message"
:	:	
<ENQ> —————>		Requests to transmit
<— Measurement values or parameters		
<— <CR><LF>		Transmits data with "end of message"

## Error processing


All strings received are verified in the VGC401. If an error is detected, a negative acknowledgment <NAK> is output. The appropriate flag is set in the ERROR word. Errors can be decoded when the ERROR word is read.

## Error recognition protocol

HOST	VGC401	Explanation
Mnemonics [and parameters] —————>		Receives message with "end of message"
<CR>[<LF>] —————>		
***** Transmission or programming error *****		
<— <NAK><CR><LF>		Negative acknowledgment of a received message
Mnemonics [and parameters] —————>		Receives message with "end of message"
<CR>[<LF>] —————>		
<— <ACK><CR><LF>		Positive acknowledgment of a received message

## 5.2 Mnemonics

### Mnemonics

		→ 
<b>BAU</b>	Baud rate	69
<b>COM</b>	Continuous mode	61
<b>COR</b>	Correction factor	68
<b>DCD</b>	Display control digits	68
<b>DGS</b>	BAG, BPG, BCG degas on/off	64
<b>ERR</b>	Error status	63
<b>EUM</b>	Emission user mode	69
<b>FIL</b>	Filter time constant	68
<b>FSR</b>	CDG full scale range	66
<b>FUM</b>	Filament user mode	69
<b>HVC</b>	HV, EMI on/off	61
<b>ITR</b>	BAG, BPG, HPG, BCG, CDGxxxD data output	62
<b>LOC</b>	Parameter setup lock	72
<b>OFS</b>	Offset correction	67
<b>PNR</b>	Program number	71
<b>PRE</b>	Pirani range extension	70
<b>PR1</b>	Pressure measurement	60
<b>RES</b>	Reset	63
<b>SAV</b>	Save parameters to EEPROM	69
<b>SP1</b>	Setpoint	64
<b>SPS</b>	Setpoint status	65
<b>TAD</b>	A/D converter test	73
<b>TDI</b>	Display test	73
<b>TEE</b>	EEPROM test	72
<b>TEP</b>	EPROM test	72
<b>TID</b>	Sensor identification	62
<b>TIO</b>	I/O test	74
<b>TKB</b>	Keyboard test	74
<b>TLC</b>	Torr lock	71
<b>TRA</b>	RAM test	72
<b>TRS</b>	RS232 test	74
<b>UNI</b>	Pressure unit	67
<b>WDT</b>	Watchdog control	71

## 5.2.1 Measurement Mode

Measurement data

Transmit: **PR1** <CR>[<LF>]  
 Receive: <ACK><CR><LF>  
 Transmit: <ENQ>  
 Receive: x,sx.xxxxEsxx <CR><LF>

└─ Measurement value <sup>1)</sup>  
[in current pressure unit]

└─ Status, x =

- 0 → Measurement data okay
- 1 → Underrange
- 2 → Overrange
- 3 → Sensor error
- 4 → Sensor off (BAG, PEG)
- 5 → No sensor
- 6 → Identification error
- 7 → Error BAG, BPG, HPG, BCG



<sup>1)</sup> The 3<sup>rd</sup> and 4<sup>th</sup> decimal are always 0, except for the CDG gauge.

Continuous output of  
measured values  
(RS232)

Transmit: **COM** [,x] <CR>[<LF>]

Mode x = 0 → 100 ms  
1 → 1 s (default)  
2 → 1 min.

Receive: <ACK><CR><LF>

<ACK> is immediately followed by the continuous output of the measured value in the desired interval.

Receive: x,sx.xxxxEsxx y <CR><LF>

Measured value <sup>1)</sup>  
with pressure unit

Status, x =  
0 → Measurement data okay  
1 → Underrange  
2 → Overrange  
3 → Sensor error  
4 → Sensor off (BAG, PEG)  
5 → No sensor  
6 → Identification error  
7 → Error BAG, BPG, HPG, BCG



<sup>1)</sup> The 3<sup>rd</sup> and 4<sup>th</sup> decimal are always 0, except for the CDG gauge.

Activating/deactivating  
the HV circuit and EMI

Transmit: **HVC** [,x] <CR>[<LF>]

Mode x = 0 → off (default)  
1 → on

Receive: <ACK><CR><LF>



Transmit: <ENQ>

Receive: x <CR><LF>


Mode

Data output BAG, BPG,  
HPG, BCG, CDGxxxD

Transmit: **ITR** <CR>[<LF>]  
 Receive: <ACK><CR><LF>  
 Transmit: <ENQ>  
 Receive: xxx...xxx,y <CR><LF> <sup>1)</sup>

- └─ Gauge status ERS y  
 (→  BAG)
- └─ Transmission string (17 character)  
 (→  BAG)

xx,xx,xx,xx,xx,xx,xx,xx <CR><LF> <sup>2)</sup>

- └─ Transmission string byte  
 0 ... 7 in hex format  
 (→  BPG, HPG, BCG,  
 CDGxxxD)

<sup>1)</sup> Only for BAG

<sup>2)</sup> For BPG, HPG, BCG, CDGxxxD

Gauge identification

Transmit: **TID** <CR>[<LF>]  
 Receive: <ACK><CR><LF>  
 Transmit: <ENQ>  
 Receive: x <CR><LF>

- └─ Identification, x =
  - PSG (Pirani)
  - PCG (Pirani/Capacitive)
  - PEG (Cold cathode)
  - MPG (Cold cathode/Pirani)
  - CDG (Capacitive)
  - BAG (Hot cathode)
  - BPG (Hot cathode/Pirani)
  - BPG402 (Hot cathode/Pirani)
  - HPG (Hot cathode/Pirani)
  - BCG (Hot cathode/Pirani/  
Capacitive)
  - noSEn (no Sensor)
  - noid (no identification)

## Error status

Transmit: **ERR** <CR><LF>  
 Receive: <ACK><CR><LF>  
 Transmit: <ENQ>  
 Receive: xxxx <CR><LF>  
     └─ x =  
         0000 → No error  
         1000 → Controller error  
                 (See display on front panel)  
         0100 → NO, HWR No hardware  
         0010 → PAR, Inadmissible parameter  
         0001 → SYN, Syntax error



The ERROR word is cancelled when read out. If the error persists, it is immediately set again.

## Reset

Transmit: **RES** [,x] <CR><LF>  
     └─ x = 1 → Reset  
 Receive: <ACK><CR><LF>  
 Transmit: <ENQ>  
 Receive: [x]x,[x]x,... <CR><LF>  
     └─ List of all present error messages  
         xx =  
             0 → No error  
             1 → Watchdog has responded  
             2 → Task fail error  
             5 → EPROM error  
             6 → RAM error  
             7 → EEPROM error  
             9 → DISPLAY error  
             10 → A/D converter error  
             11 → Sensor error (e.g. filament rupture, no supply)  
             12 → Sensor identification error

Transmit: **DGS** [,x] <CR>[<LF>]  
 └ x = 0 → off (default)  
       1 → on (3 min.)

Transmit: <ENQ>

```
Receive:      x <CR><LF>
              |
              └ Degas status
```

Transmit: **SP1** [,x.xxEsx,x.xxEsx] <CR>[<LF>]

└── Upper threshold <sup>1)</sup>  
[in current pressure unit]  
(default = depending on gauge)

└── Lower threshold <sup>1)</sup>  
[in current pressure unit]  
(default = depending on gauge)

<sup>1)</sup> Values can be entered in any format. They are internally converted into the floating point format.

Transmit: <ENQ>

Receive: x.xxxxEsxx,x.xxxxEsxx <CR><LF>

└─ Upper threshold  
[in current pressure unit]

└─ Lower threshold  
[in current pressure unit]



Switching function  
status

Transmit: **SPS** <CR>[<LF>]

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x <CR><LF>

└ Switching function x = 0 → off  
1 → on

Measurement range  
(F.S.) of capacitive  
gauges



The full scale value of the measurement range (Full Scale) of linear gauges has to be defined by the user; the full scale value of logarithmic gauges is automatically recognized.

Transmit: **FSR** [,x] <CR>[<LF>]

└ Measurement range, x =

- 0 → 0.01 mbar
- 1 → 0.01 Torr
- 2 → 0.02 Torr
- 3 → 0.05 Torr
- 4 → 0.10 mbar
- 5 → 0.10 Torr
- 6 → 0.25 mbar
- 7 → 0.25 Torr
- 8 → 0.50 mbar
- 9 → 0.50 Torr
- 10 → 1 mbar
- 11 → 1 Torr
- 12 → 2 mbar
- 13 → 2 Torr
- 14 → 5 mbar
- 15 → 5 Torr
- 16 → 10 mbar
- 17 → 10 Torr
- 18 → 20 mbar
- 19 → 20 Torr
- 20 → 50 mbar
- 21 → 50 Torr
- 22 → 100 mbar
- 23 → 100 Torr
- 24 → 200 mbar
- 25 → 200 Torr
- 26 → 500 mbar
- 27 → 500 Torr
- 28 → 1000 mbar
- 29 → 1100 mbar
- 30 → 1000 Torr
- 31 → 2 bar
- 32 → 5 bar
- 33 → 10 bar
- 34 → 50 bar

Receive:

<ACK><CR><LF>

Transmit:

<ENQ>

Receive: x <CR><LF>

└ Measurement range (F.S.)

## Offset correction

Transmit: **OFS** [,x,x.xxxEsx] <CR>[<LF>]

- └─ Offset <sup>1)</sup>  
[in current pressure unit]  
(default = 0.000E0)
- └─ Mode, x =
  - 0 → Off (default)  
No offset value needs to be entered.
  - 1 → On  
If no offset value has been entered, the previously defined offset value is taken over.
  - 2 → Auto  
(offset measurement)  
No offset value needs to be entered.
  - 3 → Zero adjustment CDGxxxD  
No offset value needs to be entered.

<sup>1)</sup> Values can be entered in any format. They are internally converted into the floating point format.

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x,sx.xxxxEsxx <CR><LF>

- └─ Offset  
[in current pressure unit]
- └─ Mode

## Measurement unit

Transmit: **UNI** [,x] <CR>[<LF>]

- └─ x = 0 → mbar/bar (default)
  - 1 → Torr
  - 2 → Pascal
  - 3 → Micron

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x <CR><LF>

- └─ Measurement unit

## Correction factor

Transmit: **COR** [,x]x.xxx <CR><LF>  
 ↳ 0.100 ... 10.000  
 (default = 1.000)

Receive: <ACK><CR><LF>  
 Transmit: <ENQ>  
 Receive: [x]x.xxx <CR><LF>  
 ↳ Correction factor

## Number of digits in the display

Transmit: **DCD** [,x] <CR><LF>  
 ↳ x = 2 → 2 digits (default)  
 3 → 3 digits

Receive: <ACK><CR><LF>  
 Transmit: <ENQ>  
 Receive: x <CR><LF>  
 ↳ Number of digits

When the PrE (→ 46) is ON and the pressure is in the range  $p < 1.0E-4$  mbar the display resolution of the PSG and PCG Gauges is reduced by one decimal digit.

## Measurement value filter

Transmit: **FIL** [,x] <CR><LF>  
 ↳ x = 0 → fast  
 1 → medium (default)  
 2 → slow

Receive: <ACK><CR><LF>  
 Transmit: <ENQ>  
 Receive: x <CR><LF>  
 ↳ Filter time constant

## Transmission rate

Transmit: **BAU** [,x] <CR>[<LF>]

└ x = 0 → 9600 baud (default)  
1 → 19200 baud  
2 → 38400 baud



As soon as the new baud rate has been entered, the report signal is transmitted at the new transmission rate.

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x <CR><LF>

└ Transmission rate

## Emission

Transmit: **EUM** [,x] <CR>[<LF>]

└ x = 0 → Manually  
1 → Automatically (default)

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x <CR><LF>

## Filament

Transmit: **FUM** [,x] <CR>[<LF>]

└ x = 0 → Automatically (default)  
1 → Filament 1  
2 → Filament 2

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x <CR><LF>

## Save parameters to EEPROM

Transmit: **SAV** [,x] <CR>[<LF>]

└ x = 0 → Save default parameters  
1 → Save user parameters

Receive: <ACK><CR><LF>

Pirani range  
extension

Transmit: **PRE** [,x] <CR>[<LF>]

└ x = 0 → off (default)  
          1 → on

Receive:      <ACK><CR><LF>

Transmit: <ENQ>

Receive:      x <CR><LF>



PSG and PCG gauges only, measurement range up to  $5 \times 10^{-5}$  mbar.

### 5.2.3 Test Mode

(For service specialists)

Firmware version

Transmit: **PNR** <CR>[<LF>]

Receive:      <ACK><CR><LF>

Transmit: <ENQ>

Receive:      xxx-xxx-x <CR><LF>

-x = Modification index  
(-- = original version)

Firmware number

## Watchdog control

Transmit: **WDT** [,x] <CR>[<LF>]

- $x = 0 \rightarrow$  Manual error acknowledgement
- $1 \rightarrow$  Automatic error acknowledgement (default)



<sup>1)</sup> If the watchdog has responded, the error is automatically acknowledged and cancelled after 2 s.

Receive:      <ACK><CR><LF>

Transmit: <ENQ>

Receive:      x <CR><LF>

## Watchdog control

Torr lock

Transmit: **TLC** [,x] <CR>[<LF>]

- x = 0 -> off (default)
- 1 -> on

Receive:      <ACK><CR><LF>

Transmit:     <ENQ>

Receive:        x <CR><LF>

Torr lock status

## Parameter setup lock

Transmit: **LOC** [,x] <CR>[<LF>]  
                   └ x = 0 → off (default)  
                       1 → on

Receive:      <ACK><CR><LF>

Transmit: <ENQ>

Receive:      x <CR><LF>  
                 |  
                 └ Parameter setup lock status

## RAM test

Transmit: **TRA** <CR>[<LF>]

Receive:      <ACK><CR><LF>

Transmit: <ENQ> Starts the test (duration <1 s)

Receive:      xxxx <CR><LF>  
                 |  
                 └ ERROR word

## EPROM test

Transmit: **TEP** <CR>[<LF>]

Receive:      <ACK><CR><LF>

Transmit: <ENQ> Starts the test (duration  $\approx 10$  s)

Receive:      xxxx,xxxx <CR><LF>  
                |       |  
                |       └─ Check sum (hex)  
                └─ ERROR word

## EEPROM test

Transmit: **TEE** <CR>[<LF>]

Receive:      <ACK><CR><LF>

Transmit: <ENQ> Starts the test (duration <1 s)



Do not keep repeating the test (EEPROM life).

Receive:      xxxx <CR><LF>  
                 |  
                 └ ERROR word



## Display test

Transmit: **TDI** [,x] <CR>[<LF>]

- └ x = 0 → Stops the test – display according to current operating mode (default)
- 1 → Starts the test – all LEDs on

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x <CR><LF>

- └ Display test status

## ADC test

Transmit: **TAD** <CR>[<LF>]

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: [x]x.xxxx, x.xxxx, x.xxxx <CR><LF>

- └ ADC channel 2  
Gauge identification  
[0.0000 ... 5.0000 V]
- └ ADC channel 1  
Measurement signal (negative portion)  
[0.0000 ... 5.0000 V]
- └ ADC channel 0  
Measurement signal (positive portion) [0.0000 ... 11.0000 V]

## I/O test

Transmit: **TIO** [,x] <CR>[<LF>]

└ x =

- 0 → Stops the test (default)
- 1 → Setpoint relay off, error relay off
- 2 → Setpoint relay on, error relay off
- 3 → Setpoint relay off, error relay on
- 4 → Setpoint relay on, error relay on

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: x <CR><LF>

└ I/O test status

## Operator key test




Transmit: **TKB** <CR>[<LF>]

Receive: <ACK><CR><LF>

Transmit: <ENQ>

Receive: xxx <CR><LF>

└

- Key 3  x = 0 → Not pushed  
1 → Pushed
- Key 2 
- Key 1 

## RS232 test

Transmit: **TRS** <CR>[<LF>]

Receive: <ACK><CR><LF>

Transmit: <ENQ> Starts the test (repeats each character, test is interrupted with <CTRL> C).

## 5.2.4 Example



"Transmit (T)" and "Receive (R)" are related to the host.

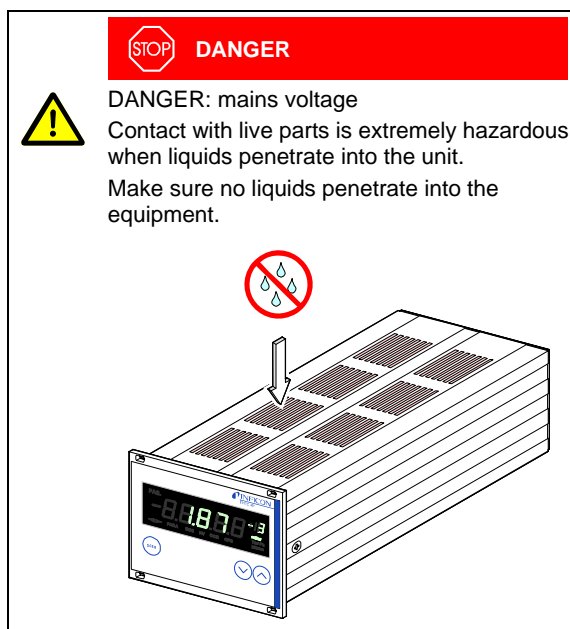
T: <b>TID</b> <CR> [<LF>]	Request for gauge identification
R: <ACK> <CR> <LF>	Positive acknowledgement
T: <ENQ>	Request for data transmission
R: PSG <CR> <LF>	Gauge identification
T: <b>SP1</b> <CR> [<LF>]	Request for parameters of switching function (setpoint)
R: <ACK> <CR> <LF>	Positive acknowledgement
T: <ENQ>	Request for data transmission
R: 1.0000E-09,9.0000E-07 <CR> <LF>	Thresholds
T: <b>SP1</b> ,6.80E-3,9.80E-3 <CR> [<LF>]	Modification of threshold values of switching function (setpoint)
R: <ACK> <CR> <LF>	Positive acknowledgement
T: <b>FOL</b> ,2 <CR> [<LF>]	Modification of filter time constant (syntax error)
R: <NAK> <CR> <LF>	Negative acknowledgement
T: <ENQ>	Request for data transmission
R: 0001 <CR> <LF>	ERROR word
T: <b>FIL</b> ,2 <CR> [<LF>]	Modification of filter time constant
R: <ACK> <CR> <LF>	Positive acknowledgement
T: <ENQ>	Request for data transmission
R: 2 <CR> <LF>	Filter time constant
T: <b>PR1</b> <CR> [<LF>]	Request for measurement data
R: <ACK> <CR> <LF>	Positive acknowledgement
T: <ENQ>	Request for data transmission
R: 0,8.3400E-03 <CR> <LF>	Status and pressure
T: <ENQ>	Request for data transmission
R: 1,8.0000E-04 <CR> <LF>	Status and pressure

## 6 Maintenance

The product requires no maintenance.

### Cleaning the VGC401

For cleaning the outside of the VGC401, a slightly moist cloth will usually do. Do not use any aggressive or scouring cleaning agents.



## 7 Troubleshooting

### Signalization of errors

**FAIL**



and the error relay opens (→ 24).

### Error messages

**LE0000**


Possible cause and remedy/  
acknowledgement

Parameter setup lock activated  
(→ 50).

**SE0000**

Possible cause and remedy/  
acknowledgement

Interruption or instability in sensor line  
or connector (Sensor error).

⇒ Acknowledge with the  key.  
If the problem persists, **noSEn** or  
**noPBn** is displayed

**EP0000**

0 ... 9

Possible cause and remedy/  
acknowledgement

Error messages concerning BPG, BAG  
and HPG.

Meaning → [6], [7], [8], [14].

0 = no communication to the gauge

1...9 = High-Byte of Error-Byte  
(BPG400, HPG)

1...6 = Error status (BAG)

**EPxx00**














xx





Possible cause and remedy/  
acknowledgement

Error messages concerning BCG and  
BPG402.

Meaning → [15], [21].

xx = Error byte (HEX)

	Possible cause and remedy/ acknowledgement
	<p>The VGC401 has been turned on too fast after power off.</p> <p>⇒ Acknowledge with the  key <sup>1)</sup>.</p>
	<p>The watchdog has tripped because of a severe electric disturbance or an operating system error.</p> <p>⇒ Acknowledge with the  key <sup>1)</sup>.</p>
<p><sup>1)</sup> If the watchdog is set to , the VGC401 acknowledges the message automatically after 2 s (→  49).</p>	
	Possible cause and remedy/ acknowledgement
	<p>Main memory (RAM) error.</p> <p>⇒ Acknowledge with the  key.</p>
	Possible cause and remedy/ acknowledgement
	<p>Program memory (EPROM) error.</p> <p>⇒ Acknowledge with the  key.</p>
	Possible cause and remedy/ acknowledgement
	<p>Parameter memory (EEPROM) error.</p> <p>⇒ Acknowledge with the  key.</p>
	Possible cause and remedy/ acknowledgement
	<p>Display driver error.</p> <p>⇒ Acknowledge with the  key.</p>

	Possible cause and remedy/ acknowledgement
	A/D converter error. ⇒ Acknowledge with the  key.
	Possible cause and remedy/ acknowledgement
	Operating system (Task Fail) error. ⇒ Acknowledge with the  key.

Technical support



If the problem persists after the message has been acknowledged for several times and/or the gauge has been exchanged, please contact your local INFICON service center.

## 8 Repair

Return defective products to your local INFICON service center for repair.

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

## 9 Accessories

	Ordering number
Adapter panel for installation into a 19" rack chassis adapter, height 3 U	398-499

## 10 Storage



### Caution



Caution: electronic component

Inappropriate storage (static electricity, humidity etc.) can damage electronic components.

Store the product in a bag or container. Observe the corresponding specifications in the technical data (→ 9).

## 11 Disposal



### 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

Non-electronic components

Electronic components

After disassembling the product, separate its components according to the following criteria:

Such components must be separated according to their materials and recycled.

Such components must be separated according to their materials and recycled.



## Appendix

### A: Conversion Tables

#### Weights

	kg	lb	slug	oz
kg	1	2.205	$68.522 \times 10^{-3}$	35.274
lb	0.454	1	$31.081 \times 10^{-3}$	16
slug	14.594	32.174	1	514.785
oz	$28.349 \times 10^{-3}$	$62.5 \times 10^{-3}$	$1.943 \times 10^{-3}$	1

#### Pressures

	N/m <sup>2</sup> , Pa	bar	mbar	Torr	at
N/m <sup>2</sup> , Pa	1	$10 \times 10^{-6}$	$10 \times 10^{-3}$	$7.5 \times 10^{-3}$	$9.869 \times 10^{-6}$
bar	$100 \times 10^3$	1	$10^3$	750.062	0.987
mbar	100	$10^{-3}$	1	$750.062 \times 10^{-3}$	$0.987 \times 10^{-3}$
Torr	133.322	$1.333 \times 10^{-3}$	1.333	1	$1.316 \times 10^{-3}$
at	$101.325 \times 10^3$	1.013	$1.013 \times 10^3$	760	1

#### Pressure units used in the vacuum technology

	mbar	Pascal	Torr	mmWs	psi
mbar	1	100	$750.062 \times 10^{-3}$	10.2	$14.504 \times 10^{-3}$
Pascal	$10 \times 10^{-3}$	1	$7.5 \times 10^{-3}$	0.102	$0.145 \times 10^{-3}$
Torr	1.333	133.322	1	13.595	$19.337 \times 10^{-3}$
mmWs	$9.81 \times 10^{-2}$	9.81	$7.356 \times 10^{-2}$	1	$1.422 \times 10^{-3}$
psi	68.948	$6.895 \times 10^3$	51.715	703	1


#### Linear measures


















	mm	m	inch	ft
mm	1	$10^{-3}$	$39.37 \times 10^{-3}$	$3.281 \times 10^{-3}$
m	$10^3$	1	39.37	3.281
inch	25.4	$25.4 \times 10^{-3}$	1	$8.333 \times 10^{-2}$
ft	304.8	0.305	12	1

#### Temperature

	Kelvin	Celsius	Fahrenheit
Kelvin	1	$^{\circ}\text{C} + 273.15$	$(^{\circ}\text{F} + 459.67) \times 5/9$
Celsius	K-273.15	1	$5/9 \times ^{\circ}\text{F} - 17.778$
Fahrenheit	$9/5 \times \text{K} - 459.67$	$9/5 \times (^{\circ}\text{C} + 17.778)$	1

## B: Default Parameters

The following values are activated when the default parameters are loaded (→  33):

	Default	User	
	oFF		
	$5 \times 10^{-4}$ mbar		
	$1 \times 10^3$ mbar		
	1000 Torr		
	oFF		
	mbar		
	1.00		
	nor		
	oFF		
	2 Digits		
	9600		
	oFF		
	Auto		
	oFF		
	oFF		
	Auto		
	Auto		

## C: Firmware Update



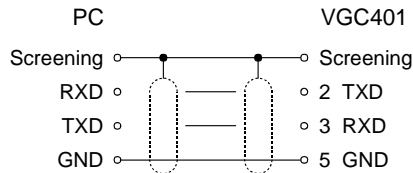
If your VGC401 firmware needs updating, e.g. for implementing a new gauge type, please download it from our website ([www.inficon.com](http://www.inficon.com)) or contact your local INFICON service center.

### User parameters

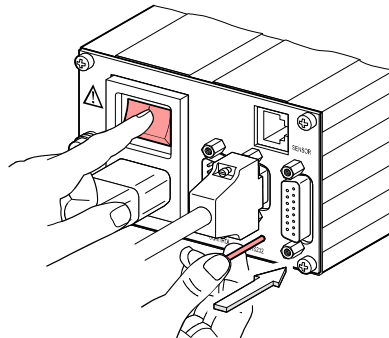
Most of the settings you may have defined in the Parameter and Test mode will not be affected by a firmware update. To be sure, note your parameter settings before upgrading the firmware (→ [82](#)).

### Preparing the VGC401 for a program transfer

- 1** Turn the VGC401 off
- 2** Connect the VGC401 with the serial COM1 (COM2) interface of your PC via a 9-pin D-Sub extension cable (the firmware of the VGC401 cannot be loaded from a Mac).



- 3** With a pin ( $\varnothing < 2$  mm) depress the switch behind the rear panel and turn the VGC401 on.

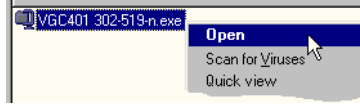


After power on, the display remains dark.

## Program transfer

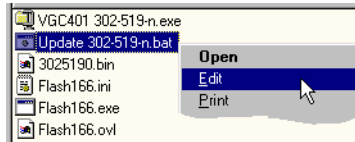
In the following instructions, the index -n is used instead of the actual index.

1. **1** Unpack the self extracting file \*.exe or the packed file \*.zip.



2. **2** If you have not connected the VGC401 to the COM1 interface:

Open the batch file \*.bat ...

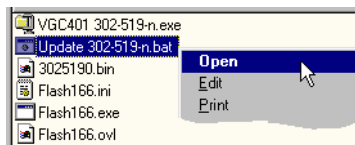


... edit the interface ...



... and save the new setting.

3. **3** Start batch file \*.bat.



⇒ The new firmware is transmitted to the VGC401.

```

D:\VGC401\0\update>FLASH166 /P 302519n.BIN /COM1
FLASH166 --- Utility for 80C166, C16x and ST10 using bootstrap
Copyright (C) FS FORTH-SYSTEME GmbH, Breisach
Version 3.03 of 06/14/2000, limited OEM Version (21279)

Loading bootstrap code (32 Bytes)
Loading target monitor (262 Bytes)
Target monitor located to 00FA40H
Infineon C161PI
CPU clock = 24.115.200 MHz
Configuration loaded from file FLASH166.INI
Target: VGC401, INFICON

WSI PSD813Fx-A/913Fx detected
Loading Flash algorithm (138 Bytes)
Erasing Flash-EEPROM Block #:0 1 2 3 4 5 6 7
Programming File 302519n.BIN (131072 Bytes)
131072 Bytes programmed
programming ok

Erase Time      : 9.5 sec
Programming Time: 32.0 sec
  
```

Starting the VGC401 with the updated firm-ware

If the program transfer was successful, quit the Update mode by turning the VGC401 off.











Wait at least 10 s before turning the VGC401 on again in order for it to correctly initialize itself.








The VGC401 is now ready for operation. To be sure, check that the current parameter settings are identical with the previously defined settings (→ 82).

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## ETL Certification



### ETL LISTED

The product VGC401 complies with the requirements of the following Standards:

UL 61010-1, Issued: 2004/07/12 Ed: 2 Rev: 2005/07/22

CAN/CSA C22.2#61010-1, Issued: 2004/07/12

## EC Declaration of Conformity



We, INFICON, hereby declare that the equipment mentioned below complies with the provisions of the Directive relating to electrical equipment designed for use within certain voltage limits 2006/95/EC and the Directive relating to electromagnetic compatibility 2004/108/EC.

Product

**Single-Channel Controller**  
**VGC401**

Part number

398-010

Standards

Harmonized and international/national standards and specifications:

- EN 61010-1:2001 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61000-3-2:2006 (EMC: limits for harmonic current emissions)
- EN 61000-3-3:1995 + A1:2001 + A2:2005 (EMC: limitation of voltage changes, voltage fluctuations and flicker)
- EN 61000-6-2:2005 (EMC: generic immunity standard)
- EN 61000-6-3:2007 (EMC: generic emission standard)

Signatures

INFICON AG, Balzers

28 November 2008



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