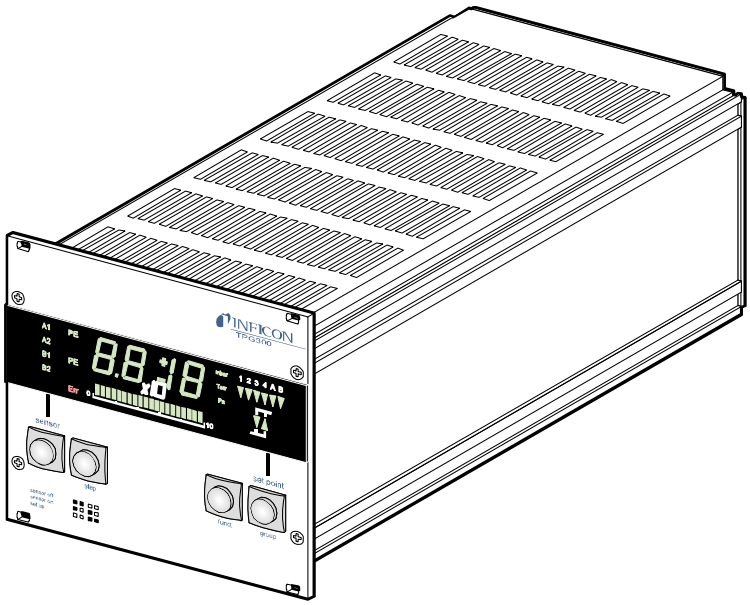
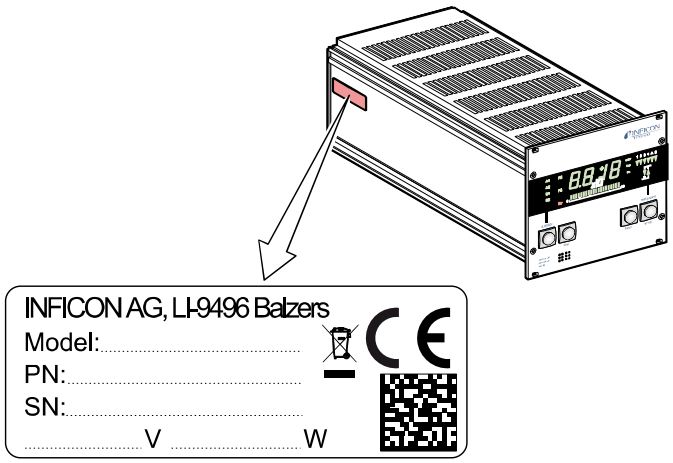
Total Pressure Gauge Controller

TPG300



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.



Validity

This document applies to products with part number

IO546900.

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

This document is based on firmware 302-654

If your unit does not work as described in this document, please check that it is equipped with the above firmware version (→ 🗎 33).

All dimensions in mm.

Intended Use

Depending on the options chosen, the TPG300 can measure total pressure from atmosphere to 10^{-11} mbar. It can trigger a number of pressure-dependent functions to control and monitor vacuum devices and processes. The instructions contained in this document must be strictly followed.

Contents

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

1 Safety

1.1 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.

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

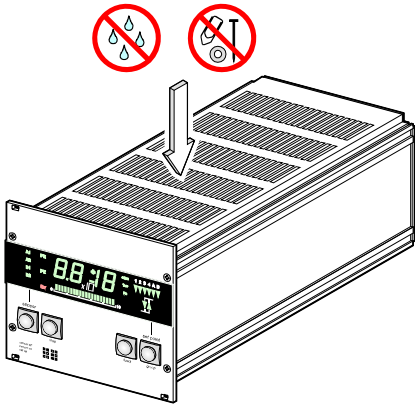
Adhere to the applicable regulations and take the necessary precautions for all work you are going to do and consider the safety instructions in this document.

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.



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, options and add-ons not listed in the corresponding product documentation.

1.5 Further Symbols

… please contact your local INFICON service center.

Important Notice

Note
Special information on cost-effective use.

< … > Labeling

« … » Display, response

» … « Operating mode, effect

Waiting time, reaction time, duration of test

→ 🕮 See document …

→ 🗎 See page …

2 System Overview

2.1 Basic Unit

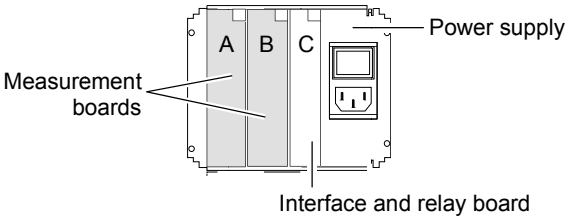
TPG300, Technical Data → 🗎 8.

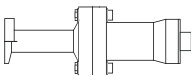
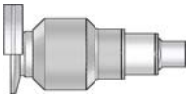
A list of all plug-in boards suited for the TPG300 can be found on 🗎 8.

For detailed information on the plug-in boards → 🕮 [1].

2.2 Measurement Plug-In Boards

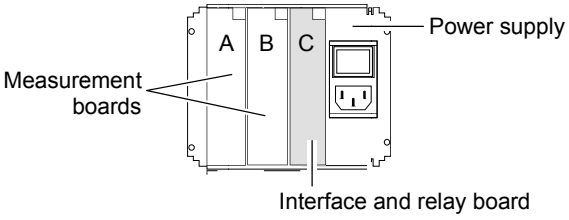
Two slots (A and B) at the back of the TPG300 can accommodate up to two measurement boards.



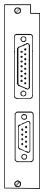
Measurement plug-in board:	Pirani / cold cathode combined
	
	CP300C9
Compatible gauges:	
TPR018	
IKR085	

2.3 Interface and Relay Plug-In Boards

An interface and relay board can be plugged into slot C.



Profibus-DP Interface and Relays
IF300P



3 Technical Data

Mains Power Connection	Voltage	90 … 264 VAC ±10%
	Frequency	47 … 63 Hz
	Power consumption	<55 VA
	Overvoltage catagory	II
	Degrees class	1
	Connection	European appliance connector IEC 320 C14
	Fuses	none
Ambiance Conditions	Admissible temperature	
	Storage	–40 … +65 °C
	Operation	
	Rack installation	+ 5 … +50 °C
	Bench-top unit	+ 5 … +40 °C
	Relative humidity	≤80% at temperatures up to +31 °C decreasing to 50% at +40 °C
	Use	Indoors only, height up to 2000 m
	Pollution degree	2
	Degree of protection	IP20
Safety	IEC384 class1, VDE 0411, part 2.80	
Slots for Plug-In Boards	Measurement boards	2 (slot A and B)
	Interface and relay boards	1 (slot C)
Compatible Measurement Boards	Pirani / Cold cathode combined	CP300C9
Compatible Interface and Relay Boards	Profibus-DP interface and relays	IF300P
Measurement Range		1×10^{-11} … 1000 mbar (depending on the measurement boards used (→ 🕮 [1])
Setpoint / relays	Setpoint	8 parameters – lower and upper threshold
	Relays	8 relays
Error display / relays	Error display	red LED
	Relays	1 relays
Radiation resistant	Radiation resistant	no
External magnetic field (IF300P, CP300C9)	Vertical, max.	21 mT [1)]
	Horizontal, max.	11 mT [1)]

[1)] Values validated with +3 dB (=141% of indicated value) applied magnetic field.

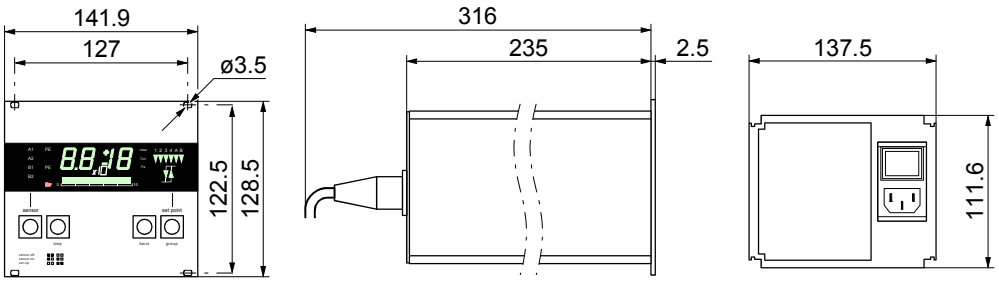
Operation Controls

Manually	by 4 push buttons (keys) on the front panel
Computer controlled	via RS232C, RS422 or Profibus-DP interface, depending on the interface relay boards used (→ 🕮 [1]

Measured Values

Measurement range	depending on the measurement boards used → 🕮 [1]
Measurement rate	100 Hz
Display rate	5 Hz
Filter time constant	
Fast (FI 1)	≈ 16 ms
Normal (FI 2)	≈160 ms
Slow(FI 3)	≈ 1.6 s
Measurement unit	mbar, Torr, Pa
Display	15 mm high numbers, 7 segment LED

Dimensions [mm]



Installation Modes

Rack mounted, panel mounted or bench top.

Weight

1.35 kg (without plug-in boards)

4 Installation

DANGER

Putting a product which is visibly damaged into operation can be extremely hazardous. If the product is visibly damaged do not put it into operation and make sure it is not inadvertently put into operation.

Skilled personnel

The unit may only be installed by persons who have suitable technical training and the necessary experience or who have been instructed by the end-user of the product.

4.1 Installation

The TPG300 can be installed in a 19" rack, a control panel or operated as a desk top unit.

4.1.1 Rack Installation

The TPG300 is designed for installation in a 19" rack frame, built according to the DIN 41 494 standard (screws and plastic parts are supplied with it).

DANGER

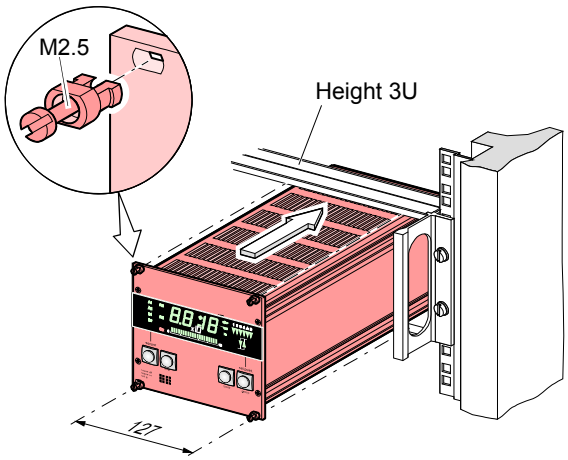
DANGER: protection class of the rack

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. according to the EN 60204-1 regulations for switching cabinets.

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

Installation in a Height 3 U Rack Chassis Adapter

Install rack chassis adapter in rack cabinet and slide TPG300 into the adapter. Secure TPG300 with the screws supplied with it.



The temperature inside the rack must not exeed the maximum admissible temperature (→ 🖹 8).

4.1.2 Installation in a Control Panel

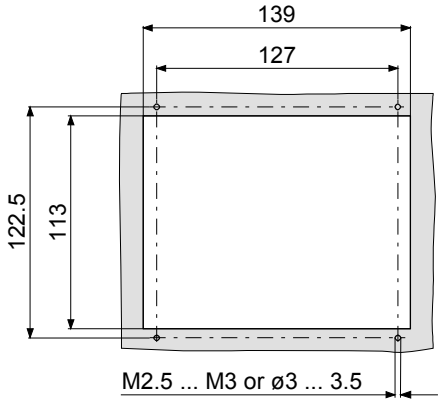
STOP DANGER

DANGER: protection category of the control panel

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

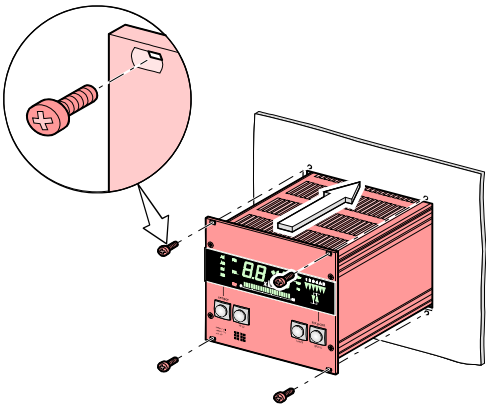
Take appropriate measures for the control panel to meet the specifications of the protection category.

For mounting the TPG300 into a control panel, the following cut-out is required:



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

Slide the TPG300 into the cut-out of the control panel and secure it with four M2.5 … M3 (or equivalent) screws.



The temperature inside the cabinet must not exeed the maximum admissible temperature (→ 🗎 8).

4.2 Mains Power Connection

DANGER

DANGER: line voltage

Incorrectly grounded products can be extremely hazardous in the event of a fault.

Use only a 3-conductor power cable 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.

DANGER

No mains line fuse

The TPG300 has no fuses accessible by the end user.

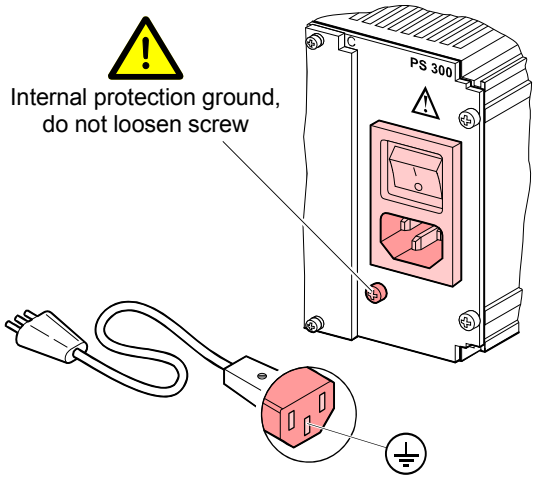
The line power socket for the TPG300 has to be fused with max. 10 A.

DANGER

Grounding screw for internal protective ground

The internal protective ground is connected to the TPG300 power supply rear panel with a grounding screw.

Do not turn or loosen grounding screw.



A 2.5 m mains cable is delivered with the TPG300. If its plug is not compatible with your local power system, replace the cable to suit the local circumstances. Use only a 3-conductor cable with protective ground.

If the TPG300 is installed in a rack cabinet, the use of a switched mains distributor is strongly recommended.

4.3 Installing / Removing Plug-In Boards

Turne the TPG300 off and wait at least 15 seconds before any work is performed.

Factory Configuration

In most cases, the TPG300 is supplied ready for operation, (with the plug-in boards already installed). In addition, in units for combined measurement of medium and high vacuum, the high vacuum measuring circuit is controlled automatically according to pressure. This is because switching function A and / or B is factory assigned to a medium vacuum measuring circuit (→ 🗎 19).

The controlling Pirani gauge and the controlled cold cathode gauge must both be connected to the same vacuum chamber to guarantee efficient operation.

Installing / Removing Plug-in Boards

Further information and details on installing/removing plug-in boards and handling of empty slots you find in 🕮 [1].

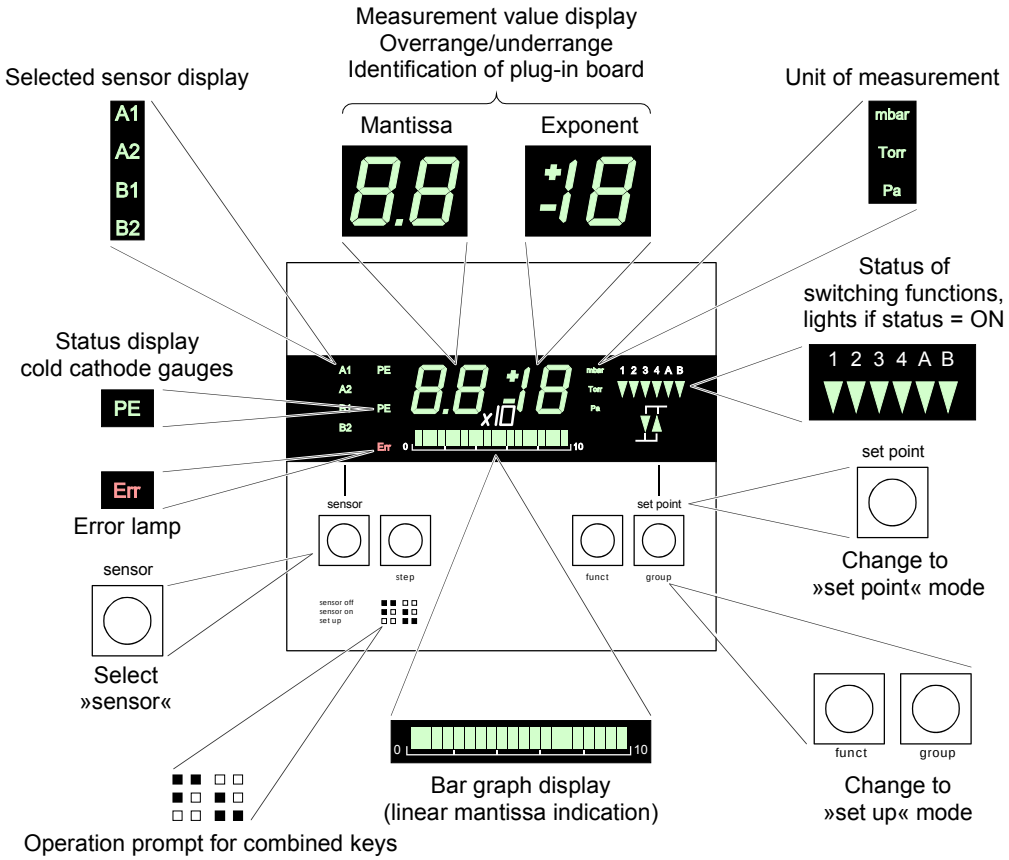
4.4 Connecting Plug-In Boards

Electrical connections of gauges, analog signals, relays contacts etc. depend on the plug-in boards used and are described in 🕮 [1] in detail.

- The TPG300 control unit must be turned off before any work is performed on the Cold Cathode Gauge or the sensor cable for the Cold Cathode Gauge.
- Wait at least 15 seconds after turning off, before any work is performed.

5 Operation

5.1 Front panel



Status Messages

Status messages will be shown on the display instead of the measured value (→ 🖹 18, 37).

5.2 Switching TPG300 On and Off

Before switching the unit on, check that all plug-in boards, connection cables and gauges are installed correctly and that the technical requirements are satisfied.

Switching TPG300 On

The mains power switch is located on the back panel of the unit.

To switch the TPG300 on, operate the mains power switch (or the centrally switched mains power distributor in case of installation into a rack).

After the power has been switched on …

- The unit performs a self-test
- It reactivates the parameters in effect before the unit was switched off
- All measuring circuits with activated hot start (→ 🖹 31) and all operational Pirani gauges are switched on
- The measurement value of the first measuring circuit in operation is displayed.

Switching TPG300 Off

To switch the TPG300 off, operate the mains power switch (or the centrally switched mains power distributor in case of installation into a rack).

Wait at least 10 seconds before switching the TPG300 on again to allow the unit to initialize itself properly.

5.3 Measuring with the TPG300

Gas Type Dependence

The measured pressure depends on the gas type present. It is referenced to nitrogen (N_2). For other gases please refer to the characteristic curves shown in the appendix of 🕮 [1].

Validity of Displayed Data

If you intend to use the measurement results for control functions, allow for the time constants of the TPG300, the gauges, possible ignition delays etc., until valid measurements are displayed (→ 🕮 [1], [3]).

Accuracy of measurement

A generally applicable statement on the accuracy of the measurement cannot be made. The type of gas being measured is a major factor affecting the accuracy, and so is the current condition of the gauge.

The accuracy of the gauge at any particular moment can only be assessed by comparing the results with a reference unit. Calibration pumping systems are available for reliable measurements, particularly for pressures above 10^{-4} mbar.

Alignment

Cold cathode measuring circuits are factory aligned and require no recalibration.

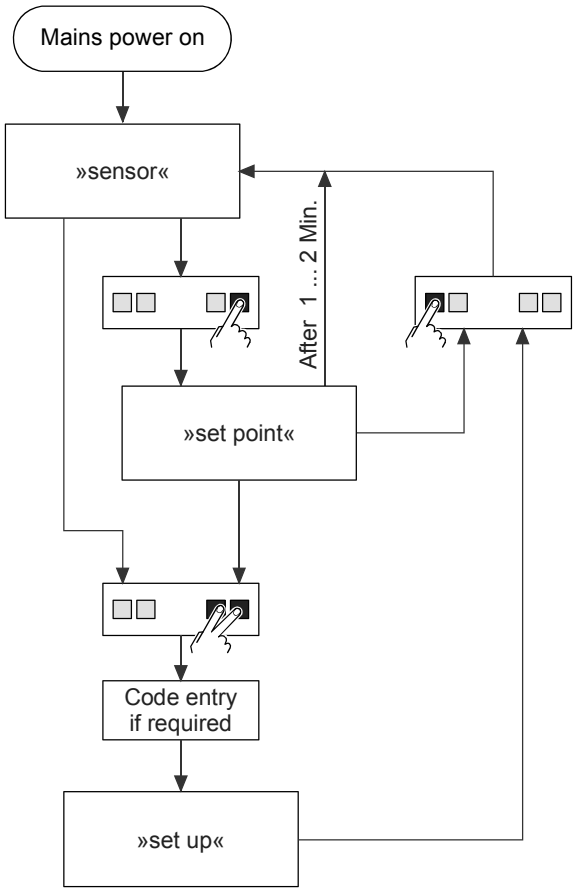
Pirani measuring circuits are factory prealigned. For accurate measurement → 🕮 [1].

5.4 Operating Modes

The TPG300 has three operating modes:

- »sensor«
  Pressure measurement (→ 🗎 17)
  Selection of the measuring circuit (→ 🗎 17)
  Switching gauges on/off (→ 🗎 18)
- »set point«
  Display of the switching function parameters (→ 🗎 20)
- »set up«
  Display of the unit parameters (→ 🗎 22)
  Modification of the unit parameters (→ 🗎 23)
  Execution of test programs (→ 🗎 33)

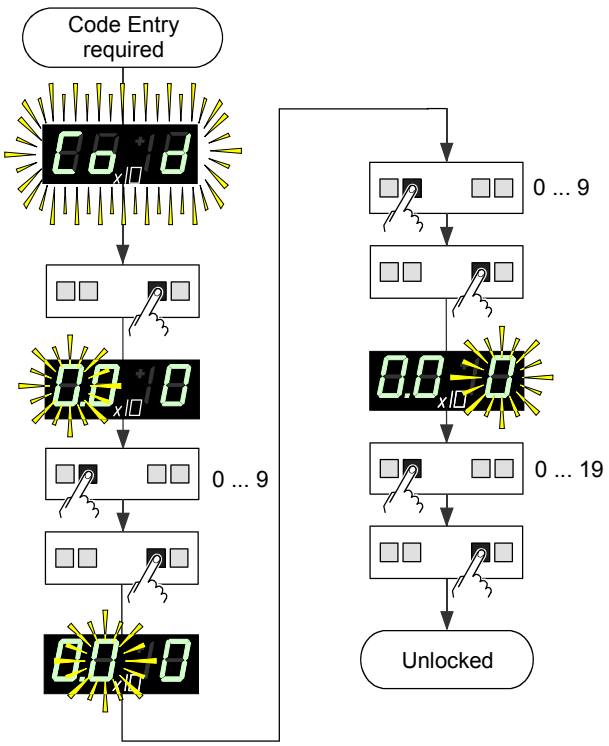
Changing the Operating Mode



Entering a Code

Changing the operation mode to »set up« and some operations in »sensor« mode require the input of a code, in case it has been assigned previously (→ 🗎 31).

By a flashing display («Co d») you will be reminded to input the correct number in the following manner:



5.5 Operating Mode »sensor«

The »sensor« operating mode is the standard mode of the TPG300, showing measurement value, status information or a plug-in board identification on the display.

The TPG300 is in »sensor« mode …
After being switched on

- After the <sensor> key has been pushed
- 1 … 2 minutes after the last keystroke in »set point« mode.

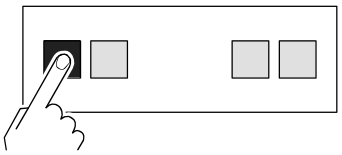
Quitting the »sensor« mode …

- Switch the mains power switch of the TPG300 off
- Push the <set point> key (change to <set point> mode)
- Push the <set point> keys simultaneously and enter code, if required (change to »set up« mode).

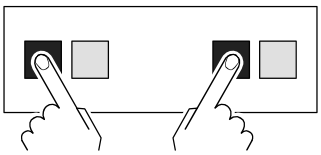
5.5.1 Key Entries

The following entries are possible in »sensor« mode:

Select Measuring Circuit

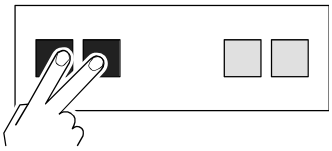


Switch On Selected Gauge



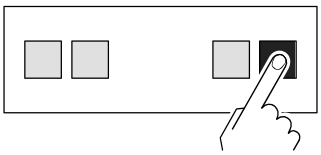
Push simultaneously

Switch Off Selected Gauge



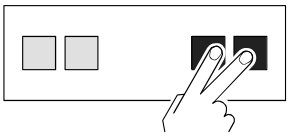
Push simultaneously

Change to »set point« Mode



(→ 🗎 20)

Change to »set up« Mode



Push simultaneously (→ 🗎 22)

5.5.2 Switching the Measuring Circuit On / Off

Each individual measuring circuit can be manually switched on or off with <step> and <funct> (after entering the code → 🗎 31).

Manual on/off-switching has priority over the automatic control.

Measuring Circuit Switched On

Measured value is displayed:

Switch on cold cathode gauges at pressures <10^{-3} mbar only, in order to prevent excessive contamination of the gauges.

When the cold cathode measuring circuit is switched on, the lamp «PE» on the front panel lights up.

Measuring Circuit Switched Off

The plug-in board identification is displayed (→ 🗎 19):

Pirani gauges are not deactivated by switching them off, only their measuring results and the error message are suppressed.

Switching off the cold cathode gauge helps to prevent it from becoming contaminated.

5.5.3 Measurement Range Violation

If the measured value is outside the measuring range of the measuring circuit, this will be indicated if the corresponding measuring circuit is selected.

If the cold cathode measuring circuit is controlled by another measuring circuit, the display changes over automatically.

Overrange

Overrange: «or» and exponent indicating the range limit:

If the upper measuring range limit is exceeded, the cold cathode gauge can become contaminated if it remains switched on.

Underrange

Underrange: «ur» and exponent indicating the range limit:

If the under range control is switched off the system cannot distinguish between a gauge failure, cable interruption and underrange of a cold cathode measuring circuit. «ur» is displayed in all cases.

5.5.4 Automatic Measuring Circuit Switchover

If a measuring circuit is controlled by another measuring circuit and either one is selected, the display automatically changes over …

- When the measured value drops below the lower threshold
- When the measured value exceeds the upper threshold.

Automatic Control

Automatic control: «Au», cold cathode measuring circuit waits for the fulfillment of the power on condition by the Pirani measuring circuit:

5.5.5 Self-Monitoring

If the cold cathode measuring circuit is self-monitored, it automatically switches off

- when the measured value exceeds the upper threshold.

The measuring circuit must be restarted manually. Restarting can be prevented by another measuring circuit (e.g. Pirani).

Measured value or plug-in board identification:

5.5.6 Plug-In Board Identification

When the measuring circuit is switched off, its identification is displayed (→ 🗎 18):

Cold cathode measuring circuit 5×10^{-9} mbar, automatic operation

Cold cathode measuring circuit 1×10^{-10} mbar, automatic operation

Cold cathode measuring circuit 10^{-11} mbar, automatic operation

Cold cathode measuring circuit 5×10^{-9} mbar

Cold cathode measuring circuit 1×10^{-10} mbar

Cold cathode measuring circuit 10^{-11} mbar

Pirani measuring circuit

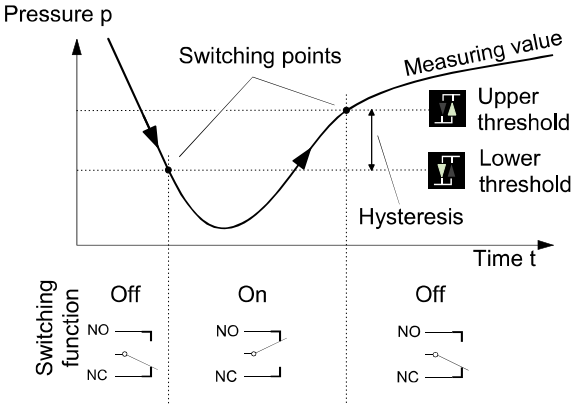
Pirani measuring circuit for nickel filament

5.6 »set point« Mode

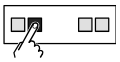
With <set point> you can cyclically read, enter and modify the threshold values and assignments of the switching functions.

The Switching Functions

The TPG300 has six switching functions (1, 2, 3, 4, A, B) with two adustable thresholds each. The status of each switching function is displayed on the frontpanel. Four of the switching functions provide floating relay contacts accessable on the interface and relay board (→ 🕮 [1]).



Upper/Lower Threshold

Display	Description / value
	Lower threshold, defines pressure value at which the switching function turns on when pressure is dropping.
	Upper threshold, defines pressure value at which the switching function turns off when pressure is rising.

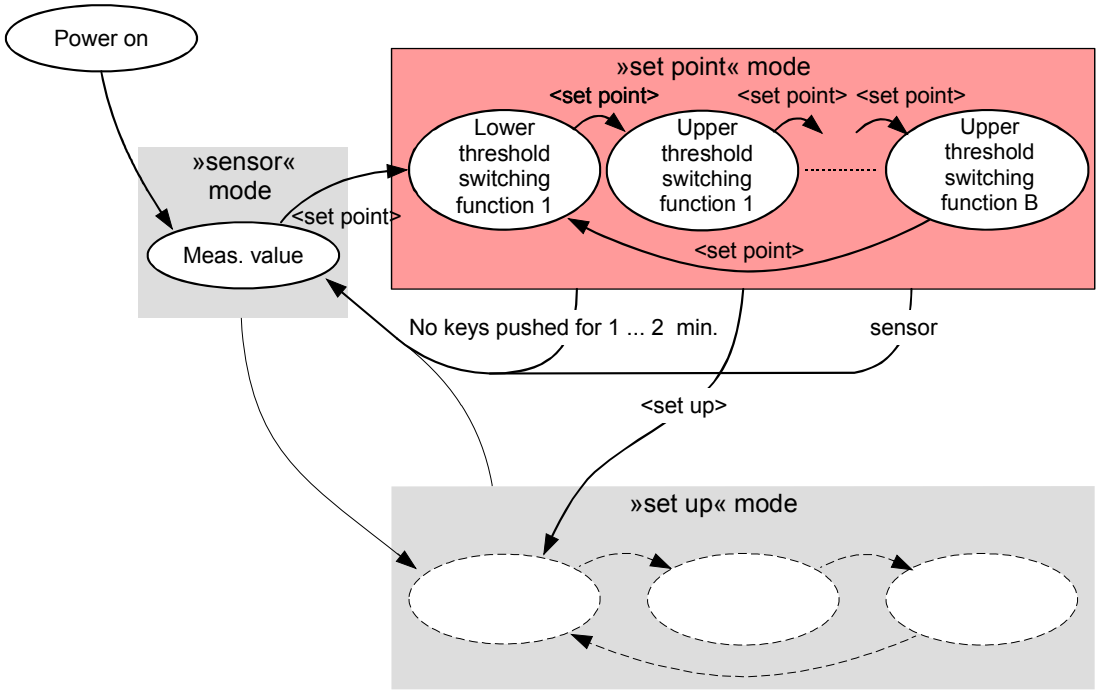
Hysteresis (difference between lower and upper threshold) is a minimum of 10% of the lower threshold. This prevents unstable states. If you set the upper threshold too low, the minimum hysteresis will go into effect automatically.

Selecting the »set point« mode:

- Push the <set point> key (only possible in »sensor« mode), the bar graph display extinguishes.

Quitting the »set point« mode:

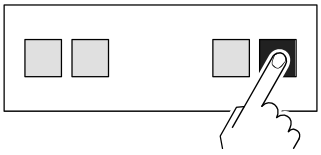
- Switch off the TPG300
- Push <sensor> key (change to »sensor« mode)
- Push »set up« keys simultaneously and enter code if necessary (change to »set up« mode)
- Wait 1 … 2 minutes after the last key was pushed. The TPG300 then switches automatically back to »sensor« mode (measuring mode).



5.6.1 Key Entries

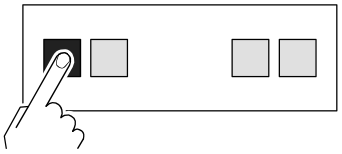
The following entries are possible in the »set point« mode:

Display Threshold Values of Switching Functions



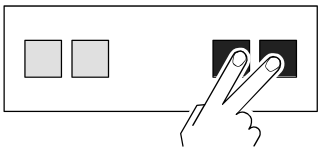
Advance to next threshold

Change to »sensor« Mode



(→ 🗎 17)

Change to »set up« Mode

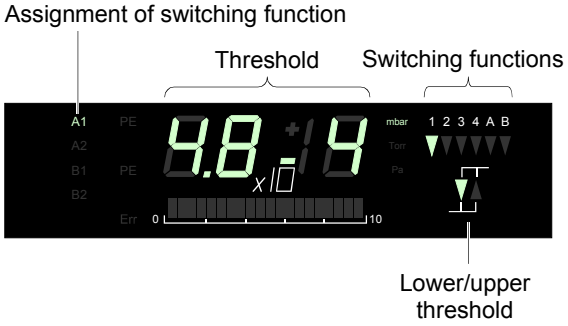


Push simultaneously (→ 🗎 22)

(Enter code if required→ 🗎 16)

5.6.2 Parameter

With <set point> you can read cyclically the threshold values and assignments of the switching functions.



The function of the measuring circuits is not influenced.

The current status of the switching functions is not displayed, but they work nevertheless.

With <set up> you can go directly to the »select threshold« function of the »set up« mode to change the displayed threshold value.

5.7 »set up« Mode

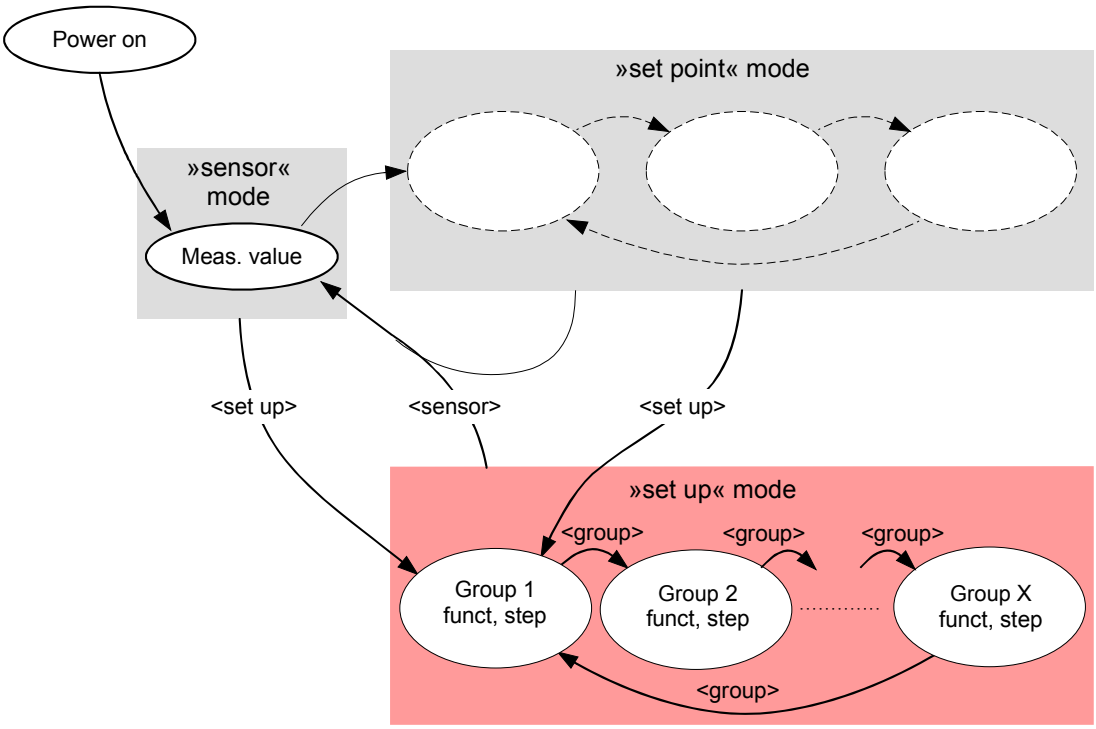
In »set up« mode you can read, enter and modify parameters and run the test programs available on the TPG300.

Selecting the »set up« mode

- Simultaneously push the <funct> and <group> keys. Enter the code with <step> and <funct> if required (→ 🕮 16).

Quitting the »set up« mode

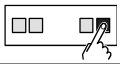
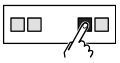
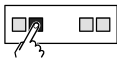
- Switch the mains power switch of the TPG300 off
- Push the <sensor> key (change to »sensor« mode).



5.7.1 Key Entries, Overview

»set up« mode is organized in three levels. An overview of the structure is shown in the table below.

Inputs in groups, functions and parameters always work cyclically. In case of error, simply go ahead up to the right spot again.

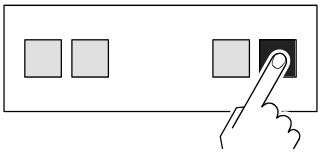
Group <group> 	Function <funct> 	Parameter values <step> 
Switching functions	Switching function selection	1, 2, 3, 4, A, B
	Threshold selection	lower, upper
	Threshold 1st digit	1 … 9
	Threshold 2nd digit	0 … 9
	Threshold exponent	-11 … +3
	Measuring circuit assignment	A1, A2, B1, B2
PE measuring circuit underrange control		0 (disabled) 1 (enabled)
Measurement unit		mbar, Torr, Pa
Filter	Filter assignment	A1, A2, B1, B2
	Filter time constant	1, 2, 3
Interface	Baud rate	1200 … 19200 Baud
Parameter storage	Parameter set selection	u (user) H (Hot start) d (default)
	Storage	Store command
Test programs	Test program selection	dI (display) rA (RAM) EP (EPROM) EE (EEPROM) Ad (A/D converter channels 0 … 7) Io (keys) rS (interface) Pn (firmware number) Start test

Comments to the table above:

- Groups, functions or parameters which do not exist because of the unit configuration will be bypassed.

The following key entries are possible in »set up« mode:

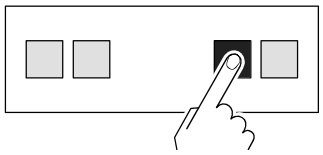
Select Group



The group is characterized by a flashing display of the first parameter value.

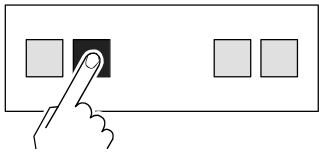
Switching functions (→ 🗎 24)
PE Measurement Underrange Control (→ 🗎 27)
Measurement unit (→ 🗎 27)
Filter (→ 🗎 28)
Interface (→ 🗎 30)
Parameter storage (→ 🗎 31)
Test programs (→ 🗎 33)

Select Function

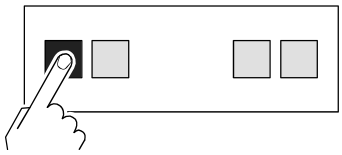


(If existing in this group)

Modify Selected Parameter



Change to »sensor« Mode

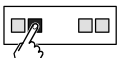


(→ 🗎 17)

5.7.2 »Switching Functions« Group

»Switching Function Selection« Function

Switching functions 1 … 4 affect the relays of an interface and relay plug-in board (→ 🕮 [1]). A and B can control the on/off switching of the cold cathode gauges.

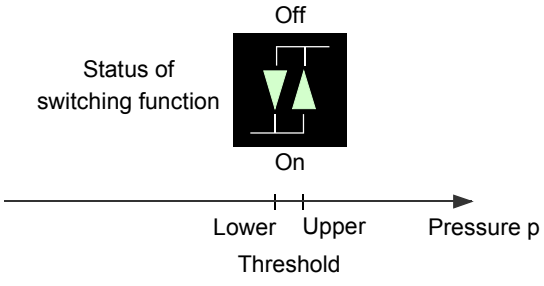


Switching function	Parameter value acts upon:
1	Interface and relay plug-in board Relay 1
2	Interface and relay plug-in board Relay 2
3	Interface and relay plug-in board Relay 3
4	Interface and relay plug-in board Relay 4
A	Cold cathode measuring circuit(s) in slot A
B	Cold cathode measuring circuit(s) in slot B

»Threshold Selection« Function

Defining an upper and a lower threshold defines a hysteresis for each switching function.

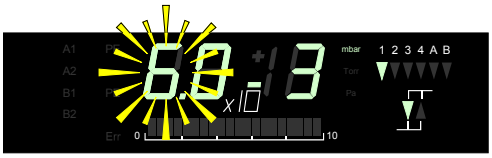
When the pressure is dropping, the status changes to »on« at the lower threshold and to »off« at the upper threshold (with rising pressure → 🗎 20).



Hysteresis (difference between lower and upper threshold) is a minimum of 10% of the lower threshold. This prevents unstable states. If you set the upper threshold too low, the minimum hysteresis will go into effect automatically.

	Threshold selection
	Lower Threshold
	Upper Threshold

»Threshold Setting« Function



Digit	Value	
	1 … 9	(1st digit mantissa)
	0 … 9	(2nd digit mantissa)
	-11 … +3	(exponent)

Modifications only become effective when the switching function, group or operating mode is changed.

»Measuring Circuit Assignment« Function

Any of the switching points can be assigned to any of the measuring channels.

Changing the assignment can trigger a change in the switching function status.

Display	Measuring circuit Assignment [1]
A1	Measuring circuit A1
A2	Measuring circuit A2
B1	Measuring circuit B1
B2	Measuring circuit B2

[1] The cycle depends on the plug-in boards installed.

Available measuring circuits are indicated by an lamp.

The upper and lower thresholds of switching functions 1 … 4 cannot be assigned to different measuring circuits. The last entry made applies.

The upper and lower thresholds of switching functions A and B can be assigned to different measuring circuits (→ 🗎 19).

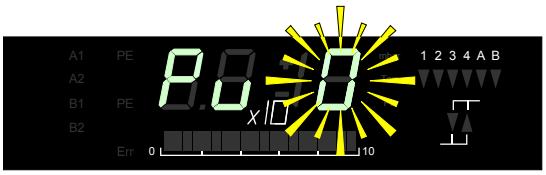
The lamp for the assigned measuring circuit flashes.

It is possible to leave a switching function unassigned (no measuring circuit lamp will flash). The switching function is ineffective.

Modifications only become effective when the switching function, group or operating mode is changed.

5.7.3 »PE Measurement Underrange Control« Group

The behavior of switching functions assigned to the cold cathode measuring circuit (PE) can be adjusted when underrange occurs (→ 🗎 18) (except in the case of self assignment).



Display	Description
	»UnderRng« is interpreted as valid measured value; the switching function remains »on«.
	»UnderRng« is interpreted as an error; the switching function changes to »off«. The switching function does not change to »on« until the measured value has remained within the measurement range of the cold cathode measuring circuit for at least 10 seconds.

Cold cathode measuring circuits for 10^{-11} mbar sometimes require more than 10 seconds for the transition «OverRng» ⇨ «UnderRng» and thus lead the switching function being »on« for a short time.

5.7.4 »Measurement Unit« Group

Select the desired measurement unit:

The modification is made immediately.

The threshold values for the switching functions are adapted automatically.

Display	Valid measurement unit
mbar	mbar
Torr	Torr
Pa	Pa

(Conversion table → 🗎 41).

5.7.5 »Filter« Group

In the event of fast varying measurement signals, the measured values can be filtered to stabilize both, the display and the switching functions.

Analog signal output is not affected by the filter (→ 🕮 [1]

»Filter Assignment« Function

You can set the filter separately for each individual measuring circuit.

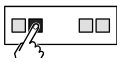
Display [1]	Filter assignment [1]
A1	A1
A2	A2
B1	B1
B2	B2

[1] The cycle depends on the plug-in boards installed.

»Filter Time Constant« Function

Three filter time constants are available.

In the case of signal fluctuations, a faster filter can cause 'fluttering' of switching functions.

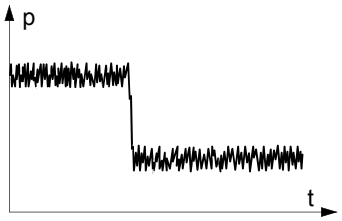


Display	Filter time constant	
1	Fast	(16 ms)
2	Medium	(160 ms)
3	Slow	(1.6 s)

Any modification becomes effective immediately.

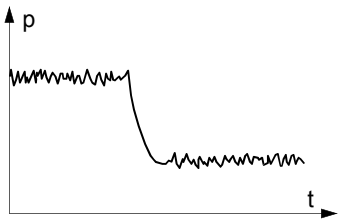
FI 1 ⇨ fast:

The TPG300 reacts immediately on variations in measurment value. Therefore it is sensitive to unwanted transients.



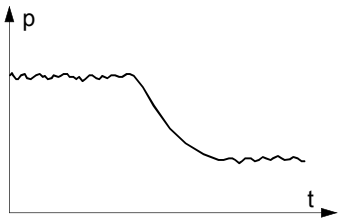
FI 2 ⇨ normal:

Moderate setting. Represents a good compromise between response time and transient immunity for steady readings and reliable operation of switching functions.



FI 3 ⇨ slow:

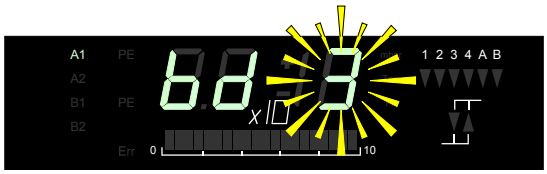
The TPG300 does not react on small changes of measuring value, has a slow response time but suppresses transients effectively.

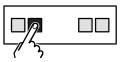


5.7.6 »Interface« Group

»Baud Rate« Function

Data transfer rate of the RS232C Interface.





Display	Baud rate
bd 1	1200
bd 2	2400
bd 4	4800
bd 9	9600
bd 3	19200

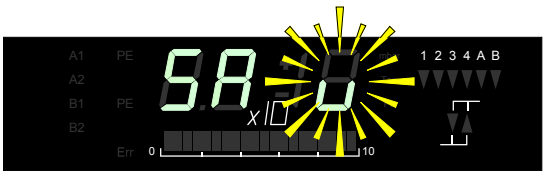
The Baud rates for the TPG300 and any interfaced computer must be the same.

Using a Profibus-DP interface and relay board IF300P with the TPG300, the Baud rate must always be set to 19200 Baud (→ 🕮 [4]).

5.7.7 »Parameter Storage« Group

The stored parameters are activated when the TPG300 is switched on. If no parameters have been stored, the unit defaults to the standard parameter set (→ 🗎 42).

»Parameter Set« Function



You can either select your own set of parameters (user) or the default set to be saved.

Display	Description
SA u	**SA**ve **u**ser parameters
SA H	Save user parameters with immediate start up (**SA**ve **H**ot start)
SA d	Save default (factory set) parameters (**SA**ve **d**efaults)

By activating the immediate start-up (hot start), a measuring circuit can be automatically re-enabled after a power failure. This is particularly useful in the case of self-monitoring

The immediate start-up is jointly activated for all measuring circuits. The measuring circuit must however be switched on during storage.

Code Lock

If «SA u» or «SA H» is selected (store user parameters), you will be asked to enter a code before storage takes place. This is a protection against inadvertent or unauthorized manipulations on the operating states of the sensors or the parameters. In this mode the unit may be unlocked in the same way.

Code	Effect
00 0	No code required for operation
99 19	Operation only possible with this particular code (can not be modified)
xx yy [1)]	Operation only possible after entering matching code

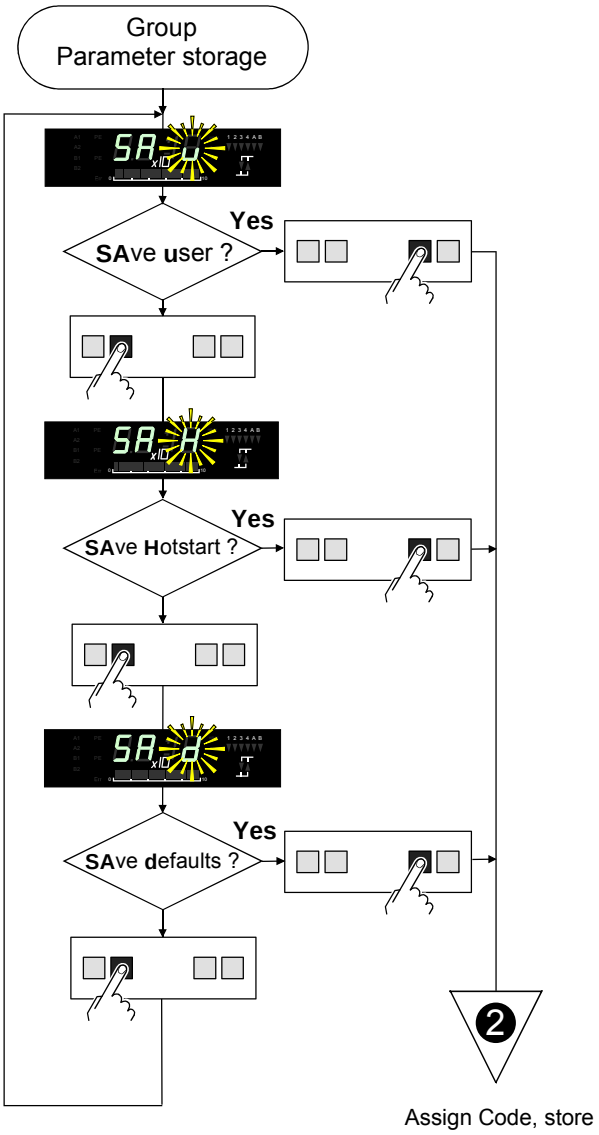
1) Any number is permissible, except "00 0" and "99 19" (xx = mantissa, yy = exponent on the display).

An existing code lock can be reset or modified (→ 🗎 32).

Storing the Parameters

Since the input sequence for »Parameter storage« group deviates slightly from the rest, it is recommended to follow the flow diagram below.

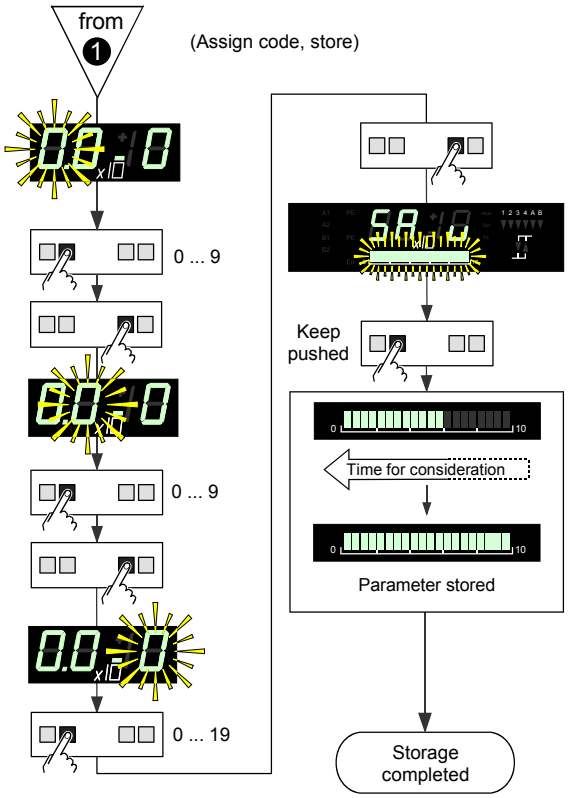
❶ Select type of parameter storage following the diagram:



❷ Store the settings made under ❶ by following the instructions in the diagram below. If desired, assign a code to this parameter set. If a modification of an already stored code is not desired, skip these steps by pushing <funct> three times.

Saving the default parameters has the following effects:

- The switching function assignments are lost
- The relays are de-energized, i.e. the switching functions change to »off«
- Communication with a computer may no longer be possible.



Keep <step> pushed until the bar graph is completely dark. This will lead to properly stored parameters. When the storage process is finished, the bar graph lights again.

Releasing <step> during consideration time will abort the storage process.

Pushing <funct> will bring you back to the start of »Parameter storage«, where the process can be repeated if desired.

❸ Take a note of the valid code number (if assigned) and keep it save.

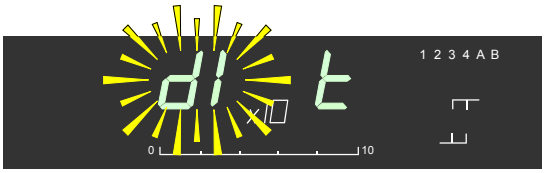
✓ The storage procedure is now completed. The TPG300 now operates using the new set of parameters.

5.7.8 »Test Programs« Group

Tests marked with * are carried out automatically when the TPG300 is switched on. You can also run all tests during operation. They do not influence measurements and switching functions.

On selecting the group »test programs«, the display will show "dl", the first item on the list of elements to be tested.

»Test Program Selection« Function



The following tests can be carried out:

Display	Element tested
dI *	Display
rA *	RAM
EP *	EPROM
EE *	EEPROM
Ad	A/D converter
A0	Channel 0
A1	Channel 1
A2	Channel 2
A3	Channel 3
A4	Channel 4
A5	Channel 5
A6	Channel 6
A7	Channel 7
Io *	Keys
rS	RS232C interface
Pn	Program number (Firmware version)

Display Test

The display test lights first all lamps together and then individually.

RAM Test

The RAM routine tests the two kByte of the RAM.

EPROM and EEPROM Test

A check sum is formed and controlled in both, the EPROM and EEPROM test.

A/D Converter Test

You must enter the channel (0 … 7) when running the A/D converter test.
(A/D input voltage = display × 5 mV)

Key Test

«Io» checks whether any key contact is stuck

Interface Test

«rS» echoes HOST characters coming from the host. It displays them in the Hex format in the mantissa field and their number in the exponent field.

Program Version

«Pn» shows the installed firmware version. You can read out the program version of your unit by conducting the corresponding test (Pn).

Display	Test sequence
	The test is carried out automatically: ⇨ Both parts of the firmware version number are displayed in succession.

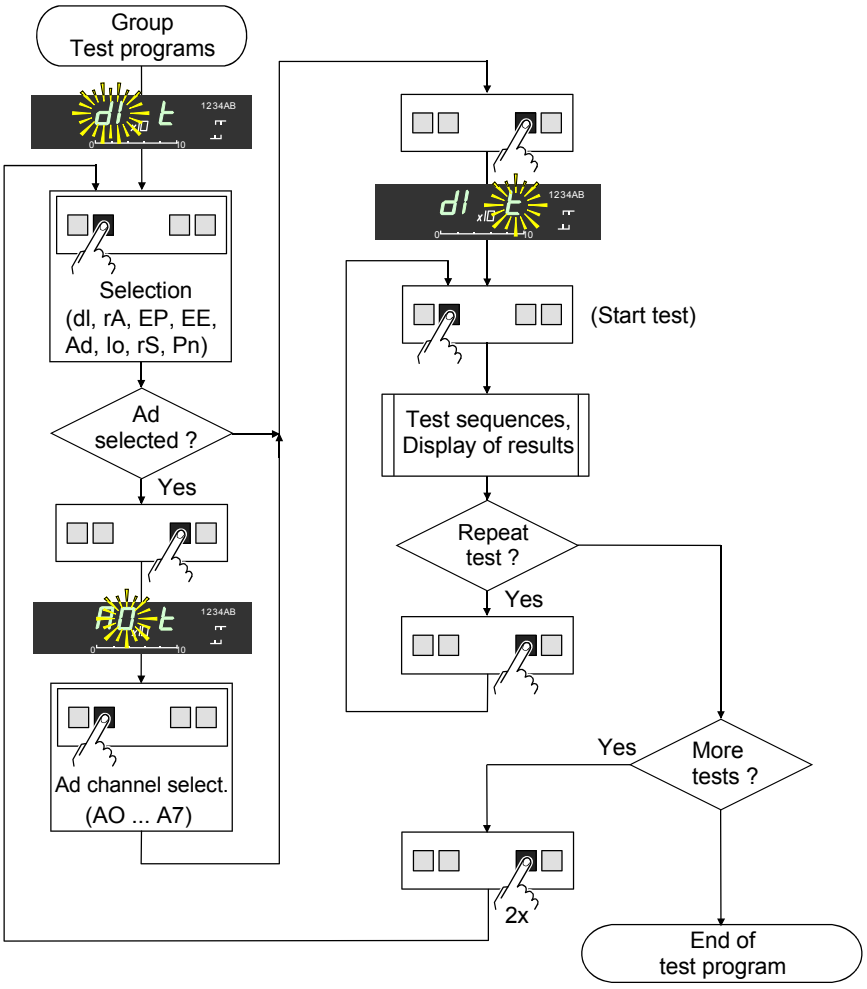
Modification index (A … Z, -)

A program number with a higher modification index will eventually provide additional services.

This operating manual is not valid for a more recent program number.

Selection and Execution of Test Programs

Since the input sequence for the group »Test programs« deviates slightly from the rest, it is recommended to follow the flow diagram below.



You can always return to »test« by pushing the <funct> key once or twice (depending on status).

The programs «dI», «Ad», «rS», and «Pn» run continually and must be stopped by pushing <funct> or <group>. All the other tests run through once. When they are finished, a line appears in the exponent display field or the checksum is shown.

You can stop the «dI» by pushing <step> and start it again as often as you like.

Detected errors will be reported (→ 37).

6 Maintenance

The TPG300 requires no maintenance. For maintenance of the gauges refer to the respective documents (→ 🕮 [2], [3]).

Cleaning the TPG300

Turn the unit off and remove all cables (the mains cable last) before doing any of the work described below.

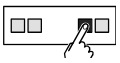
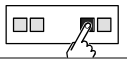
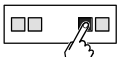
For cleaning the outside of the unit, a slightly humid cloth will usually do. Do not use under any circumstances an aggressive or scouring leaning agent.

No water must get into the unit. Before putting the unit into operation again, allow it to dry thoroughly.

7 Troubleshooting

7.1 Error Messages

An error message is indicated by a lit or a flashing «Err» lamp (Example shown: TPR gauge not connected):

Display	Possible cause	Correction
«dt» [2]	Watch Dog timer – overflow due to strong external influence (electromagnetic)	 If this error occurs frequently, replace the basic unit
«EE» [2]	Error during parameter reading	Store default or user parameters (→ 🗎 31)
	EEPROM defective	Service center
«EP» [2]	EPROM defective	Service center
«Id» [2]	Operating system overloaded	
«IF» [2]	Interface and relay plug-in board in slot A or B	Put the interface and relay plug-in board into slot C [1]
«Io» [2]	Key pushed	Release Key
	Key stuck	Service center
«rA» [2]	RAM defective	Service center
«rS» [2]	Data transmission or programming error	Correct/check interface parameter or cable, program
	Interface defective	Replace interface and relay plug-in board [1]
«SE» [3]	TPR gauge not connected	Connect gauge
	TPR cable open circuit	Replace cable
	TPR gauge defective	Replace gauge
«So» [2]	Stack overflow	

[1] Read the information on 🗎 13 and in 🕮 [1] before performing any manipulations on the plug-in boards

[2] Fatal error

[3] Fault in measuring circuit (lamp of the corresponding measuring circuit flashes)

7.2 Contact Setting of the Relays in the Event of a Fault

The relays on the IF300P plug-in board behave as follows when a fault occurs:

A contact 1 … 4 (switching functions) is de-energized in the event of:

- A fault in a measuring circuit
- A fatal error.

Contact 5 (error status) is de-energized in the event of:

- A fault in a measuring circuit
- A fatal error.

Additional information on relay contact states → 🕮 [1].

7.3 Installation Problems

Problem	Possible cause	Correction
The control unit cannot be installed into the rack	Old rack system	Use a rack mount adapter according to DIN 41 494 (→ 🗎 10)

7.4 Operating and Calibration Problems

Problem	Possible cause	Correction
No display appears when the unit is switched on	Unit switched off for too short a period of time	After switching the unit off, wait approx. 10 seconds before restarting
Pressure display unstable	Filter time constant too low	Increase the filtering (→ 🗎 28)
Switching functions (relays) flutter	Hysteresis too small	Modify the threshold values (→ 🗎 24)
		Increase the filtering (→ 🗎 28)
Pirani pressure reading too high	Pirani gauge contaminated	Calibrate the measuring circuit
		Clean the gauge (→ 🕮 [2]
		Replace the gauge
Pirani measurement circuit cannot be calibrated	Combination measurement plug-in board / gauge cable / gauge is not compatible	Select correct combination (→ 🕮 [1])
	Pirani gauge severely contaminated	Clean the gauge (→ 🕮 [2])
		Replace the gauge
Cold cathode pressure reading too high	Contaminated or moist connector insulation	Clean or replace connector (→ 🕮 [3])
	Humidity (⇒ leak current)	Keep humidity low, keep the unit switched on
Cold cathode pressure reading too low	Cold cathode gauge contaminated	Clean the gauge (→ 🕮 [3])
«no P» is displayed	No plug-in board has been installed	Install the appropriate plug-in board [1)]
Incomprehensible reading	Plug-in board not screwed down	Tighten the screws
	Contacts contaminated / bent	Clean / carefully straighten contacts [1)]
Problem	Possible cause	Correction
Unit cannot be locked	Code 99 19 activated	Pull the measurement plug-in boards approx. 1 cm out of the slots A and B Change the code in »set up« mode Reinstall the measurement plug-in boards [1)]
Code forgotten	—	Pull the measurement plug-in boards approx. 1 cm out of the slots A and B [1)] Select the code in »set up« mode Read out the code Reinstall the measurement plug-in boards [1)]

[1)] Please read the instructions on 🗎 13 and in 🕮 [1] before performing any manipulations on the plug-in boards.

8 Profibus Interface

The TPG300 is able communicate in a Profibus-DP network if the interface and relay board IF300P is installed in slot C of the TPG300. The IF300P features an interface according to Profibus-DP standards and five relay contacts (switching functions and error status).

The complexity of the Profibus-DP communication protocol is beyond the scope of this document and is therefore described separately (→ 🕮 [1], [4]).

9 Accessories

Type	Accessory	Ordering number
CP300C9	Pirani / cold cathode measurement board	IO441000
IF300P	Interface and relay board (Profibus)	IO441395
	Mains cable, German plug, 2.5 m	IG456309YU
	Mains cable, U.S. plug, 2.5 m	IG456309YX
	Mains cable, U.K. plug, 2.5 m	IG456309Y1
	Mains cable, Swiss plug, 2.5 m	IG456309YR
	Blanking panel for measurement boards	IO441259
	Blanking panel for interface and relay boards	IO441017

10 Storage

Caution

Caution: electronic components.

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

Store the product in an antistatic bag or container. Observe the relevant specifications under Technical Data (→ 🗎 8).

11 Disposal

WARNING

WARNING: substances detrimental to the environment.

Products or parts thereof (mechanical and electric components, operating fluids etc.) may be detrimental to the environment.

Please dispose of such materials in accordance with the relevant local regulations.

Separating the components

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

Contaminated components

Contaminated components (radioactive, toxic, caustic or biological hazard etc.) must be decontaminated in accordance with the relevant national regulations, separated according to their materials, and disposed of.

Other components

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

Appendix

A: Conversion Tables

Weights

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

Pressures

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

Pressure units used in the vacuum technology

	mbar	bar	Pa	hPa	kPa	Torr mm HG
mbar	1	1×10^{-3}	100	1	0.1	0.75
bar	1×10^{3}	1	1×10^{5}	1×10^{3}	100	750
Pa	0.01	1×10^{-5}	1	0.01	1×10^{-3}	7.5×10^{-3}
hPa	1	1×10^{-3}	100	1	0.1	0.75
kPa	10	0.01	1×10^{3}	10	1	7.5
Torr mm HG	1.332	1.332×10^{-3}	133.32	1.3332	0.1332	1

1 Pa = 1 N/m^2

Linear measurements

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

Temperature

	Kelvin	Celsius	Fahrenheit
Kelvin	1	°C+273.15	(°F+459.67)×5/9
Celsius	K-273.15	1	5/9×°F-17.778
Fahrenheit	9/5×K-459.67	9/5×(°C+17.778)	1

B: Default Parameters

Loading the default parameter set will activate the following values (→ 🗎 31):

Parameter		Default	User
Lower threshold	Switching function 1	1.0×10^{-11} mbar	
	Switching function 2	1.0×10^{-11} mbar	
	Switching function 3	1.0×10^{-11} mbar	
	Switching function 4	1.0×10^{-11} mbar	
	Switching function A	6.0×10^{-3} mbar	
	Switching function B	6.0×10^{-3} mbar	
Upper threshold	Switching function 1	9.0×10^{-11} mbar	
	Switching function 2	9.0×10^{-11} mbar	
	Switching function 3	9.0×10^{-11} mbar	
	Switching function 4	9.0×10^{-11} mbar	
	Switching function A	8.0×10^{-3} mbar	
	Switching function B	8.0×10^{-3} mbar	
Measuring circuit assignment	Switching function 1	– (none)	
	Switching function 2	– (none)	
	Switching function 3	– (none)	
	Switching function 4	– (none)	
	Switching function A	– (none)	*)
	Switching function B	– (none)	*)
PE Measurement Underrange Control		0 (off)	
Pressure unit		mbar	
Filter time constant	Measuring circuit A1	2 (normal)	
	Measuring circuit A2	2 (normal)	
	Measuring circuit B1	2 (normal)	
	Measuring circuit B2	2 (normal)	
Baud rate		9 (9600)	
Hot start	Measuring circuit A1	– (no)	
	Measuring circuit A2	– (no)	
	Measuring circuit B1	– (no)	
	Measuring circuit B2	– (no)	
Code		00 0 (unlocked)	

*) Factory configuration in units equipped for measurement of medium and high vacuum (→ 🗎 13).

C: Program Examples

To assist program development, two examples of BASIC program examples are listed below. The will run on a IBM compatible PC under BASICA:

```
20 OPEN "COM1:9600,N,8,,CS,DS,CD" AS #1
21 REM Eroeffnet COM1: mit 9600 bps,keine Paritaet und acht Daten-Bits.
22 REM CTS,DSR und CD werden nicht geprueft.
23 REM
30 ACK$ = CHR$(6): ENQ$ = CHR$(5): LF$ = CHR$(10)
100 LINE INPUT "Mnemonics? ";m$
101 REM Lesen der Nachrichten von der Tastatur, die Kommas(,)
102 REM oder andere Trennzeichen enthalten koennen.
103 IF m$ = "END" THEN GOTO 300
110 PRINT #1,m$
111 REM Sendet die Nachricht zum TPG300.
120 LINE INPUT #1,a$
121 REM Wartet auf die Quittierung der Nachricht.
130 IF INSTR(a$,ACK$) THEN PRINT "     Acknowledge"; ELSE GOTO 200
131 REM Bei positiver Quittung.
140 PRINT #1,ENQ$
141 REM Aufforderung zur Datenuebertragung.
150 LINE INPUT #1,mp$
151 REM Lesen der Messwerte oder Parameter vom TPG300.
160 PRINT "      "+RIGHT$(mp$,(LEN(mp$)-INSTR(mp$,LF$)))
161 REM Anzeige der Messwerte oder Parameter.
190 GOTO 100
200 PRINT "      Negative Acknowledge";
201 REM Bei negativer Quittung.
210 PRINT #1,ENQ$
211 REM Aufforderung zur Uebertragung des Error-Wortes.
220 INPUT #1,e
221 REM Lesen des Error-Wortes vom TPG300.
230 IF e >999 THEN PRINT "     FATAL ERROR"; : E = E-1000
240 IF e >99  THEN PRINT "     NO HARDWARE"; : E = E-100
250 IF e >9   THEN PRINT "     PARAMETER ERROR"; : E = E-10
260 IF e      THEN PRINT "     SYNTAX ERROR";
270 PRINT
280 GOTO 100
300 END
```

```
20 OPEN "COM1:9600,N,8,,CS,DS,CD" FOR RANDOM AS #1
21 REM Eroeffnet COM1: mit 9600 bps,keine Paritaet und acht Daten-Bits.
22 REM CTS,DSR und CD werden nicht geprueft.
23 REM
30 CLS
40 ACK$ = CHR$(6): ENQ$ = CHR$(5): LF$ = CHR$(10)
100 LOCATE 1, 47
101 PRINT " TPG 300   "; TIME$; " soro"
102 LOCATE 10, 1
110 P$ = "PA1"
120 FOR I = 1 TO 4
121 IF I = 2 THEN P$ = "PA2"
122 IF I = 3 THEN P$ = "PB1"
123 IF I = 4 THEN P$ = "PB2"
130 PRINT #1, P$: REM Abfrage der Druck Messstelle.
140 GOSUB 1000: REM Kommunikationsprotokoll
150 PRINT #1, ENQ$; : REM Aufforderung zur Datenuebertragung.
160 INPUT #1, s, m: REM Lesen des Messwertes.
170 IF s THEN PRINT "                ": GOTO 200: REM Status >0
180 PRINT USING "        \ \=##.#^^^^"; P$; m; : REM Messdaten o.k.
200 NEXT I
300 LOCATE 5, 22
310 PRINT #1, "SPS": REM Abfrage des Waechterstatus.
320 GOSUB 1000: REM Kommunikationsprotokoll
330 PRINT #1, ENQ$; : REM Aufforderung zur Datenuebertragung.
340 INPUT #1, r1, r2, r3, r4, ra, rb: REM Lesen des Status.
350 PRINT USING "R1>#  R2>#  R3>#  R4>#  RA>#  RB>#"; r1; r2; r3; r4; ra; rb;
999 GOTO 100
1000 REM *** Kommunikationsprotokoll ***
1010 LINE INPUT #1, a$: REM Wartet auf die Quittierung der Nachricht.
1020 IF INSTR(a$, ACK$) THEN FOR J = 1 TO 200: NEXT J: RETURN:REM Zeit >2ms (LF)
1021 REM Bei negativer Quittung.
1030 PRINT #1, ENQ$: REM Aufforderung zur Uebertragung des Error-Wortes.
1040 INPUT #1, e: REM Lesen des Error-Wortes vom TPG300.
1050 IF e > 999 THEN PRINT "      FATAL ERROR"; : e = e - 1000
1060 IF e > 99 THEN PRINT "       NO HARDWARE"; : e = e - 100
1070 IF e > 9 THEN PRINT "        PARAMETER ERROR"; : e = e - 10
1080 IF e THEN PRINT "            SYNTAX ERROR";
1090 PRINT
2000 END
```

D: Literature

🕮 [1] www.inficon.com
Operating Manual
Plug-In Boards for Total Pressure Gauge Controller TPG300
IG9972BEN
INFICON AG, LI–9496 Balzers, Liechtenstein

🕮 [2] www.inficon.com
Operating Manual
Pirani Gauge TPR018
BG9976BEN
INFICON AG, LI–9496 Balzers, Liechtenstein

🕮 [3] www.inficon.com
Operating Manual
Cold Cathode Gauge IKR085
IG9048BEN
INFICON AG, LI–9496 Balzers, Liechtenstein

🕮 [4] www.inficon.com
Communication Protocol
Profibus-DP Interface Board IF300P
IG9973BEN
INFICON AG, LI–9496 Balzers, Liechtenstein

EU Declaration of Conformity

CE

We, INFICON, hereby declare that the equipment mentioned below complies with the provisions of the following directives:

- 2014/35/EU, OJ L 96/357, 29.3.2014
  (Low Voltage Directive; directive relating to electrical equipment designed for use within certain voltage limits)
- 2014/30/EU, OJ L 96/79, 29.3.2014
  (EMC Directive; directive relating to electromagnetic compatibility)
- 2011/65/EU, OJ L 174/88, 1.7.2011
  (RoHS Directive; directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment)

Product

Total Pressure Gauge Controller

TPG300

Standards

Harmonized and international/national standards and specifications:

- EN 61000-6-2:2005
  (EMC: generic immunity standard)
- EN 61000-6-3:2007 + A1:2011
  (EMC: generic emission standard)
- EN 61010-1:2010
  (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326-1:2013; Class 1, Group B
  (EMC requirements for electrical equipment for measurement, control and laboratory use)

Manufacturer / Signatures

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