Leybold

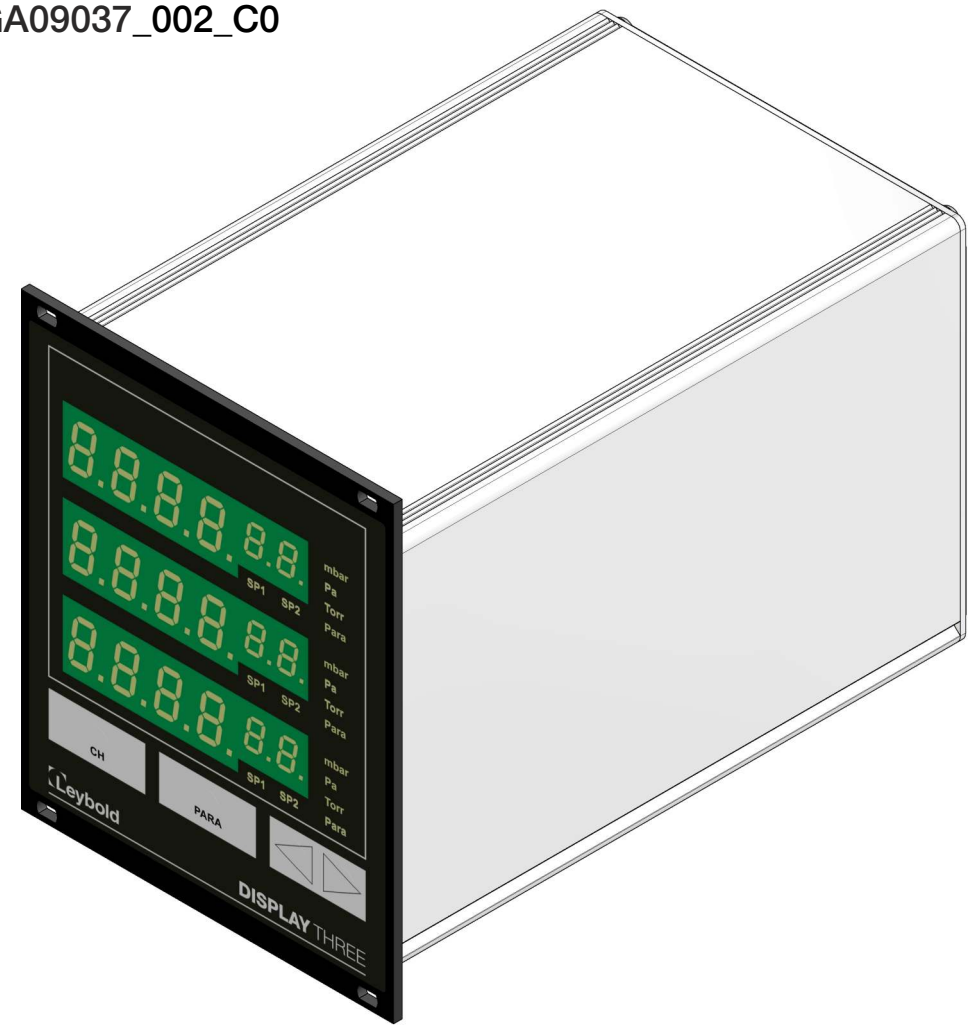
DISPLAY TWO
DISPLAY THREE

Vacuum Gauge Controller

Instruction Manual GA09037_002_C0

Catalog No.

230024
230025



0. Table of Contents

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1. Description

1.1 Validity

1.1.1 Part Number

This document applies to the following products:

Part Number	Product	Version	Serial Number
230024	DISPLAY TWO Two-channel measuring instrument for active vacuum sensors	2.1 et seq.	1000 et seq.
230025	DISPLAY THREE Three-channel measuring instrument for active vacuum sensors	2.1 et seq.	1000 et seq.

Table 1 – Part numbers

1.1.2 Nameplate

A nameplate is located on the bottom side of the instrument. When communicating with the Leybold GmbH, stating the information on the nameplate is necessary. For this reason please enter the following information:

Figure 1 – Nameplate (Examble)

1.2 Conforming Utilisation

The DISPLAY TWO and DISPLAY THREE is a display and operating unit for sensors with an analogue interface of the company Leybold GmbH.

Depending on the version, the unit offers two or three channels, and it is used in combination with the sensors from the series THERMOVAC and PENNINGVAC as well as DU sensors for the measurement of pressures above and below atmospheric pressures (vacuum).
The DISPLAY TWO respectively DISPLAY THREE multichannel vacuum gauge is called in the following "multichannel gauge" for short.

Operate all connected sensors in agreement with the information given in the corresponding Operating Instructions.

NOTICE:
Based on the technical data please check first whether your measuring instrument is suited to your kind of application.

1.3 Instrument Versions

The multichannel gauge is available in two different versions:

DISPLAY TWO (two-channel measuring instrument)
DISPLAY THREE (three-channel measuring instrument)

The two versions differ as to the following:

- Number of measurement channels
- Number of switching functions
- Power consumption
- Weight

☞🕮 Chapter 4 - Technical Data, page 11

Described in these Operating Instructions are both the DISPLAY TWO as well as the DISPLAY THREE.

1.4 Responsibility and Warranty

Leybold GmbH will not assume any responsibility or warranty in case the operator or third persons

- do not observe the information given in this document.
- do not use the product as intended.
- modify the product in any way (conversions, repair work etc).
- operate the product with accessories not listed in the corresponding product documentation.

Subject to technical alterations without prior notice. The figures are not binding.

1.5 Shipping Damage

- Examine the shipping package as to any external damage.
- In case any damage is determined, file a damage report to the forwarding agent and the insurer.
- Retain the packaging material since damages can only be claimed when returning the instrument in the original packaging of the manufacturer.
- Examine the delivery to ensure that it is complete.
- Examine the instrument as to any visually apparent damage.

DANGER: Damaged product.
Commissioning or operating a damaged product is dangerous to life.

2. Safety

2.1 General Information

The multichannel gauge is delivered ready for operation. Even so, we recommend that you carefully read these Operating Instructions so as to ensure optimum operating conditions right from the start.
This manual contains important information for understanding, installing, commissioning, operating and troubleshooting the multichannel gauge.

2.2 Key to the Symbols

Important instructions relating to technical safety and safe operation are emphasised by symbols.

DANGER or WARNING:
Information designed to prevent any kind of injury to persons.

DANGER:
Information designed to prevent injury to persons and damage to equipment in connection with electricity.

NOTICE:
General information pointing to further information, respectively reference sections.

2.3 Basic Safety Information

- During all work like installation, maintenance and repair activities, comply with the pertinent safety regulations.

DANGER: Mains Voltage
Coming into contact with components at mains voltage level within the instrument can be dangerous to life when inserting objects or allowing liquids to enter the instrument.

WARNING: Improper usage.
Improper usage can damage the instrument. Use the instrument only in agreement with the specifications issued by the manufacturer.

WARNING: Wrong Connection and Operating Data.
Wrong connection and operating data can damage the instrument. Comply with all specified connection and operating data.

3. General Equipment Description

3.1 Multichannel Gauge

The DISPLAY TWO and DISPLAY THREE is a display and operating unit for sensors with an analogue of the company Leybold GmbH.

Depending on the version, the unit offers two or three channels, and it is used in combination with the sensors from the series THERMOVAC and PENNINGVAC as well as DU sensors for the measurement of pressures above and below atmospheric pressures (vacuum).

Operate all connected sensors in agreement with the information given in the corresponding Operating Instructions.

3.2 Suitable Sensors

The following sensors can be operated with the multichannel gauge:

Sensor	Type	Display
THERMOVAC	TTR81N TTR90 / TTR91 / TTR91N TTR96S / TTR96SN TTR211 / TTR216S TTR911 / TTR911N TTR916 / TTR916N	ttr (ttr^{E})
THERMOVAC	TTR100 / TTR100S2 TTR101 / TTR101N TTR101S2 / TTR101S2N	ttr 1 (ttr 1^{E})
PENNINGVAC	PTR81N PTR225 / PTR225N PTR225S / PTR225SN PTR237 / PTR237N	Ptr
PENNINGVAC	PTR82N PTR90 / PTR90N	Ptr90
DU sensor	DU200 / DU201 DU2000 / DU2001	du200 du2000
DU relative pressure sensor	DU2001 rel.	durEL

Table 2 – Suitable sensors

4. Technical Data

4.1 General Data

4.1.1 Mechanical Data

Dimensions:	Width: 106.4 mm (1/4 19“) Height: 128.4 mm (3 HU) Depth: 174.5 mm
Weight:	DISPLAY TWO ≤ 1.3 kg DISPLAY THREE ≤ 1.4 kg
Installation depth:	≤ 230 mm approx. (including connected plugs)
Usage:	Rack installation Front panel installation Benchtop instrument

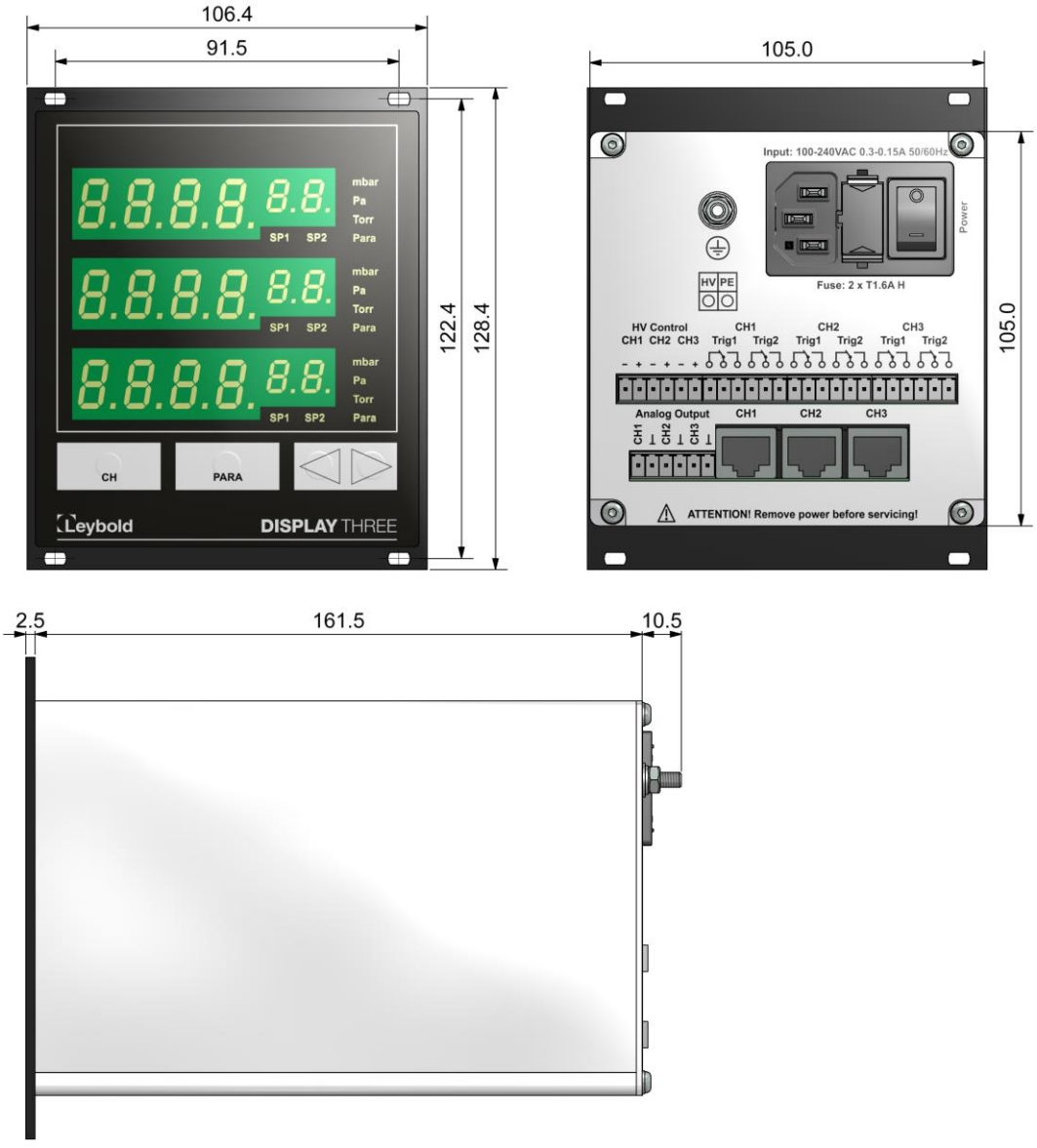

Figure 2 – Multichannel gauge dimensions (in mm)

4.1.2 Standard Parameters (factory defaults)

Parameter	Parameter description	Setting
PrE	Pirani range extension	oFF
FiLt	Measured value filter	3
rEAdY	Function Ready signal	on
Cor	Gas correction	1.00
S-on	Sensor switch-on mode	HAnd
S-oFF	Sensor switch-off mode	HAnd
unit	Measurement unit	bAr
diGit	Display format	2
bri	Display brightness	Hi
AnALoG	Analog output	Hi

Table 3 – Default parameters (factory defaults)

4.1.3 Enviroments

Temperature:	Storage:	-20 – +60 °C
	Operating:	+5 – +50 °C (sea level)
		+5 – +30 °C (2000 m above sea level)
Relative atmospheric humidity:	80 % max. (up to 30 °C)	
	decreasing to 50 % max. (over 40 °C)	
Use:	indoors (altitude 2000 m max. above sea level)	
Ingress protection type:	IP20	

4.1.4 Standards

- Conformity with respect to Low Voltage Directive 2014/35/EU
- Conformity with respect to EMC Directive 2014/30/EU
- Conformity with respect to RoHS Directive 2011/65/EU

International/national standards as well as specifications:

- DIN EN 61010-1 (2011)
  (Safety requirements for electrical equipment for measurement, control and laboratory use).
- DIN EN 61326-1 (2013)
  (Electrical equipment for measurement, control and laboratory use – EMC requirements. Industrial interference immunity; electromagnetic emissions household sector Class B).

4.2 Mains Connection

Voltage:	100 – 240 V AC	
Frequency:	50/60 Hz	
Fuses:	2 x T1.6A H	
Power consumption:	DISPLAY TWO	< 10 W
	DISPLAY THREE	< 15 W

Current consumption:	0.3 – 0.15 A approx.
Overvoltage category:	II
Protection class:	1
Connection:	Cold-device plug IEC 320 C14

4.3 Measurement Channels

Number:	DISPLAY TWO	2	
	DISPLAY THREE	3	
Connection:	RJ45 (FCC 68)		
Suitable sensors:	THERMOVAC		TTR81N
			TTR90 / TTR91 / TTR91N
			TTR96S / TTR96SN
			TTR211 / TTR216S
			TTR911 / TTR911N
			TTR916 / TTR916N
	THERMOVAC		TTR100 / TTR100S2
			TTR101 / TTR101N
			TTR101S2 / TTR101S2N
	PENNINGVAC		PTR81N
			PTR225 / PTR225N
			PTR225S / PTR225SN
			PTR237 / PTR237N
	PENNINGVAC		PTR82N
			PTR90 / PTR90N
	DU sensor		DU200 / DU201
			DU2000 / DU2001
	DU relative pressure sensor	DU2001 rel.	

4.3.1 Sensor Powering

Voltage:	+24 VDC ±5 %
Current:	100 mA approx.
Fusing:	200 mA, self resetting

Power feeding complies with the requirements of a safety extra-low voltage (SELV-E in accordance with EN 61010).

4.3.2 Measurement Technology

Measurement ranges:	Sensor dependent
Measurement error:	Gain error ≤ 0.1 % FS
	Offset error ≤ 0.02 % FS
Measurement rate:	1000 s^{-1}
Display rate:	4 s^{-1}
Filter time constant:	Slow … Fast
	15 … 7 … 3 … 1
Units of measurement:	mbar, Pa, Torr
Correction options:	Correction factor
A/D converter resolution:	> 15 Bit

4.4 Switching Functions

Number of switching functions:	DISPLAY TWO	4
	DISPLAY THREE	6
Assignment:	2 per channel	
Response time:	< 50 ms	
Adjustment range:	Sensor dependent	
Hysteresis:	adjustable ≥ 10 % of measurement value	

4.4.1 Switching Function Relay

Number:	1 per channel	
Type of contact:	Changeover contact, floating	
Load (resistive):	Switched current:	1 A approx.
	Switched voltage:	30 VAC / 30 VDC approx.
Service life:	Mechanical:	$5 \cdot 10^6$ actuations
	Electrical:	10^5 actuations at maximum load
Connection:	Plug-in terminals, screw terminals	

4.4.2 Ready Signal Relay

Number:	1 per channel, as the 2. switching function configurable	
Type of contact:	Changeover contact, floating	
Load (resistive):	Switched current:	1 A approx.
	Switched voltage:	30 VAC / 30 VDC approx.
Service life:	Mechanical:	$5 \cdot 10^6$ actuations
	Electrical:	10^5 actuations at maximum load
Connection:	Plug-in terminals, screw terminals	

4.5 Outputs and Inputs

4.5.1 Analog Output

Number:	1 per channel
Voltage range:	0 – 10 VDC / 0 – 5 VDC selectable
Deviation from the displ. value:	± 0.1 % FS
Internal resistance:	100 Ω
Relationship between voltage and pressure:	Sensor dependent
Connections:	Plug-in terminals, screw terminals

4.5.2 Control Inputs

Number:	1 per channel
Voltage range:	0 – 24 VDC
Connections:	Plug-in terminals, screw terminals

5. Installation

5.1 Supplied Equipment

Designation	Quantity
Multichannel Gauge	1
Mains cord with shockproof plug (EU)	1
Mains cord with shockproof plug (US)	1
Operating Instructions (each EN and DE)	1
Spare fuse	2
Neck collar screw	4
Plastic sleeve	4
Edge protection rubber	2
Adhesive feet	2
Mating connectors	DISPLAY TWO 4 DISPLAY THREE 5

Table 4 – Supplied equipment

5.2 Mechanical Installation

The multichannel gauge can be used as follows:

- Rack installation
- Front panel installation
- Benchtop instrument

WARNING: Powering down
Install the instrument or place it so that you are in a position to operate the mains power switch at any time or ensure that the instrument can be deenergised at any time.

5.2.1 Rack Installation

The multichannel gauge has been designed for installation within a sub-rack (19", 3 U) in accordance with DIN EN 60297 (IEC 60297) (☞🕮 Figure 3, page 16). For this purpose the supplied equipment includes four neck collar screws and four plastic sleeves.

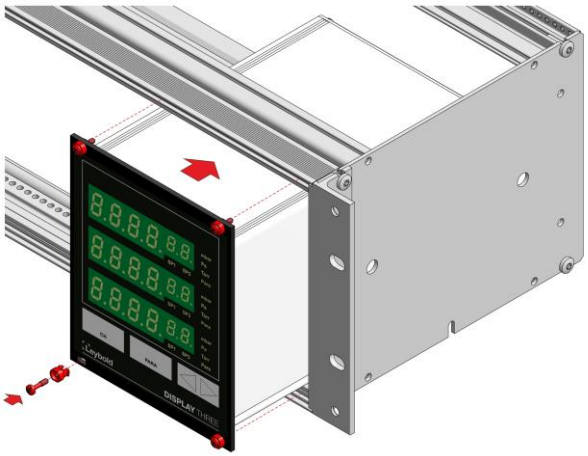

Figure 3 – Rack installation

- Attach the sub-rack within the rack.
- Push the multichannel gauge into the sub-rack.
- Affix the instrument to the sub-rack with the neck collar screws and the plastic sleeves included in the delivery.

5.2.2 Front Panel Installation

For panel mounting of the instrument, the following cutout (☞🕮 Figure 4, page 16) is required:

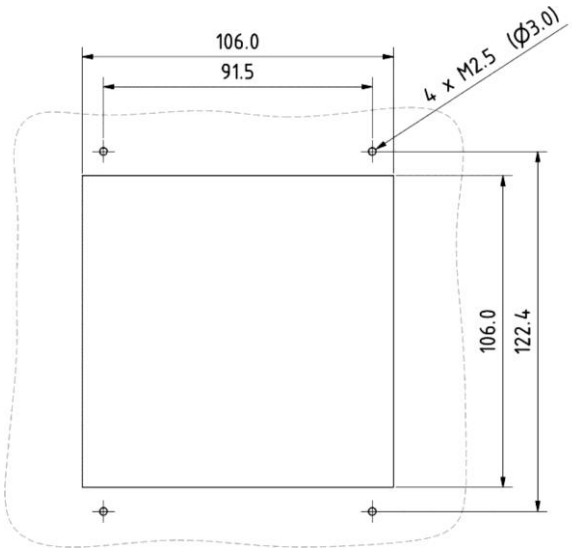

Figure 4 – Front panel cutout dimensions (in mm)

- Guide the multichannel gauge into the cut-out.
- Affix the instrument with the neck collar screws and the plastic sleeves included in the delivery.

5.2.3 Benchtop Instrument

When planning to use the multichannel gauge as a benchtop instrument, proceed as follows:

- Push one of the two edge protection rubber pieces included in the delivery over the top edge of the front panel (☞🕮 Figure 5, page 17)
- Place the multichannel gauge on its back (☞🕮 Figure 6, page 17)
- Push the second edge protection rubber piece included in the delivery onto the bottom edge of the front panel

WARNING: Risk of suffering injury.
When using the multichannel gauge as a benchtop instrument fit the two edge protection rubber pieces onto the top and bottom edge of the front panel so as to avoid injury by sharp edges.

- Stick the two rubber feet included in the delivery onto the bottom of the housing.

Figure 5 – Preparing the top side of the instrument for utilisation as a benchtop unit

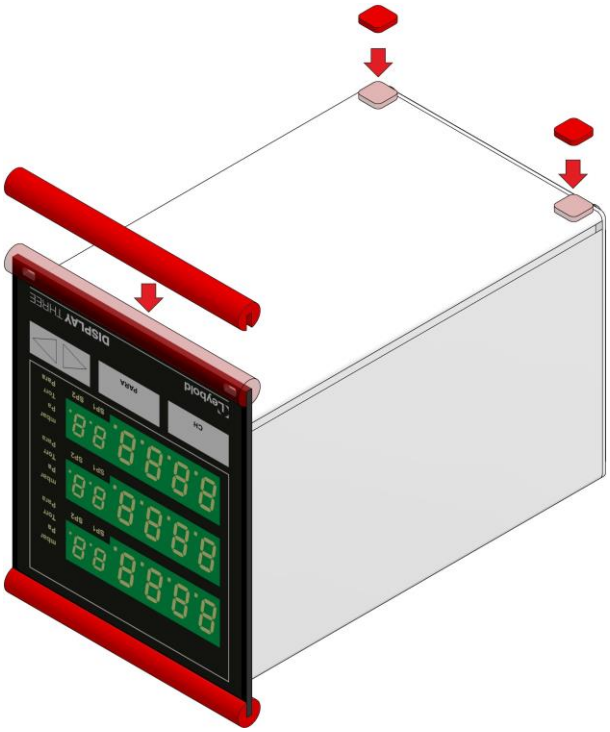

Figure 6 – Preparing the bottom side of the instrument for utilisation as a benchtop unit

- Turn the multichannel gauge over again and move it to the desired place.

5.3 Connections

5.3.1 Rear Side of the Instrument

The Figure 7, page 18 depicts the rear panel of the multichannel gauge. The way in which the individual connections have been wired is described in the following sections.

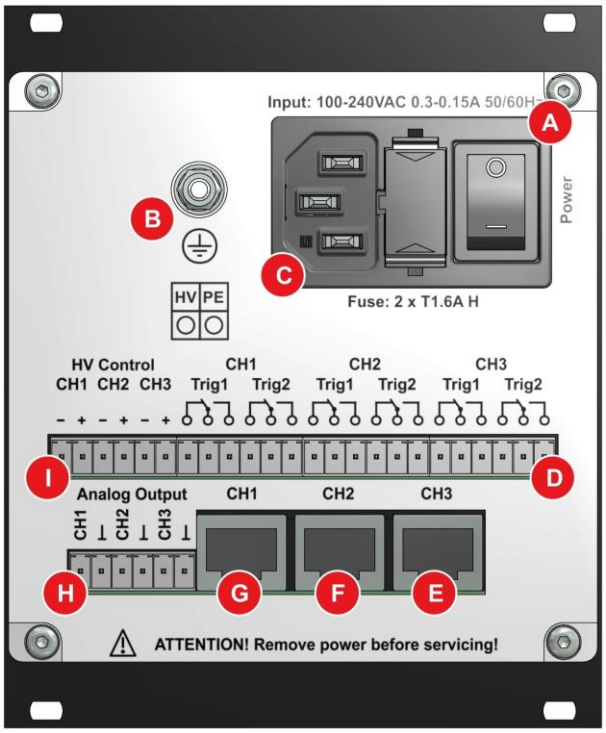

Figure 7 – Rear panel of the instrument

A	Mains switch
B	Ground screw
C	Mains connection
D	Connection Relay
E	Connection for sensor, measurement channel 3
F	Connection for sensor, measurement channel 2
G	Connection for sensor, measurement channel 1
H	Connection Analog Output
I	Connection HV Control

5.3.2 Mains Connection

The mains connection on the rear panel (☞📖 Figure 7, C, page 18) has been designed to accept a mains cord which on the instrument side is equipped with a cold-device plug.

NOTICE: Mains cord
Included in the delivery of the instrument is a mains cord. If the plug on the mains power side is not compatible with your mains power outlets, you will need a mains cord which meets the following specifications:

- Three-wire cable with protective earthing.
- Conductor cross-section: 3 x 0.75 mm² or greater.
- Cable length 2.5 m maximum.

DANGER: Mains voltage
Appliances, which have not been professionally connected to Earth, can be life-threatening in the event of a malfunction. For this reason use three-wire mains cords, respectively extension cords with protective earthing only. Insert the mains plug into a mains power socket, which provides an Earth contact.

- Insert the plug of the mains cord into the mains socket provided on the instrument.
- Insert the mains plug of the mains cord into the mains outlet.

5.3.3 Earthing

With the aid of the earthing screw (☞📖 Figure 7, B, page 18) the multichannel gauge can be connected to the protective ground of the vacuum chamber.

NOTICE: Earthing
Connect the Earth connection on the vacuum chamber by means of a protective earth conductor to the earthing screw on the instrument

5.3.4 Sensor

The connection marked Sensor serves the purpose of connecting sensors. For each measurement channel an 8-way modular socket is available. (☞📖 Figure 7, E, F, G, page 18 and Figure 8, page 19).

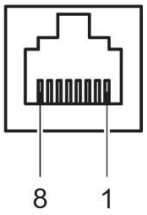

Figure 8 – Connector Sensor (modular socket, 8-way)

1	+24 V DC	5	Signal ground
2	Power ground	6	Status (for PTR)
3	Signal	7	HV on (for PTR)
4	Ident resistant	8	not available

CAUTION: Impermissible Sensors.
Connecting sensors which have not been designed to be operated in connection with the multichannel gauge or which do not comply with current EMC guidelines can impair operation of the instrument or even damage it. Always operate the multichannel gauge with approved sensors. ☞📖 Chapter 3.2 Suitable Sensors, page 10 .

Connecting:

- Measurement channel 1, 2 and/or 3: Connect of the sensor using a shielded straight through cable to the connection CH1, CH2 and/or CH3.

5.3.5 Relay

The switching functions and the ready monitor influence the switching action of various relays within the multichannel gauge. Through the connection marked Relay (☞📖 Figure 7, D, page 18 and Figure 9, page 19) you may utilise the relay contacts for switching purposes. The relay contacts are floating.

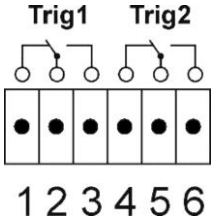

Figure 9 – Connector Relay (plug-in terminals, screw terminals)

1	SP 1 Normally closed contact (NC)
2	SP 1 Common contact (COM)
3	SP 1 Normaly open contact (NO)
4	SP 2 Normally closed contact (NC)
5	SP 2 Common contact (COM)
6	SP 2 Normaly open contact (NO) or Ready contact

DANGER: Dangerous voltage
Voltages exceeding 60 VDC or 30 VAC are dangerous when touched. You may only switch at the connector marked Relay Output voltages of 30 VDC or 30 VAC with a maximum current of 1 A. The voltage must comply with the requirements of a safety extra-low voltage (SELV-E in accordance with EN 61010).

5.3.6 HV Control

The connection HV Control (☞🕮 Figure 7, I, page 18 and Figure 10, page 20) provides the following connections:

- HV ON. Here the high vacuum circuit of the PENNINGVAC sensors PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 and PTR237N can be switched on and off. The following applies to the signal level: On = +12 – 24 VDC. Off = 0 VDC.

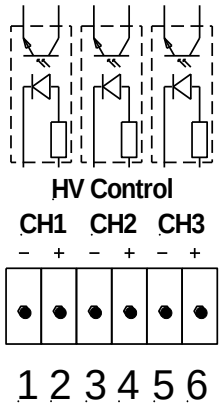

Figure 10 – Connector HV-Control (plug-in terminals, screw terminals)

1	Measurement channel 1 -
2	Measurement channel 1 +12 – 24 VDC
3	Measurement channel 2 -
4	Measurement channel 2 +12 – 24 VDC
5	Measurement channel 3 -
6	Measurement channel 3 +12 – 24 VDC

Connecting:

- Connect the peripheral components using a shielded connecting cable to the connector marked HV Control on the rear of the multichannel gauge.

5.3.7 Analog Output

The connection marked Analog Output (☞🕮 Figure 7, H, page 18 and Figure 11 , page 20) provides the following connections:

- Analog outputs for the signals of the individual measurement channels.

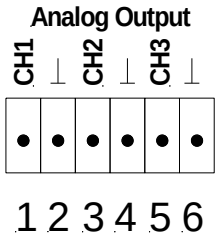

Figure 11 – Connector Analog Output (plug-in terminals, screw terminals)

1	Analog output of measurement channel 1
2	Ground of measurement channel 1
3	Analog output of measurement channel 2
4	Ground of measurement channel 2
5	Analog output of measurement channel 3
6	Ground of measurement channel 3

Connecting:

- Connect the peripheral components using a shielded connecting cable to the connector marked Analog Output on the rear of the multichannel gauge.

6. Operation

6.1 Front Panel

Shown in Figure 12, page 21 is the front panel of the DISPLAY THREE. In the case of the DISPLAY TWO the display for measurement channel 3 (Item C) are not present.

Figure 12 – Front panel

A Display of channel 1 with two corresponding switching thresholds
B Display of channel 2 with two corresponding switching thresholds
C Display of channel 3 with two corresponding switching thresholds
D Status indication operating pushbuttons

6.1.1 Display

A separate display area is provided for each measurement channel (☞📖 Figure 12, A, B, C, page 21). In the display area, the following information is shown from left to right:

Display	Description
8.8.8.8.8.8.	Measured value or status message
SP1, SP2	Switching function status When the symbol is lit, the pressure is then below the lower threshold When the symbol is not lit, then the pressure is above the upper threshold
mbar, Pa, Torr	Pressure unit (applies to all channels)
Para	Channel selection, configuration mode for channel

Table 5 – Display components

6.1.2 Control Pushbuttons

CH
Through the key marked CH you can select a measurement channel. This is necessary, for example, when wanting to switch a certain sensor on or off, or when wanting to change the sensor parameters. The symbol Para for the selected measurement channel flashes for 10 seconds.

PARA
Through the pushbutton PARA you can invoke the parameter mode for switching threshold, sensor and general parameters. The indicator Para for the selected measurement channel comes on. You can set up different parameters.

Arrow pushbuttons (<I DOWN / I> UP)
The arrow pushbuttons are needed so as to be able to enter data in the parameter mode or switch the PENNINGVAC sensors PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 and PTR237N on or off (☞🕮 Chapter 6.4.3.3 Switching on the High Vacuum Measurement Circuit, page 24 and chapter 6.4.3.4 Switching off the High Vacuum Measurement Circuit, page 25). By operating the pushbuttons, a default value can be reduced or increased. The corresponding pushbuttons are designated in the following as DOWN (**<I**) and UP (**I>**).

6.2 Switching on and off

6.2.1 Switching on

- Switch the instrument on through its mains switch.

After switching on, the multichannel gauge runs the following:

- Self test
- Display test
- Display of the software version used
- Re-establishing the parameters set up last
- Identification of the connected measuring equipment
- Activation of the measurement mode

6.2.2 Switching off

- Switch the instrument off through its mains switch.

CAUTION: Waiting Time
Wait for at least five seconds before switching the instrument on again.

6.3 Operating Modes

The multichannel gauge may be operated in one of the following operating modes:

Measurement Mode
The measurement mode is the standard operating mode. Here the measured values or status messages are displayed. ☞🕮 Chapter 6.4 Measurement Mode, page 23

Parameter Mode
In the parameter mode you have access to different parameters. You can simply view the parameters all change them with the aid of the arrow keys. In this way you can configure the multichannel gauge. ☞🕮 Chapter 6.5 Parameter Mode, page 26

6.4 Measurement Mode

6.4.1 Selection

After switching on the multichannel gauge it will automatically run the measurement mode. If running the parameter mode and when not operating a key for 10 seconds the instrument will then automatically revert back to the measurement mode.

6.4.2 Description

In the measurement mode the measured values of the sensors are displayed. When the pressure is outside the permissible range, then a status message is displayed. Measurement channels to which no gauge head has been connected will indicate noSEn. This status message is erased after 30 seconds and 4 dots are displayed.

Display	Description
8888 or 8.88	Above the permissible range (DU Sensors excluded)
oooo	Above the measurement range (DU Sensors only)
8.888	Within the permissible range
c8.88	Below the permissible range (DU Sensors excluded)
oFF	PENNINGVAC sensor PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 or PTR237N has been switched off
HU on	PENNINGVAC sensor PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 or PTR237N is on (Switching-on procedure, still no valid measured value available)
c0	Lowly below the measurement range (DU Sensors only)
cc0	Middle below the measurement range (DU Sensors only)
ccc0	Large below the measurement range (DU Sensors only)

Table 6 – Display in the measurement mode

6.4.3 Pushbutton Functions

6.4.3.1 Measurement Channel Selection

- Press the pushbutton CH.
  The instrument selects the next measurement channel. The display of Para for the selected measurement channel will flash for 10 seconds.

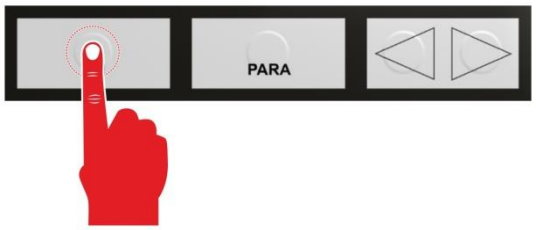

Figure 13 – Operating the pushbutton CHANNEL

6.4.3.2 Parameter Mode Selection

- Press the pushbutton PARA and keep it depressed for approximately 2 seconds. The instrument will change to the parameter mode (☞🕮 Chapter 6.5 Parameter Mode, page 26).
  When not operating any pushbutton within 10 seconds, the instrument will then automatically return to the measurement mode.

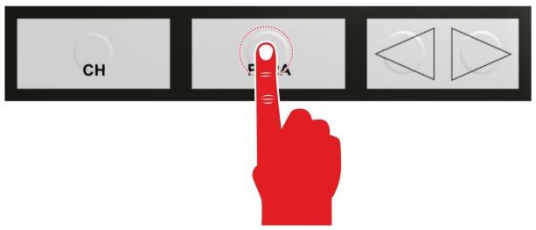

Figure 14 – Operating the pushbutton PARA

6.4.3.3 Switching on the High Vacuum Measurement Circuit

The high vacuum measurement circuit of the following sensors can be switched on manually: PENNINGVAC sensors PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 and PTR237N. For this the sensor control must be set to HAnd (☞🕮 Chapter 7.2.5 Sensor Switch-on Type (S-on), page 31).

- Keep the key marked CH pressed so as to select the respective measurement channel.
- Keep the key marked UP pressed for approximately two seconds.
  The sensor for the selected measurement channel is switched on. Either the measured value or a status message will be displayed. ☞🕮 Table 6, page 23.

Figure 15 – Operating the pushbutton UP

6.4.3.4 Switching off the High Vacuum Measurement Circuit

The high vacuum measurement circuit of the following sensors can be switched off manually: PENNINGVAC sensors PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 and PTR237N. For this in the sensor control must be set to HAnd (☞🕮 Chapter 7.2.7 Sensor Switch-off Type (S-oFF), page 32).

- Keep the key marked CH pressed so as to select the respective measurement channel.
- Keep the key marked DOWN pressed for approximately two seconds.
  The sensor for the selected measurement channel is switched off. The display will indicate the status oFF.

Figure 16 – Operating the pushbutton DOWN

6.4.3.5 Sensor Identification

- Keep the keys UP and DOWN pressed for approximately one second.
  On the displays for the individual measurement channels the in each case connected sensors are indicated. ☞🕮 Table 7, page 25.

Figure 17 – Operating the pushbuttons UP and DOWN

Display	Sensor type
ttr (ttrE)	THERMOVAC (TTR81N, TTR90, TTR91, TTR91N,TTR96S, TTR96SN, TTR211, TTR216S, TTR911, TTR911N, TTR916, TTR916N)
ttr 1 (ttr 1E)	THERMOVAC (TTR100, TTR100S2, TTR101, TTR101N, TTR101S2, TTR101S2N)
Ptr	PENNINGVAC (PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237, PTR237N)
Ptr90	PENNINGVAC (PTR82N, PTR90, PTR90N)
du200	DU sensor (DU200, DU201)
du2000	DU sensor (DU2000, DU2001)
durEL	DU relative pressure sensor (DU2001 rel.)
no SEn	No sensor connected (no sensor). The indication will disappear after 30 seconds.
. . . .	No sensor connected (no sensor).

Table 7 – Sensor identification

6.5 Parameter Mode

6.5.1 Selection

By operating the PARA pushbutton for approximately 2 seconds the instrument changes from the measurement mode to the parameter mode. The Para indicator comes on for the channel selected in each case. When the instrument is running in the parameter mode and if no pushbutton is operated for 10 seconds, then the instrument will automatically return back to the measurement mode. The Para indicator for the channel which was selected in each case is turned off.

6.5.2 Parameter Groups

In the parameter mode you have access to different parameters. You may view these parameters or change these with the aid of the arrow pushbuttons. In this way you can configure the instrument. Table 8, page 26 depicts all available parameters.

Parameter group	Parameter
PArA SP	SP 1-L SP 1-H SP2-L (only with deselected ready function) SP2-H (only with deselected ready function)
PArA SEn	PrE F iLt rEAdY Cor S-on S-oFF
PArA GEn	un it d iG it br i AnALoG

Table 8 – Parameter groups and corresponding parameters

The available parameters have been divided into the following parameter sets:

Switching function parameters (PArA SP)
These parameters affect only the sensor of the selected measurement channel. Per measurement channel, two switching functions are available. ☞🕮 Chapter 7.1 Switching Function Parameters (PArA SP), page 28.

Sensor parameters (PArA SEn)
These parameters affect only the selected measurement channel. For each measurement channel a separate set of parameters is available which will depend on the type of connected sensor. ☞🕮 Chapter 7.2 Sensor Parameters (PArA SEn), page 29.

General parameters (PArA GEn)
With the aid of these parameters you can generally configure the instrument. The parameter is applied to all measurement channels. ☞🕮 Chapter 7.3 General Parameters (PArA GEn), Page 33.

6.5.3 Operating Concept

From the measurement mode, you can select and change a certain parameter as follows:

- Press the pushbutton CH, so as to select the desired measurement channel (only necessary when wanting to change a sensor parameter)
  The Para status indicator flashes for the selected channel.
- Press the PARA pushbutton for about 2 seconds.
  You have now invoked the parameter menu.
- Use the arrow pushbuttons to select the desired parameter group.
  The name of the parameter group is displayed.
- Press the PARA pushbutton to select the desired parameter.
  The name and the value of the parameter are displayed.
- Use the arrow pushbuttons and to change the value of the parameter.
  The value of the parameter is changed.
- Repeat the last 2 steps so as to change further parameters of the same parameter group.

After having accessed the last parameter of a parameter group, the instrument will switch back to the measurement mode. Changes to the parameters become effective immediately and are automatically saved to the EEPROM.

When the instrument is running in the parameter mode and if for a period of 10 seconds no changes are made to the parameters, then the instrument will automatically return to the measurement mode. Any parameter changes made up to this point are automatically saved to the EEPROM.

NOTICE:
When the instrument is running in the parameter mode, and when not entering a change for more than 10 seconds, then the instrument will automatically return back to the measurement mode.
Any changes, which have been entered and confirmed up to this point of time, are automatically saved in the EEPROM.

7. Parameters

7.1 Switching Function Parameters (PArA SP)

In this parameter group you can configure the switching functions. The multichannel gauge provides the following switching function parameters:

- SP1-Lo
- SP1-Hi

- SP2-Lo (only with deselected ready function)
- SP2-Hi (only with deselected ready function)

7.1.1 Basic Terms

Switching functions
The DISPLAY TWO contains four relays with change-over contacts, from which two for switching functions and two are available as ready function. The relays for the ready functions can be used alternatively also for switching functions.

The DISPLAY THREE contains six relays with change-over contacts, from which three for switching functions and three are available as ready function. The relays for the ready functions can be used alternatively also for switching functions.

The contacts of the relays are floating and may be used for switching purposes through the connection marked Relay Output (☞🕮 5.3.5 Relay, page 19).

Threshold values
The switching behaviour of individual relays is defined in each case through two parameters: the lower threshold and the upper threshold value of the switching function.

Lower threshold value SPx-Lo
The lower threshold value governs switching on of the assigned switching function. When the pressure drops below the lower threshold value, then the relay is energised. The common contact of the relay is then connected to the normally open contact.

Upper threshold value SPx-Hi
The upper threshold value governs switching off of the assigned switching function. When the pressure exceeds the upper switching threshold, then the relay is de-energised. The common contact of the relay is then connected to the normally closed contact.

Hysteresis
In the pressure range between the two thresholds, the current relay status is maintained. Within this range the relay will not switch over and the relay status depends on the history (☞🕮 Figure 18, page 29).

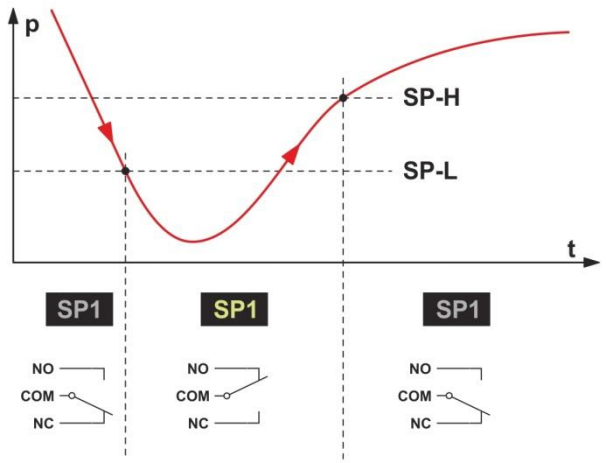

Figure 18 – Behaviour of a switching function in response to pressure changes

p	Pressure
t	Time
NO	Normally open contact
COM	Common contact
NC	Normally closed contact

The range between the lower and the upper threshold value produces a certain amount of hysteresis between switching on and switching off of the relay. The hysterisis prevents rapid switching on and off of the switching function when the pressure is close to a switching threshold.

7.1.2 Configuring the Switching Functions

- Select the desired measurement channel by operating the pushbutton CH several times.
- Keep the pushbutton PARA depressed for approximately 2 seconds.
  The instrument is now running the parameter mode in the parameter group SP.
- Press the pushbutton PARA to select the desired parameter.
  The name and the value of the parameter are displayed.
- Use the arrow pushbuttons so as to change the threshold value.
  The value of the parameter is changed.
- Repeat the steps to change further parameters of the parameter group.

7.1.3 Adjustment Range

The upper and the lower threshold value can be changed depending on the type of sensor in the range between $1 \cdot 10^{3}$ and $1 \cdot 10^{-12}$ mbar.
Hysteresis amounts to at least 10% of the lower threshold value.

CAUTION:
Select the threshold values only within the range of the selected sensor.

CAUTION:
The threshold values have to be adjusted when the sensor type on a measuring channel has been changed.

7.2 Sensor Parameters (PArA SEn)

For each measurement channel there exists a separate set of sensor parameters. Depending on which sensor is connected to the respective measurement channel, different parameters are available (☞🕮 Table 9, page 30).

Sensor	PrE	FiLt	rAEdY	Cor	S-on	S-oFF
ttr (ttrE)	✓	✓	✓			
ttr 1 (ttr 1E)	✓	✓	✓			
Ptr		✓	✓	✓	✓	✓
Ptr90		✓	✓			
dU200		✓	✓			
dU2000		✓	✓			
durEL		✓	✓			

Table 9 – Available sensor parameters

- Select the desired measurement channel by operating the pushbutton CH several times.
- Keep the pushbutton PARA depressed for approximately 2 seconds
  The instrument is now running the parameter mode.
- Use the arrow keys to access the parameter group SEn.
- Press the pushbutton PARA to select the desired parameter.
  The name and the value of the parameter are displayed.
- Use the arrow keys to change the parameter setting.
- Repeat the steps to change further parameters of the parameter group.

7.2.1 Pirani Range Extension (PrE)

Pirani range extension for THERMOVAC sensors.

Display	Description
oFF	Pirani range extension deactivated Sensor indicated as ttr or ttr 1
on	Pirani range extension activated Sensor indicated as ttrE or ttr 1E

Table 10 – Values for the parameter PrE

7.2.2 Measured Value Filter (FiLt)

The measurement value filter improves processing of unstable signals or signals suffering from interference. The filter has an effect on the display and on the switching functions. However, the analog outputs are not influenced.
For the measured value filter you may select between the values **1**, **3**, **7** and **15**. Here **1** stands for **fast** and **15** for **slow**. The values **3** and **7** are **corresponding intermediate values**. In case of a two digit display the use of filter factor of 3 is recommended, in the case of a three digit display filter factor 15 is recommended.

7.2.3 Ready Function (rAEdY)

The second relay per channel makes according to standard a ready signal available. Alternatively, this relay can be used in addition, as the second switching function.

Display	Description
on	Ready signal function activeted
oFF	Switching function activeted

Table 11 – Values for the parameter rEAdY

7.2.4 Type of Gas Correction (Cor)

Sensors have normally been calibrated for measurements in nitrogen or air. With the aid of the parameter Cor you can adjust the measurement channel to other type of gases (PENNINGVAC sensors PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 and PTR237N only).

For this proceed as follows

- Select the parameter Cor.
- Press the key marked PARA.
  The correction factor is displayed.
- Use the arrow keys to change the correction factor.
  The value of the parameter is changed.

You can adjust the correction factor for a sensor within the range of 0.1 – 1.0 – 9.9. The setting of 1.0 supplies the uncorrected measured values (for nitrogen or air).

7.2.5 Sensor Switch-on type (S-on)

This parameter defines how the PENNINGVAC sensors PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 and PTR237N are switched on.

You can set up the switch-on type to the following:

HAnd
Manual. The sensor can be switched on by pressing the key marked UP.
(☞🕮 Chapter 6.4.3.3 Switching on the High Vacuum Measurement Circuit, page 24)

ECt
Externally through optocoupler (static signal +12 – 24 V DC)

Hot
Warm start. The sensor is switched on automatically upon switching on the instrument. After a power failure the measurement is started automatically.

CH 1
Through measurement channel 1. With the aid of the next parameter t-on you can define a switch-on threshold. As soon as the pressure in measurement channel 1 drops below the switch-on threshold, the sensor will be switched on.

CH 2
Through measurement channel 2. With the aid of the next parameter t-on you can define a switch-on threshold. As soon as the pressure in measurement channel 2 drops below the switch-on threshold, the sensor will be switched on.

CH 3
Through measurement channel 3. This setting is only available in the case of the DISPLAY THREE. With the aid of the next parameter t-on you can define a switch-on threshold. As soon as the pressure in measurement channel 3 drops below the switch-on threshold, the sensor will be switched on.

7.2.6 Sensor Switch-on Value (t-on)

This parameter will only appear when the sensor switch-on time has been set to CH 1, CH 2 or CH 3 (☞📖 Chapter 7.2.5 Sensor Switch-on type (S-on), page 31).

Through the parameter t-on you can define a switch-on value. If the pressure in the respective measurement channel drops below the switch-on value, the PENNINGVAC sensors PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 and PTR237N are switched on.

7.2.7 Sensor Switch-off type (S-oFF)

This parameter defines how the PENNINGVAC sensors PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 and PTR237N are switched off.

You can set the switch-off type to the following:

HAnd
Manual. The sensor can be switched off by pressing the key marked DOWN.
(☞📖 Chapter 6.4.3.4 Switching off the High Vacuum Measurement Circuit, page 25)

ECt
Externally through optocoupler (static signal +12 – 24 V DC)

SELF
Self monitoring. With the aid of the next parameter t-off you can define a switch-off threshold. When the pressure at the sensor exceeds the switch off threshold, the sensor will be switched off.

CH 1
Through measurement channel 1. With the aid of the next parameter t-off you can define a switch-off threshold. As soon as the pressure in measurement channel 1 exceeds the switch-off threshold, the sensor will be switched off.

CH 2
Through measurement channel 2. With the aid of the next parameter t-off you can define a switch-off threshold. As soon as the pressure in measurement channel 2 exceeds the switch-off threshold, the sensor will be switched off.

CH 3
Through measurement channel 3. This setting is only available in the case of the DISPLAY THREE. With the aid of the next parameter t-off you can define a switch-off threshold. As soon as the pressure in measurement channel 3 exceeds the switch-off threshold, the sensor will be switched off.

7.2.8 Sensor Switch-off Value (t-off)

This parameter will only appear when the sensor switch-off type has been set to CH 1, CH 2 or CH 3 (☞🕮 Chapter 7.2.7 Sensor Switch-off type (S-oFF), page 32).

Through the parameter t-off you can define a switch-off value. If the pressure in the respective measurement channel exceeds the switch-off value, the PENNINGVAC sensors PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 and PTR237N are switched off.

7.3 General Parameters (PArA GEn)

With the aid of these parameters you can generally configure the instrument. The parameters apply to all measurement channels.

- Keep the pushbutton PARA depressed for approximately 2 seconds.
  The instrument is now in the parameter mode.
- Use the arrow pushbuttons so as to access the parameter group GEn.
- Press the pushbutton PARA to select the desired parameter.
  The name and the value of the parameter are displayed.
- Use the arrow pushbuttons so as to change the parameter setting.
- Repeat the steps so as to change further parameters of the parameter group.

7.3.1 Unit of Measurement (unit)

Unit of measurement for pressure values. This unit of measurement affects the displayed pressure values, threshold values etc.

Display	Description
bAr	Unit of measurement mbar
torr	Unit of measurement Torr
PA	Unit of measurement Pascal

Table 12 – Values for the parameter unit

The unit of measurement is indicated on the display (☞🕮 Figure 12, page 21).

7.3.2 Display Format (diGit)

Number of digits on the display.

Display	Description
2	2 digits, for example $2{,}5^{-1}$ or 370
3	3 digits, for example $2{,}47^{-1}$ or 373

Table 13 – Values for the parameter diGit

7.3.3 Display Brightness (bri)

Display brightness.

Display	Description
Hi	High brightness
Lo	Low brightness

Table 14 – Values for the parameter bri

7.3.4 Analog Output (AnALoG)

Voltage at the analog output.

Display	Description
Hi	Analog output voltage same as at the sensor output
Lo	Halved Analog output

Table 15 – Values for the parameter AnA

8. Maintenance and Service

8.1 Maintenance

8.1.1 General Maintenance Information

For external cleaning please only use a dry piece of cotton cloth. Do not use any aggressive or abrasive cleaning agents.

DANGER: Mains voltage
The instrument contains voltage carrying components inside. Do not insert any objects into the openings of the instrument. Protect the instrument against moisture. Do not open the instrument.

8.2 Troubleshooting

8.2.1 Fault Indication

A malfunction affecting the multichannel gauge is indicated by an error message on the display. (☞🕮 Chapter 8.2.2 Error Messages, page 35)

8.2.2 Error Messages

Error (display)	Fault cause and remedy
Err Lo	Significantly below the measurement range. The Ready relay switches off.
Err Hi	Significantly above the measurement range. The Ready relay switches off.
Err S	Sensor error. Malfunction affecting the connection to the sensor. The message will only be displayed in the display field for the affected measurement channel. Acknowledge by pressing any key.
no SEn	No sensor connected to the measurement channel. The status message disappears after 30 seconds.
notr iG	Error affecting the switch-on or switch-off channel. No switch-on or switch-off threshold has been defined for the PENNINGVAC sensors PTR81N, PTR225, PTR225N, PTR225S, PTR225SN, PTR237 or PTR237N.

Table 16 – Error messages

8.2.3 Help the Case of Faults

If the malfunction persists even after having replaced the sensors, please contact your nearest Leybold GmbH service office.

8.2.4 Fuse Replacement

To replace blown fuses use only the type of fuse T1.6A H specified on the rear of the instrument. The two fuses of the instrument are located in the fuse insert at the mains filter (☞🕮 Figure 7, page 18), which may be levered out using a small screwdriver.

8.2.5 Repair

Send defective products for repair to your nearest Leybold GmbH service office. The company Leybold GmbH will not assume any responsibility or honour a warranty if the operator or third persons have attempted repair work on the multichannel gauge.

9. Storing and Waste Disposal

9.1 Packaging

Please retain the original packaging. You will need this packaging material when wanting to store the multichannel gauge or when returning it to the Leybold GmbH.

9.2 Shelving

The multichannel gauge must only be stored in dry room. During storage, the following ambient conditions need to be maintained:

- Ambient temperature: -20 – +60 °C
- Humidity of the air: As low as possible.
  Preferably in a sealed plastic bag with desiccant.

9.3 Waste Disposal

As to waste disposal, the branch-specific and local waste disposal and environment regulations for equipment containing electronic components apply.
When returning the equipment to the Leybold GmbH, proper and professional separation of the recyclable fraction and its disposal is ensured.

Leybold

CE

EU Declaration of Conformity

(Translation of original Declaration of Conformity)

The manufacturer:

Leybold GmbH
Bonner Strasse 498
D-50968 Köln
Germany

herewith declares that the products specified and listed below which we have placed on the market, comply with the applicable EU Council Directives. This declaration becomes invalid if modifications are made to the product without agreement of Leybold GmbH.

Product designation:	Vacuum gauge controller
Type designation:	DISPLAY TWO, DISPLAY THREE
Part numbers:	230024, 230025

The products complies to the following European Council Directives:

Low Voltage Directive (2014/35/EU)

Electromagnetic Compatibility (2014/30/EU)

RoHS Directive (2011/65/EU)

The following harmonized standards have been applied:

EN 61010-1:2010	Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 1: General requirements
EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use — EMC requirements — Part 1: General requirements Emissions: Group 1, Class B Immunity: Industrial electromagnetic environment

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Declaration of Contamination of Compressors, Vacuum Pumps and Components

The repair and / or servicing of compressors, va cuum pumps and components will be carried out only if a correctly completed de claration has been submitted. Non-completion will result in delay. The manufacturer can refuse to accept any equipment without a declaration.
A separate declaration has to be completed for each single component.
This declaration may be completed and signed only by authorized and qualified staff.

Customer/Dep./Institute :
Address :
Person to contact:
Phone : Fax:
End user:

Reason for return: ☒ applicable please mark
Repair: ☐ chargeable ☐ warranty
Exchange: ☐ chargeable ☐ warranty
☐ Exchange already arranged / received
Return only: ☐ rent ☐ loan ☐ for credit
Calibration: ☐ DKD ☐ Factory-calibr.
☐ Quality test certificate DIN 55350-18-4.2.1

A. Description of the Leybold product:

Material description :
Catalog number:
Serial number:
Type of oil (ForeVacuum-Pumps) :

Failure description:
Additional parts:
Application-Tool:
Application- Process:

B. Condition of the equipment

	No [1]	Yes	No
1. Has the equipment been used	☐	☐	
2. Drained (Product/service fluid)		☐	☐
3. All openings sealed airtight		☐	
4. Purged		☐	☐

If yes, which cleaning agent
and which method of cleaning

[1] If answered with "No", go to D.

Contamination :	No [1]	Yes
toxic	☐	☐
corrosive	☐	☐
flammable	☐	☐
explosive [2]	☐	☐
radioactive [2]	☐	☐
microbiological [2]	☐	☐
other harmful substances	☐	☐

C. Description of processed substances (Please fill in absolutely)

1. What substances have come into contact with the equipment ?
   Trade name and / or chemical term of service fluids and substances processed, properties of the substances
   According to safety data sheet (e.g. toxic, inflammable, corrosive, radioactive)

X	Tradename:	Chemical name:
a)		
b)		
c)		
d)		

	No	Yes
2. Are these substances harmful ?	☐	☐
3. Dangerous decomposition products when heated ?	☐	☐

If yes, which ?

[2] Components contaminated by microbiological, explosive or radioactive products/substances will not be accepted without written evidence of decontamination.

D. Legally binding declaration

I / we hereby declare that the information supplied on this form is accurate and sufficient to judge any contamination level.

Name of authorized person (block letters) :

Date

signature of authorized person

firm stamp

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