Leybold

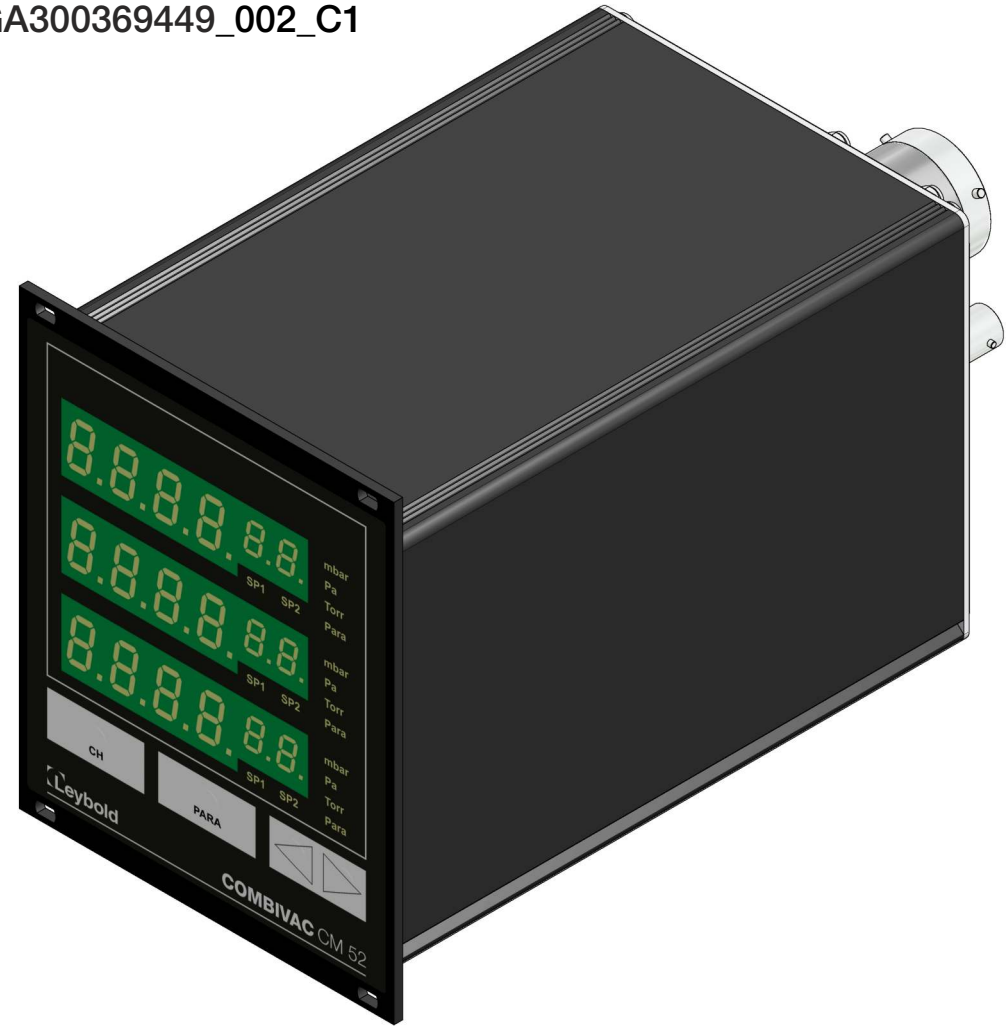
COMBIVAC CM 52

Vacuum Gauge Controller

Instruction Manual GA300369449_002_C1

Catalog No.

230115
230116



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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
230115	COMBIVAC CM 52 Three-channel measuring instrument for passive vacuum sensors	1.0 et seq.	100 et seq.
230116	COMBIVAC CM 52 Three-channel measuring instrument for passive vacuum sensors with Profibus DP	1.0 et seq.	100 et seq.

Table 1 – Part Numbers

1.1.2 Nameplate

A nameplate is located on the bottom side of the instrument. When communicating with 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 COMBIVAC CM 52 is a universal vacuum gauge which by combining two principles of measurement – Pirani (Thermovac) and ionisation gauge (Ionivac) provides full coverage and control over vacuum pressures ranging between $1 \cdot 10^{-12}$ mbar and atmospheric pressure. One IONIVAC sensor (Extractor or Bayard-Alpert) or a maximum of 2 THERMOVAC sensors can be connected.
The built-in RS232/RS485 as well as Profibus-DP interfaces permit computer-controlled operation as well as the exchange of the measurement data between the COMBIVAC CM 52 and a computer.

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 Responsibility and Warranty

The 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.

1.4 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 COMBIVAC CM 52 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 COMBIVAC CM 52.

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 COMBIVAC CM 52

This combination instrument offers three measurement channels, two THERMOVAC and one IONIVAC. Thus, measurements and checking of vacuum pressures over 15 full decades from $1 \cdot 10^{-12}$ to atmospheric pressure is possible. Six switching thresholds permit the integration of the COMBIVAC CM 52 within complex vacuum control facilities. The two THERMOVAC channels are immediately active upon powering up. The IONIVAC channel may be switched on and off by one of the two THERMOVAC channels or externally or manually. The operating status of the switching thresholds and the measurement systems is displayed and signalled corre-spondingly through the outputs.

3.2 THERMOVAC (Pirani) Method of Measurement

This method of measurement covering the range of $5 \cdot 10^{-4}$ to $1 \cdot 10^{3}$ mbar utilises the heat conductance of the gas for the purpose of measuring its pressure. In order to attain a response time which is as short as possible, all THERMOVAC instruments rely exclusively the principle of the controlled Pirani where the measurement filament is part of a Wheatstone Bridge. When the temperature of the filament changes due to pressure changes, then the bridge is unbalanced. The quickly responding control circuitry adapts the heating power for the filament so that the filament temperature again reaches its nominal level thereby balancing the measurement bridge again. The displayed pressure is dependent on the type of gas. By default the display of the instruments has been calibrated for nitrogen, respectively air.

3.3 Principle of Measurement for IONIVAC (Extractor or Bayard-Alpert)

This principle of measurement relies on the ionisation probability of gases which is here used for measuring pressures. The ion current produced during ionisation is output as a signal which is proportional to the pressure. The Bayard-Alpert gauge head (IE 414) is suited for pressure measurements in the high vacuum and ultra-high vacuum ranges. The Extractor gauge head (IE 514) has been specially designed for measurements in the UHV and XHV ranges.

3.4 Connectable Gauge Heads

The following gauge heads can be operated by the COMBIVAC CM 52:

Gauge heads	Type	Catalog number
THERMOVAC	TR 211, DN 16 KF	157 85
	TR 211, 1/8“ NPT	896 33
	TR 212, DN 16 KF	158 52
	TR 212, DN 16 CF	157 86
	TR 216, DN 16 KF	157 87
IONIVAC (BAYARD-ALPERT)	IE 414, DN 40 CF	158 66
IONIVAC (EXTRAKTOR)	IE 514, DN 40 CF	158 67

Table 2 – Connectable gauge heads

3.5 Gauge Head Cables

Designation	Specification	Catalog number
Gauge head cables THERMOVAC	5 m	162 26
	10 m	162 27
	15 m	124 34
	20 m	162 28
	30 m	124 35
	50 m	124 37
	75 m	124 38
	100 m	124 39
Gauge head cables to IONIVAC	5 m	158 68
	10 m	150 88
	5 m, bakeable up to 200 °C	158 44
Extension cables for IONIVAC	10 m	245 002
	20 m	200 02 937
	50 m	245 010 V01
	up to 100 m (application dependent)	upon request

Table 3 – Gauge head cables

3.6 Accessories

Designation	Specification	Catalog number
Options	Installation frame 19“	161 00
	Blank panel 1/4 19“	161 02

Table 4 – Accessories

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 HE) Depth: 185.0 mm
Wight:	≤ 1.4 kg
Installation depth:	≤ 280 mm approx. (including connected plugs)
Usage:	Rack installation Front panel installation Benchtop instrument

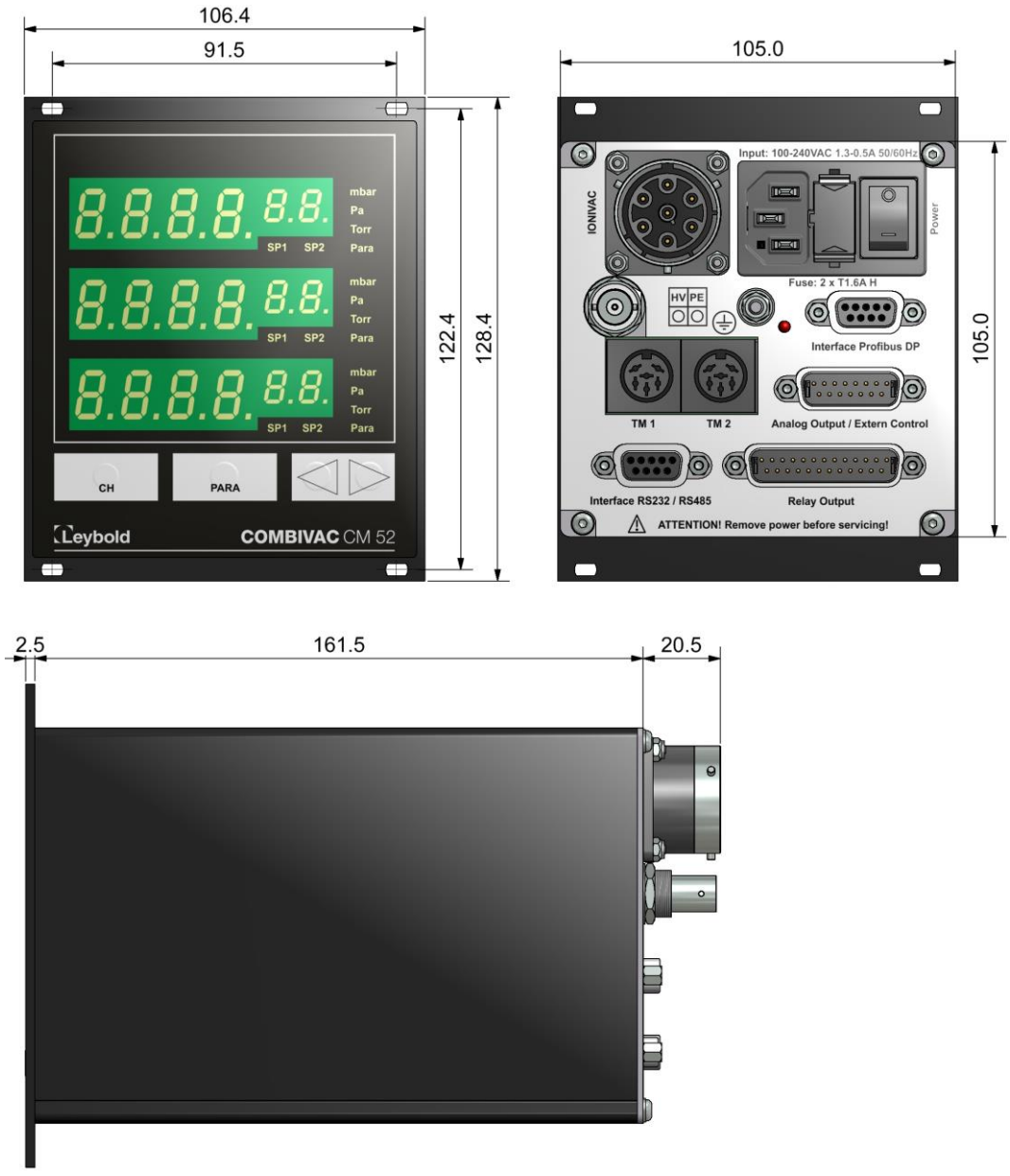


Figure 2 – COMBIVAC CM 52 dimensions (in mm)

4.1.2 Standard Parameters (factory defaults)

4.1.2.1 Sensor-dependent Parameters

Parameter	Parameter description	THERMOVAC setting	IONIVAC setting
SP 1 Lo	Switching thresold 1 – lower threshold	5.0 $^{-3}$	1.0 $^{-8}$
SP 1 Hi	Switching thresold 1 – upper threshold	5.5 $^{-3}$	1.1 $^{-8}$
SP2 Lo	Switching thresold 2 – lower threshold	5.0 $^{-3}$	1.0 $^{-8}$
SP2 Hi	Switching thresold 2 – upper threshold	5.5 $^{-3}$	1.1 $^{-8}$

Table 5 – Switching parameters, factory defaults

Parameter	Parameter description	THERMOVAC setting	IONIVAC setting
FiL	THERMOVAC filament material	tu (tungsten)	-
FiLt	Filter factor	-	15
GAStY	THERMOVAC gas type correction characteristic	n2 (nitrogen)	-
GAS iE	IONIVAC gas type correction factor	-	1.00
S-on	Switch-on type for sensor	-	CH2
S-oFF	Switch-off type for sensor	-	HAnd (IE 514) CH2 (IE 414)
SEnS	Sensitivity for IONIVAC gauge head	-	6.25 (IE 514) 17 (IE 414)

Table 6 – Sensor parameters, factory defaults

4.1.2.2 General Parameters

Parameter	Parameter description	Setting
unit	Displayed unit of measurement	bAr
AnALoG	Analog output	2 (CM 52)
dIGit	Number of displayed digits	3
bri	Display brightness	Hi
Adr Pb	Profibus address	7
bAud	Baud rate	19.2
rS	Serial interface	232

Table 7 – General parameters, factory defaults

4.1.3 Environment

Temperature:	Storage: -20 – +60 °C
Operation:	+5 – +50 °C (sea level) +5 – +30 °C (2000 m above sea level)
Relative atmospheric humidity:	max. 80 % (up to 30 °C) decreasing to max. 50 % (from 40 °C)
Usage:	in interior rooms (height 2000 m max. above sea level)
Protection category:	IP40

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
- Conformity with respect to WEEE Directive 2012/19/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 VAC
Frequency:	50/60 Hz
Fuses:	2 x T1.6A H
Power consumption:	< 60 W
Current consumption:	1.3 – 0.5 A approx.
Overvoltage category:	II
Protection category:	1
Connection:	Cold-device plug IEC 60320 C14

4.3 Measurement Channels

Number:	2 THERMOVAC measurement channels 1 IONIVAC measurement channel
Connection:	6-way DIN socket for THERMOVAC Metalock Bantam UTG0187SVDEU + BNC for IONIVAC

4.3.1 TM Measurement Channels

Measurement range:	$5 \cdot 10^{-4}$ – 1000 mbar
Measurement inaccuracy:	± 20 % of measured value (10^{-3} – 10^{-2} mbar) ± 15 % of measured value (10^{-2} – 10^{2} mbar)
Cable length:	up to 100 m
Cable length alignment:	automatic

4.3.2 IONIVAC Measurement Channel

		Extraktor (IE514)	**Bayard-Alpert** (IE414)
Measurement range:		$2 \cdot 10^{-12}$ – $1 \cdot 10^{-4}$ mbar	$2 \cdot 10^{-11}$ – $1 \cdot 10^{-2}$ mbar
Measurement inaccuracy:		± 2% of measured value, ± $5 \cdot 10^{-13}$ mbar	± 2 % of measured value, ± $3 \cdot 10^{-13}$ mbar
Filter time constant:		15 … 7 … 3 … 1 (slow … fast)	
Anode voltage:	Operation:	220 V	220 V
	Degassing:	480 V	480 V
Reflector voltage:	Operation:	205 V	
Cathode voltage:	Operation:	100 V	80 V
	Degassing:	10 V	20 V
Emission current:	Operation:	1.6 mA	100 µA / 10 mA
	Degassing:	45 mA	90 mA
Switching point of emission current:			100 µA ▸ 10 mA: $1 \cdot 10^{-6}$ mbar 10 mA ▸ 100 µA: $1 \cdot 10^{-5}$ mbar
Cable length:	up to 50 meters		

4.3.3 Measurement

Display rate:	$4\ s^{-1}$
Unit of measurement:	mbar, Pa, Torr

4.4 Switching Functions / Relay Outputs

4.4.1 Switching Function Relay

Number:	6	
Assignment:	2 per channel	
Response time:	< 50 ms	
Adjustment range:	EXTRAKTOR	$1 \cdot 10^{-11}$ – $1 \cdot 10^{-4}$ mbar
	BAYARD-ALPERT	$1 \cdot 10^{-8}$ – $5 \cdot 10^{-3}$ mbar
	THERMOVAC	$5 \cdot 10^{-3}$ – $5 \cdot 10^{2}$ mbar
Hysteresis:	adjustable ≥ 10 % of measured value	
Contact type:	changeover contact, floating	
Load (resistive):	Switched current:	1 A max.
	Switched voltage:	max. 30 VAC / 30 VDC
Service life:	Mechanical:	$5 \cdot 10^{6}$ switching cycles
	Electrical:	10^{5} switching cycles at maximum load
Connection:	SUB-D, 25-way, plug	

4.4.2 Ready Signal Relay

Number :	3
Assignment:	1 per channel
Response time:	< 50 ms
Contact type:	normally open contact, floating
Load (resistive):	Switched current: 1 A max.
	Switched voltage: max. 30 VAC / 30 VDC
Service life:	Mechanical: $5 \cdot 10^{6}$ switching cycles
	Electrical: 10^{5} switching cycles at maximum load
Connection:	SUB-D, 25-way, plug

4.5 Outputs and Inputs

4.5.1 Analog Output

Number: 1 per measurement channel
Voltage range: 0 – 10 VDC (limit values 0 – 10.5 VDC)
Output voltage for fault: 10.2 – 10.5 VDC
Deviation of display value: ± 0.2 %
Internal resistance: 100 Ohm
Characteristic: logarithmic

Measurement Channel	AnALoG 1 (CM 31 for TM only)	AnALoG 2 (CM 52)
IONIVAC	1.0 VDC/decade (0 V ≙ $1 \cdot 10^{-12}$ mbar) $p = 10^{-12}$ mbar $\cdot 10^{U[V]}$ $p = 10^{-10}$ Pa $\cdot 10^{U[V]}$ $p = 0.75 \cdot 10^{-13}$ Torr $\cdot 10^{U[V]}$	1.0 VDC/decade (0 V ≙ $1 \cdot 10^{-12}$ mbar) $p = 10^{-12}$ mbar $\cdot 10^{U[V]}$ $p = 10^{-10}$ Pa $\cdot 10^{U[V]}$ $p = 0.75 \cdot 10^{-13}$ Torr $\cdot 10^{U[V]}$
THERMOVAC	1.67 VDC/decade (0 V ≙ $1 \cdot 10^{-3}$ mbar) $p = 10^{-3}$ mbar $\cdot 10^{(U[V]/1.67V)}$ $p = 10^{-1}$ Pa $\cdot 10^{(U[V]/1.67V)}$ $p = 0.75 \cdot 10^{-3}$ Torr $\cdot 10^{(U[V]/1.67V)}$	1.286 VDC/decade (1.9 V ≙ $5 \cdot 10^{-4}$ mbar) $p = 5 \cdot 10^{-4}$ mbar $\cdot 10^{((U[V]-1.9V)/1.286V)}$ $p = 5 \cdot 10^{-2}$ Pa $\cdot 10^{((U[V]-1.9V)/1.286V)}$ $p = 3.75 \cdot 10^{-4}$ Torr $\cdot 10^{((U[V]-1.9V)/1.286V)}$

Response time: 100 ms approx.
Resolution: 10 Bit
Connection: SUB-D, 15-way, plug (jointly used together with the connection for external control)

4.5.2 External Control

PLC compatible logic level: (Low) < 7 VDC; 0 A
(High) > 13 VDC; 7 mA (at 24 V DC)
Contact via relay: 24 VDC approx., is provided by the instrument via a self-resetting fuse (100 mA)
Connection: SUB-D, 15-way, plug (jointly used with the analog output connection)

4.5.3 Serial Interfaces

4.5.3.1 RS232

Standard: RS232
Parameters: 8 data bits, 1 stop bit, no parity, no protocol
Signals: RXD and TXD
Baud rate: 9600, 19200, 38400 baud
Connection: SUB-D, 9-way, socket (jointly used with RS485)

4.5.3.2 RS485

Standard: RS485 (half-duplex)
Parameters: 8 data bits, 1 stop bit, no parity, no protocol
Signals: A and B
Baud rate: 9600, 19200, 38400 baud
Connection: SUB-D, 9-way, socket (jointly used with RS232)

4.5.4 Profibus-DP

Standard: Profibus-DP
Connection: SUB-D, 9-way, socket

5. Installation

5.1 Supplied Equipment

Designation	Quantity
COMBIVAC CM 52 or CM 52PB	1
Mains cord with shockproof plug (EU)	1
Mains cord with shockproof plug (US)	1
Operating Instructions (each GER and ENG)	1
Spare fuses	2
Neck collar screws	4
Plastic sleeves	4
Edge protection	2
Adhesive feet	2

Table 8 – Supplied equipment

5.2 Mechanical Installation

The COMBIVAC CM 52 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 COMBIVAC CM 52 has been designed for installation within a sub-rack (19", 3 HU) in accordance with DIN EN 60297 (IEC 60297) (☞🕮 Figure 3, page 19). For this purpose the supplied equipment includes four neck collar screws and four plastic sleeves.

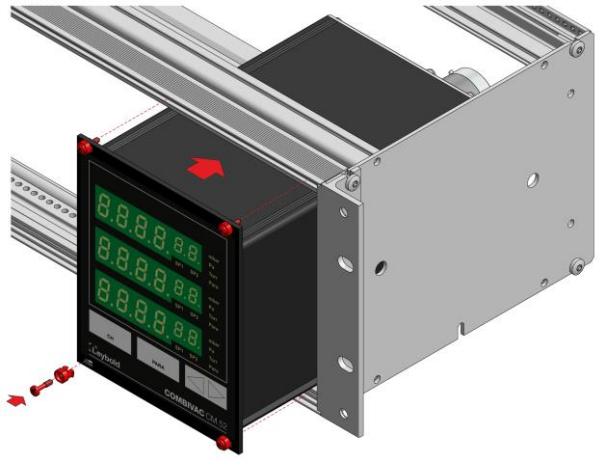


Figure 3 – Rack installation

- Attach the sub-rack within the rack.
- Push the COMBIVAC CM 52 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 19) is required:

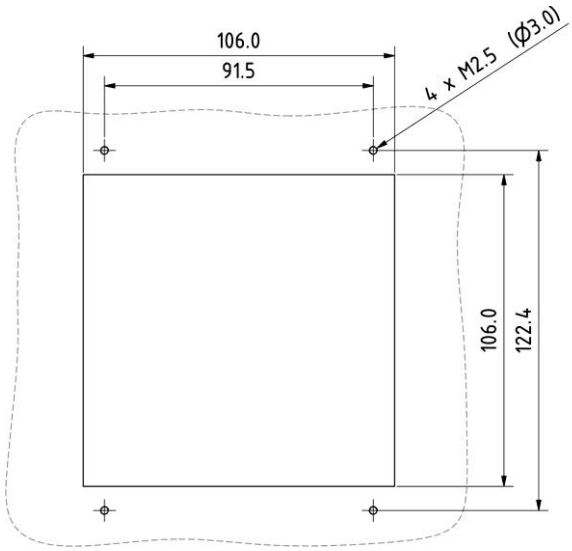


Figure 4 – Front panel cutout dimensions (in mm)

- Guide the COMBIVAC CM 52 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 intending to use the COMBIVAC CM 52 as a benchtop instrument, then 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 20)
- Place the COMBIVAC CM 52 on its back (☞🕮 Figure 6, page 20)
- 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 COMBIVAC CM 52 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

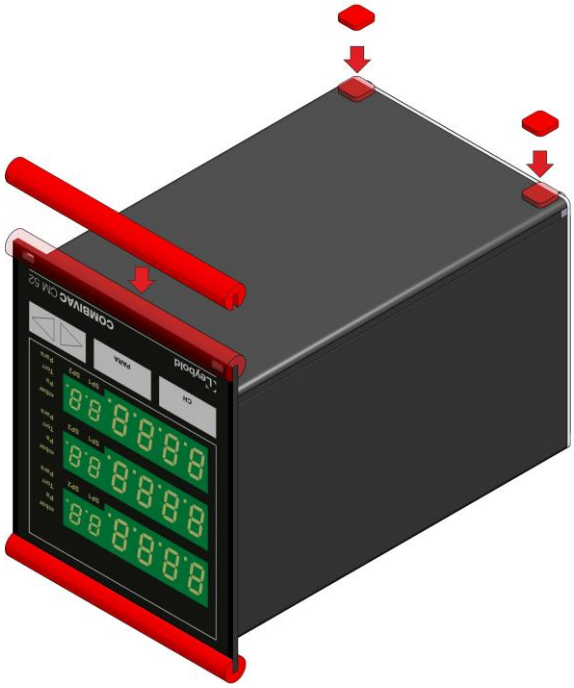


Figure 6 – Preparing the bottom side of the instrument for utilisation as a benchtop unit

- Turn the COMBIVAC CM 52 over again and move it to the desired place.

5.3 Connections

5.3.1 Rear Side of the Instrument

The Figure 7, page 21 shows the rear panel of the COMBIVAC CM 52. The way in which the individual connections have been wired is described in the following sections.

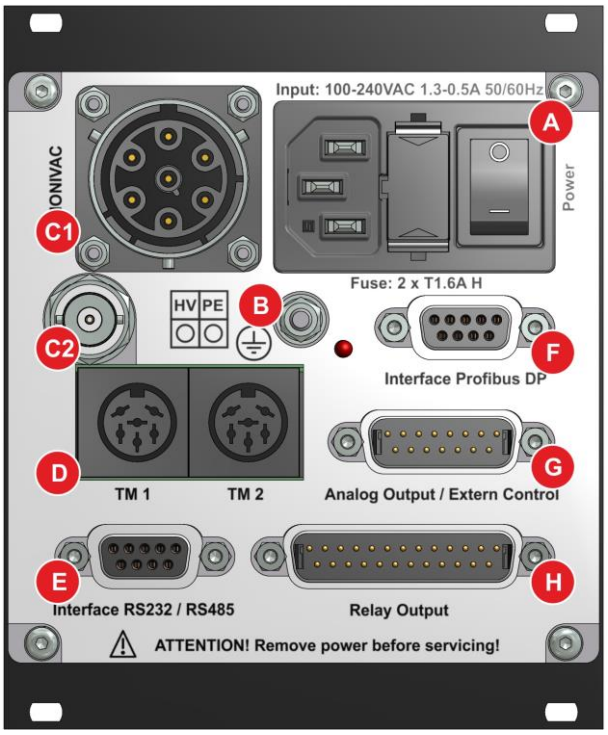


Figure 7 – Rear panel of the instrument

A	Mains connection with mains switch and fuses
B	Ground connection and shield of the TM measurement cables
C1	Control signal connection for IONIVAC gauge head (IONIVAC)
C2	Measurement signal connection for IONIVAC gauge head (IONIVAC)
D	Connections for the THERMOVAC gauge heads (TM1, TM2)
E	Connection for the RS232 or RS485 interface
F	Connection for the Profibus-DP interface with error indicator (red LED) - optional
G	Connection for analog output and external control
H	Connection for relay output

5.3.2 Mains Connection

The mains connection on the rear panel (☞🕮 Figure 7, A, page 21) is intended only for a mains cord which on the instrument side is provided with a inlet connector for non-heating apparatus.

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

The COMBIVAC CM 52 is earthed with the aid of the earth connection screw (☞📖 Figure 7, B, page 21) to the earth connection on 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 THERMOVAC Measurement Channels (TM 1 and TM 2)

The connections TM 1 and TM 2 (☞📖 Figure 7, D, page 21) serve the purpose of connecting two THERMOVAC gauge heads (☞📖 Chapter 3.4 Connectable Gauge Heads, page 12). For both measurement channels one each 6-way DIN socket is provided.

CAUTION: Impermissible Sensors.
Gauge heads which have not been designed to be operated in connection with the COMBIVAC CM 52 or which do not comply with current EMC guidelines can impair operation of the instrument or even damage it. Always operate the COMBIVAC CM 52 with approved gauge heads ☞📖 Chapter 3.4 Connectable Gauge Heads, page 12.

Connecting:

- TM 1: connect the gauge head using the corresponding connecting cable to connection TM1 on the rear of the COMBIVAC CM 52.
- TM 2: connect the gauge head using the corresponding connecting cable to connection TM2 on the rear of the COMBIVAC CM 52.

WARNING:
For utilisation of the connections TM1 and TM2 a special cable is required. The ground connection (☞📖 Figure 7, B, page 21) of the special cable must under all circumstances be connected to the ground connection on the rear of the instrument.

5.3.5 IONIVAC Measurement Channel (IONIVAC)

The connection marked IONIVAC (☞📖 Figure 7, C1 and 2, page 21) serves the purpose of connecting an Extractor or Bayard-Alpert gauge head (☞📖 Chapter 3.4 Connectable Gauge Heads, page 12).

Control signals
For this measurement channel a nine way socket of the type Metalock Bantam is available (☞📖 Figure 7, C1, page 21 and Figure 9, page 22).

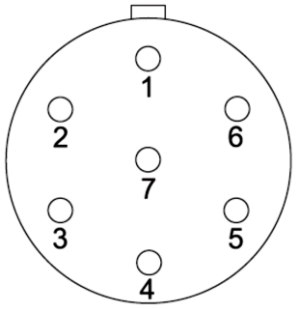


Figure 8 – Connection for the IONIVAC gauge head (Metalock Bantam UTG0187SVDEU)

1	Filament	5	Gauge head identification
2	Filament	6	Gauge head identification
3	Anode	7	Ground
4	Reflector		

Measurement signal
The measurement signal i.e. the ion current is transferred via a coaxial cable (☞📖 Figure 7, C1, page 21).

Pin assignment: Inside conductor: Ion current
Outside conductor: Shield

CAUTION: Impermissible Sensors.
Gauge heads which have not been designed to be operated in connection with the COMBIVAC CM 52 or which do not comply with current EMC guidelines can impair operation of the instrument or even damage it. Always operate the COMBIVAC CM 52 with approved gauge heads ☞📖 Chapter 3.4 Connectable Gauge Heads, page 12.

WARNING:
For utilising the connection IONIVAC, a special cable from the Leybold GmbH must be used.

Connecting:
- Connect the IONIVAC gauge head through the corresponding connecting cable to the connection IONIVAC on the rear of the COMBIVAC CM 52.

5.3.6 Analog Output and External Control (Analog Output / Extern Control)

The Connection Analog Output / Extern Control (☞📖 Figure 7, G, page 21 and Figure 9, page 23) provides the connections of the analog outputs for the signals of the individual measurement channels as well as the inputs for externally controlling the IONIVAC gauge.

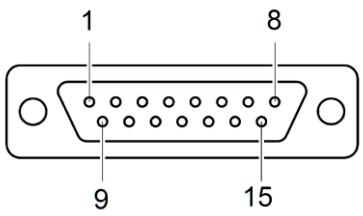
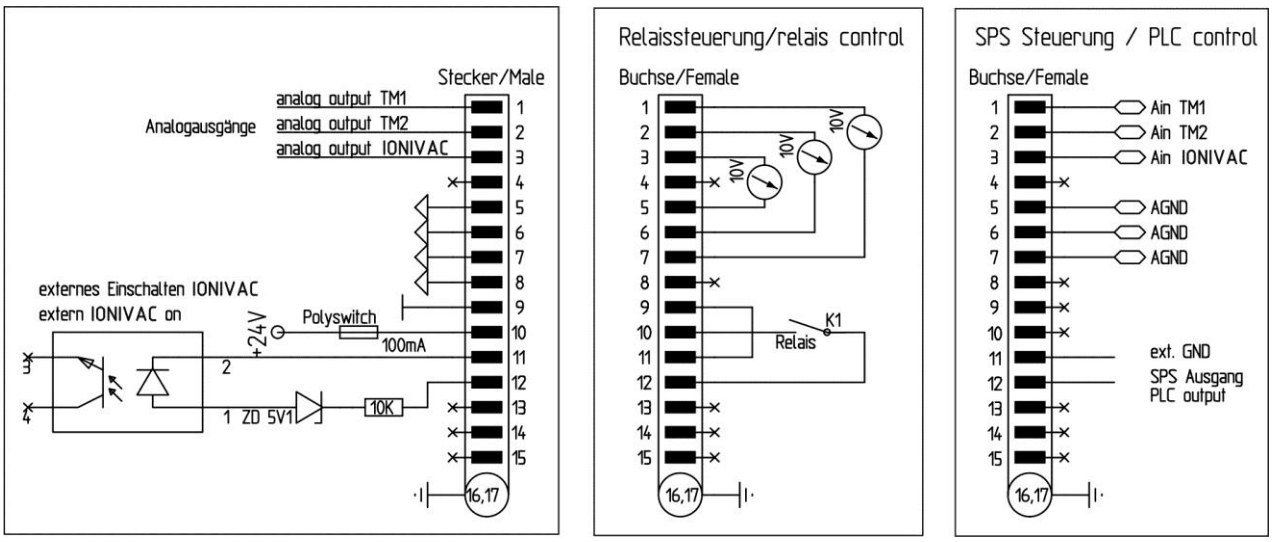


Figure 9 – Connection plug for analog output and external control (SUB-D, 15-way)



Connecting:

- Connect the peripheral components using a shielded connecting cable to the connection Analog Output/Extern Control on the rear of the COMBIVAC CM 52.

5.3.7 RS232 / RS485 Interface (Interface RS232 / RS485)

The connection Interface RS232 / RS485 (☞🕮 Figure 7, E, page 21 and Figure 10, page 24) permits operation of the instrument via a computer or a terminal.

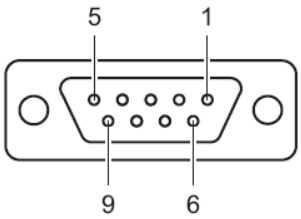


Figure 10 – Interface connection socket (SUB-D, 9-way)

1	B (RS485)	6	Link with 4
2	TxD (RS232)	7	Link with 8
3	RxD (RS232)	8	Link with 7
4	Link with 6	9	A (RS485)
5	Ground		

Connecting:

- Connect the serial interface of the computer using a shielded cable to the connection RS232/RS485 on the rear of the COMBIVAC CM 52.

WARNING:
When using the serial interface RS232 use a serial extension cable with a 9-way plug and a 9-way socket. The wires in the cable must not be crossed. Utilisation of the RS485 requires a special cable.

5.3.8 Profibus-DP Interface (Interface Profibus-DP)

The connection Interface Profibus DP (☞🕮 Figure 7, F, page 21 and Figure 10, page 24) provides full integration of the instrument within a Profibus-DP bus system.

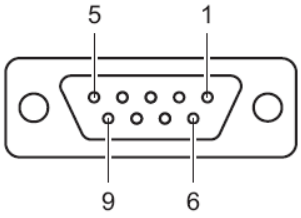


Figure 11 – Connection socket for Profibus DP interface (SUB-D, 9-way)

1	not used	6	+ 5 VDC
2	not used	7	not used
3	RxD / TxD-P	8	DGND
4	CNTR	9	DGND
5	DGND		

Connecting:

- Connect the bus system using a corresponding bus cable to the connection Profibus DP interface on the rear of the COMBIVAC CM 52.

WARNING:
For utilisation of the Profibus DP interface a standard compliant bus cable is required.

5.3.9 Relay Output (Relay Output)

Through the connection Relay Output (☞🕮 Figure 7, H, page 21 and Figure 12, page 25) you can utilise the floating relay contacts for switching purposes and ready signals.

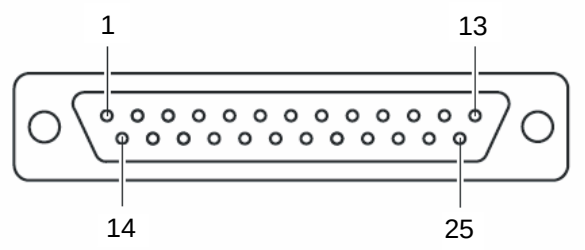
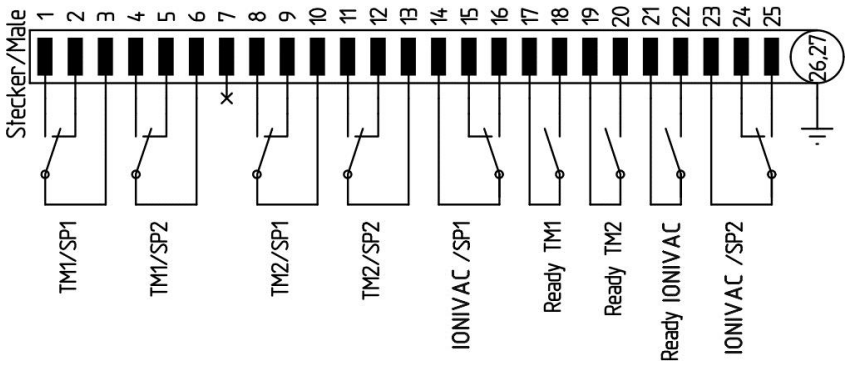


Figure 12 – Connection plug for relay output (SUB-D, 25-way)



	**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).

6. Operation

6.1 Front Panel

Figure 13, page 26 depicts the front panel of the COMBIVAC CM 52.

Figure 13 – Front panel

A Display of channel 1 with two corresponding switching thresholds and display unit
B Display of channel 2 with two corresponding switching thresholds and display unit
C Display of channel 3 with two corresponding switching thresholds and display unit
D Operating pushbuttons

6.1.1 Display

Display	Description
8.8.8.8.8.8	Measured value or status message When the measured value readout for measurement channel 3 flashes, then thedegassing function for the IONIVAC gauge head is active
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 9 – Display components

6.1.2 Control Pushbuttons

CH
With the pushbutton CH you can select a measurement channel. This is necessary, for example, when wanting to switch the IONIVAC gauge head on or off, or when wanting to change the sensor parameters. The number of the selected measurement channel is displayed flashing 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 IONIVAC gauge head on or off (☞🕮 Chapter 6.4.3.3 Switching the IONIVAC on and 6.4.3.5 Switching the IONIVAC off, page 30). 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

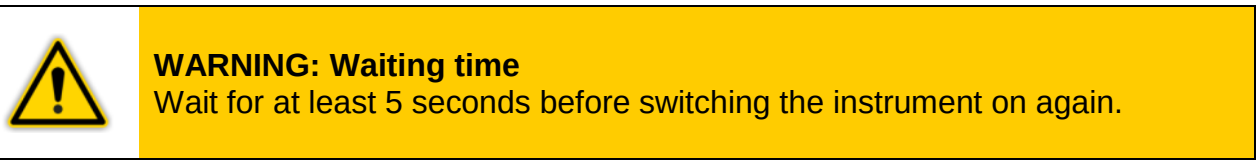
- Switch the instrument on through its mains switch.

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.



6.3 Operating Modes

The COMBIVAC CM 52 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 28

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 COMBIVAC CM 52. ☞🕮 Chapter 6.5 Parameter Mode, Page 32

6.4 Measurement Mode

6.4.1 Selection

After switching on the COMBIVAC CM 52 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 gauge heads 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
1000 mm	Above the permissible range (overrange)
8.888-8	Within the permissible range
c8.88-8	Below the permissible range (underrange)
S oFF	Gauge head has been switched off
HU on	IONIVAC is on

Table 10 – 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.

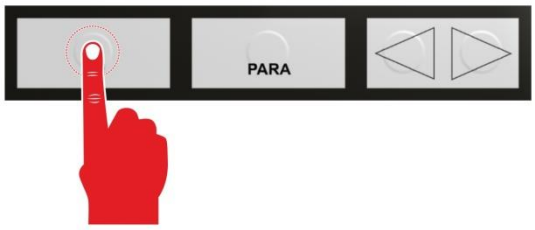


Figure 14 – Operating the pushbutton CHANNEL

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 32).
  - When not operating any pushbutton within 10 seconds, the instrument will then automatically return to the measurement mode.

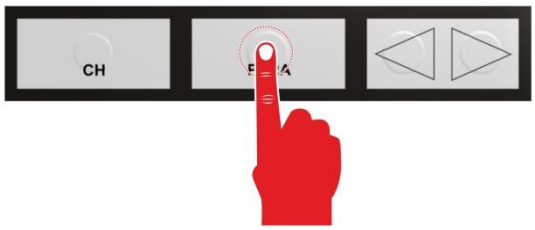


Figure 15 – Operating the pushbutton PARA

6.4.3.3 Switching the IONIVAC on

The IONIVAC gauge head can be switched on manually. For this, sensor control must be set to Hand (☞🕮 Chapter 7.2.5 Sensor Switch-on Type (S-on), page 38).

- Press the pushbutton CH so as to select measurement channel 3.
- Keep the key marked UP pressed for approximately two seconds.
  - The IONIVAC gauge head at measurement channel 3 is switched on. Either the measured value or a status message will be displayed (☞🕮 Table 10, Page 28).

Figure 16 – Operating the pushbutton UP

6.4.3.4 Funktion Degas

The IONIVAC gauge head can be cleaned by running the function Degas. For this the gauge head must be switched on (☞🕮 Chapter 6.4.3.3 Switching the IONIVAC on, page 30) and the measured pressure must be below < $5 \cdot 10^{-5}$ mbar.

- Press the pushbutton CH so as to select measurement channel 3.
- Keep the key marked UP pressed for approximately two seconds.
  - The function Degas at measurement channel 3 is switched on. The measured value readout for measurement channel 3 flashes (☞🕮 Table 9, page 26).
  - The process ends automatically after 2 minutes or can be terminated prematurely by pressing the pushbutton DOWN. Thereafter the gauge head will again be running in the measurement mode.

Figure 17 – Operating the pushbutton UP

6.4.3.5 Switching the IONIVAC off

The IONIVAC gauge head can be switched off manually.

For this, sensor control must be set to Hand (☞🕮 Chapter 7.2.8 Sensor Switch-off Type (S-oFF), page 39).

- Press the pushbutton CH so as to select measurement channel 3.
- Keep the key marked DOWN pressed for approximately two seconds.
  - The IONIVAC gauge head at measurement channel 3 is switched off. The display will indicate the status oFF.

Figure 18 – Operating the pushbutton DOWN

6.4.4 THERMOVAC Alignment

Ageing and contamination of the sensor filament will impair the accuracy of the pressure readout. For this it is recommended to align the THERMOVAC gauge head as required. For this, the gauge head must be orientated in the same way in which it is subsequently operated. The alignment process is run as follows:

- Vent and the vacuum apparatus and adjust the 100% potentiometer at the THERMOVAC gauge head so that the following readout is obtained:

Alignment too high

Alignment is precise

Alignment is too low

Figure 19 – Full-scale alignment for the THERMOVAC gauge head

- In order to ensure a stable but also precise alignment of the 100% point, the alignment potentiometer (100%) should be turned further by 90° in the clockwise direction after the indication of 1000 mbar has been displayed. Here the overrange indicator should just come on.
- Evacuate the vacuum apparatus to a pressure < $5 \cdot 10^{-4}$ mbar and adjust the “0” potentiometer at the THERMOVAC gauge head so that the following reading is attained:

Alignment too high

Alignment is precise

Alignment is too low

Figure 20 – Zero alignment for the THERMOVAC gauge head

- Vent the vacuum apparatus and check the 100% setting once more. Correct a possible deviation with the potentiometer.
- If a correction of the 100% setting was necessary, then repeat the Zero adjustment.

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 11, Page 32 depicts all available parameters.

Parameter Groups	Parameter
PArA SP	SP 1-L SP 1-H SP2-L SP2-H
PArA SEn	F iL F iLt GAS bn GAS iE S-on S-oFF SEnS
PArA GEn	un it AnALoG d iG it br i Adr Pb bAud rS

Table 11 – 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 34.

Sensor parameters (PArA SEn)
The parameters affect only the selected measurement channel. Per measurement channel, two switching functions are available. ☞🕮 Chapter 7.2 Sensor Parameters (PArA SEn), page 36.

General parameters (PArA GEn)
With the aid of these parameters you can generally configure the instrument. Parameters apply to all measurement channels. ☞🕮 Chapter 7.3 General Parameters (PArA GEn), page 40.

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.

7. Parameters

7.1 Switching Function Parameters (PArA SP)

In this parameter group you can configure the switching functions. The COMBIVAC CM 52 provides the following switching function parameters:

- SP1-Lo
- SP1-Hi

- SP2-Lo
- SP2-Hi

7.1.1 Basic Terms

Switching functions
The COMBIVAC CM 52 contains in all 6 switching function relays, i.e. the switching functions 1 and 2 are available for each measurement channel. These switch depending on the measured pressure. The contacts of the relays are floating and may be used for switching purposes through the connection marked Relay Output (☞🕮 Chapter 5.3.9 Relay Output (Relay Output), Page 25).

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 21, page 35).

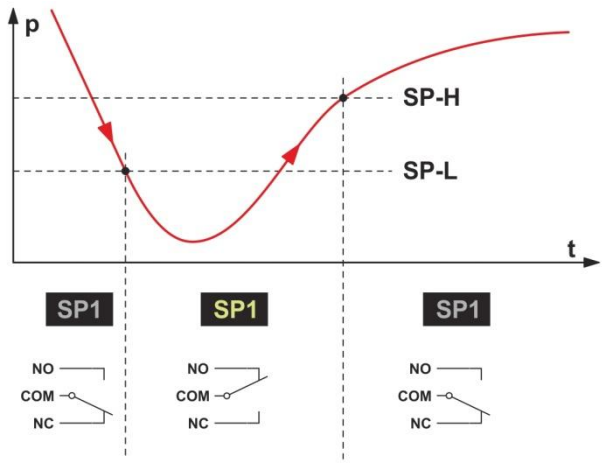


Figure 21 – Behaviour of a switching function in response to pressure changes

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 $5 \cdot 10^{2}$ und $1 \cdot 10^{-11}$ mbar. Hysteresis amounts to at least 10% of the lower threshold value.

CAUTION:
Select the thresholds for the Extractor gauge head in the range of $1 \cdot 10^{-11}$ to $1 \cdot 10^{-4}$ mbar, for the Bayard-Alpert gauge head in the range of $1 \cdot 10^{-8}$ to $5 \cdot 10^{-3}$ mbar and for the THERMOVAC gauge head in the range of $5 \cdot 10^{-3}$ to $5 \cdot 10^{-2}$ mbar.

7.2 Sensor Parameters (PArA SEn)

For each measurement channel there exists a separate set of sensor parameters. Depending on which transmitter is connected to the respective measurement channel, different parameters are available (☞🕮 Table 12, page 36).

Gauge heads	FIL	FILt	GASti	GASAE	S-on	S-oFF	SEnS
IONIVAC		✓		✓	✓	✓	✓
THERMOVAC	✓		✓				

Table 12 – 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 Filament Material THERMOVAC (FIL)

Filament material of the connected THERMOVAC gauge head.

Display	Description
tU	Tungsten TR 211, TR 212
Pt	Platinum TR 216

Table 13 – Values for the parameter FIL

7.2.2 Measured Value Filter (FiLt)

The measured values filter allows for improved evaluation of noisy signals or signals suffering interference. This filter is applied to the readout on the display and to the switching functions. However, the analogue outputs are not influenced by this filter.

For the measured values filter you may select between the values of **1**, **3**, **7** and **15**. Here **1** stands for **fast** and **15** for **slow**. In between values can be set up through **3** and **7**.

In the case of a two-digit readout, we recommend a filter factor of 3, for a three digit readout, a filter factor of 15.

7.2.3 Type of Gas Correction THERMOVAC (GAS^{tM})

The THERMOVAC gauge heads are normally calibrated for measurements in nitrogen or air. With the aid of the parameter GAS^{tM} you can set up the measurement channel to the other type of gas in each case. You may select the characteristic for a gauge head between nitrogen (N2) and argon (Ar).

For this proceed as follows:

- Select the parameter GAS^{tM}.
- Press the pushbutton PARA.
  - The setup characteristic is displayed.
- Use the arrow pushbuttons so as to change the characteristic.
  - The value of the parameter is changed.

7.2.4 Type of Gas Correction IONIVAC (GAS^{iE})

The IONIVAC gauge heads are normally calibrated for measurements in nitrogen or air. With the aid of the parameter GAS^{iE} you can set up the measurement channel to other types of gas.

For this proceed as follows:

- Select the parameter GAS^{iE}.
- Press the pushbutton PARA.
  - The setup characteristic is displayed.
- Use the arrow pushbuttons so as to change the characteristic.
  - The value of the parameter is changed.

You can set up the correction factor for a gauge head in the range of 0.2 – 1.0 – 8.0. The setting of 1.0 supplies the uncorrected measured value.

7.2.5 Sensor Switch-on Type (S-on)

This parameter defines how the IONIVAC gauge head is switched on.

You can set the switch-on time to the following values:

HAnd
Manual. The gauge head can be switched on by pressing the pushbutton UP (☞🕮 Chapter 6.4.3.3 Switching the IONIVAC on, page 29).

ECt
Externally through optocoupler (PLC compatible high-level > 13 VDC; 7 mA at 24 VDC).

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 TM1. With the aid of the next parameter t-on you can define a switch-on value. When the pressure in the measurement channel TM1 drops below the switch-on value, the sensor is switched on.

CH 2
Through measurement channel TM2. With the aid of the next parameter t-on you can define a switch-on value. When the pressure in the measurement channel TM2 drops below the switch-on value, the sensor is 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 or CH 2 (☞🕮 Chapter 7.2.5 Sensor Switch-on Type (S-on), page 38).

Through the parameter t-on you can define a switch-on value. When the pressure in the respective measurement channel drops below the switch-on value, the gauge head is switched on.

7.2.7 Switch-on Delay for Extractor Gauge Head (dELAy)

This parameter will only be displayed provided an Extractor gauge head has been connected and provided the sensor switch-on type has been set to CH1 or CH2 (☞🕮 Chapter 7.2.5 Sensor Switch-on Type (S-on), page 38).
Through the parameter dELAy the switch-on Delay for the Extractor gauge head is defined. You may set up switch-on delays within a range of 60 to 600 seconds. Resolution is one second. The default is 60 seconds.

The switch-on delay becomes effective from the point onwards when the switch-on value set according to Chapter 7.2.6 Sensor Switch-on Value (t-on), page 38 is enabled.

7.2.8 Sensor Switch-off Type (S-oFF)

This parameter defines how the IONIVAC gauge head is switched off.

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

HAnd
Manual. The gauge head can be switched off by pressing the pushbutton DOWN (☞🕮 Chapter 6.4.3.5 Switching the IONIVAC off, Page 30).

ECt
Externally through an optocoupler (PLC compatible low-level < 7 VDC; 0 A at 24 VDC).

SELF
Self-monitoring. With the aid of the next parameter t-off you can define a switch-off value. When the pressure at the gauge head exceeds the switch-off value then the gauge head is switched off.

CH 1
Through measurement channel TM1. With the aid of the next parameter t-off you can define a switch-off value. When the pressure in the measurement channel TM1 exceeds the switch-off value then the sensor is switched off.

CH 2
Through measurement channel TM2. With the aid of the next parameter t-off you can define a switch-off value. When the pressure in the measurement channel TM2 exceeds the switch-off value then the sensor is switched off.

7.2.9 Sensor Switch-off Value (t-off)

This parameter will only appear when the sensor switch-off type has been set to CH1 or CH2 (☞🕮 Chapter 7.2.8 Sensor Switch-off Type (S-oFF)Sensor Switch-off Type (S-oFF), Page 39).

Through the parameter t-off you can define a switch-off value. When the pressure in the respective measurement channel exceeds the switch-off value, the gauge head is switched off.

7.2.10 Sensitivity Setting for IONIVAC Gauge Head (SEnS)

Through this menu, you may adjust the sensitivity of the IONIVAC gauge head.
The sensitivity is adjusted through the respective sensor constant.

You may set up the sensor constant in the range 1.00 – 30.0 $mbar^{-1}$. Resolution is 0.01 $mbar^{-1}$ in the range between 1.00 – 9.99 and 0.1 $mbar^{-1}$ in the range 10.0 – 30.0. The default for the Extractor gauge head is 6.25 $mbar^{-1}$ and for the Bayard-Alpert gauge head it is 17 $mbar^{-1}$.

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 14 – Values for the parameter unit

The unit of measurement is indicated on the display (☞🕮 Figure 13, page 26).

7.3.2 Analog Output (AnALoG)

Analog output fort he gauge heads.

Display	Description
1	CM31 mode (☞🕮 Chapter 4.5.1 Analog Output, page 17)
2	CM52 mode (☞🕮 Chapter 4.5.1 Analog Output, page 17)

Table 15 – Values for the parameter AnALoG

7.3.3 Display Format (diGit)

Number of digits on the display.

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

Table 16 – Values for the parameter diGit

7.3.4 Display Brightness (bri)

Display brightness.

Display	Description
Hi	High brightness
Lo	Low brightness

Table 17 – Values for the parameter bri

7.3.5 Profibus (Pb)

Selection of the Profibus adress.

Display	Description
1 – 126	Adress 1 – 126

Table 18 – Values for the parameter Pb

CAUTION:
The changed Profibus bus address will only become effective after having restarted the instrument.

7.3.6 Baud Rate (bAud)

Baud rate oft he interface

Display	Description
9.6	Baud rate 9600 baud
19.2	Baud rate 19200 baud
38.4	Baud rate 38400 baud

Table 19 – Values for the parameter bAud

CAUTION:
The changed baud rate will only become effective after having restarted the instrument.

7.3.7 Interface (rS)

Selection of the interface.

Display	Description
232	Interface RS232
485	Interface RS485

Table 20 – Values for the parameter rS

8. Computer Interface

8.1 Basics

8.1.1 Connection

The COMBIVAC CM 52 can communicate with the computer through a serial interface. The interfaces RS232 or RS485 are selectively available. The selection is made through the parameter group PArA GEn in the parameter mode (☞🕮 Chapter 7.3 General Parameters (PArA GEn), page 40).
The respective connecting socket and the necessary connecting cable are described in the Chapter 5.3.7, page 24.

8.1.2 Nomenclature

The following terms and symbolical spellings are used in order to describe the computer interface:

Terms	Description
Send	Data transfer from the host to the instrument
receive	Data transfer from the instrument to the host
Host	Terminal (Computer)
ASCII	American Standard Code for Information Interchange

Table 21 – Terms Computer Interface

Square Brackets [...]
Square brackets mark parameters.

Sharp Brackets <...>
Abbreviations in sharp brackets mark control characters. The complete term including the sharp brackets is replaced by a numerical value.

Terms	Value	Description
<,>	0x2C	Separator
<CR>	0x0D	Terminator

Table 22 – Control Characters Computer Interface

8.2 Communication

8.2.1 Protocol

The following log is used for communication:

- 8 data bits
- no parity bit
- 1 stop bit

The baud rate is selectable.

- 9600
- 19200
- 38400

No hardware handshake is used. The messages are transferred by way of ASCII strings. A comma (0x2C) in the string is taken as a separating character. Space characters (0x20) or tabs (0x09) may be contained in the string. As to the communication, the computer is always the master. The input buffer of the computer must have a capacity of at least 50 bytes.

8.2.2 General String Structure

Input of ***Address*** is necessary for command input via RS485 only

Write command

S: ***Address*** **Command <,> [Parameter] <CR>**
E: **OK <CR>**

Reading command

S: ***Address*** **Command <CR>**
E: **[Parameter] <CR>**

Error code

E:	**? <*TAB*> X**	Incorrect command
E:	**? <*TAB*> P <,> <*TAB*> z**	Incorrect parameter , Parameter number of the transmitted command
E:	**? <*TAB*> C <,> <*TAB*> x**	Channel x on device not available
E:	**? <*TAB*> S <,> <*TAB*> x**	No sensor or unsuitable sensor on Channel x connected
E:	**? <*TAB*> K**	No divider in the command available

8.3 Command Set (Mnemonics)

8.3.1 Command Overview

Read Commands	Description
RPV	Read Pressure Value. Read the pressure value for a measurement channel.
RVN	Read Version Number Read the instrument software version number.
RSS	Read Setpoint Status Read the status of the switching thresholds for a channel.

Table 23 – Mnemonics for read commands

Write Commands	Description
SHV	Set HV on/off Switch the high voltage on or off for a channel.
SDG	Set Degas on/off Start or terminate the degas function.
SKL	Set Key Lock on/off Switch the keylock on or off.
SAC	Save Actual Configuration Save the current configuration for switching threshold, sensor and general parameters.

Table 24 – Mnemonics for write commands

Read and Write Commands	Description
RSA	Read Serial Address Read address for RS485.
SSA	Set Serial Address Set address for RS485.
RGP	Read General Parameter Read instrument settings.
SGP	Set General Parameter Set instrument settings.
RGC	Read Gas Correction Read type of gas correction factor for a measurement channel.
SGC	Set Gas Correction Set type of gas correction factor for a measurement channel.
RSC	Read Sensor Control Read type of sensor control for a measurement channel.
SSC	Set Sensor Control Set type of sensor control for a measurement channel.
RSP	Read Setpoint Read switching thresholds for a channel.
SSP	Set Setpoint Set switching thresholds for a channel.

Table 25 – Mnemonics for read and write commands

CAUTION:
All changes to values are only permanently saved to the EEPROM after having issued the write command SAC. For this reason after having set all values, save the current configuration through the SAC write command before restarting the instrument.

8.3.2 RPV (Read Pressure Value)

Reading a pressure value for a measurement channel.

S: **RPV[a]<CR>**

E: **b[,][TAB]x.xxxxE±xx**

Parameter	Description
a	Channel number 1 = Channel 1 (TM1) 2 = Channel 2 (TM2) 3 = Channel 3 (IONIVAC)
b	Status 0 = Measured value OK 1 = Measured value < measurement range 2 = Measured value > measurement range 3 = Measured values << measurement range (Err Lo) 4 = Measured values >> measurement range (Err Hi) 5 = Sensor off (S oFF) 6 = HV on (HU on) 7 = Sensor error (Err S) 9 = No sensor(no Sen) 10 = No switch-on or switch-off threshold (notriG) 12 = Pirani error (Err Pi) 16 = Measured value OK degas function
x.xxxxE±xx	Pressure value of the selected channel in the current unit of measurement

8.3.3 RVN (Read Version Number)

Reading the version number of the instrument software.

S: **RVN<CR>**

E: **x.xx<CR>**

Parameter	Description
x.xx	Version number

8.3.4 RSS (Read Set Point Status)

Reading the status of the switching thresholds for a channel.

S: **RSS[a]<CR>**

E: **b[,][TAB]c<CR>**

Parameter	Description
a	Channel number 1 = Channel 1 (TM1) 2 = Channel 2 (TM2) 3 = Channel 3 (IONIVAC)

Parameter (continued)	Description
b	Status SP1 0 = low 1 = high
c	Status SP2 0 = low 1 = high

8.3.5 SHV (Set HV on/off)

Setting HV on/off for IONIVAC, if switch-on and switch-off type have been set to manual.

S: **SHV[a, b]<CR>**

E: **OK<CR>**

Parameter	Description
a	Channel number 3 = Channel 3 (IONIVAC)
b	HV on/off 0 = off 1 = on

8.3.6 SDG (Set Degas on/off)

Start or terminate degas function.

S: **SDG[a, b]<CR>**

E: **OK<CR>**

Parameter	Description
a	Channel number 1 = Channel 3 (IONIVAC)
b	Degas on/off 0 = off 1 = on

8.3.7 SKL (Set Key Lock on/off)

Switching the keylock on or off.

S: **SKL[a]<CR>**

E: **OK<CR>**

Parameter	Description
a	Key lock 0 = off 1 = on

8.3.8 SAC (Save Actual Configuration)

Saving current configuration for switching threshold, sensor and general parameters.

S: **SAC<CR>**

E: **OK<CR>**

8.3.9 RSA (Read Serial Adress)

Read adress for RS485.

S: **RSA<CR>**

E: **a<CR>**

Parameter	Description
a	Adress 1 – 126 (01 – 7E) (output in the HEX format)

8.3.10 SSA (Set Serial Adress)

Setting adress for RS485.

S: **SSA[a]<CR>**

E: **OK<CR>**

Parameter	Description
a	Adress 1 – 126 (01 – 7E) (entry must be in the HEX format)

8.3.11 RGP (Read General Parameter)

Reading instrument settings.

S: **RGP<CR>**

E: **a[,][TAB]b[,][TAB]c[,][TAB]d[,][TAB]e[,][TAB]f[,][TAB]g <CR>**

Parameter	Description
a	Unit 0 = mbar 1 = Pa 2 = Torr
b	Analog output 0 = CM31 mode 1 = CM52 mode
c	Number of displayed digits 0 = 2 1 = 3

Parameter (continued)	Description
d	Brightness 0 = hoch 1 = gering
e	Profibus 1 – 126
f	Baud rate 0 = 9600 1 = 19200 2 = 38400
g	Serial interface 0 = RS232 1 = RS485

8.3.12 SGP (Set General Parameter)

Setting instrument settings.

S: **SGP[a, b, c, d, e, f, g]<CR>**

E: **OK <CR>**

Parameter	Description
a	Unit 0 = mbar 1 = Pa 2 = Torr X = Parameter remains unchanged
b	Analog output 0 = CM31 mode 1 = CM52 mode X = Parameter remains unchanged
c	Number of displayed digits 0 = 2 1 = 3 X = Parameter remains unchanged
d	Brightness 0 = high 1 = low X = Parameter remains unchanged
e	Profibus 1 – 126
f	Baud rate 0 = 9600 1 = 19200 2 = 38400 X = Parameter remains unchanged
g	Serial interface 0 = RS232 1 = RS485 X = Parameter remains unchanged

CAUTION:
Changes to the parameters baud rate and Profibus address become only effective after having restarted the instrument. Before restarting, save the current configuration using the SAC write command.

8.3.13 RGC (Read Gas Correction)

Reading the type of gas correction factor for a measurement channel.

S: **RGC[a]<CR>**

E: **b<CR>**

Parameter	Description
a	Channel number 3 = Channel 3 (IONIVAC)
b	Gas type correction factor channel Format X.XX with a range of values 0.20 – 8.00

8.3.14 SGC (Set Gas Correction)

Setting the type of gas correction factor for a measurement channel.

S: **SGC[a, b]<CR>**

E: **OK<CR>**

Parameter	Description
a	Channel number 3 = Channel 3 (IONIVAC)
b	Gas type correction factor channel Format X.XX with a range of values 0.20 – 8.00

8.3.15 RSC (Read Sensor Control)

Reading the type of sensor control for IONIVAC.

S: **RSC[a]<CR>**

E: **b[,][TAB]c[,][TAB]x.xxxxE±xx[,][TAB]x.xxxxE±xx<CR>**

Parameter	Description
a	Channel number 3 = Channel 3 (IONIVAC)
b	Sensor switch-on type channel 0 = Manual 1 = External 2 = n.a. 3 = Through channel 1 4 = Through channel 2
c	Sensor switch-off type channel 0 = Manual 1 = External 2 = Self-monitoring 3 = Through channel 1 4 = Through channel 2
x.xxxxE±xx	Switch-on value in the current unit of measurement
x.xxxxE±xx	Switch-off value in the current unit of measurement

8.3.16 SSC (Set Sensor Control)

Setting the type of sensor control for IONIVAC.

S: **SSC[a, b, c, x.xxxxE±xx, x.xxxxE±xx]<CR>**

E: **OK<CR>**

Parameter	Description
a	Channel number 3 = Channel 3 (IONIVAC)
b	Sensor switch-on type channel 0 = Manual 1 = External 2 = n.a. 3 = Through channel 1 (TM1) 4 = Through channel 2 (TM2)
c	Sensor switch-off type channel 0 = Manual 1 = External 2 = Self-monitoring 3 = Through channel 1 (TM1) 4 = Through channel 2 (TM2)
x.xxxxE±xx	Switch-on value in the current unit of measurement
x.xxxxE±xx	Switch-off value in the current unit of measurement

8.3.17 RSP (Read Set Point)

Reading the switching thresholds for a channel.

S: **RSP[a]<CR>**

E: **b[,][TAB]c[,][TAB]d[,][TAB]e<CR>**

Parameter	Description
a	Channel number 1 = Channel 1 (TM1) 2 = Channel 2 (TM2) 3 = Channel 3 (IONIVAC)
b	SP1 low (pressure value of the switching threshold in the current unit of measurement in the form of x.xxxxE±xx)
c	SP1 high (pressure value of the switching threshold in the current unit of measurement in the form of x.xxxxE±xx)
d	SP2 low (pressure value of the switching threshold in the current unit of measurement in the form of x.xxxxE±xx)
e	SP2 high (pressure value of the switching threshold in the current unit of measurement in the form of x.xxxxE±xx)

8.3.18 SSP (Set Set Point)

Setting the switching thresholds for a channel.

S: **SSP[a, b, c, d, e]<CR>**

E: **OK<CR>**

Parameter	Description
a	Channel number 1 = Channel 1 (TM1) 2 = Channel 2 (TM2) 3 = Channel 3 (IONIVAC)
b	SP1 low (pressure value of the switching threshold in the current unit of measurement in the form of x.xxxxE±xx)
c	SP1 high (pressure value of the switching threshold in the current unit of measurement in the form of x.xxxxE±xx)
d	SP2 low (pressure value of the switching threshold in the current unit of measurement in the form of x.xxxxE±xx)
e	SP2 high (pressure value of the switching threshold in the current unit of measurement in the form of x.xxxxE±xx)

9. Maintenance and Service

9.1 Maintenance

9.1.1 General Maintenance Information

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

DANGER: Mains voltage
The instrument contains inside components at a high voltage. Never introduce any objects into the openings of the instrument. Protect the instrument against moisture. Do not open the instrument.

9.2 Troubleshooting

9.2.1 Fault Indication

A malfunction affecting the COMBIVAC CM 52 is indicated by an error message on the display. (☞🕮 Chapter 9.2.2 Error Messages, page 52)

9.2.2 Error Messages

Error (display)	Fault cause and remedy
Err Lo	Measurement signal from the gauge head significantly below the permissible range.
Err Hi	Measurement signal from the gauge head significantly above the permissible range.
Err S	Sensor error. Malfunction affecting the connection to the gauge head. The message will only be displayed in the display field for the affected measurement channel. Acknowledge by pressing any key.
Err P	Pressure Error. Shutdown of the IONIVAC gauge head by a pressure value which is much too high. Acknowledge by pressing any key.
Err 01	Anode voltage error. Anode voltage under minimum. Acknowledge by pressing any key.
Err 02	Anode voltage error. Anode voltage over maximum. Acknowledge by pressing any key.
Err 04	Bias voltage error. Bias voltage under minimum. Acknowledge by pressing any key.
Err 08	Bias voltage error. Bias voltage over maximum. Acknowledge by pressing any key.
Err 10	Emission current error. Emission current under minimum. Acknowledge by pressing any key.
Err 20	Emission current error. Emission current over maximum. Acknowledge by pressing any key.
Err 40	Filament current error. Emission current under minimum or filament of the IONIVAC vacuum gauge head is defective. Acknowledge by pressing any key.
Err 80	Filament current error. Filament current over maximum. Acknowledge by pressing any key.

Error (display) (continued)	Fault cause and remedy
no SEn	No gauge head connected to the measurement channel. The status message disappears after 30 seconds.
notr ıG	Error affecting the switch-on or switch-off channel. No switch-on or switch-off threshold has been defined for the IONIVAC gauge head (malfunction of the THERMOVAC gauge head, for example).
F ıL br	Filament broken. Filament of the THERMOVAC vacuum gauge head is defective. The error message persists until the sensor is replaced.

Table 26 – Error messages

9.2.3 Help the Case of Faults

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

9.2.4 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 21), which may be levered out using a small screwdriver.

9.2.5 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 COMBIVAC CM 52.

10. Storing and Waste Disposal

10.1 Packaging

Please retain the original packaging. You will need this packaging material when wanting to store the COMBIVAC CM 52 or when returning it to the company Leybold GmbH.

10.2 Shelving

The COMBIVAC CM 52 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.

10.3 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 Leybold GmbH, proper and professional separation of the recyclable fraction and its disposal is ensured.

Notes:

Notes:

Notes:

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:	COMBIVAC CM52, COMBIVAC CM52PB
Part numbers:	230115, 230115

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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Cologne, September 01, 2016

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Document No.: 300493574–002-A1

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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